46th Annual National Conference
Association of Medical Physicists of India (AMPI)

AMPICON 2025

4th–6th December | Guwahati

Theme: Medical Physics in Precision Medicine : Bridging Science and Patient Care

Venue: Srimanta Sankardev Kalakhetra International Auditorium, Guwahati, Assam

Physics meets compassion when a photon saves a life

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Commissioner & Secretary
Medical Education & Research Department
Government of Assam

सत्यमेव जयते

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Dispur, 25th November, 2025

Message

I extend my greetings and best wishes for the inauguration ceremony of the "Association of Medical Physicists of India National Annual Conference "(AMPICON-2025) hosted by the State Cancer Institute, Gauhati Medical College.

The Association of Medical Physicists of India has played a pivotal role in advancing the application of physics in medicine and strengthening multidisciplinary collaboration across the country. I am pleased to note that this year's conference will bring together professionals from India and abroad, marking a significant milestone as the event is being held in this region for the first time.

I appreciate the efforts of the organizers and all those associated with this endeavour, and I wish the event every success. My best wishes for the successful conduct of AMPICON-2025 and for meaningful deliberations that will enrich the field of medical physics.

(Dr. Siddharth Singh, IAS)

GOVERNMENT OF ASSAM
OFFICE OF THE DIRECTOR OF MEDICAL EDUCATION, ASSAM
SIXMILE, KHANAPARA, GUWAHATI-22
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Dated: **14-11-2025**

MESSAGE

It gives me immense pleasure to learn that the "Association of Medical Physicists of India" is going to organize the National Annual Conference (AMPICON, 2025) under the auspices of the State Cancer Institute, GMC, Assam to be held on 4th to 6th, December, 2025 at Srimanta Sankaradeva Kalakshetra Auditorium, Guwahati.

I hope the souvenir will reflect various aspects of recent development in the field of Physics' in Medicine wherein the theme of innovation, collaboration and commitment in medical physics. This conference reinforces the pivotal role of medical physicists in advancing precision medicine, patient safety and quality assurance in cancer care.

I am delighted and proud to have you all as part of Association of Medical Physicists of India and congratulate the entire team of AMPICON, 2025 for their tremendous efforts which will continue to enrich its contribution towards Application of Physics' in Medicine.

I extend my warm wishes to the entire team for this endeavor and wish grand success of the event.

[Prof. (Dr.) Anup Kr. Barman]
Director of Medical Education, Assam

डॉ. भुवनेश्वर बरूआ कैंसर संस्थान
टाटा स्मारक केन्द्र, परमाणु ऊर्जा विभाग, भारत सरकार
DR. BHUBANESWAR BOROOAH CANCER INSTITUTE
Tata Memorial Centre, Dept. of Atomic Energy, Government of India

MESSAGE

Association of Medical Physicists of India Conference, AMPICON 2025, hosted by the State Cancer Institute, Gauhati Medical College, at the serene and culturally vibrant Srimanta Sankardev Kalakhetra, celebrates the theme of innovation, collaboration, and commitment in medical physics. This conference reinforces the pivotal role of medical physicists in advancing precision medicine, patient safety, and quality assurance in cancer care.

The deliberations and scientific exchanges at AMPICON 2025 emphasize the integration of cutting-edge technologies—AI, image-guided therapies, adaptive radiotherapy, particle therapy, personalised medicine and molecular imaging—into clinical practice. Equally, the conference highlights the importance of continuous education, inter-disciplinary teamwork, and the translation of research into improved outcomes for patients across diverse healthcare settings.

As participants return to their institutions, the key message is clear: embrace innovation with responsibility, uphold the highest ethical and safety standards, and work collectively to ensure equitable access to advanced cancer care. Let Guwahati's spirit of unity in diversity inspire us to strengthen the fabric of the medical physics community—where science serves humanity with compassion, precision, and purpose.

Together, let us shape the future of medical physics—empowering technology, enriching knowledge, and enhancing lives.

Dr B B Borthakur
Director

Prof. (Dr.) Achyut Ch. Baishya
DGO, MD (SPM)
Principal cum Chief Superintendent
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Message

It gives me immense pleasure to know that "Association of Medical Physicists of India (AMPI)" is going to organize the "National Annual Conference – AMPICON-2025" under the auspices of the State Cancer Institute, GMC, Assam to be held on 4th to 6th December, 2025 at Srimanta Sankardeva Kalakshetra Auditorium, Guwahati.

I am confident that this conference will provide a unique platform for researchers, scientists and professionals to exchange ideas, share innovations and foster collaborations that will further strengthen the role of physics in advancing healthcare technology.

I extend my sincere best wishes to the organizing committee and all participants for a successful and impactful event.

With Thanks

Date: 28th November, 2025

Prof. (Dr.) Achyut Ch. Baishya
Principal-cum-Chief Superintendent
Gauhati Medical College & Hospital,
Guwahati-32

Dr. (Maj.Gen) Jai Prakash Prasad
Chief Operating Officer,
Assam Cancer Care Foundation

Message from Chief Operating Officer, Assam Cancer Care Foundation

It is a matter of immense pride and joy for the State Cancer Institute, Guwahati to host the **46th Annual National Conference of the Association of Medical Physicists of India (AMPICON)** for the first time in North East India. This moment marks a milestone not only for our institute but also for the entire region, showcasing our growing role in advancing medical science and cancer care.

Medical Physicists hold a pivotal role in ensuring the precision and safety of radiation therapy. They form the crucial bridge between the laws of physics and the art of cancer healing. Their expertise continues to shape the future of oncology care with accuracy, innovation and compassion.

It is also my pleasure to extend my heartfelt congratulations to my dear friend Dr. Manoj Semwal, serving as the President of AMPI, whose leadership continues to inspire the community of medical physicists across the nation. I would also like to express my deep appreciation to Mr. Jibon Sharma for his remarkable initiative and dedication in organizing this grand event at the State Cancer Institute, Guwahati.

Wishing **AMPICON 2025** great success and meaningful deliberations, interactions, and collaborations during this conference that strengthen the foundation of cancer care in the country.

Warm Regards

Dr (Maj.Gen) Jai Prakash Prasad
Chief Operating Officer,
Assam Cancer Care Foundation.

Dr. Smriti Goswami

It gives me immense pleasure to be a part to host the Annual National Conference of the **Association of Medical Physicists of India (AMPI) from 4th to 6th December, 2025.** This prestigious event is being organised for the first time in North East India and the venue is the historic Guwahati city. The conference is expected to be attended by a large number of National as well as International Faculty & Delegates.

The conference venue is **Srimanta Sankaradeva Kalakshetra and this is Northeast India's largest cultural congregation,** conceived as a grand exposition of the life and culture of the people of Assam and North-East India, of its diverse ethnic groups & sub-groups that created the cultural mosaic of the North-East in general and particularly of Assam, in respect to all its beauty and splendour. I am sure that all the visiting guests will carry back the pleasant memory of visiting the North East.

The members of AMPI are medical physicists & scientist dedicated to the use of radiation for peaceful purpose & sophisticated medical uses. Their scope of activity is expanding & there are many diagnostic & therapeutic procedures where medical physicists play vital role. This type of conference will bring together experts for better human service bridging science & patient care.

I wish the conference a grand success.

Dr. Smriti Goswami
HOD, Radiation Oncology
State Cancer Institute, Guwahati

Dr. Manoj K Semwal

Dear Colleagues,

On behalf of AMPI, I extend a warm welcome you all to **46th AMPICON** in the beautiful city of Guwahati organized by State Cancer Institute of Assam and Eastern Chapter of AMPI.

It's a matter of great happiness that this is the first ever **AMPICON** in the north eastern part of India. A clear reflection of the rapid expansion of medical radiation facilities and with it the medical physics activities in this part of the country in the recent times. It gives us double happiness that this year happens to be the **50th year of foundation of AMPI**. And what a pleasant coincidence that we start the celebrations from the eastern part of the country- the land of rising for India.

I am personally aware of the tireless efforts of the organizing team coordinated by the hardworking Organizing Secretary Mr. Jibon Sharma and the Scientific Committee Chairperson Dr A K Rath in creating a great experience for the delegates in both scientific content and social events. AMPI through its office bearers and EC have been closely interacting with the organizers to make the conference a success.

Eminent international and national scientists, medical physicists and entrepreneurs and industry have confirmed their participation for the conference. Their talks and personal interactions during the conference will be immensely motivating and useful to the younger medical physics colleagues. The theme of the conference **'Medical Physics in Precision Medicine: Bridging Science and Medical Care'** conveys it all - the role of medical physicists in medicine and the need for translational research. A dedicated session is being planned on the opportunities of translational research in the area of cancer care specially related to medical physics.

I congratulate the conference organizers for putting together such an impressive show overcoming many challenges and wish the conference a grand success.

Looking forward to an enriching scientific conference and social interactions,

With best wishes and regards,

Dr. Manoj K Semwal, PhD
President, AMPI

Prof. Anuj Kumar,
Secretary, AMPI

Dear Esteemed Faculty Members and Delegates of the 46th Annual Conference of the Association of Medical Physicists of India, It is with great warmth and immense enthusiasm that I welcome you to AMPICON 2025, to be held from 4th to 6th December 2025 at the Srimanta Sankardev Kalakshetra Auditorium, Guwahati. This year's conference is being hosted by the prestigious State Cancer Institute (SCI), Guwahati, under the distinguished leadership of Senior Physicist Mr. Jibon Sharma.

AMPICON 2025 brings together eminent experts and passionate participants from across the country, offering a valuable opportunity for insightful discussions, the exchange of pioneering ideas, and the strengthening of collaborations that will influence the future of medical physics. The theme of this year's conference, "Medical Physics in Precision Medicine: Bridging Science and Patient Care," reflects our shared commitment to harnessing advanced technologies and scientific innovation to elevate patient care–guided by the exemplary leadership of Senior Physicist Dr. A. K. Rath.

With an impressive lineup of keynote speakers, invited faculty, panel discussions, and hands-on workshops, this conference promises to be a vibrant platform where knowledge meets innovation. It will inspire and empower all of us in our respective domains of expertise.

I extend my sincere appreciation to the authorities of the State Cancer Institute (SCI), Guwahati, for their gracious support in hosting this important event. I also express my heartfelt gratitude to Mr. Jibon Sharma and the entire Organizing Committee for their unwavering dedication and meticulous efforts in curating a conference of such significance. Your vision and hard work have laid the foundation for an event that will undoubtedly leave a lasting impact on our professional community.

I eagerly look forward to welcoming you at AMPICON 2025 and to sharing in productive discussions, meaningful interactions, and enriching networking experiences.

Prof. Anuj Kumar,
Secretary, AMPI

Dr.Devajeet Choudhury
Organizing Chairman
AMPICON-2025

Organizing Chairman, AMPICON 2025

The 46th Annual Conference of the Association of Medical Physicists of India (AMPI), as the first-ever AMPICON to be hosted by State Cancer Institute, Guwahati, from the North Eastern part of India, the conference served as a vital platform to showcase the region's commitment to advancing healthcare technology and education in medical physics, bringing national and international faculty to the area.

The conference highlighted the critical importance of bridging science and patient care through the advancements in medical physics, which is fundamental to the delivery of modern, high-quality, and individualized precision medicine, particularly in the rapidly evolving fields of cancer diagnosis and therapy.

The event provided a crucial forum for junior members and young medical physicists to present their work, network with top national and international experts, and enhance their understanding and skills in the field.

The core message from AMPICON 2025 in Guwahati focused on Solving New Challenges in Personalized Oncology through Automation and Accuracy in Medical Physics. The conference highlighted the adoption of emerging technologies and techniques that enable the real-time modification of cancer treatments. A key theme was the reinforcement of the medical physicist's crucial role in translating complex scientific advancements into safe, effective clinical practices and the importance of a multidisciplinary approach in patient care

Dr.Devajeet Choudhury
Organizing Chairman AMPICON-2025

Dr. Arabinda Kumar Rath, PhD
Chairman and MD, Hemalata Hospitals, Bhubaneswar

Message from the Chairman, Scientific Committee – AMPICON 2025

It is indeed my honor and pleasure to invite you all to the **AMPICON – 2025 being held in Guwahati, Assam during 4th to 6th December 2025.** With a panel of distinguished Medical Physicists from all over India and overseas, with diverse expertise, we had formed the Scientific committee. We had several online and off line meetings. With several days of thoughtful work by participation from one and all we have curated a scientific program for **AMPICON – 2025** that will be appealing to the new entrants as well professional with experience in our field.

There were more than **250 scientific abstracts** received which were reviewed by a double-blind method and based on the scoring and choice of presentation a tentative scientific program was developed. In consultation with the organizing committee as well as the AMPI Office, a detailed scientific program spanning three days with several parallel sessions has been planned. With **25 Invited talks, 60 plus Oral presentations** and **140 plus posters** a fully packed three days of quality Medical Physics academics program awaits you. Plenary Sessions, Scientific Sessions, Specific Symposiums and Sessions with diverse expertise have been put together. The final program looks like a true scientific feast and is heading towards a grand success. My thanks are due to one and all who helped us plan this scientific program.

This is for the first time an AMPI national conference is being organized in North Eastern India. With the kind of hospitality and cultural heritage that Assam is known for we are bound to have an excellent conference that will leave lasting memories for all of us for decades to come. Please enjoy every moment of the event.

Welcoming you all to Guwahati and with best wishes

Dr. Arabinda Kumar Rath, Chairman,
Scientific Committee, AMPICON-2025

Dr Dwipen Khanikar
Superintendent I/c
State Cancer Instiurte, GMC

Message from Medical Superintendent, SCI

I am delighted to learn that the Association of Medical Physicists of India (AMPI) is organising the "Association of Medical Physicists of India-2025 National Conference" (AMPICON-2025) from December 4th to 6th, 2025, at the Srimanta Sankaradeva Kalakshetra Auditorium in Guwahati, Assam.

Experts, students and delegates from various parts of India and abroad will gather to share their experiences, discuss research in Medical Physics, and new developments in evidence-based management. The conference will focus on future research and innovations that will enhance treatment efficacy and safety, ultimately improving treatment outcomes and patient care. The conference souvenir, which is being published, will reflect the latest advancements and ongoing research in Medical Physics.

I offer my best wishes for the grand success of the conference.

Dr Dwipen Khanikar
Superintendent I/c
State Cancer Instiurte, GMC

Mr.Jibon Sharma
Organizing Secretary
AMPICON-2025, Guwahati

Message from the Organizing Secretary

The annual conference of the Association of Medical Physicists of India is the live wire of the Medical Physicist in the sub-continent for last 50 years. It is privilege for us to host the 46th annual conference of Association of Medical Physicists of India this year at Guwahati, the 'gateway of North East India' and also creating a significant milestone for us as it is being held first time in this region.

The conference aims to attain the namesake of the venue and build a global platform for the Medical Physicist of the sub-continent and beyond. The congress promises to consolidate the existing knowledge, challenge the old order, and build newer skills and patronage, innovation and education. The congress promises to provide a networking platform so as to develop camaraderie between young and the experienced professionals and build a gap between experience based and evidence-based medicine.

The rich cultural, spiritual heritage and indomitable spirits of Assam will guide us to achieve the excellence goal of AMPICON-2025.

Assam also boasts of the widest natural fauna and fauna ranging from the river "Brahmaputra" to the "One horn Rhino of Kaziranga National Park". December will be an excellent month to spend some quality time with your family and friends after the academic debates.

The success of this conference is solely on the dedication and efforts of the members of organizing committee. I express my thanks and appreciation to the members of the organizing committee.

I, on behalf of the organizing team and office bearers of AMPICON-2025, would like to extend my hearty welcome to each one of you for joining us on this magnificent and memorable event.

I look forward to enjoy this memorable Union, Get-together & a Landmark Event!

Long Live Association of Medical Physicists of India.

Mr.Jibon Sharma
Organizing Secretary
AMPICON-2025, Guwahati

About the AMPICON 2025

Dear Friends,

Greetings from Guwahati, the gateway of Northeast India. On behalf of the organizing committee of the **AMPICON 2025,** It is indeed a great pleasure to invite you all to **The 46th Annual Conference of the Association of Medical Physicists of India at Srimanta Sankardev Kalakshetra Auditorium, Guwahati from 4th to 6th December 2025.**

The ancient name of Guwahati was Pragjyotishpur (the light of the East). Guwahati derives its name from the Assamese words "Guwa" means areca nut and "Haat" means market. Guwahati has a magical aura that still lingers over the ever-expanding city. According to history, the demon king Narakasura is said to have built this ancient city. Guwahati is famous for the ancient temple of Maa Kamakhya Devi and its mystic experiences. Many temples in the city will leave you mesmerized. The city is also famous for its traditional handicrafts, textiles, and handloom products.

The conference will aim to give our junior members a platform while also presenting an academic feast of the most recent advancements in the field of medical physics. The top national and international faculties with extensive knowledge of medical physics have been invited whose lectures would improve and enhance our understanding and skills.

We believe in "Atithi Devo Bhava"-Our Guest is God. It is our sacred duty to offer you the best hospitality we can.

We welcome you all with open arms to Guwahati for the AMPICON-2025 and we are sure you will take back beautiful memories to cherish from your stay here.

The State Cancer Institute (SCI), Guwahati was established on 17th February, 2017 to cater the needs of the cancer patients of the region who used to go to metro cities located outside of the state for treatment. The hospital started with 135 beds & by 2024, it has been expanded to 350 beds. The hospital serves as the Apex centre of ACCF- an initiative of the Government of Assam & the Tata Trusts. The Government of Assam has entrusted the operational charges to ACCF while the academic section continues with Gauhati Medical College. The expansion of SCI to a total area of 4.76 lakh square feet represents a significant enhancement in infrastructure- allowing incorporation of additional advanced facilities and services to better serve cancer patients. The hospital will significantly increase its capacity to accommodate patients, ensuring they receive high- quality affordable care in a comfortable environment. The groundbreaking Proton Therapy Centre to be initiated at SCI, Guwahati, by ACCF will revolutionise in Eastern India & Southeast Asia.

The rapid advancement of technology in healthcare management, particularly for cancer patients, has revolutionized the application of radiation for diagnostic and therapeutic purposes. This progress has significantly altered the concepts, procedures, and practices of radiation dosimetry and quality assurance within the discipline of Medical Physics. The upcoming conference, themed "Medical Physics in Precision Medicine: Bridging Science and Patient Care," aims to discuss and adopt these new concepts in the field of Medical Physics.

Keep checking back in the upcoming weeks for more information about the agenda, speakers, and registration. It will be a pleasure to have you attend **AMPICON 2025.**

Keep the date in mind and prepare to be a part of something truly remarkable.

Organising Chairman
Dr. Devajit Choudhury
Medical Superintendent, State Cancer Institute,
Guwahati, Assam- 781032

Organising Secretary
Mr. Jibon Sharma
Senior Physicist & RSO, State Cancer Institute,
Guwahati, Assam, 781032

Abstract ID: B01

Title: A Cost-Effective Deep Learning-Based Auto-Segmentation Method for Treatment Planning

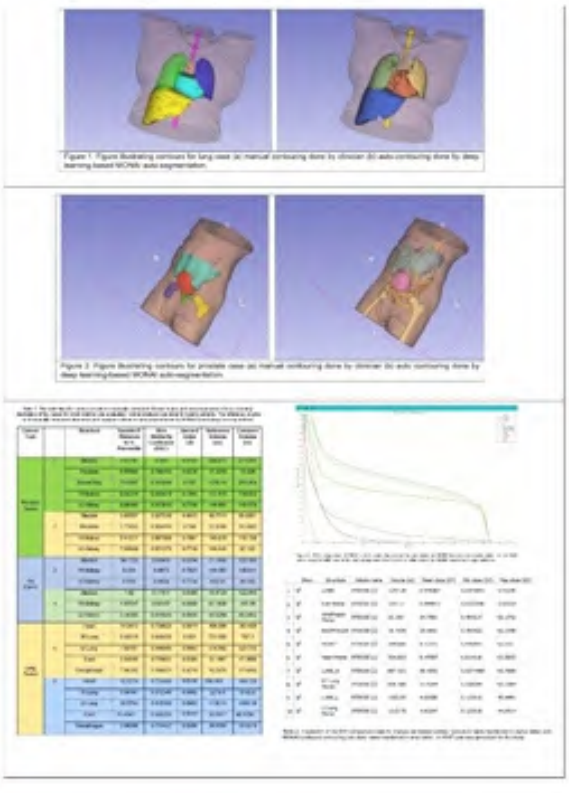
Abstract Category: Artificial Intelligence in Medical Physics, Imaging and Oncology

Author Names: Gopishankar Natanasabapathi

Co-Authors: Surendra Kumar Saini, Dhanabalan Rajasekaran, Vellaiyan Subramani, Suman Bhasker

Institute: All India Institute of Medical Sciences, New Delhi

Full Abstract: Purpose/Objective(s): To demonstrate a cost-effective deep learning (DL) based auto-segmentation (AS) of organs in thoracic and pelvis region to enhance the efficacy of radiotherapy planning (RTP) workflow. Materials/Methods: A retrospective study six male patients having tumor in upper body region, eight male patients having tumor in abdominal region and six female patients having gynaecological tumor were reprocessed for auto-contouring. The CT images were acquired with following parameters: slice thickness - 3 mm, tube Voltage - 90 kVp, tube current - 235 mAs, pixel size - 0.976 mm. The site-specific critical structures and tumor were delineated by clinical team for treatment planning in Monaco TPS (Version 5.3). The anonymized CT images of each patient in DICOM format were imported into 3D slicer a free, open-source software for source framework for DL. The Medical Open Network for AI (MONAI) a PyTorch-based, open-source framework for DL in healthcare imaging was imported into the 3D slicer. The MONAI tool performed AS on the CT images of each patient. The manual segmentation (MS) was compared with AS through metrics such as Hausdorff distance (HD), dice similarity coefficient (DSC), Jaccard index (JI). Results: The MS by clinical team took an average time of one hour for each patient. Whereas MONAI AS generated organ contours in < 1 minute. The MONAI tool auto-segmented > 15 critical structures in < 1 minute time for each patient. The average HD, DSC and JI were 3.5, 0.94, 0.91 for urinary bladder, 9.2, 0.89, 0.77 for right kidney, 9.8, 0.87, 0.78 for left Kidney, 4.1, 0.83, 0.71 for prostate in pelvis region and 17.10, 0.75, 0.59 for heart, 5.30, 0.96, 0.92 for right lung, 9.38, 0.95, 0.90 for left lung, 12.99, 0.80, 0.64 for cord and 5.96, 0.68, 0.53 for oesophagus respectively in thoracic region. The bowel bag MS was incomparable with AS. The contours auto-segmented were convertible to DICOM format for planning purpose. The present MONAI tool is a pretrained model that predicts organ contours with good accuracy from CT images of male patients for both thoracic and pelvis region. For female patient direct application of AS failed. More training of imaging data is required to predict contours of female breast, vagina, uterus and etc. The integration of auto-contoured structures to TPS for planning will be demonstrated in our future study. Conclusion: We have demonstrated a cost-effective and time saving AS solution for speeding up the contouring process in RTP.



Abstract ID: B02

Title: Xception Based Transfer Learning Model for Brain Tumor Classification from Magnetic Resonance Imaging Scans

Abstract Category: Artificial Intelligence in Medical Physics, Imaging and Oncology

Author Names: Ankur Mourya

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Full Abstract: Introduction and Objective: Brain tumors are life-threatening conditions, and their early detection significantly impacts treatment strategies, including radiotherapy planning. Accurate classification of tumor type–such as glioma, meningioma, or pituitary tumor is crucial for defining treatment intent, prescribing doses, and delineating target volumes in radiotherapy workflows. Manual interpretation of MRI scans is time-intensive and prone to variability. Deep learning-based automated classification can aid radiologists and radiation oncologists by improving diagnostic efficiency and enabling personalized radiotherapy planning. This study aimed to develop an optimized deep learning model for multi-class brain tumor classification using Magnetic Resonance Imaging (MRI) and assess its accuracy, precision, and recall. Materials and Methods: The study utilized a publicly available Brain Tumor MRI dataset comprising 7,023 images categorized into four classes: glioma, meningioma, pituitary tumor, and no tumor. Python program with TensorFlow Kera deep learning library was used. Data preprocessing included normalization and resizing the image's pixels. Data augmentation techniques such as brightness adjustment and rotation were applied to reduce overfitting. The dataset was divided into training, validation, and test sets. A pre-trained Xception architecture was adopted for transfer learning, followed by additional layers, including Flatten, Dense, Dropout, and a softmax output layer for four class prediction. Performance metrics included accuracy, precision, and recall, along with a confusion matrix and classification report. Results and Discussions: The model achieved performance across all sets: training accuracy of 99.90%, validation accuracy of 99.50%, and test accuracy of 99.20%. Precision and recall were consistently above 99% for all classes. The confusion matrix indicated minimal misclassification, and the macro-averaged F1-score reached 0.99. Data augmentation and fine-tuning significantly enhanced model generalization, reducing validation loss to 0.014 at the optimal epoch. Compared to conventional CNN-based models, the Xception-based approach provided superior accuracy and robustness. Visualization of training curves confirmed stable convergence without overfitting, validating the model's reliability for clinical application. In the radiotherapy department, accurate tumor classification facilitates protocol selection, margin definition, and adaptive planning, ultimately improving treatment precision and reducing normal tissue toxicity. Conclusion: The proposed Xception-based deep learning model achieves greater than 99% accuracy high performance for brain tumor classification using MRI. Integration of this Artificial Intelligence (AI) model into radiotherapy planning systems can enable rapid decision support, particularly in resource limited settings where expert review may be delayed.

Abstract ID: B03

Title: Cardiac Dose Prediction Using Machine Learning for DIBH Selection in Left-Sided Breast Cancer.

Abstract Category: Artificial Intelligence in Medical Physics, Imaging and Oncology

Author Names: Dr. Mukesh Kumar Zope

Co-Authors: Dr. Deepali Bhaskar Patil, Dr. Rishi Raji, Prof. (Dr.) Rajesh Kumar Singh

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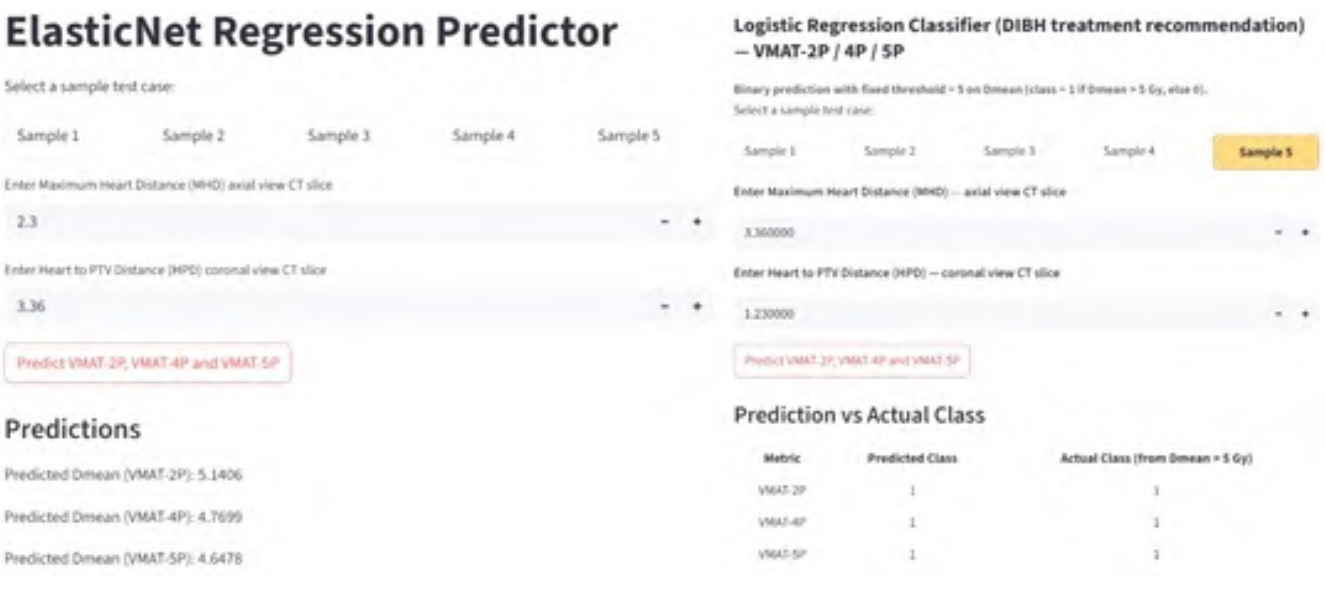
Full Abstract: Introduction and Objective Cardiac toxicity after left-sided breast cancer radiotherapy causes long-term cardiovascular complications. Deep inspiration breath hold (DIBH) spares the heart by increasing separation from the target volume during treatment delivery. However, DIBH implementation requires time-consuming free-breathing versus breath-hold planning techniques comparisons, causing workflow inefficiencies. Treatment decisions still rely on physician experience and basic anatomy, with little use of standardized quantitative tools. The purpose of this study was to develop and validate a machine learning (ML) framework that can accurately predict the mean heart dose and provide reliable DIBH treatment recommendations before comprehensive treatment planning. Materials and Methods This retrospective study included 120 consecutive patients with left-sided breast cancer who received volumetric modulated arc therapy (VMAT) after modified radical mastectomy. Two geometric predictors were utilized: heart-planning target volume distance (HPD) and maximum heart distance (MHD), both derived from standard planning CT images. A total 360 treatment plans utilizing three distinct VMAT techniques: 2-partial arc (VMAT-2P), 4-partial arc (VMAT-4P), and 5-partial arc (VMAT-5P). Patients were randomly allocated into training (80%, n=96) and independent testing (20%, n=24) groups. Elastic Net regression was implemented for continuous heart dose prediction, while logistic regression was used for binary classification based on a clinically relevant 5 Gy threshold. Model performance was evaluated through 5-fold cross-validation, with the area under the receiver operating characteristic curve (AUC) as the primary endpoint. Results and Discussion: The Elastic Net regression model exhibited strong predictive accuracy, recording mean absolute errors of 0.976 Gy, 0.931 Gy, and 0.769 Gy for VMAT-2P, VMAT-4P, and VMAT-5P respectively. The superior performance of VMAT-5P reflects enhanced dose conformity achievable with multi-arc strategies. Logistic regression provided reliable treatment classification, achieving AUC values of 0.938, 0.854, and 0.826 for the three techniques. Independent testing validation affirmed clinical utility, with specificity at 91.7%, sensitivity at 83.3%, and overall accuracy at 87.5% for DIBH recommendations. These performance metrics exceed clinical decision-making thresholds and indicate the potential to decrease unnecessary DIBH procedures while ensuring proper cardiac protection. Conclusion The validated ML framework enables accurate prediction of cardiac dose and offers clinically dependable DIBH treatment recommendations before full treatment planning. The strong predictive performance (AUC >0.82 across all techniques) justifies immediate clinical adoption for enhancing cardiac-sparing strategies in left-sided breast cancer radiotherapy, which could improve long-term cardiovascular health while streamlining workflow efficiency. Keywords: Machine learning; cardiac dose prediction; deep inspiration breath hold; breast cancer; radiotherapy planning



Abstract ID: B04

Title: Evaluation of a Cycle-Generative Adversarial Network-Based Synthetic CT Generation Method for Brain Radiotherapy Planning

Abstract Category: Artificial Intelligence in Medical Physics, Imaging and Oncology

Author Names: Sumanta Manna

Co-Authors: Rumita Singh, Sharad Singh, Pramod Kumar Gupta, Ragul T

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Full Abstract: Magnetic Resonance Imaging (MRI)-only workflows in radiotherapy have the potential to reduce registration errors and streamline clinical processes. However, the absence of electron density information in MRI necessitates synthetic CT (sCT) generation. This study evaluates the performance of a cycle-generative adversarial network (cycle-GAN)-based MRI-to-sCT algorithm for the brain site, focusing on segmentation accuracy and dosimetric consistency. Methods & Materials: A prospective analysis was conducted on fifteen patients with brain cancer. sCT images were generated using a cycle-GAN model trained on T1-weighted Dixon in-phase and out-of-phase MRI images. The sCTs were rigidly registered to their corresponding planning CTs, and identical clinical structures were transferred to facilitate direct comparison. Volumetric Modulated Arc Therapy (VMAT) plans were mapped onto the sCT datasets, and dose recalculations were performed. Segmentation accuracy was evaluated using Dice Similarity Coefficient (DSC) and Mean Distance to Agreement (MDA), while dosimetric comparisons were made using gamma analysis and mean dose differences for target volumes and organs at risk (OARs). Results & Discussions: The mean DSC values were more than 0.9 for the brain and Clinical Target Volume (CTV), with an average MDA of <2.0 mm. Dosimetric evaluation showed a mean dose difference of <1% for the Planning Target Volume (PTV), and a maximum deviation of 4% for OARs. In post-operative patients, bone artifacts caused by metal implants led to overestimated bone density in the sCT; however, this did not affect the overall mean dose to the PTV. The findings suggest that careful planning margins near metal implants can mitigate underdosage risks. Conclusion: The proposed cycle-GAN-based method for MRI-to-sCT conversion demonstrates high geometric fidelity and clinically acceptable dosimetric accuracy for brain radiotherapy planning. These results support its integration into MRI-only workflows, with considerations for metal-induced artifacts in post-surgical cases.

Abstract ID: B05

Title: Development of Indigenous CT-based Head & Neck Phantom Using 3D Printing Technique for Radiotherapy Applications

Abstract Category: Innovative & Emerging Technologies

Author Names: Subhalaxmi Mishra

Co-Authors: Vandana Shrivastava, Rajesh Kumar, T. Palani Selvam, S. D. Sharma, B. K. Sapra

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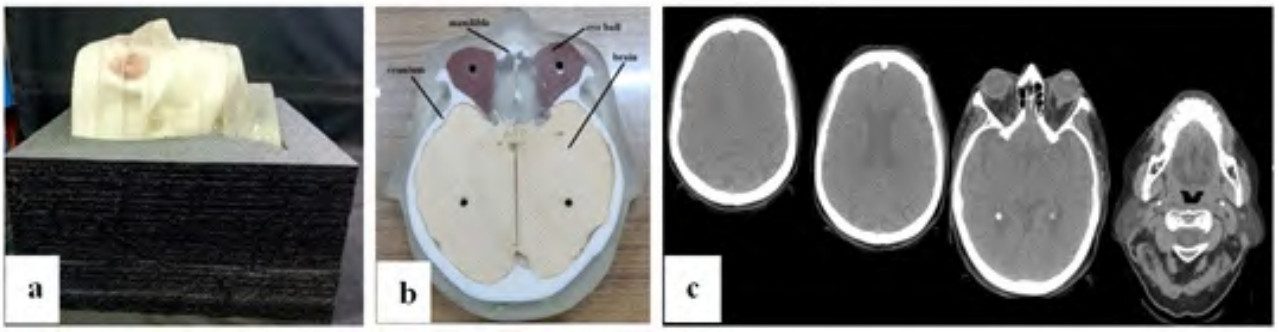
Full Abstract: Anthropomorphic phantoms are essential in radiotherapy for dose verification. However, the high cost and limited customization of commercially available phantoms restrict their clinical use. The objective of this study is to design and fabricate a CT-based Head & Neck phantom using 3D printing technology. Materials and Methods: The phantom design is based on CT images of a male patient. It consists of 2.5 cm-thick slabs containing different organs such as brain, eyes, skull, mandible and soft tissue. The phantom has provisions to place dosimeters at desired locations. Interlocking features, numbering, and midline markings are incorporated into the design. A suitable tissue-equivalent material, in terms of composition and density, is selected by comparing its HU values with the reference HU values from real CT scans. The segmented 3D model is sliced into thin horizontal layers and printed with different tissue-equivalent materials using 3D printing technique. For dose verification, CT images of the phantom are imported into the TPS and the ROIs are contoured. A treatment plan is then generated to deliver a 2 Gy dose to the PTV, which is executed on a 6 MV LINAC. The delivered doses to the PTV and OARs are measured using LiF:Mg,Ti TLDs and compared with the planned doses. Results and Discussions: Figure 1 presents the 3D-printed Head & Neck phantom fabricated using different tissue-equivalent materials. A good correlation is observed between the HU values obtained from the original patient CT scan and phantom CT scan across all analyzed slices. This agreement indicates the correctness of the methodology for selecting the suitable material for 3D printing in replicating the characteristics of human tissues. Furthermore, the uniformity of HU values within a given organ or region of interest is found to be within acceptable tolerance limit, demonstrating consistent material distribution in the printed phantom. Distal points receiving a dose of less than 10 cGy showed greater deviations between TPS-calculated and measured values. However, since these points receive only a small fraction of the prescribed dose compared to the PTV, the observed deviation has minimal clinical impact. Conclusion: The 3D-printed indigenous CT-based phantom accurately replicates both the anatomical and tissue equivalence characteristics of the original patient data. It is simple to use, cost effective and suitable for radiotherapy applications. Figure 1: Prototype anthropomorphic Head & Neck phantom fabricated using 3D printing technique. (a) full phantom (b) slice of phantom (c) CT images of the phantom.



Abstract ID: B06

Title: DIBH Reproducibility and Stability in Breast Radiotherapy: Insights from Python-Based DICOM Waveform Analysis.

Abstract Category: Innovations in Imaging, Motion Management & Treatment Delivery

Author Names: Prarthana Singha

Co-Authors: Soumen Bera

Institute: Chittaranjan National Cancer Institute, Kolkata

Full Abstract: DIBH Reproducibility and Stability in Breast Radiotherapy: Insights from Python-Based DICOM Waveform Analysis Introduction and objectives: Deep inspiration breath-hold (DIBH) radiotherapy is widely used in breast cancer treatment to reduce cardiac and pulmonary radiation exposure. This study aims to quantitatively assess the reproducibility and stability of the DIBH technique using respiratory waveform analysis from CT simulation and treatment delivery. A custom Python-based pipeline was used to decode DICOM waveform data and extract key respiratory metrics for evaluating breath-hold performance. Materials and Methods: In this study, we evaluated 11 patients undergoing breast cancer radiotherapy (40 Gy in 15 fractions) using a voice-assisted RGSC system with the DIBH technique. DICOM Motion Waveform (MWF) files were extracted for each patient from both the planning CT simulation and all 15 treatment fractions using the Eclipse Treatment Planning System (Varian Medical Systems, Palo Alto, USA). A custom-developed Python-based processing pipeline was used to decode and analyze the respiratory waveform data, with a primary focus on the anterior–posterior (Ant–Post) displacement channel–responsible for tracking respiratory motion and serving as the gating surrogate during treatment delivery. Key respiratory metrics were extracted, including mean amplitude, weighted average, maximum and minimum displacement, beam-hold duration, and standard deviation. These metrics were then compared to simulation baselines to assess breath-hold stability and reproducibility. Results: A total of 2,346 beam-on events were analyzed across 11 patients. The majority (52%) of breath-hold amplitude deviations remained within ±0.2 cm (Range: -0.68cm to 0.66cm) of the CT-derived reference value, demonstrating high geometric fidelity during gated treatment delivery. The overall mean deviation of daily weighted average amplitude from the simulation reference was –0.04 cm, with a standard deviation of 0.16 cm, indicating strong inter-fractional reproducibility. Additionally, the mean amplitude deviation calculated per beam-on interval across all patients was –0.09 cm (SD = 0.26 cm), supporting the consistency of breath-hold execution throughout treatment. The median intra-fractional standard deviation was 0.1 cm, with most values clustering between 0.05 cm and 0.2 cm–peaking at 0.1 cm–reflecting a narrow range of variability and excellent breath-hold stability. Conclusion: The extracted respiratory waveform metrics confirmed minimal amplitude variation and low intra-fractional variability, highlighting the reproducibility and reliability of the technique. A subset of breath-hold events (7%) exceeded the ±0.5 cm deviation threshold, indicating an area for improvement. Enhancements such as stricter amplitude gating thresholds and the incorporation of real-time visual feedback–e.g., video-assisted breath-hold guidance–may further improve breath-hold accuracy and treatment precision.

Abstract ID: B07

Title: Indigenously developed Gating instrument with Real time motion monitoring capabilities without any electricity

Abstract Category: Innovations in Imaging, Motion Management & Treatment Delivery

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Co-Authors: Raghul Rj, Abishek Gulia , Prekshi Chaudary, Swheta, Subhalakshmi

Institute: Max Super Speciality Hospital, Noida

Full Abstract: Introduction and Objective Gating technique with deep inhalation breath hold-DIBH is used in treating thoracic malignancies to decrease radiotoxicities in organs at risk-OAR. The device discussed in this paper shall be used in gating to monitor during DIBH without any electronics. Material and Methods This study is performed in an indigenously developed thoracic phantom capable of mimicking breathing motion along with OARs. The gating instrument consists of a stand with freely moving piston which has a pad at patient end. There are markings on the piston to monitor full inhale and full exhale positions. This can be viewed through in-room CCTV camera. Truebeam STx Linear Accelerator and Eclipse Treatment planning system-TPS is used for the study. Results and Discussion The indigenous phantom was inflated and deflated to resemble the breathing pattern. Treatment was switched on only at the desirable lung position. Treatment was executed on the phantom which was planed using the computed topograph images in the Eclipse TPS. to compare the study, two treatment plans were made and executed. In one treatment, lung motion was included and in other treatment, lung motion was excluded. Film dosimetry was used with GaF chromic films to check and compare the doses to OARs. Doses to the chest wall and heart were compared. The dosed to the OARs are well controlled in the gated treatment using the indigenous instrument. Conclusion The instrument discussed in this study is highly accurate in tracking the lung motion, easy to fabricate and very affordable. Further there are no electronics and complex software needed. Very less maintenance needed. This gating instrument can be used in any radiotherapy centers.

Abstract ID: B08

Title: Accelerating Robust Proton Therapy: A Synthetic CT-Based Framework for Efficient and Clinically Feasible Adaptive IMPT

Abstract Category: Particle Therapy

Author Names: Mahammood Suhail Mundodan

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Institute: Apollo Proton Cancer Centre, Chennai

Full Abstract: Objective: To develop and evaluate a novel synthetic CT-based robust optimization framework for intensity-modulated proton therapy (IMPT) that significantly reduces computational time while maintaining or improving dosimetric robustness. This method aims to enhance the feasibility of online adaptive radiotherapy (ART) by replacing conventional multi-scenario approaches with a streamlined two-scenario model. To introduce and evaluate an innovative synthetic CT-based two-scenario robust optimization framework for intensity-modulated proton therapy (IMPT), aimed at reducing computational complexity without compromising dosimetric robustness, to support the implementation of adaptive proton therapy (APT). Methods: The proposed method involves generating a synthetic CT that simulates worst-case anatomical conditions through voxel-wise Hounsfield Unit (HU)/RSP? modifications. These modifications are derived from beam-specific water-equivalent thickness (WET) perturbations to account for both setup and range uncertainties. Using this synthetic CT alongside the nominal planning CT, robust optimization was conducted with only two scenarios instead of the conventional 21 or more. The framework was implemented in RayStation v12 and retrospectively tested on 14 diverse clinical cases–including lung, sacral chordoma, and gastrointestinal tumors–using original beam geometries and planning objectives. Dosimetric robustness was assessed by evaluating CTV V95% 95% under standard perturbation scenarios, and organ-at-risk (OAR) doses were compared in nominal and worst-case conditions. Results: Plans optimized using the synthetic CT consistently met the robustness criterion (CTV V95% 95%) across most cases. In three cases with borderline coverage in the original plans, robustness was notably improved. While worst-case CTV coverage showed a minor decrease, the conservative nature of the synthetic CT led to safer dose margins. Additionally, worst-case doses to critical OARs such as the lungs, heart, stomach, duodenum, and kidneys were reduced in the majority of cases, improving adherence to institutional dose constraints. The proposed method demonstrated significant computational efficiency. For a large sacral chordoma (3364 cc), 150 optimization iterations completed in 17.1 minutes–down from over 70 minutes with conventional robust planning. For smaller tumors, similar iterations completed in under 5 minutes, even under high clinical server load. Conclusion: The proposed synthetic CT-based robust optimization framework offers a clinically viable, efficient alternative to traditional scenario-based planning. By reducing the number of scenarios while maintaining robust target coverage and OAR sparing, this approach supports rapid re-planning for adaptive IMPT. Its compatibility with commercial planning systems makes it highly suitable for integration into workflows, representing a significant advancement in APT.

Abstract ID: B09

Title: Dose Optimization at Different Depths in Boron Neutron Capture Therapy (BNCT)

Abstract Category: Particle Therapy

Author Names: Muhammed Jaseel TP

Co-Authors: Aneesa A, Midhun CV, M M Musthafa, Rijin NT

Institute: [1]University of Calicut, Malappuram, [2]Jain University, Banglore

Full Abstract: Background/Objective: Boron Neutron Capture Therapy (BNCT) is an emerging binary radiotherapy technique that leverages the high neutron capture cross-section of Boron-10 for selective tumour cell destruction. Optimizing neutron dose at various tumour depths is vital to ensure therapeutic effectiveness while minimizing damage to healthy tissues. This study aims to determine optimal neutron energies for tumours at different depths by analysing neutron transmission and capture through boron-containing targets under variable shielding. Materials and Methods: Experiments were conducted at TIFR using boric acid pellets (diameter: 1 cm, thickness: 1.5 mm, weight: 169 mg) as the target. Wax blocks of varying thicknesses (0 cm, 2 cm, 4 cm, and 6 cm) were used to simulate different tissue-equivalent depths. Data acquisition was performed using LAMPS software. Time calibration was achieved using monoenergetic gamma sources (Co, Am, Cs), and energy calibration was verified using Compton edge fitting. Neutron energy spectra were analysed for blank (no target), and for boron with different wax layers. The kinetic energy of neutrons was calculated from time-of-flight data using the equation: $E = (0.5 \times m \times (d/t)^2 \times 1.0e31)/1.602$, where m is neutron mass, d is distance, and t is time. Neutron transmission at each depth was computed, followed by neutron capture cross-sections using: $\sigma = \ln(I_0/I)/(\rho \times t) \times 1.0e24$, where ρ is atomic density and t is target thickness. Flux measurements were then derived using: $\phi meas = \phi blank \times \exp(-\sigma \times t)$. All results were compared with ENDF library data for validation and plotted as Energy vs Counts and Energy vs Neutron Capture. Results: Neutron transmission decreased with increasing wax depth, as expected. Neutron capture cross-sections were highest for shallow depths, confirming greater boron interaction at surface-proximal regions. Optimal neutron energies for different depths were inferred from the shape and peak of the neutron capture spectra. Flux discrepancies were observed in ENDF comparison, indicating areas for further refinement. Conclusions: This study successfully demonstrates an experimental approach for depth-wise dose optimization in BNCT. The findings support tailored neutron energy selection based on tumour location, offering a pathway for more personalized and effective BNCT planning. Future work will focus on integrating these measurements into simulation-based treatment planning. Keywords: BNCT, Neutron Capture, Boron-10, Depth Optimization, Radiotherapy, Flux Measurement, LAMPS, ENDF.

Abstract ID: B10

Title: Influence of Lattice Array Design on Plan Complexity and Dosimetric Parameters in VMAT and IMRT for Lattice Radiotherapy

Abstract Category: Quality Assurance, Patient Safety & Uncertainty Management

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Co-Authors: Dr . K . Mayakannan

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Full Abstract: Objective This study investigates the influence of lattice geometry on treatment plan quality in LRT. Plan quality is evaluated using dosimetric indices, plan complexity metrics, and patient-specific quality assurance (PSQA) passing rates for VMAT and IMRT plans across different lattice configurations. Methods & Materials A systematic review of 68 publications identified four lattice geometries: Hexagonal Close-Packed (HCP), Face-Centered Cubic (FCC), Equilateral Close-Packed, and NaCl-type Close-Packed arrays. A Python-based lattice generator was developed to create these arrangements with variable sphere radii inside a selected region of interest (ROI). Generated lattices were imported into the Monaco Treatment Planning System for VMAT and IMRT planning. A prescription of 18 Gy to vertex regions and < 3 Gy to valley regions was applied. SFRT-specific metrics–Vertex-to-Peak Dose Ratio (VPDR), Dose Ratio (DR), Dose Ratio at 1.5 cm (DR1.5), and Equivalent Uniform Dose (EUD)–were calculated to assess dosimetric quality. Plan complexity was quantified using the Universal Complexity Metrics Extractor (UCoMX) along with Monaco's modulation indices and dose-per-MU values. Plans were delivered to a Sun Nuclear ArcCHECK phantom to obtain gamma passing rates. Correlations between plan complexity, dosimetric indices, gamma passing rates, and lattice geometries were evaluated using Spearman's rank correlation. One-way ANOVA determined statistical significance ($p < 0.05$). Results & Discussion Statistical analysis revealed significant variations in dosimetric and complexity metrics between lattice geometries. Correlation matrices identified specific arrangements offering superior dosimetric quality while maintaining acceptable complexity and delivery accuracy. Certain close-packed designs demonstrated a balanced trade-off between homogeneous coverage and reduced modulation complexity, improving clinical robustness. Conclusion Lattice geometry plays a significant role in influencing plan quality, complexity, and delivery accuracy in VMAT and IMRT-based LRT. Identifying optimal array designs can enhance treatment efficiency and dosimetric performance. Keywords Lattice Radiation Therapy (LRT), Spatially Fractionated Radiation Therapy (SFRT), plan complexity metrics

Oral Abstract

Oral Abstract ID: 01

Title: To develop and validate Knowledge based Planning of VMAT for Craniospinal Irradiation

Author Names: Udita Upreti

Co-Authors: Akhil P.K, Yashika, Abhishek Chatterjee, Tejpal Gupta, Rituraj Upreti

Full Abstract:

Introduction: Craniospinal Irradiation (CSI) involves large target volumes (brain and entire spinal cord) exceeding conventional treatment field size. VMAT planning of CSI poses challenges of dose homogeneity and OAR sparing over a large treatment volume with multiple isocentre and increased planning time. Present study was carried out to develop and validate Knowledge - Based Planning (KBP) model for CSI. Single optimization KBP plans were evaluated and compared with clinical treatment plans.

Materials and Methods: Twenty clinically approved VMAT plans of CSI using Eclipse v16.1 for Varian True Beam linear accelerator were selected for training of KBP model (Rapid Plan). Plans were made placing two to three isocenter with an incremental longitudinal shift of 25 cm. A constant lateral and vertical couch coordinates for each isocenter were maintained to enhance the setup and positional accuracy. Two full arcs for each isocenter were optimized using Photon Optimizer (PO) with Acuros algorithm, incorporating feathering for dose homogeneity at junctions for the prescription of 35Gy in 21 fractions. Rapid Plan involved data extraction, model training, and generation of DVH predictions and optimization objectives for new patients. Model validation was performed on 10 new patients by comparing single optimization KBP generated plans with clinically accepted plans. Plans were compared using dosimetric indices [Conformity Index (CI) and Homogeneity Index (HI)] and clinical goals of Planning Target Volume (PTV) of brain, spine and Organ at risks (OAR). Results The mean±SD of CI for total PTV (brain and spine) was 1.03 ± 0.018 and 1.055 ± 0.022 for KBP and clinical plans respectively. However, the mean±SD of HI was 0.087 ± 0.0095 for KBP and 0.082 ± 0.0067 for clinical plans. Variation in the mean prescription dose coverage of both individual PTV's was within 1% between two plans. KBP plans showed improved sparing of the thyroid and heart with19% and 8% reduction in mean doses, respectively. A 16% higher mean maximum dose was observed for the esophagus, while doses to the stomach & intestine and pancreas were reduced by 11% and 10% respectively. Dose constraints were met for all OARs, with comparable PTV coverage and OAR sparing between KBP and clinical plans.

Conclusion: Single optimized Knowledge-based planning for CSI produced plans comparable to clinical plans, showed its potential to optimize planning time and yielded consistent plan quality. Further refinement with additional patient data is needed to improve model robustness and achieve optimal clinical implementation.

Table:PTV and OAR does comparison for Clinical and KBP Plans

PTV Dose	Mean coverage (%) Clinical plan	Mean coverage (%) KBP plan
PTV BRAIN	97.36	96.62
PTV SPINE	97.21	96.52
OAR (organ at Risk)	**Mean Dose (cGy) Clinical plan**	**Mean dose (cGy) KBP plan**
Esophagus	1555.26	1544.26
Left Eye	1257.937	1264.81
Right Eye	1211.38	1241.75
Left Parotid	1067.142	1021.107
Right Parotid	1006.13	1043.55
Left Sub mandible	716.79	663.64
Right Sub mandible	713.066	660.884
Throid	1513.72	1218.272
Left Kidney	536.98	566.94
Right Kidney	542.409	571.064
Laryax	1521.546	1588.122
Left Lens	653.85	674.909
Right Lens	678.574	689.539
Pancreas	1067.14	1021.107
Stomach and Intestine	925.4	881.72
Heart	1010.51	928.436
Left Lung	678.534	689.54
Right Lung	797.69	812.78
OAR (organ at Risk)	**Max Dose (cGy)Clinical plan**	**Max dose (cGy) KBP plan**
Stomach and Intestine	2697.33	2384.515
Esophagus	2349.64	2735.17
Left Eye	2855.23	2886.45
Right Eye	2817.88	2868.01
Pancreas	2234.43	1996.48

Oral Abstract ID: 02

Title: Predicting pCR in LARC: Radiomic Modelling from Pre-Treatment CT Using an Automated Python Pipeline

Author Names: Liya Muthukulathil Antony

Co-Authors: Paola Francisca Caprile Etchart

Full Abstract:

Introduction and Objective: Total neoadjuvant therapy (TNT) followed by total mesorectal excision (TME) remains the standard treatment for patients with locally advanced rectal cancer (LARC). However, studies indicate that 15–30% of patients achieve a pathological complete response (pCR) following TNT–a status that can only be verified through examination of the resected surgical specimen. For this subset, undergoing TME may constitute overtreatment, exposing them to avoidable surgical morbidity. Radiomics offers a powerful, noninvasive approach to identify potential pCR responders before treatment. This study proposes a fully automated Python-based pipeline for radiomic feature extraction from CT images, aiming to develop a predictive model for pCR using machine learning (ML) techniques.

Materials and Methods: The Automated DICOM anOnymization and Radiomic feature Extraction for CT (ADORE-CT) is the Python-based pipeline we developed to automatically create binary label maps and extract radiomic features. To assess reliability, the labelmaps generated using ADORE-CT were compared with those from 3D Slicer using Dice similarity scores. Feature selection is performed through a multi-step process involving reproducibility assessment using the intraclass correlation coefficient, statistical significance testing via Mann–Whitney U test, univariate logistic regression analysis, and Spearman correlation filtering to remove redundancy. The features retained will be used to train ML classifiers for pCR prediction. Results and Discussions: Dice scores showed variability between labelmaps generated by ADORE_CT and 3D Slicer, with feature value differences reaching up to 19.8% and processing times extending nearly one hour. These discrepancies, often manifested as streaks and protrusions, were attributed to poor mesh quality generated during the "closed surface" pathway. Whereas the ADORE_CT demonstrated consistent and reproducible performance in automated radiomic feature extraction for all the cases. The "Ribbon Model" pathway within 3D Slicer yielded smoother binary masks and minimized software crashes; however, its elevated computational demands and default-disabled status limit accessibility for users unfamiliar with its advantages. Notwithstanding, ADORE_CT produced labelmaps closely aligned with those from the Ribbon Model, underscoring its stability and precision. These extracted features will be used to build an ML model aimed at predicting pCR from pre-treatment CT, which is currently under active development.

Conclusion: ADORE-CT presents a reproducible and scalable alternative to existing platforms. Accurate pCR prediction from CT-based radiomics may enhance individualized treatment planning, potentially sparing selected LARC patients from unnecessary surgery and its associated risks. Keywords: Machine Learning, Radiomics, CT, PCR, LARC.

Oral Abstract ID: 03

Title: Development of Knowledge based planning model for Prostate Node Positive Stereotactic Body Radiation Therapy with empty bladder v

Author Names: Reena Phurailatpam

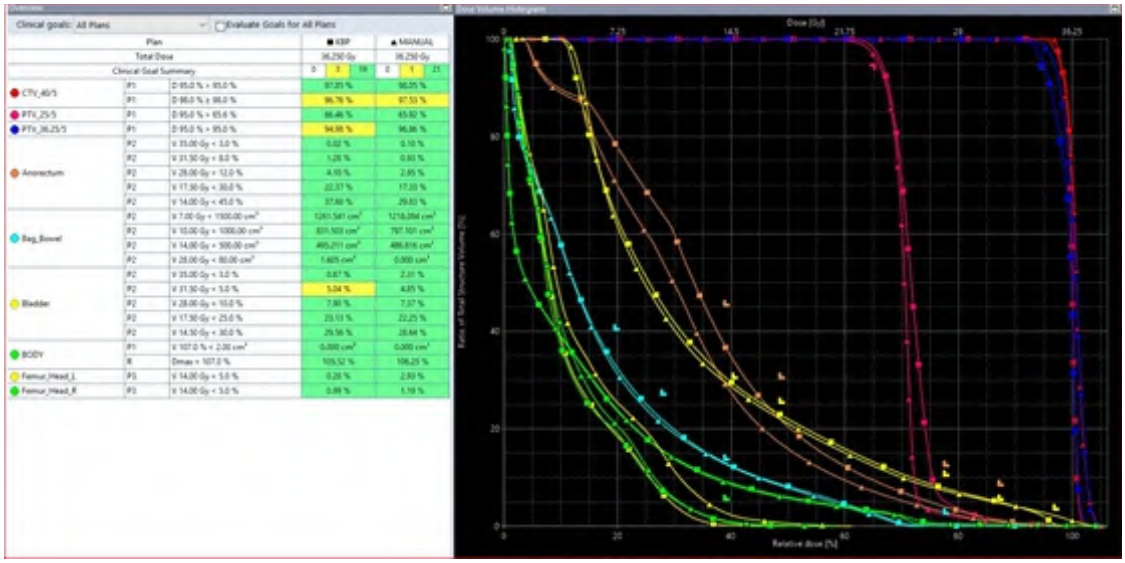
Co-Authors: Priyanka Halsana, Mahima Tiwari, Divya Patil, Jeevanshu Jain, Priyamvada Maitre , Vedang Murthy

Full Abstract:

Purpose: Prostate SBRT with full bladder protocol are associated with common problems that patients are unable to maintain consistent full bladder volume during planning and treatments. Bladder size obtained during the time planning CT does not represent the actual bladder volume at the time of treatment. The extent of daily IGRT corrections required for patients in the full bladder group was higher than the empty bladder group. Our aim is to develop and to validate Knowledge based planning (KBP) model for Prostate Node Positive Stereotactic Body Radiation Therapy with empty bladder Method: The KBP model was created by Varian Rapid PlanTM (V.16.1) using 36 clinical plans. Dose of 36.35 Gy in 5 fractions was prescribed at the prostate planning target volume (PTV 36.35) and Dose of 25 Gy in 5 fractions prescribed at the nodal region (PTV 25). Volumetric Modulated Arc therapy (VMAT) plans were generated with 10MV flattening filter-free beam with full arcs. The model was validated on 13 patients by comparing the plans generated by KBP with the clinical plans generated manually. Paddick conformity index (CI), homogeneity index (HI), Conformation Number (CN) for targets and dose to Organs at Risks (OARs) viz bladder, rectum, bowel and femoral heads were compared between clinical and KBP plans for each 13 patients. Statistical analysis was done using t-test or Wilcoxon signed-rank test.

Result: Out of 13 patients, nine KBP plans could achieved the Institutional clinical goals, and four patients could not achieve the clinical goals for bladder and achieve clinical goals for other OARs. Target coverage for PTV 36.25 and PTV 25 for both the plans were not significant different with CI of p=0.901 and 0.76 respectively. In addition, CN for PTV 36.25 and PTV 25 for both the plans were not significantly different with p=0.814 and 0.928 respectively. However, HI for PTV 36.25 was significantly better in KBP plans compared to the manual plans with p=0.032.

Conclusion: KBP model for the prostate node-positive SBRT with empty bladder created and validated. The KBP model could achieve consistent quality plans in lesser planning time than the manual plans. This empty bladder approach can provide better patient comfort and reproducibility during the whole treatment course.



Oral Abstract ID: 04

Title: A Comparative Analysis of Dose to Organs-at-Risk in Co60 HDR Brachytherapy for Cervical Cancer using the Monte Carlo toolkit egs_brachy and a Commercial Treatment Planning System

Author Names: Megha Rai

Co-Authors: Bhaveshwar Yadav, Shantanu Kumar Mishra

Full Abstract:

Introduction and Objective: Most commercial treatment planning systems for Brachytherapy rely on the AAPM TG 43 formalism for dose calculation. This formalism is based on the assumption that the entire treatment volume consists of water and fails to take into account tissue heterogeneities in the patient when calculating the dose distribution. The egs_brachy usercode of EGSnrc allows us to overcome this limitation by running monte carlo simulations with patient data while including different tissue densities in the calculation. This study evaluates dose estimates to organs-at-risk (OARs) in high-dose-rate (HDR) cervical brachytherapy using a commercial treatment planning system (TPS) based on the AAPM TG-43 formalism, and compares them with Monte Carlo (MC) simulations using the EGSnrc usercode, egs_brachy.

Methods: The analysis included 25 cervical cancer patients treated with Co-60 HDR brachytherapy. Dose distributions were initially calculated with the Sagiplan 2.2.1 TPS. Virtual patient phantoms were created using the egs_brachy user interface eb_gui from the CT image files, RTPLAN, and RTSTRUCT DICOM files exported from the TPS. Each voxel in the virtual phantom was assigned a tissue density based on the Hounsefield Unit (HU) data in the patient CT dataset and the default CT calibration curve provided with eb_gui. The RT STRUCT file gave information about the contours so that the bladder contour was assigned the tissue density for bladder, and the rectum contour was assigned the tissue density for rectum. The source dwell positions and dwell times were extracted from the RTPLAN file. The dose was then recalculated in the virtual phantoms using the same dwell positions and dwell times as in the clinical treatment. Dose parameters D2cc and D0.1cc were compared for the bladder, rectum, and sigmoid. Results: TPS-calculated doses were consistently higher than those from MC simulations. The mean percentage differences in D2cc were 2.59%, 5.12%, and 2.25% for bladder, rectum, and sigmoid, respectively. For D0.1cc, the mean percentage differences were 2.26%, 4.57%, and 2.40%, respectively.

Conclusion: The findings indicate that TPS calculations of dose based on the TG-43 formalism tend to be greater compared to MC simulations. This highlights the need for further studies on the influence of tissue heterogeneities on dose distribution in brachytherapy.

Keywords: HDR brachytherapy, AAPM TG-43, EGSnrc, egs_brachy, Monte Carlo simulations, tissue heterogeneities.

Oral Abstract ID: 05

Title: Design And Development of Interstitial-Intracavitary Gynaecological Brachytherapy Applicator

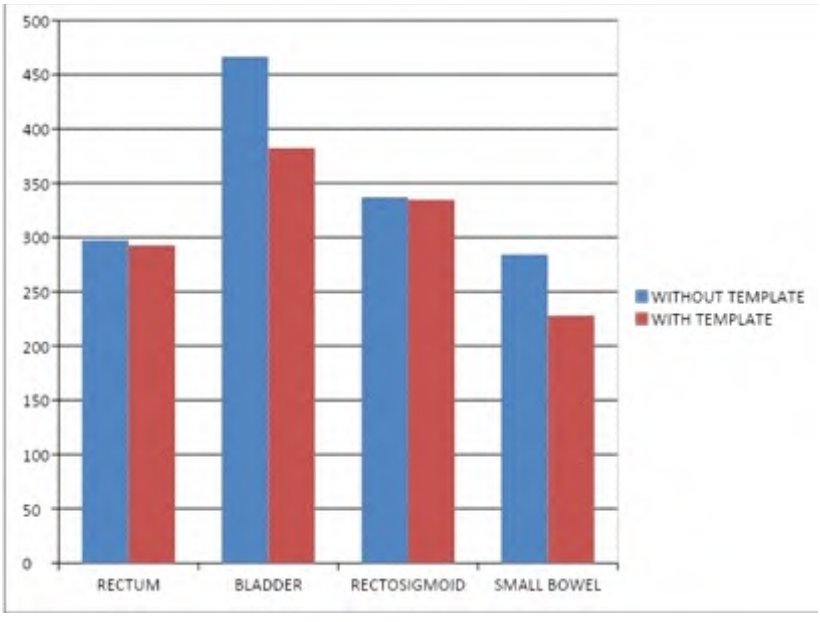
Author Names: Muthukarthikeyan G

Co-Authors: Harish Kumar M, Vivekanandan N, Velraj G

Full Abstract:

Introduction and Objective: Brachytherapy remains a critical modality in the management of gynaecological cancers, enabling high-dose delivery to tumor volumes while sparing organs at risk (OARs). The precision of dose distribution relies heavily on the design and placement of applicators. Commercially available applicators often present limitations in accommodating diverse pelvic anatomies and complex tumor geometries, particularly when both intra-cavitary and interstitial techniques are required. This study aimed to design, develop and evaluate a cost-effective, patient-adaptable, multi-channel brachytherapy applicator using 3D printing technology to enhance tumor coverage and reduce OAR doses.

Materials & Methods: A novel applicator was designed using CATIA V5 software after assessing the geometric and functional constraints of standard commercial devices. The design incorporated six catheter channels (four parallel and two oblique) to facilitate combined intra-cavitary and interstitial insertions. The prototype was fabricated using PLA filament on a Flash Forge Finder single-extruder 3D printer. Flexible catheters were inserted into the printed template, and the assembly was CT scanned using an OPTIMA GE 580 scanner. The applicator CT dataset was retrospectively registered with brachytherapy planning CTs from six previously treated patients in ECLIPSE V15.5. Treatment plans were created in ONCENTRA V4.6.3 using the new applicator geometry, a central tandem, and six catheters. Dose-volume histograms (DVHs) were generated to compare HR-CTV coverage and OAR doses (bladder, rectum, rectosigmoid, small bowel) between new applicator plans and original clinical plans without the 3D printed template. Results and Discussion Plans generated with the 3D printed applicator demonstrated improved dose conformity to the HR-CTV and a significant reduction in OAR doses across all six patients compared to their original treatment plans. The inclusion of oblique channels improved coverage for irregular tumor extensions, enabling better adaptation to individual anatomy. Enhanced geometric flexibility allowed for optimized dwell positions and dwell times, contributing to superior dose distribution. Conclusion The proposed 3D printed applicator offers an adaptable, low-cost solution for combined intra-cavitary and interstitial gynaecological brachytherapy. Its design overcomes anatomical and tumor geometry challenges, resulting in improved target coverage and reduced OAR exposure. It provides improved dosimetric outcomes, offering enhanced adaptability to patient anatomy and provides a cost-effective alternative to commercial applicators and potentially increases treatment outcomes.



Oral Abstract ID: 06

Title: Validity of using X-Ray Beam Calibration for Beta Dosimetry: An Uncertainty Analysis

Author Names: Harishchandra Gupta

Co-Authors: Aruna Kaushik, Sakshi Singhal, CP Bhatt, Piyush Sharma, Julipriya Jena, Manoj K Semwal

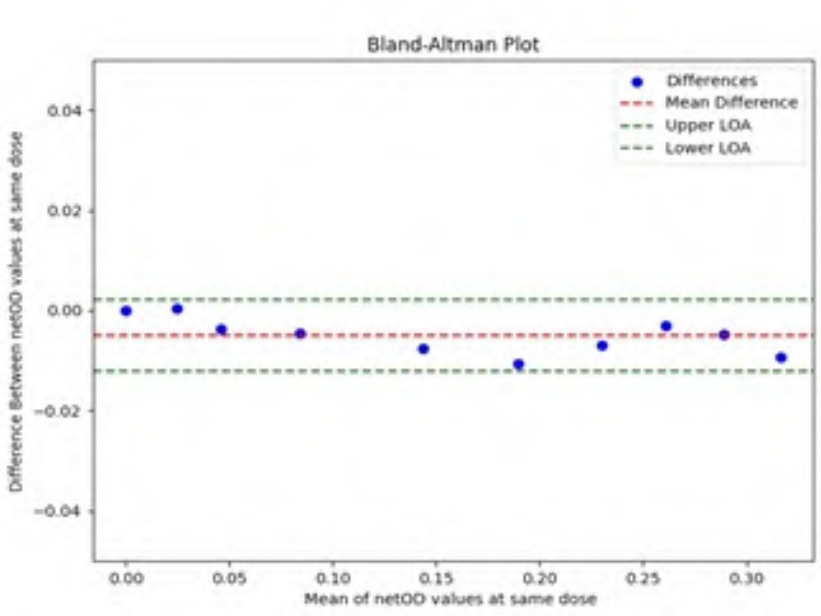
Full Abstract:

Introduction and Objectives: In clinical settings, electron and X-ray beams are commonly used for radiation treatment. Calibrated dosimeters are essential for accuracy in dose delivery. Film, diode, or any similar type of secondary dosimeter is generally calibrated with high-energy X-ray beams (MV) as a reference, even for beta/electron dosimetry. It is assumed that these dosimeters have similar responses to both types of radiation. We test the assumption experimentally by analysing the response of radiochromic film for X-rays and electron beams.

Materials and Methods: EBT4 radiochromic films were irradiated to radiation doses of 0, 0.25, 0.5, 1, 2, 3, 4, 5, 6, and 7 Gy using 6 MeV electron and 6 MV X-ray beams with SSD 100 cm and field size 10 × 10 cm². A water-equivalent solid phantom was used for irradiation at 5 cm depth for the X-ray beam and 1 cm depth for the electron beam. For each dose value, four films were irradiated. These films were then scanned in a flatbed scanner 36 hours post irradiation, and mean pixel intensities were obtained from the scanned images for computing the net optical densities (absorbance values). Dose-response curves were drawn by plotting absorbance values with dose for both the X-ray beam and the electron beam. The Bland-Altman plot was also drawn for comparison of the results.

Results & Discussion: The maximum percentage deviation of net optical density for the electron beam from the net optical density of the X-ray beam was 2.82% for all dose values. The difference in the net optical density lies within the 95% confidence interval from the mean of the difference for all dose values. Conclusions: Calibration performed using an X-ray beam can be reliably applied to beta dosimetry with an uncertainty within 5%.

Keywords: Fildom simetry, Bland-Altman plot, Calibration



Oral Abstract ID: 07

Title: Impact of Optimization Strategy on Dose Distribution in Intracavitary Brachytherapy for Cervical Cancer: Manual Versus Inverse Planning

Author Names: Sumanth G Madivala

Co-Authors: Nallapati Brahmaiah, Amrutha P, Susanjita Biswal, Nidhi Jain, Bhagyalakshmi At, Suresh Chaudhari

Full Abstract:

Introduction and Objective: High-Dose Rate (HDR) intracavitary brachytherapy (ICBT) plays a vital role in cervical cancer management. Optimization in treatment planning affects both target coverage and organ-at-risk (OAR) sparing. This study compares manual and inverse optimization techniques in HDR ICBT, with a focus on target coverage, OAR doses, and plan quality.

Materials and Methods: A retrospective analysis was performed on HDR ICBT plans of 20 cervical cancer patients prescribed 7 Gy per fraction. For each patient, two plans were generated using the same CT dataset: one with manual optimization and the other with inverse optimization using the VEGO TG-43 volume-based algorithm. Evaluated dosimetric parameters included: D90%(Gy), D100%(Gy) for high-risk clinical target volume (HR-CTV), D2cc(Gy) for bladder and rectum, Coverage Index (CI), Conformity Index (COIN), Dose Homogeneity Index (DHI), Overdose Volume Index (OI), Dose Non-uniformity Ratio (DNR), External Volume Index (EI), and Total Reference Air-Kerma (TRAK)(mGym2). Dwell time distribution was analyzed via the percentage increase of maximum dwell time in inverse plans compared to the average in manual plans. Paired t-tests were used for statistical analysis.

Results and Discussions: Inverse optimization led to a statistically significant enhancement in HR-CTV coverage, with D90% increasing by 2.24% ($p = 0.04$) and D100% by 7.21% ($p < 0.001$). CI also showed a significant improvement of 2.08% ($p < 0.001$), indicating better dose conformity. No significant differences were observed in bladder and rectum D2cc values, indicating comparable OAR sparing between the two planning approaches. Other dosimetric indices, including COIN, DHI, OI, DNR, EI, and TRAK showed no significant changes, confirming that inverse optimization maintains plan quality. The dwell time distribution showed a mean increase of 105.61% in inverse plans, with 50% of patients exhibiting increases greater than 100%. This reflects benefits in dose shaping but highlights the need for caution to avoid potential hotspots.

Conclusion: Inverse optimization in HDR ICBT improves target coverage while preserving OAR sparing and plan quality. Its dosimetric advantages and planning efficiency support routine clinical adoption, though careful control of dwell times is advised.

Keywords: HDR Brachytherapy, Cervical Cancer, Inverse Optimization, Dosimetric Comparison

Oral Abstract ID: 08

Title: Evaluating the feasibility of beam matching between independently commissioned proton therapy gantry treatment rooms

Author Names: Lalit Chaudhari

Co-Authors: Vysakh Raveendran, A. Chithambara Prabu, Lilawati Meena, Prakash Shinde

Full Abstract:

Purpose/Objective: Proton beam matching lacks standard guidelines and sufficient literature. This study evaluates the feasibility of beam matching between two independently commissioned gantry treatment rooms (GTRs) in a multi-room proton therapy facility.

Materials/Methods: The study was conducted in two GTRs of an IBA Proteus Plus proton therapy facility. During the commissioning of GTR2, its dosimetric parameters were measured and compared to those of the previously commissioned GTR3. Parameters such as Range, Spot size, and absolute output for GTR2 were measured across 33 energies and adjusted to match with GTR3 following beam-matching criteria before beam model generation. Separate beam models were for each gantry and analyzed for dosimetric consistency. Beam model validation adhered to AAPM TG-185 guidelines. The feasibility of patient interchangeability was assessed through in-air measurements using 2D scintillation detectors, patient-specific QA (PSQA) measurements in homogeneous water phantoms, and heterogeneous pig head phantoms with a 2D detector array. This involved irradiating and comparing specific spot patterns, homogeneous dose cubes, and clinical treatment plans with the designated beam models and swapping machines during irradiation. Results: The beam energy-related parameters, such as Range (Distal R90%), Bragg peak width, Dose Distal fall-off (R80%-R20%), and Surface dose (Dose at 4.5 mm and Dose at 1 cm), were compared, and the maximum differences observed were -0.5 mm, 0.2 mm, -0.1 mm, -0.39%, and -0.45%, respectively. All values were within the established tolerance limits. The central spot sizes (σ_x, σ_y) at the isocenter (IC) and two other planes (±20 cm from IC) were compared. All energies, except 215 MeV at the IC plane (σ_x,: -0.28 mm (-9.83%)), were within the ±5% or ±0.25 mm tolerance, and spot sizes at other planes were within tolerance for all energies. Measurements for 12 gantry angles at IC plane showed median spot sizes within tolerance. The maximum variation in absolute beam output was -0.46% (±1% tolerance). When recalculated by swapping the respective beam models, the treatment plans showed hardly any dosimetric differences in Target coverage or normal tissue doses, as shown in Figure 1. The PSQA results were well within the AAPM TG-218 [4] tolerances for homogenous and heterogenous medium measurements. Conclusions: The feasibility of beam matching was confirmed through the interchange of TPS beam models and PSQA in both homogeneous and heterogeneous media. Patient interchangeability between treatment rooms is achievable, provided consistency in validated measurement data is maintained, especially after each preventive maintenance.

Homogenous dose cube measurements in water phantom with 2D array				PSQA in water phantom with 2D array					PSQA in Pig head measurements with 2D array			
Sr. No.	Plan name	Depth in cm	Gamma Passing (3% 2mm)	Sr. No.	Plan/Site name	Beam name	Depth in cm	Gamma Passing (3%;2mm)	Sr. No.	Plan name	Beam name	Gamma Passing (3%2mm)
1	10X10X10 Low Range Cube	6	100.00%	1	CNS	G180	3	100.00%	1	AP Beam	AP Beam	100.00%
		8	96.70%				4.5	100.00%	2	2 Field_SFO	RAO	97.00%
		10	99.60%				6	100.00%			LAO	97.00%
		12	100.00%			G285	3	100.00%	3	2 Field_MFO	RAO	98.60%
		14	100.00%				4.5	100.00%			LAO	100.00%
2	10X10X10 Medium Range Cube	11	100.00%	2	Pelvic	G45	8	100.00%	4	3 Field_SFO	RAO	99.40%
		13	100.00%				3	100.00%			LAO	96.50%
		15	100.00%				10	100.00%			ANT	100.00%
		17	100.00%				15	100.00%	5	3 Field_MFO	RAO	100.00%
		19	100.00%			G90	3	100.00%			LAO	99.30%
3	10X10X10 High Range Cube	21	100.00%				7	100.00%			ANT	100.00%
		23	100.00%				14	100.00%	6	3 Field_NC_MFO	RAO	100.00%
		25	100.00%			G170	3	100.00%			LAO	98.60%
		27	100.00%				9	100.00%			VERTEX	100.00%
		29	100.00%				14	100.00%	7	2 Field with range shifter	RAO	99.00%
				3	Semicona	G165	3	96.60%			LAO	98.00%
							12	97.80%	8	2 Field with large airgap and range shifter	AP	100.00%
							14.48	99.40%			LAO	94.60%
						G195	3	95.70%			RAO	100.00%
							10.5	97.20%				
							14	98.30%				

Oral Abstract ID: 09

Title: Design, Manufacturing and Validation of Hybrid Apertures for Stereotactic Treatments with Pencil Beam Scanning Proton Therapy

Author Names: Kantaram Popat Darekar

Co-Authors: Umesh Bharat Gayake, Lalit Chaudhari, Siddhartha Laskar, Sanjay D. Dhole, Bhushankumar J. Patil

Full Abstract:

Introduction and Objectives: Stereotactic treatments using pencil beam scanning (PBS) proton therapy present specific challenges, particularly in minimizing the lateral penumbra due to the physical characteristics of proton beams. One established method for improving penumbra sharpness is the use of brass metallic apertures. This work aims to design, fabricate, and experimentally validate a cost-effective shell-and-core hybrid aperture system–featuring a stainless-steel outer shell and a brass inner core–for stereotactic PBS proton therapy. The goal is to assess both the mechanical and dosimetric performance of these apertures as a potential alternative to standard full-brass apertures.

Materials and Methods: Six circular, cylindrical brass core apertures were designed, with a thickness of 4 cm, an outer diameter of 100 mm, and central opening diameters ranging from 10 mm to 35 mm in 5 mm increments. A stainless-steel ring was designed to encase and support the brass core, ensuring compatibility with a dedicated PBS scanning nozzle (Proteus Plus 235, IBA, Belgium). The mechanical components were designed using AutoCAD 3D and fabricated via CNC machining. Elemental composition of the brass cores was determined through Energy Dispersive X-ray (EDX) analysis. The water equivalent thickness (WET) of the cores was measured at multiple proton beam energies using a Giraffe Multi-Layer Ionization Chamber (IBA Dosimetry, Germany). Isocentre accuracy was evaluated using a Lynx 2D scintillation detector (Fimel, Paris, France) with MyQA software (IBA Dosimetry, Germany) for a 70.18 MeV beam at gantry angles of 0°, 90°, and 270°, across snout positions with 5–30 cm air gaps.

Results and Discussion: All apertures were fabricated within ±0.5 mm of design specifications. EDX analysis confirmed the brass composition to be 60% Cu and 36% Zn. The measured WET values for the brass cores were 22.8, 22.6, and 22.6 g/cm² for the 226.2, 200, and 190 MeV beams, respectively. So, the aperture can be used clinically for proton beams with ranges up to ~20 g/cm², allowing an adequate safety margin beyond the practical range. Isocentre accuracy deviations were 0.9 mm for all measurements, remaining within the ±1 mm clinical tolerance. Conclusion: A cost-effective shell-and-core hybrid aperture system for stereotactic PBS proton therapy was successfully designed, fabricated, and mechanically validated. Initial dosimetric tests demonstrated performance comparable to standard apertures. With further comprehensive validation for beam data commissioning and TPS dose modelling, these apertures may serve as a practical clinical alternative in stereotactic proton therapy.

Keywords: pencil beam scanning proton therapy, apertures, Stereotactic treatments

Oral Abstract ID: 10

Title: A Comparative Evaluation of Multiple Detectors in Dosimetric Parameters Using Flattening Filter Free Photon Beams for High Precision Radiotherapy

Author Names: Ms. Syed Fiza Mohammed Aslam

Co-Authors: Dr. Athiyaman. M, Dr. Hemalatha. A, Mr. Premkumar P, Mr. Chandrasekar G, Dr. Neeti Sharma, Dr. Shankar Lal Jakhar, Dr. Kamlesh Kumar Harsh

Full Abstract:

Introduction and Objectives: This study aimed to measure and compare the performance of multiple radiation detectors in estimating the dosimetric parameters for high precision radiotherapy techniques and to identify the optimal detector for each specific parameter.

Materials and Methods: The measurements were performed using 6 MV and 10 MV flattening filter-free (FFF) photon beams on a Varian TrueBeam SVC linear accelerator. Three detector systems, namely, a microvolume ionization chamber (IBA CC01), a cylindrical ionization chamber (IBA CC13), and a p-type silicon diode detector (IBA PFD), were used in common to perform small-field output factor measurements across field sizes ranging from 0.5 × 0.5 cm^2 to 5 × 5 cm^2 and at the reference 10 × 10 cm^2; couch transmission factor at 10 × 10 cm^2 field size; and gantry angular dependence at gantry angles 0°, 90°, 180°, and 270° for a 10 × 10 cm^2 field size. Additionally, surface dose at 0.5 cm depth was measured using a diode detector (IBA PFD) and a parallel plate chamber (IBA PPC40) for field sizes of 4 × 4 cm^2, 5 × 5 cm^2, 7 × 7 cm^2, and 10 × 10 cm^2. All measurements adhered to established protocols from AAPM Task Group reports (TG-51, TG-106, TG-142, TG-155) and incorporated stereotactic-specific guidelines from TG-101 and TG-135 to ensure accuracy and reliability.

Results and Discussion: For both beam energies, all three detectors showed increasing output factor with field size, converging at the reference field. Pronounced variations were seen in sub-centimeter fields, with reduced differences at larger sizes. Couch transmission factor values were consistent between ionization chambers, while the diode measured slightly lower. Gantry angular dependence measurements demonstrated minimal variation for all detectors, with stable performance across tested angles. Surface dose readings were consistently higher with the diode compared to the parallel plate chamber, with minimal variation across field sizes for both detectors. The dosimetric parameters were analyzed with the Friedman test, which showed a significant difference between the detectors. Conclusion: The microvolume chamber is recommended for fields above sub-centimeter dimensions, while the diode is preferable for sub-centimeter fields, for small-field output factors. Couch transmission factor evaluation should be performed with ionization chambers for higher reproducibility. Gantry angular dependence can be reliably measured with any tested detector, with the diode offering marginally better stability. Surface dose estimation is best performed with the diode chamber.

Keywords: Microvolume chamber, CC13 chamber, Diode detector, FFF photon beams.

Oral Abstract ID: 11

Title: A Dosimetric and Plan Quality Comparison of the VOLO Classic and VOLO Ultra Optimization Algorithms for Total Marrow and Lymphoid Irradiation (TMLI)

Author Names: Dr Dayananda Shamurailatpam Sharma

Co-Authors: Dr Arjunan Manikandan, Dr Ganapathy Krishnan, Dr. Sham Sundar, Dr.Srinivas Chilukuri

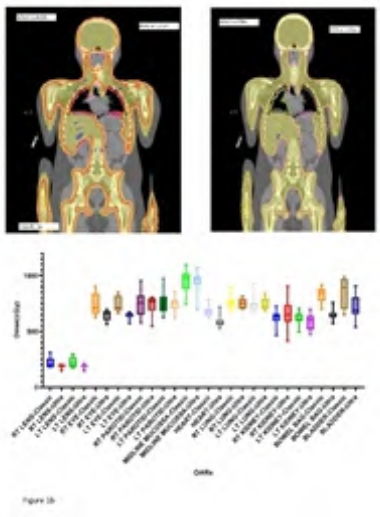
Full Abstract:

Introduction and Objectives: Total Marrow and Lymphoid Irradiation (TMLI) is a highly complex, high-precision radiotherapy technique that involves the meticulous optimization of very large target volumes closely surrounded by multiple critical organs at risk (OARs). This demands significant optimization effort and computing resources. This study evaluates the performance of the newly implemented VOLO Ultra optimization algorithm and compares it with VOLO Classic, with a particular focus on plan quality, optimization efficiency, and treatment delivery time.

Materials and Methods: Eleven patients undergoing TMLI were included in this study. Delineation of target and OARs were performed following institutional protocol. Treatment plans for each patient were created using same optimization settings in both VOLO Classic and VOLO Ultra algorithms within the Accuray Precision Treatment Planning System. VOLO Ultra utilizes an advanced L-BFGS-B–based optimizer in combination with the fluence-convolved broad-beam (FCBB) algorithm, whereas VOLO Classic employs a conventional optimization approach. Dose was prescribed at 12 Gy in six fractions. The outcome of the treatment plans was compared based on planning target volume (PTV) coverage, mean and maximum OAR doses, optimization time and beam-on time (BOT). Quantitative comparisons of plan quality, computational efficiency, and delivery parameters between the algorithms were performed using appropriate statistical tests in GraphPad Prism.

Results and Discussion: (Figure 1a) illustrates the comparative dose distributions obtained from VOLO Classic and VOLO Ultra optimizations for a representative patient, while (Figure 1b) presents the box plots of OAR mean dose. The results indicate comparable and clinically acceptable target coverage, with no statistically significant differences in PTV coverage (D98%, D95%). However, VOLO Ultra plans produced a significantly lower V107 ($p < 0.00023$). Compared to VOLO Classic, VOLO Ultra achieved significantly lower mean doses to the eye ($p = 0.0018$), lens ($p = 0.0211$), heart ($p = 0.0029$), bowel bag ($p = 0.0001$), and urinary bladder ($p = 0.0011$). Mean and maximum dose differences to other OARs such as lung, parotid, midline mucosa and kidney were not statistically significant (Figure 1b). Furthermore, VOLO Ultra demonstrated an average reduction of 84.01% in optimization time and 5.24% in beam-on time. Conclusion In TMLI planning, VOLO Ultra demonstrated markedly improved computational efficiency along with comparable or enhanced dosimetric outcomes relative to VOLO Classic, indicating its potential as a valuable solution for centres seeking to optimize workflow without compromising plan quality.

Keywords: TMLI, VOLO Ultra, VOLO Classic, Tomotherapy, treatment planning optimization, OAR sparing



Oral Abstract ID: 12

Title: Evaluating Mean Heart Dose as a Predictor of Cardiac Substructure Exposure in Left-Sided Breast Cancer Radiotherapy

Author Names: Dr. Deepali Bhaskar Patil

Co-Authors: Dr. Mukesh Kumar Zope, Dr. Rishi Raj, Prof. (Dr.) Rajesh Kumar Singh, Prof. (Dr.) Seema Devi

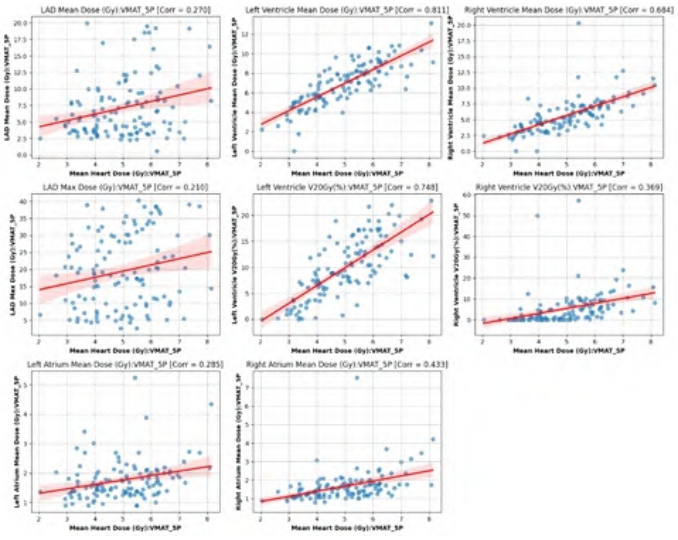
Full Abstract:

Introduction and Objectives: Cardiac toxicity continues to be a major issue in radiotherapy for left-sided breast cancer, with radiation-induced heart disease being a leading factor in long-term morbidity. The mean heart dose (MHD) is typically used as a surrogate marker for assessing cardiac risk, however, its accuracy in predicting exposure to individual cardiac substructures is not well established. This study investigates the dosimetric relationship between MHD and the doses to cardiac substructures across different volumetric modulated arc therapy (VMAT) planning techniques to evaluate the effectiveness of MHD as a thorough cardiac risk predictor.

Materials and Methods: A retrospective dosimetric study was performed on 128 patients diagnosed with left-sided breast cancer who underwent adjuvant hypofractionated radiotherapy (40 Gy delivered in 15 fractions of 2.67 Gy). Three VMAT planning methods were evaluated: 2-partial arc (VMAT_2P), 4-partial arc (VMAT_4P), and 5-partial arc (VMAT_5P). Cardiac substructures, including the left and right ventricles, left and right atrium, and the left anterior descending artery (LAD), were contoured established protocols. The dosimetric parameters analyzed included mean doses, V5Gy, V10Gy, V20Gy, and maximum doses for each substructure. To evaluate the relationships between mean heart dose (MHD) and the doses to individual cardiac substructures, Pearson correlation coefficients, the coefficient of determination (R^2), and predictive reliability measures were computed, with statistical significance defined as $p<0.05$.

Results and Discussion: Strong correlations ($r > 0.7$) were found between MHD and the mean dose to the right ventricle across all VMAT techniques (VMAT_2P: r=0.797, p<0.001; VMAT_4P: r=0.626, p<0.001; VMAT_5P: r=0.684, p<0.001). The mean dose to the left ventricle showed the strongest correlation with MHD in the VMAT_4P and VMAT_5P techniques (r=0.808 and r=0.811, respectively, p<0.001). Conversely, significantly weaker correlations were observed for LAD doses (r=0.246-0.363, p<0.05) and atrial exposures (r=0.287-0.501, p<0.05), indicating that MHD has limited predictive capability for these important structures. VMAT_5P demonstrated enhanced predictive reliability for left ventricle V20Gy (r=0.749, R^2=0.560), indicating better control over dose distribution and spatial optimization. Conclusion This analysis reveals the variability in the predictive ability of MHD across cardiac substructures, with significant correlations found in ventricular structures (r>0.7) but weaker in the LAD and atrial regions (r<0.5). MHD alone may not be sufficient for effective cardiac risk stratification in the context of left-sided breast cancer radiotherapy. Multi-arc VMAT, particularly VMAT_5P planning, enhances predictability. These findings support the need to incorporate substructure-specific dose constraints alongside MHD to enhance cardiac protection and long-term outcomes.

Keywords: Left-sided Breast cancer,



Oral Abstract ID: 13

Title: Development of graphite thin-walled homogeneous spherical ionization chamber for dosimetry of kilovoltage x-ray beams

Author Names: Sudhir Kumar

Co-Authors: Rahul K Chaudhary, S D Sharma, B K Sapra

Full Abstract:

Background/Objective: Measurement of radiation dose to the patient is important both from imaging and patient safety point of view. Imaging dose to the patient should be measured with the highest possible accuracy. Dosimetry of kilovoltage (kV) x-rays is challenging because the response of practical radiation detectors generally has a marked energy dependence for kV x-rays (upto 150 keV). A graphite thin-walled homogeneous spherical ionization chamber (GTHSIC) was designed and fabricated for use as an absolute dosimeter to measure air-kerma rate from cone beam computed tomography (CBCT) unit. The newly developed GTHSIC is nearly energy independent dosimeter.

Materials and Methods: The GTHSIC has nominal diameter of 56 mm and the graphite wall thickness of 2.1 mm. Main components of this chamber are wall and central electrode (graphite, ρ = 1.9 g cm-3), insulating ring (Teflon) and a guard ring (copper). A ventilating hole is also created at the right side of the bottom of the chamber. The electrical connections to the wall, central electrode and guard ring have been provided. The guard ring connection surrounding the central electrode has been extended up to the active air volume in order to achieve the smaller pre-irradiation effect so that the stable reading could be obtained quickly. The sensitive cavity is surrounded almost completely by graphite with only a small amount of insulating material exposed at the bottom of the central electrode to maintain as a Burlin general cavity. The nominal estimated volume of the chamber is around 91 cm3. Basic dosimetric characteristics and inverse square law (ISL) validity were evaluated experimentally using 100 kVp diagnostic x-ray beams generated using Polydoros-LX diagnostic x-ray machine. Chamber was operated at an applied potential of 400 V for all the measurements.

Results: Charge leakage, precision, linearity, stability and ISL validity of the GTHSIC were found equal to 0.02%, 0.03%, 0.02%, 0.1% and ±0.5% respectively. The measured dosimetric characteristics of this chamber are in conformity with requirements specified in IAEA TRS-374 which indicates that the chamber fulfills the requirement of absolute dosimeter for dosimetry of kV x-ray beams.

Conclusions: The performance of the developed GTHSIC was found satisfactory as per design and expectation and qualified to be used as an absolute dosimeter for the measurement of air-kerma from the CBCT x-rays. Having the uniform response, this GTHSIC will help in enhancing the accuracy in imaging dose determination to the cancer patients treated by the image guided radiotherapy technique.

Oral Abstract ID: 14

Title: Management and maintenance of radio-diagnostic machines in a large clinical setup

Author Names: Raj Kishor Bisht

Co-Authors: Sneha Theres, Deepika S , Thamarai Selvi, Karan Verma, Sushma Rani Mandal, Avinav Bharti, Pratik Kumar

Full Abstract:

Introduction and Objectives: The maintenance of radiological-machines through periodic inspections of the installation and prior management for quality imaging is equally important, following the regulatory quality assurance (QA) and quality control tests. The presented study incorporates the use of metadata in the maintenance of a large number of radio-diagnostic machines, besides the regulatory mandate.

Materials and Methods: Substantial information of 190 radio-diagnostic machines, including X-ray, fluoroscopy, CT, mammography, DEXA, and dental-equipment, was listed to prepare a metadata sheet in Excel. The data includes information on regulatory mandates, operational, and validated machine status. Official documentations, informal correspondence, chief complaints, "to-do list", and regulatory information are elementary factors of the collected vital record. Machine-Learning (ML) models were trained on the historical QA data collected to predict various dosimetric results and trends for advanced management.

Results and Discussion: The data was created with extreme care and maintained for a long period. The metadata was powered using various practical legends for all equipment and trained to rigorously prepare data. A controlled knowledge of mathematical and statistical modelling was applied to achieve preliminary modest aims. Tables, inter-departmental correspondence, and decisive remarks were also mentioned to create a robust database. The data and foremost remarks are audited monthly. The metadata sheet was able to demonstrate the regulatory and operational status of each equipment. The status of the equipment can be inspected for the regulatory steadiness such as procurement, installation, licensing, QA, non-compliance, safety and decommissioning etc., whereas major repair of the installation, equipment, service reports, status of quality assurance agency, radiation survey, safety checks, essential documentation, downtime, equipment age, trend and its behaviour at once convenience. In addition to the elementary maintenance, metadata support in an initial study on ML, where various models, able to identify the dosimetric status and make predictions on equipment health.

Conclusion : Routine and regulatory QA of diagnostic X-ray equipment is essential to ensure the quality and radiation safety of the patient and staff. Maintenance of all radiation-generating equipment through the proposed metadata sheet helps in tracking the problem well timed, prompt service, machine status, and rectification of encountered issues. ML algorithms certainly aid in early detection of performance drifts, proactive maintenance, and lowering the machine downtime. Future studies on real-time monitoring using sophisticated AI methods will certainly improve timely notification and overall performance of equipment.

Keywords: metadata, machine learning, quality assurance

Oral Abstract ID: 15

Title: Comprehensive Dosimetric Evaluation of Integral Dose and Intermediate Dose Spill in HyperArc vs. Conventional VMAT for Brain Metastases SRS

Author Names: Srimanta Pramanik

Co-Authors: Dr. Dilip Kumar Ray, Dr. Sayan Das, Dr. Debanjali Dutta, Subhabrata Ghosal, Abhinandan Pal, Meghna Mukherjee

Full Abstract:

Introduction and Objectives: Stereotactic radiosurgery (SRS) is a cornerstone in the management of brain metastases, providing focused, high-dose radiation while sparing surrounding tissues. This study compares HyperArc VMAT (HA_VMAT) and conventional VMAT (C_VMAT) techniques, emphasizing their performance in sparing healthy brain tissue, integral dose reduction, and intermediate dose control.

Materials and Methods: This retrospective dosimetric study included 18 patients with one or more brain metastases, all treated clinically with HA_VMAT. For comparative analysis, corresponding C_VMAT plans were retrospectively created using the same datasets. Treatment planning was performed in Eclipse Planning systems with 6 MV FFF beams on a TrueBeam STx linear accelerator (Varian Medical Systems). Dosimetric indices–Conformity Index (CI), Paddick CI, Gradient Index (GI), Homogeneity Index (HI), integral dose, and monitor units (MU)–were evaluated. Intermediate dose spill was assessed via DVH analysis from V2Gy to V16Gy for brain, brain-GTV, and brain-PTV structures. Statistical significance was determined using paired t-tests and Wilcoxon signed-rank tests ($p < 0.05$).

Results and Discussion: HA_VMAT yielded a significantly lower Gradient Index (2.735 vs. 2.907; $p = 0.037$) and integral dose (2.58 ± 1.08 Gy vs. 2.79 ± 1.13 Gy; $p = 0.0031$) compared to C_VMAT. Moreover, it showed meaningful reductions in intermediate dose volumes (V2Gy–V12Gy), particularly in brain-PTV and brain-GTV regions ($p < 0.05$), indicating better normal tissue sparing. While CI, Paddick CI, HI, and MU values did not differ significantly between the two techniques, this suggests that the improvements in dose gradient and integral dose with HA_VMAT did not compromise plan quality or delivery efficiency. These findings highlight HA_VMAT's ability to deliver sharper dose fall-off, which is crucial in brain SRS where adjacent critical structures are highly sensitive. The lower integral dose supports its potential to reduce radiation-induced toxicities such as radio-necrosis and long-term cognitive impairment. Strong positive correlations ($r > 0.91$, $p < 0.001$) between HA_VMAT and C_VMAT plans confirm consistency in dosimetric behaviour, further validating HA_VMAT as a reliable planning strategy.

Conclusion : HA_VMAT offers distinct dosimetric advantages over conventional VMAT in brain metastases SRS by reducing intermediate and integral doses while maintaining treatment precision. These benefits make it a preferred option for maximizing tumour control and minimizing adverse effects. Prospective studies with clinical outcome data are warranted to confirm these findings and assess their translational impact

Keywords: HyperArc-VMAT, Brain Metastases, Integral Dose, Stereotactic Radiosurgery, Intermediate Dose Spill

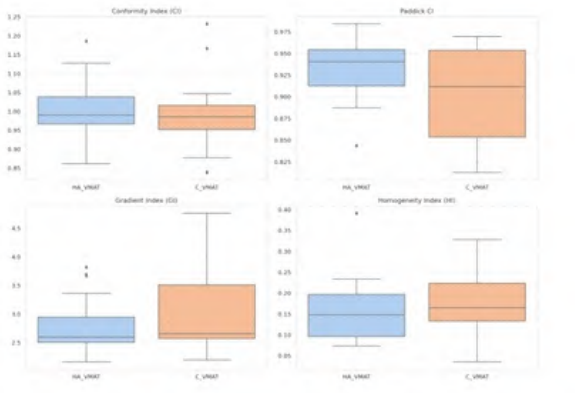


Figure 1. *Boxplot analysis of key dosimetric indices for HA_VMAT and C_VMAT plans.* The figure compares the dosimetric performance of HA_VMAT and C_VMAT techniques using four indices: Conformity Index (CI), Paddick Conformity Index (PCI), Gradient Index (GI), and Homogeneity Index (HI). Each boxplot shows the median, interquartile range, and outliers.

Oral Abstract ID: 16

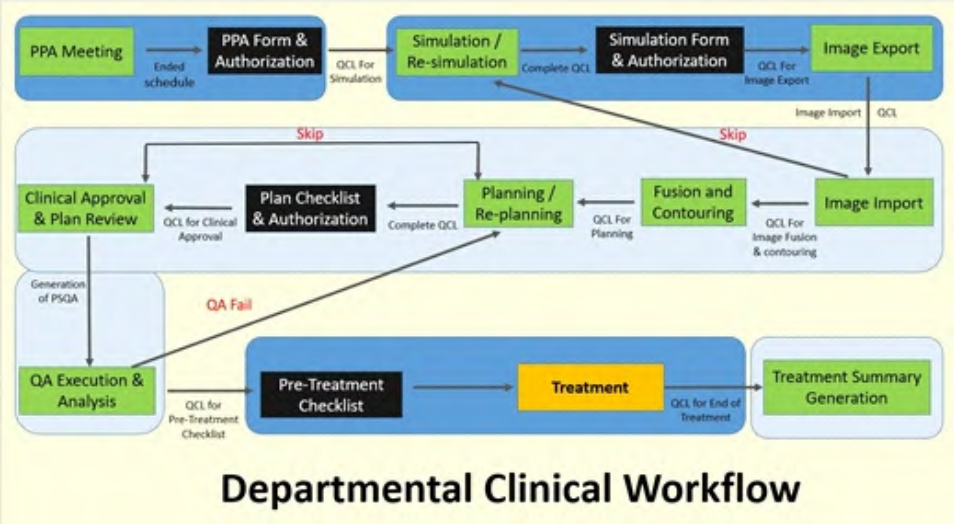
Title: Adoption of Automated Paperless Workflow in Proton Therapy: A Review of the First Two Years

Author Names: Kantaram Popat Darekar

Co-Authors: Vysakh Raveendran, Rachana Kulkarni, Abhijit Powar, Nanasaheb Khatik, Dr. Shwetabh Sinha, Lalit Chaudhari, Dr. Siddhartha Laskar

Full Abstract:

Purpose: The conventional workflow in radiation oncology departments, which predominantly relies on manual and paper-based processes, presents inherent vulnerabilities to human error and process inefficiency. Proton therapy, as a resource-intensive and highly precise modality, necessitates the coordinated efforts of specialized, highly trained staff. The objective of this study is to design, implement, and rigorously evaluate a paperless workflow system utilizing a dedicated Oncology Information System (OIS), aiming to streamline clinical operations, optimize workflow efficiency, and reduce the incidence of manual errors throughout the patient care continuum. Materials and Methods: A multidisciplinary team comprising radiation oncologists, medical physicists, and radiation therapy technologists collaboratively designed the framework through structured brainstorming sessions based on AAPM Task Group (TG)-272 and TG-100 reports. Mosaiq® OIS (Version 2.83, Elekta Inc., California, USA) was utilized to implement the proposed workflow. The implementation involved customizing Mosaiq® OIS using various modules and functionalities with department-specific IQ scripts, eScribe templates, assessment forms, and quality control lists (QCLs). Multiple process flowcharts at virtual workspaces were designed and customized to replicate department-specific clinical practices. Results: Comprehensive workflow automation was achieved through the development of 41 IQ scripts, enabling logical task transitions from pre-planning audits to treatment completion. Additionally, 30 QCLs were implemented for critical clinical milestones including pre-planning meetings, imaging, contouring, treatment planning, plan verification, quality assurance (QA), and pre-treatment checks. Furthermore, 20 task-specific assessment forms (simulation, prescription, QA analysis, and plan technical checks, etc.) and three e-Scribe templates (consent form, treatment summaries, etc.) were integrated within the system to ensure structured data capture across all treatment stages. Between August 2023 and August 2025, 541 patients were successfully treated using the automated workflow. System utilization metrics demonstrated extensive adoption across all clinical processes, with 13,721 completed QCLs documented, including 1,043 treatment planning, 502 adaptive/re-planning QCLs, 674 simulation checklists, 969 image fusion and contouring tasks, 843 physics reviews, and 780 pre-treatment checklists. Additionally, 1,594 electronic assessment forms and 13,789 daily treatment records were captured digitally. The structured and automated task assignment system ensured complete traceability, consistency, and compliance with established safety protocols throughout the treatment process. Conclusion: The successful implementation of a fully automated, paperless workflow utilizing Mosaiq® OIS was achieved in a newly established proton therapy center. This digital workflow transformation significantly enhanced multidisciplinary coordination and streamlined patient data access, resulting in improved operational efficiency, enhanced accuracy in clinical processes, comprehensive record-keeping capabilities, and elevated patient safety standards in proton therapy delivery.



Departmental Clinical Workflow

Oral Abstract ID: 17

Title: Advancing AI-Based Parotid Segmentation: Role of Composite Loss Functions in 3D U-Net Models

Author Names: Dr. Mohini Manab

Co-Authors: Dr. Anuj Kumar, Mr. Sandeep Kumar, Ms. Soniya Pal, Vadhiraja B M, Manindra Bhushan, Anuj Vijay, Raj Pal Singh, Riyas M

Full Abstract:
Advancing AI-Based Parotid Segmentation: Role of Composite Loss Functions in 3D U-Net Models Introduction and Objective Artificial Intelligence (AI) methods are increasingly being integrated into radiotherapy workflows to improve accuracy, efficiency, and reproducibility. In particular, deep learning models such as 3D U-Nets have shown promise in the automatic segmentation of organs-at-risk (OARs), including the parotid glands in head-and-neck CT imaging. Despite architectural advances, the choice of loss function remains a key factor in determining segmentation performance, especially for small and imbalanced structures. The object of the study is to evaluate the impact of three different composite loss functions on the segmentation quality of a fixed 3D U-Net model for the parotid glands. Materials and Methods All three models modelA, modelB and modelC in this study shared the same 3D U-Net architecture and three different loss function. CT volumes were preprocessed and uniformly padded before training. The modelA employed a class-weighted Dice loss to manage class imbalance, modelB combined Dice and Focal losses, equally weighted and model C integrated Dice, Focal, and Tversky losses, each contributing equally. Class weights were set to 0.1 for background and 0.45 for each parotid gland. Segmentation performance was assessed using Dice Similarity Coefficient (DSC) and Intersection over Union (IoU), reported separately for both glands and as average scores. Results and Discussions The model C consistently outperformed the other two models. It achieved the highest Dice Mean (0.8663) and IoU Mean (0.7679) for the right parotid and showed strong results for the left parotid (Dice Mean 0.8411, IoU Mean 0.7378). When averaged across both glands, Model C had the best overall Dice (0.8537) and IoU (0.7528) scores, along with lower standard deviations, indicating higher reliability. The highest Dice Median (0.8716) and IoU Median (0.7725) achieved by modelC further support its consistent performance across the dataset. Conclusion This study demonstrates that composite loss functions significantly enhance the accuracy and consistency of AI-based segmentation models in radiotherapy. The triple-loss strategy combining Dice, Focal, and Tversky losses yielded the best performance. The Tversky loss improved boundary sensitivity, while the Focal loss emphasized difficult regions, resulting in more stable and accurate predictions. This approach offers a valuable solution for robust parotid gland segmentation in AI-assisted head-and-neck treatment planning.

Oral Abstract ID: 18

Title: Investigation of variation in Surface dose in high energy photon beams due to Couch & Immobilization devices

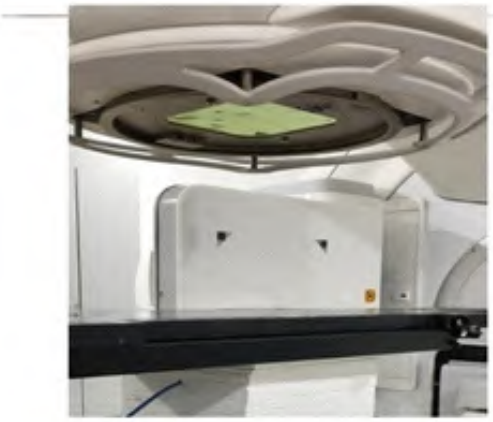
Author Names: Mr. P Sabari Kumar

Co-Authors: Dr Kaginalli Shanmukappa

Full Abstract:

INTRODUCTION: The Carbon Fibre material was chosen as couch top or other devices due to negligible radiation beam attenuation. With the introduction of IMRT/VMAT/SRS/ SRT, significant portion of beam delivery takes place through the couch & other patient positioning devices which alters the skin dose and reduces basic property of high energy photon beam skin sparing effect. The accurate measurement of it is utmost important. The AAPM TG 176 specifies procedures and review of various publications for accurate measurement of surface dose due to immobilization devices. Material & Methods: Elekta Versa HD Linear Accelerator with energies 6, 10, 15, 6FFF & 10FFF used for the study. The Orfit Company Immobilization system (2nd Generation) was considered for surface dose assessment. The PTW Advanced Markus Chamber with Slab phantom used for dose measurement. Initially, open field PDD's were measured of field size 10*10cm2 with SSD setup of 100cm. The PDD's acquired by placing couch top & immobilization devices on surface of chamber. The measured PDD's were corrected with Ktp & Kion. The Parallel Plane Chamber over response correction applied to correct the PDD's. The open field PDD was considered as reference to compare PDD with immobilization devices. Results & Discussion: The open field surface doses of 6MV, 10MV, 15MV, 6FFF &10FFF for the field size 10*10 cm2 are 44.4%, 36.7%, 35.5%, 47.7%, 40.8% respectively. The Surface doses with couch top are 80.1%, 75.2%, 70.2%, 77.5% & 72.3% of 6, 10, 15, 6FFF & 10FFF beams respectively. The integrated setup of Couch top, Base plate and Breast board results surface doses of 6, 10, 15, 6FFF & 10FFFF are 87.1%, 86.5%, 83.6%, 85% & 82% respectively. Even though the couch top & other patient immobilization or positioning devices are less attenuation to radiation beam, but causes significant increase of surface dose almost double the value of open field surface dose. Conclusion: Assessment of surface dose due to couch top & other immobilization devices is very important and must be consider during the treatment planning.

Open Field Measurement



Couch + Base Plate Measurement

Oral Abstract ID: 19

Title: Dosimetric Feasibility of Discrete-Step Proton Arc Therapy on IBA Proteus Plus

Author Names: Manimala Devi Konthoujam

Co-Authors: Lilawati Meena, Pooja Sahegal, ACP Prabu, Lalit Chaudhari, Siddharth Lasker

Full Abstract:

Background: Proton arc therapy (PAT) is an advanced form of radiotherapy delivery technique in which proton beams are delivered continuously or semi-continuously as the gantry rotates. PAT can be delivered in two ways: (a) Dynamic arc, which is a true continuous spot scanning technique that requires specialised hardware and software. (b) Discrete Arc, a short static delivery that simulates an arc with reduced speed without full dynamic capability that can be tested with present systems [1][2]. Also, literature suggests that PAT shows better results than multi-field intensity-modulated proton therapy (IMPT) in target coverage, conformity, and organs at risk (OAR) doses. The clinical implementation of PAT depends on delivery system capabilities, also demonstrable dosimetric gains, and smooth integration into existing clinical workflow. Aim: The objective of this study is to evaluate the planning feasibility of proton-ARC therapy dosimetrically on IBA Proteus Plus. Materials and Methods: Using the IBA Proteus Plus beam model and RayStation TPS version 12A SP1. We intended to create two simulated discrete-step proton arc (DSPA) plans for each different clinical sites; a) Coarse- DSPA with gantry spacing of 10°–30° and b) Fine- DSPA with gantry spacing of 5°, adapted from previously described PAT feasibility methods [1][2]. In addition, a hybrid gantry spacing approach was employed based on the proximity of critical structures [3]. Robustly optimised plans were created for each beam arrangement for comparison with the standard IMPT plans. Dosimetric parameter like target coverage (D95, Dmean), OAR doses, conformity index (CI), homogeneity index (HI), and integral dose were analysed [1][2]. Discussion: Study [1] and [2] show that PAT is more effective at treating cancer and sparing OARs as compared to IMPT. Our main aim was to improve the planning time by employing coarse and fine DSPA while preserving the plan quality, as the current planning station version lacks arc optimisation capability. With Dynamic Arc implementation, overall treatment time could be reduced by 50-60% compared to delivering the same dose with multiple fields [4]. Conclusion: This study will demonstrate the technical capability and planning feasibility of PAT in IBA Proteus Plus and its dosimetric superiority for serving the foundation of clinical adoption in the near future. Key words: Proton arc therapy, gantry Spacing, planning Feasibility Reference: 1. Ding et al., 2016 2. Li et al., 2019 3. Modiri et al., 2024 4. IBA global DynamicARC® Consortium, 2024

Oral Abstract ID: 20

Title: Effect of Variations in Set-up Margin on Dosimetric Parameters in Image-Guided Radiotherapy for Carcinoma Endometrium Patients using the Halcyon Machine

Author Names: Jumana Maryam

Co-Authors: Dr. Zhenia Gopalakrishnan, Deepa M.V.

Full Abstract:

Introduction & Objective: Accurate radiation delivery is crucial for tumour control and sparing normal tissue. The planning target volume (PTV) margin compensates for setup errors and anatomical changes, ensuring adequate tumour coverage. This study aims to determine the optimal PTV margin for radiotherapy in carcinoma endometrium by evaluating the dosimetric impact of margin variations on target coverage and organ-at-risk (OAR) doses using Cone Beam Computed Tomography (CBCT) and Dose-Volume Histogram (DVH) analysis. Methods & Materials: CT images of 31 carcinoma endometrium patients were retrospectively analysed. A base Volumetric Modulated Arc Therapy (VMAT) plan with a 5 mm PTV margin was generated on the Halcyon system (45 Gy/25 fractions). Additional plans were created with 3 mm and 8 mm margins. Dosimetric outcomes were assessed using the Conformity Index (CI), Homogeneity Index (HI), and OAR parameters including bowel V15 Gy (cc) and V45 Gy (cc), and bladder and rectum V40 Gy (%). Target dose constraints followed RTOG criteria; OAR limits followed ESTRO guidelines. Results & Discussion: The CI for base plan and treated plan with a 5mm PTV margin were 0.995 ± 0.017 and 0.889 ± 0.065 respectively. For the 3 mm and 8 mm margins, the CI values for base plan and treated plan were 0.993 ± 0.019 and 0.846 ± 0.074, and 0.995 ± 0.017 and 0.930 ± 0.048, respectively. The CI difference between the base and treated plans decreased with larger margins. The HI mirrored the CI trends, with smaller differences observed for larger margins. For the bowel, the volume receiving 15 Gy did not significantly differ across margins, but the volume receiving 45 Gy significantly increased for the 8 mm margin compared to the 3 mm and 5 mm margins. Significant differences in the volume receiving 40 Gy were observed for the rectum, while for bladder this difference was more or less similar. Conclusion: In cases with notable positional shifts, an 8 mm PTV margin can improve tumour coverage and dose homogeneity compared to smaller margins. For treatments without image guidance, a minimum of 8 mm is advisable to accommodate daily setup variations. However, the use of adaptive radiotherapy will be best for pelvic radiotherapy treatments, since the PTV margin can be reduced and plans can be tailored based on daily anatomical variations, resulting in a comparatively lower dose to OARs. Keywords: PTV margin, Pelvic Radiotherapy, IGRT

Oral Abstract ID: 21

Title: Advancements and Challenges in Total Body Irradiation Under Anaesthesia for Paediatric Patients

Author Names: Supratik Sen

Co-Authors: Abhay Singh, Sandeep Singh, Dipesh, Manindra Bhushan , Anuj Vijay , Raj Pal Singh

Full Abstract:

IPurpose: This study evaluates the dosimetric and procedural challenges associated with total body irradiation (TBI) in a 2.5-year-old paediatric patient under general anaesthesia. The objective is to adapt advanced radiation techniques and procedural modifications to ensure optimal dose delivery, patient safety, and treatment efficacy. Methods and Materials: The TBI procedure was performed using a TrueBeam STx linear accelerator, employing a meticulously planned multi-isocenter approach to overcome field size limitations due to the presence of high-definition (HD) multileaf collimators (MLC). A total of five isocenter were utilized, with each isocenter configured with three full arcs to achieve uniform dose distribution. The prescribed single-fraction dose was 2 Gy. The average monitor units (MU) per arc were approximately 160, and the total treatment duration, including setup and beam-on time, was around 25 minutes. The cumulative beam-on time across all fields was approximately 10 minutes. Due to the patient's young age, general anaesthesia was administered throughout the procedure, with continuous physiological monitoring from the control console to ensure stability. A multidisciplinary team comprising medical physicist, Radiation oncologists and anaesthesiologists oversaw the treatment. Special attention was given to patient immobilization, alignment accuracy, and the management of field overlaps at isocenter transitions to maintain dose homogeneity. Results and Discussion: Dosimetric evaluation using optically stimulated luminescent dosimeters (OSLDs) demonstrated satisfactory dose coverage and homogeneity. The maximum dose recorded was 2.3 Gy in the thoracic region, while the minimum dose of 1.85 Gy was observed in the foot region. The multi-isocenter technique effectively addressed field junction challenges, minimizing risks of overdose in overlapping regions. Continuous physiological monitoring confirmed stable vital signs, and no anaesthesia-related complications were encountered. The treatment was completed within the planned timeline, highlighting the feasibility of advanced TBI techniques in paediatric patients. The involvement of a multidisciplinary team was crucial in managing procedural complexities and ensuring precision. Conclusion: Advanced TBI techniques, combined with a collaborative multidisciplinary approach, can effectively address the unique challenges of paediatric patients undergoing treatment under anaesthesia. Tailored protocols are essential for optimizing safety and efficacy, underscoring the need for continued research to refine these approaches and enhance treatment outcomes. Keywords: TBI, Paediatric, anaesthesia, Patient Safety, OSLDs.

Oral Abstract ID: 22

Title: Commissioning And Operation of Primary Standard Calibration Laboratory in India

Author Names: V.S. Iyer

Co-Authors: Ramesh Yadav

Full Abstract:

Introduction and Objective: Conrad Medical Solutions LLP, Mumbai, has established a calibration laboratory dedicated to the calibration of Quality Assurance (QA) kits used for performance testing of radiological equipment. This Primary Standard Laboratory provides indigenous calibration services by utilizing primary standards based on absolute measurement techniques – i.e., measurements performed without relying on pre-calibrated instruments. This technique enables accurate and traceable calibration of QA instruments such as kVp meters and dosimeters, ensuring compliance with national and international standards. Materials and Methods a) Measurement and Standardization of Tube Potential (kVp) To achieve direct and traceable measurement of the X-ray tube peak potential A precision high-voltage voltmeter is connected between the anode and cathode terminals of the X-ray tube. This allows for direct measurement of the peak tube potential, which serves as the reference value for calibrating users' kVp meters. b) Measurement and Standardization of X-Ray Beam Output To accurately quantify and standardize beam output The X-ray tube and Free-Air Chamber (FAC) are aligned using alignment lasers incorporated in the laboratory setup. The absolute beam output is measured using the FAC in conjunction with a digital electrometer. The obtained output value is used for calibrating the users' dosimeters. Additional studies are conducted to assess Dose variation with tube current Dose variation with exposure time from these studies, linear coefficients are derived, aiding in comprehensive dosimeter calibration. Results and Discussion The variation in X-ray beam output (Dose) and Operating Potential (kVp) was measured using the laboratory's reference standards and compared with the readings obtained from the Device Under Calibration (DUC). Conclusions 1. The coefficient of linearity with respect to both tube current and exposure time was found to be within the limits specified by the regulatory authority. 2. The variation observed in the measurement and standardization of tube potential (kVp) was also within the permissible tolerance set by the regulatory body. Confirming the accuracy and reliability of the calibration process. 3. All radiation safety measures have been fully complied with, the Atomic Energy Act – 1962 and the Atomic Energy (Radiation Protection) Rules, 2004. REFERENCES 1. IAEA Dosimetry in Diagnostic Radiology: An International Code of Practice-IAEA (Chapter 6 and chapter 7, Technical reports series no. 457) 2. International Organization for Standardization General Requirements for the Competence of Testing and Calibration Laboratories Rep. ISO 17025, ISO, Geneva (1999) 3. IAEA Dosimetry laboratory SSDL News letter41, IAEA Vineea (1999) 13-21.

Set Value	DUC Model	Dose (mGy)		% Dev.	Set Value	kVp Reading		% Dev.
		FAC	DUC			Std.	DUC	
50Kv/50mA	Piranha 657	5.32	5.01	3.6	50kV/50mA	50.74	51.3	1.10
50Kv/100mA	Piranha 657	10.97	10.58	5.8	100kV/50mA	99.54	99.99	0.36
50kV/50mA	Thin XRad	7.8	7.74	0.77	50kV/50mA	50.74	51.43	1.36
50kV/100mA	ThinX Rad	14.31	14.56	1.75	100kV/50mA	101.3	101.1	0.20

Oral Abstract ID: 23

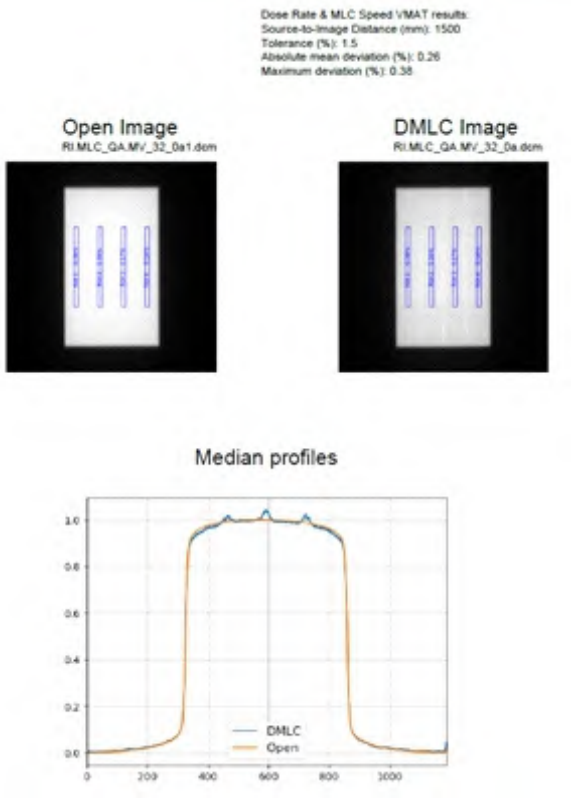
Title: Conventional Versus Automated Quality Assurance of the Multileaf Collimator in Varian TrueBeam Linear Accelerator: A Comparative Study Using Pylinac

Author Names: Avinash Kadam

Co-Authors: Nitesh Sontakke

Full Abstract:

Introduction and Objective: Precision in multileaf collimator (MLC) performance is critical for the safe and effective delivery of advanced radiotherapy techniques, including Intensity Modulated Radiation Therapy (IMRT), Volumetric Modulated Arc Therapy (VMAT), and Stereotactic Radiosurgery (SRS). Conventional MLC quality assurance (QA) methods are time-consuming, prone to human variability, and can limit QA frequency. This study aims to compare conventional MLC QA techniques with an automated Python-based framework–Pylinac on Varian TrueBeam linear accelerators, focusing on efficiency, reproducibility, and clinical reliability. Materials and Methods: This study involved performing MLC QA using both conventional methods (manual Electronic Portal Imaging Device (EPID) image analysis using Eclipse TPS) and Pylinac modules, including Field Analysis, Picket Fence, and VMAT for Dose Rate and Gantry Speed (DRGS) tests and MLC speed (DRMLC) tests during RapidArc delivery. Tests were conducted using standard 10×10 cm² MLC fields and vendor-supplied RapidArc plans. EPID images were analyzed manually and via Pylinac's automated routines to assess field congruence, leaf positioning accuracy, and dynamic delivery parameters. Results and Discussion: Pylinac accurately quantified MLC field sizes (e.g., 9.99 cm × 9.95 cm for a nominal 10×10 cm² field), demonstrating agreement within clinical tolerances. For the Picket fence test for RapidArc with intentional error, Pylinac detected sub-millimeter deviations (max error: 0.297 mm) and automatically flagged pass/fail conditions based on configurable tolerances whereas same test was visually inspected in conventional method. For VMAT tests, Pylinac yielded consistent results with conventional methods, e.g., DRGS test shows absolute mean deviation of 0.32% (vs. 0.30% manually) and DRMLC test shows absolute mean deviation of 0.26% (vs. 0.43.% manually), reducing manual effort and analysis time significantly. Pylinac provided detailed PDF reports and robust visualizations, enhancing traceability and reducing subjectivity. Overall, automation streamlined QA workflows, supported TG-198 and TG-142 compliance, and enabled more frequent QA. Conclusion: Pylinac provides a robust, efficient, and precise alternative to convention MLC QA methods for Varian TrueBeam linacs. The automation enhances the frequency and consistency of QA while detecting clinically relevant deviations with sub-millimeter sensitivity. The integration of open-source tools like Pylinac into clinical practice can empower physicists, optimize linac performance, and contribute to safer, higher-quality of radiotherapy treatment.



Oral Abstract ID: 24

Title: An animal study, from 2.0Gy to 1.36Gy per fraction: sparing effect in rat spinal cord

Author Names: Swati Verma

Co-Authors: Dr Manoj Gupta, Dr Shailendra Handu, Dr Shalinee Rao

Full Abstract:

Introduction Spinal cord is major dose limiting organ in radiotherapy due to its anatomical location at risk in a large number of Radiotherapy treatments. Spinal cord myelitis limits the dose to tumours in Head and neck, Thoracic and upper abdominal regions resulting in the reduction of tumour control probability. Radiobiologist has recommended 45.0 Gy total dose to spinal cord with 2.0 Gy per day fraction size as an acceptable level. Reducing dose /fraction will result in higher spinal cord tolerance. Higher tolerance of spinal cord will enable to deliver higher dose to tumors Objective To compare total dose resulting into paralysis by two fraction size i.e. 2 Gy and 1.36 Gy per fraction. Radiation sensitivity of spinal cord with low radiation dose per fraction (1.36 Gy). Method and Material: Adult Male Wistar rats were used. Eighteen rats were taken under controlled group with dose per fraction 2.0Gy and other 18 rats were taken under experimental group with fraction dose of 1.36Gy. Same Biological effective dose 120 was delivered on 6MV Linear accelerator 60Gy in 30 fractions and 70.72Gy /52 fractions 5days /week in controlled and experimental group, Both groups are further divided into three subgroups based on the timing of the reporting of the outcome with six rats in each control and experimental arm. The outcome was reported I) after 1 month (first subgroup), II) after 3 months (second subgroup) and III) after 7 months (third subgroup), radiation effects in both groups were scored by observing motor coordination, motor activity, paralysis analysis and at the end histopathology of rats taken. Result: Locomotor activity was observed to be decreasing continuously at one, three and seven months in both control and experimental groups. The reduction in motor activity was relatively higher in rats irradiated with 2Gy per fraction (Control group) as compare to rats exposed to 1.36Gy per fraction. The effect of radiation on motor coordination and balance was not seen until 3 months after completion of radiation in both groups. However, after 5 months, motor coordination and balance was decreased significantly in 2Gy arm as compare to 1.36Gy arm. Conclusion: Less than 2Gy per fraction dose to spinal cord of rat results in less damage to spinal cord leading to lower toxicities in terms of motor coordination and balance as well as motor activity. The finding of this study will have an important clinical

Oral Abstract ID: 25

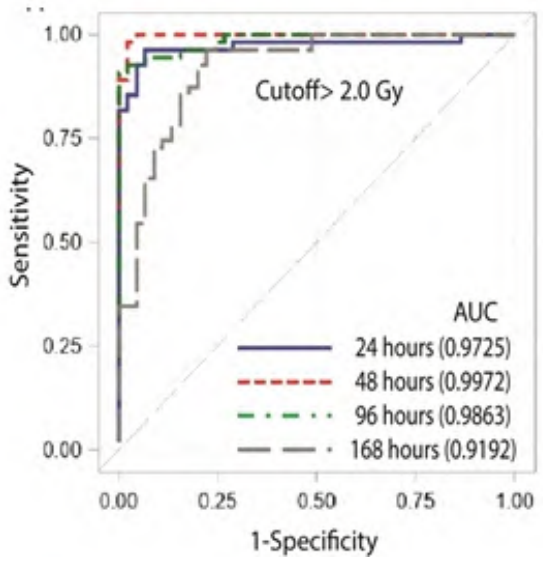
Title: MicroRNA based fingerstick blood test for radiation biodosimetry

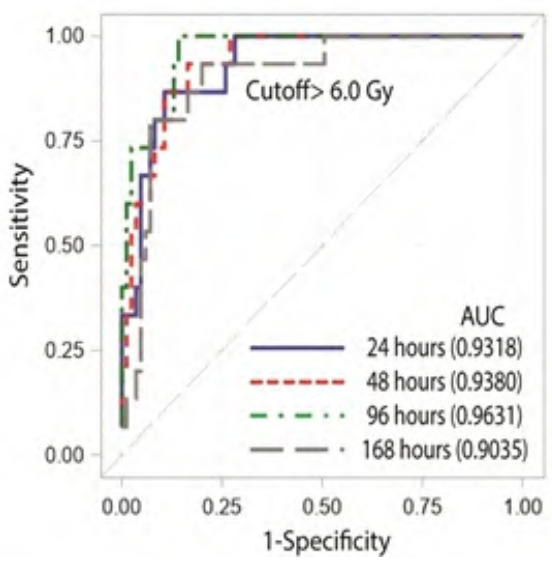
Author Names: Naduparambil Korah Jacob

Co-Authors: Marshleen Yadav, Sapna Puri, Lanchun Liu, Arnab Chakravarti

Full Abstract:

Introduction and Objectives: Total body radiation is a commonly used preparative regimen in acute myeloid and lymphoblastic leukemia patients before allogeneic hematopoietic stem cell transplantation (HSCT). Inefficient clearance of cancer cells and radiation-induced normal tissue toxicities contribute to relapses and morbidity in patients. As such, there is variation in radiation response in patients. There is a need for developing a biomarker-guided personalized treatment strategy, dose adaptation, and follow-up. Methods and Results: Discovery of a panel of circulating miRNA biomarkers of which changes are dependent on radiation doses in rodent and non-human primate models as well as their validation in human AML/ALL patients receiving total body irradiation (TBI) allowed us to develop a novel radiation biodosimetry test. We demonstrated the feasibility of using circulating microRNA150-5p (miR150) as a sensitive biodosimeter (Yadav et al., Science Translational Medicine, 2020; PMID: 32669422). Our finding of miR23a as a non-responsive internal normalizer enhanced the feasibility of absorbed dose estimation in blood (Jacob et al., PLOS One, 2013; PMID: 23451251). The internally normalizedmiR150/23a-based sensitive finger-stick blood test showed capability for radiation dose estimation within hours to a week after exposure. Our follow-up study demonstrated the utility of the assay in evaluating the extent of bone marrow ablation, correlating with lymphocyte depletion. We bridged the responses in leukemia patients and mice exposed to a similar fractionated dose (FD) and further in mice exposed to single dose (SD), showing adaptability for dose estimation in victims of radiological events and utility for evaluating marrow myeloablation and reconstitution efficiency after sublethal irradiation and after transplantation. Analyses of hematological parameters and survival in wild-type and miR150 null mice demonstrated functional roles for miR150 in modulating radiation response, hematopoiesis, and marrow reconstitution (Yadav et al., International Journal of Radiation Oncology, Biology, Physics, 2022; PMID: 34767935). Overexpression of miR150 in human leukemia cell lines showed an increase in apoptosis after radiation with a shift in percentage of cells at sensitive G2/M phases of cell cycle. Conclusions: Multiple lines of evidence suggest the translational utility of miR150 for biodosimetry and near real-time evaluation of physiological response of an individual during ablation and reconstitution. Future studies would include validation in larger animal models and larger cohorts of patients and optimization of diagnostic methods. Keywords: Radiation Biodosimetry, microRNAs, Biomarkers





Oral Abstract ID: 26

Title: Design, Development and Quality Assurance Testing of an Indigenous Self-Contained X-Ray Blood Irradiator System for TA-GVHD Prevention

Author Names: Syamantak Das

Co-Authors: Virendra Ukey, Rajesh Harsh, Nitin Bansode, Anil Patil, Ruchee Bhagwat

Full Abstract:

Introduction and Objectives: Transfusion-associated graft-versus-host disease (TA-GVHD) is a rare, but fatal, potential complication that occurs when viable donor T- lymphocytes proliferate and engraft in susceptible patients after transfusion of whole blood and cellular components. The irradiation of the blood components is the only proven method of preventing the risk of TA-GVHD. SAMEER has developed two units of an affordable, indigenous self-contained X-ray blood irradiator to provide an indigenous solution for the prevention of TA-GVHD. This abstract presents the current status of the indigenously developed self-contained X-ray blood irradiator. Materials and Methods: The self-contained X-ray blood irradiator unit has been designed using a Comet MXR-225/26 tube and was assembled with 15 mm lead shielding and additional steel shielding. Leakage surveys found stray radiation < 1 µSv h-1 at 5 cm. A custom-made Microsoft Visual Basic Graphical User Interface system displays the status of High Voltage, filament, interlocks, etc., and allows setting tube voltage, current, exposure time, etc. It also provides controls for Filament current ON/OFF. The X-ray ON/OFF and emergency stop switches are hardwired and mounted on the panel along with the Safety indicator. Beam profiles were measured at the treatment distance using a Farmer-type ionization chamber, with a 0.3 mm Cu filter placed at the X-ray source. These profiles matched those obtained from film dosimetry. Timer linearity and dose uniformity tests showed linear dose–time response and uniformity within limits. Beam output was stable across operating voltage. The half-value layer at 200 kV was 0.82 mm Cu. Point dose measurements and dose mapping were performed using custom-made Acrylic phantoms. Results: The prototype delivers the required 25 Gy central dose at approximately 5 Gy min-1. Dose uniformity and leakage radiation comply with regulatory limits. Measured ion-chamber and film doses agree. Beam output is reproducible. These results indicate readiness for technology transfer and clinical use. Conclusions: The system has progressed from conceptual design to an assembled, tested unit. A CDSCO test license has been obtained, and AERB type approval is pending. The AERB authorization for the supplier of a self-contained X-ray blood irradiator unit is received by SAMEER. Keywords: TA-GVHD, X-ray blood irradiator, Dosimetry, Prototype, Phantom

Oral Abstract ID: 27

Title: Biological gEUD-Guided VMAT Optimization Improves Dose Gradient and OAR Sparing in Head-and-Neck SIB Radiotherapy

Author Names: Shekhar Dwivedi

Co-Authors: Aditya Upadhyay, Devaraju Sampathirao, Ramandeep Singh, Gurvinder Singh, Shefali Pahwa , Tapas Dora

Full Abstract:

Purpose: To evaluate whether volumetric-modulated arc therapy (VMAT) with generalized equivalent uniform dose (gEUD)–based biological optimization improves plan quality in head-and-neck simultaneous-integrated-boost (SIB) radiotherapy, focusing on dose gradient control and organ-at-risk (OAR) sparing. Methods: Twenty-five head-and-neck cancer patients (60/54 Gy, 30 fractions) were replanned in Eclipse (Photon Optimizer, Acuros-XB). Two VMAT plans were compared per case: conventional dose–volume optimized (VMAT-PO) and biologically optimized (VMAT-gEUD). Endpoints included target coverage (D2, D95, D98, HI, CI95, CI98), dose gradient (R50), and OAR parameters for spinal cord, parotids, and mandible. Paired t-tests ($p < 0.05$) were applied. Results: VMAT-gEUD achieved significantly sharper dose fall-off and superior OAR protection compared to VMAT-PO, while maintaining target coverage. Spinal cord Dmax was reduced by ~5.4 Gy (23.8 Gy ± 6 Gy vs 18.4 ± 6.5 Gy Gy, $p < 0.01$). Parotid sparing improved (left-parotid V20 1.7 cc, $p = 0.01$; V30 1 cc, $p = 0.02$). Intermediate dose-spill (R50%) was lower (2.53 ± 0.5 vs 2.59 ± 0.3). Mandible endpoints also improved. HI and CI values were non-inferior or marginally improved. Conclusions: gEUD-driven VMAT optimization delivers sharper gradients and clinically meaningful OAR dose reductions, particularly for spinal cord and parotids, without compromising target coverage. This biologically guided strategy offers a practical pathway to enhance VMAT plan quality in head-and-neck SIB and may support reduced late toxicities in clinical practice. Keywords: VMAT, gEUD, biological optimization, head-and-neck, dose gradient, spinal cord, parotid sparing

Oral Abstract ID: 28

Title: Efficacy and clinical use of novel high-resolution EPID-based 2D and 3D automated patient-specific QA for SRS and SBRT Patients

Author Names: Raghavendra Hajare

Co-Authors: Taushiful Hoque, Shanmukhappa Kaginelli, Abhilasha Rao, Gopal Chandra Sahoo, Debasish Sahoo, Rohit Vadgaonkar, Umesh Mahantshetty

Full Abstract:

Introduction: Stereotactic radiosurgery (SRS) and stereotactic body radiation therapy (SBRT) deliver high doses per fraction with steep dose gradients, requiring stringent delivery accuracy. Patient-specific quality assurance (PSQA) is critical to ensure treatment safety and effectiveness. While traditional high-resolution detectors such as films and SRS MapCHECK® provide accurate verification, they suffer from limitations like cumbersome setup, cost, and field size constraints. Electronic portal imaging devices (EPIDs) offer real-time, high-resolution, phantom-less PSQA with cost-effectiveness, but their comprehensive evaluation for SRS/SBRT remains limited, especially regarding their sensitivity to typical delivery errors.

Materials and methods: Twenty volumetric modulated arc therapy (VMAT) SRS/SBRT plans, each with field sizes under 7.7 cm × 7.7 cm from diverse tumor sites, were retrospectively analyzed. PSQA was performed using ion chamber point dose measurements, films (Gafchromic EBT3), SRS MapCHECK®, ArcCHECK®, and EPID-based methods including Portal Dose Image Prediction (PDIP) and PerFRACTION™ in both 2D integrated and 3D cine/log modes. Deliberate errors comprising multileaf collimator (MLC) shifts (0.25–1 mm), stuck leaves, collimator angle offsets (1°–2°), gantry angle deviations (2°–5°), and monitor unit (MU) variations (2%–5%) were introduced to assess detector sensitivity. Gamma Passing Rates (GPR) were calculated using criteria of 3%/2 mm, 2%/2 mm, 2%/1 mm, and 1%/1 mm, with 90% considered passing.

Results: Point dose differences relative to treatment planning system (TPS) were 0.1% ± 1.5% for ion chamber and 0.94% ± 1.8% for EPID. At 2%/2 mm, average GPRs were 98.6% (film), 99.0% (SRS MapCHECK®), 98.7% (PDIP), 99.5% (PerFRACTION™ 2D), 99.8% (PerFRACTION™ 3D), and 93.2% (ArcCHECK®). Under the more stringent 2%/1 mm, high-resolution detectors maintained >94% GPR, while ArcCHECK® dropped to 73.5%. EPID detected most errors, excluding very small MLC (0.25 mm) and gantry angle errors. PerFRACTION™ cine 3D detected all errors at 2%/1 mm but flagged some clinical plans below threshold, leading to a practical 2%/2 mm adoption. SRS MapCHECK® exhibited highest MLC error sensitivity and uniquely detected 2° gantry errors among high-resolution systems.

Conclusion: High-resolution EPID-based automated PSQA is a reliable, efficient, and cost-effective alternative for SRS and SBRT verification, offering performance comparable to films and SRS MapCHECK® without additional hardware or setup complexity. EPID's phantom-less workflow and adaptability to larger SBRT field sizes position it as a practical solution for clinical environments with resource constraints or broad treatment indications.

Modality	Films	SM	PDIP	PF(2D)	PF(3D)	PF(CINE)	ArcCHECK
3%, 2mm	99.5	99.8 (p=0.59)	99.5 (p=0.71)	99.8 (p=0.33)	100.0 (p<0.01)	98.5 (p<0.01)	95.9 (p<0.01)
2%, 2mm	98.6	99.0 (p=0.88)	98.7 (p=0.99)	99.5 (p<0.05)	99.8 (p<0.01)	96.9 (p<0.01)	93.2 (p<0.01)
2%, 1 mm	94.4	95.3 (p=0.62)	96.3 (p=0.40)	97.6 (p<0.05)	99.2 (p<0.01)	90.0 (p<0.01)	73.5 (p<0.01)
1 %, 1mm	89.6	87.5 (p=0.12)	92.8 (p=0.50)	95.6 (p<0.05)	94.0 (p<0.01)	71.7 (p<0.01)	64.3 (p<0.01)

Table 1: The comparison of average gamma passing rates (GPRs) with p values for 20 stereotactic plans using different PSQA devices with different gamma evaluation criteria. SM: SRS MapCHECK, PDIP: portal dose image prediction, PF: PerFRACTION™, AC: ArcCHECK.

Oral Abstract ID: 29

Title: Simultaneous Integrated Boost vs. Sequential Boost in Breast Cancer Radiotherapy: A Comprehensive Analysis of Dosimetric, Radiobiological, Cost-Effectiveness

Author Names: Md. Jobairul Islam

Co-Authors: Sadia Afrin Sarah, Md. Arifur Rahman, Qamruzzaman Chowdhury, Md. Abdul Mannan, Ahammad Al Mamun

Full Abstract:

Purpose: This study compares two radiotherapy techniques for breast cancer Simultaneous Integrated Boost (SIB) and Sequential Boost (SeqB) by comprehensively evaluating dosimetric performance, radiobiological efficacy, and cost-effectiveness. By comparing dosimetric quality, radiobiological outcomes, and cost-effectiveness, this analysis aims to inform modern radiotherapy protocols optimizing both efficacy and resource utilization. Methods: Fifteen early-stage breast cancer patients underwent paired planning with SIB and SeqB. The SIB regimen delivered 48 Gy to the tumor bed and 40 Gy to the whole breast in 15 fractions, while SeqB comprised 40 Gy to the whole breast in 15 fractions followed by a sequential 10 Gy boost over 5 fractions. Dosimetric endpoints included PTV V95%, conformity index, maximum dose, Heart D5, Heart Mean Dose, Lung V20Gy, and MU. Radiobiological assessment utilized BED calculations with α/β ratios, enabling TCP and NTCP estimations for heart and lung. Cost-effectiveness incorporated direct costs and indirect savings. Statistical analysis employed paired t-tests. Results: Both techniques achieved excellent target coverage V95%: 98.97 ± 0.97% [SIB] vs. 99.33 ± 0.86% [SeqB], and CI was same. SIB demonstrated superior high-dose control, with a 2.8% reduction in maximum dose 105.46% vs. 108.27%. Lung sparing favored SIB, with significantly lower V20Gy (15.2% vs. 17.0%), translating to a clinically meaningful NTCP reduction (5.8% vs. 6.9%). Cardiac metrics Mean Dose: 3.45 ± 0.8 Gy vs. 3.78 ± 0.9 Gy, were comparable. Radiobiologically, SIB's higher tumor BED (86.4 Gy vs. 81.7 Gy) enhanced TCP (93.2% vs. 89.6%), suggesting improved local control. Economically, SIB reduced MU by 45%, shortening delivery time and lowering costs despite a marginally higher per-fraction expense. Conclusion: SIB offers significant dosimetric and radiobiological advantages over SeqB, with lower maximum doses, enhanced lung sparing, and improved tumor control probability all while maintaining comparable cardiac safety and offering cost benefits. These findings support the potential of SIB as a more efficient and effective strategy for breast cancer radiotherapy.

Oral Abstract ID: 30

Title: Impact of skull definition resolution on treatment planning in gamma knife radiosurgery

Author Names: Anuprabha S

Co-Authors: Gopishankar Natanasabapathi, P Venkatraman, Vellaiyan Subramani, Dhanabalan Rajasekaran, Megha Singh, Sweta Kedia

Full Abstract:

AIM: To evaluate the influence of skull definition resolution on planning accuracy in Gamma Knife radiosurgery (GKRS). BACKGROUND: Precise target delineation in (GKRS) heavily depends on the accuracy of imaging and skull modeling. MRI is the gold standard for GKRS imaging. Skull definition is essential in GKRS to define the beam entry points for precise dose delivery. In early times skull surface was defined based on merely 33 points measured through a depth helmet tool. Advances in treatment planning software now allow segmentation-based skull definition. This study assesses the effect of different skull definition resolutions on treatment planning accuracy in GKRS for peripheral cancers. MATERIALS AND METHODS: A retrospective analysis of patients' plans was conducted for 24 treatment planning scenarios using the ICON model Leksell Gamma knife, which has 192 Co-60 sources arranged hemispherically in the central body. The treatment plans were generated with the latest Lightning software (Gamma Plan Version 11.1) through the auto planning method by modifying the skull definition resolutions at 1 mm, 1.5 mm, 2 mm, 2.5 mm, and 3 mm. Dosimetric parameters such as target coverage (C), selectivity (S), gradient index (GI), and treatment time (T) were analyzed to assess the effect of varying skull definition resolutions on plan quality and dose distribution. RESULTS & DISCUSSION: The 1 mm resolution was set as the gold standard value. Evaluation of dosimetric parameters to the 1 mm resolution showed up to 5 % variation in overall treatment time in skull definitions having a resolution of 3 mm. The variation in gradient index reached up to 15 % variation at 3 mm resolution. The mean dose to the target varied by up to 4 %. Higher resolution 1 mm provided smooth skull surface delineation in comparison with other resolutions. On the other hand, target coverage and selectivity do not show much difference across different resolutions. CONCLUSION: The study concludes that skull definition resolution influences the dosimetric accuracy in GKRS planning for peripheral tumors. Skull definition of 1 mm provided a smooth skull surface and reasonable dosimetric accuracy, suggesting their routine use for a precise and effective radiosurgery procedure.

SUPPLEMENTARY DOCUMENTS:

Image 1:

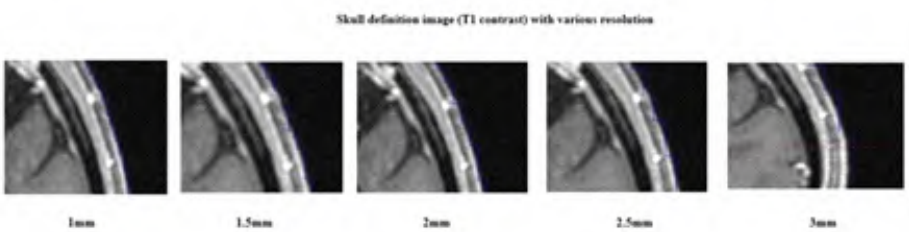


Table 1 Dosimetric Evaluation:

Resolution(mm)	Mean (Gy)	% Variation in mean dose w.r.t to 1 mm resolution	GI	% Variation in GI w.r.t to 1 mm resolution	Time(min)	% Variation in time w.r.t to 1 mm resolution
1	14.4	-	4.1	-	30.56	-
1.5	14.6	1.3	3.85	-6.09	30.44	-0.4
2	14.5	0.7	3.9	-4.8	30.14	-1.3
2.5	14.8	2.7	3.74	-8.7	31.52	3.1
3	15	4.2	3.46	-15.6	31.65	3.5

Oral Abstract ID: 31

Title: Magnetic Resonance Spectroscopy helps metabolite profiling for prostate cancer diagnosis

Author Names: Bimal Kumar Sarkar

Co-Authors: Bimal Kumar Sarkar

Full Abstract:

Introduction and Objective A non-invasive imaging technique called magnetic resonance spectroscopy (MRS) supplements magnetic resonance imaging (MRI) with biochemical and metabolic data about tissues. In vivo MRS allows for metabolite profiling in prostate cancer evaluation, which may lessen the need for invasive biopsies by distinguishing malignant from healthy tissue. We will show that MRS becomes a potential tool for prostate cancer diagnosis. Materials and Methods: The use of MRS for the quantitative assessment of prostate metabolites and its potential for cancer localization are given emphasis in this work. Choline, citrate, creatine, and myo-inositol are important metabolites that can be found using proton 1H MRS. The metabolite ratios and concentrations, especially ratio of (choline + creatine)/citrate plays an important role for the disease diagnosis. Spectral acquisition from specific prostate regions is part of the protocol, which is followed by signal processing for peak identification and quantification. Results and Discussions Reduced citrate levels suggest changed metabolic pathways in cancer cells, while elevated choline levels in cancerous prostate tissue represent enhanced membrane turnover. In diseased tissue, creatine and myo-inositol also exhibit quantifiable changes. Ratios that can accurately differentiate between malignant and normal prostatic zones are produced by quantitative MRS measurement of these metabolites. When combined with MRI results, these biochemical markers help locate tumour foci and direct focused treatments. Conclusion As a supplement to MRI in the diagnosis of prostate cancer, MRS can be considered as a potential tool. MRS helps risk stratification, improves early diagnosis, and facilitates treatment planning by enabling non-invasive assessment of important metabolites and their ratios. By incorporating MRS into clinical imaging techniques, prostate oncology patient care may be enhanced by increasing diagnostic precision and lowering reliance on invasive procedures. Keywords: Magnetic Resonance Spectroscopy, MRS, Metabolite profiling, Prostate cancer.

Oral Abstract ID: 32

Title: Automated Planning for Tongue Carcinoma: Achieving Clinical Plan Quality with Significant OAR Sparing - A Dual Plan Cohort Analysis

Author Names: G George Leo Ranjit

Co-Authors: Amanapu Govinda Rao, Dr. Ashutosh Pattanaik, Dr. Shefali Kanwar, Dr. Venkatesan

Full Abstract:

Introduction Automated treatment planning using knowledge-based solutions like RapidPlan has emerged as a powerful tool for improving plan consistency and reducing planner variability in radiotherapy. However, its ability to enhance organ-at-risk (OAR) sparing while maintaining clinical plan quality in complex head and neck cases particularly Tongue carcinoma remains a critical area of investigation. Objective: This study comprehensively evaluates whether RapidPlan generated volumetric VMAT plans for tongue carcinoma can achieve dosimetric parity with manually optimized clinical plans while significantly reducing OAR doses, thereby potentially lowering treatment associated toxicities. Methods and Materials: We conducted a comprehensive dual plan analysis of 40 patients with squamous cell carcinoma of the tongue who were treated previously with manually optimized VMAT plans. The plans were replanned using a validated RapidPlan model. Each patient had paired plans (Manual vs. RapidPlan) compared across multiple dosimetric parameters. Target coverage (PTV_High and PTV_Low) was evaluated using V95%, D98%, homogeneity and conformity indices. OAR sparing was assessed for parotids, larynx, pharynx, DARS, spinal cord, and brainstem. Plan complexity was calculated using an open-source Python program. Results: The automated RapidPlan showed admirable reduction in OAR doses while increasing the target coverage. RapidPlan demonstrated superior target coverage for both PTV_High (99.12% ± 0.92% vs. 98.56% ± 1.31%, $p < 0.05$) and PTV_Low (98% ± 3.64% vs. 97.13% ± 4.16%, $p < 0.05$) compared to manual plans. Lt Parotid Mean: Manual (2474.83 cGy) vs. Automated (2198.17 cGy), $P < 0.001$ Rt Parotid Mean: Manual (2265.99 cGy) vs. Automated (2062.84 cGy), $P < 0.001$ Larynx Mean: Manual (3392.60 cGy) vs. Automated (2811.41 cGy), $P < 0.001$ Pharynx Mean: Manual (4053.25 cGy) vs. Automated (3735.56 cGy), $P < 0.001$ Esophagus Mean: Manual (1571.09 cGy) vs. Automated (1390.36 cGy), $P < 0.001$ DARS Mean: Manual (4569.41 cGy) vs. Automated (4260.98 cGy), $P < 0.001$ Brainstem Max: Manual (3078.41 cGy) vs. Automated (2804.72 cGy), $P = 0.003$ The Spinal cord maximum dose did not differ significantly ($P = 0.104$). Conclusion: Automated planning with RapidPlan not only achieves clinically healthier target coverage but also consistently improves OAR sparing in tongue carcinoma VMAT. The significant dose reductions to critical structures particularly salivary glands and swallowing muscles suggest potential benefits in reducing xerostomia and dysphagia. These findings support the integration of knowledge-based planning into routine

Oral Abstract ID: 33

Title: Low-Dose, High Impact: Out-of-Field Dose Evaluation in SRS/SBRT with Film Dosimetry

Author Names: Pronoy Majhi

Co-Authors: Varsha

Full Abstract:

Introduction & Objectives: In Stereotactic Radiosurgery (SRS), while the primary focus is on delivering a highly conformal dose to small intracranial targets, unintended dose to out-of-field regions poses clinical significance–especially in terms of secondary malignancy risk and sensitive organ exposure. This study aims to quantify out-of-field dose differences between Gafchromic EBT4 film measurements and treatment planning system (TPS) calculations in SRS patients, using a slab phantom with embedded film inserts. In SRS/SBRT, where the fractional dose is substantially higher than in conventional fractionated radiotherapy, any dose deposited outside the target area can lead to more severe consequences, increasing the need for accurate out-of-field dose estimation. Methods & Materials: Fifty-Four patient-specific SRS plans were delivered using 6FFF photon beams from a linear accelerator. Gafchromic EBT4 films were inserted at predefined positions in a solid slab phantom. Film calibration was performed against known doses to generate a dose-response curve. Films were scanned after 24 hours using an Epson Expression XL11000 scanner. Dose analysis was performed using myQA Film software (IBA Dosimetry), and results were compared with corresponding TPS-calculated (Monte-carlo) Doses at the same coordinates. Results & Discussion: At the isocentre, the average dose variation between film and TPS was within 1.5%across all patients, and the gamma passing rate averaged 95% using 3%/3 mm criteria with a 5% threshold, confirming high in-field dosimetric accuracy. For out-of-field regions, dose differences between film and TPS were evaluated at the 15% and 30% isodose levels on both lateral sides. The average dose difference was –8.11% (SD = 13.37%) at the 15% isodose level and –5.94% (SD = 9.52%) at the 30% isodose level. This consistent underestimation by TPS in out-of-field regions highlights the need for independent validation. Conclusion: This study confirms that while in-field TPS dose calculations are accurate, with minimal variation and high gamma pass rates, out-of-field doses are consistently underestimated compared to film-based measurements. Gafchromic EBT4 film, used with a slab phantom and dedicated film analysis workflow, effectively captured low-dose regions with high spatial resolution. Using Monte Carlo-based algorithm in the TPS, deviations in peripheral dose indicate the need for further refinement of its modeling capabilities–particularly for scatter, head leakage, and dose fall-off in low-dose regions. Incorporating such measurements into routine QA enhances confidence in TPS calculations and supports safer, more accurate stereotactic treatments.

Oral Abstract ID: 34

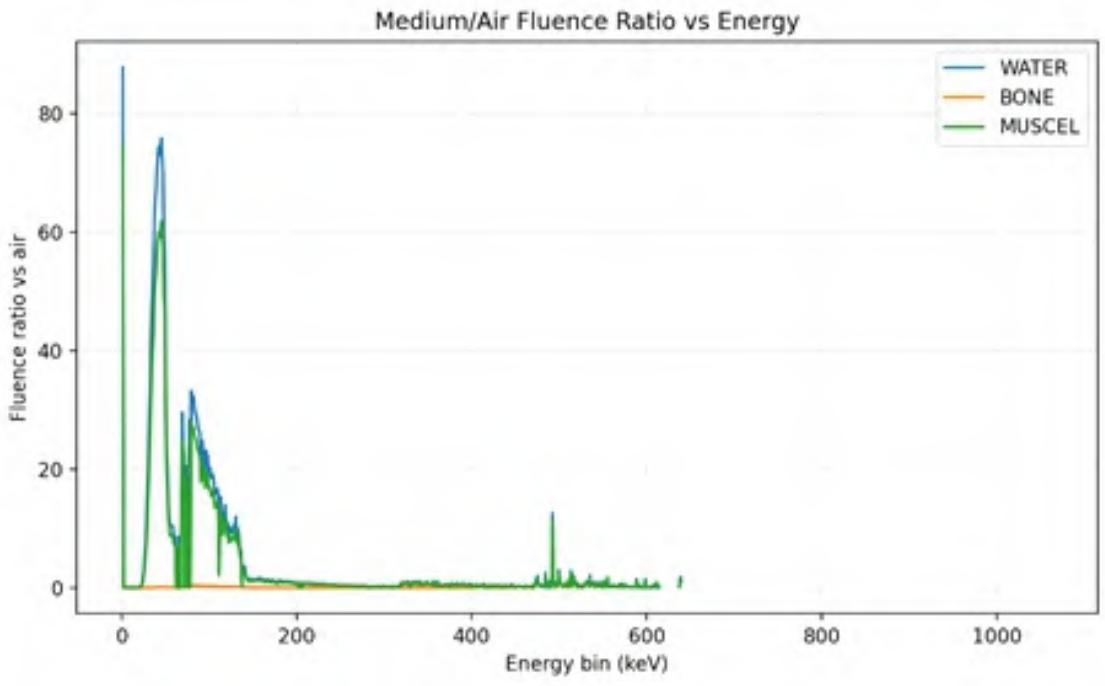
Title: A comprehensive Monte Carlo Simulation based study of the impact of tissue composition, thickness and heterogeneity on photon fluence and dose distribution of Ir-192 source used in Brachytherapy.

Author Names: Pradip Paul

Co-Authors: Dr Avinav Bharati, Dr. Y . P .Singh

Full Abstract:

Introduction & Objectives: The elemental composition and density of the medium strongly effects the scattering and absorption of the photon that reflects dose distribution of Ir192. The prime focus of this study is to investigate the effect of different biological medium and their thicknesses on the photon fluence and dose distribution of Ir192 source by Monte Carlo simulation tools. Material and methods: - Ir 192 source used in Gamma Med Plus was simulated by TOPAS Monte Carlo simulation tool. The study was performed in two main phases. First phase focused on the calculation of photon fluence in different media by simulating the source at the centre of a cubic homogeneous phantom of side 5 m. Second phase focused on variation of dose distribution due to various thickness like 0.5, 1.0, 1.5, and 2.0 cm of heterogeneity and a multi-layered (soft tissue – air – muscle – bone – water) phantom was simulated to study the cumulative effect of dose distribution. Result and discussion: - The result revealed that, at low energy (<30KeV) bone shows less medium / air fluence ratio as compared to water and muscle due to absorption of radiation by photo electric effect. For the range 30-150 Kev the said ratio for muscle and water substantially rose above air that reflected the increase in forward scattered and diminished the photo electric absorption. Above high energy the said ratio becomes flattened with respect to energy in different media that highlighted the Compton scattering dominate. The relative dose ratios decreased steadily in bone from ~0.85 at 0.5 cm to ~0.65 at 2 cm thickness. Muscle showed intermediate attenuation with relative dose ratios ranging from ~0.92 at 0.5 cm to ~0.82 at 2 cm. The relative dose ratios fluctuated between ~0.95 and 1.05, that highlight the Air gaps exhibited non-linear perturbations due to non-uniform absorption and scattering loss. In case of multilayer phantom the dose initially increased in the air layer then gradually decreased in muscle and bone layer, that highlight the strong requirement for the tissue inhomogeneity correction. The calculated mass attenuation coefficients for various medium shows deviations within 1–9% from the NIST reference data across the photon energy range of 60–1500 KeV. Conclusion: The findings shows that material type, thickness and arrangement greatly alter radiation transport and dose distribution, so those variations needs to be incorporated for accurate treatment planning.



Oral Abstract ID: 35

Title: Performance of Delta⁴ and Portal Dosimetry for Patient-Specific Quality Assurance on TrueBeam and Halcyon Linear Accelerators

Author Names: Sajini Kurup

Co-Authors: Dr. V.K.Sathiyanarayana, Pooja Moundekar, Dr. Raghavendra Holla, Sumeesh S, Sumit T

Full Abstract:

Aim: To compare Delta⁴ and portal dosimetry (PD) systems for patient-specific QA in TrueBeam and Halcyon accelerators. Introduction: Patient-specific QA plays an important role for ensuring accurate delivery of treatment plans in radiation therapy. Delta⁴ has 3D diode array for volumetric fluence verification, whereas PD utilises already existing EPID-based 2D dose verification. Materials and Methods: 38 PSQA plans (17 TrueBeam, 21 Halcyon) for different treatment sites were measured with Delta⁴ and PD. Gamma analysis were performed for 3%,3 mm and 3%,2 mm criteria under local and global normalization. Statistical significance was analysed using independent t-tests. Results: For TrueBeam, Delta⁴ achieved 98.39% (3%,3 mm) and 94.96% (3%,2 mm), compared to PD Local 99.56% and 99.04%, respectively ($p = 0.010$ and $p = 0.00074$). For Halcyon, Delta⁴ achieved 98.13% (3%,3 mm) and 95.35% (3%,2 mm), compared to PD Local 99.06% and 97.77% ($p = 0.018$ and $p = 0.0033$). Conclusion: Both systems gave high gamma pass rates, with PD showing slightly higher values. Delta⁴ showed statistically relevant differences at 3%, 2 mm, likely due to its 3D fluence-based approach, giving better result analysis for complex plans. Discussions: The 3D fluence verification of Delta⁴ provides confidence in complex plan verification, making it more valuable for high-precision treatments where small dose deviations may impact clinical outcomes. Along with fluence measurement, point dose can also be performed simultaneously in Delta⁴ as an additional PSQA method for verification.

Oral Abstract ID: 36

Title: "Innovative design of a cost-effective bunker for Tomotherapy: Optimizing Space and Safety"

Author Names: Nidamanuri Gouse

Co-Authors: Ashitha M K, Annex E H , Debnarayan Dutta

Full Abstract:

Introduction and Objective : Tomotherapy, a modern image-guided intensity-modulated radiation therapy (IMRT) technique, delivers 360° helical radiation, demanding highly specialized bunker designs. Traditional bunkers tend to be space-intensive and high cost due to uniform shielding, leading to increased infrastructure costs. The objective of this project is to design a cost-effective, space-optimized materials utilization for Tomotherapy that complies with national and international radiation safety standards. Materials and Methods: It involves detailed evaluation of radiation shielding requirements using empirical methods outlined in NCRP Report No.151, along with simulation tool. Shielding calculation parameters such as clinical workload, use factor, occupancy and distances is tailored to the Tomotherapy system's unique beam delivery pattern and space management. Architectural modeling will be done using AutoCAD software, and alternate layout geometries such as oval or semicircular designs using standard and high-density concrete will be explored. Modular Precast Concrete blocks will be evaluated for shielding efficiency and cost effectiveness. Expected Results and Discussion: It is anticipated that the final design reduce unnecessary over-shielding by applying wall-specific shielding thicknesses based on realistic workload and beam geometry. The inbuilt beam stopper (Tomo-H) allows reduction in primary wall thickness. The use of compact maze-based entryways and optimized shapes is expected to save bunker volume while maintaining safety standard. Early modelling suggests potential cost savings of 20–30% in construction materials. The design will be validated against AERB and IAEA standards to ensure compliance and safety for both patients and staff. Conclusion: The prospective study aims to develop a scalable, safe, and economically feasible bunker n design for Tomotherapy that can be applied in both new installations and facility upgrades. It can serve as a reference model for future radiotherapy centre designs focused on affordability and spatial efficiency. Keywords: Tomotherapy, NCRP 151, Cost effective, Space-optimization, Shielding.

Oral Abstract ID: 37

Title: Latent Construction Defects of a LINAC Facility Identified and Corrected through Regulatory Oversight Programme: A Case Study

Author Names: M Senthilkumar

Co-Authors: T Sai Praneeth, Firoz Alam, M K Pathak

Full Abstract:

Background/Objective: Periodic regulatory inspections are carried out by the Atomic Energy Regulatory Board to verify compliance with consent conditions. During one such inspection of a LINAC bunker, a radiation survey revealed ~190 mR/hr at a specific spot on the primary wall, much higher than baseline commissioning values. Investigation found a small air gap in a grouting hole. Sealing it with concrete restored shielding integrity. This paper aims to sensitise radiological safety officers and medical physicists about potential construction defects and the necessary measures required for radiotherapy bunkers. Materials andMethods: A regulatory inspection included a radiation survey of a bunker (internal dimensions: 9.2 × 8 × 5 m) designed for a LINAC having photon energies of 6, 10, and 15 MV (FF mode, 600 MU/min) and 6 MV, 10 MV (FFF mode, 1400 and 2400 MU/min). The primary wall of 2.4 m thick (density: 2.35 g/cm³) was surveyed with a calibrated Fluke 451P-RYR ion chamber at gantry angle 270°, 10 MV, 600 MU/min, with no scattering medium. A localized peak dose rate of ~ 190 mR/h was recorded on a 5 cm diameter area, which was significantly higher compared to 5 mR/h measured during commissioning and previous periodic surveys. A second survey meter confirmed the readings. Expert team of the facility verified the anomaly. Root cause analysis identified a small air gap within a grouting hole, likely from incomplete filling during construction, reducing local shielding effectiveness. The gap was sealed with concrete, restoring integrity. Post-repair readings showed 1.5–2.0 mR/h for the 15 MV beam, matching design specifications. A comprehensive survey using a 0.5 × 0.5 m grid across the primary wall revealed no further deficiencies. Results & Discussion: Review of construction QA records suggested sacrificial tie rods at the hotspot location. Drilling revealed an air gap compromising shielding, which was filled with concrete. This highlights the need for strict construction QA and structured radiation protection surveys during commissioning and periodically in operation. Maintaining complete survey archives aids anomaly detection and remediation. Radiotherapy bunkers must last decades; robust QA ensures material integrity, prevents defects, and maintains shielding adequacy throughout the facility's operational life. This case highlights the need for meticulous construction practices and thorough shielding evaluations to detect localized defects in radiotherapy bunkers. Conclusions: Regulatory oversight revealed a latent construction defect, emphasizing the need of structured programme for radiation protection survey and stringent QA during bunker construction of radiotherapy installations to ensure long-term shielding integrity for protection of staff and public.

Oral Abstract ID: 38

Title: Assessing Manufacturing Defects in a New Telecobalt Source Flask Using a Disused Cobalt-60 Teletherapy Source

Author Names: Mohamed Ashraf Thondikkodan

Co-Authors: Saeed Anwer Tariq, Rmakant Sahu, Vellaiyan Subramani, Suman Bhasker, Dr. Kamlesh Kumar Harsh, Dr. Shankar Lal Jakhar, Dr. Neeti Sharma

Full Abstract:

Keywords: Gamma Radiometry Testing, Cobalt-60 Teletherapy Source, Radioactive Material Transport Flask, Shielding Effectiveness. Introduction and Objective: The safe transportation of high-activity telecobalt sources is paramount in radiation oncology. This study investigates the preliminary gamma radiometry of a newly fabricated 15 kCi capacity Telecobalt source transportation flask from Panacea Medical Technologies Pvt. Ltd., aimed at verifying its shielding integrity prior to active service. Materials and Methods: A preliminary gamma radiometry test was conducted by loading approximately 10% of the flask's designed capacity with a Teletherapy source. Radiation levels were assessed using both fixed ion chamber-based in-cell monitors and a remote teletector for contact and area surveys. Results and Discussions: Despite utilizing only 10% of the designed source activity, the flask exhibited alarming radiation leakage. In-cell monitors registered a significant 4 R/hr, while a remote teletector survey revealed an extreme localized hot spot on the top portion, between the lifting legs, measuring up to 200 R/hr on contact. These critically high radiation levels prevented a complete periphery survey due to immediate safety concerns. Analysis strongly indicates a severe shielding defect, likely a void or improper lead pouring during fabrication. Conclusion: The newly fabricated Telecobalt source transportation flask is found unsuitable for its intended purpose. The observed high radiation field clearly indicates a profound lapse in manufacturing quality control, posing an unacceptable risk of radiation exposure. This case highlights the importance of standard procedure followed like stringent and independent radiometry verification of all newly fabricated high-activity source transportation containers. This practice is crucial for preventing severe radiological incidents and ensuring that ALARA (As Low As Reasonably Achievable) principles are rigorously upheld.

Fig.1: Side view of the flask with high radiation area marked

Oral Abstract ID: 39

Title: Analysis of operational safety awareness among medical practitioners working with interventional radiology equipment in India: Strengthening radiation safety compliances

Author Names: Pampa Modak

Co-Authors: S. Mahalakshmi, G. Sahani, P. K. Dash Sharma

Full Abstract:

Background and Objective: Interventional Radiology (IR) procedures are complex and performed for a relatively longer duration at close proximity to radiation field, hence it contributes higher radiation exposures to physician and supporting staff compare to other diagnostic X-ray facilities. Objective of this study to assess the radiation safety awareness among medical practitioners, as well as to identify the particular areas to focus on. The inputs were sought from the medical practitioners involved in interventional radiology procedures. Based on the outcomes of the study to identify the areas for improvement on operational safety aspects. Materials and Methods: A sample questionnaire was developed to obtain the required inputs, in order to understand the routine work practice followed by the medical practitioners while carrying out interventional radiology procedures. The questionnaire was sent to interventional radiology facilities all over the country. Results and Discussion: Based on the analysis of the obtained inputs, ~99% of the respondents have stated that they are using lead aprons which are provided by their institution. Use of lead apron is one of the promising way to reduce the radiation exposure of radiation professional. The consistent use of lead goggles and thyroid shields during fluoroscopic procedures is also a common practice among ~89% most of the respondents. In our study, ~69% stated that the examinations are carried out by using the ceiling suspended shield during procedures. ~77% of respondents stated that they always use couch hanging protective flaps during procedures. From the responses, it is noted that majority of the respondents (Cardiologists/interventional radiologists) have good awareness on the use of personnel protective equipment. The study also revealed lack of awareness on certain areas such as use of magnification mode, use of different angulation, use of last image hold feature, proper use of ceiling suspended screen etc. for optimization of dose to operator and patient. Conclusion: This study indicates good awareness on the use of personnel protective equipment. The survey brought out the areas requiring more focus and spreading awareness among the relevant medical practitioners to further strengthen the safety aspects in IR procedures in India.

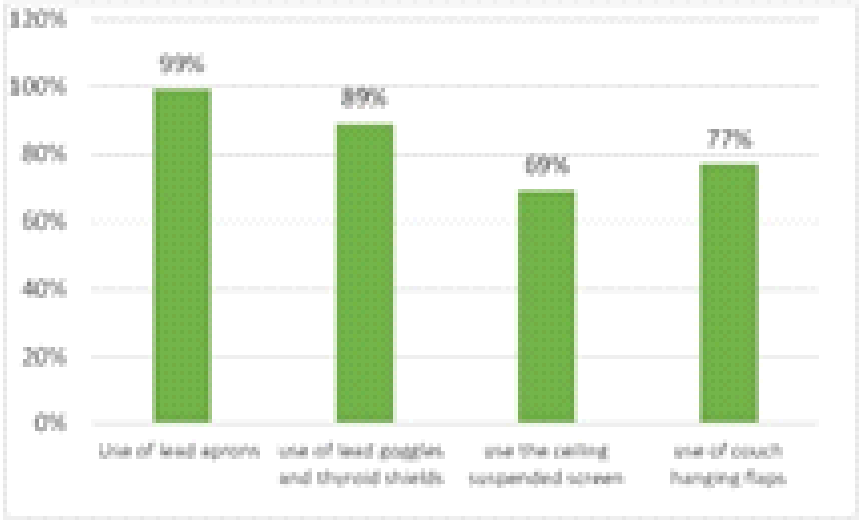


Fig.: Use of protective accessories during IR procedure

Oral Abstract ID: 40

Title: Simplification of Type Approval Process of Medical Diagnostic X-ray Equipment

Author Names: Rajendra Kumar Chaturvedi

Co-Authors: Pramod Kumar Dixit, S Mahalakshmi, P K Dahs Sharma

Full Abstract:

Background and Objective: AERB has been issuing type approval (TA) for medical diagnostic x-ray equipment since 1989. TA certificate is issued to manufacturers / suppliers on assessment of x-ray models as per radiation safety requirements specified in Indian Standards/ applicable IEC Standard(s) and AERB Safety Code of Diagnostic Radiology Practice [AERB/RF-MED/SC-3 (Rev.2), 2016]. Owing to large number of type approvals being issued earlier, we explored methodology to issue TA rather than model approval. This paper outlines methodology for simplify TA process of x-ray equipment. Materials and Methods: During1989-2023, AERB type approved 1690 x-ray models. For simplification of TA process, technical aspects of approved models were analysed. We noted that large number of models were introduced due to changes in values of maximum operating potential (kV) & tube current (mA), x-ray tube(s), image receptors and number of slices & slice thicknesses for computed tomography scanner. From end-users' operational feedbacks (Figure) received in Renewal of TA applications, we noted that issues related to mechanical components, calibration of exposure time & tube current stations; display of voltage & current at control console; communication error between control console & x-ray equipment, failure of x-ray tube, software error etc. of x-ray equipment. These issues can be rectified via recalibration of exposure parameters, software upgrade and replacement of mechanical components. However, no unusual incidents having radiation safety implications were reported. Therefore, AERB decided to simplify TA process of x-ray equipment. For simplification, types of x-ray equipment were decided based on the modalities. Terms & conditions of TA are revised for allowing manufacturers/suppliers for supply x-ray models with lower technical specifications, compatible components and image receptors without obtaining new approval. New application 'Add Variant to Existing Type Approved Models' is introduced for adding higher technical specifications (voltage & current) in type approved models. Results and Discussions: Based on above, AERB revised TA process of x-ray equipment in March, 2025. As a result, (a) 14 Types of Equipment are merged in 7 categories based on imaging modalities. (b) Manufacturers/suppliers can submit applications for addition of new models in simpler process. (c) Approval process for addition of new models becomes faster. By analysing data of last six months, we noted that around 70 % models are added with type approved models via Add variant whereas 30 % are added by issuing new type approval. Conclusion: Revised procedure has simplified TA process of x-ray equipment without compromising on radiological safety.

Oral Abstract ID: 41

Title: Study of incidents & accidents reported worldwide in radiotherapy: A way forward to strengthen radiation safety

Author Names: Bibekananda Mishra

Co-Authors: Pramod Dixit , Kishore Joshi, Pragya Shree, G. Sahani, Pankaj Tandon, P.K. Dash Sharma

Full Abstract:

Background and Objective: Accidents/incidents in radiotherapy possess potential risk to the patients, public and workers. It is highly essential to have proactive measures for the anticipated possible failures in the equipment and overall process of radiotherapy. In this study, worldwide reported radiotherapy accidents/incidents were studied, contributing factors identified and preventive measures suggested. Materials and Methods: Reported accident/incident published by IAEA, ICRP, USNRC, etc. were studied. Some of the significant events happened due to error in beam calibration, treatment planning, patient setup and dose calculation, measuring/monitoring and QA tools, training of staffs, incorrect diagnosis of the equipment error/malfunction and repairs, patient set-up verification, preventive maintenance of the equipment were analyzed. Results and Discussion: Based on the lesson learned and considering an optimized radiation safety measures, the outcomes are suggested in the form of contributing factors for the accident/incident and the preventative actions to avoid/minimize the accident/incident which are listed in Table-1. It is observed that accident/incident are occurred due to various contributing parameters. A minor requirement may also cause serious/fatal radiation injury, if not addressed in the radiation safety regime. Conclusions: In order to enhance radiation safety in radiotherapy and to avoid/minimize accident/incident, it is evident from this study that the preventive action points should be implemented in radiotherapy practice by the user institution.

Table-1

(Contributing factors and preventative actions)

Contributing factors	Preventative actions
Verification of Beam Calibration and Commissioning data.	To be carried out by another independent experienced Medical Physicist.
Cross verification of treatment planning, patient setup and dose calculation.	To be carried out by another Medical Physicist. Patient setup should be verified preferably using imaging techniques. During the first fraction of treatment all the concerned staff should be present to ensure the right treatment delivery.
Unavailability of Measuring, Monitoring and QA tools.	RSO/Medical Physicist should sensitize the management to ensure all time availability of Measuring, Monitoring and QA tools.
Training of newly joined staff w.r.t Equipment operation, Treatment Planning System, use of Dosimetric Instruments.	Employer should ensure that all the new staff members are trained.
Requirement of SOP for all the steps involved while implementing radiotherapy for patients.	SOP should be prepared for dosimetry, simulation, treatment planning, treatment delivery, for any change in patient treatment plan, prescription or any change that impacts patient treatment delivery etc.
Acceptance/QA test of all the new Treatment Planning System (TPS).	End to end testing of TPS should be carried out thoroughly and training to be imparted for the staff members involved.
Repair of equipment malfunction and preventive maintenance of the equipment.	The servicing and maintenance of the equipment should be carried out only by trained and authorised (by AERB and OEM) service engineers. Preventive maintenance of the equipment should be mandatory.
Competency and adequacy of staff member	Staff involving in the radiation treatment should have appropriate education & training in radiation therapy and radiation safety. Competency of the personnel should be assessed by recognized professional organization/agency.

Oral Abstract ID: 42

Title: Physics-Guided Cardiac MRI Flow Quantification: Linking Ventricular Mechanics with Hemodynamic Pressure Gradients

Author Names: Dr. Deb Kumar Boruah

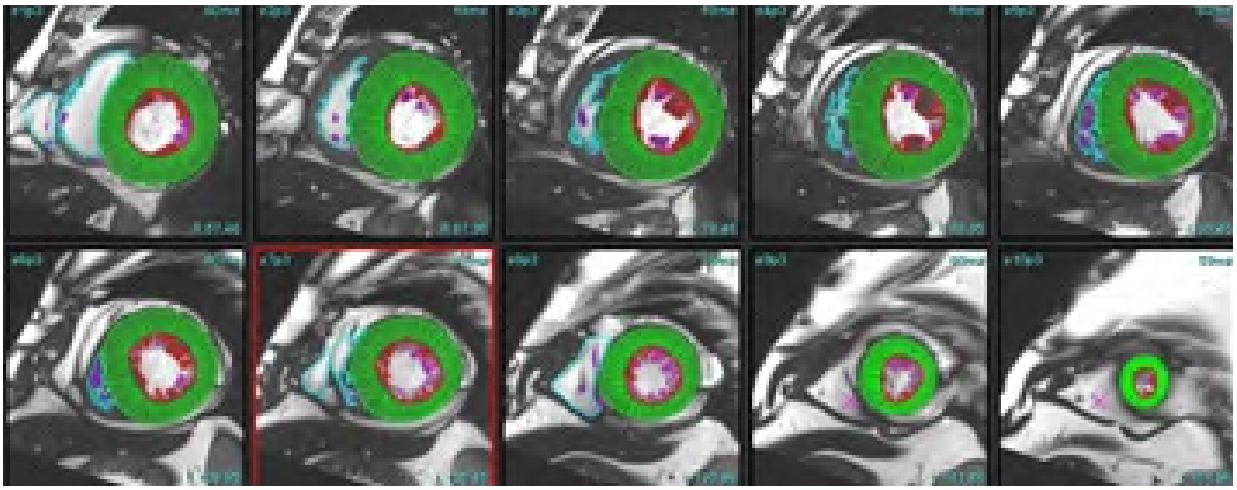
Co-Authors: Prof. Dr. Pranjal Phukan, Dr. Kalyan Sarma, Dr. Prince Das, Dr. Rajeev Bharadwaj

Full Abstract:

Aims and Objectives: Hypertrophic cardiomyopathy (HCM) involves altered ventricular geometry and dynamic LVOT obstruction, making precise haemodynamic quantification critical. Cardiac MRI (CMR) phase-contrast (PC) imaging encodes velocity in the MR signal phase ($\Delta\varphi = \gamma \cdot G \cdot \Delta x \cdot v \cdot TE$), enabling direct calculation of flow and pressure gradients. From peak velocity (Vmax), the modified Bernoulli equation estimates instantaneous pressure drop:

$$\Delta P = 4V2$$

Manual post-processing, while established, is sensitive to aliasing artifacts (phase wrapping > π radians) and operator variability. Deep learning (DL)-based segmentation provides automated contouring and phase-unwrapping, potentially improving reproducibility. This study compares DL and manual quantification of volumetric (EF, LVEDV) and flow-derived (aortic flow, LVOT pressure gradient) parameters in HCM patients. Materials and Methods: Twenty-five HCM patients (mean age: 51 ± 10 years) underwent 3T CMR with cine TrueFISP imaging and 2D-PC acquisitions at the LVOT and ascending aorta. Manual analysis (syngo.Via) and DL-based automated software (SuiteHeart) were used for post-processing. LVEDV and EF were derived from cine stack segmentation. Aortic flow and LVOT Vmax were extracted from PC velocity–time curves, with ΔP computed using Bernoulli's principle. Agreement between methods was assessed using Bland–Altman analysis, paired t-tests, and intraclass correlation coefficient (ICC).



Oral Abstract ID: 43

Title: Mammographic image quality analysis in line with the target filter combination and the thickness of breast.

Author Names: Sneha Theres O J

Co-Authors: Raj Kishor Bisht, Deepika S, Dharuman Vadivel, Thamarai Selvi P , Avinav Bharti, Sushma Rani Mandal, Pratik Kumar

Full Abstract:

Objective The aim of presented study is to perform comparative analysis of the image quality in digital mammography using Tungsten/Rhodium (W/Rh) and Tungsten/Silver (W/Ag) target/filter combinations. Material and methods: The images were acquired on "Hologic Selenia Dimensions" a mammography unit, under standardized conditions. The American College of Radiology (ACR) mammography phantom and polymethyl methacrylate (PMMA) slabs of varying thicknesses were used to simulate compressed breast tissues. The thickness was incremented up to 3 cm in the step size of 1 cm. For respective thickness level, a set of image was obtained using W/Rh and W/Ag filter combinations. The consistent exposure parameters were maintained for imaging under automatic exposure control (AEC). The "image quality metrics" were assessed quantitatively. Regions of interest (ROIs) were placed over uniform background and phantom test structures to compute signal-to-noise ratio (SNR) and contrast-to-noise ratio (CNR) as objective image quality indicators. Each measurement was repeated to improve statistical robustness. Mean values and standard deviations were computed to compare trends between combinations and thickness levels. Results The analysis revealed a distinct dependence of image quality on either filter combination and the breast thickness. At lesser thicknesses, the W/Rh combination demonstrated superior SNR and CNR, which is commendable to optimized spectral match for thinner breast tissues. In contrast, for larger thicknesses, W/Ag combination showed enhanced CNR values, prospectively due to harder X-ray spectrum, its penetration and contrast in denser tissues. Intermediate thicknesses presented relatively equivalent performance between both the target/filter combinations. Conclusion The findings highlight the importance of target/filter optimization in the imaging protocol of mammography. An evidence-based approach using W/Rh for thinner breasts and W/Ag for thicker breast tissue may yield improvements in image quality without compromising diagnostic sensitivity. The result support customization of clinical protocols and enhance patient-specific imaging strategies in breast cancer screening and diagnosis.

Oral Abstract ID: 44

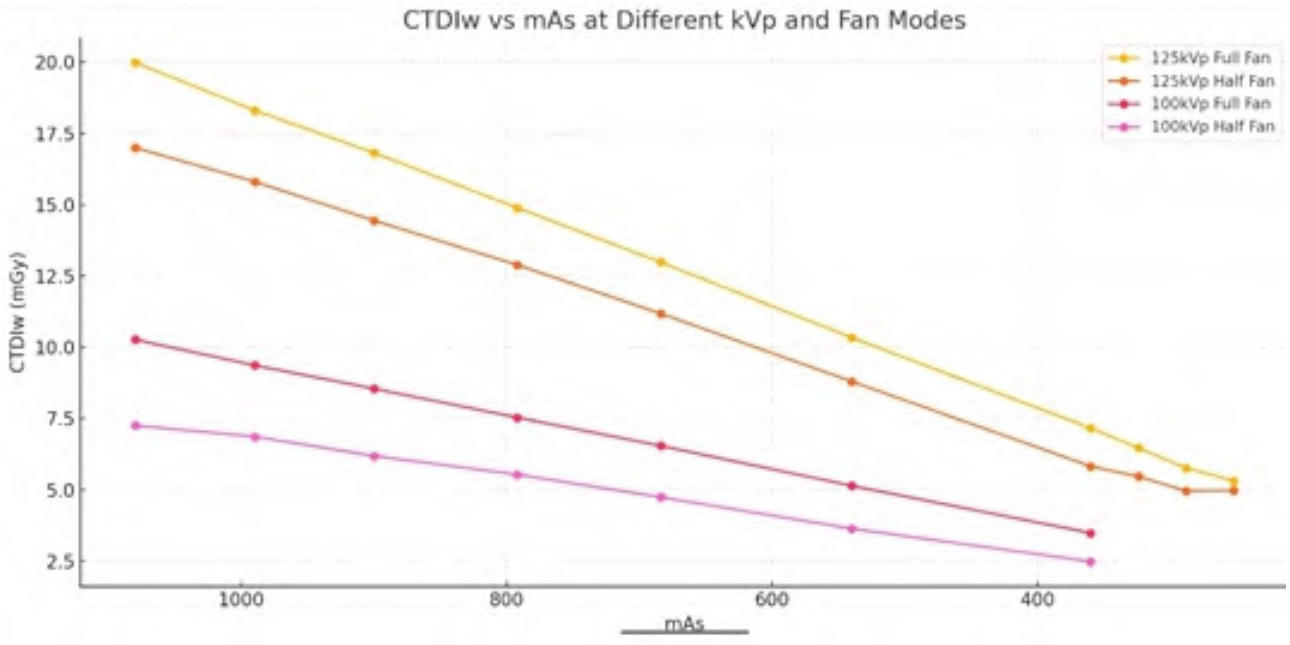
Title: Implementation of Optimized kV CBCT Pelvis Protocols in TrueBeam STx: Dose Audit and Image Quality Assessment

Author Names: Muhammed Fazil K U

Co-Authors: Dr Reshma Bhaskaran, Kamalaharan W, Dr Sushama P, Krishna Prasad P, Saveri J S, Arathi C, Murshida P

Full Abstract:

Background: Cone Beam Computed Tomography (CBCT) is a critical imaging modality in image-guided radiotherapy (IGRT), enabling precise patient positioning before treatment delivery. However, frequent CBCT scans, especially in protocols involving daily imaging, can lead to significant cumulative radiation exposure to patients. Therefore, optimization of CBCT protocols is essential to reduce patient dose while maintaining the image quality required for accurate anatomical visualization. Objective: This study aimed to develop and evaluate optimized kV CBCT protocols for pelvic radiotherapy using the TrueBeam STx linear accelerator. The goal was to reduce patient radiation exposure through protocol adjustments while ensuring image quality suitable for clinical alignment and verification. Materials and Methods: The standard pelvis CBCT protocol (125 kVp, 1080 mAs, half fan, full trajectory) was modified by varying kVp (100, 125) and mAs settings for both half and full fan configurations. A dose audit using a CTDI pelvis phantom and a pencil ionization chamber measured CTDIw. To evaluate image quality, a Catphan 604 phantom embedded in a 6.0 cm paraffin wax annulus was used to simulate average pelvic anatomy. Metrics such as HU linearity, contrast, spatial resolution, and signal-to-noise ratio (SNR) were quantitatively assessed using the Eclipse Treatment Planning System (TPS). Clinical experts also conducted qualitative evaluations of anatomical clarity for setup verification. Results: The optimized protocol using 125 kVp and 540 mAs in full fan and full trajectory mode achieved a 40% dose reduction compared to the standard setting. Image quality metrics remained within acceptable clinical thresholds. Visual assessments by clinical experts confirmed sufficient anatomical detail for patient setup and verification. These findings support using the optimized protocol as a standard option for pelvic imaging. Conclusion: The 125 kVp, 540 mAs full fan protocol for pelvic CBCT on TrueBeam STx effectively reduces radiation dose while preserving image quality. Its clinical adoption is recommended to enhance patient safety and workflow efficiency. Broader validation in other anatomical regions is encouraged. Keywords: kV CBCT, TrueBeam STx, Dose optimization, CTDIw, IGRT, Image quality, Pelvic imaging, Catphan 604 , paraffin wax annulus.



Oral Abstract ID: 45

Title: Age dependent Radiological safety assessment of packaged bottle drinking water in India

Author Names: Mahasin Gazi

Co-Authors: Arindam Kumar Naskar, Argha Deb

Full Abstract:

Objective: To present a detailed first-hand picture of different water quality parameters namely 222Rn, TDS and pH in the packaged bottled drinking water in different states of India on radiological safety point of view. Materials and Methods: Radioactive radon (222Rn) concentrations in 100 different packaged bottle drinking water (PBDW) samples from different states of India have been assessed in the present study using a portable AlphaGUARD radon monitor along with AlphaGUARD aqua kit. Among the collected samples, the production sites of 51 number of PBDW samples are different places of West Bengal and the remaining 49 samples are different places of other different states of India. Thus, assessing the radon levels in different brands of packaged drinking water that are accessed from West Bengal as well as other parts of India give a general picture of the 222Rn concentrations in packaged bottled water throughout India. Results and Discussions: Measured radon concentration levels vary between 0.56 – 5.72 Bq/l with an average value of 1.56 Bq/l. Radon concentration of no sample has exceeded the WHO and EU Commission prescribed reference level of 100 Bq/l or even USEPA's proposed MCL (11.11 Bq/l). The measured radon concentrations of the collected samples manifest no significant correlation with either Total Dissolved Solids (TDS) or pH values of the samples. Annual effective dose (AED) due to radon from these bottled drinking water for three age groups namely infants, children and adults are found to vary between 7.14 – 72.90 μSv/y with a mean of 19.90±1.03 μSv/y, 7.37 – 75.30 μSv/y with a mean of 20.54±1.09 μSv/y and 6.62 – 67.60 μSv/y with a mean of 18.44±1.0 μSv/y respectively. Assessment of dose shows that the total annual effective dose to the children is the highest among the age groups. No sample has exceeded the WHO and the EU commission proposed reference dose limit of 100 μSv/y. Conclusion: It may be concluded from this study that radon content and other drinking water parameters in bottled drinking water available in different states of India including Kolkata Metropolitan city and nearby areas, are well within the reference limits proposed by the international agencies. This study also indicates that in general bottled drinking water available in India is radiologically safe, at least as far as radon is concerned.

Oral Abstract ID: 46

Title: Commissioning of 3D printer and dosimetric validation of inhouse prepared 3D printed silicone gel bolus.

Author Names: Surpreet Kaur

Co-Authors: Gaurav Trivedi, Arun S. Oinam, Ranjit Singh, Ngangom Robert

Full Abstract:

Objective: This study explores the commissioning process of a 3D printer for the use in a radiotherapy department, focusing on its integration into clinical workflows for creating patient-specific accessories such as boluses. This study involves the characterization of the physical, radiological and dosimetric properties of the 3D printed material to be used for application in patient specific bolus. MATERIAL AND METHODS: For commissioning process, mechanical and extrusion calibration of the printer was performed and the dimensional accuracy of printed objects was analyzed. The test for dimensional accuracy was performed by printing test objects of known dimensions and verifying the printed dimensions using vernier callipers. CT scan (SOMATOM go. Sim., Siemens Healthcare) was acquired to perform radiological characterization of the objects. Mean HU value and relative electron density was used for radiological characterization. For dosimetric validation, depth dose distribution was studied using gafchromic films. Films were placed inside the bolus material and then abutted within the RW3 slab phantom for obtained PDD profiles. The measured depth doses were compared with TPS calculated depth doses. Increase in surface dose after using 5mm bolus was studied. The study was performed using gafchromic films, FC-65G chamber and PPC-40 chambers. Difference in response of the modalities were studied to validate the use of gafchromic film for dosimetric study. RESULTS AND DISCUSSION: Dimensional accuracy of the printed objects were found to be well within clinically acceptable range i.e., 0.5 mm. Radiologically, HU value and hence relative electron density of silicone was found to be greater than conventional bolus materials used. On comparative dosimetric analysis, it was found that the thickness required for achieving specific dose prescription vary with the bolus materials. Depth of maximum dose for silicone gel bolus was found to be less than conventional wax and universal gel bolus owing to its higher mass density and relative electron density. Surface dose increased to about 88% for both 6MV and 6MeV beams on using 5mm thick silicone bolus. Film measured and TPS calculated PDD curves showed a good agreement with each other. CONCLUSION: 3D printer can prove to be a good tool for creating patient specific applications in radiation oncology. Silicone gel can be effectively used as bolus to increase dose at surface during radiotherapy.

Oral Abstract ID: 47

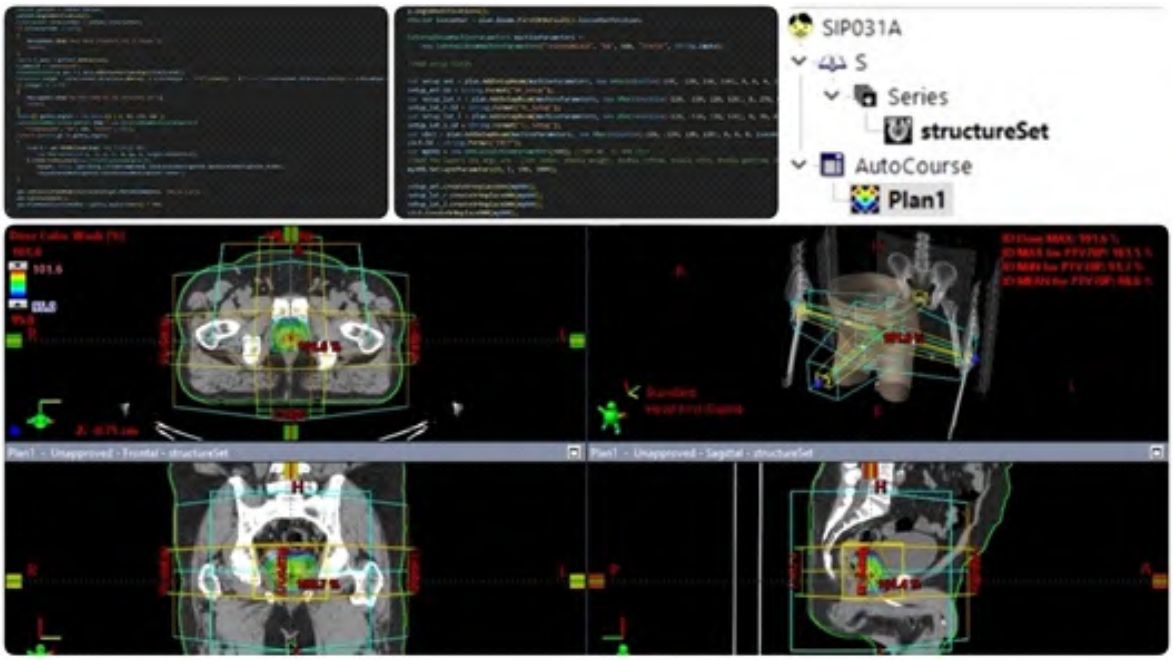
Title: Development of an Automated Workflow for Four-Field Plan and Setup Field Generation via Eclipse Scripting API

Author Names: Dibakar Barman

Co-Authors: Bhagyalakshmi AT, Nidhi Jain, Naveen M, Nameer PV, Rajasekar M, Shama Bhandary, Suresh Chaudhari

Full Abstract:

Introduction and Objectives: This study presents a semi-automated tool, developed using the Eclipse Scripting API (ESAPI), for efficient and reproducible generation of four-field box plan and orthogonal setup fields in single-PTV 3D conformal radiotherapy, aiming to streamline and standardize clinical planning workflows. Materials & Method: A C# script was developed using ESAPI (Varian Eclipse v16.1) and executed via Visual Studio. Prior to execution, the treatment planner manually selects the patient and associated structure set within the Eclipse environment. Upon initiation, the script identifies the Planning Target Volume (PTV), computes its center of volume, and assigns it as the isocenter. It then automatically generates four treatment beams at gantry angles 0°, 90°, 180°, and 270°, using 6 MV photons and a collimator angle of 0°. Collimator field sizes are dynamically adjusted to encompass the PTV in all directions, and the multi leaf collimators (MLCs) are shaped to the PTV with an isotropic margin of 0.7 cm. In addition to the CBCT setup, three orthogonal setup fields were created with fixed dimensions of 20×20 cm² and dedicated DRRs for image guidance. Field labelling, geometry, and machine parameters are standardized across all plans. Dose prescription and plan normalization are performed manually by the planner within Eclipse Treatment Planning System. Results & Discussion: The script was evaluated on twenty clinical test cases, all from pelvis sites (five each of sacral metastases, rectal cancer, and prostate cancer) with single PTVs. Execution time averaged 12 ± 5 seconds, after which we get an immediate dose Color Wash enabled visual assessment. Plans achieved 90–95% PTV volume coverage with at least 95% of the prescribed dose, particularly effective for PTVs sized approximately 10 × 10 × 13 〖cm〗^3. Beam geometry, MLC shaping, and isocenter placement were consistent across all cases. Compared to manual planning, time savings of over 75% were observed. Conclusion: The proposed ESAPI-based scripting tool provides a fast, consistent, and clinically viable method for automating four-field box planning and setup beams. With accurate PTV conformity, rapid Color wash feedback, and substantial time savings, it enhances 3DCRT workflow while preserving planner control over dose prescription and normalization. The approach is readily integrable into clinical routines and serves as a foundation for future intelligent planning systems. Keywords: Eclipse Scripting API (ESAPI), Auto Planning, Microsoft Visual Studio, C# programming language.



Oral Abstract ID: 48

Title: Digital Transformation of Radiation Oncology: Design and Implementation of e-Register

Author Names: Jenifer Sneha P

Co-Authors: Henry Finlay Godson, Timothy Peace, Simon Pavamani, Thomas Samuel Ram

Full Abstract:

Background: Numerous research studies have examined gamma analysis for PTV. Advanced planning algorithms such as the Anisotropic Analytical Algorithm (AAA) and AcurosXB (AXB)–in both dose-to-medium (DTM) and dose-to-water (DTW) modes–aim to enhance dosimetric precision. Objectives: This study compares AAA, AXB DTM, and AXB DTW in terms of dosimetric accuracy and clinical suitability, using system-based QA PerFRACTION™ for organs at risk (OARs) in thoracic cases. Material and Methods: This study adopts a comparative dosimetric validation approach to assess the accuracy and clinical reliability of three algorithms for calculating photon doses available in the Varian Eclipse Treatment Planning System (TPS), version 16.1.01. The algorithms being investigated include the AAA and Acuros XB AXB, which operate in two reporting modes: dose-to-water (Dw) and dose-to-medium (Dm). A cohort of 30 patients diagnosed with oesophageal carcinoma was retrospectively selected. All treatment plans were generated using the Eclipse TPS. The TPS-generated DICOM RT plan, dose, and structure sets, along with the patient's planning CT, were exported and imported into perFRACTION. Simultaneously, delivery log files from the Varian TrueBEAM SVC for each treatment plan were used by PerFRACTION™ to reconstruct the actual delivered fluence. Using the Collapsed Cone Convolution (CCC) algorithm within PerFRACTION™, the reconstructed fluence was recalculated on the patient's CT. The resulting dose distribution was compared against the calculated TPS dose, allowing one to assess the deliverable dose accuracy and beam modelling performance of each algorithm. Gamma analysis pass rates were evaluated at 1%/1 mm, 2%/2 mm, 3%/2 mm, and 3%/3 mm criteria. Results & Discussion: AXB DTM: Demonstrates superior consistency and accuracy for OAR in all spatial and dose metrics compared to CCC doses. AAA: Provides acceptable performance with good mean dose agreement with the CCC dose distribution but lacks consistency under tight gamma criteria. AXB DTW: Consistently underperforms, especially in gamma analyses, making it less suited for critical organ dosimetry. Conclusion: For OAR evaluation, AXB DTM is the preferred algorithm due to its spatial stability, dosimetric precision, and reliability under all gamma thresholds.

Dosimetric evaluation of AAA and Acuros XB for organ and risk assessment in thoracic cases utilising SunCHECK Patient Dosimetry

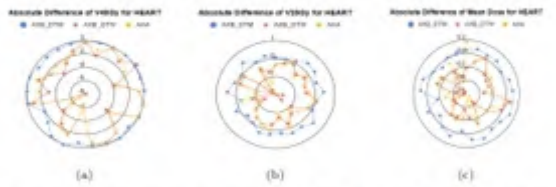


Figure 1: (a) Absolute Difference with CCC for V40Gy of Heart for three algorithms (AXB_DTM, AXB_DTW, AAA) (b) Absolute Difference with CCC for V25Gy of Heart for three algorithms (AXB_DTM, AXB_DTW, AAA) (c) Absolute Difference with CCC for Mean Dose of Heart for three algorithms (AXB_DTM, AXB_DTW, AAA).

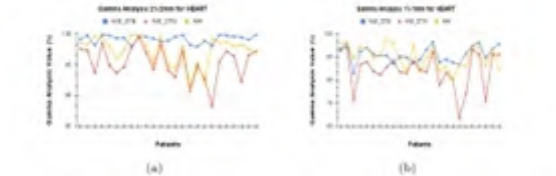
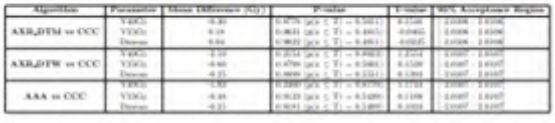


Figure 2: (a) Gamma Analysis 2%/2mm for Heart with CCC as the reference dose distribution (b) Gamma Analysis 1%/1mm for Heart with CCC as the reference dose distribution

Table 1: Comparative Statistical Analysis with CCC of V40Gy, V25Gy, and mean dose for HEART across AXB_DTM, AXB_DTW, and AAA algorithms.



Oral Abstract ID: 49

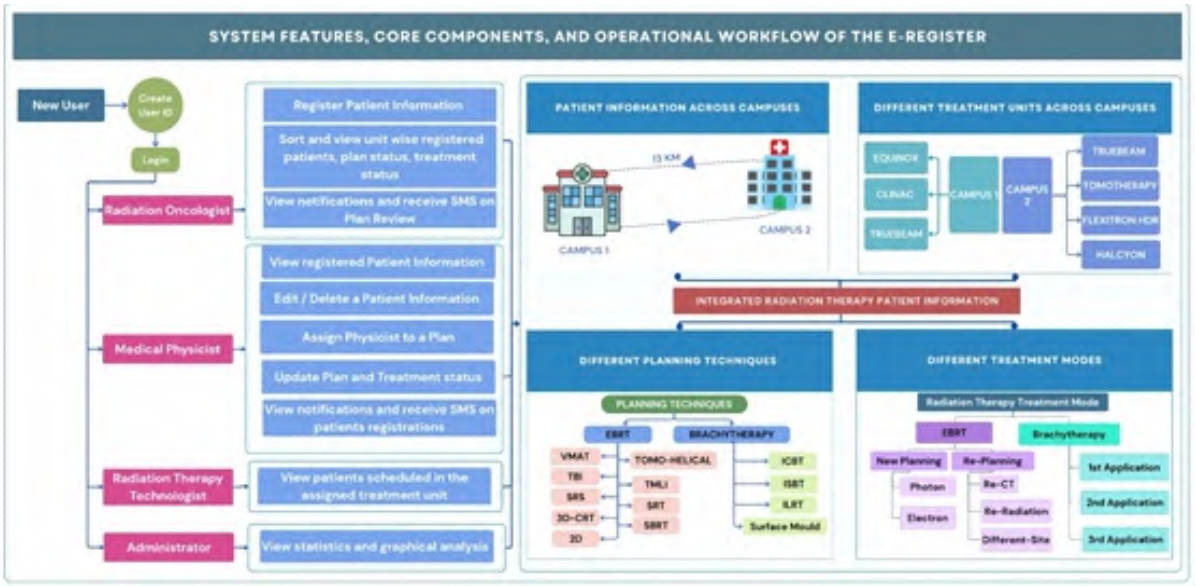
Title: Dosimetric evaluation of AAA and Acuros XB for organ and risk assessment in thoracic cases utilising SunCHECK Patient Dosimetry

Author Names: Devaraju Sampathirao

Co-Authors: Nimi Mathew , Shekhar Dwivedi, Gurvinder Singh, Ramandeep Singh, Shefali Pahwa, Tapas Dora

Full Abstract:

Background: The primary objective was to develop a secure web-based application, termed the Treatment Planning e-Register, to replace the traditional paper-based ledgers for managing treatment planning and execution. The application was designed to streamline workflow, enhance interdisciplinary communication among Oncologists, Physicists, and Radiotherapy Technologists (RTTs), and ensure real-time access to treatment data of multiple treatment units across campuses. It also aimed to provide a centralized, integrated solution for Radiation Therapy patient and treatment plan information. Along with automated scheduling for VMAT and 3D-CRT Techniques, treatment progress tracking and centralized storage of patient records enhances the efficiency, accuracy, and accountability in the department. Method: The e-Register was developed as a client–server-based web application, using HTML, CSS, and JavaScript for the interface, PHP for backend logic, and Structured Query Language for database management. Hosted on a Linux-based intranet server, the application incorporates role-based access for Oncologists, Physicists, RTTs, and Administrators. The platform supports registrations for multiple modalities, including VMAT, 3D-CRT, SRS, SRT, SBRT, TBI, TMLI, TOMO-Helical, and Brachytherapy, making it a unified solution for both External Beam Radiation Therapy and Brachytherapy for different treatment units. Key features includes automated slot allocation for VMAT and 3D CRT to manage high weekly workloads, Planning Timeline (PTL) mechanism to track delays in treatment planning progress, and notification mechanisms on new plan registrations, pending QA and an integrated SMS mechanism updates Oncologists and Physicists on plan status changes, ensuring real-time update of patient progress. Results: Since its implementation in April 2023, the e-Register has registered 6,744 patients, including 6,272 new EBRT plans and 472 brachytherapy treatments. Additionally, registrations included Re-CT (989), Electron (162), Re-radiation (88), Different Site (147), and Re-planning (270) cases. The application reduced patient registration time to less than a minute. Administrators benefitted from real-time analytics and graphical statistics, enabling machine-wise, unit-wise, and campus-wise performance monitoring. Machine-wise and applicator-wise brachytherapy statistics supported evidence-based procurement planning. Conclusion: The e-Register transformed Radiation Oncology practices by reducing paper waste, minimizing communication errors, and simplifying complex clinical workflows. Its integrated design enabled seamless coordination across geographically distributed campuses, ensuring real time access to patient data and treatment techniques. By providing a one stop solution for streamlined documentation, efficient reporting, and workflow management, it enhanced patient care while optimizing resource and machine utilization. With its secure, role based framework and user friendly interface, the e-Register established a modern, sustainable, and scalable approach to advancing clinical practices in radiation therapy.



Poster Abstract

Poster ID: 01

Title: Evaluation of dosimetric accuracy of clinical plans generated using different image reconstruction algorithms for adaptive radiotherapy of gynaecological cancers in Accuray Radixact X9

Author Names: Devika R Sekhar, Niya Maria Baby, Annex E H, Debnarayan Dutta

Full Abstract:

Introduction and Objective: The use of megavoltage computed tomography (MVCT) for performing dose calculations in radiation therapy has been widely investigated as it could provide a quantitative analysis of the dosimetric impact of changes in patients during the treatment. Image reconstruction algorithms for MVCT scans can influence the image quality. This study aims to evaluate the dosimetric accuracy of clinical plans generated using different image reconstruction algorithms for adaptive radiotherapy (ART) of gynaecological cancers in Radixact X9 system (Accuray, Inc., Sunnyvale,

CA) **Materials and Methods:** MVCT scans of five gynaecological cancer patients are used to evaluate the dosimetric accuracy of treatment plans generated using three different image reconstruction techniques- standard, iterative general and iterative soft tissue techniques with different pitch combinations-fine, normal and coarse. MVCT scans of the patients are acquired in Radixact X9 machine using three different image reconstruction techniques and three different pitch combinations prior to the patient treatment. Treatment plans are generated in the Accuray Precision® 3.3.1.3 treatment planning system for the Radixact X9 system for all reconstructed MVCT images. Dosimetric accuracy of clinical plans generated on different MVCT scans were evaluated against the clinical plan generated on kVCT image, approved by the oncologist based on dose-volume histogram (DVH) parameters. RESULTS AND DISCUSSION: The comparative analysis of MVCT images reconstructed using different algorithms revealed that all MVCT reconstruction algorithms provided consistent and clinically acceptable results when used for ART planning. These findings suggest that the choice of MVCT reconstruction algorithm does not introduce significant variability in the resulting dose distribution. The results support the robustness of the system and allow flexibility in clinical practice without compromising treatment accuracy.

Conclusion: This study concludes that there is no significant impact of different MVCT reconstruction algorithm on the dosimetric quality of adaptive radiotherapy plans for gynaecological cancers using the Radixact X9 system. The consistency in PTV coverage and OAR sparing across all reconstruction methods confirms that any of the available algorithms on the Radixact X9 system can be reliably used in ART planning without negatively affecting treatment quality. KEYWORDS: Adaptive Radiotherapy, Radixact X9, Image Reconstruction Algorithms.

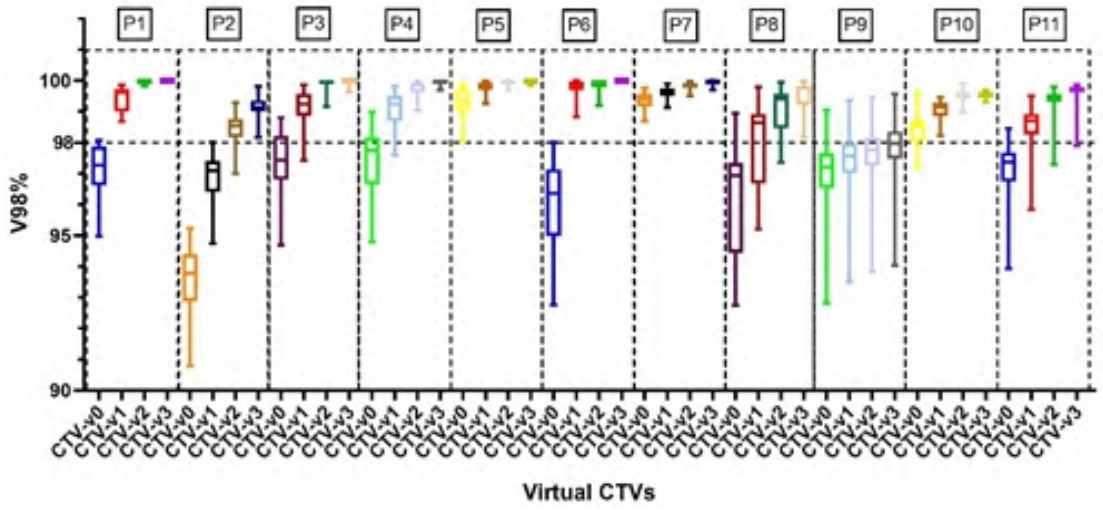
Poster ID: 02

Title: Assessing the optimal safety margin based on dose accumulation using adaptive radiotherapy framework

Author Names: Dr.Dayananda Shamurailatpam Sharma, Ms.Aishwarya G , Dr.Arjunan Manikandan, Dr.Ganapathy Krishnan, Dr.Uday Krishna, Dr.Rakesh Jalali

Full Abstract:

Objective: To develop a novel methodology for planning target volume (PTV) margin determination by analysing minimum coverage probabilities of virtual clinical target volumes (CTV) with reduced-margins, using accumulated doses in an offline adaptive radiotherapy (ART) framework. Materials and Methods: Treatment plans from 11 brain tumour patients with varying histologies, geometries, and volumes were analysed. Virtual CTVs (CTV-v0 to CTV-v3) were generated by isotropically contracting the clinical PTV (PTV-c) by 0–3 mm in 1 mm increments, with corresponding virtual PTVs assigned equal margins. For each treatment fraction, dose distributions were recalculated on setup-corrected daily megavoltage CT (MVCT) images using the clinically approved sinogram. A total of 303 fractions were assessed using two coverage thresholds: V98% 98% and V95% 99%. Results and Discussions: Box plot showing the variation in the volume of virtual CTVs receiving at least 98% and 95% of the prescribed dose are shown in figure 1. A 1 mm margin achieved V98% 98% in 81.8% of fractions. Margins of 2 mm and 3 mm met this criterion in 90.1% and 94.06% of fractions, respectively. Using the V95% 99% criterion, all patients met the threshold with a 0 mm margin, though only 85.48% of fractions achieved this level, indicating reduced consistency. Margins of 1–3 mm consistently met this threshold in over 97% of fractions. Maximum differences between planned and accumulated doses were <3% for V98%, <0.5% for V95%. Margin reductions of 1–3 mm significantly ($p<0.001$) decreased the volume of normal brain receiving the prescription dose by 8.27%, 16.19%, and 23.68%, respectively. Conclusion: This approach enables patient- and site-specific PTV margin adaptation in ART, improving normal tissue sparing without compromising target coverage. Keywords: Adaptive radiotherapy; PTV margin; margin reduction; OARs sparing



Poster ID: 03

Title: Dosimetric Impact of Photon Beam Energy, Fields, and Arcs: A Comparative Analysis of 3DCRT, IMRT, and VMAT for Preoperative Short-Course Radiotherapy in Rectal Cancer

Author Names: Sadia Afrin Sarah, Md Jobairul Islam

Full Abstract:

Purpose: To compare dosimetric performance of 3D conformal radiotherapy (3DCRT), intensity-modulated radiotherapy (IMRT), and volumetric-modulated arc therapy (VMAT) for short-course preoperative rectal cancer treatment, assessing target coverage, organ-at-risk (OAR) sparing, and delivery efficiency to identify the optimal technique. Methods: Fifteen rectal cancer patients prescribed 25 Gy/5 fractions were replanned using 3DCRT (4-field box, X10/X15), IMRT (5, 7, 9, and 11 fields), and VMAT (1–3 arcs) with 6 MV flattening filter-free (FFF), 10 MV (flattened [FF] and FFF), and mixed 6/10 MV energies in the Eclipse™ treatment planning system. Target coverage (D98%, D95%, Dmax%), homogeneity index (HI), conformity index (CI), OAR doses (bowel, bladder, femoral heads), and monitor units (MUs) were evaluated. Results: 3DCRT achieved adequate PTV coverage (D98%: 98.5 ± 1.0%) but poor conformity (CI: 1.81 ± 0.31) and elevated OAR doses bowel 180cc: 1,135–2,460 cGy; bladder D40Gy: 2,514 ± 55 cGy). VMAT and IMRT ensured consistent coverage (D98% variation 2.6%) with superior conformity (VMAT CI: 1.0–1.1). 2A-VMAT (X6 FFF) optimized homogeneity (HI: 0.07–0.11) and efficiency (MU: 1,945 ± 210), outperforming 9F-IMRT (X6 FFF), which required 72% more MUs (6,167 ± 580). Mixed-energy plans reduced MUs marginally but compromised HI (6% decline). OAR doses met RAPIDO constraints, with VMAT achieving the lowest bowel (180cc: 1,440–1,520 cGy) and bladder (D40Gy: 2,134–2,252 cGy) exposure. Conclusion: VMAT (2A-X6 FFF) is optimal for short-course rectal radiotherapy, balancing rapid delivery, OAR sparing, and protocol compliance. While 9F-IMRT (X6 FFF) matches dosimetric quality, its higher MU demand limits practicality. 3DCRT, though efficient (MU: 610 ± 23), poses toxicity risks due to poor conformity and should be reserved for resource-limited settings. Prioritizing VMAT ensures precision and workflow efficiency, with clinical validation of toxicity outcomes recommended for protocol standardization.

Poster ID: 04

Title: Multi-Institutional Evaluation of Customized PTV and PORV Margins in Head and Neck Radiotherapy: A National Study in Bangladesh

Author Names: Abu Kausar

Full Abstract:

Background: Head and neck cancers (HNC) pose unique challenges due to anatomical complexity and setup uncertainties during radiotherapy. In resource-limited settings like Bangladesh, standardized planning target volume (PTV) margins may inadequately address institutional variations in imaging and setup protocols. This multicentric study evaluates PTV margins across four Bangladeshi institutions, quantifying systematic (Σ) and random (σ) errors to optimize precision. Methods: Forty (40) HNC patients underwent intensity-modulated radiotherapy (IMRT) or volumetric modulated arc therapy (VMAT) at four centers (May–September 2024). Translational setup deviations (left-right [LR], anterior-posterior [AP], superior-inferior [SI]) were measured using electronic portal imaging devices (EPID) or cone-beam computed tomography (CBCT). Σ (standard deviation of mean displacements) and σ (root mean square of daily variations) errors were calculated. PTV margins were derived using van Herk's ($2.5\Sigma + 0.7\sigma$) and Stroom's ($2.0\Sigma + 0.7\sigma$) formulas. Planning organ-at-risk volume (PRV) margins followed McKenzie's method ($1.3\Sigma + 0.5\sigma$). Results were compared to 16 global studies (737 patients). Results: Significant institutional disparities were observed. PTV margins ranged from 4.7 mm (CBCT-equipped center) to 8.0 mm (mean: 6.8 ± 1.2 mm), aligning with literature (weighted mean: 6.8 mm; range: 3.6–9.9 mm). PORV margins varied from 2.6–4.4 mm. Institutions using CBCT demonstrated smaller margins ($p<0.05$, Kruskal-Wallis/Dunn's test), with lower Σ errors (1.2 ± 0.3 mm vs. 1.4 ± 0.5 mm in EPID-only centers). Daily CBCT reduced PTV margins by 3.3 mm, correlating with advanced imaging's role in error mitigation. Conclusion: Institution-specific PTV margins, tailored to local imaging capabilities, are critical in resource-constrained settings to balance tumor coverage and organ sparing. Daily CBCT enables margin reduction, directly supporting toxicity reduction strategies. These findings advocate for adaptive protocols and context-specific guidelines to enhance global radiotherapy equity, emphasizing technology integration in low-resource environments. Keywords: Setup Uncertainty, Head and Neck Radiotherapy, PTV Margin

Poster ID: 05

Title: Radiotherapy in head and neck Cancers with telecobalt beam and tissue Compensation – Clinical trial in high grade tumors 7fr/wk and 5fr/wk

Author Names: Ramamoorthy Ravichandran, Tarani Mondal, Gopal Datta, Kapil Malik, Ravi Kannan

Full Abstract:

Introduction: Radiotherapy (RT) with telecobalt beam using Aluminium Tissue Compensation (ATC) (Fig 1) has shown reduction in skin sequelae in head and neck treatments. Preservation of build-up dose pattern with orfit cut window and hot spots evened out by tissue compensation are the reasons. It is opined that the failure in local control of head and neck tumours is due to accelerated tumour growth beyond overall treatment time (OTT) >28 days. Because of better tolerance using ATC, a study is undertaken to reduce OTT by adding extra fractions on the weekends, reduce cumulative inter-fraction interval (CIFI), and look for better tumour control. Materials and Methods: A pilot clinical trial in RT of high-grade head and neck malignancies by 6fr/wk, 7fr/wk, 2 Gy fractionation in Theratron 780E telecobalt machine showed compliance for full course 70 Gy dose, with acceptable morbidity (Ravichandran and Ravi Kannan,2023). The morbidities observed in 7fr/wk were 0/92(Grade IV), 15/92(16%) in Grade III, 23/92(25%) in Grade II, 43/92(47%) Grade 1 skin reactions; 0/92(Grade IV), 24/92(26%) (Grade III), 35/92(38%) (Grade II) and 29/92 (32%) (Grade I) mucositis. Based on the above results, a Phase III randomised non inferiority trial comparing acute toxicities of standard (5fr/wk) with accelerated (7fr/wk) in locally advanced head and neck carcinoma was conducted. In a sample size of 206 patients, percentage of Grade 3-4 toxicity in our data were, skin 2.4% and mucosa 6.8% much less than the literature reported value of 69% (GORTEC 99-02) ($p<0.0001$ for both skin and buccal mucosa) for 7fr/wk, 64 Gy with 6MV linac beam quality. Conclusion: A therapeutic gain in biological end point BEDtumor enhancement of 19.4% (77.7 Gy against 65.1 Gy for 5fr/wk 70 Gy tumour dose) we expect higher local control. Further objective follow-up of these cohort is necessary for resultant local control. Our results with telecobalt treatments for head and neck malignancies are most promising. Cobalt 60 treatments show an edge over linac treatments, in head and neck tumours, because of enhanced tolerance, simple beam directed treatment plans, using tissue compensation. 15 mm build up depth in linac needs to be overcome with orfit casts, adding skin dose, thereby affecting tolerance. Key Words: head and neck, reduction in OTT, changed fractionation, biologically effective dose.

Poster ID: 06

Title: EPID Portal Dosimetry-Based Quality Assurance in Coplanar and Non-Coplanar IMRT: Clinical Insights from treatment of Esophageal Carcinoma

Author Names: Vinay Desai, Shanmukhappa B Kaginelli, K M Ganesh, Gopenath T S , Bhudevi Soubhagya Kulkarni, Naveen Bellutagi, Shruthi Venkateshalu

Full Abstract:

Introduction & Objectives: Radiotherapy planning can be performed using coplanar or non-coplanar beam arrangements. Coplanar beams are confined to a single plane, while non-coplanar approaches introduce additional angles, improving conformity and sparing of surrounding organs-at-risk (OARs). In oesophageal carcinoma, precise dose delivery is particularly challenging due to the tumour's proximity to critical structures such as the heart, lungs, and spinal cord. This study aims to compare coplanar and non-coplanar Intensity-Modulated Radiotherapy (IMRT) plans for esophageal carcinoma, with dosimetric verification using Electronic Portal Imaging Device (EPID) portal dosimetry. Methods & Materials Twenty patients with esophageal carcinoma were retrospectively evaluated. For each case, coplanar and non-coplanar IMRT plans with three and five beams were generated using Varian Eclipse v13.7.14. Non-coplanar plans were derived from coplanar arrangements by adjusting gantry and couch angles. A 6 MV photon beam was prescribed to deliver 50.4 Gy in 30 fractions. Dose constraints included: PTV coverage (D95% >47.88 Gy, D5% <53.92 Gy), spinal cord (<45 Gy), lung (V20 <25%, V10 <50%, mean <13 Gy), and heart (V40 <40%, mean <30 Gy). Plans were optimized using the Photon Optimizer and calculated with the Anisotropic Analytic Algorithm (AAA) using a 0.5 cm dose grid. EPID portal dosimetry was applied for patient-specific QA with 3%/3 mm gamma analysis. Dosimetric indices–Homogeneity Index (HI), Conformity Index (CI), and Integral Dose–were evaluated for all plans. Results & Discussion All plans met clinical dose constraints. Non-coplanar IMRT demonstrated improved conformity (higher CI) and better sparing of lung and heart compared to coplanar plans, while maintaining acceptable homogeneity. The integral dose was lower in non-coplanar arrangements, suggesting reduced exposure to healthy tissues. EPID portal dosimetry confirmed high treatment accuracy, with >95% of points passing the 3%/3 mm gamma criteria in all cases. Maximum gamma values and dose deviations were within tolerance. These findings establish the reliability of EPID-based QA in validating complex beam arrangements. The results support non-coplanar IMRT as a promising approach for optimizing esophageal carcinoma treatment. Conclusion Non-coplanar IMRT provides superior conformity and OAR sparing compared to coplanar techniques, without compromising homogeneity or treatment accuracy. EPID portal dosimetry proved to be a robust QA tool, ensuring precise dose delivery. Further validation across head, neck, and pelvic sites is underway to generalize these findings for broader clinical applications. Keywords IMRT, Coplanar, Non-Coplanar, Esophageal Carcinoma, EPID Portal Dosimetry, Gamma Analysis, Quality Assurance.

Poster ID: 07

Title: A dosimetric evaluation of breast radiotherapy treatment planning using volumetric modulated arc therapy: Comparing sequential plans versus bias dose plans

Author Names: Thirumal M, Palanivelu D, Dr Ajay Kumar Kondeti, Dr Chandramouli R

Full Abstract:

Aim/Purpose: This study aims to evaluate and compare the dosimetric parameters of breast cancer radiotherapy plans using Volumetric Modulated Arc Therapy (VMAT), specifically contrasting the use of the bias dose planning (BDP) feature with sequential planning (SP) without bias in the Monaco Treatment Planning System (TPS). Materials and Method: A total of ten breast cancer patients were randomly selected for this study, which followed a two-phase treatment regimen. In Phase 1, a dose of 40 Gy was delivered using the Elekta Versa HD, and the treatment plans were generated with 6 MV beams in the Monaco TPS using the VMAT technique. Phase 2 involved a sequential boost, delivering an additional 12.5 Gy, also using VMAT. For each patient, two treatment plans were created for Phase 2: one utilizing the BDP feature and the other SP, allowing for a direct dosimetric comparison of target volume, Organ at risk (OAR), normal tissue exposures, conformity index (CI) and Homogeneity index (HI). Results: Both the Bias Dose Plan (BDP) and Sequential Plan (SP) achieved comparable target volume coverage, with similar conformity and homogeneity indices. However, BDP demonstrated superior sparing of organs at risk (OARs). Specifically, BDP significantly reduced the mean doses to the left lung (1496.4 ± 47.9 cGy vs. 1594 ± 189.3 cGy), right lung (465.9 ± 109.1 cGy vs. 591.6 ± 251.4 cGy), and heart (770.1 ± 232.0 cGy vs. 970.2 ± 65.5 cGy) compared to SP (all $P < 0.05$). Additionally, volume-based metrics, including V20 and V5Gy, consistently favoured BDP. There was no substantial difference in the absolute volumes (cc) of the Body-PTV structure receiving 10% to 90% of the prescription dose between the BDP and SP plans, and the differences were not statistically significant (P 0.05). These findings underscore the dosimetric advantage of BDP in minimizing radiation exposure to critical structures without compromising target coverage. Conclusion: The integration of the bias dose feature in VMAT-based breast cancer radiotherapy planning offers dosimetric advantages by improving sparing of critical organs without compromising target coverage or plan quality. This study highlights the importance of incorporating bias dose planning in multi-phase breast radiotherapy, especially when sequential boosts are required and supports its suitability for adoption in routine clinical practice. Key words: Breast, Bias dose plan, sequential plan, Volumetric Modulated Arc Therapy

Poster ID: 08

Title: Coplanar vs Non-Coplanar IMRT for Rectal Cancer: A Planning and DVH-Based Dosimetric Study

Author Names: Vinay Desai, Shanmukhappa B Kaginelli, K M Ganesh, Gopenath T S , Bhudevi Soubhagya Kulkarni, Naveen Bellutagi, Shruthi Venkateshalu

Full Abstract:

Introduction & Objectives This study performed a dosimetric comparison of coplanar (CP) versus non-coplanar (NCP) IMRT plans for 20 patients with rectal carcinoma. The objective was to evaluate and compare key dosimetric parameters, including target volume coverage, dose homogeneity, conformity, and sparing of organs at risk (OARs), to determine which approach offers a superior treatment plan. Methods & Materials Treatment plans for 20 rectal cancer patients were retrospectively analyzed. Both CP and NCP plans were IMRT-based and prescribed a total dose of 50.4 Gy in 28 fractions to an average PTV of approximately 1360cc. CP plans used seven or nine beams, while NCP plans introduced ±90deg collimator and ±15deg couch rotations to two beams. The study compared PTV dose coverage and homogeneity, along with doses to the small bowel, bladder, and femoral heads. The Homogeneity Index (HI), Conformity Index (CI), and Integral Dose were also evaluated. Results & Discussion NCP plans showed superior dose homogeneity and conformity, with an average HI of 0.024 (vs. 0.049 for CP) and a CI of ±0.75 (vs. ±0.65 for CP). NCP plans, however, delivered a higher maximum dose to the bladder (21.7 Gy vs. 18.6 Gy) and the left femoral head (10.0 Gy vs. 7.9 Gy). The maximum small bowel dose was comparable between techniques. A notable finding was that CP plans resulted in a significantly lower Integral Dose. Conclusion In conclusion, NCP plans offer improved dose homogeneity and conformity for rectal cancer. However, this benefit comes with a higher integral dose and increased maximum doses to the bladder and femoral head. The selection of a treatment approach should be carefully weighed on a patient-specific basis, considering the trade-offs between PTV coverage and OAR sparing. Keywords Dosimetry, Rectal Cancer, Radiotherapy, IMRT, Coplanar-CP, NCP-Non-Coplanar, Organ at Risk

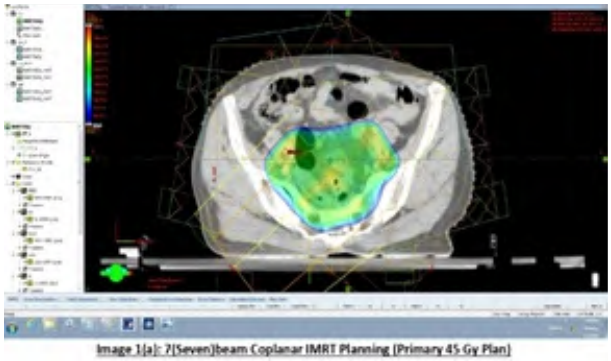


Image 1(a): 7(Seven)beam Coplanar IMRT Planning (Primary 45 Gy Plan)

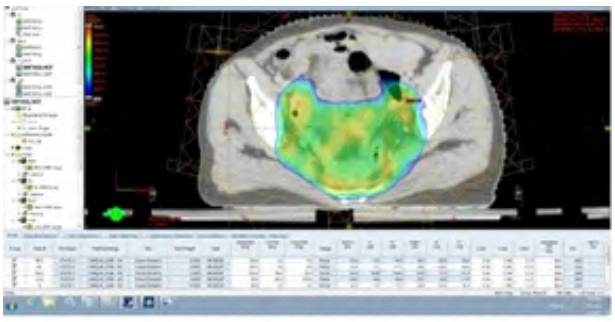


Image 1(b): 7(Seven)beam Non-Coplanar IMRT Planning (Primary 45 Gy Plan)

Poster ID: 09

Title: AI Applications in Radiation Dose Estimation for Diagnostic Radiology: A Literature Review

Author Names: Alok Pandey

Full Abstract:

1.0 Introduction Radiation exposure from diagnostic imaging procedures, particularly Interventional Radiology (IR) and Computed Tomography (CT), has become a growing concern for both patients and healthcare professionals. Traditionally, dose tracking has relied on scanner-generated indices such as CTDIvol, DLP and DAP, which provide only generalized estimations of radiation exposure. More precise assessments, such as organ-specific and effective dose calculations, are often time-consuming and not readily integrated into clinical practice. This literature-based review presents current developments in AI-driven radiation dose estimation and risk modelling in diagnostic radiology, along with simulation-based studies that do not require real-world patient data. 2.0 AI in Radiation Dose Estimation Artificial intelligence techniques are increasingly applied to estimate radiation dose metrics such as dose-length product (DLP), dose-area product (DAP), and organ-specific doses in interventional and fluoroscopic procedures. Machine learning models, trained on retrospective data, use parameters like tube voltage (kV), tube current (mA), slice thickness, and scan length–often extracted from DICOM metadata–to predict dose with accuracy comparable to traditional simulation methods. Simulation results, particularly from Monte Carlo-based models, provide valuable ground truth data for training and validating AI algorithms. Deep learning approaches further enable real-time anatomical segmentation and dose map generation, offering scalable, automated solutions for clinical dose monitoring while enhancing both safety and procedural efficiency. Table 1 provides summary of Studies on AI & Computational Methods in Radiation Dose Estimation for diagnostic radiology. 3.0 Challenges Despite promising advances, several challenges remain in the application of AI. Model generalizability across various equipment type, patient anatomies, and imaging protocols and requirements of big data are the key concern. Additionally, AI-based models must undergo rigorous validation before clinical implementation. Ethical and regulatory considerations related to patient-specific risk prediction also require attention, particularly in risk communication to patients and providers. 4.0 Conclusion AI-driven radiation dose estimation, bolstered by simulation techniques like Monte Carlo modelling, provides a robust framework for improving radiation safety in clinical practice. These technologies enable precise, patient-specific monitoring and optimization of imaging protocols in real time, helping to minimize unnecessary exposure. Furthermore, the integration of AI is expected to facilitate adherence to regulatory dose limits and reinforces radiation protection frameworks such as the ALARA principle, thereby enhancing the safety of diagnostic procedures. Keywords: Artificial Intelligence, Diagnostic Radiology, Dose estimation, radiation protection

Table 1: Summary of Studies on AI & Computational Methods in Radiation Dose Estimation for Diagnostic Radiology

Modality / Context	AI / Computational Method	Application Focus	Key Findings (Dose / Risk Impact)	References
Estimation of occupational radiation dose in interventional cardiology	ML algorithms+ Monte Carlo simulations	Application of Machine learning for occupational dose estimation.	Gradient Boosting ML algorithm accurately predicts occupational radiation dose	Kevser A Hışıroğlu, Ozan Toker, et al., Machine learning-based estimation of occupational radiation dose in interventional cardiology, Radiation Protection Dosimetry, Volume 201, Issue 10, June 2025, Pages 690–700
IR operators' hand exposure	ML detection of hand in beam	Machine learning algorithm for hand detection + Alarm tool to prevent operator hand dose	Conceptual approach; potential to reduce operator skin dose	M. Aboseria, M. Hotait, et al. A Machine Learning Approach to Reducing Radiation Exposure to the Hands of the Interventionalist, Journal of Vascular and Interventional Radiology, abstract no. 530, Vol. 34(3), S144, 2023.
X ray guided IR Endovascular Aneurysm Repair procedures	3D U Net DL model + Monte Carlo simulation	Fast deep learning dose map estimation; Rapid patient specific skin & organ dose estimation	Mean error −5 % for peak/average skin dose; fast enough for intra operative use	Villa M, Nasr B, Benoit D, et al., Fast dose calculation in x-ray guided interventions by using deep learning. Phys Med Biol. 2023 Jul 31;68(16)
Estimate the significant DLP value during the abdominal CT examinations	Artificial Neural Network (ANN) modelling	ANN modelling for Different types of learning algorithms checked in terms of the accuracy of the training data.	The Levenberg-Marquardt algorithm comprehensively detects DLP values for abdominal CT exams	Tekin H. O. , Almisned Faisal et al., Utilization of artificial intelligence approach for prediction of DLP values for abdominal CT scans: A high accuracy estimation for risk assessment, Frontiers in Public Health, Vol 10(2022)
Fluoroscopy guided endoscopic IR	AI enabled ultrafast collimation control	AI enabled collimation system ; Reduce radiation exposure via targeted beam collimation	Patient dose DAP reduced (2,178 vs 5,708 mGy cm^2); staff scatter reduction-59 %	J. Y. Bang, M. Hough, R. H. Hawes et al., Use of Artificial Intelligence to Reduce Radiation Exposure at Fluoroscopy-Guided Endoscopic Procedures, The American Journal of Gastroenterology, vol. 115, no. 4, Apr. 2020, pp. 555–561.
Fluoroscopic IR (clinical cases)	using Monte Carlo (MC) simulation with a graphical processing unit	Estimation of the patient skin dose rapidly and accurately; Rapid skin dose simulation from patient CT and fluoro logs	Relative statistical error (2 σ) for the simulated dose ≤3.5%.	Takeshi Takata et al., Fast skin dose estimation system for interventional radiology, Journal of Radiation Research, Volume 59, Issue 2, March 2018, Pages 233–239.
Various fluoroscopic IR procedures	Real time dosimetry systems (hardware + analytics)	Comprehensive dose monitoring; Track patient and staff dose in real time	Enabled insight into procedural vs occupational dose; supports behaviour change	A. M. Sailer, L. Paulis, L. Vergoossen, et al., Real-Time Patient and Staff Radiation Dose Monitoring in IR Practice, Cardiovasc. Intervent. Radiol., vol. 40, no. 3, pp. 421–429, 2017.

Poster ID: 10

Title: Role of Artificial Intelligence in Pediatric Radiology: Opportunities and Challenges

Author Names: Muthuvelu K , Preethi B, Alfred Samuel A, Harini C R, Indurani M S, Karan S, Victor R Lazar , Senthil Kumar A

Full Abstract:

Introduction and Objective Artificial Intelligence (AI) has emerged as a transformative technology in diagnostic imaging, offering enhanced accuracy, efficiency, and workflow optimization. In pediatric radiology, timely and precise diagnosis is critical due to the unique anatomical and physiological characteristics of children. This study aims to explore the potential applications, benefits, and challenges of integrating AI into pediatric radiology, focusing on diagnostic improvement, personalized care, and ethical considerations. Materials and Methods A narrative review was conducted, analyzing recent literature on AI applications in pediatric imaging. The review focused on deep learning algorithms, data analysis approaches, and real-world case studies addressing pediatric-specific challenges such as variable anatomy, age-appropriate radiation dosing, and limited datasets. Results and Discussions AI demonstrate significant promise in pediatric radiology, notably in enhancing diagnostic accuracy, automating routine image analysis, and reducing human error. Its ability to analyze large datasets enables pattern recognition for personalized care strategies. However, challenges include scarcity of diverse pediatric datasets, difficulty in adapting models to children's developmental changes, and ethical issues surrounding data privacy, bias, and parental transparency. Effective implementation will require collaboration among radiologists, data scientists, and policymakers, as well as robust validation of AI models for pediatric use. Conclusion AI holds great potential to revolutionize pediatric radiology by improving accuracy, efficiency, and patient-specific care. Overcoming data limitations, ethical concerns, and developmental variability is crucial for safe adoption. A multidisciplinary approach and ongoing research will be key to ensuring that AI meets the evolving needs of pediatric healthcare.

Poster ID: 11

Title: Optimisation of point A based brachytherapy for cervix cancer

Author Names: Suryakanta Acharya

Full Abstract:

Objective: Brachytherapy is an integral part of cervical cancer treatment. Most parts of the developing world are still practicing point A based planning. Optimising 2D brachytherapy planning makes good sense until they adopt CT or MRI based 3D planning. The study was done to find out the optimum isodose distribution by changing brachytherapy application parameters in point A based planning. Methods & Materials: 10 individual HDR brachytherapy parameters were included in this study. Fletcher suit applicator was used, and the procedure was performed under sedation. Various parameters like ovoid separation, dose to bladder and rectum points as specified in ICRU-38 were recorded. Distance between bladder point and rectum point was noted in each brachytherapy session. 100% isodose line with maximum separation, both in AP and Lateral directions were recorded. All parameters are subjected to bi-variate analysis. Results & Discussion: All recorded parameters are co-related with the isodose coverage, both in AP and Lateral direction, and inter-ovoid distance comes out as the most significant parameter affecting point A isodose distribution. Lateral isodose coverage increases with increase in ovoid separation up to approximately 25 to 30 mm, while AP isodose coverage remains constant throughout. Conclusions: Ovoid separation of 25 to 30 mm gives optimum isodose coverage of point A in cervical cancer brachytherapy. Key words: Point A, HDR Brachytherapy.

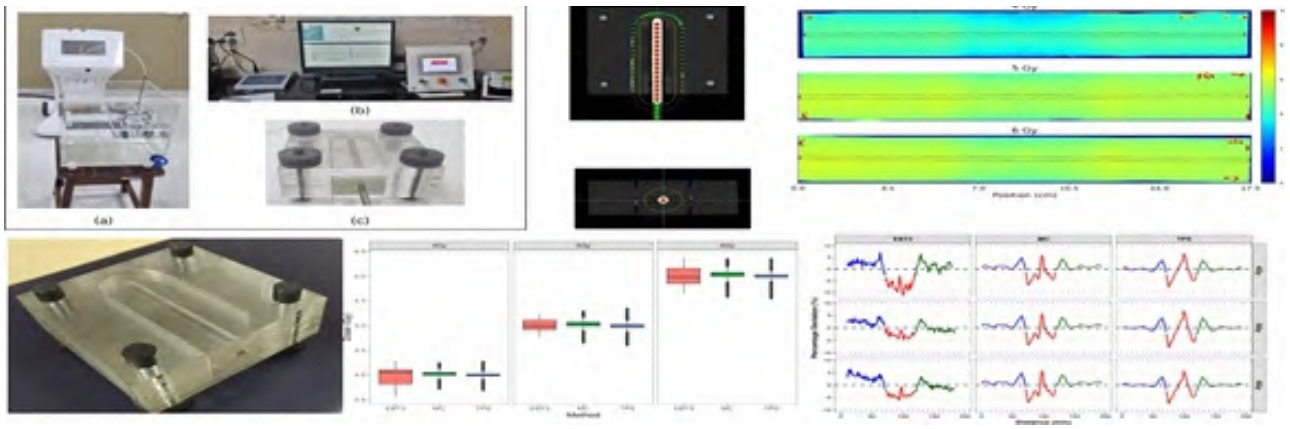
Poster ID: 12

Title: Phantom-based dosimetric verification of a high dose rate 60Co brachytherapy for vaginal cuff treatment using EBT3 film and Geant4 Monte Carlo simulations

Author Names: Mahesha Jayakody, J.Jeyasugiththan, Athiyamaan M S, Sourjya Banerjee, Dilson Lobo, Pooja M S

Full Abstract:

Introduction: High dose rate (HDR) vaginal cuff brachytherapy is a standard adjuvant treatment for endometrial and cervical cancers in the post operative setting. However, uncertainties in dose delivery may lead to local recurrence. Aim & Objectives: Aim of this study is to perform phantom-based dose verification in HDR 60Co brachytherapy using EBT3 film and Geant4 Monte Carlo (MC) simulations to cross-validate dose calculated by (TPS). Methods & Materials: A custom-designed perspex slab phantom was used to simulate vaginal cuff anatomy. Dose distributions for 4 Gy, 5 Gy and 6 Gy prescriptions were delivered using a single-channel vaginal applicator. EBT3 film dosimetry was used to measure absorbed doses, while MC simulations replicated the experimental setup for computational dose prediction. Comparative analysis was performed among EBT3, MC and TPS data. Results & Discussion: Good agreement was observed among the three methods, with most percentage deviations within ±10% and spatial regions of largest variation occurring near the applicator apex. EBT3 film and MC deviations highlighting potential discrepancies in TPS estimates. Conclusion: Independent dosimetric verification using EBT3 films and MC methods confirms the accuracy of delivered dose and reveals limitations in TPS- based dose predictions, particularly in anatomically sensitive regions such as the vaginal cuff apex. These findings support the integration of film and MC-based verification into clinical quality assurance (QA) protocols for HDR-BT to enhance treatment reliability and patient safety. Keywords: Vaginal Brachytherapy (VBT), EBT3 Film dosimetry, Geant4



Poster ID: 13

Title: Comparative Calibration of Co-60 HDR Brachytherapy Source Using In-Air, Phantom, and Well-Type Chamber Methods

Author Names: Navin Singh, Rijin NT, Munshid E.M, M M Musthafa, Aparna PK, Hari Govind, Aneesa A

Full Abstract:

Background/Objective: The calibration of high-dose-rate (HDR) brachytherapy sources is essential for quality assurance and patient safety. While established international protocols guide the calibration of Ir-192 sources, there is limited guidance for Co-60 HDR sources. This study aimed to evaluate the accuracy and suitability of three calibration techniques for Co-60, using an in-air setup, a solid phantom, and a well-type ionisation chamber, and to compare their outcomes with manufacturer-stated values. Materials and Methods: A Flexitron HDR brachytherapy unit with a Co-60 source (Elekta Medical Systems) was evaluated using three approaches: (i) in-air calibration with a 0.6 cc PTW Farmer-type ionisation chamber, (ii) measurements within an RW3 solid water phantom, and (iii) a Standard Imaging HDR-1000 Plus well-type chamber. Reference Air Kerma Rate (RAKR) was calculated for each technique following DGMP DIN 6809-2 recommendations. Parameters, including correction factors for air attenuation, temperature-pressure, recombination, and beam quality, were meticulously applied. In-air measurements required a locally fabricated calibration jig, and phantom-based RAKR was derived through comparative TPS-based dose calibration. The well-type chamber was calibrated using a traceable calibration factor for air Kerma strength. Results: All three methods provided RAKR values consistent with the manufacturer's certificate. Deviations were within acceptable limits: -0.54% for in-air, -0.55% for phantom, and -2.78% for well-type chamber measurements. When considering the well chamber as the reference, the in-air and phantom methods showed deviations of approximately +2.2%. Each method's uncertainty contributions were evaluated, with the well-type chamber showing the least procedural complexity, while the phantom method offered practical flexibility for clinical setups. Conclusions: This comparative study confirms that all three calibration methods are viable for Co-60 HDR sources. In-air calibration offers precise results but requires a mechanical setup. Solid phantom calibration is practical and reproducible without needing specialised equipment. The well-type chamber, despite its calibration limitations, remains a straightforward and reliable option. These findings support the inclusion of Co-60-specific guidelines in existing brachytherapy protocols to improve global standardisation. Keywords: Co-60 brachytherapy, HDR source calibration, Reference Air Kerma Rate, Ionisation chamber, Quality assurance.

Poster ID: 14

Title: Intra-Application Dosimetric Variations in Two-Application HDR Brachytherapy for Cervical Cancer in resource-constrained settings: An institutional experience

Author Names: Shraddha Srivastava, Aneesa A, Hari Govind B

Full Abstract:

Introduction and Objective: In resource-constrained settings, brachytherapy protocols involving single or two applications may be used. This study aimed to assess the intra-application dosimetric variations resulting from keeping the applicator in situ overnight during intracavitary brachytherapy for cervical cancer. Materials and methods 10 patients of locally advanced cervical carcinoma treated with high dose rate intracavitary brachytherapy (ICBT) were studied. All patients received external beam radiotherapy with a total dose of 46 Gy delivered in 23 fractions. Two fractions were delivered on consecutive days in single application by keeping the applicator in situ overnight. The second set of two fractions was delivered one week later, following the same procedure. The prescribed dose was 28 Gy in four fractions with 7 Gy per fraction. CT scan with a slice thickness of 3 mm was done before each fraction. HR-CTV and organs at risk (OARs) including bladder, rectum and sigmoid were contoured. Optimized plans were generated for each fraction in the TPS. The dose-volume parameters of HR-CTV (D90) and OARs (D2cc, D1ccc and D0.1cc) were evaluated. The applicator displacement was assessed in vertical (z), longitudinal (y) and lateral (x) directions. Results and Discussions: Mean D90 of HR-CTV was 8.20±1.98 Gy. Mean % change in D90 is between first and second fraction was 20.02±39.08 % and between third and fourth fraction was and 11.28± 81.94 %. Mean D2cc for bladder was 4.53±1.12 Gy, mean % change in D2cc between first and second fractions was 1.63±24.00 % while between third and fourth was 28.44±61.15 %. The mean D2cc of rectum was 3.37±1.40 Gy. The mean % change in D2cc rectum between first and second fraction was -35.76±22.91 % and between third and fourth fraction was -20.54±61.54 %. The mean D2cc for sigmoid was 2.64±1.29 Gy. The mean % change in D2cc between first and second fraction was -40.53± 27.26 % and between third and fourth fraction was -31±31.36 %. Mean displacement of left and right ovoid in x direction was 0.08±0.20 cm and -0.02±0.27 cm respectively while in y and vertical z direction was 0.10±0.29 cm and -0.40±2.10 cm respectively. Average shift of tandem in y and z direction was 0.03±0.60 cm and -0.41±1.31 cm respectively while the lateral shift was negligible. Conclusion: Retaining the patient overnight per application leads to increased intra-application dosimetric variations. However, delivering 4 fractions across two applications can be resource-efficient, provided the factors contributing to these variations are properly managed.

Poster ID: 15

Title: Design and Validation of a Patient-Specific 3D-Printed phantom for Dosimetry in Intracavitary Cervical Cancer Brachytherapy.

Author Names: V. Subramani, N. Gopishankar, R. K. Bisht, D. N. Sharma, Sukhvir Singh, Suman Bhaskar, Pratik Kumar

Full Abstract:

Introduction and Objective: Intracavitary radiotherapy (ICRT) is a conventional treatment for cervical carcinoma (Ca Cx), and it is administered after completion of external beam radiotherapy for many patients. The primary benefit of brachytherapy is its steep dose gradient, which allows for maximum tumor irradiation while minimizing exposure to surrounding tissues. The availability of commercial dosimetric phantoms for dose verification in ICRT is limited, and the use of rigid phantoms can lead to incorrect applicator positioning, resulting in inaccurate dose measurements. To address these issues, we have utilized material extrusion 3D printing with flexible thermoplastic polyurethane (TPU) filaments to print various patient-specific cervical anatomies and performed film dosimetry using this phantom. Materials and Methods: An anonymized DICOM CT scan of a CaCx patient with a Fletcher suit in situ, obtained from the patient's CT simulation data, was used to generate Stereolithography (STL) files. Segmentation of various structures, including the bladder, rectum, uterus, vagina, and sigmoid colon, was performed using Slicer3D V 5.6.1 software. Creality Slicer 4.8.2 software was used to generate G-codes for these organs, utilizing an 80% infill, a grid pattern, and a 100% filament flow rate. A 230°C extruder temperature and 80°C build plate temperature were used for printing using the Creality Ender 3 S1 Pro 3D printer. These organs were arranged in anatomical position and immersed in a water phantom with applicators. After taking the CT scan, Oncentra Brachy TPS V 4.6.0 was used to prepare a brachytherapy plan. After reconstructing applicators and activating appropriate dwell positions in tandem and ovoids, a 7 Gy dose was prescribed at point A. We delivered this plan to the phantom using Elekta's MicroSelectron HDR V3 brachytherapy machine, measured the bladder and rectal doses using EBT3 film stripes, and compared the radiation dose at bladder and rectal points with TPS-calculated doses. Results & Discussion: EBT3 film measurements showed significant deviations from TPS-calculated doses, ranging from +8.6% to -12.5%. For the rectum and bladder, measured doses were 3.8 Gy, 2.5 Gy, 1.6 Gy, and 5.2 Gy, compared to calculated doses of 3.5 Gy, 2.3 Gy, 1.4 Gy, and 5.8 Gy. These deviations are due to steep dose gradients in brachytherapy and are consistent with literature findings. Conclusion: Our study demonstrated that our phantom is a useful tool for patient-specific radiation dosimetry in ICRT. Using flexible materials for printing the phantom allows for easier applicator insertion and dosimetry in the treatment position.

Poster ID: 16

Title: Comparative Evaluation of Rectal and Bladder Doses in Image-Guided Interstitial Brachytherapy for Cervical Carcinoma Using Different Basal Point Geometries

Author Names: Anoop Kumar Srivastava, Sahil Shaikh, Madhup Rastogi, Rohini Khurana, Ajeet Kumar Gandhi, Shubham Das, Sagar l Singha, S. P. Mishra

Full Abstract:

Introduction Interstitial brachytherapy is increasingly being employed in the treatment of large tumour size of cervical carcinoma especially with parametrial extension. This study explores the impact of differently modulated basal dose points on the curved surfaces. The objective was to deduce the bladder and rectum doses in various implant geometries for optimizing the brachytherapy applications.Basal dose point dosimetry has historically played a critical role in obtaining appropriate dose distribution in the target volume. However, dose distribution based on target volume in the light of ICRU 58 recommendations require point dose modulations. Materials and Methods 10 carcinoma cervix patients, treated with interstitial implants using basal dose-based plans, were retrospectively replanned and evaluated. All the patients were scanned on CT simulator (Siemens Somatom Sensation Open) with 3mm slices. OARs and target volumes were delineated. All plans were generated using Oncentra TPS (v4.5.3) by using the basal dose points and modulated basal dose points for obtaining the suitable dose distribution. Thus, for each patient two treatment plans were developed by altering the basal point arrangements between triangle and square geometries for desired CTV coverages. Dose volume matrices of 2cc, 5cc, 10cc and 20cc were evaluated in both the geometrical configurations and distributions. Results Analysis revealed that for 7 out of the 10 cases, square geometry resulted in slightly reduced doses to rectum and bladder, ranging from 0.05% to 0.6% which is lower than those observed with triangular geometry. In the remaining 3 cases, the triangular configuration provided comparable sparing of the organs at risk (by 0.03% to 0.7%). Conclusion The study suggest that classical basal dose point geometries may not yield the real dosimetric distribution in the curved region hence rectum and bladder doses need to be obtained with optimized basal points. However, investigation on a larger patient cohort is warranted to draw definitive conclusions

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Poster ID: 17

Title: Can VMAT-based treatment planning replicate tandem-and-ovoid brachytherapy isodose distributions in the treatment of cervical cancer?

Author Names: Lalit Mohan Aggarwal, Gogul Priean V, Sunil Choudhary, Sachin Sakthivel

Full Abstract:

Introduction & Objective To evaluate the feasibility of replicating tandem-and-ovoid brachytherapy isodose distributions using VMAT-based external beam radiotherapy for cervical cancer, and to compare doses to organs at risk (OARs). Materials & Methods A dosimetric study was conducted on 5 cervical cancer patients (FIGO stage IB–IIIC) treated between 2021–2022. All patients received external beam radiotherapy (45 Gy in 25 fractions), followed by point-A–based tandem-and-ovoid intracavitary brachytherapy (7 Gy × 4 fractions). OARs were contoured by a single oncologist for consistency. All contours and isodose volumes (IV20% - IV200%) from the Oncentra brachytherapy TPS were transferred to Eclipse TPS. Using IV100% as the planning target volume (PTV), VMAT plans with two full arcs were generated to replicate IV100%, IV150%, and IV200% while minimizing OAR doses. The conformity index (CI) was calculated as the ratio of VMAT to brachytherapy isodose volumes for each dose level. Integral dose (ID) to OARs and the maximum dose (Dmax) to the right and left femoral heads were compared using statistical analysis. Results & Discussion The conformity index (CI) was 2.94 for IV20%, 2.70 for IV50%, 1.55 for IV100%, 1.2 for IV150%, and 0.98 for IV200%. Mean integral doses (ID) for the bladder, rectum, sigmoid, right and left femoral heads in the brachytherapy versus VMAT plans were 0.21 J vs. 0.27 J, 0.11 J vs. 0.11 J, 0.12 J vs. 0.11 J, 0.03 J vs. 0.07 J, and 0.03 J vs. 0.07 J, respectively. The average Dmax increased from 1.48 Gy (brachy) to 3.61 Gy (VMAT), and for the left femoral head from 1.77 Gy to 3.76 Gy. All differences were significant ($p < 0.005$), except for bladder ID, rectum ID, and sigmoid ID, as well as IV200% volume. VMAT achieved good conformity in high-dose regions, including the 200% isodose volume, closely replicating the brachytherapy dose distribution. However, conformity declined at lower dose levels, reflecting the inherent nature of VMAT, which produces a broader low-dose spread and a less steep dose gradient compared to brachytherapy. This limitation, combined with tight bladder, rectum, and sigmoid constraints during optimization, contributed to the markedly higher femoral head doses observed with VMAT. Conclusion VMAT can replicate brachytherapy's high-dose regions (100%, 150%, and 200% isodose volumes) with comparable bladder, rectum, and sigmoid doses, but results in higher femoral head doses. Brachytherapy maintains superior dose fall-off, reducing low-dose exposure to distant structures.

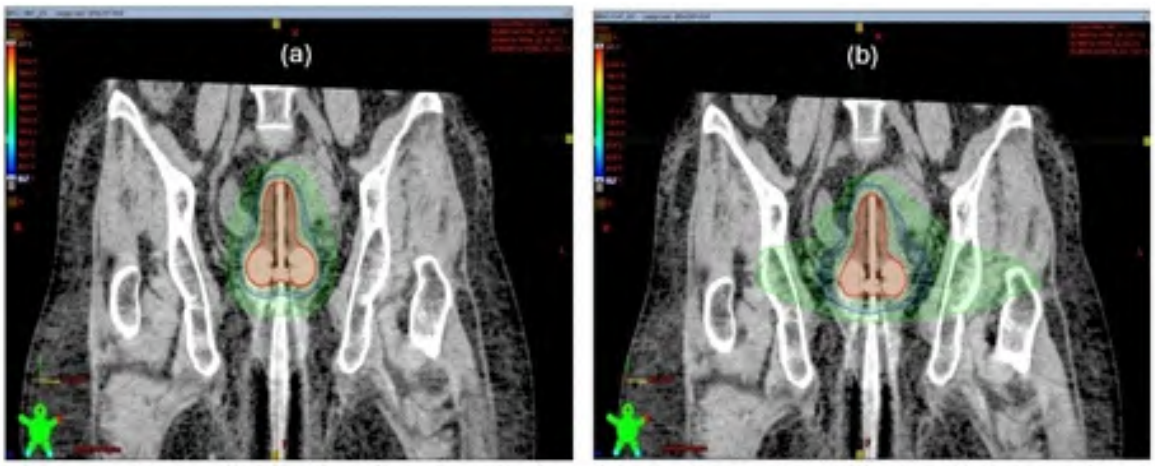


Figure 1. Dose distribution in coronal view (a) tandem-and-ovoids–based Intracavitary brachytherapy (b) external therapy with VMAT technique. Isodose volumes 50% (green), 100% (blue), 150% (yellow), and 200% (red) of the prescribed dose.

Poster ID: 18

Title: Dosimetric assessment of multi-fractionated MRI-guided high-dose-rate rectal brachytherapy: evaluating the necessity for replanning of individual fractions.

Author Names: Jeevanshu Jain, Abhishek Wagh, Yogesh Ghadi, Dr. Aditi Jain, Dr. Rahul Krishnatry

Full Abstract:

Objective: MRI-based high-dose-rate rectal brachytherapy (MR-HDR-RB) is being practiced as a treatment regime in rectal cancer with generally three fractions delivered once weekly. MRI acquisition prior to each treatment and the subsequent reconstruction and planning lead to logistics challenges, time inefficiency and patient discomfort. In this study, the dosimetric feasibility of using a single treatment plan versus replanning before each fraction has been evaluated. Methods and Materials: 30 fractions from 10 patients treated with multi-channel rectal applicator were chosen retrospectively. MR imaging was done prior to each fraction, and a corresponding treatment plan was generated using Elekta Oncentra system. Simultaneously, the first fraction plan was simulated on the second and third fraction images to simulate a single-plan treatment effect. GTV and Rest of Rectum (RoR) volumes, GTV doses (D98% and D50%), RoR doses (D0.1cc, D2cc, V100%, V150% and V200%) were calculated for the clinical plans as well as the simulated plans. Differences in the doses received by the GTV and the RoR between the clinical and the simulated plans were analysed. The paired T-test and Wilcoxon Signed Rank test were used to check the statistical significance of the dosimetric differences. Result: The GTV volumes for the 2nd and 3rd fractions showed a mean variation of 0.441 cc ± 0.433 & 0.680 cc ± 0.722, respectively. The absolute mean dose difference for GTV D98% between the clinical plan and simulated plan for fractions 2 and 3 was 1.038 Gy ± 0.937 and 0.860 Gy ± 0.512, respectively. For RoR, the maximum difference between the clinical and the simulated plans was seen for D0.1cc, which was 2.775 Gy ± 2.404 (p = 0.116) and 3.186 Gy ± 2.727 (p = 0.031) for the second and third fractions, respectively. The RoR D2cc doses showed a mean difference of 1.389 Gy ± 1.192 (p = 0.462) and 1.555 Gy ± 1.236 (p = 0.025) for the 2nd and 3rd fractions, respectively. All the RoR parameters showed a significant difference between the 3rd clinical plan and the corresponding simulated plan. The mean differences, standard deviation and statistical significance for various parameters are given in Table 1. Conclusion: Dosimetric difference between the clinical and simulated plans for GTv and RoR, though majorly statistically insignificant, exists. This difference can be attributed to anatomical variation or applicator insertion uncertainty. Robust mechanisms to reduce inter-fractional applicator insertion variation may positively impact the dosimetric difference reducing the need of replanning.

Parameter	Mean Difference between F2 & simulated F2 ± Std Dev	p-value (F2 & simulated F2)	Mean Difference between F3 & simulated F3 ± Std Dev	p-value (F3 & simulated F3)
GTV D98% (Gy)	1.038 ± 0.937	0.176	0.860 ± 0.512	0.678
GTV D50% (Gy)	1.253 ± 1.345	0.549	1.042 ± 0.695	0.156
RoR D0.1cc (Gy)	2.775 ± 2.404	0.116	3.186 ± 2.727	**0.031**
RoR D2cc (Gy)	1.389 ± 1.192	0.462	1.555 ± 1.236	**0.025**
RoR V100% (cc)	1.720 ± 1.260	0.658	1.694 ± 1.386	**0.030**
RoR V150% (cc)	0.642 ± 0.584	0.109	0.559 ± 0.513	**0.021**
RoR V200% (cc)	0.133 ± 0.239	0.063	0.150 ± 0.239	**0.031**

Table 1: Mean difference between the clinical and simulated plans with standard deviation and statistical significance. P-value less than 0.05 is considered significant and is highlighted.

Poster ID: 19

Title: Clinical Implementation of a 20 Gy Total Skin Electron Beam Therapy Protocol: Dosimetric Feasibility and Early Outcomes from a Single-Institution Experience

Author Names: Misba Hamid Baba, Benoy Singh, Aijaz Ahmad Khan, Mushtaq Ahmad Sofi

Full Abstract:

Background: Total Skin Electron Beam Therapy (TSEBT) is a well-established modality for treating cutaneous lymphomas and widespread skin malignancies. Traditional regimens delivering 30–36 Gy often pose significant logistical and toxicity burdens. Recent studies support the efficacy of lower-dose regimens. In alignment with the shift toward patient-centric precision therapy, our institute implemented a 20 Gy low-dose TSEBT protocol to balance efficacy with tolerability. Objective:To evaluate the feasibility, dosimetric adequacy, and clinical outcomes of a new 20 Gy TSEBT protocol delivered via a six-dual-field Stanford technique in a cohort of patients treated at our center. Materials and Methods: Eight patients with biopsy-proven Mycosis Fungoides or diffuse cutaneous T-cell lymphoma were treated with TSEBT using a Varian linear accelerator. A six-position dual-field technique was used with beam energies of 6 MeV, extended SSD, and customized acrylic degraders. Total dose: 20 Gy in 10 fractions over 2 weeks. Dosimetric verification was performed with in-vivo thermoluminescent dosimeters (TLDs) at reference skin sites (chest, back, thighs, and arms). Clinical responses were assessed at 6 and 12 weeks using standardized response criteria. Results: Median skin dose: 19.3 Gy (range: 18.5–20.2 Gy), confirming uniformity across anatomical surfaces. Gafchromic film-measured doses showed ±7% agreement with planned values.Clinical response:Complete response (CR): 5/8 (62.5%), Partial response (PR): 3/8 (37.5%). No Grade 3 acute toxicities observed. Most common side effects were Grade 1–2 erythema and fatigue.No treatment interruptions occurred. Patient-reported outcomes favored the shorter course. Conclusion:Our experience demonstrates that a 20 Gy TSEBT protocol is dosimetrically feasible, well-tolerated, and provides promising early clinical response rates. This approach aligns with modern goals of precision radiotherapy–offering effective palliation with reduced toxicity and treatment burden. Larger studies with longer follow-up are underway to evaluate sustained outcomes. Keywords: Total Skin Electron Beam Therapy, Low-Dose TSEBT, Cutaneous Lymphoma, 20 Gy Protocol, In-Vivo Dosimetry, Skin Dose Verification

Parameter	Mean Difference between F2 & simulated F2 ± Std Dev	p-value (F2 & simulated F2)	Mean Difference between F3 & simulated F3 ± Std Dev	p-value (F3 & simulated F3)
GTV D98% (Gy)	1.038 ± 0.937	0.176	0.860 ± 0.512	0.678
GTV D50% (Gy)	1.253 ± 1.345	0.549	1.042 ± 0.695	0.156
RoR D0.1cc (Gy)	2.775 ± 2.404	0.116	3.186 ± 2.727	**0.031**
RoR D2cc (Gy)	1.389 ± 1.192	0.462	1.555 ± 1.236	**0.025**
RoR V100% (cc)	1.720 ± 1.260	0.658	1.694 ± 1.386	**0.030**
RoR V150% (cc)	0.642 ± 0.584	0.109	0.559 ± 0.513	**0.021**
RoR V200% (cc)	0.133 ± 0.239	0.063	0.150 ± 0.239	**0.031**

Table 1: Mean difference between the clinical and simulated plans with standard deviation and statistical significance. P-value less than 0.05 is considered significant and is highlighted.

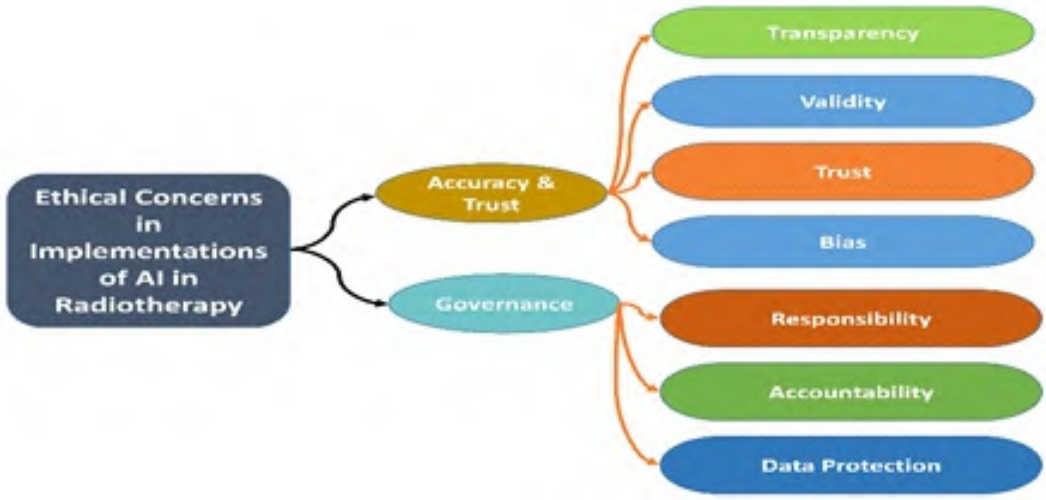
Poster ID: 20

Title: Importance of Ethical Governance for Safe Practice of Artificial Intelligence in Radiotherapy

Author Names: Shriram Rajurkar, Teerthraj Verma , Rajeev Gupta , M. L. B. Bhatt, S. P. Mishra

Full Abstract:

Introduction and Objective: Radiotherapy is a field depending upon the emerging technology. In last few decades drastic enhancement of Artificial Intelligence (AI) applications in the radiotherapy has been observed. Currently AI is the emergence aspects, with the development of AI models for toxicity prediction, auto contouring, automated and adoptive treatment planning. The application of AI in radiotherapy offers several advantages; however, it also raises ethical concerns, including consistency, relevance, applicability, algorithmic bias, and data privacy. In the present study, authors highlighted the importance of the governance for ethical practice of AI in radiotherapy. Materials and Methods: A literature search strategy was optimised using PubMed search engine 'add with AND' operator to collect the relevant articles and datasets concerning ethical governance in AI and ethical aspects in radiotherapy. A total of 48 articles were collected, covering the period from 2021 to 2025. Results and Discussions: The radiotherapy workflow is complex, but it can be streamlined through the implementation of AI. To facilitate a smoother workflow, AI applications can be integrated into various stages of radiotherapy, such as decision-making tools, auto contouring, automated planning, AI based quality assurance, and toxicity prediction models. Over the past decade, numerous research papers have guaranteed effective decision making in AI technologies. However, a significant gap remains between such studies and their real time clinical application. There is also a lack of clarity regarding the authenticity and ethical accountability of AI tools. Questions arise who is responsible for AI tools: the developer, the clinical practitioner, or the management? Ethical concerns include consistency, relevance, applicability, bias in algorithms, data privacy, and the four pillars of ethical guidelines as shown in figure no. 01. To ensure the safe practice of AI, it is essential to monitor each step of its application and address ethical concerns at every stage. Integrating ethical guidelines at every step may help ensure the safe and responsible use of AI in radiotherapy. Conclusion: Applications of AI has improved radiotherapy workflow reducing the time involved as well. Integration of AI in radiotherapy has resulted in powerful approach towards patient benefit reducing potential harm, but their responsible use could be ensured by rolling out it under the ethical governance. The integration of ethical governance at every step from its development stage to the practice of AI model in radiotherapy setup is essential to ensure safety and trust.



Poster ID: 21

Title: Study of dosimetric impact of Grid Size on Monte Carlo Algorithm in VMAT Planning with Monaco TPS for Glioma.

Author Names: Arun Adhikari, Pankaj Kalita, Bindiya Dhakal, Ashis Rai

Full Abstract:

Introduction and Objectives: Grid size is an important factor in Monte Carlo (MC) based Treatment Planning System (TPS), as it affects how the radiation dose is calculated and delivered. This study aims to understand how different grid sizes affect dose distribution in brain glioma cases using Monaco TPS. Materials and Methods: Ten brain glioma cases with different tumor volumes were selected for this study. VMAT (Volumetric Modulated Arc Therapy) plans were created using Monaco TPS version 5.51.10, with grid sizes ranging from 0.2 cm to 0.4 cm. Usually, a grid size of 0.3 cm is used in treatment planning. The dose distribution obtained using 0.2cm and 0.4 cm grid sizes were compared with the standard 0.3 cm grid sizes. All other planning parameters were kept the same. The effect of grid size on dose distribution in the Planning Target Volume (PTV) and Nearby Organs at Risk (OAR) was tabulated and analyzed. Results and Discussion: The results showed that grid size has a significant effect on the dose distribution. The average variation in dose from a standard grid size for a 0.2 cm grid was 1.7%, while for 0.4 cm grid was 3.12%. Study showed smaller grid sizes gave more accurate dose distribution in PTV but may result in more dose to nearby OARs. However, the impact of grid size also depends on the tumour size and the location of nearby OARs from PTV. Conclusion: Selection of ideal Grid size is critical for treatment planning system as it have significant impact on the dose distribution. Further investigation is required to explore all suitable dose calculation parameters to select ideal VMAT planning parameters. Keywords: VMAT, Monte Carlo, Monaco, Glioma

Poster ID: 22

Title: Institutional experience on Total Marrow and Lymphoid Irradiation using Helical Tomotherapy

Author Names: Soumya N M, Annex E H, Haridas M Nair, Debnarayan Dutta

Full Abstract:

Introduction and Objective: TMLI is an intensity-modulated form of TBI that selectively targets the total marrow and lymphoid regions. Its advantages include significant dose reduction to normal tissues and the ability to safely escalate the treatment dose. Quality Assurance in TMLI is crucial due to the complexity of the treatment, the large target volume, and the potential for significant side effects if errors occur. The objective of this study is to demonstrate the experience of TMLI with Helical tomotherapy planning and Quality assurance of the same. Materials and Methods: In Tomotherapy based TMLI, two sets of CT scans HFS (Head First scan) and FFS (Feet First Scan) were taken in order to include the full body with an overlapping area in the mid-thigh region. During simulation reference points to be marked in head, chest, pelvis and lower limbs. Treatment is done in the HFS orientation followed by FFS where the patient along with the immobilization manually rotated to 1800. The field width used for the plans was 5 cm with dynamic jaws. Dose gradient structures were created at the field junction. Dose prescription was 12 Gy in 6 fractions. Planning goal was to deliver 95% of 12 Gy to 95% of Planning Target Volume with dose limits to the critical organs as specified. Daily Set-up verification is done using MVCT before and in between treatments. Patient specific quality assurance is done using Arc check for Gamma Analysis, Cheese Phantom with Exradin A12 chamber for point dose measurement and Film for Junction dosimetry. Results and Discussions: The planning goals are achieved in all cases with above 95 % coverage to PTV and limiting the critical organ constraints. For all cases, the treatment position was confirmed by taking MVCT scans prior to treatment. The average scanning time was around 20 min for HFS and 6 min for FFS and average treatment time was around 22 min for HFS and 13 min FOR FFS. Gamma analysis showed above 95 % pass criteria for all the cases. The point dose measurement was also within 3%. Conclusions: This section outlines the procedures involved in TMLI simulation and planning. We successfully achieved adequate PTV coverage without increasing doses to critical organs or expanding the hot volume. Quality Assurance checks showed good results as well. Keywords: TMLI, Helical Tomotherapy, HFS, FFS

Poster ID: 23

Title: Dosimetric Evaluation of 3DCRT Versus VMAT for Craniospinal Irradiation in Pediatric Medulloblastoma

Author Names: Dr. Kailash Kumar Mittal, Dr. Anoop Kumar Srivastava, Dr. Surendra Prasad Mishra

Full Abstract:

Introduction: Craniospinal irradiation (CSI) is a cornerstone in the treatment of pediatric medulloblastoma. Traditionally, CSI has been planned using a conventional two-dimensional (2D) technique, involving lateral-opposed fields for the brain and a direct posterior field for the spine. This approach presents significant challenges, particularly with field junction alignment, which can lead to excessive exit doses to surrounding organs at risk (OARs), such as the thyroid, mediastinum, and heart. Objective: This study aims to compare two radiation therapy techniques 3D conformal radiotherapy (3D-CRT) and volumetric modulated arc therapy (VMAT) for the treatment of pediatric medulloblastoma. The evaluation focuses on planning target volume (PTV) coverage and radiation dose to OARs. Methods and Materials: Sixteen treatment plans were created for eight pediatric patients. For each patient, both 3D-CRT and VMAT plans were generated and optimized. The VMAT technique employed a 180° half-arc, extending from the posterior to lateral angles. A total dose of 36 Gy was prescribed, delivered in 20 fractions. Results: VMAT provided superior PTV coverage and enhanced dose conformity compared to 3D-CRT. Notably, VMAT resulted in significant reductions in mean doses to critical OARs, including the heart, thyroid, and gonads. Furthermore, VMAT demonstrated improved sparing of the lungs and breasts from low-dose radiation exposure compared to 3D-CRT. Conclusions: VMAT offers dosimetric advantages over 3D-CRT by enhancing target conformity and reducing radiation doses to critical organs, potentially lowering the risk of long-term radiation-induced complications. However, the increased volume of low-dose exposure associated with VMAT must be carefully considered when selecting the optimal treatment approach. Keywords: Pediatric radiation, Medulloblastoma, Craniospinal irradiation, Partial VMAT

Poster ID: 24

Title: Comparative dosimetric study of advanced IMRT techniques for bone marrow sparing in cervical cancer radiotherapy

Author Names: Jesmi Sunny, Sreedevi E, Annex E H, Debnarayan Dutta

Full Abstract:

Introduction and Objective: Effective radiotherapy for cervical cancer requires precise dose delivery to the tumor while minimizing exposure to surrounding healthy tissues, especially bone marrow, to reduce hematologic toxicity. Intensity-Modulated Radiotherapy (IMRT) techniques such as Volumetric Modulated Arc Therapy (VMAT) and Helical TomoTherapy (HT) offer advanced dose modulation capabilities that may facilitate bone marrow sparing (BMS). These techniques differ in their beam delivery and optimization strategies, potentially leading to variations in organ sparing. VMAT delivers radiation through dynamically modulated arcs, while HT delivers continuous helical beams with precise modulation. This study aims to perform a comparative dosimetric analysis of VMAT, utilizing the Monte Carlo algorithm, and HT, utilizing the convolution superposition algorithm, to evaluate their efficacy in BMS during cervical cancer radiotherapy. Patients and Methods: A retrospective analysis was performed on radiotherapy plans for 20 cervical cancer patients. For each patient, two treatment plans were generated: one with Volumetric Modulated Arc Therapy in Monaco version 5.51 and the other with Helical TomoTherapy in Accuracy Precision® version 3.3.1.3. The planning target volume (PTV) coverage was standardized, and dose constraints were applied to critical organs at risk (OARs), including the bladder, rectum, and bowel. The pelvic bone marrow was contoured based on standardized CT imaging guidelines and evaluated using dose-volume histogram (DVH) parameters such as volume receiving 10Gy, 20Gy and 30Gy (V10Gy, V20Gy, V30Gy), and mean dose (Dmean). Results and Discussion: Helical TomoTherapy and VMAT, both achieved comparable PTV coverage but TomoTherapy provided more effective pelvic bone marrow sparing. The goal to achieve the same PTV coverage, resulted in higher bone marrow dose in VMAT plans. This indicates that VMAT's ability to spare bone marrow may be compromised when PTV coverage is prioritized. Conclusion: Helical TomoTherapy demonstrated superior pelvic bone marrow sparing, suggesting it may be the preferred technique when minimizing hematologic toxicity is a clinical priority. Differences in dosimetric behaviour may be attributed due to the distinct delivery modalities and planning algorithms employed in each technique. KEYWORDS: Computed Tomography (CT), Bone Marrow Sparing (BMS)

Poster ID: 25

Title: Measurement of Entrance Surface Dose in Different Skin Layers during Radiotherapy using various Megavoltage Photon Energies with & without Thermoplastic cast.

Author Names: Shubham Das, Dr. Anoop Kumar Srivastava, Dr. Madhup Rastogi, Dr. Rohini Khurana, Dr. Rahat Hadi, Sahil Shaikh, L. Sagar Singha, Dr. S. P. Mishra

Full Abstract:

Measurement of Entrance Surface Dose in Different Skin Layers during Radiotherapy using various Megavoltage Photon Energies with & without Thermoplastic cast. Introduction: Skin sparing and doses to various skin layers has been a subject of intense discussion in megavoltage radiotherapy to harness the skin sparing effect. During External radiotherapy the radiation beam passes through different layers of skin i.e. Epidermis, Dermis and Hypodermis (Subcutaneous Tissue) which has limited radiation tolerance. The skin dose may also be modulated by the quality of collimator, SSD and immobilization thermoplastic cast. The doses to skin may result in acute as well as late toxicities of skin such as erythema, desquamation, telangiectasia and necrosis. Several studies have been published which have associated incidence of basal-cell-carcinoma (BCC) due to skin doses. In this study an elaborate effort is been made to quantify the doses to various layers of skin during treatment by 6, 10, 15 MV photons using gafchromic films. Materials & Methods: In the evaluation artificial skin layer of 3mm with y-dent material were created on head phantom (CIRS- 605-U580) to mimic the three layers of skin. The CT-Simulation scan was performed of the Phantom and slices of 2mm were obtained and transferred to Treatment Planning System (TPS) (Elekta Monaco 5.11.03) using DICOM 3.0. Two set of images were acquired with & without perforated thermoplastic cast (2mm). Dosimetric plan of 200cGy using a standard field size of 10x10 cm2 at depth of 10cm were planned and transferred to Linear Accelerator (Elekta Infinity). Radiation dose was delivered using different photon energies 6MV, 10MV, and 15MV. Gafchromic films (EBT4) of 2×2 cm^2 were placed at the interface of artificially created different skin layers at various locations (cranial, central, and caudal) to estimate the dosage to various layers of skin. A calibration curve for EBT4 gafchromic film was obtained between Optical Density (OD) and dose. Densitometer was used to measure Optical Density (OD) for the films thus exposed under treatment conditions. The process was repeated without thermoplastic cast. Results: For 6MV the ratio of dose delivered to the three skin layers v/s their corresponding Dmax were 66.1% (Hypodermis), 58.1% (Dermis) and 50% (Epidermis) respectively. Similarly, for 10MV and 15MV the ratio was found to be 56.9%, 50%, 43.2% and 52.3%, 46.2%, 40.1% respectively for all skin layers. The lowest surface dose was observed with 15MV beams which are in coherence with the established dosimetric results. The percentage increment in surface dose with thermoplastic cast for 6MV were 1.4% (Epidermis), 0.3% (Dermis), 0.2% (Hypodermis) respectively. Similarly, for 10MV 1.7%, 2.3%, 1.65% and for 15MV were 3.3%, 2.7%, 2.8%. Conclusion: Artificially created skin layers exposed using thermoplastic cast for 6MV showed higher entrance surface dose compared to open skin exposure. However, for 10MV and 15MV entrance surface dose observed to be lower using thermoplastic cast.

Poster ID: 26

Title: Objectives: In this study response of Gafchromic film type XR-RV-3 is evaluated for fluoroscopy x-ray beam quality and dose calibration of XR-RV-3 film performed to measure entrance skin dose in fluoroscopy guided IR procedures.

Author Names: Dr Bhupendra Singh Rana, Mr susheel Kashyap, Dr Arun Singh Oinam, Dr Paramjeet Singh

Full Abstract:

Fluoroscopy guided procedures results in long fluoroscopy beam on time, and hence increase in radiation doses to the patients and may results in radiation induced skin injuries. The occurrence of these effects and degree of their severity can be estimated from ESD. Methods: Gafchromic XR-RV3 Radiochromic films are calibrated at 90 kVp x-ray beam quality. The output of machine in terms of incident air kerma in scatter free geometry is measured using shadow free ionization chamber and UnidosE electrometer, PTW, Freiburg, Germany. The incident kerma rate is measured in scatter free geometry for beam energy used for calibration. The films are exposed free in air kerma values between 15cGy – 4oocGy as used for ionization chamber. For the calibration of XR-RV3 film a single sheet of film of size 43.2 cm× 35.6 cm was used and grids of 6 cm × 6 cm cut from it. The XR-RV3 film cut into film strips as per guidelines recommended in Task Group Report -55. The film strips are stored in lightproof envelopes before and after the exposures. During exposures, storage, and scanner measurements, the ambient temperature was kept between 22 and 24 °C. For the calibration in 90 kVp, nine air kerma exposures of 15, 45, 100, 150, 200, 250, 300, 350 and 400cGy were performed and two unexposed strips are used for background value. In order to measure the response of the film under backscattering conditions phantom is used to simulate patient scattering conditions. After the irradiation of film strips, the stripes are transferred in airtight envelope. The exposed film strips are scanned using Epson Expression 11000XL flatbed scanner and reflective density of the exposed film strips were measured after 24±4 hours and analyzed using Film QA-XR software. Film reflective density to AK calibration was constructed for the beam quality. Results and Conclusions: Calibration curve between reflective density verses air kerma were plotted. It is observed that the response of XR-RV3 film to dose depends on kVp used to irradiate the film, backscattering medium and orientation of film during exposure. The film shows increase in its response with increase in kVp during measurement. The modification of the x-ray energy spectrum due to the presence of back-scatterer medium shows increase in the density value from free in air measured values as presence of phantom increases the photon fluence in the film sensitive layer.

Poster ID: 27

Title: Dosimetric Study on Double Arc VMAT Radiotherapy Plan Using Different Photon Energies Combination for Carcinoma Cervix

Author Names: Shalini T , Sarath S Nair, Jyothi Nagesh, Shambhavi C, Shirley Lewis, Umesh Velu, Jayashree N P

Full Abstract:

Aim: The intent of this study is to evaluate dosimetry on double arc volumetric modulated arc therapy using different photon energies combination for carcinoma cervix radiotherapy. Materials and Methods: Double Arc Volumetric Modulated Arc Therapy (VMAT) was compared Retrospectively in 15 selected cancer patients treated for cervical cancer in our department. The prescribed dose for all patients was 45 Gy and was administered in 15 fractions for different photon energy combination of 6-6,10-10 and 15-15, 6-10, 6-15,10-15MV. For statistical analysis, comparisons were made for target volume, organ at risk (OAR), and monitor units (MU). Results: According to the research, no significant difference was found in PTV coverage between 6, 10 and 15 MV energies. The average of PTV doses (cGy) were 4524.64 ± 52.85; however, here was a wide range in maximum dose. The use of 6 MV showed advantages over 10 MV and 15 MV. While 6-6MV and 6-15MV had good V95 coverage, conformity index just slightly altered the results. Conclusion: This study was conducted to compare the dosimetric impact of various photon energies combination on cervical carcinomas in radiation planning. In this study, the effects of various photon energies on the dosimetric planning of Vmat radiation for cervical carcinomas are examined. There were similarities in; PTV coverage, OARs sparing, HI, and CI; for the 6-6MV, 10-10MV, 15-15MV, 6-10MV, and 10-15MV designs. Normal tissues were exposed to considerably more MUs at low doses in 6-6 MV designs than in other plans, but these drawbacks can be ignored since secondary malignancies resulting from photoneutron generation are more likely to be severe in other Plans. The Vmat at a point using a 6 MV beam thus is dosimetrically greater than that at a position with a 10 and 15 MV beam.

Poster ID: 28

Title: Monte Carlo Modelling for Accurate Small Field Dosimetry in Modern LINACs

Author Names: Jooli Shukla, Shekhar Dwivedi, Vinod Kumar Dangwal, K P Tiwari

Full Abstract:

Background & Purpose: Small photon beams play a critical role in advanced radiotherapy techniques such as stereotactic radiosurgery (SRS), stereotactic body radiotherapy (SBRT), and intensity-modulated radiotherapy (IMRT), where precise dose delivery is vital. However, accurate dosimetry in these fields remains a challenge due to detector volume effects, partial source occlusion, and loss of lateral charged-particle equilibrium. Monte Carlo (MC) simulations provide a gold-standard approach for overcoming these limitations. This study aims to develop and validate a Monte Carlo model of a modern linear accelerator (LINAC) for small photon beams using the TOPAS MC code, focusing on both flattened (FF) and flattening filter free (FFF) beams. Methods: A Varian TrueBeam LINAC will be modelled in TOPAS to simulate small photon beams ranging from 5×5 mm² to 50×50 mm². Dosimetric parameters–including percentage depth dose (PDD), beam profiles, and output factors–will be generated for 6 MV FF and FFF beams. The MC simulations will be benchmarked against reference measurements obtained with ionization chambers, diodes, and OSLDs in water, following IAEA TRS-483 and AAPM TG-142 recommendations. Results: Preliminary Monte Carlo simulations show good agreement with reference datasets, with deviations within 2% for small fields. FFF beams demonstrate enhanced central-axis dose and reduced scatter, improving small-field accuracy. The commissioned model provides reliable dosimetric parameters in regions where conventional detectors show significant uncertainties. Conclusion: This work establishes a validated TOPAS Monte Carlo model for small photon beams, enabling accurate small-field dosimetry in modern LINACs. The model serves as a robust reference for treatment planning system verification and detector evaluation, ultimately enhancing precision radiotherapy delivery and improving patient outcomes.

Poster ID: 29

Title: Comparison of Monte Carlo simulation and measurements for analyzing the effect of different types of implant materials on Cranial radiotherapy

Author Names: Sumeesh S, Dr. Saral Kumar Gupta , Dr. Raghavendra Holla , Dr. V.K. Sathiya Narayanan, Dr. Bhooshan Zade, Sumit Thorat, Sajini Kurup

Full Abstract:

Background/Objective: This study is to evaluate the dosimetric impact of cranioplasty implant materials on intracranial radiotherapy planning using the Monte Carlo dose calculation versus the treatment planning system (TPS) and measurements. Materials and Methods: The Simulation of TrueBeam has been carried out using the PRIMO Monte-Carlo code. Simulations were performed for a 6 MV photon beam with 109 histories using the default values. A 3D printed phantom was used to quantify the effect of different cranioplasty implants in the dose calculations of the AAA, AXB algorithms, and the PRIMO MC code. Phantom was designed with a 2 mm-thick outer layer, 3D-printed to replicate the scalp, and filled with RW3 slabs. 5 types of Alloplastic materials were modeled, PLA, Teflon, ABS (bio-compatible), Stainless Steel, and Titanium. The implants were placed on the RW3 Slab phantom, and point dose measurements were performed at various depths. Monte Carlo simulation and TPS dose calculations were compared to find the dosimetric effect of these implant materials. In the first phase of this study, the AAA, AXB algorithms, and the PRIMO MC model were compared against point dosimetry at different depths. The intention of this phase is to assess the accuracy of the AAA, AXB algorithms, and MC model in the presence of high-Z materials for a 6MV photon beam and to assess the dose discrepancies of these implants. In the second phase, the simulated and calculated dose at various depths for implants of varying thicknesses (1mm, 2mm, and 3mm) were compared using the gamma index evaluation tool available in PRIMO, to assess dose discrepancies and dose variations related to the thickness of these implants. Results: The central axis depth dose for five cranioplasty implants have been generated with PRIMO were compared against TPS dose calculation Algorithms. In the presence of high-Z materials, the gamma analysis (2%, 2 mm) shows good agreement in the build-up region, with a maximum gamma index of 1.73. Both the simulated and measured dose deviations showed significant differences between titanium and stainless implants, in comparison with other implant materials. It is evident that the deviations are greater near implants with increasing thickness, particularly for high-Z materials. Conclusion: This study offers important insights into optimizing radiation therapy approaches for patients with cranial implants. The study illustrates the importance of taking into account both implant characteristics and the choice of dose calculation algorithm during treatment planning.

Poster ID: 30

Title: Polymerization reaction mechanism and effect of polarization on the readout of radiochromic film

Author Names: Dr. Ranjit Singh, Parsee Tomar, Dr. Ngangom Robert

Full Abstract:

Aim: In this study, the mechanism of the polymerization reaction due to the interaction of radiochromic film's active monomer with ionizing radiation is proposed, and impact of polarization on film readout is examined. Method and material: EBT3 films are irradiated over a dose range of 0.1-20Gy and film readout was performed under four different conditions namely, (a) un-polarized source and detector, (b) only source polarized, (c) only detector polarized, and (d) both source and detector polarized. Effect of film's orientation and position under these combinations are also analyzed. Results and discussion: The monomer unit of the Radiochromic film undergoes polymerization reaction upon interaction with ionizing radiation following three steps, namely, initiation, propagation and termination, to form long cross-linked chained molecules. Radiochromic film monomers polymerize upon ionizing radiation via initiation, propagation, and termination. Radiation rearranges electrons, forming a triple bond (C2–C3) and di-carbene radicals (C1, C4) for 1,4-addition polymerization into ene-yne conjugated structure. Termination occurs when active sites are exhausted, halting further chain growth. Optical Density (OD) decreased from un-polarized to both polarized conditions by mean value of 34.3% (range 22.4-39.5 %), 33.9% (range 30.5-42.9%) and 26.2% (range 17.7-53.7%), respectively for red, green and blue channels in the portrait mode. Similarly, for red, green and blue channels, the average drop in the OD, from the both un-polarized condition to both polarized in the landscape mode is 48.6% (range 39.4-63.9%), 47.5% (range 39.2-65.8%) and 37% (range 21.7-46.5%), respectively. Mean difference among OD for all three combinations with both source and detector polarized, and also with orientation and position, are statistically significant (p 0.05). Conclusion: Polarization of light emitted from the source or transmitted light reaching the detector, brings a significant variation in the value of optical density. This will attribute to a measurable difference in the dose determination from the scanned film which is also depends on the three different channels e.g., Red, Green and Blue, used for dose analysis. Standardizing the scanning procedure, including orientation, is crucial for both calibration and clinical film analysis in order to reduce dosimetric errors.

Poster ID: 31

Title: Determination of 3D Dose distribution inside a Low Dose Irradiator chamber using radiochromic FBX gel

Author Names: Sakshi Singhal, Aruna Kaushik, Harishchandra Gupta, Julipriya Jena, Manoj K Semwal

Full Abstract:

Introduction & Objectives: The low dose irradiator (LDI) at our institute is used for irradiating biological samples. Samples are placed inside a hollow cylindrical chamber (diameter 13 cm, height 21.7 cm). Irradiation times are calculated using the manufacturer's quoted dose rate, assuming uniform distribution. Aim of the present study was to measure the dose distribution within the chamber using FBX gel dosimetry and assess dose uniformity. Methods & Materials: An acrylic vessel (diameter 2 cm, height 10.5 cm) filled with FBX gel was placed at the chamber center, with six similar gels positioned peripherally, equidistant from the central dosimeter. 5 Gy dose was delivered to the samples at the dose rate 1.065 Gy/min. Calibration was carried out for radiation doses from 0 - 10 Gy on a linear accelerator (Model Primus from Siemens, Germany) using 6 MV X-Rays. Samples were scanned in the optical imaging system and 3D images were reconstructed. Unirradiated sample images were subtracted from corresponding irradiated sample images and mean pixel intensities were obtained. These values were converted to dose using the calibration data and were normalized to the delivered dose of 5 Gy. Validation of the gel dosimetry results was done using FBX solution. Results & Discussion: Dose was minimal at the base of the chamber and increased vertically upwards. From 5 cm above the base, the dose became approximately constant. Radially, dose increased towards the periphery of the chamber anisotropically. Across all positions, the measured dose ranged from 1.61 Gy to 7.08 Gy, with a median of 3.63 Gy, differing by 27.5% from the delivered dose. At the center of the chamber (10 cm above the base), average dose value was estimated to be 4.4 Gy which differed by 12% from the expected dose (5 Gy). FBX aqueous dosimeter readings at the same point differed by 11.26%. Conclusions: Non-uniformity (27.5%) in the dose inside the chamber could be attributed to the arrangement of Co-60 source pencils in the irradiator and is well explained by the specified uncertainty of ±25% quoted by the manufacturer. Keywords Low dose irradiator, FBX gel

Poster ID: 32

Title: Dosimetric Prediction of Acute Radiation Dermatitis in Head and Neck Cancer Patients Treated with Volumetric Modulated Arc Therapy

Author Names: Mr.Thirunavukkarasu Mani1, Mr.Rohit Bankar, Dr. Prasad Tanwade, Dr. Yogesh Anap, Dr. Pratik Arote, Mr Singaravel Boopathi, Mr. Girish Yadav, Dr. Ashlesha Bhutada

Full Abstract:

Introduction and Objective: ARD is a common acute side effect in patients undergoing radiotherapy, particularly for head and neck squamous cell carcinoma [HNSCC]. Its severity depends on radiation dose, volume of skin exposed, and total treatment dose. Objective of this study is to determine the pattern of dose distribution to skin and its correlation with acute radiation dermatitis [ARD]. Materials and Methods: In this study 100 patients of HNSCC planned for definitive radiotherapy were included. All patients were planned using MONACO treatment planning software with VMAT technique and treated on Elekta Versa HD linear accelerator. The dose planned was 66Gy in 33 fractions over 6.5 weeks in all the patients. Three ring structures were semi-automatically created using Boolean tool by subtracting 2, 3, and 5mm below the external patient surface labelled as skin 2mm, skin 3mm and skin 5mm respectively. Dosimetric data was collected for these ring structures and planning target volume intersecting with 5 mm ring structure. V50, V60, D15cc, Dmax and Dmean was calculated. ARD was monitored by oncologist during the course of radiotherapy every week. Analysis was done for co-relation between dose and ARD. Results and Discussions: Grade – I ARD was seen in 20 [20%], Grade-II ARD was seen in 74[74%] and Grade III-IV ARD was seen in 6[6%] patients. Mean V60 of Skin 2mm, 3mm & 5mm was 15.9cc, 18.4cc and 59.0cc and 2.4cc, 3.8cc and 16.4cc and it was 6.6, 4.8 and 3.5 times higher for Grade III-IV than for Grade-I respectively. Intersection of 5 mm ring with PTV66Gy volume is 4.9 times higher for Grade III-IV (38.6cc) than for Grade-I(7.8cc) ARD. Conclusions: V60 of skin 2mm ring and Intersection of 5mm ring with PTV66Gy volume is predictor of Grade III-IV ARD. However out of 94(100%) patients from Grade I & II, 14(15%) patients having PTV intersection with the 5mm ring skin volume in between 20cc to 40cc, still they are falls under the category of Grade I & II. Because of this, probability of prediction by 5mm skin ring with PTV66Gy volume reduces to 85%. Any measures and special care can be taken before and during treatment in such high-risk group. KEYWORDS: ARD, HNSCC

Poster ID: 33

Title: Characterization and Validation of Transfer Factors between Water and Water-Equivalent White Polystyrene Phantom for High Energy Photon and Electron Beams: Implications for Extended SSD Dosimetry

Author Names: Smrithy M. L., Rojas K Jose, Dr. Raghukumar P

Full Abstract:

Background and objectives: Water phantom is the standard for absolute and relative dosimetry in radiotherapy, but setting up water phantoms for routine quality assurance can be difficult. Plastic phantoms offer a practical alternative, though their use in electron and high-energy photon dosimetry is limited due to dose discrepancies. Since no plastic is truly water-equivalent, transfer factors dependent on energy, field size, and depth, must be established. International protocols advise user-end commissioning due to batch-based density variations. This study commissions white polystyrene phantoms, determines water-to-plastic transfer factors, evaluates their dosimetric accuracy and analyse validity of these transfer factors in the dosimetry of Total Body Irradiation (TBI) and Total Skin Electron Therapy (TSET). Materials and methods: The study used a water-equivalent white polystyrene (SP34) phantom. Each slab's thickness and uniformity were measured, and CT images were analyzed to assess material consistency. Charge storage effects in plastic were examined to determine if corrections were needed. Scaling factors from protocols were used to relate plastic measurements to water. A parallel plate chamber was used for electron beams, while CC13 and FC65-G chambers were used for relative and absolute photon dosimetry. All positioning and corrections followed TRS 398 guidelines. Depth scaling factors were determined by comparing depth ionization data in water and plastic across energies and field sizes. Fluence scaling factors were derived by comparing meter readings at reference depth. Their validity at extended SSD was verified in both photon and electron beams by evaluating fluence scaling at normal and extended SSD. Results: For photon beams, the depth scaling factor is 1.003 ± 0.006 for depth expressed in cm and the fluence scaling factor 1.001 with a standard deviation of ±0.005. For electron beams, the depth scaling factor is 0.992 ± 0.006 and the fluence scaling factor is 1.018 ±0.002. These values were compared with values in the TRS 398 protocol for white polystyrene. The protocol specifies a depth scaling factor of 0.922, showing 7% variation from the value obtained in our study. The fluence scaling factor provided by the protocol is 1.019, which reflects a 0.1% variation from our study's result. For extended SSD, the h pl does not show significant variation from that of normal 100 cm SSD. Conclusion: Transfer factors between plastic and water phantom is established. Using this transfer factor will remove potential discrepancies in absorbed dose determination in solid phantom. Keywords: Solid Phantom, Dosimetry, Depth scaling factor, Fluence

Poster ID: 34

Title: Comparison between two Halcyon Specific Dose calculation models Acuros XB vs AAA

Author Names: Lakshmipriya T U, Man Gobinda Chowdhury, Susanjita Biswal, Sudam Masanta, Nidhi Jain, Bhagyalaksmi AT, Suresh Chaudhari

Full Abstract:

Introduction and Objective: This study aims to evaluate the dosimetric and DVH difference between Anisotropic Analytical Algorithm (AAA_16.01.10) and Acuros XB (AXB_16.01.10) in VMAT plans for Head & Neck, Oesophagus and Gynae/Prostate cases using Halcyon 6FFF beam. Materials and Method: A total of 34 patients treated with VMAT were included: 13 Head & Neck, 12 Oesophagus, and 9 Gynae/Prostate cases. Each patient had a clinically approved treatment plan calculated with either AAA or AXB. All treatment plans were re-optimized and re-calculated using the alternate algorithm, while maintaining the same optimization criteria. The treatment plans were evaluated firstly by point dose measurements using both homogeneous phantom (HE solid water phantom) and in-homogeneous phantom (inserting air equivalent Styrofoam material sandwiched between slabs).Secondly by dosimetric evaluation including Conformity Index (CI), Homogeneity Index (HI) and site-specific OAR doses and thirdly by portal dosimetry using EPID and analyzed statistically. Results and Discussions: In the homogeneous phantom, AXB algorithm demonstrated close agreement with TPS dose predictions in point dose measurements for 29 out of 34 patients. In the in-homogeneous phantom, AXB showed better agreement in 19 patients, while the remaining patients exhibited closer agreement with the AAA. The mean values of CI and HI showed minimal variation between AAA and AXB across all sites which was not clinically significant. DVH analysis showed mean dose differences (MD) between AAA and AXB for Head & Neck case: brainstem 0.69 Gy, PRV brainstem 0.62 Gy, oral cavity –0.80 Gy, parotid(L) 0.28 Gy, parotid (R) 0.38 Gy. For Oesophagus case: lungs 0.626 Gy, heart 0.089 Gy, spinal cord 0.54 Gy. Similarly, for Gynae/Prostate case: rectum (D50) 0.72 Gy, bladder –0.18 Gy, bowel –0.55 Gy. Gamma analysis using the γ(3%, 3 mm) criterion showed >99% pass rate across all treatment sites, and >93% with the stricter γ (2%, 2 mm) criterion. Conclusion: This study highlights that AXB demonstrated superior agreement with TPS dose predictions in both homogeneous and in-homogeneous conditions, as AAA may oversimplify scatter and electron transport in heterogeneous regions. While point dose measurements in in-homogeneous phantoms showed variability–likely due to measurement uncertainties. The high gamma pass rates and minimal DVH differences affirm that both algorithms are clinically acceptable, though AXB may offer improved reliability in heterogeneous treatment sites with Halcyon 6FFF VMAT plans. Keywords: AAA, Acuros AXB, volumetric modulated arc therapy (VMAT), Halcyon

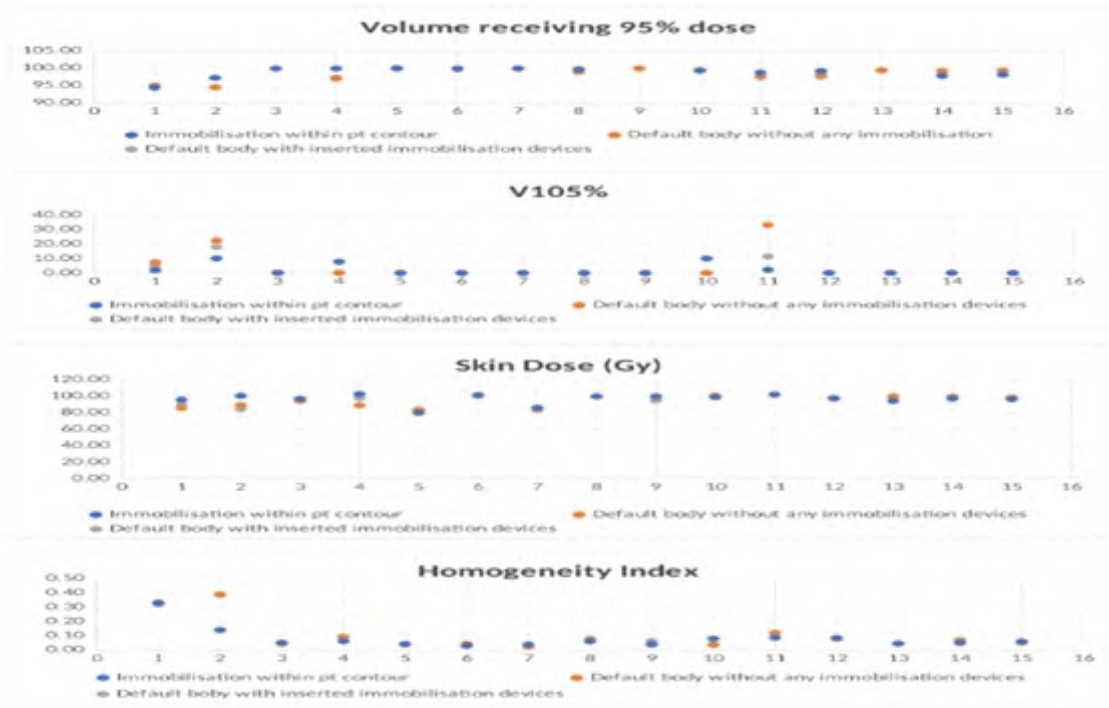
Poster ID: 35

Title: Dosimetric Impact of Immobilization Devices in VMAT Planning for Head and Neck Cancer: A Comparison of Contour Inclusion and Separate Modeling Approaches

Author Names: Aswathi T, Anna George T, Bhagyalakshmi AT, Nidhi Jain, Suresh Chaudhari

Full Abstract:

Introduction and Objective: This study aimed to evaluate the dosimetric impact and quality assurance performance of different immobilization device configurations (headrests B, C, and D) in radiotherapy. Materials and Methods: In this study, Volumetric Modulated Arc Therapy (VMAT) plans were generated by Eclipse (Version 16.0) for 15 head and neck cancer patients to evaluate the dosimetric impact of immobilization devices. Three different VMAT plans were created for each patient: VMAT_B, where the body contour was auto-generated by the Eclipse treatment planning system (TPS); VMAT_TB, where the immobilization devices were included within the body contour, and VMAT_B_IM, where the body and immobilization devices were contoured separately. Dosimetric parameters assessed included PTV coverage (V95%, V105%, V106%, V107%, V108%, V109%, V110%), hotspot volume, homogeneity index (HI), and skin dose. Monitor units and other optimization settings were kept constant across all plans. The Friedman test was used for statistical analysis. To validate patient plan findings, a phantom study measured point doses and transmission factors for various headrests and compared them with TPS- calculated values. Results and Discussion: No statistically significant differences were observed in V95%, V106%, V107%, V108%, V109%, V110%, Skin Dose (%), and HI across the three contouring scenarios, as determined by the Friedman test. However, V105% and hotspot values demonstrated statistically significant differences ($p < 0.05$). Subsequent pairwise comparisons using the Wilcoxon signed-rank test with Bonferroni correction ($p < 0.0166$) revealed no statistically significant differences between any individual pairs, confirming overall dosimetric comparability among the contouring methods. Phantom measurements showed good agreement between TPS-calculated and measured transmission factors for various headrest types, with deviations within ±0.5%. Point dose variations were minimal for the VMAT_B_IM plans (0.14–0.39%) and slightly higher for the VMAT_TB plans (1.1–2.0%). EPID QA showed excellent gamma passing rates (97.6%) and consistent CAX CU agreement (within ±1.2%). Conclusion: All three immobilization configurations showed similar dose distributions, likely due to the low-density materials causing minimal beam attenuation. Any contouring approach can thus be used confidently, allowing planners to choose the most efficient method. The Phantom study also supports the patients study findings. Keywords: Radiotherapy, immobilization devices, dosimetry, transmission factors, quality assurance



Poster ID: 36

Title: Dosimetric comparison of FF and FFF Beam RapidArc plans

Author Names: Sangeeta Hazarika, Jaswin Raj, Dr Seema Sharma, Dr Hajee Reyaz Ali, Dr V Subramani, Dr Suman Bhasker, Ashu Abhishek, Dayananda Shamurailatpam Sharma

Full Abstract:

Introduction and Objective: Flattening filter is used in the path of the beam to provide flat dose profiles at a certain depth. Development of intensity modulated treatment technique eliminates the need for a flat beam profile for planning. Therefore, current study examines the dosimetric evaluation of RapidArc (RA) plans for head and neck cancer (HNC) utilizing 6 MV with flattening filter (FF) and flattening filter-free (FFF) photon beams. Materials and Methods: Ten previously treated head and neck cancer patients (Buccal mucosa cancer-left side) were randomly selected for this study. The dose prescription was 50Gy for respective planning target volumes RapidArc (RA) technique. Treatment plans were generated in Eclipse Treatment Planning System- Acuros XB algorithm (TPS) and delivered using a Varian TrueBeam linear accelerator, employing both 6FF and 6FFF beams, keeping all other parameters constant. Plan evaluation was done in terms of homogeneity index (HI), conformity index (CI), target coverage (TC), gradient index (GI), and unified dosimetric index (UDI), with statistical analysis performed using paired t-test. To check the plan deliverability patient-specific quality assurance (PSQA) was conducted with a PTW Octavius 4D phantom and electronic portal imaging device (EPID) based on gamma passing criteria of 3%/2 mm with a 10% dose threshold. Results and Discussions: From the evaluation, it is observed that PTV and ORA doses were achieved as planned, and the results of the indices are shown in Table 1. In particular, the PTVV-95%, Minimum, Maximum, and Mean doses were 48.50, 27.19, 55.32, and 50.75 Gy for FF beam, and 48.42, 27.84, 55.10, and 50.85Gy for FFF beam. There is no statistically significant variance observed between the plans. Finally, the passing criteria of the PSQA of the RA plans were found to be greater than 95% in both FF and FFF beams. Conclusion: Results showed that RapidArc planning for, both FF and FFF beams provide similar target coverage and conformity; however, FFF beams typically reduce beam-on time and require a higher number of monitor units (MUs) to achieve the dose. Gamma pass rate was same for both the energies. Key Words: RapidArc, Varian TrueBeam, Patient-specific quality assurance (PSQA)

Table 1: Dosimetric parameters of SIB-RA plans

CT-structure sets	SIB-RA (Mean values) plans		Paired T test
	RA using FF beam	RA using FFF beam	
$PTV_{95\%\ of\ 50Gy}$	48.50	48.42	NS
Minimum dose Gy	27.19	27.84	NS
Maximum dose Gy	55.32	55.10	NS
Mean dose Gy	50.75	50.85	NS
HI	0.091	0.094	N
CI	0.95	0.94	
TC	0.991	0.985	
GI	1.87	1.91	
UDI	0.155	0.166	
Brain Stem (Max Dose)	26.25	26.29	NS
Spinal cord (Max Dose)	26.92	26.82	NS
Optic nerve-left (Max Dose)	10.52	9.99	NS
Optic nerve-right (Max Dose)	7.47	6.61	S
Eye-left	32.91	32.12	NS
Eye-right	13.94	15.77	S
Anterior tongue (Mean Dose)	22.13	27.05	S
Base of tongue (Mean Dose)	21.86	24.99	S
Lips (Mean Dose)	21.86	25.19	S
Parotids-left (Mean Dose)	48.74	49.65	NS
Parotids-right (Mean Dose)	7.78	7.89	S
Cochlea-left (Mean Dose)	25.43	26.20	NS
Cochlea-right (Mean Dose)	6.37	7.11	NS
MU-CW	414.1	461.7	S
MU-CCW	509.5	404.1	S
PSQA-(Octavius-2D)	98.3	98.5	NS
PSQA-(EIPD-2D)	98.8	99.5	NS

Significant denote as "S" and not significant denote as "NS"

Poster ID: 37

Title: Standardization and Calibration of CaSO4: Dy (TLD-900) For In-vivo Entrance and Exit Dose Measurement In 6 MV Flattened X-Ray Beam

Author Names: Dr.Athiyaman, Ms.Sowndarya, Dr.Hemalatha, Mr.Chandrasekar, Ms.Fiza Mohammed, Dr.Kamlesh Kumar Harsh, Dr.Shankar Lal Jakhar, Dr.Neeti Sharma

Full Abstract:

Introduction: In vivo dosimetry (IVD) refers to the measurement of radiation dose delivered during radiotherapy treatment, thereby enhancing treatment outcome. Thermoluminescent dosimeters (TLD), recognized for miniaturization, versatility, stability, and reusability, are mostly used for IVD measurements. This study focused on standardizing $CaSO_4$:Dy (TLD-900) to measure entrance and exit radiation doses in patients undergoing radiotherapy. Materials and Methods: Twenty circular $CaSO_4$:Dy (TL-900) discs were selected and irradiated with 6 MV flattened X-ray beams from a linear accelerator. The discs were read out 24 hours post-irradiation using a TL Reader. Reproducibility, linearity, and homogeneity were estimated. Qualified TL discs were then used to measure doses in a tissue-equivalent phantom and on patients' skin during radiotherapy. Results: The mean net TL count for repeated 10 cGy exposures was 171,747 ± 17,730, confirming consistent responses. The desired homogeneity index threshold was 30%, yet we achieved superior consistency of 14% by excluding six non-uniform outlier discs. The selected 13 discs showed linearity close to unity. Dose estimations in phantom and patient skin measurements had average deviations of 1.51% and 3%, respectively. Conclusion: This study standardized TLD-900 for accurate radiation dosimetry in routine radiotherapy treatments. A qualified TL disc batch was formed with discs demonstrating excellent homogeneity and linearity. Entrance and exit skin doses were measured with low deviations of 1.51% and 3%, respectively. $CaSO_4$:Dy (TLD-900) proves to be an ideal, cost-effective solution for in vivo radiotherapy dose measurements, enabling routine clinical implementation for enhanced patient care.

Poster ID: 38

Title: Dosimetric comparison of Craniospinal Irradiation Techniques: Atom Anthromorphic Pediatric Phantom Study

Author Names: Parsee Tomar, Ranjit singh, Ngangom Robert , Gaurav Trivedi, Renu Madan, Rakesh Kapoor

Full Abstract:

Objective: Cranio-spinal irradiation (CSI) is one of the most technically challenging processes in radiation therapy (RT) treatment planning and delivery. Different methods are used to achieve uniform dose distributions for large target volume treatment field junctions. Cold or hot doses at the junctions may cause treatment failure or radiation induced toxicities in the pediatric CNS tumors. Methods and Materials: An Atom anthropomorphic pediatric phantom was scanned on a Philips Big Bore CT with a 3 mm slice thickness in the supine position. The target and organs at risk (OARs) were delineated in the Varian Eclipse 11.6 Palo Alto Treatment Planning System (TPS). Five treatment plans using 6 MV and 15 MV photon energies on the Clinac Trilogy Varian medical system were generated for different techniques ie. Plan_F (Feathering), Plan_DM (Divergence Match), Plan_DME (Divergence Match Extended SSD), Plan_IM (Intensity-Modulated Radiotherapy), Plan_VA (Volumetric Arc Therapy). Optimisation was performed using the Progressive Resolution Optimizer (PRO), and dose calculations were done using the Anisotropic Analytic Algorithm (AAA). The prescribed dose regimen was 36 Gy in 20 fractions, with 1.8 Gy per fraction, five fractions per week. All five plans were evaluated based on dosimetric parameters–Homogeneity Index (HI), Conformity Index (CI), mean dose, maximum dose, and minimum dose for the target–and mean dose, maximum dose, volumetric doses, and irradiated dose for the OARs. Results: Table 1 shows that all techniques achieved more than 95% dose coverage of the target volume, while Plan_VA demonstrated the most homogeneous dose distribution, with the highest HI value of 0.93 among all techniques. The CI for both Plan_VA and Plan_F was similar (0.93) compared to the other plans.The PTV maximum doses for Plan_DME, Plan_DM, Plan_IM, Plan_VA, and Plan_F were 42.03, 41.93, 46.02, 40.86, and 46.22 Gy, respectively. The PTV D2cc doses were 41.4, 41.13, 42.71, 39.59, and 44.24 Gy, respectively. The brain volume exposed to 110% of the dose (V110) was smallest in Plan_VA (1.82 cc) and largest in Plan_F (109.17 cc). The spinal V110 volume was smallest in Plan_VA (0 cc) and largest in Plan_DME (138.70 cc). Mean and maximum doses for all OARs are shown in Figures 1 and 2. Conclusion: This study evaluates PTV and OAR dose parameters for all five techniques and supports Plan VA as the preferred method in most aspects, except for irradiation in the low-dose region. Key words: Cranio-spinal Irradiation, Field Junction, Feathering Technique, Divergance Matching, Dose Modulation

Table 1: PTV evaluation Indices

Indices	PLAN_DME	PLAN_DM	PLAN_IM	PLAN_VA	PLAN_F
HI	0.89	0.89	0.91	0.93	0.89
CI	0.59	0.55	0.81	0.93	0.93
Max	42.03	41.93	46.02	40.866	46.22
Min	2.6	2.46	7.75	2.54	2.56
Mean	37.6	36.53	38.8	36.56	38.16
D2cc	41.4	41.13	42.71	39.59	44.24
MU	564	525	2349	560	577
D95	35.51	34.67	37	35.24	35.48
D5	39.87	39.01	40.5	37.8	39.94
V110 Brain(cc)	46.92	2.1	531.9	1.82	109.17
V110 Spine(cc)	138.7	51.06	167.92	0	116.56

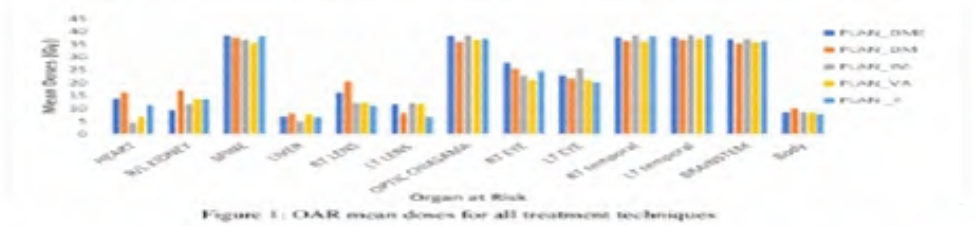


Figure 1: OAR mean doses for all treatment techniques

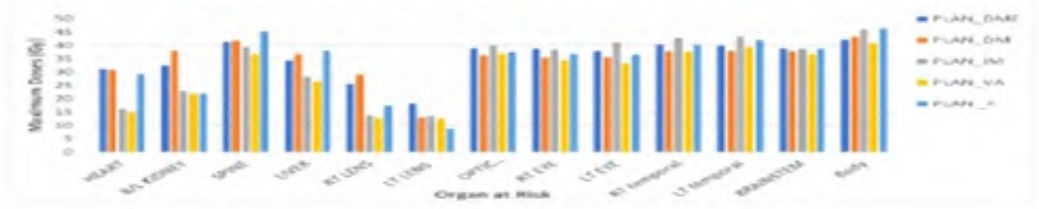


Figure 2: OAR maximum doses for all treatment techniques

Poster ID: 39

Title: Flattened vs. unflattened Beams on organ Substructure using Tangential Volumetric Modulated Arc Therapy in Carcinoma of the Breast

Author Names: Jyothi , Lahari Udyawar, sarath s nair, Shambhavi C, Rabia Suzanne Angiras, Krishna Sharan, Shirley Lewis Salins

Full Abstract:

Introduction and Objective: Despite the advancements in radiation therapy treatment planning, incidental radiation exposure to the heart and lungs still carries a risk of cardiopulmonary damage and is linked to radiation-induced morbidity and mortality. Usage of 6FFF beams is increasing because of their advantages in terms of dose rate, reduced peripheral dose, and reduced treatment time. To explore their role in heart and lung substructures, hence, a study comparing the Flattening Filter (FF) with the Flattening Filter Free (FFF) beam using Tangential Volumetric Modulated Arc Therapy (t VMAT) in breast cancer for effective treatment and benefits. Materials and methods: Eighteen breast cancer Patients planning images were selected for this study. (PTV) planning target volume and organ at risk (OAR) were defined as per the Radiation Therapy Oncology Group (RTOG). Each patient receives a prescription dose of 40.05 Gy/15 fractions to the PTV. Tangential volumetric modulated arc therapy(tVMAT) plans using 6 MV flattening and free flattening beams were generated to achieve 95% prescribed dose to PTV and OAR sparing as per normal tissue guidelines in the Monaco 5.11 planning system of Elekta. Heart sub-structures (left ventricle, right ventricle, right atrium, left atrium, and Left Anterior Descending (LAD)), spinal cord, lungs sub-volumes (left upper and lower lobes, right upper, lower, and middle lobes) were contoured and assessed. Result and discussions: A paired t-test is used to analyse the PTV and OAR dose. Hence, we are using two dependent variables. To find the statistical significance of the study, the p-value should be used ($p<0.05$). Comparing two plans, Conformity index($p=0.025$), monitor units($p<0.001$), heart mean ($p=0.005$), right lung ($p=0.047$), and peripheral lung doses ($p=0.048$) are found to be significant. LAD mean and max dose ($p=0.058$, $p=0.053$) ipsilateral lung V20Gy, V12Gy($p=0.051$,0.053), right upper lung ($p=0.064$) Right atrium($p=0.052$) nearly equivalent to significant. Homogeneity index, other heart-related and lung-related substructures, and the spine are comparable. Conclusions: 6MV flattened tVMAT can be used for better conformity and less MUs and OAR (substructure)sparing in breast cancer. Contouring of cardiac and pulmonary structures, better sparing, and evaluating their doses, which may contribute to an advantage in identifying doses to reduce cardiopulmonary complications. Keywords: Tangential volumetric modulated arc therapy, substructure, Flattened, unflattened

Poster ID: 40

Title: Commissioning of Total Body Irradiation With 10MV Photon

Author Names: Jishnu P., Dr. Saju B, Mr. Mithun Sajeev, Dr. Raghu Kumar P

Full Abstract:

Introduction Total Body Irradiation (TBI) is a key component of conditioning for allogeneic myeloablative stem cell transplantation in high-risk acute lymphoblastic leukemia. The objective of TBI is to deliver a uniform dose within ±10% throughout the patient body. TBI can be performed in extended source to surface distance (SSD) setup with bilateral field techniques either standing or lying patient position. Bilateral TBI technique, involved angulated gantry (90° or 270°) with 45° angulated collimator to maximize the treatment field. The present study is aim to commission 10MV photon beam for TBI, and comparison with 6MV TBI beam data. In addition, to determine the optimal setup for achieving uniform dose distribution for TBI. Material and methods For TBI commissioning, the VitalBeam® LINAC was chosen because of its ability to deliver 10MV photon beam. For acquiring dosimetric data the solid water phantom (SP34) and ionization chambers (PPC05 and FC65G) was used. PDD and machine output calibration was performed at standard SSD. The beam data (central axis PDD, beam profile, output) was acquired at extended SSD. The diode detectors (EDD5-3G) were used for in-vivo dosimetry. The obtained PDD at extended SSD, was compare with Mayneord's F factor calculated PDD. The effective thickness and positioning of acrylic tissue compensator was also evaluated. Result and discussion: The measured output at patient treatment plane is 0.06852 cGy/MU. The dose uniformity within ±5% obtained across the ±95 cm from the central axis at treatment plane for beam spoiler and phantom surface distance 30cm. The obtained mid-plane dose factor is varying (0.91- 1.1) with decreasing patient thickness. There is a good agreement (withing 5%) between the measured and calculated PDD. The output for 6MV and 10MV beam differ by 5.25% at treatment plane. PDD comparison validate that the higher energy delivers more uniform dose to thicker patient. Small variation in compensator ratio between central and off-axis is observed that is attributed to dose profile variation and the oblique beam incident relative to the compensator and phantom. Conclusion 10MV photon beam was successfully commissioned for TBI in accordance with AAPM TG- 17. The obtained results are in good agreement with literature. Thus, 10MV photon can be effectively used for treating TBI patients with large IFDs. During treatment, the patient to compensator distance should be same for throughout the treatment for consistent dose delivery and desired uniformity. Keywords: TBI, Compensator, VitalBeam®, dose uniformity

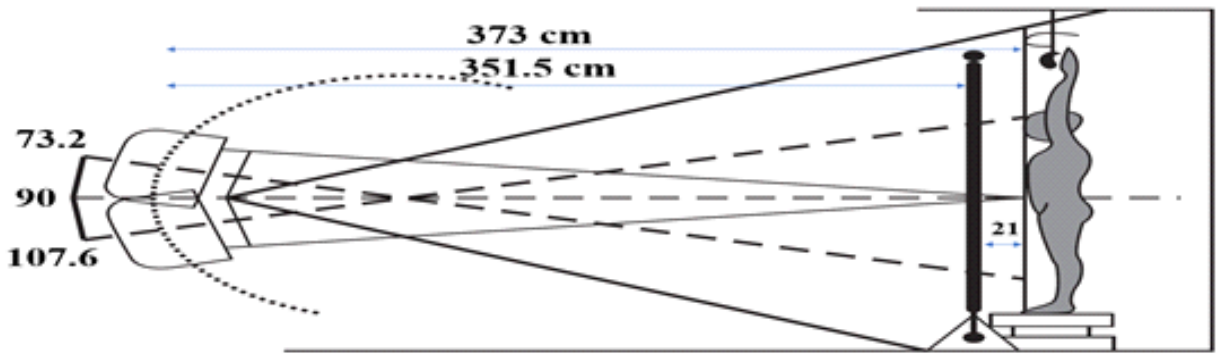
Poster ID: 41

Title: Commissioning of Total Skin Electron Therapy (TSET) on Elekta Axesse linear accelerator: Experience at Fortis Memorial Research Institute, Gurugram.

Author Names: Vinayaka R Shenoy, Dr. Radhakrishnan B Nair, Heigrujam Malhotra, Tarun Kumar, Atreyee Sharma

Full Abstract:

Introduction and Objectives: Total Skin Electron Therapy (TSET) is a radiotherapy technique mainly used to treat mycosis fungoides, a form of cutaneous lymphoma. It involves delivering a uniform dose to the entire skin surface while limiting radiation to internal organs, which poses technical and dosimetric challenges. This study presents the commissioning of Total Skin Electron Therapy (TSET) at our institution. The technique and associated dosimetric parameters were thoroughly investigated and evaluated. Material and Methods: TSET was commissioned using the Modified Stanford six-dual-field technique with a high dose rate (27.6 Gy/min) 6 MeV HDRE (High Dose Rate Electron) electron beam, delivered at a source-to-skin distance (SSD) of 373 cm using an Elekta AXESSE linear accelerator. The optimal irradiation geometry and dosimetric characteristics were determined through a series of phantom measurements and beam configuration analyses. The QA program follows recommendations from the AAPM Task Group Report 30 in order to maintain the safety, reliability, and functionality of the HDRE system through continuous monitoring and testing. Results & Discussion: Optimal field uniformity was achieved at gantry angles of +17.6° & -16.8° from 90°. The use of a 0.5 cm thickness of Perspex scatterer reduced the mean electron energy from 6 MeV to approximately 3.6 MeV. The depth of maximum dose (dmax) was observed at the surface to a depth of 5.6 mm, with R80 and R50 measured at 13 mm and 15.4 mm, respectively. The absolute dose to water at the calibration point using the dual gantry setup in high dose rate mode was 0.5063 Gy per 100 MU. The overlap factor (B) was calculated to be 3.11. The average X-ray contamination dose was almost negligible. The dosimetric data was further validated by measurements using Gafchromic film in Phantom set-up by delivering 2 Gy at surface and it was accurate within ±5% Conclusion: The successful commissioning of Total Skin Electron Therapy (TSET) demonstrated reliable and reproducible dosimetric performance. The system's calibration and quality assurance protocols, in accordance with AAPM TG-30 recommendations, ensured accurate dose delivery, validated through phantom and film measurements. The dosimetric validation confirms the readiness of our TSET program for safe and effective clinical use.



Poster ID: 42

Title: FF vs. FFF Beams in Hybrid Post-Mastectomy Radiotherapy: Finding the Optimal Plan

Author Names: Dr.Hemalatha.A, Dr.Athiyaman.M, Mr.Chandrasekar, Ms.Fiza Syed, Dr.Neeti Sharma, Dr.Shankar lal Jakhar, Dr.Kamlesh Kumar Harsh

Full Abstract:

Introduction & Objective: Novel hybrid techniques for chest wall irradiation have shown promising results in achieving adequate target coverage while sparing organs at risk (OARs). This study aims to evaluate the application of flattening filter-free (FFF) beams in hybrid treatment planning for post-mastectomy chest wall irradiation in breast cancer patients. Materials and Methods: Twenty post-mastectomy breast cancer patients previously treated with either 3DCRT or IMRT were retrospectively selected. Additional replanning was performed using 6 MV FF and FFF beams in a hybrid approach (Eclipse, V15.6 Varian Medical Systems, Palo Alto, USA). The selected plan weighting was 70% 3DCRT forward intensity-modulated fields (FIF) + 30% VMAT (FF or FFF). Dose–volume histograms (DVHs) were analyzed for the planning target volume (PTV) and in-field OARs, including the ipsilateral lung, heart, and esophagus. A MOSFET (Best Medical Canada Ltd, Canada)) dosimeter in a phantom setup was used to measure out-of-field doses to the contralateral breast (CLB). Results: Plans were ranked using the Unified Dosimetry Index (UDI), which integrates dose gradient, homogeneity, conformity, and coverage into a single score. UDI analysis showed no significant difference in PTV dose distribution between the 3DCRT+VMAT FF and 3DCRT+VMAT FFF hybrid plans. Similarly, no significant differences were observed between FF and FFF beams for ipsilateral lung doses (V5Gy, V10Gy, V20Gy, Dmean) and dose to heart (V5Gy, V10Gy, V20Gy, V25Gy, V30Gy). Differences in dose distribution to the esophagus and spinal cord were also negligible. Phantom measurements showed that the FFF beam reduced CLB dose by 26% compared to the FF beam. While total monitor units (MU) were higher for the FFF beam, the beam-on time (BOT) was reduced (1.57 min for FF vs. 0.77 min for FFF) due to the higher dose rate. Conclusion Hybrid plans using FFF photon beams provided comparable PTV and in-field OAR dose distributions to FF beams, while significantly reducing out-of-field dose to the contralateral breast. Given these potential advantages, further studies with larger patient cohorts are warranted to validate the benefits of FFF-based hybrid techniques in chest wall irradiation.

Poster ID: 43

Title: Feasibility of Acoustic Schwannoma SRT on Halcyon Using Dosimetric Comparison with TrueBeam

Author Names: Pooja Moundekar, Sajini Kurup, Dr. V.K.Sathiyanarayana, Dr. Raghavendra Holla, Sumit T, Sumeesh S

Full Abstract:

Purpose: Stereotactic radiotherapy is a standard treatment for acoustic schwannomas, requiring high precision and conformity to spare critical brain structures. Platforms like TrueBeam STx are optimized for such treatments. Though Halcyon's stacked and staggered MLC design effectively achieves a 0.5 cm MLC width despite using 1 cm leafs it may lacks some stereotactic hardware specifications. Despite these technical facts patients at single-machine Halcyon centers may still need intracranial SRT. This study evaluates the dosimetric feasibility of delivering SRT for acoustic schwannomas using Halcyon, by comparing plan quality using conformity index, dose gradients, and brainstem dose with that of the TrueBeam platform. Material and Method: 10 patients previously treated for acoustic schwannoma on TrueBeam STx were retrospectively replanned on the Halcyon system. A total dose of 25 Gy in 5 fractions was prescribed. PTV sizes ranged from 2.6 cc to 36.2 cc. Plans were optimised to achieve clinical goals. Dosimetric indices compared included conformity index (CI), gradient index (GI), and maximum dose to the brainstem (0.5 cc). Pearson correlation coefficients and standard deviations were calculated to evaluate consistency and variability across patients. Results and Discussions: The CI was comparable between Halcyon and Truebeam platforms, with mean values ranging from 0.97 to 1.10 for TrueBeam and 0.96 to 1.14 for Halcyon. The standard deviation of CI was slightly higher for Halcyon (0.08 vs. 0.04). Gradient indices were generally higher for Halcyon (range: 0.72–1.18) than TrueBeam (range: 0.62–1.07), indicating a marginally less steep dose fall-off (σ = 0.17 for Halcyon vs. 0.15 for TrueBeam). Plans were optimised such that dose received by 0.5cc of brainstem was similar between platforms, with TrueBeam ranging from 15.68 to 23.09 Gy and Halcyon from 20.86 to 23.23 Gy. The average absolute difference in brainstem dose was 1.7 Gy (range: -0.29 to +5.18 Gy), with most values within clinically acceptable limits. Correlation analysis showed strong agreement for gradient index (r = 0.88) and moderate correlation for conformity index (r = 0.49) between the two systems. Conclusion: Halcyon demonstrated dosimetric feasibility for SRT in the treatment of acoustic schwannomas, achieving target conformity and OAR sparing comparable to TrueBeam. Although Halcyon plans showed slightly higher GI and minor variability in brainstem dose, these remained within clinically acceptable thresholds. Despite the differences in specifications, in centres equipped only with a Halcyon linear accelerator, SRT can still be performed effectively with some trade-off in GI provided that machine-specific QA is conducted diligently.

Poster ID: 44

Title: Impact of Convolution Algorithm on Treatment Planning in Gammaknife Radiosurgery

Author Names: Julipriya Jena, Manoj K Semwal, Rohit Verma, Aruna Kaushik

Full Abstract:

Aim: To evaluate the impact of convolution calculation algorithm that takes into account medium heterogeneity on patient plan parameters as compared to standard TMR10 algorithm in Gammaknife Radiosurgery (GKRS). Material and Methods: Leksell Gamma Plan (Vers 11.3.2) treatment planning system and Leksell Gammaknife Icon unit (Elekta, Sweden) were used for treatment planning and delivery, respectively. Conventionally, treatment planning was performed on magnetic resonance imaging (MRI) scans at our centre with TMR10 algorithm chosen as the default algorithm. For this retrospective study, we selected treatment plans performed on Brilliance 16 slice computed tomography (CT) scanner (Philips, The Netherlands). The CT protocol was 1 mm thick contiguous axial slices. Ten dummy targets for each patient were contoured at five different locations with two target volumes. The locations were centre, superior, inferior, anterior and posterior part of skull with 5 cc and 10 cc target volumes. Treatment plans were created using the Lightning inverse dose optimizer tool once with TMR10 and then with Convolution algorithm for a prescription dose of 10 Gy. For optimization, the same selectable parameters namely beam on time weightage (0.5) and low dose volume weightage (0.5) were kept. Key plan evaluation parameters namely Paddick conformity index (PCI), dose gradient index (GI), beam on time (BOT), integral dose (ID), volume receiving prescription dose (PD) and optimization time (OT) were estimated and statistically analyzed for descriptive statistics as well as for significance level with two paired t-test in the software OriginPro 2025 (ver 10.2.0.196). Result: The mean BOT was 8.4 % higher for convolution-based plans as compared to TMR10 based plans and the difference was statistically significant ($p<0.05$). This finding was similar to the published literature. ID and GI were found to be higher with TMR10 as compared to convolution-based plans ($p<0.05$) and OT was significantly higher for convolution-based planning. For ID 3.2% higher for convolution-based algorithm and this may be the first reporting of such a finding as we couldn't find any reference on it in the published literature. There were no statistically significant differences on other plan parameters such as PCI and target coverage. Conclusion: Our study validates that Convolution algorithm results in higher BOT having implications for dose prescription in GKRS. Other major plan evaluation parameters except GI were broadly similar for both the calculation algorithms. As ID imposes secondary cancer risk which necessitating careful investigation during planning stage and later can help in management of it.

Poster ID: 45

Title: Surface Dose Evaluation in Breast Radiotherapy Using the Halcyon Linear Accelerator

Author Names: Pratibha Bauskar, Ankit Srivastava, Shreyasee Karmakar1, Rajesh Kumar, Pooja Khandekar, Shyam Kishor Shrivastava

Full Abstract:

Introduction and Objective: Accurate quantification of surface dose in breast radiotherapy is crucial due to its direct impact on skin toxicity, cosmetic outcomes, and local tumor control. Knowledge of the magnitude of surface dose is essential to ensure that radiation-induced side effects remain within acceptable limits while still delivering an adequate dose to prevent tumor recurrence. Dose calculation algorithms in commercial treatment planning systems (TPSs) have limitations in predicting patient surface doses. In this study, thermo luminescent dosimeter (TLD) powder was used to measure the surface dose. Material and Methods: The breast cancer patients were assigned to three technique-specific groups 3DCRT, IMRT, and VMAT with two patients in each group. Freshly annealed TLD-100 powder was calibrated over a dose range of 0–4Gy. For measurements, 20 mg of TLD powder was packed into plastic pouches and evenly distributed to achieve an overall thickness of less than 1 mm, five such TLD packets were placed at predefined surface locations on each patient during treatment. The exposed TLDs were read using a Harshaw 3500 TLD reader 24 hours post-irradiation, and the measured doses were compared with the corresponding TPS calculated doses at the corresponding depth from the skin surface. Results and Discussion: Mean dose discrepancies between TLD measurements and TPS calculations were 11.9%, 11.5%, and 5.2% for VMAT, IMRT, and 3DCRT techniques, respectively. These differences can be attributed primarily to the steep dose gradient in the buildup region, where accurate dose estimation is challenging for both TLD measurements and TPS calculations due to complex electron scatter and partial volume effects. Overall, 8 out of 45 measurement points demonstrated agreement within the ±5% tolerance level. To improve the statistical robustness and reliability of the results, the study is being extended to include a larger number of patients. Conclusion: This study shows that the surface dose for patients undergoing 3DCRT and IMRT is similar, whereas VMAT displays the highest level of variability; nonetheless, this variability is considered acceptable. To improve the statistical robustness and reliability of the results, the study is being extended to include a larger number of patients. Keywords: Breast Cancer, Surface Dose, Halcyon.

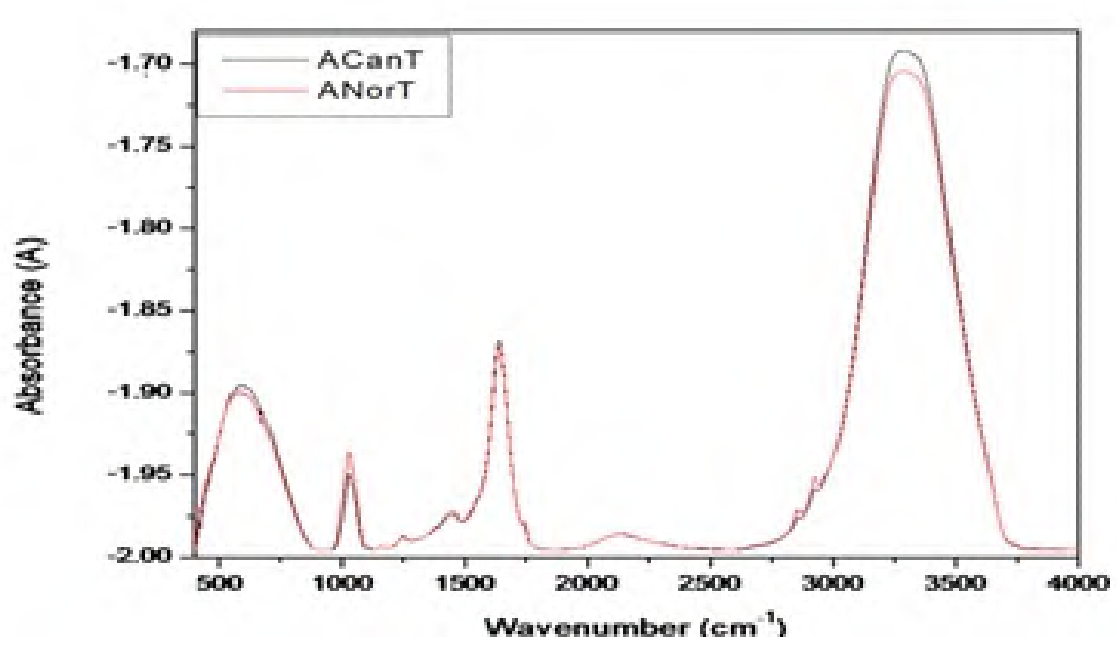
Poster ID: 46

Title: Fourier Transform Infrared Spectroscopy in serum sample of Breast Cancer Patients

Author Names: D Qaiser

Full Abstract:

Background: Breast cancer is the second most common cancer worldwide and the leading cause of cancer death among women. Early detection and diagnosis can significantly improve patient outcomes. Fourier transform infrared (FTIR) spectroscopy is a non-invasive diagnostic tool that can provide valuable information on the molecular composition of biological samples. It has been shown to be effective in diagnosing various diseases, including cancer. Objective: To identify the spectral differences in molecular composition between cancer tissue and normal tissue obtained from the breast cancer patients using Fourier transform infrared (FTIR) spectroscopy which help in diagnostic accuracy, sensitivity and specificity for breast cancer using FTIR spectroscopy. Methods: we collected blood sample of breast cancer patients and separate out the serum from the blood and then we will record the FTIR spectra of serum sample. FTIR spectra of the samples were recorded in the mid-infrared region (4000-400 cm-1) using a high-resolution detector. Results: The study indicates spectral differences between breast cancer and normal patients serum samples in FTIR spectra. This indicates differences in molecular composition between breast cancer patients and healthy controls. Conclusion: Results of the study confirm the hypothesis, development of FTIR spectroscopy as a diagnostic tool for breast cancer could have significant implications for breast cancer diagnosis and treatment, particularly in resource-limited settings. FTIR spectroscopy could potentially be used as a non-invasive, rapid, and cost-effective diagnostic tool for breast cancer, which could improve patient outcomes and survival rates.



Poster ID: 47

Title: Innovative Printable Flexible Metal-Free Radiopaque Markers for Artifact-Free Radiotherapy

Author Names:

Full Abstract:

Introduction and Objective: Radiopaque markers are widely used in radiotherapy planning CT, CT-guided biopsies, and interventional radiology to aid accurate localization. Conventional metallic markers, though effective in visibility, often cause beam-hardening or streak artifacts, limiting image quality and potentially affecting diagnostic or treatment accuracy. They also lack flexibility, making application challenging on irregular body surfaces. This study aimed to design, develop, and evaluate flexible, printable, metal-free radiopaque markers that eliminate imaging artifacts while providing high visibility across multiple imaging modalities. The objective was to create a customizable, patient-friendly alternative suitable for diverse clinical applications. Materials and Methods: A novel biocompatible polymer-based ink was formulated by incorporating high atomic number non-metallic powders to achieve optimal radiopacity. This ink was optimized for precision printing on medical-grade adhesive substrates. Markers were fabricated in multiple formats: 2 mm × 2 mm circular dots and 2 mm linear strips for radiotherapy CT planning; and larger sizes (5 cm × 5 cm, 10 cm × 10 cm) for CT-guided biopsies and interventional procedures. Some designs incorporated radiopaque guide lines with a central aperture for needle positioning. The markers were evaluated for radiopacity using X-ray, CT, and C-arm fluoroscopy in catheterization lab settings. Performance tests included adhesion strength on flat and contoured surfaces, flexibility assessment, and durability under simulated clinical use. Phantom studies and limited patient applications were conducted to assess feasibility. Conventional metallic markers were used for comparison. Results and Discussion: The developed non-metallic markers demonstrated excellent radiopacity in all imaging modalities without producing metal-induced artifacts such as beam hardening or streaking. Their flexibility allowed seamless adaptation to complex anatomical contours, improving localization accuracy. Adhesive performance was consistent, ensuring stable fixation throughout imaging and procedures. Customizable shapes and sizes enabled adaptation to specific clinical requirements, from small, discrete reference points in radiotherapy to larger, high-visibility guidance markers in interventional radiology. Compared to metallic markers, the new design offered superior image clarity, greater patient comfort, and easier contour adaptation, thereby improving procedural efficiency and safety. Conclusion: This study introduces a novel category of printable, flexible, metal-free radiopaque markers that combine high imaging visibility with complete artifact elimination. Their adaptability, patient comfort, and clinical versatility make them a superior alternative to traditional metallic markers. The technology holds significant potential to enhance radiotherapy planning accuracy, improve interventional guidance, and reduce imaging distortions, while being cost-effective and easily integrated into routine clinical practice.

Poster ID: 48

Title: Development of a Novel Indigenous Metal-Free Locking Applicator for HDR Brachytherapy

Author Names:

Full Abstract:

Introduction and Objective: High Dose Rate (HDR) brachytherapy is an advanced cancer treatment technique that delivers highly localized radiation to tumors while minimizing dose to surrounding healthy tissues. Applicator precision and reproducibility are vital for clinical success. However, commercial HDR applicators are costly, offer limited customization, and often contain metallic locking components that cause imaging artifacts, affect dose calculations, and complicate workflows. This study aimed to design, develop, and evaluate a cost-effective, biocompatible, sterilizable, and artifact-free HDR brachytherapy applicator with a fully integrated metal-free locking mechanism, manufactured using accessible 3D printing technology. Materials and Methods: The applicator was designed entirely in-house using open-source CAD software and fabricated via Fused Deposition Modeling (FDM), a low-cost and widely available additive manufacturing method. Medical-grade polymer materials were chosen for mechanical strength, sterilization compatibility, and patient safety. A key innovation was the polymer-based locking system that securely retained brachytherapy catheters without metallic parts. Multiple design iterations were developed with feedback from radiation oncologists and medical physicists. The final prototype included multiple catheter channels, secure locking slots, and an ergonomic handle. Mechanical testing involved stress loading, catheter retention force measurements, and repeated sterilization cycles. Dosimetric evaluation used a water-equivalent phantom and Gafchromic film to assess source positioning accuracy and dose distribution. CT imaging was used to check for artifacts. Results and Discussions: The developed applicator showed robust mechanical strength and maintained catheter retention forces within clinically acceptable limits after repeated sterilizations. Dosimetric testing confirmed source positioning reproducibility within ±1 mm, meeting clinical standards. The absence of metallic components eliminated CT imaging artifacts, improving target and organ-at-risk delineation during image-guided brachytherapy (IGBT). Fabrication costs were <10% of imported commercial equivalents, offering significant economic benefits for government and rural cancer centers. Clinical feedback highlighted ease of use, adaptability to varied patient anatomy, and improved imaging clarity for treatment planning. The integrated locking mechanism streamlined handling and reduced procedural time. Conclusion: This study demonstrates the successful design and fabrication of an indigenous, metal-free HDR brachytherapy applicator using 3D printing. The device offers a low-cost, artifact-free, and clinically reliable alternative to commercial applicators. Its adoption can expand access to high-quality brachytherapy in resource-limited settings, promote self-reliance, and improve patient-centered cancer care.

Poster ID: 49

Title: Pseudo Black Body Theory of Dose Deposition Characteristics in Theoretical 4π and Clinical 2π Geometry: A Proof of Concept and Potential Implications for Dose Escalation

Author Names:

Full Abstract:

Aim: To evaluate the characteristic of the dose fall inside and outside the stereotactic radiotherapy. This will allow dose escalation to the target volume, without affecting dose falloff to the organs at risk. Material and Method: Theoretical and clinical models, were used to establish the black body theory. In the theoretical model, targets with diameters of 0.5 cm, 1 cm, 2 cm, and 3 cm were placed inside a 10 cm diameter "body". Dose escalation was 120%, 150%, and 200% at the core. Dose falloff characteristics for the "body" were determined. In the clinical model, 30 SRS patients were planned for uniform, 120%, 150%, and 200% doses to the core. Dose fall off at the body and variation in OAR doses were evaluated. Results: In the theoretical model, the maximum escalated dose was 181.6%. The characteristic dose falloff was a parabolic function, and there was little change in the spillage dose. Average spillage dose for 0.5 cm, 1 cm, 2 cm, and 3 cm targets were 0.4±0.5%, 1.3±1.9%, 1.5±2.0%, and 0.8±0.8%, respectively. For clinical model, the maximum dose was 213.9%. Maximum dose differences Δ(120%-uniform), Δ(150%-uniform), Δ(200%-uniform) for the brainstem were 1.3%±3%, 2.5%±5%, and 5.4%±13%. For the chiasma 0.4%±0.9%, 0.3%±0.9%, and 0.3%±1.0%. Left and right optic nerve, they were 0.3%±0.6%, 0.2%±0.4%, 0.7%±0.7%, and 0.0%±0.8%, -0.2%±1.8%, and -0.1%±1.4%. Conclusion: A radiotherapy target volume does not fulfil all the characteristics of classical black body. Nonetheless, it full fills the other characteristics like the radiation outside the blackbody is the function of the surface temperate of the blackbody. For example, the radiation reaching to earth from sun (black body) is function of its surface temperature (5800 Kelvin) not the temperature of the core (15700000 Kelvin). For radiotherapy target, the dose falloff outside the target is solely a function of the temperature of the surface, represented by the isodose coverage of the target. Dose spillage to the "body" and dose to organs at risk will not increase if they are outside the target. Increased doses for different organs are only observed when they overlap with the target. This study establishes the black body theory, partially, for radiotherapy targets and might be helpful for dose escalation in the central part of the tumor, where more hypoxic cells are present, potentially offering better local control. The clinical and radiobiological consequences of high dose escalation need to be established through proper experiments and are beyond the scope.

Supporting Documents

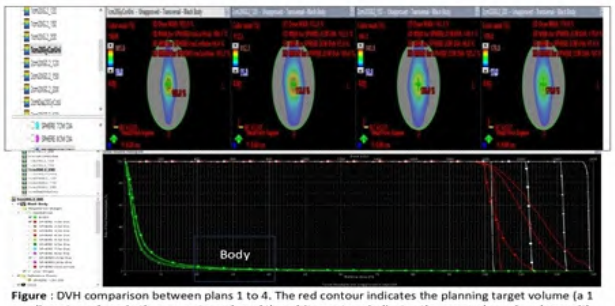
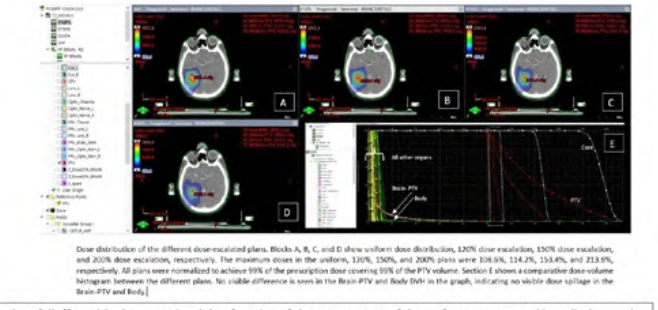


Figure : DVH comparison between plans 1 to 4. The red contour indicates the planning target volume (a 1 cm diameter sphere in the present case), and the white contour indicates the core volume (a sphere with a 0.2 cm diameter).



Dose distribution of the different dose-escalated plans. Blocks A, B, C, and D show uniform dose distribution, 120% dose escalation, 150% dose escalation, and 200% dose escalation, respectively. The maximum doses in the uniform, 120%, 150%, and 200% plans were 108.6%, 114.2%, 153.4%, and 213.9%, respectively. All plans were normalized to achieve 99% of the prescription dose covering 99% of the PTV volume. Section E shows a comparative dose-volume histogram between the different plans. No visible difference is seen in the Brain-PTV and Body DVH in the graph, indicating no visible dose spillage in the Brain-PTV and Body.

The dose falloff outside the target is solely a function of the temperature of the surface, represented in radiotherapy by the dose coverage of the target. Dose spillage to the "body" and dose to organs at risk will not increase if they are outside the target. Increased doses for different organs are only observed when they overlap with the target.

This study establishes the dose fall off characteristics of radiotherapy targets and might be helpful for dose escalation in the central part of the tumor, where more hypoxic cells are present, potentially offering better local control. The clinical and radiobiological consequences of high dose escalation need to be established through proper experiments and are beyond the scope of this study. This dose fall-off characteristics somewhat typically resemble characteristic of black body, however the other characteristics of black body is not followed or fulfilled in the target vs. photon interaction.

Poster ID: 50

Title: Reducing Radiation Exposure in CT Imaging through AI-Based Denoising

Author Names: Dr Susama Rani Mandal, Dr Avinav Bharati, Dr Pratik Kumar, Dr R K Bisht

Full Abstract:

Introduction and Objective: This phantom study provides crucial insights into the degree of acceptable dose reduction without compromising image quality. That is to investigate the use of AI technology, to enhance the quality of CT images while simultaneously reducing the radiation dose during the imaging process. CT scans are vital in diagnosing and managing various medical conditions, but their usage contributes significantly to overall radiation exposure in medical care. By employing an advanced deep learning-based AI technique, to improve image quality and decrease radiation exposure. Materials and Methods Phantom studies using catphan600 were performed at various radiation dosages with or without the AI Software technique. Various image quality parameters such as CT number uniformity, CT number linearity, Noise Low contrast resolution and High Contrast resolution were analysed and compared at various radiation dosages with or without the AI Software technique. Results and Discussions Image quality test with two routinely used protocol for abdomen and thoraces were performed. Relative average reduction in noise with AI de-noising software was 36.4% [min 7.20% & max 69.29%] Conclusion In this phantom study statistically significant improvement was found in image quality while reducing the dose. Therefore use of de-noising software will give clinically accepted image quality of scan with reduced radiation dose.

Poster ID: 51

Title: From Heat to Healing: Clinical Applications of Infrared Thermography in Vascular Diagnostics and Monitoring – A Narrative Review

Author Names: Bitesh Kumar, Anjan Kumar Dhua

Full Abstract:

Background Infrared thermography (IRT) is a non-invasive, radiation-free imaging modality that enables real-time visualization of skin surface temperature, serving as a surrogate for underlying vascular perfusion. Despite its diagnostic promise across diverse clinical conditions, its routine application in vascular medicine remains underutilized. This review aims to synthesize current clinical evidence supporting the diagnostic and monitoring roles of IRT in vascular and related conditions. Objective: To synthesize and critically evaluate clinical evidence on the diagnostic and monitoring applications of IRT in vascular medicine and related conditions. Materials and Methods A structured narrative review was conducted using literature from PubMed, Scopus, and Google Scholar (2000–2025), focusing on clinical studies reporting on the use of IRT in human subjects. Included studies were appraised using tools such as QUADAS-2, NOS, JBI, and PROBAST. Diagnostic thresholds (e.g., ΔT), accuracy metrics (e.g., AUC), and clinical contexts (e.g., peripheral arterial disease, diabetic foot, flap viability) were systematically summarized. Result: Infrared thermography has demonstrated promising utility across a range of vascular and related clinical scenarios. In peripheral arterial disease (PAD), it effectively identified perfusion deficits through side-to-side temperature differences exceeding 1.09°C, and also aided in surgical planning for limb amputation. In diabetic foot management, IRT detected early signs of inflammation and neuropathy, with temperature asymmetries greater than 2.2°C predicting ulcer formation. In reconstructive surgery, it enabled early detection of arterial or venous flap compromise–up to 4–6 hours before clinical signs–using temperature differences 2°C. Applications extended to burn wound assessment, where IRT estimated depth and healing potential, and in oncology, where it differentiated malignant from benign soft tissue tumors with high diagnostic accuracy (AUC › 0.99). The integration of artificial intelligence further enhanced sensitivity in areas like breast cancer detection and surgical wound monitoring, making IRT a viable tool for both hospital-based and remote care settings. Conclusion: IRT is a valuable adjunct in non-invasive diagnostics, particularly in resource-limited, pediatric, and bedside settings. Its strengths–real-time imaging, functional insight, and safety–support its integration into vascular medicine. Standardization and AI-enhanced tools will be critical for wider clinical adoption. Keywords: Infrared Thermography, Diagnostic Imaging, Non-Invasive, Vascular Perfusion, Thermal Imaging, Artificial Intelligence

S.No.	Clinical condition	IRT Application	Key Diagnostic Parameters	Supporting Studies/References
1	Peripheral Arterial Disease	Detect perfusion deficits, and surgical planning	ΔT > 1.09°C (plantar); ΔT > 2°C → amputation level	Ilo et al., 2020; Morais et al., 2024; Bagavathiappan et al., 2009
2	Diabetic Foot	Detect inflammation, predict ulcers, monitor neuropathy	ΔT > 2.2°C; Mean plantar temp > 32°C in neuropathy	Ilo et al., 2019; van Netten et al., 2013; Bagavathiappan et al., 2010; Faus Camarena et al., 2024
3	Raynaud's Phenomenon	Evaluate thermal recovery post-cold provocation	Delayed rewarming (>10–15 min); baseline cold digits	Fernández-Cuevas et al., 2015; Chojnowski, 2017
4	Burn Wounds Monitoring	Estimate burn depth; predict healing time	ΔT > 0.6°C → healing <14 days; ΔT < –2.3°C → deep burn	Carrière et al., 2020; Korambayil et al., 2019; Pedrosa et al., 2024
5	Chronic / Neuropathic Pain	Detect asymmetry, track treatment effect	ΔT = 0.8–2.2°C; SSIM, MSE, Entropy metrics	Zou et al., 2023; Liu et al., 2024; Bansal et al., 2025; Polidori et al., 2018
6	Reconstructive Surgery	Monitor flap viability; detect arterial/venous compromise	ΔT ≥ 2°C between flap and surrounding skin	Chubb et al., 2011; Singla et al., 2024
7	Orthopedic Trauma / Fractures	Detect infection, assess healing, pediatric fracture detection	ΔT ≥ 1°C; Hot spot over tibial cortex	Auf der Strasse et al., 2021; Saatchi and Ramlakhan, 2023
8	Postoperative Monitoring	Predict wound healing; monitor hemodynamics	Persistent cold zones; ΔT between inner canthus-hallux	Siah et al., 2019; Bridier et al., 2023; Li et al., 2024
9	Oncology / Tumor Detection	Differentiate malignant vs benign lesions	ΔT > 0.85°C (tumor); AUC > 0.99	Domínguez González et al., 2023; Arora et al., 2008; Fernandes et al., 2019

Poster ID: 52

Title: Optimization of Gaussian Smoothing and Ramp Filter Parameters for Enhanced CT Image Reconstruction Using PSF-Deconvolved ML-EM Algorithm

Author Names: Hari Govind B, Muhsin T, Mithun Cv, Prof M M Musthafa

Full Abstract:

Objective: This study investigates the influence of Gaussian smoothing and ramp filter tuning on reducing coordinate-based singularities and enhancing the Point Spread Function (PSF) response in CT image reconstruction through a deconvolved ML-EM framework. Materials and Methods: An iterative reconstruction algorithm was developed using the Maximum Likelihood-Expectation Maximization (ML-EM) method. Gaussian filters were embedded within the spatial frequency domain to mitigate noise and coordinate singularities, with PSF-guided parameterization. A compact tomographic imaging system utilizing a ^{241}Am source and gas detector, combined with a laser-controlled LDR angular system, was built for data acquisition. Image reconstruction was carried out via filtered back projection using Fourier domain techniques implemented in SciPy. A grid-based optimization was performed varying the ramp filter cutoff frequency (0.5 to +0.5 cm) and Gaussian smoothing sigma (0.5–5 pixels), both in uniform increments. Results: Optimal imaging outcomes were achieved using a ramp filter cutoff frequency of 0.1 cm and a Gaussian sigma of 1 pixel. This configuration minimized singularity-induced artifacts, improved image sharpness, and suppressed high-frequency noise. The resulting reconstructions demonstrated enhanced resolution and contrast without compromising image integrity. Conclusion: Tuning Gaussian and ramp filter parameters in conjunction with PSF-guided deconvolution significantly improves tomographic image reconstruction. The findings support parameter optimization as a robust method for improving CT image fidelity using iterative reconstruction. Keywords: CT reconstruction, ML-EM, Point Spread Function, Gaussian smoothing, Ramp filter optimization

Poster ID: 53

Title: FLASH THE FUTURE?

Author Names: R. Pichumani

Full Abstract:

Introduction & Objective: FLASH Radiotherapy is an emerging Radiation treatment that delivers ultra-high dose(>40gy/s) in a fraction of second compared to conventional RT, which takes several minutes over multiple sessions. This is in experimental stage and may be THE FUTURE Methods and Materials: Information available shares that preclinical studies show FLASH-RT spares health tissue better than conventional RT potentially due to rapid oxygen depletion in normal tissues, creating transient radio resistance. Delivery modes include Electron beams (for superficial tumours) and, photons, protons for deep seated tumours Results and Discussion: The first human trial (FAST01,2022) as per internet sources treated 10 patients with bone metastateses in extremeties using proton FLASH_RT (8Gyin <1 sec) which demonstrated safety, pain relief and no unexpected side effects. The biological basis of the FLASH-RT needs further research to optimize protocols and ensure consistent outcome across patients and tumour types.

Poster ID: 54

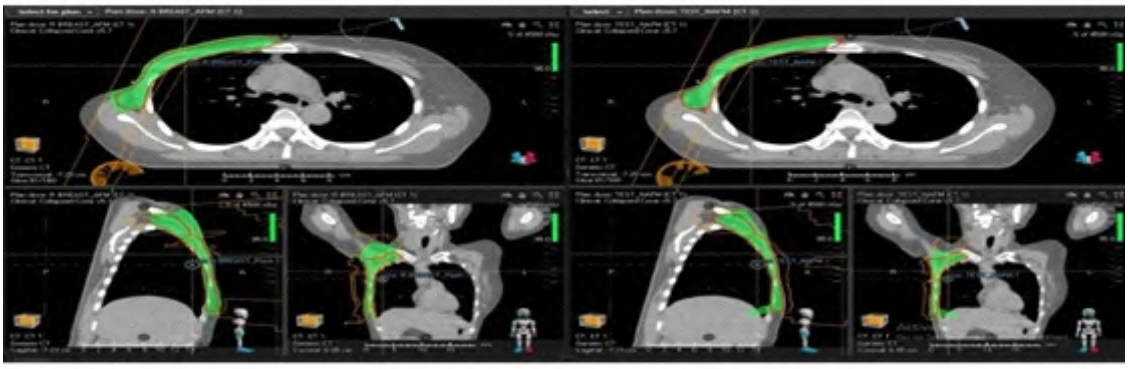
Title: Deriving the best dose distribution in Breast cases by implementing Auto Flash margin

Author Names: Rampally Kumar, Kanaparthy Raja Muralidhar, Srinivas Ponaganti, Veera Raghavendra Rao Kolluru

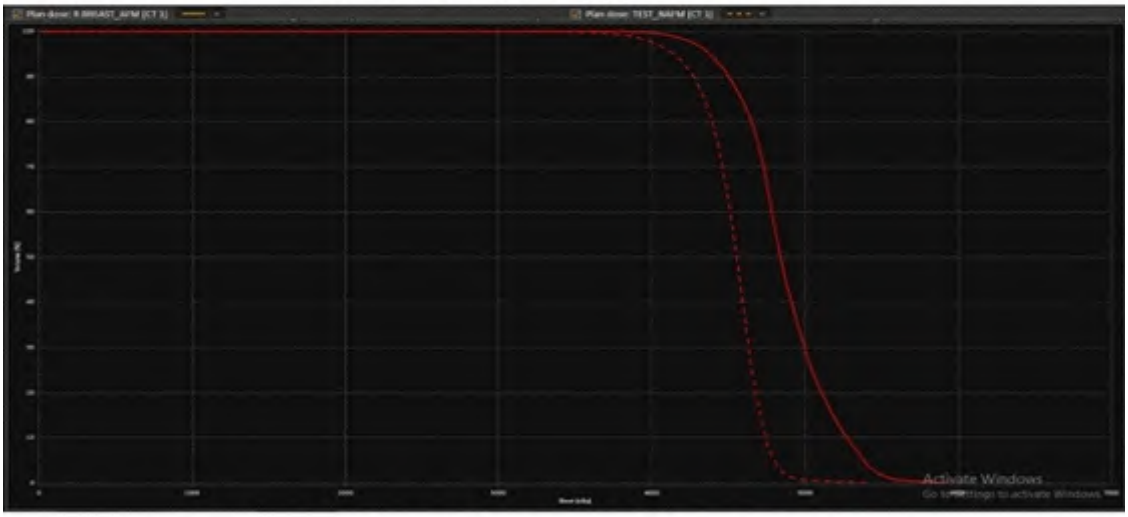
Full Abstract:

Introduction and Objective: To investigate the dose-effect of Auto Flash Margin (AFM) on breast cancers super cial tissues based on the Treatment Planning System (TPS) in the breast conserving radiotherapy plan. Materials and Methods: A total of 10 breast-conserving patients with early-stage breast cancer were selected for this study. All cases were planned by both 2 cm-Auto Flash Margin (AFM) (the value of AFM is 2 cm) and N-AFM (without AFM) techniques. Under the condition of ensuring the same con guration of collimator, the dose difference between AFM and N-AFM was compared. Results and Discussions: In the dose results for PTV V48Gy, the AFM patient plan dose distribution shown superior to that of the N-AFM patients. Higher doses were observed in N-AFM cases compared with AFM Cases. However, there was no other signi cant difference between these two techniques, AFM formed an apparent air region outside the collimator compared with the N-AFM which gives confidence that the entire target is covered in the treatment. Conclusion: These results suggest that the Auto Flash Margin (AFM) function application could signi cantly reduce the possibility of insuf cient tumour target coverage caused by breathing motion and ensure sufficient tumour target exposure.

Deriving the best dose distribution in Breast cases by implementing Auto Flash margin



A) Dose Distribution with AFM and N-AFM



B) DVH with AFM and N-AFM for Target

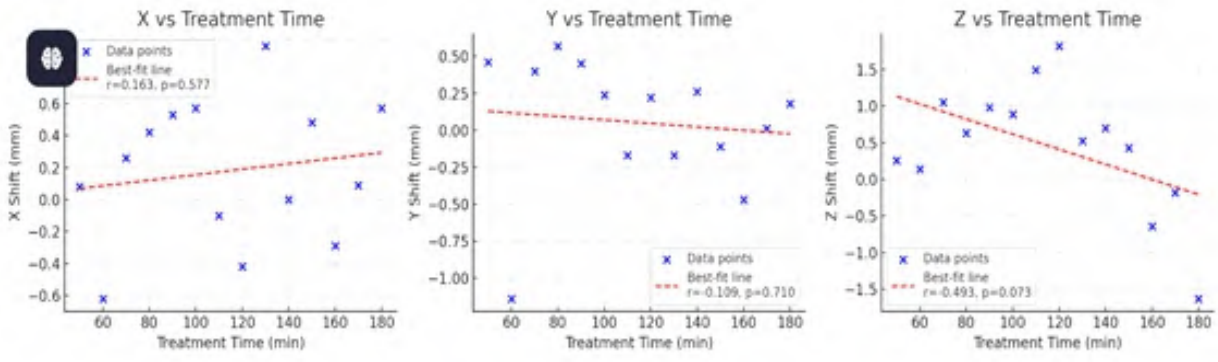
Poster ID: 55

Title: Impact of Treatment Duration on Motion Stability and Treatment Interruptions in Frameless Gamma Knife Icon Radiosurgery for Multiple Brain Metastases

Author Names: Dr Nandakarthik Sg, Ponnusamy, Vignesh, Dr,nishanth Sadashiva, Dr,dhaval Shukla

Full Abstract:

Introduction and Objective The frameless Gamma Knife Icon system enables non-invasive stereotactic radiosurgery (SRS) for patients with multiple brain metastases, offering improved patient comfort and the potential for fractionated treatment. However, longer treatment durations, often required for multi-target plans, may increase the risk of intrafraction motion and treatment interruptions, potentially compromising target accuracy. This study aims to evaluate the impact of treatment duration on motion stability and the frequency of interruptions during frameless Gamma Knife Icon procedures. Materials and Methods A retrospective analysis was conducted on thirty patients with 3 brain metastases treated using frameless Gamma Knife Icon radiosurgery. Patient motion was monitored using the system's integrated high-definition motion management (HDMM) system, with threshold limits set at 1 mm for translational and 0.5° for rotational displacement. Cone-beam computed tomography (CBCT) was employed pre-treatment and as needed intra-treatment to confirm positioning. Patients were stratified into two groups based on treatment duration: Group A (<60 minutes) and Group B (60 minutes). Data collected included the number of motion-related interruptions, CBCT rescans, and total treatment time. Statistical analyses were performed to assess correlations between treatment duration and motion events. Results and Discussion Among the 30 patients analysed, 40% experienced at least one motion-related treatment interruption. Group B exhibited a significantly higher rate of interruptions (mean: 3 ± 0.8) compared to Group A (mean: 0.8 ± 0.5; $p < 0.03$). The frequency of intra-treatment CBCT rescans was also notably greater in longer treatment sessions. Rotational deviations particularly in pitch and roll were the most common causes of threshold violations. A positive correlation was identified between the number of metastases treated among translational movements in x-co-ordinates and total treatment time ($r = 0.6$ and $p < 0.05$). Patients undergoing frameless treatments lasting more than 60 minutes were more prone to motion exceeding 1 mm, indicating increased instability. This was attributed to growing discomfort and fatigue over time. Additionally, patient age and the quality of mask preparation were found to influence the extent of intrafraction motion. Conclusion Prolonged frameless Gamma Knife radiosurgery sessions are associated with increased intrafraction motion and treatment interruptions in patients with multiple brain metastases. In cases where treatment duration exceeds 60 minutes, strategies such as scheduled breaks, patient coaching, or frame-based immobilization may be necessary to maintain positional accuracy and workflow efficiency. Individualized treatment planning based on lesion burden and session length is recommended



Poster ID: 56

Title: Dosimetric Comparison of Hybrid 3D CRT–VMAT Versus Conventional VMAT Planning in Thoracic Radiotherapy for Non-Respiratory Gated Patients

Author Names: Silas Ebeneser, Timothy peace Balasingh, Henry Finlay Godson, Ebenezer Suman Babu, Abel Juhan Thomas

Full Abstract:

Introduction and Objective: Radiotherapy for thoracic malignancies present significant challenges due to respiratory motion, which can result in geometric uncertainties and a compromise in precise dose delivery. Respiratory gating, by synchronizing radiation delivery to the tumor's motion cycle, enhances target conformity and reduces unnecessary exposure to surrounding healthy tissues. However, in certain patients, gating is not feasible due to irregular breathing patterns, inability to maintain consistent breath-holds, equipment unavailability, workflow limitations, etc., Volumetric modulated arc therapy (VMAT) may exhibit increased low-dose spillage leading to unachieved dose constraints to organ-at-risk (OAR)s during plan optimization. In such cases, a hybrid technique combining Three-dimensional conformal radiotherapy (3DCRT) and VMAT may provide an effective alternative, balancing target conformity, OAR sparing, and treatment efficiency. The primary objective is to reduce the dose to laterally positioned OARs as much as possible while maintaining adequate target coverage. This study aims to quantitatively compare the dosimetric performance of hybrid 3DCRT–VMAT against conventional full-VMAT planning in thoracic malignancies where respiratory gating is not feasible. Materials and Methods: Retrospective treatment planning was done for six patients with thoracic tumors using two techniques: (1) a hybrid approach delivering 70% of the prescribed dose through 3D CRT (AP–PA fields) and 30% through VMAT arcs, and (2) conventional full VMAT delivering the entire dose. VMAT optimization in the hybrid plan was performed using the 3D CRT dose as the base dose plan. Plans were evaluated using dosimetric endpoints including PTV coverage (D95%, D100% and D105%), OAR doses (lung V5, V20, mean lung dose, heart, spinal cord). Results and Discussion: The hybrid technique achieved comparable PTV coverage while demonstrating significant reductions in low-dose to the contralateral lung compared to full-VMAT plans. A reduction in total MUs was also observed. Although the hybrid plan showed a minimal compromise in target coverage, this reduction was clinically acceptable. It demonstrated superior sparing of OARs located laterally to the target, primarily due to the AP–PA fields delivering 70% of the prescribed dose. However, this dose distribution pattern can lead to relatively higher exposure for OARs situated along the AP–PA axis, such as the heart or spinal cord. Although these doses remained within tolerance limits, this consideration underscores the need for careful patient selection and individualized planning when applying this technique. Conclusion: Hybrid planning offers a promising alternative in non-gated thoracic cases, balancing target coverage with particular benefits for laterally positioned OARs.

Patient	Technique	PTV Coverage			Contralateral Lung			Heart		Spinal Cord
		V95 (%)	V100 (%)	V105 (%)	Dmean (Gy)	V20 (Gy)	V12 (Gy)	Dmean (Gy)	V10 (Gy)	Dmax (Gy)
Patient 1	VMAT	96.1	71.4	1.3	8.6	8.71	22.9	13.41	37.39	36.93
	Hyb-VMAT	95.02	68.5	0.082	7.04	6.4	13.5	8.05	29.27	40.9
Patient 2	VMAT	95.9	58.6	0.0001	7.2	2.78	14.63	7.76	23.62	39.79
	Hyb-VMAT	95.02	61.56	0.61	4.18	0	1.17	13.46	39.36	43.79
Patient 3	VMAT	95.8	60.81	0.26	6.12	3.64	11.33	10.96	44.33	38.5
	Hyb-VMAT	94.99	47.83	0	4.19	2.13	3.26	12.88	34.8	40.7
Patient 4	VMAT	96.23	66.5	2.04	10.75	11.05	37.25	16.9	49.33	31.78
	Hyb-VMAT	95.57	55.36	0	6.73	4.29	15.05	20.1	55.59	40.11
Patient 5	VMAT	98.43	78.29	0.25	13.68	23.9	38.31	18.82	55.66	12.6
	Hyb-VMAT	97.51	63.85	0.59	12.31	20.37	34.63	21.03	57.27	17.8
Patient 6	VMAT	97.8	66.9	2.4	3.34	5.8	7.2	5.67	20.2	9.22
	Hyb-VMAT	95.2	50.2	0.6	2.95	0	1.7	9.51	30.2	27.72

Poster ID: 57

Title: Efficacy of implementing co-optimization in treatment planning

Author Names: Veera Raghavendra Rao Kolluru, Rampally Kumar, Dr Kanaparthy Raja Muralidhar

Full Abstract:

Introduction and Objective: This study explores applying co-optimization method in treatment planning to avoid spillage of dose and for better dose distribution in two phase plans for various diagnoses. Materials and Methods: This study applied co optimization method in 10 cases of various diagnosis covering head and neck, thorasic and pelvic cases. The RayStation planning system (Version 12A) is used for this task by importing CT images, delineation of target volumes, OARS and for planning. The co-optimization process utilized RayStation's advanced optimization algorithms, allowing simultaneous adjustment of dose distributions for multiple targets and OARs. Dose objectives, constraints, and weighting factors were carefully set to achieve optimal balance between target coverage and sparing of healthy tissues. Plans were evaluated using dose-volume histograms (DVHs), conformity index (CI), and homogeneity index (HI). Results and Discussions: This study shown the advantage of using co optimization method for better Plan Quality by getting reduced OAR doses, better coverage of target with reduced planning time. It could be able to reduce the cold and hot spots in the target. This study is also proved to be useful for managing anatomical variations during treatment. Conclusion: Co-optimization planning in Ray Station TPS demonstrates promising improvements in both plan quality and efficiency in two phase plans to avoid dose spillage and by achieving better dose distribution with much lesser time for optimization and planning.

Efficacy of implementing co-optimization in treatment planning

i)Dose wash with Co-optimization

ii)Dose wash without Co-optimization

Poster ID: 58

Title: Preliminary Experience with IDENTIFY: A Surface-Guided Radiation Therapy (SGRT) System

Author Names: Shama Bhandary, Bhagyalakshmi AT, Nidhi Jain, Naveen M, Dibakar Barman, Rahila Sherin KP, Chandra Kumar R, Suresh Chaudhari

Full Abstract:

Introduction and Objectives: Surface-Guided Radiotherapy (SGRT) systems like Varian's IDENTIFY (v3.0) offer real-time, non-ionizing tracking of patient surface anatomy. However, Cone Beam CT (CBCT) remains the gold standard for internal anatomical verification. This study evaluates the accuracy and reliability of IDENTIFY compared to CBCT in both clinical and phantom settings. Materials and Methods: A retrospective analysis was performed on 10 patients undergoing breast or thoracic radiotherapy using the Ethos™ system (Varian Medical Systems). Initial patient setup was conducted with the IDENTIFY™ surface-guided radiotherapy (SGRT) system (v3.0), followed by verification using cone-beam computed tomography (CBCT). Additionally, phantom-based evaluations were performed using the Shane phantom, Cube Iso phantom, and IGRT QA phantom. Translational (X: lateral, Y: longitudinal, Z: vertical) and rotational deviations were assessed and compared between SGRT and CBCT modalities. Results and Discussion: Phantom-based comparisons demonstrated minimal translational differences between IDENTIFY and CBCT systems: IGRT phantom (vertical: 0.5 mm, longitudinal: 0.8 mm, lateral: 0.3 mm), Cube Iso phantom (vertical: 0.5 mm, longitudinal: 0.3 mm, lateral: 0.2 mm), and Shane phantom (vertical: 0.6 mm, longitudinal: 0.9 mm, lateral: 0.3 mm). Notably, the Shane phantom, designed to replicate human surface anatomy, exhibited comparable uncertainty, with a consistent positive vertical shift attributed to random setup variability. For patient data, CBCT-derived shifts were observed in the range of 0.2 ± 4.1 mm (lateral), 1.3 ± 3.8 mm (longitudinal), and 1.7 ± 3.4 mm (vertical). Conclusion: IDENTIFY provides efficient, reproducible 6D surface guidance and improves setup accuracy. It enabled more precise initial positioning, reducing CBCT correctional shifts. While SGRT can lower imaging dose, its use is limited by motion, surface shadowing, flat anatomy, ROI selection, and lack of internal anatomical information–especially in mobile regions like the thorax. Though SGRT is a good tool for intrafraction motion monitoring, CBCT cannot be avoided for accurate patient setup. Phantom studies confirmed that residual shifts remained within 1 mm of CBCT values, indicating strong concordance because of its rigid structure. Further experience and larger-scale validation are required to confirm the reproducibility and generalization of these findings. Keywords: SGRT, IDENTIFY, CBCT, surface imaging, patient setup accuracy

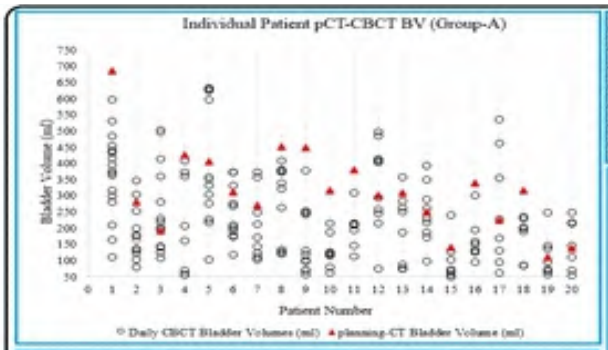
Poster ID: 59

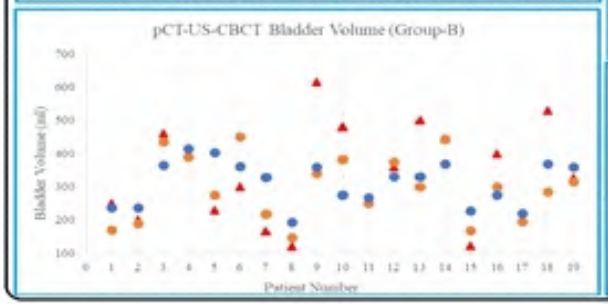
Title: Assessment of daily bladder filling consistency using ultrasound and CBCT-scans in patients receiving pelvis radiotherapy

Author Names: Mr.Thirunavukkarasu Mani1, Mr.Jayesh Dherange, Dr. Prasad Tanwade, Dr. Yogesh Anap, Dr. Pratik Arote, Mr Singaravel Boopathi, Mr. Girish Yadav, Ms Ankita Chougule

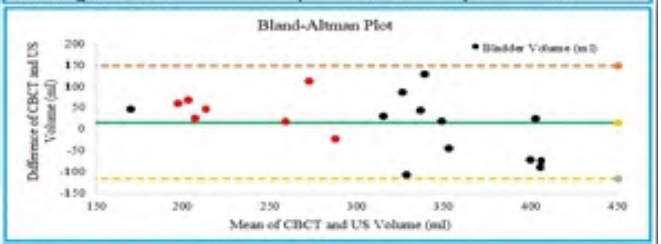
Full Abstract:

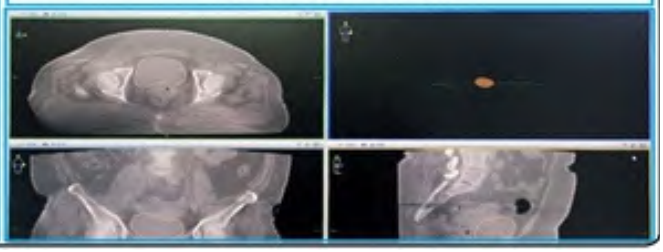
Introduction and Objective: Bladder volume variations during radiotherapy influences dose distribution to target-volumes and surrounding OARs. We aim to assess the variation in bladder filling volumes using ultrasound (US) done before RT and CBCT during daily treatment sessions in a group of patients with pelvic cancer and intra-fractional bladder filling variability between the Planning-CT and subsequent treatment CBCT-scans. Materials and Methods: This study involved 39 patients undergoing radiotherapy for pelvic malignancies. A standardized bladder filling protocol (Void urine. Drink 500mL water in 15 minutes duration. Wait for 30 minutes, then Start RT) was followed, and baseline bladder volumes were set using planning-CT scans. The group-A (20 patients/204 CBCTs) underwent only CBCT-scans before treatment, while the group-B (19 patients/84 US-Scans/73 CBCTs) had both ultrasound (US) and CBCT-scans. All patients were treated on Elekta Versa HD Linac. Bladder volumes were measured using US and CBCT during treatment sessions, and inflow-rate was calculated Pre-&-Post-RT. Results and Discussions: For Group A - the mean bladder volume at planning-CT was 314.9 ml (range 111-686 ml, SD=132.5 ml). This decreased during treatment with mean-volume 195.2 ml (range 62.5-376 ml, SD=91.79, p=0.002). For Group B - the mean bladder volume at planning-CT was 335.05 ml (range 120-615 ml, SD=145.70 ml). This decreased during treatment with US mean-volume 296.24 ml (range 148-450 ml, SD=98.33 ml, p=0.34) and CBCT mean-volume 311.71 ml (range 193-415 ml, SD=67.44 ml, p=0.53). During radiotherapy of group-A patients 17.33% (48/277), 23.47% (65/277), 59.20% (164/277) and in group-B 45% (38/84), 24% (20/84), 31% (26/84) of bladder volumes had <50 ml, 50-100 ml and >100 ml deviation, respectively compared with planning-CT. Bladder filling rate reduced from 7.7 ml/min at pre-RT to 3.9 ml/min during last RT fraction. Conclusions: Pre-treatment US provide an effective means of assessing bladder volume prior to radiotherapy for pelvic malignancies. In group-A patients, percentage deviation of mean bladder volume with Planning-CT was 38%, whereas in group-B it was 7%. Patients with a bladder volume 200-300 ml during Planning-CT have more reproducible capability during their treatment exhibition as per Bland-Altman statistical analysis. The integration of real-time bladder monitoring may enhance precision Dosimetric and clinical outcomes. KEY WORDS: Bladder filling protocol, ultrasoundscan





	Group-A patients	Group-B patients
Mean pCT Bladder Volume (ml)	314.9	335.05
Mean CBCT Bladder Volume (ml)	195.2	311.71
Mean US bladder Volume (ml)	-	296.24
Range of pCT bladder Volume (ml)	111.00 – 686.00	120.00 – 615.00
Range of CBCT Bladder Volume (ml	62.50 – 376.00	193.00 – 415.00
Range of US Bladder Volume (ml)	-	148.00 – 450.00
Percentage Deviation	38%	7%





Poster ID: 60

Title: Impact of superior shift of isocenter for mono-isocentric treatments in post mastectomy radiotherapy

Author Names: Surayya H. E., Dr. Shaiju V. S., Dr. A. M. Mohammed Faheem, Dr. Beela Sarah Mathew, Dr. P. Raghukumar

Full Abstract:

Introduction and Objectives: The most common three-dimensional conformal radiation therapy (3DCRT) planning technique used for postmastectomy radiotherapy (PMRT) is the mono-isocentric technique (MIT), which uses single-isocenter photon beams for both chestwall and supraclavicular nodal irradiation. Many of the busy centres prefer field-based 3DCRT planning without contouring the breast tissues and supraclavicular nodes. Therefore, careful consideration of the isocenter position is crucial for minimizing ipsilateral lung dose. Our study intends to compare the ipsilateral lung dose by shifting the isocenter superiorly with the patients who have undergone prior field-based radiation therapy. Materials and Methods: 30 Patients with left-sided breast cancer who underwent PMRT with supraclavicular fossa irradiation were retrospectively selected. The target volumes, comprising the chest wall and supraclavicular nodal region, were contoured following ESTRO guidelines. Organs at risk (OAR), including the lungs and heart, were delineated for dose evaluation. Treatment planning and contouring was performed using the Eclipse™ v16.0.1 workstation. A standard dose of 40 Gy in 15 fractions was prescribed. Treatment plans were generated using a mono-isocentric Field-in-Field (FiF) 3DCRT technique, with a single isocenter positioned near the lower supraclavicular notch. A direct on-field beam is used to treat the supraclavicular fossa, while opposed tangential beams targeted the chest wall. Superior isocenter shifts of 5mm and 10mm were applied to generate new plans while maintaining field of treated area. Identical planning parameters ensured that lung dose variations were solely due to isocenter shifts. Results and Discussion: Superior isocenter shifts of 5 mm and 10 mm effectively reduced ipsilateral lung dose while maintaining adequate target coverage. Target coverage and dose homogeneity were assessed using the Conformity Index (CI), Dose Homogeneity Index (DHI), and Homogeneity Index (HI). Target coverage and OAR doses were analysed through paired t-test using SPSS software. It showed a significant reduction (p-value < 0.05) in V5, V12, V20, and mean dose for the ipsilateral-lung, as well as V5 and mean dose for the right lung. While the 10 mm shift achieved greater lung sparing, it posed a risk of underdosing the supraclavicular fossa. However, no statistically significant difference was observed in heart dose (V5, V30, mean dose). Conclusion: The results suggest implementing a contour-based MIT planning approach for improved placement of the isocenter position, optimizing ipsilateral lung sparing rather than relying solely on anatomical landmarks for isocenter placement. Keywords: Postmastectomy Radiotherapy (PMRT), Mono-isocentric Technique (MIT), Field-in-Field (FiF) technique, ipsilateral lung dose, field-based planning.

Poster ID: 61

Title: Assessing the Role of Smoothing Factors in IMRT Optimization for Head and Neck and Cervix Cancer

Author Names: Kathirvel M, Rajasekar M, Nidhi Jain, Bhagyalakshmi AT, Suresh Chaudhari

Full Abstract:

Introduction & Objectives: This study aims to evaluate the impact of fluence smoothing on treatment planning in complex Intensity Modulated Radiation Therapy (IMRT) cases, specifically for tongue and cervix cancers. Materials & Methods: A total of 10 patients were selected, 5 tongue and 5 cervix cases. IMRT plans were generated using the Varian Eclipse Treatment Planning System (version 16.1) for the prescribed dose in TrueBeam STx. Each case was planned using different combinations of X and Y smoothing values (from 40:30 to 110:30 and 40:50 to 40:100), with varying priority settings during optimization. The Planning Target Volume (PTV) was normalized to receive 95% of the prescribed dose. Dosimetric evaluation includes PTV coverage parameters (D99%, D90%, and D20%), OAR sparing metrics (Dmean, D50%, D60%, V40Gy, and V45Gy), and the monitor units (MU). X & Y factors were calculated for each plan by priority-to-smoothing ratio. Plans generated with mean and low (X, Y) factors were compared with those generated with default (X, Y) factors. Statistical analysis was done using Paired t-test. Portal dosimetry was performed and analyzed using multiple gamma index criteria (DD/DTA): 3%/3 mm, 3%/1 mm, and 2%/1 mm. Results and Discussions: Factors derived by scaling X and Y smoothing based on optimization priorities is shown in the table PTV Priority (Upper, Lower) X Factor (Mean, Low) Y Factor (Mean, Low) 70, 95 1.4, 0.9 1.3, 1.0 90, 120 1.8, 1.1 1.7, 1.2 115, 150 2.2, 1.4 2.1, 1.5 In cervix cases, mean smoothing reduces MU by 12% against Default settings without compromising PTV coverage ($p > 0.05$), whereas low smoothing cuts MU by 16% but worsens coverage. In tongue cases, mean smoothing offers a significant 20% MU reduction versus default settings, maintaining comparable PTV and OAR doses–making it optimal for efficient delivery. Portal dosimetry analysis showed high pass rates across most plans. However, 23% of plans failed under the most stringent criterion (2%/1 mm), suggesting sensitivity to tighter tolerance limits. Conclusion: Changing the X and Y values in accordance with priority values can effectively reduce monitor units, which lowers the treatment duration and uncertainties in treatment delivery. Scaling the default X & Y values with the factor derived helped in achieving quality treatment plans. Keywords: Fluence smoothing, IMRT, MU.

Poster ID: 62

Title: Evaluation of Organ Deformation and Marker Drift in Gold Seed-Based Localization for Prostate Radiotherapy.

Author Names: Mr. Sumit Thorat, Dr. V.K. Sathiya Narayanan , Dr. Raghavendra Holla, Ms. Pooja Moundekar, Ms. Sajini Kurup., Mr. Sumeesh S, Mr. Pandiyaraj selvarajan

Full Abstract:

Introduction: Implantation of gold seed markers has been a standard practice for tumor localization in radiation therapy for over two decades, especially when soft tissue contrast in 3D imaging was limited. In 2D image-guided treatments, these markers also enable real-time tracking. However, in deformable organs such as the prostate, localization and tracking errors can occur. This study evaluates drift and deformation-related errors using four implanted gold seeds in a patient undergoing kVCBCT-guided radiotherapy. Aim: Seed marker drift is usually within ±1.0 mm, but daily variations in bladder and rectal filling can deform the prostate, altering inter-marker distances. Such changes affect organ geometry, potentially causing deviations between planned and delivered doses. This study analyzes deformation through inter-marker distances and the area enclosed by markers. Materials and Methods: Four gold seeds were implanted for Cyberknife treatment, but the patient was treated on TrueBeam STx. Daily kVCBCT images from 25 fractions were analyzed. Six unique distances between markers were measured. Assuming markers lay approximately in one plane, the area of the quadrilateral they formed was calculated to assess deformation. The prostate was contoured daily in CBCT to determine absolute volume. Results: Mean inter-marker distances (cm) were 2.44, 1.56, 2.79, 3.12, 1.47, and 2.72, with maximum deviations of 0.49, 0.57, 0.48, 0.26, 0.33, and 0.25 cm. Deformations of up to 6.0 mm were observed. Mean quadrilateral area was 4.02 cm^2, normally distributed (Shapiro-Wilk test). Maximum and minimum areas were 4.93 cm^2 (+20%) and 3.53 cm^2 (12%), respectively. Conclusion: Daily organ deformation in prostate radiotherapy was quantified, highlighting the importance of volumetric imaging with adequate margins. While three-marker systems are common, four-marker implantation improves accuracy, particularly for rotational errors. Inter-fraction deformation warrants further investigation.

Poster ID: 63

Title: Optimization of treatment planning for spinal implant patients in SBRT cases: Impact of Density Overrides and Plan Re-Optimization for VMAT planning

Author Names: Dr.Pawan Kumar Singh, Dr.Nidhi Marjara, Dr.Manindra Bhushan, Dr.Lalit Kumar, Dr. Rahul Lal Chowdhary

Full Abstract:

Introduction & Objectives: Metallic spinal implants often generate CT artifacts that compromise radiotherapy dose calculations. This study assessed the effectiveness of Hounsfield Unit (HU) density overrides, with and without treatment plan re-optimisation, in improving dosimetric accuracy for volumetric modulated arc therapy (VMAT) in Stereotactic Body Radiotherapy (SBRT). Methods and Materials: A retrospective analysis was performed on 15 patients with spinal stabilisation implants. CT was used to delineate the Gross Tumor Volume (GTV), Planning Target Volume (PTV), thecal sac, and a dummy structure covering artifact regions. Two structure sets were created: one without HU overrides and another with a 40 HU override. Three VMAT plans were developed for each patient: (1) no HU override, (2) HU override with re-optimisation, and (3) HU override without re-optimisation. Dose calculations employed the Analytical Anisotropic Algorithm (AAA), and dose-volume histograms (DVHs) were analysed. Results: GTV dose metrics showed no significant variation between plans. In contrast, PTV parameters–Dmean, D95, D98, V95, and D2–improved significantly ($p < 0.05$) when HU overrides were paired with optimization. Thecal sac doses remained stable across all strategies. Optimised override plans also reduced low-dose exposure to normal tissue at 27 Gy, 24 Gy, 13.5 Gy, and 12 Gy levels. Conclusion: Density overrides alone have limited dosimetric benefit in artifact-heavy regions. Combining overrides with plan re-optimisation enhances PTV coverage and limits unnecessary normal tissue irradiation. The robustness of thecal sac doses is reassuring, yet comprehensive artifact management protocols are recommended. Multi-institutional validation is needed to standardise these strategies for patients with metallic spinal implants. Keywords: CT artifacts, HU override, VMAT, spinal implants, thecal sac dosimetry

Poster ID: 64

Title: Experimental Dosimetry Study of EPID-Based PSQA for DIBH Plans with Motion-Synchronized Gating: A Comparative Study Between Gated and Non-Gated Delivery

Author Names: Sarath Kumar P, Mariyappan M R, Sreeja R, Vendhan S, Saraswathi Chitra S

Full Abstract:

Introduction and Objective: Deep Inspiration Breath Hold (DIBH) with motion-synchronized gating reduces radiation dose to organs at risk but may introduce delivery-related dosimetric variations. This study compares the accuracy of gated and non-gated deliveries of DIBH plans using EPID-based patients specific QA(PSQA). A PTW 729 detector array was additionally used for volumetric dose verification to evaluate consistency between measurement systems. Materials and Methods: DIBH and non-gated plans were delivered on a Varian Truebeam SVC with Millennium MLC using a Synchrony motion phantom and IR tracking using marker block. The Varian EPID aSi 1200 served as the primary QA tool, while the PTW 729 detector array with Octavius phantom was used for volumetric comparison under the same DIBH conditions. Each plan was measured as a full-field mode and also split arc fields into five subfields for in-depth QA analysis. Gamma analysis was performed with 3%/3 mm and 2%/2 mm criteria. Results and Discussion: Gated full-field deliveries achieved gamma pass rates above 99% (3%/3 mm) and 98% (2%/2 mm), comparable to non-gated deliveries whose pass percentage was more than 99% for most of the cases in routine PSQA practices. The PTW 729 results showed less than 1% deviation to TPS dose map in both delivery modes across all measurements, confirming strong agreement between the two delivery methods. Whereas, subfield analysis revealed slightly lower pass rates compared to full-field results, mostly in 2%/2mm criteria the pass percentages drop to 97%-98%. Though overall delivery accuracy remains high for routine 3%/3mm dose criteria. Conclusion: EPID-based in Air measurement proved reliable for both gated and non-gated DIBH deliveries, with minimal differences in dosimetric accuracy. Minor variations in split-field gated deliveries were detected but remained within clinical tolerance. Results confirm the robustness of motion-synchronized DIBH and support EPID-based QA as a viable verification method. With PTW 729 volumetric analysis confirming measurement consistency and the percentage difference between the two modes of volumetric verification is also well under with in clinical tolerance.

Poster ID: 65

Title: Influence of Thoracic Inclination on Dosimetric Outcomes in Chest Wall Radiotherapy

Author Names: Bhagat Chand, Priyamvda, Poorva Vias

Full Abstract:

Introduction and Objective: Introduction and Objective Radiotherapy is a major modality for breast cancer (BC) treatment that involves use of high energy ionizing radiations for killing tumor cells. Radiotherapy is administered as adjuvant therapy post chemotherapy and modified radical mastectomy (MRM). Patients for chest wall irradiation (CWI) are generally positioned on a wedge-shaped inclined device to make the chest parallel to the horizontal. The present study aims to study the dosimetric impact on the target coverage and organ at risk (OAR) sparing in the inclined and flat position of the patient during CWI by Volumetric modulated arc therapy (VMAT). Methods and Materials On pilot basis 15 patients of either side of chest wall post MRM have been randomly selected for the study. The CT scans of all the patients were acquired at slice thickness of 2.5 mm on an inclined positioning device (Breast Board – BB) and a flat positioning device (All in One –AIO Board), both made up of carbon fiber material. The target structures and OARs were contoured by an experienced oncologist on both the image series. The treatment plans were made in Monaco (v-5.11, Elekta Medical Systems) treatment planning system (TPS). Dual parallel opposed arcs were planned with each arc length of 50 degrees. Monte Carlo dose calculation algorithm was utilised with a grid spacing of 0.3 cm and uncertainty set at 1% per calculation. The data was analyzed using Python programing. Results and Discussions Both configurations show very similar mean and median values for target coverage, indicating comparable average performance. BB has slightly higher standard deviation, suggesting more variability in target dose delivery compared to AIO. AIO has shown better sparing of the ipsilateral lung in CWI of any side, however the doses to contralateral lung have been slightly higher in the AIO setup. Similarly, the dose to heart has been similar in both the setup with statistically insignificant differences in the volume receiving 15 Gy dose. Overall, both AIO and BB configurations appear to achieve comparable target coverage (CTV D50 and PTV D50) on average, though BB shows slightly higher patient-to-patient variability in target dose. Conclusions: The study concludes that the AIO can produce comparative and better dosimetric results in the VMAT plans of CWI of the breast cancer patients. The AIO and BB can be used interchangeably for patient setup in

Poster ID: 66

Title: Dosimetric Influence of Left Anterior Descending Coronary Artery Movement During Left-Sided Breast Cancer Radiotherapy

Author Names: Mukesh N. Meshram, Maheshkumar N. Upasani, Umesh A. Palikundwar

Full Abstract:

Introduction and Objective: This study aimed to measure the extent of the left anterior descending (LAD) coronary artery movement and its potential dosimetric impact in patients treated for left-sided breast cancer. Materials and Methods: We performed 4DCT on 11 female patients undergoing treatment for left-sided breast cancer. The LAD artery and its segments (proximal, middle, and distal) were delineated on 10 phases of the 4D-CT scan to determine its movement. Subsequently, the dosimetric impact due to the LAD motion inclusion was evaluated. Results and Discussions: The magnitude of LAD movement is different for all three segments with proximal and distal segments exhibiting the maximum displacement in the vertical and lateral directions with an average range of 18.6mm and 24.02mm, respectively. The mean dose received by LAD varied from -22.36% to +18.67%, with an average of 22.19 Gy. The LAD volume receiving at least 15 Gy (V15 Gy) varied from -14.55% to +12.03% with an average of 58.49%. Using the 4D-CT data, the average mean dose and the V15 Gy for the proximal, middle, and distal parts were 8.02 Gy, 25.91 Gy, and 19.78 Gy, and 20.36%, 76.88%, and 58.76%, respectively. The free-breathing dataset showed the same dosimetric variation for all three segments. Conclusion: The study found that the distal segment of the LAD had maximum displacement, which is in the lateral direction. Among all segments, the middle segment of the LAD received a higher dose exposure. We recommend using a variable expansion margin (PRV) for LAD to reduce motion-inclusive dose uncertainty.
Keywords: LAD MOTION, BREAST CANCER, DOSIMETRIC IMPACT

Poster ID: 67

Title: A Dosimetric Study of Stereotactic Radiotherapy in Intracranial Lesions: O-Ring vs. C-Arm Linear Accelerators

Author Names: Palanivelu D, D.Khanna, P.Mohandass, Vadhiraja B M

Full Abstract:

Introduction and Objective: Stereotactic radiosurgery (SRS) or radiotherapy (SRT) delivers high-dose, focused radiation to brain lesions. Advanced techniques use accurate localization and multiple coplanar (CP) or non-coplanar (NCP) beams for precise, conformal dose. Linear accelerator based SRT is widely adopted, with flattening filter-free (FFF) mode offering benefits over traditional flattening filter (FF) mode. Tomotherapy uses a ring-gantry linac and binary Multileaf collimator (MLC) to modulate dose in synchronize with couch movement. This study compares the dosimetry of SRT for brain lesions using Helical Tomotherapy (HT) and Volumetric modulated arc therapy (VMAT) with CP/NCP in FF and FFF modes. Materials and Methods: This retrospective study included 25 patients with single brain lesions; all treated with 25 Gy in 5 fractions using the Accuray Precision Treatment planning system (TPS) for Radixact X9 helical tomotherapy (HT). Comparative VMAT plans were generated on an Elekta Infinity linac with Agility head using Pinnacle TPS, with 6 MV FF and FFF beams in CP and NCP techniques. Evaluated parameters included V100, V98, V95, maximum and mean doses, Conformity Index (CI), Homogeneity Index (HI), Gradient Index (GI), and 50% isodose volume. Organ at risk (OARs) analysed were brainstem maximum dose, whole brain, and brain-PTV of V20Gy, V15Gy, V10Gy, V5Gy, and mean dose. Results: HT shows the highest coverage (V100 = 94.1%) followed closely by all VMAT variants (91.9–92.4%). V95 was better across all, with VMATNCP-FF and VMATNCP-6FFF slightly outperforming others (99.2–99.3%). All techniques show similar mean PTV doses (2595cGy –2621cGy). Maximum dose is highest in VMATNCP-6FFF (2770.3 cGy), possibly reflecting higher dose intensity with FFF. HT has the largest 50% isodose spread (64.5 cm^3), indicating more dose spillage. VMATNCP-6FFF has the lowest (45.0 cm^3), indicating better dose conformity and falloff. HT has a slightly higher CI LAMEX (1.06). All VMAT techniques have tighter CI LAMEX values (~0.94–0.95), and identical CI PATTIC (1.06), indicating better conformity. VMATCP-FFF, VMATNCP-FF, VMATNCP-6FFF have the highest homogeneity value (HI = 1.1).HT and VMATCP-FF are slightly less homogeneity value (1.08–1.09). HT shows the highest GI (6.2) dose falls off more gradually outside the target. VMATNCP-6FFF shows the lowest GI (5.02) steepest dose fall-off, best sparing of nearby tissues. Conclusion: HT provided better coverage but with greater low-dose bath. VMATNCP-FFF achieved better in CI, HI, GI, and OAR sparing, with VMATCP-FFF also performing well. Overall, VMATNCP-FFF offered the best balance between target coverage and normal tissue sparing. Key words: SRT, Helical Tomotherapy,VMAT

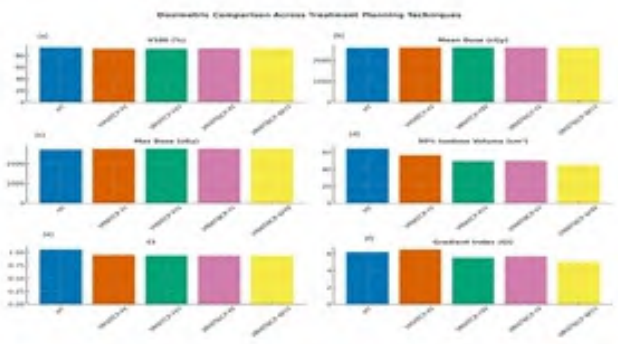


Figure1: Treatment Planning parameters of Target coverage of V100 (a), Mean dose (b), Max dose(c),50% isodose volume (d), CI (e) and GI (f).

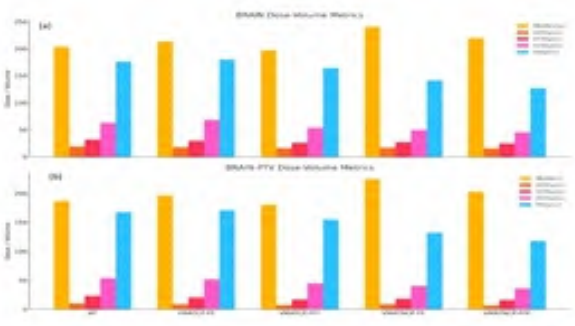


Figure2: Brain (a) and Brain-PTV (b) dose volume of V20, V15, V10, V5 and Mean dose

Poster ID: 68

Title: Determination of the Optimal Collimator Angle for Head and Neck Cancer Treatment Using Volumetric Modulated Arc Therapy (VMAT)

Author Names: Anna George Thayil, Bhagyalakshmi A T, Suresh Chaudhari

Full Abstract:

"Determination of the Optimal Collimator Angle for Head and Neck Cancer Treatment Using Volumetric Modulated Arc Therapy (VMAT)" Objective: This study aims to determine the optimal collimator angle for volumetric modulated arc therapy (VMAT) planning in head and neck cancer radiotherapy treatment. Materials and Method: A total of 20 head and neck cancer patients were selected for this study. VMAT plans were generated for each patient using two arcs: the first with a selected collimator angle and the second with its complementary angle. The collimator angle pairs evaluated were (0°, 0°), (10°, 350°), (15°, 345°), (20°, 340°), (30°, 330°), (45°, 315°), and (90°, 270°). All treatment plans were created using the Eclipse TPS (Version 16.1) for a TrueBeam linear accelerator. The plans were assessed based on dosimetric parameters for the target volume, including the CI, HI, GI, V107%, and V95%. MUs were recorded for each plan and compared across different collimator angle combinations. Dosimetric evaluation of OARs was also performed. The parameters analyzed for OARs included mean dose and maximum dose. Result: Collimator angles of 30° and 45° showed better conformity and homogeneity, with lower CI and HI values. In contrast, the 90° angle had the highest CI (1.451) and HI (0.044), indicating poorer dose distribution. The gradient index (1.068) was also most favorable at 45°. Although the MUs were lowest for the 90° collimator angle (427.2MUs), collimator angles of 15° (447MUs) and 45° (467MUs) offered a better balance between MU efficiency and dosimetric quality. The 45° angle (Parotid: 18Gy, Larynx: 29Gy, Spinal cord: 32.81Gy) provided the best sparing for the parotid glands and larynx, with the lowest doses recorded, while the 90° angle consistently showed the highest doses to these structures. However, for the spinal cord and oral cavity, the 20° angle resulted in the lowest exposure, with doses of 32.63Gy and 32.16Gy respectively. Eye and lens sparing was most effective at 0° (2Gy and 1.6Gy, respectively) and 10° (2.5Gy and 2Gy, respectively), while angles like 15° and especially 90° led to higher doses to these structures, including the highest mandible dose observed at 90° (63.35Gy). Conclusion: Collimator angles between 30° and 45° provided the optimal balance of target coverage, homogeneity, OAR sparing, and MU efficiency, with 45° showing consistently better results across most of the evaluated dosimetric parameters. Choosing non-zero and complementary angles like (30°,330°) or (45°,315°) more suitable for head and neck VMAT plans. Keywords: Volumetric modulated arc therapy (VMAT)

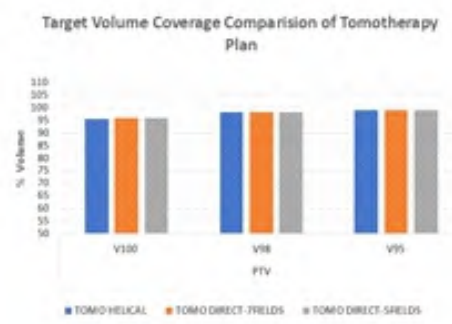
Poster ID: 69

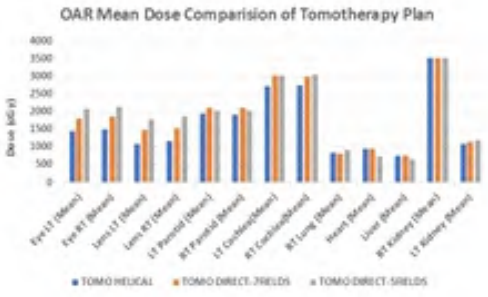
Title: Craniospinal irradiation in Medulloblastoma: Dosimetric comparison of TomoDirect and TomoHelical treatment planning using the Radixact System

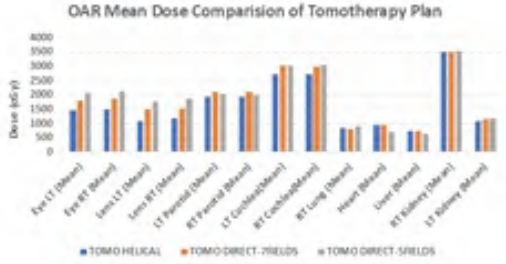
Author Names: Palanivelu D, D.Khanna, P.Mohandass, Vadhiraja B M

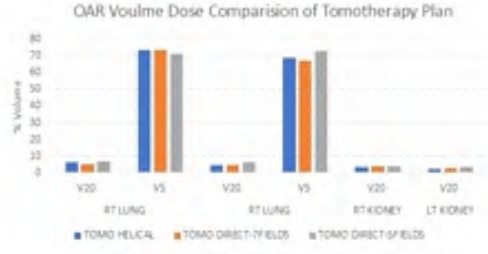
Full Abstract:

Introduction and Objective: Helical Tomotherapy (HT) offers both dosimetric and workflow improvements over conventional Linac-based craniospinal irradiation (CSI), especially when treating extensive and complex target areas like the full craniospinal axis. A major advantage of HT lies in its continuous helical delivery method, which allows for seamless radiation delivery along the entire treatment volume. This approach removes the need for multiple isocenters and intricate field-matching techniques commonly required in Linac-based treatments, thereby reducing the potential for junction-related dose inconsistencies. Objective of this study is to compare different treatment plans generated using TomoDirect (TD) and TomoHelical (TH) for CSI using Radixact® X9 system. Materials and Methods: Five CSI patients diagnosed with Medulloblastoma and prescribed dose of 36Gy in 20 fractions were selected for this study. All the patients were initially planned using helical tomotherapy with jaw width of 5cm, 0.5 pitch, and modulation factor in the range of 1.8 to 2.5. For dosimetric comparison, plans were generated using TomoDirect with 7 field (TD-7 Field) and 5 field (TD-5 Field) by keeping all other planning parameters unchanged. Dosimetric parameters included such as V100, V98, V95, mean and maximum (max) dose to target, conformity index (CI), homogeneity index (HI), organ-at-risk (OAR) dose for eyes, optic nerves, parotid glands, cochlea, constrictor, lungs, heart, liver, kidneys, and bowel. In addition, total beam-on time was compared between TD-5, TD-7 and TH. Results and Discussions: No significant dose differences were observed among TH, TD-7 Field, and TD-5 Field plans in target volume including V100, V98, V95, maximum and mean doses, CI, HI, and beam-on time (P>0.05). Similarly, no significant dose differences were found in OAR doses for optic nerves, mean dose to lungs, liver, kidneys and bowel (p>0.05). The results of TH plan revealed that max dose, mean dose and dose volume received by eyes, lens, cochlea and constrictor were significantly less as compared to TD-7 Field and TD-5 Field plans (p<0.05). A slight decrease of mean dose was seen in parotid and lung volumes (V20 & V5) in TH plans than TD-7 Field and TD-5 Field plans (p>0.05). Conclusion: Overall analysis, this study results concluded that CI, HI and target dose coverage were almost similar in all the plans except better OAR dose sparing with TH plan as compared to TD-7 Field and TD-5 Field plans. Keywords: Craniospinal Irradiation, Tomo Direct, Tomo Helical









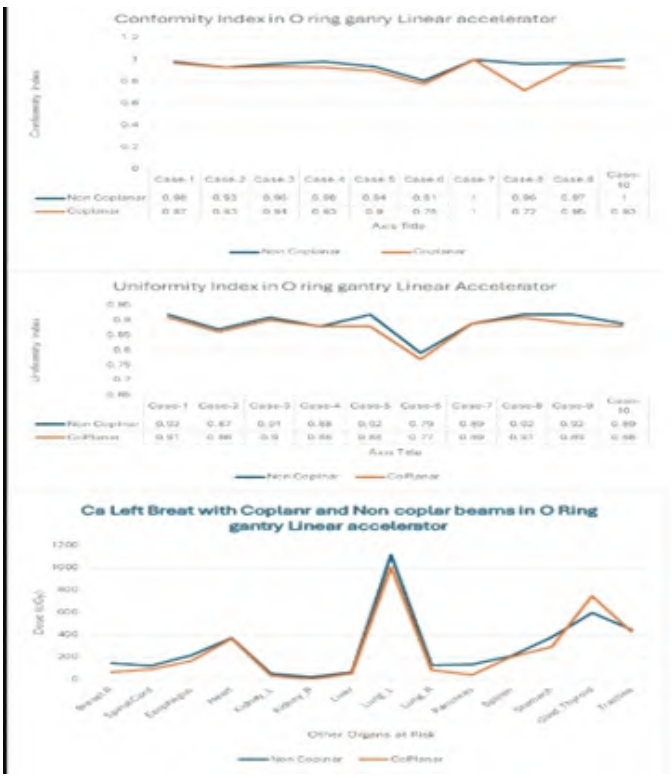
Poster ID: 70

Title: The application of non-coplanar beams in O-ring gantry Linear accelerator for better therapeutic outcomes for a wide spectrum of diagnosis

Author Names: Dr K R Muralidhar, P Srinivas, K Raghavendra, R Kumar, Sripriya Rao, R Venkataramanan

Full Abstract:

Introduction and Objective: The field of radiation oncology is continually evolving to enhance treatment precision and minimize radiation exposure to healthy tissues. Traditional C-arm linear accelerators, while effective, are constrained by a single plane of gantry rotation, which can limit the ability to create highly conformal dose distributions, especially for tumors with complex geometries or those in close proximity to critical organs-at-risk (OARs). This limitation can result in a suboptimal therapeutic ratio, potentially leading to treatment-related toxicities and long-term complications. This paper presents a comprehensive analysis of the clinical and dosimetric advantages of employing non-coplanar beam arrangements using a novel O-ring gantry linear accelerator. Unlike conventional systems, the O-ring gantry enables simultaneous, multi-axis rotation of both the gantry and the patient's couch, providing an expanded range of beam angles and greater flexibility in treatment planning. The primary objective of this study is to systematically evaluate the impact of this enhanced geometric freedom on a wide spectrum of cancer diagnoses, including Brain, head and neck and breast malignancies. Materials and Methods: A comparative dosimetric analysis was performed, contrasting non-coplanar volumetric modulated arc therapy (VMAT) plans with conventional coplanar VMAT plans. Key metrics such as target conformity and homogeneity indices, as well as dose-volume histograms (DVHs) for both the planning target volume (PTV) and critical OARs, were evaluated. Results and Discussions: The results consistently demonstrate that the application of non-coplanar beams leads to a significant improvement in dose sparing to surrounding healthy structures. For instance, in Brain cases 17% decrease in dose in Optic nerves, while in left-sided breast cancer, an average of 15% decrease in cardiac dose was observed. The findings indicate that the non-coplanar approach provides superior dose fall-off outside the target, thereby improving the overall therapeutic ratio for selected sites. Conclusion: The integration of non-coplanar beam delivery on an O-ring gantry linear accelerator represents a major technological and clinical advancement. This approach not only facilitates more precise and homogeneous tumour coverage but also allows for a substantial reduction in radiation dose to critical organs. This innovation has the potential to redefine the standard of care for a broad range of oncological conditions, leading to improved clinical outcomes, reduced patient morbidity, and an enhanced quality of life. Future research will focus on the long-term clinical validation and patient-reported outcomes of this promising technology.



Poster ID: 71

Title: SGRT Reduces the Use of CBCT for Routine Position Verification: Verify patient setup Accuracy of LUNA 3D SGRT system.

Author Names: Sougata Nag, Bhaveshwar Yadav, Shachindra Goswami

Full Abstract:

Introduction and Objective: Conventional IGRT systems, such as CBCT and MV imaging, have been considered the gold standard for patient positioning. Uses of those ionizing modalities contribute to non-therapeutic patient dose, which may increase the possibility of secondary malignancy. With the development of reliable imaging techniques, we are now going to use the non-ionizing IGRT systems for patient positioning, removing non-therapeutic doses. In our study, we have used the LUNA 3D SGRT system, which potentially reduces the use of CBCT and MV imaging modalities. A greater FOV and real-time feedback of the SGRT system improve the intrafraction and interfraction position accuracy. SGRT system would reduce the use of CBCT and MV imaging, which, moreover, reduces the excess patient dose associated with them. As a first installation site in INDIA, our study of the LUNA 3D SGRT system verifies its accuracy for patient positioning to achieve the recommended dosimetric goal. Materials and Methods: LUNA 3D by LAP is installed in the VARIAN TRILOGY machine at BBCI, Guwahati, where all our studies have been performed using a mini water phantom containing a 0.6 cc chamber slot. The chamber inserted phantom was scanned with the Siemens SOMATOM go.sim CT and exported to Eclipse TPS. The chamber volume was contoured, and some test planes were fired to calculate the mean dose in the chamber volume. After that, this phantom setup was placed to deliver the plan in the treatment room by taking a CBCT. The measured chamber reading and the couch position at that time were taken as reference, and an ROI on the phantom surface was labelled in the SGRT console. The phantom was removed and again placed using the SGRT system and irradiated with the same test plan. The position variation is noted, and the measured dose output is compared with the previous dose obtained. Result: All the position variations and dosimetric evaluation were within tolerance as per TG 302 recommendations. Multiple VMAT plans' outputs were also within tolerance with the TPS calculated and CBCT setup output. Conclusion: Our result shows the values are within tolerance, which also validates our approach to minimize the use of CBCT for patient positioning routinely. A new protocol with a reduced number of CBCT is now going to be implemented when LUNA 3D is added to the workflow.

Poster ID: 72

Title: Evaluation s of treatment between Voluntary based DIBH and with use of RGS technique in DIBH in left Breast patient.

Author Names: Amod Vinayak Vaidya, Dr. Sonali Pingle, Dr. Shailesh Shende, Mr. Kuldep Jadhav, Dr. Nilesh Deshmane, Mr. Pushkar Patil

Full Abstract:

Evaluation s of treatment between Voluntary based DIBH and with use of RGS technique in DIBH in left Breast patient. Introduction We at our institute where using voluntary based DIBH ie instructing patient to hold breath during Breast treatment by audio system on console before upgrading to RSG RPM. Objectives Study was carried out for evaluation of dosimetric benefits (heart, LAD, lungs, target coverage), patient comfort and treatment delivery time by using in both treatment techniques Methods & Materials Total 20 patients case where taken for study with left breast cancer. 10 patients where treated using voluntary-based DIBH with visual coaching and marker-based monitoring, while other 10 used a commercial Respiratory Gating System (e.g., Varian RGS RPM) to assist in maintaining and monitoring the breath-hold. All patients underwent CT simulation in the DIBH position using appropriate immobilization devices. Analytical anisotropic algorithm (AAA) was used to generate dual treatment plans after CT data were obtained in FB and DIBH Planning target volumes (PTVs) and organs-at-risk (OARs), including the heart, left anterior descending artery (LAD), and ipsilateral lung, were contoured: Mean heart dose (MHD), Maximum LAD dose, Left lung V20 and V10, PTV coverage (D95, conformity index, and homogeneity index) were studied. Results & Discussion All patients had comparable target coverage on RSG DIBH and v DIBH. RSG based DIBH statistically significantly reduced mean heart and LAD dose for both groups. Percent reduction in mean heart and LAD dose with RSG DIBH was significantly larger than v DIBH. In RSG DIBH during treatment delivery we are confirm that patient has hold the breath as we can see on monitor. Conclusion In RSG DIBH during treatment delivery we are confirm that patient has hold the breath as we can see on monitor. RGS-assisted DIBH is more effective in ensuring consistent cardiac sparing and reproducible delivery. However, voluntary DIBH remains a viable and cost-effective method where RGS systems are not available.

Poster ID: 73

Title: Impact of Age, Sex, and Gaze Direction on Lens dosimetric parameters in Nasopharyngeal Carcinoma Radiotherapy

Author Names: Mukesh N. Meshram, Dr. Umesh A. Palikundwar

Full Abstract:

Introduction and Objective: This study aimed to analyze the potential influence of age, sex, and gaze direction on dosimetric parameters of the lens during nasopharyngeal carcinoma. Material and Methods: This retrospective study included 24 nasopharyngeal carcinoma patients with ages ranging from 15 to 77 years. The patients were divided into four age groups, with each group consisting of 6 patients, to analyze the effect of age and gaze direction on lens movement amplitude and possible dosimetric impact. The displacement shift and dosimetric variation were also analyzed for the male and female groups according to gaze direction. Results and Discussions: A total of 1036 lenses were included in the final analysis. The displacement in the caudal direction had the highest magnitude compared to other directions. The mean displacement in the inferior-superior direction was not significantly different (p=0.3373). In view of the dosimetric impact due to lens movement, the average displacement of the lens from the neutral position mainly increased both the mean and maximum dose of the lens. In the worst-case scenario, the average increase in lens mean dose was found to be 14.32% +23.63% (range, -27.85% to 76.85%), and the average relative increase in lens maximum dose was 14.44% +24.06% (range, -33.73% to 77.12%). In an analysis between the male and female groups, the lens displacement in the caudal direction was higher for the female than that in the male group; however, the dose difference between the male and female groups was not statistically significant. In an analysis between younger and older groups, the amplitude of lens movement was found to be non-significant. However, the result revealed a significant difference in the maximum dose received by the lens in the younger and older groups. It is also found that there was a significant correlation between dose parameters of the lens and age. Conclusion: The study found that the amplitude of lens movement was significantly affected by the gaze direction. No statistically significant difference was observed between the male and female groups. The significant correlation was observed between the lens dose parameter and age. This study recommends considering the patient-specific factors while evaluating the lens dose during NPC radiotherapy planning. Keywords: Lens Movement, Gaze Direction, Age, Sex, NCP

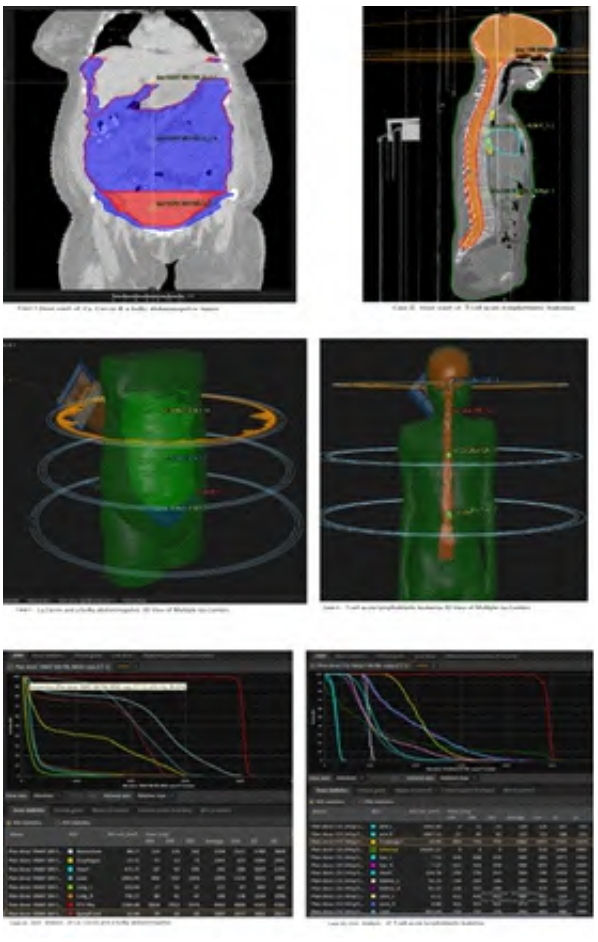
Poster ID: 74

Title: Treatment management of larger targets through Multiple Iso-center Techniques

Author Names: Ponaganti Srinivas, Rampally Kumar, Dr. Kanaparthy Raja Muralidhar

Full Abstract:

Introduction and Objective: This study aims to assess the feasibility and clinical benefits of using multiple isocenters in RayStation's Volumetric Modulated Arc Therapy (VMAT) planning system for treating large targets. The need arises from the physical limitations of conventional linear accelerators (LINACs), where a single isocenter cannot cover extensive regions such as the craniospinal axis or abdominopelvic disease spread. Materials and Methods: Two representative cases were selected. Case I involved a 49-year-old female patient with carcinoma cervix and a bulky abdominopelvic tumor, with a PTV measuring 39 cm in length and 26.3 cm in width. Case II involved a 12-year-old female patient with T-cell acute lymphoblastic leukemia requiring craniospinal irradiation, with a PTV extending 63.7 cm in length and 15.8 cm in width. Planning was performed on Ray Station TPS using VMAT and Siddarth-II LINAC equipped with a 150 cm bore ring gantry and 46-leaf-pair MLCs with rapid leaf motion. Multi-isocenter planning was implemented with three isocenters. RayStation's Multi-Criteria Optimization (MCO) and junction management tools were utilized for plan refinement. Results and Discussions: Both cases achieved clinically acceptable plans with high dose conformity and homogeneity across the target volumes. Junction doses between adjacent isocenters were well-managed, avoiding hot or cold spots. Organs-at-risk (OARs), including the spinal cord, brainstem, and optic structures, were effectively spared. The use of automation tools reduced planning time and enhanced workflow efficiency without compromising plan quality. Conclusion: RayStation's advanced VMAT planning with multiple isocenter capabilities, when combined with Siddarth-II , provide a robust solution for treating large and complex radiotherapy targets with good dose distribution in Junction fields. This approach ensures optimal dose delivery, minimal normal tissue toxicity, and improves the overall efficiency of radiotherapy planning.



Poster ID: 75

Title: Experience of Digital Radiotherapy Simulator IMAGIN, R S T Cancer Hospital Nagpur.MH

Author Names: DR kartar Singh, Dr Prashant Dhoke, Ahmad Yamani, Vijay Choube, Ashutosh Meshram, Diwakar Mishra

Full Abstract:

Experience of Digital Radiotherapy Simulator IMAGIN, R S T Cancer Hospital Nagpur ,MH. Introduction & objective : A radiotherapy simulator is a machine that helps in radiotherapy planning prior to the treatment. It helps diagnose the physical extent of the tumour and its relation to surrounding tissues for selecting the size and orientation of radiotherapy beams. It also helps plan the treatment and protect critical organs. The capability of a simulator for real-time review and analysis of images helps in accurate planning and verification in a short time. Material & Methods: Simulator IMAGIN here, The Digital Radiotherapy Simulator, named IMAGIN, was developed by Bhabha Atomic Research Centre (BARC) in Mumbai. The technology has been transferred to Panacea Medical Technologies Pvt. Ltd., Bangalore for, enabling wider accessibility for radiotherapy centres. Major sub-systems include: Gantry, Collimator, X-ray Tube, Imaging Unit, and Patient Support System. These enable operations in fluoroscopy or radiography modes, with selectable exposure parameters (tube voltage, current, and time). Anti-Collision and Safety systems Equipped with sensors, audible alerts, door interlocks, and emergency stop buttons for radiation protection. Patient Positioning Lasers, three linear lasers for accurate, repeatable positioning and isocentre marking. Image Processing and DICOM Compatibility, last image hold, multi-leaf collimator (MLC) overlay, image storage, annotations, and network connectivity for sharing with treatment planning systems. Result and Discussion : IMAGIN is cost-effective, filmless, and conforms to (IEC) standards, for clinical use. Enhanced Technical Details of IMAGIN, It provides sub-mili meter accuracy, featuring advanced Flat Panel Detector: 139-micron pixel pitch, with 3k x 3k resolution, movable in vertical, longitudinal, and transverse directions for noise-free, high-resolution images (kV up to 150, mA up to 500). Low-Dose Imaging fluoroscopy mode captures images at 9-13 frames per second to detect tumour movement near organs, aiding in healthy tissue protection. Indexed treatment couch for reproducible positioning, DICOM-compatible high-storage system for image exchange, and efficient digital radiography capturing full anatomical regions in one exposure. This design optimizes dose delivery while maintaining excellent image quality, improving spatial resolution, soft tissue visualization, and patient throughput in radiation oncology. Conclusion: This indigenous radiotherapy planning technology beneficiating , safe efficient and precise treatment simulation process. Its image quality found too good that we can see the thin scalp hairs of patient along with soft tissue and bony structures in a single image, making it essential tool for radiotherapy patient treatment planning. Keyword : IMAGINE is name of simulator unit.

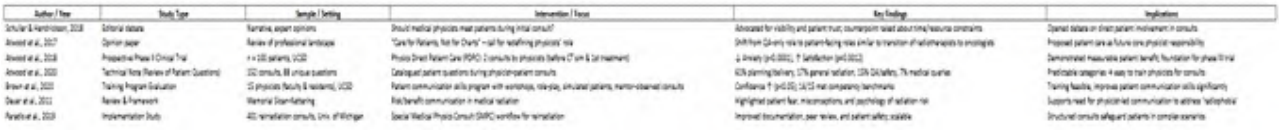
Poster ID: 76

Title: Can Medical Physicist counselling revolutionise patient care in radiation practices?

Author Names: Dr.Anurag A.Luharia, Dr.Gaurav V. Mishra, Dr. Shweta Dahake, Dr. Ashish Uke, Dr. Tejshree Telkhede, Dr. Neha Rahul, Ashwini Tiwaskar, Aqeeb Sheikh

Full Abstract:

Can Medical Physicist counselling revolutionise patient care in Medical Radiation Practices? Introduction and Objective: Medical physicists have traditionally known to be working behind the scenes in Radiation Therapy, Nuclear Medicine and Radiology. The focus of their work being equipment calibration, quality assurance (QA), treatment verification and radiation safety. However, increasing automation and evolving patient-centered models of care highlight the need for expanded roles in direct clinical engagement. As a general consensus it is observed that patients undergoing radiation therapy, nuclear medicine imaging procedure or diagnostic procedure experience anxiety mainly originating from misconceptions about radiation, and limited understanding of technical processes. Recent initiatives–such as physicist–patient consults and structured communication training–aim to enhance patient trust, satisfaction, and safety while redefining the value of physicists in oncology. The objective of this review was to investigate the existing research studying correlation between interaction of medical physicists with patients and its impact on improving patient outcomes, satisfaction and the professional scope of the idea. Materials and Method: After browsing various databases such as WebMD, Pubmed and Google Scholar a limited list of research work was found across the globe which was further shortlisted for detailed investigation. Notable institutional experiences and clinical trials were undertaken. Key resources included Prospective Phase II Physics Direct Patient Care (PDPC) trial and Special consult process for re irradiation cases. Data on patient anxiety, satisfaction, communication and workflow was extracted and compared for relevant outcomes. Results and Discussions: The PDPC trial showed a significant reduction in patient anxiety ($p < 0.0001$) between simulation and first treatment, with a parallel significant rise in technical satisfaction ($p = 0.0012$). Reirradiation consult processes standardized QA, improved multidisciplinary coordination, and supported safe dosimetric decision-making, with 401 consults conducted in 2018 alone. This format of direct patient consultation can be implemented not only in Radiation Therapy practices but also in Nuclear Medicine and Diagnostic Radiology departments at respective scale to improve patient satisfaction regarding respective procedures. Conclusion: Direct patient engagement by medical physicists significantly reduces patient anxiety, enhances satisfaction, and improves technical safety documentation.



Poster ID: 77

Title: In-vitro and In-vivo Theranostics Potential of Nanoparticles in Personalized and Precision Treatment for Cancer

Author Names: Dr. Mudasir Ashraf Shah

Full Abstract:

Introduction: Nanoparticles are revolutionizing precision and personalized medicine for cancer treatment through nanoparticle-mediated radiation and photothermal therapy, enhancing imaging techniques, improving immunotherapy, and enabling targeted drug delivery. Materials and Methods: Ruthenium and MgO nanoparticles were synthesized using chemical reduction/ biological methods and functionalized capped agents like glucose. The standard MTT assay method assessed the cytotoxicity of nanoparticles. The cells were maintained at 370C, 5% CO2, and 95% humidity, and the localization of nanoparticles in the cancer cells was evaluated. The cells were irradiated with different doses of γ-rays beam. The clonogenic survival assay technique was utilized to study the cell reproductive death after irradiation and examine the nano-sensitizers' effectiveness. NIR Laser shone on the cells, and the clonogenic assay technique was used for cell counting for in-vitro photothermal therapy. For the in-vivo photothermal study, Rats were inoculated subcutaneously on the flank with 50 50 (8×106 8×106) a cancer cell line. Once the tumor had reached a diameter of 7 in any two directions, the animals were euthanized. All the animals will be housed in IVC, and the CPCSEA guidelines will be followed for all experiments. Furthermore, the in vitro cytotoxicity of $SnWO_4$ nanoparticles against HEK-293 cells and their biodistribution in healthy Wistar rats was evaluated for CT imaging capabilities. Results and Discussion: The combined effect of nanoparticles, radiation, and NIR laser irradiation on cell killing was investigated using a colony survival assay. A paired comparison revealed a statistically significant reduction in cell survival between cells pre-treated with nanoparticles by amplifying the absorption of ionizing radiation and local surface plasmonic resonance. The effect of nanoparticles on the NIR laser photothermal therapy of the tumor was studied in vivo by the local injection of nanoparticles around the cancer. The enhanced photothermal effects under NIR laser were demonstrated, leading to significant cancer treatment efficacy both in vitro and in vivo. Conclusion: Integrating nanoparticle-based strategies with immunotherapy could revolutionize cancer treatment, enabling personalized therapies. Ru nanoparticle-mediated therapies enhance radiation and Photothermal therapy effectiveness both in- vitro and in-vivo while reducing side effects. $SnWO_4$ nanoparticles show great potential for biomedical imaging, offering excellent CT imaging capabilities and biocompatibility, making them promising candidates for future contrast agent applications.

Poster ID: 78

Title: Clinical, Financial, and Social Challenges Faced by Cervical Carcinoma Patients from Lower Socio-Economic Strata - Interim Analysis

Author Names: Ipsita Chakraborty, Dr. Biplab Sarkar

Full Abstract:

Aim: This study aimed to investigate the multifaceted challenges–clinical, financial, and social–encountered by cervical carcinoma patients from lower socio-economic strata (SES) in urban India. By identifying these barriers, the research seeks to inform targeted interventions to improve patient outcomes and equity in cancer care. Materials and Methods: A cross-sectional study was conducted at a public hospital in Kolkata from January 2024 to December 2026 period . Participants included 150 women diagnosed with cervical carcinoma (stages I-IV) from low SES backgrounds, defined by monthly household income below INR 20,000 and lack of formal education beyond secondary level. Data were collected via structured questionnaires, medical record reviews, and semi-structured interviews. Clinical challenges were assessed through treatment adherence rates and complication incidences. Financial burdens were quantified by out-of-pocket expenses and debt accumulation. Social aspects were evaluated using validated scales for stigma, family support, and psychological distress (e.g., PHQ-9 for depression). Ethical approval was obtained from the institutional review board, and informed consent was secured. Statistical analysis involved descriptive statistics, chi-square tests for associations, and thematic analysis for qualitative data using SPSS version 27. Results: Among the 150 participants (mean age 48.2 ± 8.5 years), 72% presented at advanced stages (III-IV), with 65% reporting delayed diagnosis due to limited access to screening (Pap smears unavailable in 58% of cases). Clinically, 54% experienced treatment interruptions from chemotherapy/radiotherapy side effects, exacerbated by malnutrition (prevalent in 61%). Financially, average out-of-pocket costs were INR 150,000 per patient, leading to debt in 78% and asset sales in 42%; only 22% had partial government insurance coverage. Socially, 67% faced stigma, with 49% reporting family abandonment or marital discord; psychological distress was high, with 59% screening positive for moderate-severe depression. Associations were significant: lower income correlated with higher stage at diagnosis ($p<0.01$) and poorer adherence ($p<0.05$). Discussion: The findings highlight how low SES amplifies cervical carcinoma burdens. Delayed presentations align with global patterns in underserved populations, where screening gaps perpetuate poor prognoses. Financial strains in affordable care, often forcing patients for incomplete treatment. Social stigma, rooted in cultural misconceptions about cervical cancer's links to sexual health, compounds isolation and mental health issues, consistent with prior studies in developing regions. These interconnected challenges suggest that clinical management alone is insufficient; holistic approaches integrating economic support and community education are essential to mitigate disparities. Conclusion: Patients from low SES face profound clinical delays, crippling financial loads, and social ostracism, contributing to suboptimal outcomes.

Poster ID: 79

Title: Capacity Building in Cancer Care Across South Asia through SCMPCR's Integrated Training Programs

Author Names: Hasin Anupama Azhari, Golam Abu Zakaria

Full Abstract:

The high mortality rates of cancer in South Asia result from inadequate oncology facilities, together with insufficient healthcare personnel and late diagnosis. The region needs adaptable, multidisciplinary training frameworks that match its particular requirements to fill these gaps. Since 2018, the South Asia Centre for Medical Physics and Cancer Research (SCMPCR) has established an integrated training through accredited workshops, online learning opportunities, and in-service training. SCMPCR operates its training programs together with regional cancer institutions and worldwide partnering entities and personnel. Several training workshops from SCMPCR have obtained accreditation from the International Organisation for Medical Physics (IOMP) and the European Board for Accreditation in Medical Physics (EBAMP). Training workshops, which have received accreditation, take place in active radiotherapy facilities where attendees can learn hands-on experience. The online learning platform delivers lectures through international experts, along with interactive discussions and online assessments, which now unite medical physicists and radiation oncologists in a joint framework. The three-week in-service training in local oncology centres enables professionals to gain extensive clinical experience from experts from developed countries in patient care, along with quality assurance and treatment planning in their working environment. Between 2018 and mid-2025, SCMPCR organised eight accredited training workshops, six in Bangladesh, one in India (2024), and one in Nepal (March 2025), benefiting over 150 professionals from South Asia and beyond. The next training program is planned for Sri Lanka. Nine e-learning programs have engaged participants from more than 50 countries, enhancing competencies in radiotherapy, radiation safety, quality assurance, imaging, and advanced treatment planning. In-service training has further strengthened clinical skills for local oncology teams. The expansion of activities into other South Asian nations has improved accessibility to high-quality training, while the multidisciplinary participation of medical physicists and radiation oncologists fosters stronger collaboration in clinical decision-making. SCMPCR's integrated training model demonstrates that the combination of localised clinical instruction and internationally accessible virtual learning can significantly enhance cancer care capacity in resource-limited settings. By promoting multidisciplinary education, cross-border collaboration, and south–south knowledge exchange, this approach provides a replicable framework for advancing oncology services and improving patient outcomes across South Asia. Keywords: Medical physics, radiation oncology, South Asia, capacity building, clinical training

Poster ID: 80

Title: Multi-Gantry Evaluation of Performance Consistency in Daily QA of Proteus Plus Proton Therapy Systems

Author Names: Chithambara Prabu Arunasalam, Ranjith Cp, Lalith Chaudhari, Vysakh Raveendran, Siddarth Laskar

Full Abstract:

Introduction: Regular daily quality assurance (QA) is crucial for maintaining the accuracy and reliability of proton beam delivery in clinical settings. This report outlines the methods and findings from a thorough daily QA program carried out over three years at a clinical proton therapy centre that utilizes three rotating gantry rooms. Methods and Materials: A detector-based approach was used to evaluate spot parameters, output stability, and range in a proton therapy system. Spot characterization employed a Lynx2D scintillation detector with a standard 5-spot pattern. Measurements occurred at gantry angles of 0°, 90°, and 270° on alternating days for five proton energies (70.2, 100, 150, 180, and 226.2 MeV). Spot size, position, and symmetry were assessed with custom-built automated scripts. Output constancy was checked using a PPC05 ionization chamber with a solid water phantom (5 × 5 cm² field) at gantry angle 0° for all energies. Range verification was performed with a Giraffe detector at gantry angle 270°. This QA protocol was consistently applied across all three clinical gantries. Results: Over a two-year period, data collection and analysis demonstrated excellent beam stability. Spot size, position, and symmetry consistently remained within clinical tolerances. Output constancy deviations were within ±2% for all evaluated energies, while range measurements maintained reproducibility within ±1 mm. No significant variations were observed between gantries or across the monitoring period. Conclusion: This robust, streamlined daily QA protocol demonstrates the reliability of detector-based methodologies in maintaining beam quality in proton therapy. The results emphasize the importance of regular, energy-specific, and angle-dependent QA procedures for high-precision proton treatment delivery

Poster ID: 81

Title: Implementation of Treatment delivery log file-based Patient Specific Quality assurance in Intensity modulated Proton Therapy

Author Names: Mahammood Suhail M, Rangasamy S, Gaganpreet Singh, Dayananda Sharma

Full Abstract:

Objective: This study aims to evaluate the feasibility of using treatment delivery log files recorded in the machine as an alternative to measurement-based PSQA in proton therapy. The goal is to improve PSQA efficiency without compromising the accuracy. When compare to the measurement-based methods, PSQA of the pencil beam scanning (PBS) proton therapy takes significant amount of time for every patient because of its complexity in delivery of Pencil beam spot positions patterns. Log files of treatment delivery are recorded layer by layer separately for each and every energy in the field in separate excel format and its machine specific as well. This file contains the X and Y Spot positions and MU delivered per spot for that delivered field and other machine parameters in Ion chamber2 and 3 level in the Nozzle. Extracting this information into the isocentre plane requires mathematical conversion and require significant amount of time. Materials and Methods:We have developed the in-house software using python scripting to extract the treatment delivery parameters such as Energy, Spot positions and MU delivered from the individual log files to verify the delivery accuracy of the treatment plan. The software compares the RT Plan with Treatment delivery log files saved in the machine and which are highly reliable source of information to use for verification. The report is designed in such a way to analyze the MU delivered per spot specifically within three different tolerance values such as, 0.01 MU,0.05 MU,0.1MU. the X and Y Spot positions are reported in percentage separately for every treatment field with the tolerance limit of 1mm. Graphical representation of the Action level and threshold level limits for MU per spot and Spot positions are plotted separately for the quantitative analysis Graphical representations are generated to categorize deviations as within threshold or action levels and it's shown in figure A and B. Results:Retrospectively 25 Patients were evaluated for five different anatomical sites. 99.06% of spots having the MU difference of less than .1MU observed in all these cases.98.5% X spot positions and 99.25%Y spot positions are within the aforesaid tolerance limit. The proposed method has been validated for the Daily QA deliveries as well for validation and found that the results are well within tolerance and found satisfactory with the baseline values. Hence, this method can be used to improve the PSQA time efficiency in the clinical use. Daily QA deliveries were also analysed for validation

Table: 1

S.No.	SPOTS with 1mm (Y)	SPOTS with 1mm (X)	MU difference of 0.1MU
1	99.54	98.75	99.9
2	99.67	99.35	99.9
3	99.62	99.39	99.7
4	99.84	99.16	99
5	98.89	98.5	99.9
6	98.67	98.57	99.8
7	94.67	89.55	89.8
8	99.63	99.64	99.9
9	99.47	97.84	97.9
10	99.65	98.83	99.6
11	99.5	98.9	99.5
12	99.82	99.35	99.7
13	99.86	98.93	99.7
14	99.25	98.50	99.06
15	99.84	99.19	99.9
16	99.89	99.31	99.6
17	99.87	97.62	98.2
18	99.98	98.96	99.4
19	99.3	98.5	99.5
20	99.51	100	99.8
21	97.52	99.98	99.7
22	98.29	99.97	99.9
23	100	99.03	98.3
24	99.08	99.06	99.7
25	99.99	95.77	99.6
Average	99.25217391	98.50652174	99.06086957

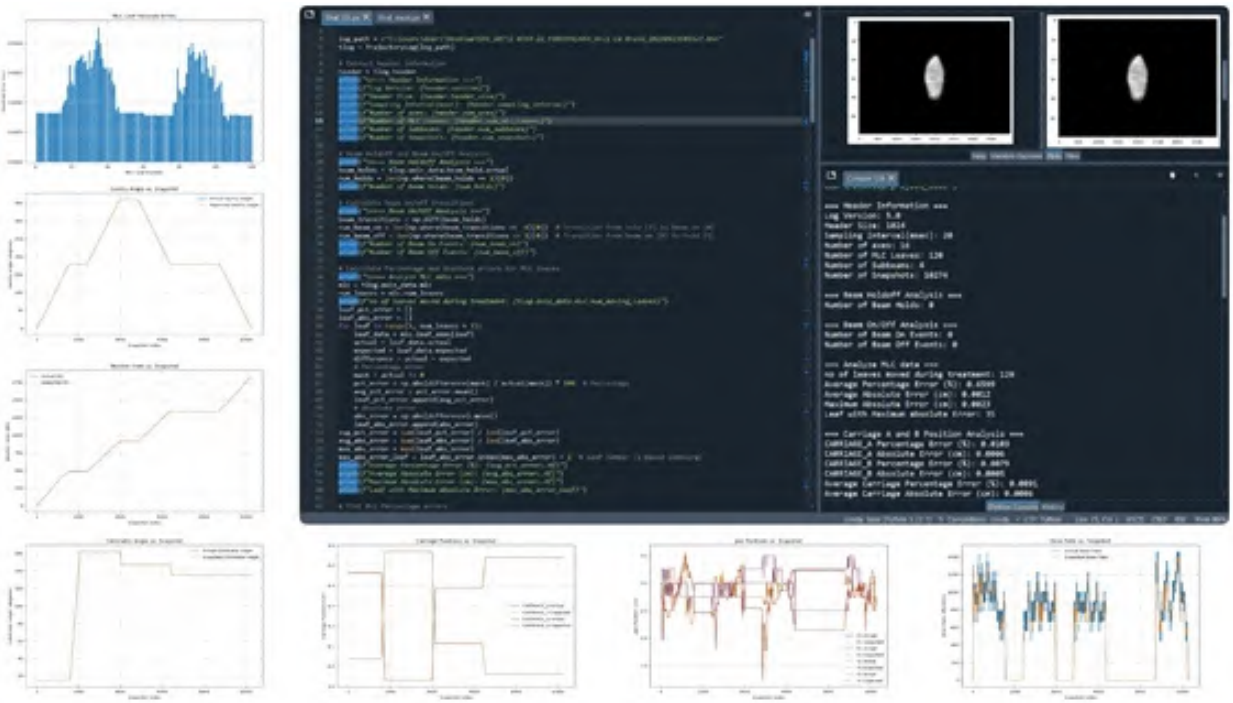
Poster ID: 82

Title: Trajectory to Perfection: Pylinac-based independent QA for SBRT and SRS/SRT treatment with Varian's Trajectory Logs

Author Names: Debrin Bhowmik, Lalit Kumar, Soumi Banerjee

Full Abstract:

This study investigates the utility of LINAC Trajectory_Log files as a robust QA tool in modern radiation therapy. A LINAC log file is a digital record documenting the operational parameters of a linear accelerator during radiotherapy, capturing real-time machine performance and component positioning. For the Varian Edge system, Trajectory Log Files, stored in the TDS folder, record snapshot data every 20ms, retained for 30 days. These files contain precise, timestamped metadata (e.g., Patient ID, Plan Label, snapshot count), beam fluence, and axis data (e.g., gantry, collimator angles, jaw carriage, MLC leaf positions, MUs) both expected and delivered, enabling verification of treatment accuracy, deviation detection thus enhancing patient safety. The methodology involved acquiring approximately 150 individual trajectory log bin files over a four-month period, encompassing the entire treatment logs for 27 individual SBRT and SRS/SRT patients. A custom Python code was developed utilizing the PyLINAC library to extract and analyse TrajectryLog bin data. Analysis of this data yielded an Excel sheet detailing error in MLC, jaw, and carriage positions; collimator and gantry angles; dose rate, MUs and comprehensive fluence gamma analysis for each patient on each treatment day. Multiple graphs were also generated, illustrating expected and actual values versus snapshot index also deviation values versus snapshot index and positional error versus leaf number and gamma. Plotting the error data for those patients' entire treatment yields the mean percentage error. For SRS/SRT patients, errors were: MLC: 0.254%, carriage: 0.007%, jaws: 0.004%, gantry angle: 0.838%, collimator: 0.007%, MU: 0.067%, with a gamma passing rate of 99.99% and average gamma 0.004. similarly, for or SBRT patients, errors were: MLC: 0.362%, carriage: 0.007%, jaws: 0.004%, gantry angle: 0.106%, collimator: 0.004%, MU: 0.049%, with a gamma passing rate of 100% and average gamma 0.003. These minimal error rates and near-perfect gamma passing rates demonstrate the Varian Edge machine's precision, exceeding 99% accuracy across all parameters, particularly for such complex treatments. This approach provides a rapid, independent QA method using TrajectoryLog data and Python-based analysis, capable of detecting minor deviations and potential mechanical issues early. However, it assumes the accuracy of recorded data by machine and does not directly measure patient-absorbed dose, relying on dose calculation algorithms that may introduce undetected errors. Despite these limitations, the results highlight the significant potential of trajectory log file analysis to enhance the precision and safety of radiation therapy, offering a valuable tool for ensuring reliable treatment delivery in clinical settings.



Poster ID: 83

Title: Impact of changes in fluence smoothing and minimum segment width parameters on VMAT plans in Monaco treatment planning system

Author Names: Lisha Jose, Fathima Shalu K, Dr. P.Raghukumar , Dr.Geetha M, Dr.Silpa Ajaykumar, Suja C A, Resmi K Bharathan, Riyas M

Full Abstract:

AIM To evaluate the impact of fluence smoothing (FS) and minimum segment width (MSW) variations on VMAT plan quality using the Monaco Treatment Planning System for rectal cancer. INTRODUCTION Volumetric Modulated Arc Therapy (VMAT) is a widely adopted technique that enables dynamic modulation of gantry speed, dose rate, and multileaf collimator (MLC) movement to deliver highly conformal radiation. While VMAT improves treatment efficiency, it may increase monitor units (MUs) and plan complexity. The Monaco TPS (V5.11.03), employing a Monte Carlo-based dose calculation, allows fine control over key parameters including FS and MSW. FS smoothens intensity patterns for easier delivery, while MSW influences beam modulation and delivery time. This study analyse the independent effects of FS and MSW on VMAT plan quality for hypofractionated rectal cancer. MATERIALS AND METHODS Thirty previously treated rectal cancer patients (25 Gy in 5 fractions) were selected and re-planned using Monaco TPS. FS levels (Off, Low, Medium, High) and MSW values (0.5, 0.8, 1.0, 1.5, 2.0 cm) were varied independently, while keeping other planning parameters and constraints constant. Plans were evaluated based on target coverage, organ-at-risk (OAR) sparing, homogeneity index (HI), conformity index (CI), and hotspot volume (V107%) as per RTOG 0822 criteria. Delivery accuracy was assessed using PTW 729 and the Octavius phantom on an Elekta Versa HD linac. Statistical analysis was performed using SPSS V29. One-way ANOVA was applied to normally distributed variables (MU, Treatment Time, CI, Dmax), and Kruskal-Wallis tests for non-normal parameters (HI, V107%, OAR doses), with significance, $p < 0.05$. RESULTS AND DISCUSSION High FS significantly reduced MUs ($p < 0.001$), improving delivery efficiency without affecting Treatment Time, Dmax, or CI ($p > 0.05$). However, a significant increase in V107% was observed with high FS ($p < 0.001$), while HI and OAR changes remained statistically insignificant .MSWs of 0.8–1.0 cm demonstrated optimal plan quality with reduced MUs. In contrast, a 2.0 cm MSW yielded the lowest MU but compromised plan quality with increased Dmax, V107%, and a non-significant rise in OAR doses. These outcomes are consistent with previous findings by Jiménez-Puertas et al and Nithiyanantham et al. CONCLUSION Higher FS improves treatment efficiency but may increase hotspots, requiring careful selection. Larger MSWs lower MUs but degrade plan quality. Based on this study, a segment width of ~1.0 cm and high FS setting, evaluated independently, offer the best balance between efficiency and dosimetric integrity. Keywords: Fluence smoothing, segment width, Monaco TPS.

Statistical Analysis of Segment Width and Fluence Smoothing Settings

Segment Width Analysis (Mean ± SD)

Parameter	0.5 cm	0.8 cm	1.0 cm	1.5 cm	2.0 cm	F-value	P-value	H-value	df	P-value (KW)
MU	1559.95 ± 363.22	1342.42 ± 247.42	1255.63 ± 203.02	1213.62 ± 210.08	1179.2 ± 147.98	11.59	<0.001			
TT (minutes)	4.2 ± 0.44	4.06 ± 0.50	4.04 ± 0.50	4.13 ± 0.59	4.19 ± 0.55	0.608	0.658			
PTV DMAX (cGy)	2731.06 ± 36.48	2733.60 ± 37.91	2739.69 ± 34.53	2756.48 ± 42.36	2745.59 ± 40.87	4.81	0.001			
CI	0.74 ± 0.06	0.73 ± 0.059	0.72 ± 0.06	0.71 ± 0.06	0.71 ± 0.05	1.52	0.19			
HI	0.06 ± 0.01	0.06 ± 0.01	0.06 ± 0.01	0.08 ± 0.02	0.08 ± 0.02			31.26	4	<0.001
V107 (cc)	31.52 ± 90.47	57.69 ± 175.42	70.21 ± 188.59	128.93 ± 238.94	175.22 ± 264.87			22.09	4	<0.001

Fluence Smoothing Analysis (Mean ± SD)

Parameter	LOW	MED	HIGH	OFF	F-value	P-value	H-value	df	P-value (KW)
MU	1600.94 ± 362.43	1442.61 ± 287.58	1287.8 ± 223.9	1575.92 ± 331.79	6.413	<0.001			
TT (minutes)	4.22 ± 0.45	4.13 ± 0.49	4.11 ± 0.057	4.22 ± 0.52	0.39	0.76			
PTV DMAX (cGy)	2730.59 ± 35.74	2737.1 ± 42.78	2737.1 ± 42.78	2726.1 ± 35.18	0.441	0.72			
CI	0.75 ± 0.06	0.73 ± 0.06	0.72 ± 0.07	0.74 ± 0.06	1.53	0.21			
HI	0.062 ± 0.014	0.0638 ± 0.013	0.07 ± 0.02	0.06 ± 0.01			4.48	3	0.21
V107 (cc)	27.75 ± 89.93	61.95 ± 166.6	96.88 ± 227.94	89.03 ± 30.98			1.79	3	<0.001

Poster ID: 84

Title: Enhancing Radiotherapy Precision for Long Tumors: Evaluating kV CBCT and Two-Isocenter Strategies

Author Names: Abhay Singh, Supratik Sen, Sandeep Singh, Dipesh, Manindra Bhushan , Anuj Vijay

Full Abstract:

Title: Enhancing Radiotherapy Precision for Long Tumors: Evaluating kV CBCT and Two-Isocenter Strategies Purpose: This study evaluates kV CBCT limitations for imaging long tumors in radiotherapy due to restricted FOV. It analyses the feasibility of two-isocenter planning as a solution, comparing imaging precision, dosimetric parameters, and dose spillage between single- and two-isocenter plans to address these constraints effectively Materials & Methods: Fifty patients with long tumor (~35 cm in length) located in regions requiring precise imaging and positioning were included in the study. Anatomical landmarks such as the coxofemoral joints, pelvic bones, femoral heads, iliac crest, and sacroiliac joints were utilized to ensure accurate patient alignment. Treatment plans were developed using both single- and two-isocenter approaches and analysed using the Varian Eclipse system with the Anisotropic Analytical Algorithm (AAA 15.5) for dose calculation. Evaluated metrics included PTV V95%, maximum dose (Dmax), conformity index (CI), and homogeneity index (HI) volumes receiving 50% and 30% of the prescribed dose. Results and Discussion: Two-isocenter planning mitigated imaging limitations caused by kV CBCT's restricted FOV. PTV coverage was comparable (single-isocenter: 98.62%; two-isocenter: 98.52%), while two-isocenter plans demonstrated reduced dose spillage (D50%: 2330.8 cc vs. 2360.53 cc; D30%: 5984 cc vs. 6289.67 cc). Dmax, CI, and HI values were similar, with slight improvements in dose modulation using the two-isocenter approach. Conclusion: Two-isocenter planning addresses kV CBCT's imaging limitations, improving imaging feasibility, alignment precision, and reducing dose spillage. Despite its advantages, the approach requires managing potential challenges, including extended treatment times, patient fatigue, and QA complexities, to optimize treatment accuracy and efficacy.

Poster ID: 85

Title: Enhancing VMAT Treatment Fidelity: End-to-End Testing Through TG-119 Quality Assurance Framework

Author Names: Poonam Ray, Srimanta Pramanik, Dilip Kumar Ray

Full Abstract:

Introduction & Objective: Accurate dosimetric commissioning of volumetric modulated arc therapy (VMAT) is essential for safe clinical implementation, especially in high-gradient dose regions near critical structures. This study aimed to evaluate the end-to-end accuracy of VMAT treatment plans calculated with the Anisotropic Analytical Algorithm (AAA) and Acuros XB algorithm using the American Association of Physicists in Medicine (AAPM) TG-119 protocol, implemented on a TrueBeam linear accelerator with the Ruby Modular QA Phantom. Materials & Methods: VMAT plans were generated for TG-119 test cases–including prostate, head & neck, multi-target, and C-shaped targets–using Eclipse TPS v16.1 with AAA and Acuros XB (6 MV FF beams). Point dose measurements were performed using a Semiflex 3D ionization chamber in the Ruby Modular Phantom. Planar dose distributions were evaluated with EPID aS1200 and Octavius 4D with a 1500 detector array. Gamma analysis (3%/3 mm) and statistical confidence limits were calculated as per TG-119 guidelines. Dose-volume metrics for targets and organs-at-risk (OARs) were also analyzed and compared to TG-119 recommended benchmarks. Results & Discussion: All planning goals defined in TG-119 were met for both AAA and Acuros XB-based plans. The confidence limits (CL) for high-dose point measurements were 0.044 (AAA) and 0.056 (Acuros XB), while for low-dose regions they were 0.044 (AAA) and 0.072 (Acuros XB). Acuros XB showed slightly higher point dose differences due to increased low-energy scatter dose, which may not be fully captured by ion chamber measurements. However, the gamma passing rates for composite planar dose distribution were consistently high and comparable for both algorithms: 98.98% (AAA) vs. 98.94% (Acuros XB) using Octavius, and 98.54% (AAA) vs. 99.24% (Acuros XB) using Portal Dosimetry. Monitor units (MU) were slightly higher for Acuros XB plans across all test cases. Conclusion: The TG-119 protocol was successfully applied to validate VMAT planning and delivery accuracy using the Ruby Modular QA Phantom. Both AAA and Acuros XB algorithms produced clinically acceptable results. Although Acuros XB showed higher confidence limits in point dose measurements, its accuracy in planar dose and dose-volume evaluations supports its suitability for clinical use.
Keywords: VMAT, TG-119, Acuros XB, AAA, Quality Assurance, Ruby Phantom

Poster ID: 86

Title: Comparision of fixed and variable iris collimators in Cyberknife M6 system using Gafchromic film EBT4 for quality assurance

Author Names: Lalnghakmawii Tlau, Annex E H

Full Abstract:

COMPARISION OF FIXED AND VARIABLE IRIS COLLIMATORS IN CYBERKNIFE M6 SYSTEM USING GAFCHROMIC FILM EBT4 FOR QUALITY ASSURANCE Lalnghakmawii Tlau1, Annex E H1 Department of Radiation Oncology, Amrita institute of Medical Sciences, Ponekkara P. O Kochi, Kerala India. Email: ngtlauedu23@gmail.com BACKGROUND/OBJECTIVE: Accurate and consistent dose delivery is critical in stereotactic radiosurgery, particularly with systems like the CyberKnife M6 that utilize both fixed and variable collimation. This study presents a focused quality assurance (QA) investigation–commonly referred to as a "spot check"–of the CyberKnife Iris variable aperture collimator using EBT4 Gafchromic film. MATERIALS AND METHODS: The fixed 15mm collimator is used as the reference standard to compare the dosimetric performance of all available Iris sizes (5 mm, 7.5mm, 10mm, 12.5mm, 15mm, 20mm, 25mm, 30mm, 35mm, 40mm, 50mm, 60 mm). EBT4 Gafchromic films, cut into required sizes, 5.1cm x5.1cm for small field sizes and 10.2cmx10.2cm for large field sizes are inserted into the Iris QA hardware accessory, base plate. 15mm buildup is kept on top of the film. This base plate is mounted on the birdcage assembly and irradiated for each selected Iris aperture size under standardized conditions, 800 mm SAD. The irradiated films are scanned using high-resolution flatbed scanner, Epson Expression 10000XL and imported to the analysis software to compare spot check data against the baseline data. Four key parameters were quantified: Nominal vs. measured size (edge detection via 50% dose threshold), Equivalent diameter (calculated from field area), Profile diameter (FWHM of orthogonal profiles), Profile consistency (σ of repeated profile diameters), Central pixel values (PV). RESULTS: The preliminary findings indicate a strong agreement (±0.2mm from baseline) between the Iris and fixed collimator size, though slight variations in smaller apertures were observed. CONCLUSIONS: This protocol serves as a reliable and efficient QA tool for maintaining high standards and accurate delivery in CyberKnife-based stereotactic treatments. KEYWORDS: CyberKnife, Gafchromic Film EBT4, Iris, fixed Collimator.

Poster ID: 87

Title: Comprehensive evaluation of output factors in linac, Tomotherapy and Cyberknife machine using film, ion chambers and diode detectors with TRS-483 based validation

Author Names: Blessy P P, Amala N Kumar , Annex E H , Debnarayan Dutta

Full Abstract:

OBJECTIVE: This multi-phase study aims to determine and verify output factors for radiation fields in Linear accelerator (LINAC), TomoTherapy and CyberKnife machine, with emphasis on detector selection, film-based validation, and uncertainty analysis in alignment with IAEA TRS-483 guidelines. MATERIALS AND METHODS: The output factors were independently measured using various active detectors (TN 31013, EDGE, Diode E, A1SL XW152293 and TN 30013) and one passive detector (Gafchromic EBT4). In the first phase, output factors were measured for symmetric and asymmetric field sizes ranging from 0.5×0.5cm² to 15×15cm², normalized to a 10×10 cm² reference field, using a solid water phantom. In the second phase, output factors were measured for same field sizes using Radiation Field Analyzer (RFA). Both the first and second phases were carried out on the Linear accelerator. In the third phase, small field dosimetric study on TomoTherapy and CyberKnife machine were performed in accordance with IAEA TRS-483, which provides guidelines for non-standard field conditions. EBT4 Gafchromic film was employed to validate these measurements through dose profile analysis in each phase. RESULTS: In the first phase, the output factors measured for larger field sizes showed close agreement with EBT4 film results, while small field sizes displayed variation. In the second phase, the EDGE detector showed better performance compared to other large volume detectors due to volume averaging effect. In the third phase, output factors for TomoTherapy and CyberKnife were more accurate when calculated using the IAEA TRS-483 protocol applying the corresponding output correction factors. CONCLUSIONS: EBT4 film and the EDGE detector were found to be more suitable for small field dosimetry due to their higher accuracy and reliability. All other active detectors exhibited under - response for small field and this under- response was found to be significantly high in the case of ionization chamber with large sensitive volume thus establishing the volume averaging effect. The use of TRS-483 protocol with output correction factors is essential for accurate small field output factor determination, especially in systems like TomoTherapy and CyberKnife.
KEYWORDS: TomoTherapy, Linear accelerator, CyberKnife, IAEA TRS-483, Output factors

Output factors measured using EBT4 film, EDGE, Diode E and TN 30013 using CyberKnife

Poster ID: 88

Title: Retrospective Evaluation of Medical Linac Performance Using Statistical Process Control (SPC) Tools on Daily QA Parameters

Author Names: Muhsin T, Yazhini N, Shrishti Bishnoi, Nidhi Jain, Bhagyalakshmi AT, Suresh Chaudhari

Full Abstract:

Introduction and Objective: The Conventional threshold-based daily QA evaluations may not effectively capture subtle or progressive trends in machine behavior over time. This study uses Statistical Process Control tools to retrospectively analyze daily linac QA data, aims to monitor performance trends, detect deviations, and establish machine- and energy-specific departmental control limits. Materials and Methods: This study analyzed one-year daily QA-data from 9 centers using Varian linacs (TrueBeam STx & SVC, Clinac ix, Halcyon, Unique) in two phases. Parameters used are output constancy, in-line/cross-line symmetry, and flatness deviations. All control charts were plotted using Minitab v21 Software. Phase I: Stabilized control limits set using 30-day I-MR (n=1) and X -R (n=4) charts based on SPC principles defined in Montgomery's SPC. Outliers removed as per Western Electric rules or linked to assignable causes. Yearly data were normalized to these limits to detect large (3σ) shifts, and data were segmented into six stages of 2 months each to study stage-wise process variation. Phase II: Filtered data were analyzed with CUSUM & EWMA charts for small shifts. EWMA parameters (λ-Smoothing Constant & L-Control Limits Width) are set for suitable sensitivity levels (0.5σ, 1.0σ, and 2.0σ). Process capability indices (Cp-Process Capability, Cpk-Process Acceptability) were evaluated per stage against 1.0%, 2.0%, 3% specification limits to depict the real working condition of the linac. Results and Discussion: The SPC analysis accurately identified calibration drift in Centres 4 and 9, and magnetron replacement in Centre 5. The recommended departmental output control limits based on SPC analysis for stable performance were as follows: For 6MV beams, Centers 1–8 had process CLs of 0.252, 0.215, -0.519, -0.139, -1.1, -0.457, 0.519, and 0.527, with corresponding control limit widths of 1.39, 0.66, 2.11, 1.24, 2.22, 1.86, 1.99, and 0.85, respectively. For 10MV, Centers 1, 2, 7, and 8 showed CLs of -0.406, -0.148, 0.323, and 0.045, with widths of 1.63, 0.84, 0.84, and 0.77. For 6MV FFF, Centers 1, 2, 7, and 8 had CLs of 0.659, -0.181, 0.804, -0.115, and 0.081, with widths of 1.94, 0.60, 1.95, 1.20, and 1.42, respectively. Conclusions: The study demonstrates that SPC tools can effectively monitor linac performance, identify both major and minor process deviations, and provide machine- and energy-specific control limits. The recommended control limits and tolerance bands derived from process capability analysis can support early detection of drift, guide timely interventions, and enhance long-term machine stability in clinical practice.

Poster ID: 89

Title: Sensitivity of Delta⁴ Phantom+ in Detecting Non-Coplanar Errors in Varian HyperArc™ Stereotactic Radiosurgery Delivery

Author Names: Vishram Naik, Avinash Chechare, Rupesh Pagare , Amit Nirhali

Full Abstract:

INTRODUCTION & OBJECTIVES: HyperArc™ is a stereotactic radiosurgery (SRS) solution from Varian that leverages automated non-coplanar volumetric modulated arc therapy (VMAT) for high-precision cranial treatments. Given the steep dose gradients and narrow margins, especially in multi-lesion brain SRS, ensuring geometric and dosimetric accuracy is critical. This study investigates the sensitivity of the Delta⁴ Phantom+ (ScandiDos) in detecting clinically relevant non-coplanar delivery errors–specifically in couch and gantry angles–during HyperArc treatments. METHODS & MATERIALS: A series of HyperArc plans targeting single and multiple brain lesions were delivered to the Delta⁴ Phantom+ using a Varian TrueBeam system. Controlled non-coplanar setup errors were introduced by altering couch angles (±1°, ±2°, ±3°) and gantry angles (±1°, ±2°). QA measurements were performed for both the baseline (error-free) and perturbed deliveries. Gamma analysis (3%/1 mm and 2%/1 mm criteria) and dose-volume histogram (DVH) deviations were analyzed to quantify the impact of angular misalignments. Pass rate sensitivity was evaluated relative to the type and magnitude of error. RESULTS & DISCUSSION: Preliminary findings indicate that even minor deviations in non-coplanar angles significantly affect gamma pass rates in HyperArc plans, especially under tight criteria (2%/1 mm). Couch angle errors 2° led to consistent reductions in pass rates by >10%, with a notable increase in dose to normal brain tissue in multi-target plans. The Delta⁴ Phantom+ demonstrated high sensitivity to angular perturbations, particularly in plans involving steep dose gradients and small PTVs. CONCLUSION: The Delta⁴ Phantom+ system is effective in detecting non-coplanar delivery inaccuracies in HyperArc SRS plans. Its sensitivity to small angular misalignments makes it a valuable tool for patient-specific QA in complex non-coplanar treatments. Routine verification of couch and gantry angles should be emphasized in clinical QA protocols for HyperArc.

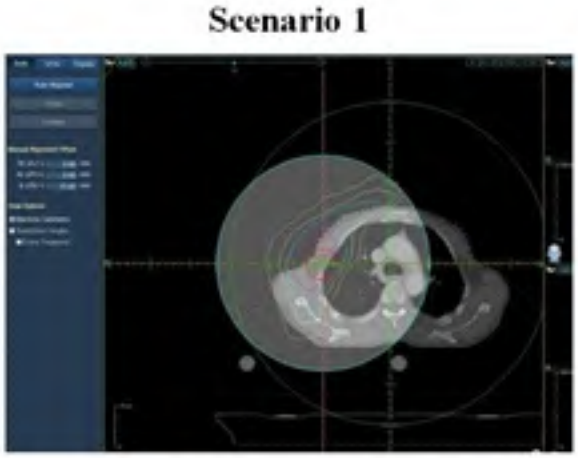
Poster ID: 90

Title: Phantom Positioning Strategy to Improve Quality Assurance for Off-Centred Targets in Tomotherapy

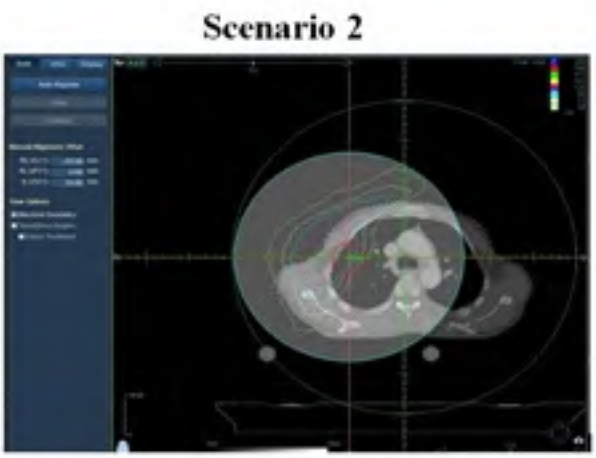
Author Names: Vikram, Dr. Maninder Mishra, Dr. Raj Pal Singh, Deepak Mahor, Sarvendra Singh, Dr. Atul Tyagi

Full Abstract:

Introduction and Objective: Delivery quality assurance (DQA) is a critical component of radiation therapy, ensuring that the delivered dose accurately reflects the planned treatment. In this study, we present our clinical experience with the ArcCHECK phantom and evaluate the impact of lateral phantom displacement on gamma passing rates during patient-specific QA for off-centred planning target volumes (PTVs), utilizing the ArcCHECK dosimetry system in a Tomotherapy platform. Materials and Methods: In this retrospective study, patient-specific QA data from 15 patients treated on a Tomotherapy system were analysed. In the initial scenario, the ArcCHECK phantom was aligned with the PTV isocentre. However, for off-centred tumors–such as in breast cancer cases–this positioning placed the phantom partially outside the optimal beam geometry, which could compromise the accuracy of dose measurements. In the second scenario, the phantom was laterally shifted by 15 mm to 40 mm to position it entirely within the optimal beam geometry. This setup was designed to reflect the treatment geometry of off-centred PTVs more accurately and to assess its impact on gamma passing rates using the 3%/3 mm criteria. Result and Discussion: The average gamma passing rate before shifting the phantom was 90.57% ± 2.29, which improved to 97.49% ± 0.76 after lateral displacement. This improvement was found to be statistically significant, with a p-value of 0.000061 based on the Wilcoxon signed-rank test. These findings suggest that proper positioning of the ArcCHECK phantom within the TomoTherapy system can enhance the accuracy and reliability of patient-specific quality assurance, especially for off-centred target volumes. Conclusion: Lateral shifting of the ArcCHECK phantom to better match the actual treatment geometry significantly improved gamma passing rates for off-centred PTVs. This approach enhances the accuracy and reliability of patient-specific quality assurance, especially in cases with asymmetrically positioned targets. Keywords: Tomotherapy, ArcCHECK, Delivery Quality Assurance, Gamma Passing Rate.



Scenario 1: No lateral shifting in "Manual Alignment offset"



Scenario 2: R[-]/L[+] = -20mm lateral shifting in "Manual Alignment Offset"

Poster ID: 91

Title: Patient-Specific QA Efficiency: A Comparative Evaluation on Efficacy and Workflow of ArcCHECK and EPID-Based EPIbeam Methods

Author Names: Maniyan Paramasivam, D Khanna, Vignesh Dharuman, Sureshbabu Pandu, Bharath Pandu

Full Abstract:

Objective: This retrospective study aims to compare the dosimetric accuracy and workflow efficiency of ArcCHECK and EPIbeam (an EPID-based software) for VMAT Patient Specific Quality Assurance. Materials and Methods: Forty VMAT plans were analysed, including 32 head and neck cases (14 with SIB and 18 with Phase 1 sequential plans) and 8 pelvic cases. PSQA was performed using ArcCHECK, a 3D diode array device, and EPIbeam Portal Dosimetry. Gamma analysis was conducted using criteria ranging from 3%/3mm to 1%/1mm with a 10% dose threshold. Workflow parameters such as setup time, calculation time, and analysis time were also recorded. Statistical analysis included mean gamma pass rates and standard deviations. Results & Discussion: EPIbeam demonstrated higher gamma pass rates compared to ArcCHECK, particularly when using stricter gamma criteria. For pelvic plans, the 3%/3mm results were 99.71% ± 0.66% for EPIbeam and 98.56% ± 1.66% for ArcCHECK. 98.8%± 1.41%, 96.58%± 2.79% at 3%2mm and 97.54% ± 2.28%, 93.73% ± 4.57% at 2%/2mm, for EPIbeam and ArcCheck respectively. For head and neck SIB plans, EPIbeam's mean pass rates were 99.93% ± 0.09% at 3%/3mm, 99.70% ± 0.40% at 3%/2mm, and 98.85% ± 1.04% at 2%/2mm. Corresponding values for ArcCHECK were 98.32% ± 1.03%, 96.33% ± 2.11%, and 93.69% ± 3.14%, respectively. In head and neck sequential cases, EPIbeam results were 99.86% ± 0.21% for 3%/3mm, 99.31% ± 1.43% for 3%/2mm, and 98.2% ± 1.18% for 2%/2mm, compared to ArcCHECK's 98.56% ± 0.82%, 96.74% ± 1.68%, and 93.38% ± 3.05%. EPIbeam had a faster setup time, as well as the ability to perform calculations concurrently. Both systems met common clinical acceptance criteria (95% passing for 3%/3mm and 3%/2mm, 90% for 2%/2mm) for most of the treatment plans. EPIbeam demonstrated superior gamma pass rates across all groups, largely due to its higher resolution and more efficient workflow. Its shorter setup and faster processing make it ideal for high-volume clinics. However, EPIbeam does not account for treatment planning system (TPS) model errors. In contrast, ArcCHECK, with its independent 3D measurement and inclusion of patient couch simulation, provides a more comprehensive QA process and is valuable for TPS validation Conclusion: Utilising both systems at different stages, depending upon the requirements can strengthen the overall QA process and provide an added layer of confidence. Keywords: Patient-specific QA, VMAT, ArcCHECK, EPID, EPIbeam, gamma analysis, workflow efficiency

Poster ID: 92

Title: Commissioning Experience of Halcyon Linear Accelerator in different Medical Institutions

Author Names: Thirumal M, Narayanan A, Balaji Kandasamy, Palanivelu D

Full Abstract:

Purpose: The aim of this study was to compare the commissioning processes of 6MV Flattening Filter Free (FFF) Linear Accelerator across three distinct medical institutions. Method: A comparative commissioning study was conducted on a newly installed ring-mounted linear accelerator of Halcyon Model E (version2.0) and Halcyon Model A (version 1.0) and Halcyon Model B (version 2.0) in three different medical institutions. Beam data measurements for the Halcyon 6MV FFF were obtained using different Radiation Field Analyzers (RFAs): Sun Nuclear circular 3D scanner and PTW square-shaped beam scanner (version 4.3). The study aimed to compare the beam parameters, including Percentage depth dose (PDD), beam quality index, beam profile, percentage surface dose, off-axis ratio, penumbra, output, radiation leakage, and electrical and mechanical tests. Results: The measured PDD values were found very similar and well within baseline values across the three institutions (63.01%, 63.01%, and 63.28%). The absolute output showed good agreement between machines (1.00 cGy, 1.003 cGy, and 1.00 cGy), respectively. The beam quality index and surface dose measurements showed minimal variation across the institutions (0.629, 0.647, and 0.622), and surface dose (66.15%, 69.1%, and 68.5%), respectively. Dmax values were the same in all three institutions (1.32cm,1.34cm,1.3cm). The beam symmetry values observed showed a maximum deviation from the baseline was 1.6%, 1.6%, and 0.7%, and the mechanical isocenter shift diameters calculated (0.6mm, 0.63mm, and 0.6mm) between the machines were very similar. Discussion: The commissioning results from the three institutions demonstrated a high degree of consistency in beam parameters, despite variations in scanner types and institutional workflows. The minimal deviations observed in PDD, beam quality index, and output indicate the robustness and reproducibility of the Halcyon platform. Surface dose and symmetry values were within clinically acceptable ranges, reaffirming the machine's reliability. The close agreement in mechanical isocenter measurements highlights the precision of Halcyon's design. Overall, these findings support the standardization of commissioning protocols across different clinical setups. Conclusion: The measurements from all three institutions were compared with each other and with predefined factory values. These measurements were within acceptable limits, indicating their satisfactory nature and suggesting their value as a reference for future Halcyon users. Key Words: Halcyon, Commissioning, Quality Assurance, Radiotherapy

Poster ID: 93

Title: Determination of inflection point for dosimetric analysis of unflattened beam using derivative method

Author Names: Ben Johnson V, Mohan Raj U, Sivakumar R, Lakshmana Perumal S, Vijay M, Rajababu CH

Full Abstract:

Background: The use of Unflattened or Flattening Filter Free (FFF) beams has become a standard in high-dose radiotherapy (RT) modalities, such as stereotactic radiosurgery (SRS) and stereotactic radiotherapy (SRT). The removal of the flattening filter (FF) from the photon beam path significantly modifies beam characteristics, making conventional dosimetric analysis methods developed for flattened beams unsuitable. An alternative approach is to analyze FFF beam profiles using inflection points (IPs), which correspond to locations where the second derivative of the dose profile changes sign, indicating a change in concavity. Aim: This study aims to determine inflection points for dosimetric analysis of FFF beam profiles and to compare the accuracy of different methods used for their estimation. Materials and Methods: In this study, inflection points and associated dosimetric parameters such as penumbra and field width were determined for 6 MV FFF beam profiles in both inplane and crossplane directions using three methods: (1) a manual graphical approach based on Atomic Energy Regulatory Board (AERB) guidelines, (2) a mathematical approach utilizing first and second derivatives implemented in Microsoft Excel, and (3) commercial PTW software as the reference standard. The results obtained from the AERB and Excel-based methods were compared against those from the PTW software. Results: For the inplane and crossplane profiles, the percentage differences in inflection point locations were 2.59% and 1.61%, respectively, for the AERB method compared to PTW, and 1.61% and 1.24%, respectively, for the Excel derivative method. Average penumbra differences were 0.15 mm (inplane) and 0.90 mm (crossplane) for the AERB method, and 0.30 mm (inplane) and 0.55 mm (crossplane) for the Excel method, relative to PTW. Field width differences among all three methods were found to be minimal, with deviations remaining below 1%. Conclusion: The comparative analysis of three methods.AERB manual estimation, Excel-based mathematical derivatives, and PTW software demonstrated that all approaches yielded comparable results for determining inflection points and penumbra in FFF beam profiles. The Excel-based method proved to be a reliable and accurate tool, offering a cost-effective and accessible alternative for dosimetric evaluation. Differences in field width were negligible, confirming the consistency and robustness of the methods. These findings support the use of mathematical derivative methods in clinical settings where commercial software may not be available.

Poster ID: 94

Title: Periodic QA of Flattening Filter-Free beam of a Medical Linear Accelerator using in-house developed software: A simplified methodology

Author Names: Smriti Sharma, G. Sahani, P. K. Dash Sharma

Full Abstract:

Introduction and Objective: Evaluation of the characteristics of FFF photon beam of medical linear accelerator (LINACs) using AERB recommended quality assurance(QA)/acceptance test protocols requires determination of key parameters such as inflection point,field size,penumbra and degree of un-flatness. Determination of key parameters using manual method is time-consuming, labour-intensive, and subject to user variability. To overcome these limitations, an in-house software was developed using Java programming language and validated against the manual method and published earlier. Periodic QA of FFF beam is essential to ensure patient safety, treatment accuracy, and equipment performance. Given the time-consuming QA of FFF beams, this study aims to use the software to expedite periodic QA and report any variation from institution's commissioning (baseline) data. Materials and Methods: This study included 72 beam profiles(inline and crossline) of 6 & 10 MV FFF beams from LINACs(Varian, USA) measured at seven institutions during commissioning and over subsequent days in Radiation Field Analyser. ASCII profile data were obtained from the institutes and stored as raw data in Excel files. These files were then imported into Java-based software, which rapidly calculates and displays QA parameters, which are field size (difference between left and right inflection points), penumbra (average of left and right penumbra) and degree of un-flatness (lateral distances at 90% (X90%), 75% (X75%), 60% (X60%) dose points). These QA parameters were compared with the institution's commissioning data. Results and Discussions: The average time to determine QA parameters through the manual method is approximately 25–30 min per profile while with software it is less than a minute. The maximum variation in QA parameters of the FFF beams, as determined using the software, was found to be within 2 mm of their respective baseline(commissioning) values across all institutions. The mean value of variation between field size,penumbra, X90%, X75% and X60% determined by software as compared with baseline value found to be 0.0, 0.1, 0.0, -0.1, 0.1 mm respectively with SD 0.6, 0.8, 0.8, 0.4, 0.7 respectively, demonstrating reliable and consistent results. Conclusion: As compared to manual method, use of software found to be simple, quick and consistent along with good agreement in all the profiles analysed through software and compared with commissioning data. The software can be utilized for periodic QA but, there is a scope of future study on using high resolution detector array while measuring profiles for day to day measurement and its analysis using software. Keywords: FFF, Software

Poster ID: 95

Title: Reimagining QA workflows in advanced radiotherapy using predictive metrics- the role of SPC and plan complexity.

Author Names: Murshida P, Dr Reshma Bhaskaran, Krishna Prasad P, Dr Sushama P, Saveri J S, Arathi C, Muhammed Fazil K U, Dr Ajay Kumar T

Full Abstract:

Introduction and Objective: Intensity - modulated Radiation Therapy(IMRT) delivers greater dose conformity to target tissues and spares more normal tissue than 3DCRT .IMRT leads to increased beam modulation and larger total monitor units which may lead to greater dosimetric uncertainity in the absence of meticulous quality assurance (QA).High QA workload and occasional failures create inefficiencies in the workflow .Hence a method to reduce the requirement for post treatment planning and pre treatment execution QA is desirable . With this study we aim to explore the possibilities of using complexity metrics as an alternative to pre treatment plan QA .The role of stastical process control in patient treatment plan QA is also explored . Materials and Methods : A total of 115 clinical treatment plans (IMRT,VMAT and SBRT) were retrospectively collected for this study . Plan complexity metrices were extracted using open-source script compatable with the Treatment planning system, based on the apertures area and monitor unit (MU) weights of each beam segment and prescribed dose. Gamma pass rate from patient specific QA were recorded and correlated with complexity metrics. Using statistical process control, control chart were constructed to determine upper and lower control limit for each metrics.if the plan complexity is within the limit ,it safe to avoid QA without compromising treatment accuracy. Results: The Beam modulation metrics had the central value of 0.69550, with lower control limit of 0.5067 and upper control limit of 0.8843. Out of the 305 fields only 0.33% of values fall below the lower control limit none exceeding the upper limit , reflecting a well-controlled process with very few exceptions. By identifying a complexity threshold , plans with complicity metrics outside the threshold value only requires QA to ascertain their suitability for treatment. Conclusions: Integration of Statistical process control and complexity metrics proves effective in reducing the workload of pre-treatment. The identified thresholds provides a quantitative basis for flagging high risk plans before delivery .This approach is not only improves work efficiency but also helps in standardization of radiation Therapy treatment planning, Ultimately contributing to safer and more reliable patient care. Keywords : IMRT QA , Complexity metrics , Beam modulation ,statistical process control , open source TPS SCRIPT, Quality assurance Prediction

Poster ID: 96

Title: Development and Implementation of an Automated Plan-Check Tool using Eclipse Scripting API (ESAPI) for Secondary Checks in External-Beam Radiotherapy Plans.

Author Names: Vinay Saini, Goura Prasad Singh, Narender Kumar, Sanjay Barman, Alka Kataria, Shivam Arora, Ashutosh Mukherjee, Satyajit Pradhan

Full Abstract:

Background: Manual plan quality checks in radiotherapy are time-consuming, prone to inter-user variability, and susceptible to oversight of institute or protocol-specific requirements. While Varian's Eclipse Scripting API (ESAPI) enables automation and customization within the Eclipse Treatment Planning System (TPS), its integration for clinical plan validation remains underutilized. To address this gap, we developed an in-house automated plan check tool using ESAPI, aimed at standardizing, accelerating, and simplifying plan evaluation with dynamic configuration through a Graphical User Interface (GUI). Materials and Methods: The plan check tool was developed using ESAPI, Microsoft Visual Studio 2022, and Windows Presentation Foundation (WPF) for a rich UI experience. Written in C#, the script reads treatment plans directly from Eclipse and performs multiple validation checks including: beam parameters, Couch inclusion, User Origin placement, Dose Algorithm, Field naming consistency, and Gantry-Couch-Body Collision. The UI allows customizable rule settings per machine or technique, which are stored in JSON for persistent reuse. Results: The tool provided rapid validation, automatically filtering out compliant checks and highlighting only discrepancies. This allowed users to focus directly on potential errors. The modular design and JSON-configured parameters enabled easy adaptation to institutional protocols. The GUI ensured intuitive navigation even for non-programming users, with live, plan-specific feedback on detected issues. Conclusions: This ESAPI-based in-house plan check tool proved to be an efficient and reliable addition to the TPS workflow. It significantly reduced manual workload, improved consistency, and enhanced patient safety through early detection of any deviations. Its GUI-based modular approach promotes scalable integration for other clinical centres using Eclipse TPS. Keywords: ESAPI, Plan Check Automation, Eclipse TPS, Secondary Check.

Poster ID: 97

Title: Independent Dose Verification of Stereotactic Body Radiotherapy Plans Using PRIMO Monte Carlo Simulation.

Author Names: Dinesh K Saroj, Suresh Yadav, Sudhanshu Rana, Rajiv Ranjan, Nishant Gaurav, Subhas Haldar

Full Abstract:

Background: Stereotactic body radiotherapy (SBRT) is a highly conformal treatment technique that delivers ablative radiation doses to lesions in a few fractions, while sparing the adjacent critical structures. The steep dose gradients and proximity of target volumes to critical organs at risk demand exceptional accuracy in both dose calculation and delivery. Although modern treatment planning systems (TPS) employ advanced algorithms, uncertainties may still arise, particularly in heterogeneous tissues and at tissue–bone interfaces. Monte Carlo (MC) simulation, considered the gold standard for dose calculation, offers superior accuracy by explicitly modelling particle transport and interactions. PRIMO, an MC simulation platform based on the PENELOPE code, allows independent dose verification of complex radiotherapy treatments, such as SBRT. Its capability to replicate linear accelerator geometry and beam delivery makes it a reliable tool for secondary dose verification, thereby enhancing treatment safety and confidence in clinical practice. Aim/Objective: This study aimed to assess the feasibility of PRIMO MC Simulation for independent dose verification of SBRT treatment plans. Materials and Methods: Retrospectively, this study includes 10 patients of SBRT previously treated with VMAT at our institute. SBRT cases were planned on a Varian EDGE with HD-MLC using 6 MV FFF beams with Eclipse (Vs. 16.1) . PRIMO was modelled for Varian EDGE. Plans were exported to PRIMO (v0.3.64.1814), configured with IAEA phase-space files for accurate dose calculation on patient CT datasets. Dosimetric parameters for the target volume and Organs at Risk were analysed. Gamma analysis (2%/2 mm) was performed to compare PRIMO-simulated dose distributions with TPS calculations. Results: Gamma analysis between measured and simulated depth dose curves and profiles for field sizes from 1x1 cm2 to 30x30 cm2 was above 99%. For SBRT treatment plans, PRIMO-simulated dose distributions showed excellent agreement with TPS, with mean gamma passing rates above 99% for 2%/2 mm criteria. Mean and maximum doses to the PTV were within ±3%, confirming the robustness of PRIMO calculations. Conclusion: PRIMO MC provides accurate and reliable independent dose verification for SBRT, complementing TPS calculations and enhancing treatment safety. Its implementation as a secondary verification tool can strengthen the quality assurance process in high-precision radiotherapy. Keywords: PRIMO, SBRT, Monte Carlo Simulation, Radiotherapy, Treatment plan.

Poster ID: 98

Title: Comprehensive Quality Assurance of MedRay-6R Mobile Diagnostic X-Ray Equipment

Author Names: Ankur Mourya , Akhilesh kumar saxena, Hitesh Sharma, Laxmi singotiya, Sunil choudhary, Lalit Mohan Aggarwal

Full Abstract:

Introduction and Objective: Mobile X-ray systems are widely used for bedside imaging and emergency diagnostics, necessitating strict adherence to radiation safety and image quality standards. The Atomic Energy Regulatory Board (AERB) mandates periodic quality assurance (QA) tests to ensure compliance and minimize radiation risks. This study aimed to evaluate the performance and radiation safety of a mobile X-ray unit in accordance with AERB guidelines. The objective was to assess the image quality and radiation safety parameters of the mobile X-ray unit and to identify potential deviations from regulatory thresholds. Materials and Methods: The QA assessment was conducted under controlled environmental conditions (temperature: 27°C; humidity: 57%) with a mobile X-ray unit (MedRay-6R). Tests were performed in accordance with AERB Test Protocol 2016 (AERB/RF-MED/SC-3 Rev. 2). The measurement tools included an RTI Piranha 657 dosimeter, survey meter, and multimeter, all within calibration validity. Parameters evaluated included congruence of radiation and optical fields, central beam alignment, effective focal spot size, accuracy of operating potential (kVp), total filtration, mAs linearity, output consistency, and radiation leakage from tube housing and collimator. Performance was compared against AERB-specified tolerance limits. Results and Discussions: All measured parameters complied with AERB standards. Congruence of radiation and optical fields was within ±2% of Focus to Film Distance (FFD), and central beam alignment deviation was <1.5°, meeting safety criteria. The accuracy of the operating potential showed a maximum deviation of ±1.8%, well within the ±5 kV threshold. Linearity of mAs loading exhibited a coefficient of linearity (CoL) of 0.018 (<0.1), and output consistency demonstrated a coefficient of variation (CoV) of 0.002 (<0.05), indicating high reproducibility. Radiation leakage from the tube housing and collimator was significantly below the permissible limit of 1 mGy/hr, ensuring operator safety. Conclusion: The mobile X-ray unit demonstrated compliance with AERB quality assurance criteria, ensuring both patient safety and optimal imaging performance. Regular QA testing, as demonstrated in this study, is essential for maintaining radiation safety and diagnostic reliability. These findings highlight the critical role of quality assurance assessments in ensuring regulatory compliance and minimizing radiological risks in mobile diagnostic imaging systems.

Poster ID: 99

Title: Studies of radiological properties for various synthetic polymer composites

Author Names: Sonal Varshney, Suraj, Alka, Satyam, Dr.puneet Pareek, Dr.bharti Devnani, Dr. Akansha Solanki, Dr.amith

Full Abstract:

1 Introduction Radiation therapy is a part of treatment in medical sector. Ionizing radiation possess high energy, which should be expose only to the organ that need to be treated. Electrons have been utilized in radiotherapy since the 1950s, which initially generated by betatrons and subsequently by linear accelerators (Linac). The unwanted exposure of ionizing radiation to the human body may create cancer. Hence, shielding of the radiation in the form of wall, wearable cloth, mask, Phantom etc. is the highly demanded field nowadays. Material and Methods 1. Acrylic sheet (Sample A) was prepared by taking Aluminium Trihydrate (ATH) powder and acrylic resin in the ratio of 8:10 by weight. 2. In a similar way as above sample, sample B was processed. Additionally, just glass fibre mat was incorporated in the mix. 3. The prepare (Sample C) was made by using epoxy resin and carbon black in the ratio of 80:20 by weight along with woven roving (WR) glass fibre in 50wt% of mix. 4. Glass fibre mat sheet (Sample D) fabricated by hand moulding followed by comparison moulding. 5. The sample E was prepared using cold curing with compression molding. The proportion of Fe particle (diameter -20 µm) to the epoxy resin was 75:25 in a mix. 6. Silica powder (70 wt %) was used to make the composite (Sample G) with epoxy matrix by hand moulding technique under vacuum condition. 7. GF Acrylic same as sample C. Results and Discussions The study concludes that percentage attenuation is higher for iron-filled glass fibre epoxy composites. Also, bremsstrahlung observations reflect that iron-filled glass fibre epoxy composites have higher range as compared to others. The radiological properties of the samples were conducted using energies of 8, 10, 12, and 15 MeV. The results indicate that increasing the energy up to 12 MeV does not yield any significant variation in bremsstrahlung observations; nevertheless, at 15 MeV, a considerable rise is observed. Conclusions The study concludes that percentage attenuation is higher for iron-filled glass fibre epoxy composites. Also, bremsstrahlung observations reflect that iron-filled glass fibre epoxy composites have higher range as compared to other one studied herein. The radiological properties of the samples were conducted using energies of 8, 10, 12, and 15 MeV. The results indicate that increasing the energy up to 12 MeV does not yield any significant variation in bremsstrahlung observations; nevertheless, at 15 MeV, a considerable rise is observed.

Poster ID: 100

Title: Commissioning and Two-Year Clinical Experience of Mobius 3D for Independent Dose Verification on a Varian TrueBeam Hyper-arc Linac

Author Names: Boopalan B, Sivasankari K, Kumaravel N, Dr. Imtiaz Ahmed, Dr. Sapna K

Full Abstract:

Introduction and Objective: Independent dose verification is an essential component of modern radiotherapy quality assurance (QA). Mobius 3D (M3D) is a commercial software platform that provides secondary 3D dose calculations using an independent collapsed cone convolution–superposition algorithm. This work reports the commissioning of M3D for a Varian TrueBeam Hyper-arc linear accelerator and summarises two years of clinical experience in its use as a routine patient-specific QA tool. Materials and Methods: Beam models for 6 MV, 10 MV, and 15 MV photon energies (including flattened and flattening filter-free beams) were commissioned in M3D using output factors, depth dose curves, and beam profile data measured during linac acceptance testing. DLG optimisation was performed with 125 plans irrespective of specific sites for all energies. Validation was performed against reference measurements in homogeneous and heterogeneous phantoms as well as against treatment planning system (TPS) calculations for IMRT and VMAT plans. Clinical implementation involved routine use of M3D for over two years, with dose–volume histogram (DVH) metrics, gamma analysis (3%/2 mm) as per TG 218 protocol and tolerance levels set according to institutional QA protocols. Results and discussion: Commissioned M3D beam models reproduced measured data within 2% for depth dose and 2 mm for profile agreement. Gamma pass rates for IMRT and VMAT plans exceeded 95% (3%/2 mm) in both phantom validation and patient plan verification. Over two years, 175 patient plans were evaluated, covering a broad spectrum of disease sites and treatment techniques. M3D demonstrated reliable detection of clinically significant deviations, particularly in cases of TPS–M3D dose discrepancies greater than 3%. Workflow integration was efficient, with recalculation times averaging less than 5 minutes per plan. Conclusion: Mobius 3D was successfully commissioned for a Varian TrueBeam linac and has provided two years of robust, efficient, and clinically valuable independent dose verification. Its consistent performance supports its role as a complementary QA tool for IMRT and VMAT, strengthening confidence in patient-specific treatment delivery. Ongoing work focuses on expanding its utility in adaptive radiotherapy with daily CBCT image set recalculation and integrating deformable dose assessment.

Poster ID: 101

Title: Assessment of Beam Quality Parameters in radio-diagnosis; a comparative study

Author Names: Deepika S, Raj Kishor Bisht, Sneha Theres O J, Dharuman Vadivel, Thamarai Selvi P, Avinav Bharti, Sushma Rani Mandal, Pratik Kumar

Full Abstract:

Assessment of Beam Quality Parameters in radio-diagnosis; a comparative study Introduction and Purpose Half-Value Layer (HVL) and effective energy, has significant implications in image quality and radiation safety to the patient and staff in diagnostic radiology. The study is designed to compare available approaches to assess the quality of diagnostic X-ray beam. Materials and Methods The beam quality of conventional X-ray radiography unit was accessed at variable tube potential and inherent filtrations. In the manual method, the HVL was assessed using available aluminium filters of different thickness which was compared with the reading recorded on a calibrated solid-state detector (RTI Piranha 657). The manual method consists of a limited number of data points based on measurements that utilized attenuation. Solid-state dosimetry approach provides a direct reading from the dosimeter. A solid-state detector also allows to calculate effective energy of the X-ray beam through HVL value. Spectrum Processor is a theoretical estimation models with an ultimate goal of processing spectrum, which included an analytical method, a semi-empirical method, and a Monte Carlo approach. SpecPy and IPEM Report 78 were used as SPM in our study. These SPMs are typically able to combined critical empirical findings and set radiation system specific parameters to provide suggestion of diagnostic features instantly. Results and Discussion The manual method used for the estimation of HVL using aluminium filters is accurate, robust and economical. The HVL measurements have a close agreement with the direct method using solid-state detector however the manual method is time consuming and user-dependent. Solid-state dosimeters are users-friendly and provided fast and consistent HVL values in addition to this we calculate an effective energy of X-ray beam through HVL of the beam. SPM showed close agreement with the measured values, graphical spectral display and calculated effective energy, provided the system parameters specified precisely. The results of SPM are comparable to manual and solid-state detector consequently are reasonably useful in the assessment of beam quality with minimal setup. Conclusion In line with, manual, solid state detector and SPM, all methods are relevant, reliable, and can be used to evaluate beam quality of a diagnostic beam. The semi-empirical spectrum processors are able to improve accuracy and create standard quality protocols. SPM is an additional tool for improved results which helps in expressing the beam quality of radio-diagnostic imaging

Poster ID: 102

Title: Determination of Relative Electron Density for Accurate improved Dose Calculation accuracy in 4D Octavius Phantom.

Author Names: Yashika

Full Abstract:

Introduction and objective: Aim of this study is to determine an optimal Relative Electron Density for Octavius phantom that improves agreement between calculated and measured dose distributions. Materials and Methods: The Octavius 4D phantom, widely used for patient-specific quality assurance (PSQA), is designed to rotate with the gantry for 3D dose verification. However, in the Verisoft software, the phantom is modelled as a uniform homogeneous structure, while in reality the lower portion is partially hollow. In Monaco-TPS, dose calculation with Monte-Carlo algorithm depends on voxel-specific mass densities. Monaco-TPS coverts the electron density to mass density using the formula 1. However, this formula is originally derived for human tissues but Octavius phantom is made of polystyrene, with vendor-reported RED as 1.016, mass density calculated using this formula comes as 1.02g/cm³ which differs from vendor quoted value i.e. 1.05 g/cm³. Therefore, using RED as 1.016 may introduce systematic error in planned fluence calculation. Rho = (((0.99)^2 + 4*(0.01)*RED)^(1/2)- 0.99)/(2*0.01) for 0 RED<1 Rho = (RED-0.15)/0.85 for RED 1 Formula 1: Formula used by Monaco-TPS to convert relative electron density, RED to mass density, Rho. In this study, a homogeneous virtual phantom scan provided by PTW was used for dose calculation in Monaco TPS (version 5.11.03). The vendor-quoted mass density (1.05g/cm³) of the phantom was used to back-calculate the corresponding RED, using the same formula 1. Further, verification was performed by delivering a 10 × 10 cm² open field to the 4D Octavius phantom equipped with a 1500 array detector. The measured transverse dose profiles, acquired using Verisoft software(version 7.2.0.68), were compared with the planned profiles calculated for both the vendor-quoted RED (1.016) and the formula-derived RED. Results and Discussion: RED derived from the formula is 1.043. Transverse dose profiles calculated with RED = 1.016 showed deviations from the measured data fig.1. In contrast, when RED = 1.043 was used, the calculated and measured transverse profiles showed excellent agreement across all evaluated points , confirming the validity of the modified RED value. Conclusion: Accurate dose calculation in non-human phantoms requires customized RED assignment. For the Octavius 4D phantom, modifying RED to 1.043 ensures correct mass density representation in Monaco TPS and eliminates systematic discrepancies in fluence prediction. This approach enhances the reliability of PSQA. Key Words: PSQA, RED, Mass density.

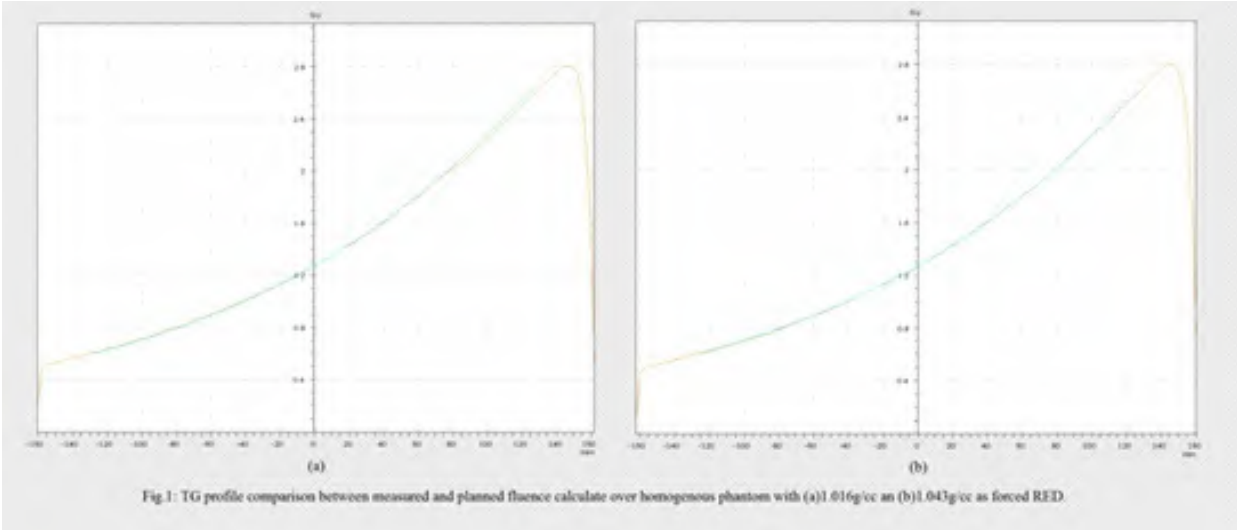


Fig.1: TG profile comparison between measured and planned fluence calculate over homogeneous phantom with (a)1.016g/cc an (b)1.043g/cc as forced RED.

Poster ID: 103

Title: Validating Dosimetric Leaf Gap (DLG) Measurements using Python Analysis of MLC Trajectory Files

Author Names: Sangeeta Hazarika, Jaswin Raj, Dr Seema Sharma, Dr Hajee Reyaz Ali, Dr V Subramani, Dr Suman Bhasker

Full Abstract:

Introduction: The accurate determination and implementation of Dosimetric leaf gap (DLG) in the treatment planning system (TPS) are paramount for accurate dose calculation and TPS modelling. Measuring DLG using the sweeping gap MLC patterns is a convenient way of measuring DLG using an ion chamber with a simple phantom. But traditional DLG measurement technique may not fully capture the dynamic behavior of MLCs. Truebeam trajectory files contain the expected and actual location of each individual leaf of the MLC, for both bank A and bank B for each time step. Detailed analysis of trajectory files provides the precise MLC gap width opened and pinpoints any deviations in individual leaf positions. Materials and Methods: Two methods were employed to calculate the DLG for two dosimetrically equivalent Truebeam machines. One of the methods was a conventional approach and the other one with trajectory files implemented with Python script. The conventional method utilizes vendor provided DLG QA plan incorporating seven sweeping gap fields of widths 2 mm, 4 mm, 6 mm, 10 mm, 14 mm, 16 mm, and 20 mm, two closed MLC fields and an open field. A reference field size of 10 cm × 10 cm was set by the X and Y jaws for all the above ten fields and measurements were performed using 0.125cc ionization chamber in Radiation field analyzer (RFA). Our alternative method involved a Python script using Python v3.11.4 to parse Varian log files from the delivered DLG QA plan. By analyzing the MLC leaf positions ascertained by this script, a subsequent Python script calculated the true gap width between opposing leaves during the DLG QA delivery. Results: The discrepancy between the actual and specified leaf gap width is minimal. The gap width-dose characteristic curve was determined from both methods, and DLG values derived from both methods are compared. Our results demonstrate that the trajectory-derived DLG values consistently agree with conventional measurements, with discrepancies less than 0.2 mm. Conclusion: This alternative method provides a significant advantage by allowing for the detection and quantification of unpredictable, transient deviations in leaf positions. By precisely identifying and measuring these deviations, this method directly contributes to a more accurate treatment planning system (TPS) modelling and patient safety.

Table: Difference in DLG values derived by Conventional method and Trajectory File based method

Energy (MV)	LINAC1 Conventional Method DLG (mm)	LINAC1 Trajectory File DLG (mm)	Difference (mm)	LINAC2 Conventional Method DLG (mm)	LINAC2 Trajectory File DLG (mm)	Difference (mm)
6	0.94697	0.78788	0.15909	1.22222	1.05147	0.17075
10	**1.04895**	**0.89510**	0.15385	**1.40278**	**1.22759**	0.17519
15	1.08054	0.92617	0.15436	1.38255	1.20000	0.18255
6FFF	**0.69231**	**0.53846**	0.15385	**1.06818**	**0.90152**	0.16667
10FFF	**0.97163**	**0.81560**	0.15603	**1.25352**	**1.07692**	0.17660

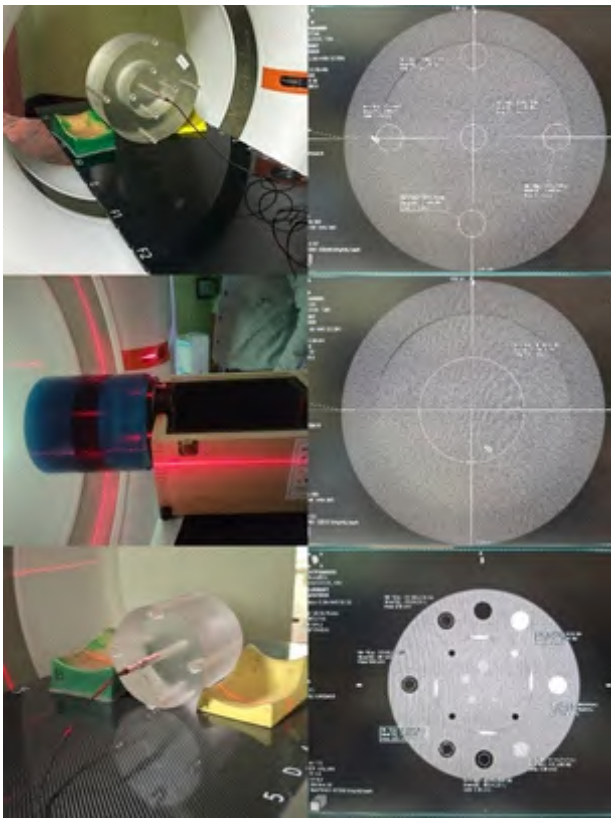
Poster ID: 104

Title: Evaluation of Image Quality and Dosimetric Performance of a Newly Commissioned CT Simulator for Radiotherapy.

Author Names: Jenifar Rahman, Shantanu Kr. Mishra

Full Abstract:

Introduction and Objective: Accurate CT simulation is fundamental to radiotherapy planning; enabling proper dose calculation, precise target and critical structure delineation. Image quality directly affects the ability to identify and delineate those target volume and surrounding critical structures. CT scanner dosimetry is a crucial component of initial acceptance testing and periodic quality assurance. This study aims to evaluate the image quality and dosimetric indices of a newly commissioned CT simulator to verify its readiness for clinical application. Materials and Methods: Comprehensive measurements were performed on a SOMATOM go.sim CT simulator using Catphan 700 phantom, Catphan 600 phantom, CTDI phantom. Initially, CT scan of the Catphan 700 phantom was taken at 120kVp and 1mm slice width and accuracy of slice reconstruction and image quality parameters like CT number linearity, spatial resolution, low contrast resolution, uniformity and noise were evaluated. Scans were reconstructed with slice thicknesses of 2, 3, 5 and 10mm and these parameters were evaluated again for respective slice thicknesses. Dependency of image parameters on tube voltage was checked by repeating the scans at tube voltages of 80kVp and 100kVp. By following the same procedures measurements were obtained for Catphan 600 phantom and both set of values were compared to check any deviation that can occur due to error present in the phantom material. Patient dose was determined by measuring Computed Tomography Dose Index (CTDI100) using a pencil ionization chamber of 10 cm length. Measurements were done in cylindrical CTDI head (16 cm diameter) and body (32 cm diameter) phantoms with different tube voltages across the axial section of the phantom. From the measured value of (CTDI100), weighted CTDI (CTDIW) is then calculated. Results and Discussions: Most image quality parameters (slice width, high contrast resolution, low contrast, uniformity, noise) and dosimetric indices (CTDI for head and body protocols) were found to be within manufacturer-specified values. However, a notable deviation was observed in the CT number linearity test, where the Hounsfield Unit for Teflon material was outside the acceptable range specified in Catphan700 manual. This specific anomaly, while not negating overall performance, highlights a potential calibration nuance that warrants further investigation due to its implications for accurate electron density assignment in treatment planning. Conclusion: The dosimetric performance of the CT simulator and image quality are within acceptable value which ensures reliable tumour visualization and dose calculation. This validates its safe and effective clinical application in radiotherapy.



Poster ID: 105

Title: DOSIMETRIC VERIFICATION OF PROSTATE SBRT ON CYBERKNIFE S7 USING SRS 1000 PROFILER`

Author Names: Sreeja R, Kalaiselvi M , Sarath Kumar P , Vendhan S, Saraswathi Chitra S

Full Abstract:

Introduction and Objective: The delivery of stereotactic body radiotherapy (SBRT) for prostate carcinoma requires meticulous patient-specific quality assurance (PSQA) to ensure the accuracy and safety of the treatment. The CyberKnife® S7 system, which utilizes non-isocentric, non-coplanar beam configurations with sub-millimeter targeting precision, necessitates verification tools capable of high-resolution analysis. This study aimed to assess the dosimetric fidelity and consistency of the SRS 1000 Profiler, a high-spatial resolution ion chamber array, for the pre-treatment verification of prostate SBRT plans. Methods: Ten prostate SBRT plans were developed using the Precision® treatment planning system for the CyberKnife S7, with each plan prescribed to a dose of 36.2 Gy delivered over 5 fractions. To acquire PSQA measurements, the SRS 1000 Profiler was integrated into a stereotactic end-to-end verification phantom, closely replicating the clinical setup geometry. The measured dose distributions were subsequently compared against the doses calculated by the treatment planning system (TPS) using PTW VeriSoft software. The primary endpoint for this analysis was the gamma passing rate, evaluated with stringent criteria of 1% dose-difference (DD) and 1 mm distance-to-agreement (DTA). Results: An exceptional mean gamma passing rate of 99.0% (± SD) was achieved across all evaluated plans using the 1 mm/1% criteria. The measured dose distributions demonstrated a high degree of concordance with the TPS calculations, confirming the robust delivery accuracy of the CyberKnife system under clinical operating conditions. Conclusion: The SRS 1000 Profiler offers an accurate, reproducible, and high-resolution method for the dosimetric verification of prostate SBRT administered via the CyberKnife S7 system. The profiler's sensitivity in the context of small-field dosimetry and steep dose gradients validates its utility as a principal quality assurance tool within SBRT workflows. Its integration ensures the consistent validation of the system's geometric and dosimetric precision before patient treatment is initiated.

Poster ID: 106

Title: Breaking the Myth: Point Dose and Gamma Index Correlation in SRS/SBRT QA

Author Names: VARSHA, PRONOY MAJHI

Full Abstract:

BACKGROUND/OBJECTIVE: High precision, high dose, fewer sessions – SRS and SBRT deliver radiation with sub-millimeter accuracy, making them effective yet error-sensitive, thus requiring robust quality assurance for safe and reliable treatment. The aim of the study is to evaluate patient-specific QA in 54 SRS/SBRT cases using point dose and 2D film dosimetry, identify potential errors, and propose strategies to enhance treatment accuracy. MATERIALS AND METHODS: Though QA may appear a single step, it involves multiple processes. Initial process began with film calibration, exposing set of film strips to known doses, scanning exposed films, followed by dose mapping in Red channel and then obtaining calibration curve. For PSQA, setup was CT simulated, exported, contoured, planned in TPS and then used for patient specific QA. Output was recorded each time prior to patient specific QA. Each case used Gafchromic EBT4 film and a pinpoint (CC01) ionization chamber for point dose and film measurements. Chamber doses were compared with TPS isocenter doses; film doses were analyzed using gamma index at various criteria and thresholds. RESULTS AND DISCUSSION: Red channel film analysis of film doses yielded good agreement with expected TPS doses. A total of 54 patients were analyzed for both Gamma index (3%3mm-95%passing rate with threshold of 5%) and Point dose deviation (±3%). 57% of cases passed both, 87% of the cases passed point dose measurements, out of which 66% passed gamma criteria. CONCLUSIONS: This demonstrates that while there is a weak overlap between the two QA methods, some discrepancies exist, highlighting the need for combined evaluation.

Poster ID: 108

Title: Establishment of National Diagnostic Reference Levels for Computed Tomography in Nepal

Author Names: Ram Narayan Yadav, Dr Buddha Ram Shah, Dr Nitu Sharma, Dr Karun Devkota, Dr NJ Ansari, Prof.Dr.HA Azhari, Prof.Dr.J.Jeyasugiththan

Full Abstract:

Establishment of National Diagnostic Reference Levels for Computed Tomography in Nepal RN Yadav1, 3, BR Shah2, N. Sharma3, K. Devkota4, NJ. Ansari5, HA Azhari6, J.Jeyasugiththan1 1Department of Nuclear Science, University of Colombo, Sri Lanka, 2Nepal academy of science and technology, Lalitpur, Nepal 3BP Koirala memorial cancer hospital, Bharatpur, Chitwan, Nepal 4Department of radiology, BP Koirala institute of health sciences, Dharan, Nepal 5Department of radiology, National Medical College, Birganj, Nepal 6Centre of Biomedical Science and Engineering, United International University,Dhaka Bangladesh Email of presenting author: rnyadav99@yahoo.com Background/Objective: Computed tomography (CT) scanner plays crucial roles for detecting pathology of patients. The CT scanner is widely used for diagnosis but it is relatively high dose imaging technique with a subsequent risk of radiation-induced cancer in radiosensitive organ. Therefore, it is imperative to minimize the radiation dose in procedures of CT imaging. Dose optimization strategies are implemented to adhere to the ALARA principle, which aims to minimize radiation exposure. This study aims to establish National Diagnostic Reference Levels (NDRLs) of CT scanner for head, chest and abdomen- pelvis procedures in Nepal to enhance dose optimization efforts. Materials and methods: This study was carried out for 24 CT scanners which are 35% of CT machines existing throughout country. The dose metrics such as volumetric CT dose index (CTDIvol), dose length product (DLP), exposure parameters and height-weight of 1440 patients were collected from Di-com header in such a way that data must be at least 20 for head, chest and abdomen-pelvis procedures performed over the period of 6 months from each scanner . Relying on inclusion and exclusion criteria, the values were excluded before analysis which were looked either extremely low or high to make sure that extracted data are from standard size patient. The typical values (median) of the dose distribution were calculated by using Microsoft Excel 2010 for every institution separately and finally NDRLs were calculated from it. Results: The NDRLs for computed tomography based on CTDIvol and DLP are proposed for non-contrast (NC) head:66.3mGy/1264.58 mGy.cm, chest(NC): 14.96mGy/530.74 mGy.cm,Chest(CE): 13.85 mGy/537 mGy.cm,Abdomen_Pelvis(NC): 15.9 mGy/840 mGy.cm, Abdomen_Pelvis(AP): 14.21 mGy/718.47 mGy.cm, Abdomen_Pelvis(PP): 16.10 mGy/788.8 mGy.cm, Abdomen_Pelvis(VP): 15.43 mGy/747.03 mGy.cm and Abdomen_Pelvis(DP): 12.39mGy/623.5 mGy.cm. Conclusions: This outcomes of the preliminary survey carried out in 24 CT scanners compared with DRLs values of other countries emphasize the potential of the dose optimization by establishment of NDRLs. Keywords: Computed Tomography (CT), Dose Reference Level (DRL), National Diagnostic Reference Levels(NDRLs)

Poster ID: 109

Title: Bulbul Hossain, Dr. Dilip Kumar Ray, Srimanta Pramanik, Dr. Bidyut Santra

Author Names: BULBUL HOSSAIN, Dr. Dilip Kumar Ray, Srimanta Pramanik, Dr. Bidyut Santra, Manindra Bhushan , Anuj Vijay , Raj Pal Singh, Riyas M

Full Abstract:

Evaluation of 2D Gamma Index for VMAT plan by Portal Dosimetry and Inhouse developed software Aim: The objective of this study was to evaluate the two-dimensional (2D) gamma index for Volumetric Modulated Arc Therapy (VMAT) treatment plans using Varian's Portal Dosimetry system and to validate the results through comparison with an in-house developed MATLAB-based analysis tool. Methods and Materials: Seventeen VMAT-treated patient plans were retrospectively selected. All treatment plans were generated using the Eclipse Treatment Planning System and delivered via a Varian TrueBEAM linear accelerator. Initial gamma index analysis was conducted using the integrated Portal Dosimetry system. An independent MATLAB-based algorithm was subsequently developed to compute 2D gamma pass rates using the same planned and measured dose distribution datasets. Gamma analysis was performed using four acceptance criteria: 2%/2 mm, 3%/3 mm, 4%/4 mm, and 5%/5 mm. The gamma passes rates derived from the MATLAB-based tool were compared with those obtained from the Portal Dosimetry system to assess agreement and validate the in-house approach. Results and Discussion: The mean gamma passes rates using MATLAB were 91.24% ± 8.28 (2%/2 mm), 99.08% ± 2.36 (3%/3 mm), 99.91% ± 0.27 (4%/4 mm), and 100% ± 0.00 (5%/5 mm). Corresponding values for Portal Dosimetry were 99.18% ± 1.34, 99.77% ± 0.58, 99.93% ± 0.20, and 99.99% ± 0.05, respectively. While both methods demonstrated strong agreement at relaxed criteria (3%/3 mm), greater variability was observed in MATLAB analysis at the strictest 2%/2 mm threshold, with pass rates ranging from 69.21% to 98.49%. In contrast, Portal Dosimetry results remained consistently above 94%, indicating higher stability. The discrepancy at tighter criteria may be attributed to differences in dose alignment, resolution, or interpolation methods. Nevertheless, the MATLAB tool successfully replicated Portal results under clinically acceptable thresholds, validating its potential for independent QA verification. Conclusion: Gamma pass rates for acceptance criteria of 3%/3 mm and above were highly satisfactory across both systems, confirming the reliability of the MATLAB-based QA tool for clinical use. However, for stricter criteria like 2%/2 mm, further refinement is needed in the MATLAB algorithm to improve accuracy and consistency. Future work will focus on expanding the tool's capabilities to include three-dimensional (3D) gamma analysis, thereby enabling more comprehensive dosimetric validation for complex treatment deliveries. Keywords: MATLAB programming, Gamma Index, Portal Dosimetry, patient specific QA

Poster ID: 111

Title: Dosimetric Evaluation of Setup Uncertainties in VMAT plans of Pelvic Cancer Using DVH Analysis

Author Names: Dr. Ramesh Gattu, Mr. A Rajesham, Dr. R Akhil , Dr. Ramidi Goutham Reddy, Prof M. Srinivas, Dr. K KrishnaMurthy

Full Abstract:

Dosimetric Evaluation of Setup Uncertainties in VMAT plans of Pelvic Cancer Using DVH Analysis Abstract Introduction & Objectives: Volumetric Modulated Arc Therapy (VMAT) offers precise dose delivery in pelvic cancer radiotherapy. However, its accuracy can be compromised by patient setup errors (PSE), which may lead to suboptimal target coverage and increased radiation to surrounding healthy tissues. This study aims to evaluate the dosimetric impact of setup errors on the planning target volume (PTV) and organs at risk (OARs) in pelvic cancer patients using the DVH Analyzer module of the Varian Eclipse Treatment Planning System. Materials & Methods: Fifty pelvic cancer patients treated with VMAT were retrospectively analyzed. For each patient, a baseline VMAT plan was created, followed by simulated plans incorporating translational setup errors in 1 mm increments upto 3mm along the X (lateral), Y (anteroposterior), and Z (craniocaudal) axes, resulting in 300 shifted plans. All plans were generated using the same beam configuration and optimization parameters. Dose-volume histogram (DVH) bands were created using the Varian-developed DVH Analyzer tool. Dosimetric indices such as D2%, D5%, D95%, and D98% for PTV, and maximum dose and volume-based metrics (e.g., D10, D5, V45) for OARs (bowel, bladder, rectum, and femoral heads) were extracted and compared with the reference plan. Statistical analysis was performed to evaluate the significance of the variations. Results & Discussion: Setup errors 3mm along X, Y and Z axes led to noticeable dosimetric changes. For the PTV, D98% and D95% were reduced by up to 8.36% and 4.76%, respectively, indicating compromised coverage. OARs showed increased dose exposure: Bowel: Max dose increased 2.94%, V45 increased 12.45% Bladder: Max dose increased 12.72%, D10 increased 0.9% Rectum: Max dose increased 4.14%, D10 increased 4.47% Left femoral head: Max dose increased 10.69%, D5 increased 24.19% Right femoral head: Max dose increased 8.14%, D5 increased 12.83% These findings demonstrate that even small positional shifts can significantly affect treatment quality, particularly for OARs close to the PTV. Conclusion: Patient setup errors can adversely impact both target coverage and OAR sparing in pelvic VMAT. The study supports the implementation of daily image guidance and robust setup verification to reduce uncertainties and improve treatment accuracy. Keywords: VMAT, Dose Volume Histogram, Patient Setup Error, Pelvic Cancer, Conformity Index, Homogeneity Index, Organs at Risk, Radiotherapy Planning

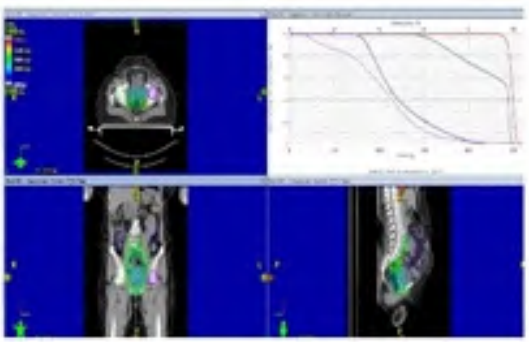


Table 1: PTV Mean and Standard Deviation

		MEAN	SD
PTV (cGy)	D98	4698.87	96.18
	D95	4808.38	57.69
	D5	5104.99	45.93
	D2	5124.48	48.97

Table 2: Mean and SD of various dosimetric parameters of OAR

		MEAN	SD
BOWEL	Max Dose(cGy)	5148.02	72.19
	V45(cc)	93.72	68.55
BLADDER	Max Dose(cGy)	5088.62	65.87
	D10	4973.01	71.04
RECTUM	Max Dose(cGy)	5120.85	74.00
	D10	4986.43	83.48
LEFH	Max Dose(cGy)	4811.98	236.45
	D5	4090.17	398.23
RIFH	Max Dose(cGy)	4624.46	251.16
	D5	3807.51	327.63

Poster ID: 112

Title: Assessment of dosimetric variation due to the creation of air cavity in vaginal cuff brachytherapy: A phantom study

Author Names: Jyoti Rawat , S.C. Uniyal , Ravi Kant , Vipul Nautiyal

Full Abstract:

Objective: A single-channel vaginal cylinder is most commonly used for postoperative vaginal cuff brachytherapy. While inserting the cylinder air pocket generates which displaces the vaginal wall from the cylinder tip and dose distribution changes simultaneously. This may cause an underdose of the vaginal cuff and failing the treatment. Methods and Material: A PMMA phantom simulating the patient of vaginal cuff brachytherapy is fabricated. Air cavities of different volumes were introduced around the applicator and at the apex of the central catheter to assess the dosimetric variation created due to their presence. Computed tomography scan of the phantom was taken with the presence of an air cavity and without an air cavity. TPS plans were generated with the same specification as for vaginal cuff brachytherapy patient and doses were calculated for both setups. Treatment plans were executed on brachytherapy HDR machine placing the Gafchromic EBT3 films in between the phantom slabs for dosimetry. Paired t test was used to examine the existence of any significance variation in both TPS doses without cavity (TD) to with cavity (TDC) and film dosimetry doses without cavity (FD) to with cavity (FDC). Results and discussion: Whisker-Box plot and Shapiro-Wilk test was used to check that the data for TD, TDC, FD, and FDC are normally distributed (p-value;0.01). Paired t test showed that there is a statistically significance variation from baseline to post change i.e. TD to TDC (p-value;0.05) and FD to FDC (p-value;0.05). Around the applicator the dose is reduced up to 19.8% in TPS dosimetry and 20.4% in film dosimetry for small volume cavity and for large cavity 35.8% in TPS dosimetry and 29.14% in film dosimetry. While at the apex of the applicator the dose is reduced up to 61.31% in TPS dosimetry and up to 50.58% in film dosimetry. Conclusion: The presence of air pocket at any location in the applicator reduces the dose coverage around the vaginal cuff and more significantly at the apex of the applicator. Therefore, each brachytherapy session should be considered for simulation and optimized for dose delivery.

Poster ID: 113

Title: Evaluation of three commercially available PSQA devices for IMRT and VMAT plans

Author Names: Hirakjyoti Baishya, Bhaveshwar Yadav

Full Abstract:

Evaluation of three commercially available PSQA devices for IMRT and VMAT plans Introduction and Objective: Patient Specific Quality Assurance (PSQA) is important and essential for the verification of TPS calculated dose against the measured dose for IMRT plans, prior to the treatment of the patient. In this study, we compared the results of PSQA done with three commercially available QA devices to investigate on the angular dependency of detector response and overall passing rate of the IMRT and VMAT plans. Materials and Method: IMRT QA plans of 10 patients were calculated and measured on the EPID portal dosimetry (OBI) of Varian, IBA MatriXX Evolution detector array and PTW Octavius 4D with Detector 1500; in two different settings- QA plans at zero-degree gantry angles and at the actual gantry angles. VMAT QA plans of 10 cases of Head and Neck patients were also evaluated using the three systems. In both the IMRT and VMAT PSQA, the IBA MatriXX Evolution detector array was placed stationary on the couch connected with a gantry angle sensor to correct for the angular response of the detector whereas the EPID(OBI) and the Octavius 4D were always perpendicular to the beam during the rotation of gantry. Result: The Dose Difference (DD) and Gamma passing criteria for 3%/3mm, 2%/2mm, 2%/1mm, and 1%/1mm were analyzed for all the plans for all the detectors. The planned and measured data were well within agreement and all the detectors have greater than 95% passing rates at 3%/3mm gamma criteria. Conclusion: The results showed that the differences in DD and gamma passing rates of the three detectors are insignificant and can be used interchangeably for routine PSQA. Keywords: IMRT, VMAT, Gamma analysis, Patient Specific Quality assurance, DD, DTA

Poster ID: 114

Title: Geometric Accuracy and Margin Evaluation in Deep Inspiration Breath Hold Radiotherapy for Left-Sided Breast Carcinoma Using Online Verification.

Author Names: Dilip Kumar Ray, Srimanta Pramanik, Poonam Ray, Souptik Maity, Atanu Kumar, Bulbul Hossain

Full Abstract:

Abstract : Objective: The primary objective of this study was to evaluate the geometric accuracy of radiotherapy delivery in left-sided breast carcinoma patients treated using the Deep Inspiration Breath Hold (DIBH) technique with a 0.5 cm gating window. The study focused on determining setup errors using online pre-treatment cone beam computed tomography (CBCT) and calculating the appropriate clinical target volume (CTV) to planning target volume (PTV) margins based on the observed setup uncertainties. Materials and Methods: A total of 23 patients diagnosed with left-sided breast carcinoma were enrolled and treated using the DIBH technique with a gating window of ±0.5 cm. All patients underwent daily online pre-treatment CBCT imaging for setup verification. The setup errors in the anteroposterior (AP), craniocaudal (CC), and mediolateral (ML) directions were quantified. These errors were further divided into systematic error (Σ), representing consistent deviations across treatment fractions, and random error (σ), representing day-to-day variations. To derive appropriate CTV to PTV margins in each direction, Van Herk's formula (2.5Σ + 0.7σ) and Stroom's formula (2Σ + 0.7σ) were applied. All image analysis and margin calculations were conducted using in-house software developed in Python. Results: The calculated systematic errors (Σ) were 0.241 cm (AP), 0.264 cm (CC), and 0.278 cm (ML), while the corresponding random errors (σ) were 0.393 cm (AP), 0.449 cm (CC), and 0.446 cm (ML). Based on Van Herk's formula, the derived margins were 1.007 cm (AP), 0.974 cm (CC), and 1.368 cm (ML). Margins calculated using Stroom's formula were slightly smaller: 0.757 cm (AP), 0.842 cm (CC), and 0.868 cm (ML). In all three directions, random errors were consistently larger than systematic errors. Conclusion: Our findings indicate that in DIBH-based radiotherapy for left-sided breast cancer, random setup errors dominate over systematic errors. The implementation of daily CBCT-guided online verification significantly enhances geometric precision, allowing for reduced and more individualized CTV to PTV margins. This approach can potentially improve target coverage while minimizing radiation dose to surrounding healthy tissues, particularly the heart and lungs. Future investigations will explore the impact of varying the gating window size on setup uncertainty and margin requirements, with an aim to further optimize DIBH protocols. Keywords: CBCT, Deep Inspiration Breath Hold (DIBH), Setup Error, Systematic Error, Random Error, CTV–PTV Margin, Breast Radiotherapy

Poster ID: 115

Title: Development and Validation of a Theoretical CT-to-RED Conversion Model for Enhanced Dose Accuracy in Radiotherapy

Author Names: Avin Kumar, Gowtham L, Sruthi Sreenivasan, K Kamalaksh Shenoy, Kavitha V S, Prathyush P Kumar, Karunakara N, Poornima S

Full Abstract:

Introduction and objective: Accurate dose calculation in radiotherapy critically depends on the fidelity of Hounsfield Unit (HU) to Relative Electron Density (RED) conversion, a cornerstone in modern treatment planning systems (TPS). Conventional calibration methods rely either on scanner-dependent default CT-to-RED tables or experimental data derived from CT tissue-equivalent phantoms. However, such approaches often lack adaptability to diverse imaging protocols and may compromise dosimetric precision, especially in advanced radiation delivery techniques. This study aims to develop a robust, theoretical, scanner-independent CT-to-RED conversion model, evaluate its dosimetric reliability, and benchmark it against existing clinical standards. Materials and methods: A custom two-segment piecewise linear function was designed to model the bilinear relationship between Hounsfield Units (HU) and Relative Electron Density (RED), with a continuity point at 100 HU, aligning with Elekta Monaco TPS calibration and CT Tissue Equivalent (CTTE) phantom data. A theoretical CT-to-RED conversion table was formulated empirically, covering a wide range of anatomical tissues, elements, and synthetic materials. CT imaging at 70–140 kVp was performed to assess HU variability and determine optimal scan settings. Three calibration curves theoretical, Monaco TPS-based, and CTTE phantom-derived were integrated into the Monaco TPS and used for treatment plan generation and dosimetric comparison to validate mapping accuracy and clinical relevance. Results and discussions: The theoretical RED curve demonstrated a high correlation with reference calibration models (adjusted $R^2 > 0.99$). The study revealed that HU values exhibited considerable kVp dependency at lower energies due to photoelectric effects, while higher voltages (120–140 kVp) produced more stable and linear HU-RED mappings due to Compton scatter dominance. Among the tested voltages, 120 kVp emerged as optimal for consistent and accurate electron density calibration. Treatment plans generated using the proposed model showed excellent agreement in target coverage and organ-at-risk sparing, with dose deviations well within ±3%, as per IAEA TRS 398 guidelines. Conclusion: The proposed theoretical CT-to-RED model provides a reliable, scanner-independent method for accurate electron density estimation and dose computation in radiotherapy. Its close alignment with phantom-derived and commercial TPS curves, along with favorable dosimetric outcomes, supports its clinical integration, particularly in high-precision modalities like Intensity Modulated Radiation Therapy (IMRT) and Volumetric Modulated Arc Therapy (VMAT). This model presents a promising solution for centers lacking access to regular phantom calibration, thereby standardizing dose calculation across varied imaging platforms. Keywords: CT-to-RED mapping, electron density calibration, radiotherapy dosimetry, treatment planning accuracy, HU conversion model

Slno	Tissue/ materials	Theoretical		Elekta Monaco TPS		CTTE Phantom	
		CT	RED	CT	RED	CT	RED
1	Air	-1000	0	-1000	0	-	
2	Low density lung	-810	0.19	-824	0.18	-	
3	Average density lung	-710	0.29	-718	0.28	-713	0.3
4	High density lung	-510	0.45	-564	0.44	-	
5	Polyvinyl pentane (PMP)	-200	0.8	-		-	
6	Adipose tissue	-		-115	0.95	-60	0.9
6	Breast	-50	0.95	-		-16	0.95
7	Solid water	-		-		-2	0.99
8	True water	-		-		17	1
9	Brain	40	1.04	-		24	1.03
10	Soft tissue / muscle	50	1.05	24	1.06	-	
11	Liver	70	1.07	-		40	1.05
12	Clotted blood	80	1.08	-		-	
13	Inner bone	-		-		200	1.2
14	Tumor / Trabecular	270	1.2	240	1.14	-	
15	Average bone	-		-		800	1.3
16	Rib	515	1.34	-		-	
17	Humerous	602	1.39	-		-	
18	Cranium	809	1.51	-		-	
19	Cortical compact bone	1138	1.7	1320	1.8	-	
20	Hard bone	-		-		1157	1.74
21	100% CaCO3	1600	1.97	-		-	
22	Bone mimic phantom	1057	2	1600	2	-	
23	Dental Enamel	2100	2.26	-		-	
24	Calcium Hydroxyapatite	3102	2.84	-		-	

Poster ID: 116

Title: Evaluation of the Impact of Patient Positioning Errors on QA Outcomes on Accuray Radixact X9 using the Delta⁴ Phantom+

Author Names: Vishram Naik, Amit Nirhali, Rupesh Pagare

Full Abstract:

INTRODUCTION & OBJECTIVES: Accurate patient positioning is critical in high-precision radiotherapy, particularly in stereotactic and small-field treatments where dose gradients are steep and margins are narrow. Minor translational or rotational errors during treatment delivery can lead to significant deviations from planned dose distributions. This study investigates the sensitivity of the Delta⁴ Phantom+ (ScandiDos) in detecting simulated patient setup errors and evaluates the clinical implications of such displacements on QA outcomes. METHODS & MATERIALS: A series of tomotheraphy helical plans, of SRT(stereotactic radiation therapy) brain, stereotactic body radiotherapy (SBRT) plans for spine, lung, and prostate, were delivered to the Delta⁴ Phantom+ under controlled conditions. After baseline QA was established with ideal alignment, deliberate couch shifts of ±1 mm, ±2 mm, and ±3 mm were introduced in the lateral (X), longitudinal (Y), and vertical (Z) directions. Additional rotations (±1–2°) were simulated using gantry rotation. Each perturbed setup was analyzed using 3D gamma index analysis (3%/2 mm and 2%/2 mm) and compared against baseline measurements. Dose differences in the high-dose regions and target volumes were quantified, and their potential correlation with planning target volume (PTV) margins was assessed. RESULTS & DISCUSSION: Results demonstrated that even small translational shifts of ±2 mm led to noticeable reductions in gamma pass rates, particularly in plans with sharp dose gradients and PTV margins 5 mm. Rotational misalignments introduced asymmetric dose deviations, especially in elongated target volumes like the spine. The Delta⁴ Phantom+ was sensitive enough to detect these variations, offering immediate feedback on the dosimetric consequences of setup uncertainties. CONCLUSION: In conclusion, this study highlights the critical impact of minor setup errors on treatment accuracy and the effectiveness of the Delta⁴ Phantom+ in identifying such errors during pre-treatment QA. These findings support the need for strict image-guided setup verification and potentially adapting PTV margins based on individual patient anatomy and treatment complexity.

Poster ID: 117

Title: Influence of IV Contrast in Bladder on Radiotherapy Dose Distribution: A Phantom-Based Study

Author Names: Sumeesh S, Dr. Saral Kumar Gupta , Dr. Raghavendra Holla , Aravind S, Dr. Bhooshan Zade, Dr. Shaiju V S, Dr. Raghukumar P

Full Abstract:

Background/Objective: Intravenous (IV) contrast administration in cervical cancer patients can alter bladder Hounsfield Units (HU) and electron density, potentially impacting dose calculations in radiotherapy. Due to inter-patient variability in contrast volume and accumulation, consistent and accurate dose estimation remains challenging. This study aims to quantify the dosimetric impact of varying bladder contrast volumes using an in-house-designed pelvic phantom. Materials and Methods: Thirty cervical cancer patients who received intravenous (IV) contrast during CT simulation were selected for initial analysis. It was observed that the amount of contrast accumulated in the bladder varied significantly among patients, introducing uncertainties in accurate dose calculation due to changes in Hounsfield Units (HU) and electron density. To systematically evaluate this effect, an in-house pelvic phantom was designed, and a 3D-printed bladder cavity was made to replicate a 500-cc volume, enabling controlled filling with up to 500 ml of intravenous contrast. To simulate varying contrast levels, the bladder was sequentially filled with water combined with 0 ml (baseline), 50 ml, 100 ml, 200 ml, 300 ml, 400 ml, and 500 ml of IV contrast medium, and CT scans were acquired at each level. For each image set, the bladder, rectum, and planning target volume (PTV) were contoured. Radiotherapy treatment plans were generated, and dosimetric parameters, including mean and maximum doses to the PTV and organs-at-risk (OARs), were calculated to assess the impact of contrast volume on dose distribution. Results: Preliminary analysis demonstrated dose discrepancies correlating with increasing bladder contrast volumes, affecting both target coverage and OAR sparing. The extent of overestimation or underestimation in dose delivery was directly related to the contrast volume within the bladder. Conclusion: IV contrast in the bladder significantly influences radiotherapy dose calculations due to changes in HU and electron density. A standardized phantom study confirms that varying contrast volumes can lead to clinically relevant dose deviations. These findings highlight the importance of accounting for IV contrast effects in treatment planning to ensure accurate and safe dose delivery in cervical cases.

Poster ID: 118

Title: Performance Characteristics of Digital PET-CT System According to the NEMA NU2-2012 Standard

Author Names: P.Kaliyappan, G.Murugan, G.M.Vignesh Krishna

Full Abstract:

Introduction and Objective: United Imaging PET-CT systems utilize digital detectors based on Silicon Photomultiplier (SiPM) technology coupled with Lutetium-Yttrium Oxyorthosilicate (LYSO) crystals. The objective is to perform NEMA procedures for acceptance testing and quality assurance (QA) to ensure optimal performance and functional reliability of PET - CT imaging system. Materials and Methods The whole-body PET scanner uMI550 PET-CT system with detector of lutetium yttrium oxyorthosilicate (LYSO) 64680 crystals. This crystal favored for high light output, high density, fast decay time, good energy resolution, non-hygroscopic as well as with unique feature of intrinsic radioactivity, the crystal contains small amount of radioactive lutetium-176. The PET scanner has 84 ring of detectors with a 722-mm diameter. The PET transverse field-of-view (FOV) is 700 mm. The simplified PET quality control (QC) tests protocol of NEMA NU2-2012 was used for evaluating spatial resolution, sensitivity, scatter fraction, Noise equivalent count rate (NECR), energy resolution, PET - CT alignment, and count rate performance, accuracy of corrections, image contrast, scatter/ attenuation correction, and image uniformity were performed. Results and Discussions The measured value of spatial resolution in tangential. radial and axial direction at the centre and 10 cm from the central axis in 3D mode acquisition was 2.87, 3.03,3.03 and 3.21, 3.36, 3.04 respectively. The measured value of sensitivity and scatter fraction were 10.56 kCPS/MBq and 38.08 % , the peak value of NECR 121.55 and activity at which this NECR achieve in 421.1, the energy resolution was 11.69%, coincidence of timing resolution for TOF was 366.796, the accuracy of attenuation and scatter correction was 7.8 %, the accuracy of activity quantitation in MBq/ml was 0.0053%, the accuracy of PET-CT image registration for matrix size of 512 x 512 0.334 and -0.559. The results were evaluated against the standards provided by the manufacturer found to be within manufacture specified reference values. Conclusion After the acceptance testing phase, the PET-CT scanner was commissioned for clinical operation and this new technology of LYSO crystals detector and its application in PET scanner eliminated the need of sealed source procurement for equipment performance evaluation, radiation exposure of the operator to radiation from the radioactive source. and the in-built daily quality control software tool of uCare iQC eliminates the time consumption of manual procedure of daily quality control test procedures of PET-CT system.

Poster ID: 119

Title: Dosimetric uncertainties in Skin Dose Estimation: Impact of Body Contours on skin dose estimation in Halcyon and TrueBeam for IMRT H&N Radiotherapy.

Author Names: Ms.Arva Meraj Pandith, Mr Kulbir Singh, Mr Munish kumar, Mr Aman kumar, Ms Nidhi Jain, Ms Bhagyalakshmi AT, Mr Suresh Chaudhri, Ms Rahila Sherin

Full Abstract:

Objective: Skin dose estimation ,which is prone to significant dosimetric uncertainties is critical in H&N radiotherapy, where most patients experience skin toxicity. This study seeks to estimate dosimetric uncertainties associated with skin dose calculations due to Body contours-True body and an Extended body for H&N IMRT using Halcyon and TrueBeam. Materials and Methods: This study took cases of 20 H&N patients with PTVs close to skin. Two structure sets representing True Body (TB),the standard patient outline, and Extended Body (EB), an extended contour including thermoplastic mask were delineated in the contouring workspace.For each structure set, a 7-field IMRT plan was generated in Eclipse 16.1,using Beam Angle Optimization (PGO 13.7) and Photon Optimizer (PO 16.1). Mean skin doses were computed using Analytical Anisotropic Algorithm (AAA 16.1). All plans maintained identical beam angle and optimization objectives,with the only variation being body contour. Further, variations were made in Grid size(1mm,2.5mm,5mm),Energy (6x,10x,15x),Treatment machine(Truebeam,Halcyon)for each body contour configuration.The effects were assessed statistically using paired t-tests and two-way ANOVA. Results: Extended Body contour predicted higher skin doses than True Body contours across all grid sizes with mean differences of +2.5–4.6 Gy & p value < 0.0001.The discrepancy was most pronounced at 5mm by True body of almost 20% underestimation. True Body contours exhibited strong grid size dependence with 1mm grids yielding 20–26% higher dose than 5mm ($p < 0.000001$).Extended Body contours were grid-stable with only 2–4% variation across grid sizes ($p = 0.003$). No significant differences in skin dose were found between Halcyon and TrueBeam ($p > 0.05$) for either contour type or grid size. Variation in beam energy posed no significant changes to the skin dose, for either of the body contours with p=0.151 Conclusion: This study recommends use of Extended Body contour at a grid size of 2.5mm. If True Body contour is to be used, then 1 mm grid should be prioritized.Choice of energy should be based on target depth rather than skin sparing concerns. Halcyon and TrueBeam achieve similar skin dose distributions in treatment planning, despite differences in their delivery systems. Keywords: Dosimetric uncertainty, Skin dose, Grid size, Halcyon, TrueBeam.

Poster ID: 120

Title: Quantifying Isocentre Accuracy Error in Medical LINACs Using a Line Spread Function Approach.

Author Names: Aneesa A, Rijin NT, Midhun CV, M M Musthafa, Aparna PK, Hari Govind, Theerthraj Verma

Full Abstract:

Background/Objective: Accurate isocentre localisation is essential for high precision radiotherapy. Gantry misalignment and non-linear rotational movement introduce systematic errors that affect treatment quality and patient safety. This study presents a theoretical and experimental framework for quantifying isocentre accuracy errors in medical LINACs, integrating signal processing concepts and a novel application of the Line Spread Function (LSF) approach. Materials and Methods: The research begins by modelling error propagation in potentiometer-based gantry rotation systems due to analogue-to-digital conversion limitations. A mathematical model was derived that links positional errors with gantry radius and angular uncertainty, resulting in a Laguerre-type differential equation. The solution yields the fifth-order generalised Laguerre polynomial, which captures rotational behaviour and associated boundary conditions. To validate the theory, experimental measurements were performed using a translation counter developed with a MEMS accelerometer and PIC-16F77a microcontroller. Isocentre accuracy was evaluated through stationery and arc-mode exposures, and the FWHM (Full Width at Half Maximum) of Gaussian line profiles was extracted using digitised film analysis. Conventional star pattern methods were also used for comparison, but showed relatively higher uncertainty Results: The theoretical model accurately predicted isocentre shifts using known ADC least counts. Digitised film methods provided a significant reduction in measurement uncertainty (0.5%) compared to traditional star-pattern evaluations (5 50%). Arc-mode exposures, when analysed with the LSF approach, enabled finer detection of sub-millimetre deviations in isocentre positioning. Experimental results matched well with theoretical predictions, reinforcing the model's validity. Conclusions: This study introduces a comprehensive mathematical model to predict isocentre shifts in rotating gantry systems, grounded in ADC error analysis and validated through experimental observations. The proposed LSF-based method enhances isocentre accuracy verification with reduced uncertainty, suggesting its potential as a QA tool in radiotherapy centres. The technique bridges a critical gap in precision measurement, offering a reliable alternative to conventional methods. Keywords: Isocentre accuracy, Line Spread Function, Gantry rotation, ADC error, Radiotherapy QA, Laguerre polynomial.

Poster ID: 121

Title: Prospective Study on Patient-Specific QA Pass Rates with Elekta Harmony Pro Using Epibeam EPID Software and IBA Matrixx Resolution.

Author Names: Akkupalle Vijaya Kumar, Dharavath Suresh, Dr. K.r Muralidhar, Mandadi Keerthi

Full Abstract:

Background: Accurate and efficient patient-specific quality assurance (QA) is essential in radiotherapy to ensure precise and safe dose delivery. The Elekta Harmony Pro linear accelerator, recently installed at our center, offers advanced intensity-modulated radiotherapy (IMRT) and volumetric-modulated arc therapy (VMAT) capabilities. To optimize QA workflows, this study evaluates and compares the performance of two QA systems–Epibeam EPID-based software (integrated with Elekta linac) and IBA Matrixx Resolution 2D ion chamber array–in terms of gamma pass rates, measurement time, and setup convenience. The objective is to determine their suitability for routine clinical use in a high-volume radiotherapy setting. Materials and Methods: A prospective study was conducted involving 50 treatment plans across five anatomical sites: cervix (n=10), breast (n=10), tongue (n=11), esophagus (n=10), and head & neck (H&N, n=9). All plans were generated using the Monaco Treatment Planning System (TPS) (v6.1.4, Elekta) and delivered on the Elekta Harmony Pro linear accelerator. Patient-specific QA was performed using two systems: 1. Epibeam EPID Software: Integrated with the Elekta linac, utilizing electronic portal imaging device (EPID) for dose measurements. 2. IBA Matrixx Resolution: A 2D ion chamber array paired with myQA software for independent dose verification. Gamma analysis was conducted per AAPM TG-218 guidelines at the following criteria: 3%/3mm (standard clinical threshold), 3%/2mm, 2%/2mm, and 1%/1mm (stringent criteria for high-precision evaluation). The table-1 summarizes gamma pass rates. Results:Both systems achieved high pass rates (>95%) at 3%/3mm and 3%/2mm, with no significant differences (p>0.05) for most sites. At 2%/2mm, Matrixx showed slightly higher pass rates for esophagus (99.84% vs. 95.54%, p=0.02). At 1%/1mm, Matrixx outperformed Epibeam for cervix (85.02% vs. 75.39%, p=0.03) and esophagus (93.03% vs. 83.47%, p=0.01), attributed to its higher spatial resolution. Conclusion: Both Epibeam EPID Software and IBA Matrixx Resolution are effective for patient-specific QA on the Elekta Harmony Pro, with comparable gamma pass rates at standard clinical criteria (3%/3mm, 3%/2mm). Epibeam's integration with the linac offers significant time savings, making it ideal for high-volume clinical environments with routine IMRT/VMAT plans. Matrixx Resolution, with its superior spatial resolution and independent verification, is better suited for complex treatment plans requiring detailed 2D dose analysis or independent QA validation.

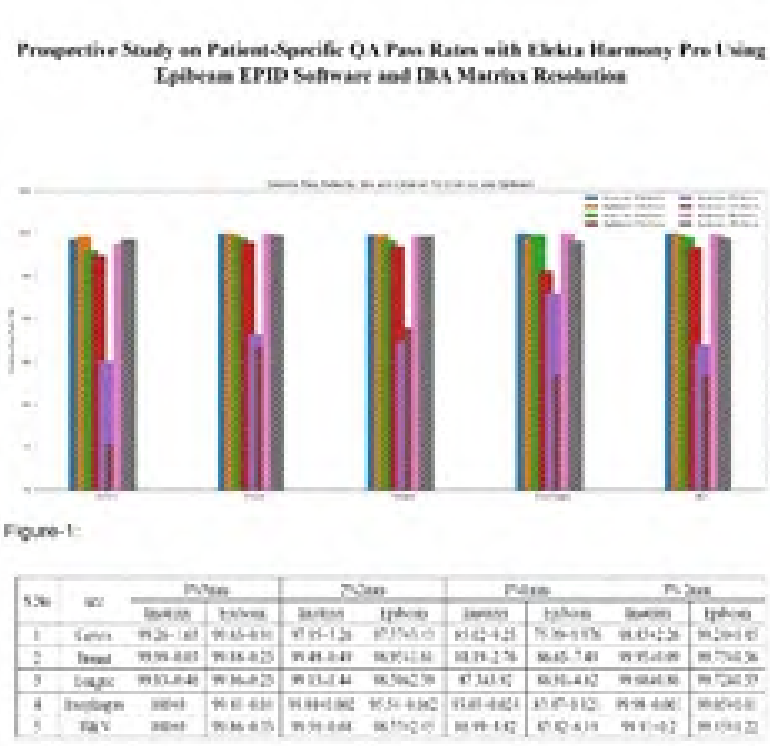


Figure-1:

Poster ID: 122

Title: IMRT Commissioning in Accordance with AAPM TG-119 Recommendations following the upgrade of the Elekta Synergy Linear Accelerator and Monaco TPS at BBCI

Author Names: Krishnajyoti Saikia, Bhaveshwar Yadav

Full Abstract:

Introduction & Objectives: American Association of Physicist in Medicine (AAPM) Task Group 119 (TG 119) provides a set of tests for the testament of accuracy of the IMRT planning and delivery systems. These commissioning tests includes Multitarget, Mock Prostate, Mock Head/Neck and C-Shape. Each having individual dose specification and dose goals to be achieved through IMRT. Here, we created both IMRT and VMAT plans based on the proposals given in the TG to check their performance in Elekta Synergy. The plans were compared and analysis of the results of Patient Specific Quality Assurance (PSQA) were carried out, with the primary objective of determination of the effectiveness of the newly implemented VMAT modality in an Elekta Synergy linear accelerator. Methods & Materials: The plans that were used for each study-set were: 7-9 IMRT fields, 1-2 full arc VMAT method. The photon energy was 6 MV, in Monaco TPS, using Monte Carlo (MC) algorithm for plan optimization and dose calculation. Both Pareto and Constrained optimization were used. The measurements performed were: 'point' dose with an ion chamber in a phantom for the composite irradiation and 'planar field-by-field' dose distributions with PTW Octavious 4D with Detector 1500 and IBA MatriXX Evolution detector array. The planer dose distribution was analysed using gamma analysis for all the plans with 3% dose difference (DD) and 3 mm distance to agreement (DTA) criteria and percent of points with gamma <= 1.00 was recorded. Also, confidence limits were determined for point doses as well as planer dose distributions. Results & Discussion: The dose goals recommended by TG 119 were achieved for all the plans in Monaco TPS. The composite point dose differences between planned and measured values for all the plans were within ±3%. For all the plans, the planar dose distributions met the 3%/3 mm gamma criteria, achieving passing rates above 95% for both 'field-by-field' and composite fields. Conclusion: The tests recommended by AAPM TG 119 were effectively carried out and the feasibility of both IMRT, VMAT was analysed. It was found that the IMRT and VMAT plans passed the tests. Keywords: TG 119, IMRT/VMAT QA, Patient Specific Quality Assurance (PSQA), IMRT commissioning, Elekta Synergy

Poster ID: 123

Title: Evaluation of the Impact of Patient Positioning Errors on QA Outcomes in Radiotherapy Using the Delta⁴ Phantom+

Author Names: VISHRAM NAIK, AMIT NIRHALI, RUPESH PAGARE

Full Abstract:

Accurate patient positioning is critical in high-precision radiotherapy, particularly in stereotactic and small-field treatments where dose gradients are steep and margins are narrow. Minor translational or rotational errors during treatment delivery can lead to significant deviations from planned dose distributions. This study investigates the sensitivity of the Delta⁴ Phantom+ (ScandiDos) in detecting simulated patient setup errors and evaluates the clinical implications of such displacements on QA outcomes. A series of tomotheraphy helical plans, of SRS(stereotactic radiosurgery) brain, stereotactic body radiotherapy (SBRT) plans for spine, lung, and prostate, were delivered to the Delta⁴ Phantom+ under controlled conditions. After baseline QA was established with ideal alignment, deliberate couch shifts of ±1 mm, ±2 mm, and ±3 mm were introduced in the lateral (X), longitudinal (Y), and vertical (Z) directions. Additional rotations (±1–2°) were simulated using gantry rotation. Each perturbed setup was analyzed using 3D gamma index analysis (3%/2 mm and 2%/2 mm) and compared against baseline measurements. Dose differences in the high-dose regions and target volumes were quantified, and their potential correlation with planning target volume (PTV) margins was assessed. Results demonstrated that even small translational shifts of ±2 mm led to noticeable reductions in gamma pass rates, particularly in plans with sharp dose gradients and PTV margins 5 mm. Rotational misalignments introduced asymmetric dose deviations, especially in elongated target volumes like the spine. The Delta⁴ Phantom+ was sensitive enough to detect these variations, offering immediate feedback on the dosimetric consequences of setup uncertainties. In conclusion, this study highlights the critical impact of minor setup errors on treatment accuracy and the effectiveness of the Delta⁴ Phantom+ in identifying such errors during pre-treatment QA. These findings support the need for strict image-guided setup verification and potentially adapting PTV margins based on individual patient anatomy and treatment complexity.

Poster ID: 124

Title: Evaluating the Clinical Goals Tool for Treatment Plan Review in Eclipse Version 18.0.1 Treatment Planning System

Author Names: R Prabhu, P.Manimegalai, Dr.Sathish, Dr.Mangaladevi

Full Abstract:

Introduction Quality assurance (QA) in radiotherapy planning plays a critical role in ensuring optimal clinical outcomes. With increasing case load and complexity of modern radiotherapy plans, the need for automated and standardized review tools has become more evident. The Clinical Goals module in Eclipse TPS version 18.0.1 Varian Medical Systems, USA inc., offers an integrated solution to evaluate dose-volume metrics against predefined clinical objectives, using a pass/fail traffic-light system. This tool promises to streamline plan reviews and reduce variability between planners and reviewers. Aims and Objectives To assess the accuracy, efficiency, and user perception of the Clinical Goals tool in Eclipse v18.0.1 across multiple treatment sites significantly enhance plan quality for complex plans like IMRT, VMAT, SBRT, SRS and to determine its suitability as a standardized QA mechanism in radiotherapy plan evaluation. Materials and Methods A retrospective study of 50 radiotherapy plans (including head & neck, breast, prostate, and thoracic cases) was conducted using Eclipse v18.0.1. For each plan, institutional dose-volume objectives were loaded into the Clinical Goals tool and evaluated. Automated assessments were compared with manual DVH reviews by two experienced medical physicists and one radiation oncologist. Metrics analyzed included sensitivity of error detection, time savings during review, inter-observer agreement, and qualitative feedback from users. Statistical analysis was performed to assess consistency and accuracy. Results The Clinical Goals tool successfully identified 96% of deviations from institutional objectives. Time required for plan review was reduced by an average of 40%, with notable improvements in high-volume departments. Agreement between reviewers increased, with Cohen's kappa values improving from 0.72 (manual review) to 0.89 (Clinical Goals-assisted review). Users found the interface intuitive and helpful for early identification of plan shortcomings. However, cases involving personalized constraints or palliative intent required manual interpretation, indicating a need for flexible goal templates. Conclusion The Clinical Goals module in Eclipse v18.0.1 proves to be an effective tool for improving treatment plan evaluation as well as the required time for plan review was reduced. It enhances efficiency, reduces subjective variation, and supports clinical decision-making in radiotherapy QA. Incorporating Clinical Goals into routine workflow can benefit busy departments aiming to maintain high standards. Future improvements could focus on greater customizability and integration with advanced planning protocols for complex and non-conventional cases and to maintain clinical relevance regular updating and customization of goals templates are recommended.

Poster ID: 125

Title: Transferability of patient treatment plans between two beam matched LINACs

Author Names: Jaswin Raj Nm, Seema Sharma, Sangeeta Hazarika, Hajee Reyaz Ali Sahib K, V.subramni , Suman Bhaskar

Full Abstract:

Introduction and Objective: To evaluate the transferability of patient treatment plans between two beam matched LINACs. Purpose: Beam matching of linear accelerators (LINACs) plays an important role for transferability of treatment plans between two beam matched LINACs. The aim is to evaluate the variation in treatment plan delivery on changing between beam matched LINACs. Materials and Methods: Two Varian TrueBeam™SVS (V2.7) (Millennium 120-leaf Multi-Leaf Collimator) have been commissioned for having beam profiles, percentage depth doses, beam quality index, dose rate, output factor, dosimetric leaf gap (DLG), penumbra and output within 1%. Other mechanical parameters are also matched 1mm. Twenty treatment plans of different sites have been generated for LINAC-1 using Varian Eclipse treatment planning system using Acuros XB (15.6), with 6 MV (FF and FFF) photon beams. Monitor unit (MU) calculations were performed using a grid size of 0.25 cm. Plan was also transferred to LINAC-2 , pre-treatment patient specific quality assurance (PSQA) has been done for both the LINAC's using Verisoft Patient Plan Verification Software for verification with PTW OCTAVIUS 4D phantom & OCTAVIOUS1500 detector. Evaluation was done using gamma index 3%/2mm criteria. Results and Discussions: Measurement shows that PSQA result was 99.2± 3% for LINAC-1 and 98.6± 2% for LINAC-2 using Gamma passing criteria of (3%/2mm). The maximum variation in Gamma Passing rate between two LINACs was 0.82±0.11%. Variation in plan delivery may be due to daily treatment output and difference in other mechanical parameters. Conclusion: The variation in PSQA is less that 1% on interchanging between LINACs and shows dosimetric equivalent. This allows transferring plan either of the LINAC interchangeably providing flexibility in patient scheduling, treatment delivery and LINAC maintenance. Key Words: Beam matched LINAC, Portability of plans, Patient specific quality assurance

Poster ID: 126

Title: Evaluation of the True-Beam machine performance check (MPC) application

Author Names: Seema Sharma, Sangeeta Hazarika, Jaswin Raj, Hazee Reyaz Ali, Jyoti Yadav, V. Subramani, Suman Bhaskar

Full Abstract:

Introduction and Objective: The Machine Performance Check (MPC) is a Varian semi-automated application designed to be used on a daily basis to verify the mechanical and dosimetric performance of Truebeam linear accelerators. Therefore, aim is to evaluate stability of output measurements over a period of six months (n=24) and compare it with MPC results. Materials and Methods: The MPC was performed weekly, for six months, on a Varian TrueBeam for five photon energies (6x, 10x, 15x, 6xFFF, and 10xFFF). MPC Output result was compared with 0.6cc ionization chamber (TM30013, PTW) and a daily check device (Quick Check, PTW). The MPC daily check requires the Varian IsoCal™ phantom to be attached to the couch top at index position H2. For ion chamber-based measurement the source to surface distance (SSD) was kept at 100 cm and the ion chamber was inserted into the adapter Plate at 10 cm depth. The Quick Check, daily check device has 13 vented ion chambers. The Quick Check was placed on the couch, aligned to the crosshairs, with SSD of 100 cm using a 20 x 20 cm2 field size and 100 MU was delivered per measurement. Whenever output variation was more than 2.0% in ion chamber measurement, output calibration was done and MPC baseline was resaved. Results and Discussions: The variation of 6x MPC output compared to ion chamber and Quick Check was 1.56±0.23% and 1.21±0.15% respectively. Similarly, output variation between MPC versus ion chamber for 10x, 15x, 6xFFF and 10xFFF was 1.32±0.62%, 1.51±0.18%, 1.71±0.25%, 1.36±0.13% respectively. Output variation between MPC versus Quick Check for 10x, 15x, 6xFFF and 10xFFF was 1.24±0.32%, 1.47±0.11%, 1.56±0.13%, 1.28±0.43% respectively. The maximum difference between ion chamber and MPC was 1.82%. Result showed the maximum difference between Quick Check and MPC was 1.74%. The results also suggest that the MPC output is comparable to the Quick Check measurements compared to ion chamber. Conclusion: Although MPC measured output result was in good agreement with the output measured with the Quick Check and ion chamber. But for daily output verification machine-independent ion chamber-based measurement will be more reliable. Key Words: Daily Output, MPC, Quick check

Poster ID: 127

Title: Safety Significance of Quality Assurance Test parameters for Positron Emission Tomography (PET) Imaging Systems

Author Names: Seepika Reddy, Jolly Joseph, Namitha Krishnakumar, G. Sahani, P. K. Dash Sharma

Full Abstract:

Introduction and Objective: Positron Emission Tomography (PET) is a vital tool in nuclear medicine, for acquiring high-resolution functional images. Technological advancements such as time-of-flight (TOF), digital detectors, and hybrid PET/CT and PET/MRI systems have enhanced spatial accuracy, signal-to-noise ratio, and lesion detectability. PET systems can provide accurate, reliable, and reproducible results when they perform optimally through proper calibration and regular quality checks. For this, Atomic Energy Regulatory Board (AERB) has established a quality assurance (QA) test protocol, considering national/international recommendations such as NEMA NU 1-2021 and IAEA. This study provides technical basis for each PET QA parameter prescribed by AERB correlating them with safety performance of the equipment. Materials and Methods: AERB QA protocol includes assessments of spatial resolution, system sensitivity, scatter fraction, noise equivalent count rate (NECR), energy and coincidence timing resolution, attenuation/scatter correction accuracy, PET/CT co-registration, image uniformity, normalization, and quantitation accuracy. Each QA parameter was analyzed for its technical basis and associated safety significance. Results and Discussions: The Standardized Uptake Value (SUV) is a quantitative PET parameter that measures radiotracer concentration in tissue, normalized to injected activity and patient body metrics. Tests for spatial resolution accuracy are crucial as they determine how sharply small lesions or fine anatomical structures appear; poor spatial resolution causes quantitative errors in SUV and can mislead clinical decisions. TOF timing degradation reduces contrast recovery, limiting lesion detectability in low-contrast regions. Reduced system sensitivity can lead to longer scan durations and increased administered activity; both increase patient dose. An elevated scatter fraction and poor attenuation/scatter correction result in non-uniform background and inaccurate SUV values, leading to potential clinical misinterpretation. PET and CT image misregistration compromises lesion localization and may cause inaccurate tumour delineation in radiotherapy planning. Uniformity variations are associated with ring artefacts and edge non-uniformities, which can introduce artificial false negatives (missed pathology) or false positives (artefacts) resulting in repeated scans. NECR trends indicate the optimal count-rate range for maintaining image quality without dose escalation. Failure in any of these tests can compromise image accuracy, leading to misleading clinical decisions, repeat scans, and increased patient dose. Conclusion: QA protocols are vital for evaluating and maintaining the safety performance of PET equipment. QA tests enable early detection of hardware drift, image-artifacts, and quantification errors. Integrating QA into routine workflows ensures equipment longevity, minimizes unnecessary radiation exposure to patients, reduces the need of repeat scans, and optimizes exposure in accordance with the ALARA principle.

Poster ID: 128

Title: Dosimetric Assessment of Treatment Plan Transferability Between Factory Beam-Matched Varian Linear Accelerators: A Multi-Site VMAT and IMRT Analysis

Author Names: Dr. Deepali Bhaskar Patil, Dr. Mukesh Kumar Zope, Prof. (Dr.) Seema Devi, Prof. (Dr.) Rajesh Kumar Singh

Full Abstract:

Introduction and Objective Modern radiation therapy departments typically utilize multiple linear accelerators to improve patient throughput and maintain service continuity during downtimes. Factory beam-matched linear accelerator is built to support seamless transfer of treatment plans, there is limited clinical validation available. This study investigates the dosimetric consistency and clinical transferability of plans between Varian TrueBeam SVC and Clinac-iX linear accelerator across different anatomical regions, aiming to create safe transfer protocols. Materials and Methods A comprehensive dosimetric evaluation of eighty clinical treatment plans was carried out, consisting of 40 intensity-modulated radiotherapy (IMRT) plans (20 for cervix and 20 for head and neck) and 40 volumetric modulated arc therapy (VMAT) plans (20 for breast and 20 for urinary bladder). Both accelerators underwent independent commissioning according to standardized AAPM protocols. Treatment plans that were initially optimized on one machine were recalculated on the other accelerator using identical parameters. The dosimetric comparisons included metrics for planning target volume coverage (D95%, D50%, D2%) and constraints for organs at risk. Patient-specific quality assurance was conducted using the Arc-CHECK phantom with gamma analysis criteria of 3%/2mm. Transferable fractions were computed based on ICRU-50 (±5% tolerance) and AAPM (±2% tolerance) guidelines. Results and Discussion Commissioning validation revealed excellent agreement within ±1% for all dosimetric parameters. Head and neck IMRT presented minimal differences (PTV D95%: -0.26%, $p<0.001$) and the highest transferability (median 39%, 10-14 fractions per ICRU-50). Breast VMAT successfully preserved organ-at-risk sparing with moderate transferability (median 19%, 2-4 fractions). Urinary bladder VMAT showed acceptable transferability (median 29%, 7-11 fractions). Cervical IMRT demonstrated systematic dose increases on TrueBeam (PTV D95%: +1.57%, $p=0.012$) with limited transferability (median 14%, 1-2 fractions). All plans achieved gamma passing rates exceeding 97.3%, with VMAT exhibiting better consistency compared to IMRT (99.1% versus 97.3-98.6%). Conclusion Beam-matched linear accelerators in factories allow for the transfer of treatment plans that are clinically acceptable, maintaining high dosimetric consistency across most anatomical regions. VMAT provides superior transferability and delivery accuracy in comparison to IMRT. However, the site-specific variations indicate a need for personalized validation. Overall, these findings support the safe clinical sharing of treatment plans between beam-matched accelerators, provided that strict quality assurance protocols are followed. Keywords: Factory beam matching LINAC, dosimetric comparison, treatment planning, patient specific QA

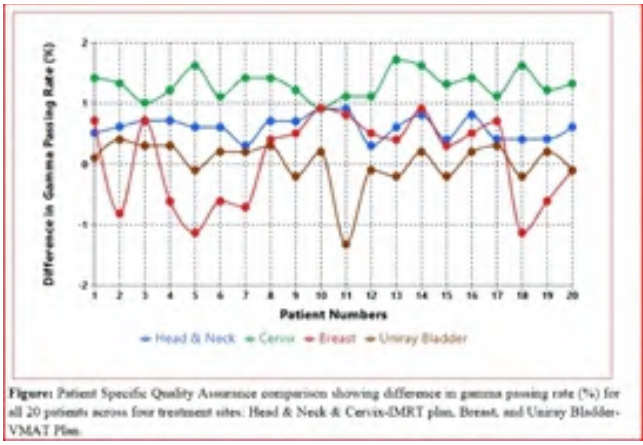


Figure: Patient Specific Quality Assurance comparison showing difference in gamma passing rate (%) for all 20 patients across four treatment sites: Head & Neck & Cervix-IMRT plan, Breast, and Urinary Bladder-VMAT Plan.

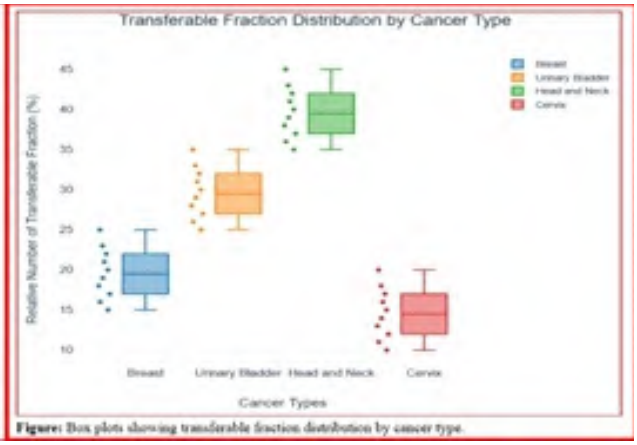


Figure: Box plots showing transferable fraction distribution by cancer type.

Poster ID: 129

Title: Evaluation of doses to different parts of left ventricle (i.e lateral, apical, septal, inferior) and different segments (i.e proximal, mid and distal) of LAD, LCX and RCA for left sided breast cancer patients by different radiotherapy techniques

Author Names: L Sagar Singha, Dr. SP Mishra, Dr. Mohsin Khan, Dr. Deepika Ramola, SD Gupta, Dr Aastha Verma, Dr. Surbhi Kumari

Full Abstract:

Evaluation of doses in different parts of left ventricle (lateral, apical, septal and inferior) and different segments (i.e proximal, mid and distal) of LAD, LCX, RCA for left sided breast cancer patients by different radiotherapy techniques L. Sagar Singha, Dr. SP Mishra, Dr. AK Srivastava, Dr. Mohsin Khan, SD Gupta, Dr. D Ramola, Dr. A Verma, Dr. S Kumari. Abstract Aim: The aim of this study is to evaluate the doses to different parts of left ventricle (LV) and different segments of LAD (left anterior descending artery) , LCX (left circumflex) and RCA (right coronary artery) for left sided breast cancer patients and compare them by different radiotherapy techniques. Methods : In this study we randomly selected 10 post mastectomy left sided breast cancer patients and generated four treatment plans for each patient: 1) standard tangential field-in-field (FinF) , 2) intensity modulated radiotherapy (IMRT) , 3) tangential VMAT (tVMAT) with a dual arcs of 35-50° , 4) continuous VMAT (cVMAT) with a dual arc of 240-260°. The plans were created using Monaco treatment planning system for Elekta Infinity accelerator and 6MV or 10MV energy was used. Results: The lateral and apical LV received minimum Dmean (7.66 ± 4.56Gy and 17.33 ± 4.61Gy respectively) from cVMAT and highest Dmean (21.29 ± 6.96Gy and 38 ± 4.87Gy respectively) from IMRT. However V5Gy of lateral and apical LV was delivered minimum (49.93 ± 15.24 % and 87.56 ± 7.31% respectively) by tVMAT. Also tVMAT delivered least Dmean to septal and inferior LV (3.72 ± 0.93Gy and 2.40 ± 0.49Gy respectively). And V5Gy for septal and inferior LV was delivered minimum (13.31 ± 12.49% and 2.32 ± 2.93% respectively) by tVMAT. Significant dose sparing of LAD (proximal Dmean=4.33 ± 1.24Gy, mid Dmean=19.93 ± 10.81Gy, distal Dmean=36.96 ± 6.16Gy) was achieved by cVMAT as compared to other techniques. However, standard FinF delivered minimum dose to LCX (proximal Dmean=2.12 ± 0.49Gy, distal Dmean=1.13 ± 0.23Gy) and RCA (proximal Dmean=2.63 ± 1.33Gy, mid Dmean=2.26 ± 1.13Gy, and distal Dmean=1.55 ± 0.87Gy) as compared to other techniques. Conclusion: cVMAT gave higher dose avoidance to lateral LV, apical LV and LAD (proximal, mid and distal). However, tVMAT delivered minimum dose to septal and inferior LV. Also standard FinF delivered minimum dose to LCX (proximal, distal) as well as RCA (proximal, mid and distal).

Poster ID: 130

Title: Influence of Target Volume on Tumor Control Probability in Radiotherapy: A Retrospective Analysis

Author Names: Dr. Gurpreet Kaur, Dr. Vinod Kumar Dangwal, Dr. Garima Gaur, Dr. Pardeep Garg

Full Abstract:

Introduction and Objective: Tumor Control Probability (TCP) represents the probability of eliminating a tumor with a given radiation dose. Target volume is a key variable that may influence TCP, especially in the context of conformal radiotherapy. The objective of the study is to analysis the relationship between target volume and TCP in radiotherapy patients. Materials & Methods: A retrospective analysis was performed on 49 clinical plans. All these patients were treated with external radiotherapy of 46Gy in 23 fractions to the central disease followed by 6Gy in 3 fractions to parametrium involved with central shielding along with concurrent cisplatin chemotherapy (3 weekly cycles) followed by brachytherapy of 7.5Gy per fraction of 3 fractions. The target volume involved in the study is the volume of target in brachytherapy only. Target volumes ranged from 17.84 cc to 61.92 cc and TCP values ranged from 73% to 98%. Volumes were grouped into 5 bins (like histogram intervals), and trend was identify by using suitable statistics. Result & Discussions: The outcome of the study showed that small volumes (15–25 cc) are highly favorable and showing consistently high TCP (96–98%). The volume ranges from 25–35 cc still performs well but have some cases with lower TCP (87%). The 35–45 cc group volume is the most populated, with a wider TCP range and lower average, including the lowest TCP value (73%). The volumes above 45 cc showed a consistent decline in average TCP and having increased variability. The group having largest volumes (55–65 cc) had the lowest average TCP (86%), indicating significant challenges in treatment control. The analysis shows that larger tumor volumes are associated with reduced TCP, likely due to hypoxia, dose inhomogeneity, and geometric complexity. This highlights the need for adaptive planning, dose escalation, and biologically-guided optimization in treating high-volume tumors conformity, accounting for biological heterogeneity, and allowing for real-time adjustments based on tumor response. Conclusion: TCP is inversely related to target volume, with small tumors showing excellent control rates and large tumors exhibiting decreased effectiveness despite advanced planning. This analysis help to identify certain tumor volume limits that can be used to categorize patients based on their risk levels and to adjust treatment plans more effectively in clinical radiotherapy. Keywords: Tumor Control Probability, Radiotherapy, Brachytherapy, Target Volume, Volume Binning

Poster ID: 131

Title: Planning and Designing of Structural Shielding Layout for Computed Tomography Scanner - Our experience:

Author Names: Dr N Balasubramanian, Dr Ashok Chauhan, Dr Rajeev Atri, Dr Rakesh Dhankar, Dr Narayan Prasad Patel, Dr Jyotsna Sen, Dr Seema Rohilla, Mr Jai Singh

Full Abstract:

Background: Tomography (CT) scanners are widely utilized as an essential imaging modality, both in India and globally. During the planning and installation of a CT facility, it is necessary to ensure radiation safety for radiation workers, the general public, and the environment at all levels. The structural shielding requirements, particularly the thickness of secondary barriers, must be determined in accordance with the methodology outlined in the National Council on Radiation Protection and Measurements (NCRP) Report No. 147 and the Atomic Energy Regulatory Board (AERB) safety code and associated shielding guidelines. It is important to note that primary barrier shielding calculations are not applicable for CT installations, as the primary X-ray beam is confined within the gantry and does not directly strike any of the structural barrier. Aim: This study aims to design a structural shielding layout plan to enable the safe installation and operation of a CT scanner within a diagnostic radiology facility. Materials and Methods: A multidisciplinary committee was formed in line with national protocols, comprising the hospital administrator, radiologist, medical physicist, vendor, structural engineer, and a representative from HITES (HLL Infra Tech Services Limited). A Memorandum of Understanding (MoU) was signed between HITES and the institutional authority to construct the CT scanner room on a turnkey basis. The shielding design layout was prepared as per AERB standards and incorporates all required parameters: workload (W), use factor (U), occupancy factor (T), distance from the isocenter (d), and permissible dose limit (P). Shielding thickness for stray radiation–encompassing both scattered and leakage radiation–was calculated using methodologies from IAEA, NCRP, and AERB guidelines. Dose constraints were set at 20 µSv/week for the general public and 400 µSv/week for radiation workers. The figure 1 shows the layout plan of Diagnostic CT Scanner room with shielding thickness. Results and Discussion: The final site and layout plans were prepared following the e-Licensing of Radiation Applications (eLORA) portal guidelines and submitted for regulatory review. Upon approval by the competent authority, construction was executed in accordance with the approved shielding design. Conclusion: The completed CT scanner room demonstrates compliance with national and international radiation safety norms. The shielding design ensures optimal protection for staff, the public, and the environment, validating the facility as safe for the installation and operational use of a CT scanner within the diagnostic radiology department. Keywords: CT scanner, structural shielding, radiation safety, shielding calculation, AERB, NCRP

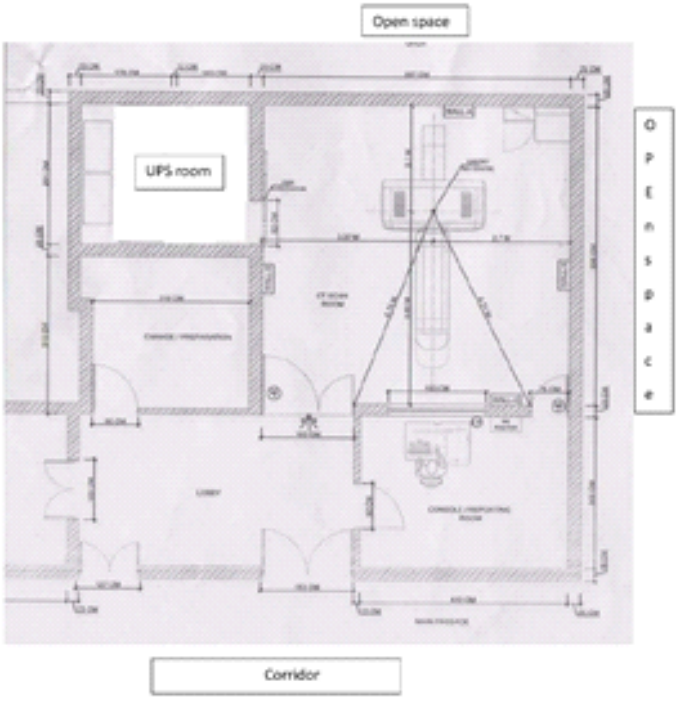


Figure 1 shows that CT scanner position, console and space around CT room and their shielding thickness around the CT room.

Poster ID: 132

Title: Non-compliance-our experience a study

Author Names: R. Pichumani

Full Abstract:

NON-COMPLIANCE OUR EXPERIENCE Introduction: Every Institute may have some NON-Compliances in elora and based on that espi(Electronic Safety performance indicator) values are assigned by elora. Generally for any institute it is good to have espi>0.95 to be in good books of AERB. Objective: Our institute under 3 roles viz ., Radiology,Radiotherapy and Nuclear medicine has many NCs and some are quite unique under different circumstances and we solved it to achieve a espi >0.95. Materials and methods: The NCs under different head and challenges faced to solve and possible ways to avoid are discussed in this poster Results and Discussion: The NCs are successfully solved and our institute attained an espi value of >0.95.

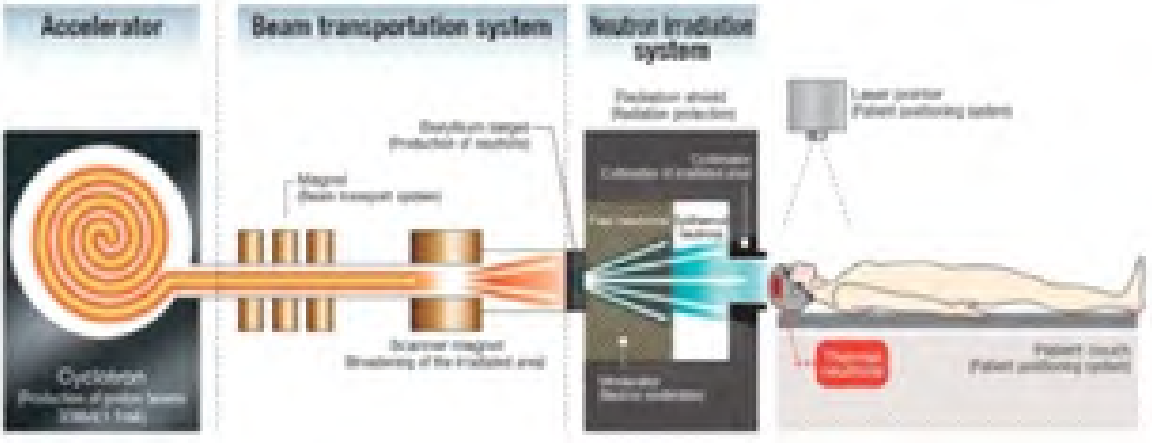
Poster ID: 133

Title: Regulatory challenges for Accelerator based Boron Neutron Capture Therapy (AB-BNCT) Facilities

Author Names: Dr. Rajib Lochan Sha, Dr. Pankaj Tandon, Dr. G. Sahani

Full Abstract:

Background/Objective: Accelerator based Boron Neutron Capture Therapy (AB-BNCT) is an emerging field viable for providing one of the best treatment to cancer patients (mostly for brain and head & neck tumors). BNCT involves the use of a boron-containing drug that is injected into the patient's bloodstream, which is then absorbed by the tumor cells. The patient is then exposed to a beam of neutrons, which interact with the injected boron atoms in the tumor cells, causing them to release high-energy particles that destroy the tumor cells while sparing neighboring healthy cell unlike other current methods of cancer treatment. Materials and methods: Radiotherapy facilities in India are mainly regulated with the help of the Safety Code on "Radiation Therapy Sources, Equipment and Installations AERB/RF/SC/ MED-1 (Rev.1) 2011" published by AERB. This Code does not address Accelerator Based Boron Neutron therapy facilities (AB-BNCT) since no such facility is in operation in our country . However, on view of the rapid growing and uses of advanced technology in health care, it is expected that, there will be AB-BNCT facility in India in near future. Hence, there is need to establish regulatory requirements for BNCT facilities in India to ensure safe operation (in-built safety & operational safety) of such facilities. Results and Discussions: The regulatory challenges to establish regulatory requirement for AB-BNCT facility to ensure safe use of such facilities are identified such as: i) Siting & shielding evaluation criteria, ii) Safety interlock mechanism, iii) Infrastructure to start BNCT facility such as trained man power, type of phantom, type of radiation measuring & monitoring instruments, iv) requirement of Radiation protection gears, v) activation product . In addition, development of various application formats, acceptance test/QA formats for licensing such facility are essential to regulate such facilities. The facility in which the accelerator will be installed needs to be designed and constructed under the supervision of appropriate radiation safety personals. As recommended in IAEA recent publication on “Advances in AB-BNCT”, the following functional spaces such as neutron delivery space, boron laboratory space, radioactive waste space etc. need to be installed and to be considered when designing an Accelerator based BNCT facility. Conclusion: AERB has identified the regulatory challenges for regulating AB-BNCT facility. As a proactive approach to address the regulatory challenges for regulation of such facility, a guidance document on regulatory aspects of AB-BNCT has been prepared. Keywords: radiation safety, Boron Neutron Capture Therapy (BNCT), accelerator.



Poster ID: 134

Title: Safety Significance of Quality Assurance Test parameters for Single Photon Emission Computed Tomography (SPECT) Imaging Systems.

Author Names: Dheera A, Jolly Joseph, Namitha Krishnakumar, Dr.G.Sahani, Dr.P.K.Dash Sharma

Full Abstract:

Introduction & Objective: Single Photon Emission Computed Tomography (SPECT) is essential for acquiring functional images critical to medical diagnosis. The accuracy and reliability of these diagnostic outcomes largely depend on the optimal performance of the SPECT system. To ensure this, the Atomic Energy Regulatory Board (AERB) has established a quality assurance (QA) test protocol, considering national/international recommendations such as NEMA NU 1-2021 and IAEA. Systematic QA protocol help in mitigating system-related errors, obtaining desired diagnostic information with minimum radiation dose. This study provides technical basis for each SPECT QA parameter prescribed by AERB correlating them with safety performance of the equipment. Materials & Methods: AERB QA test protocol comprises several test parameters such as intrinsic and extrinsic spatial resolution, integral and differential uniformity, centre-of-rotation (COR) accuracy, energy peaking, system sensitivity, multiple window spatial registration (MWSR) and tomographic contrast and resolution. Technical basis of each test parameters were analysed for its impact on image quality and radiation safety. Results & Discussions: Energy peaking and uniformity tests are critical for issues such as degraded image quality, improper event selection, hotspots, artifacts etc. which leads to misinterpretation of images. Poor spatial linearity causes geometric distortion of images, incorrect sensitivity can result in under or over estimation of radiotracer uptake which leads to reacquisition of images and thereby increasing the patient dose, Accurate count rate performance is required for better image quality. Poor spatial resolution can blur small lesions leading to false negatives (missed pathology) or false positives (artifacts) resulting in repeated scans or misinterpretation of scans. Tomographic uniformity and rotational uniformity assessments validate system response across angular views, ensuring the consistency of reconstructed images. The integrity of shielding is required to prevent absorption of scattered gamma rays and for better image quality. Poor energy resolution leads to overlap of scatter and photo peak regions, degraded image contrast and higher chances of false positives or negatives. Failure in any of these tests can compromise image accuracy, leading to clinical misinterpretation or repeated scans. Conclusion: A robust QA program is essential to ensure the performance of the equipment as intended. It plays an integral part in fulfilling the regulatory requirement, for establishing a comprehensive quality assurance programme for acceptance of the unit for clinical use as well as for generating baseline data for subsequent annual performance survey. Any deviation from baseline values should trigger corrective actions to maintain optimal system performance.The AERB established QA

Poster ID: 135

Title: Analysis of Non-Genuine Excessive Exposure Cases Reported for Nuclear Medicine Practice: Causes and Preventive Measures

Author Names: Aswini. N, Namitha. Krishnakumar, Jolly Joseph K, Dheera. A, Dr. G.Sahani, Dr. P.K. Dash Sharma

Full Abstract:

Introduction and Objective: In Nuclear Medicine (NM) practice, where radiopharmaceuticals involving open isotopes are routinely used for diagnostic and therapeutic purposes, adherence to radiation protection and safety measures is critical. Atomic Energy Regulatory Board (AERB) has prescribed dose limit of 1 mSv per year for the members of public, and 20 mSv per year averaged over five consecutive years, with a maximum of 30 mSv in any single year for occupational radiation workers. Thermoluminescent dosimeter (TLD) badges are used for personnel monitoring of radiation workers and dose evaluated on a quarterly basis. Exposure of 10 mSv to occupational worker in a monitoring period is considered to be investigation level. Therefore, investigation is carried out above 10 mSv to find out root cause to take corrective measures. Such exposure cases also indicates poor safety culture of the institute. Materials and Methods: Nuclear medicine (NM) practices accounted for only 0.7% of total reported radiation exposure cases, and a total of 139 incidents exceeding investigation levels across India between 2016 and 2024. Each case underwent detailed assessment, including review of TLD dose records, facility reports, exposure history, isotopes handled by the worker, safety practices, safety precautions followed and dose reports of other staff members. For doses 100 mSv, chromosome aberration tests were conducted. AERB's review committee analyses exposures as genuine or non-genuine. Results and Discussions: The analysis of these exposure cases reveals that ~ 80% of the reported cases were non genuine and ~ 20% were considered to be genuine. Genuine cases were mainly due to contamination or spillage of radiopharmaceutical and procedural lapses. The major causes of non-genuine cases were found to be inappropriate storage of TLD badges (in active areas, hot labs and source storage rooms), inadvertent contamination/ accidental spillage of radioactivity on wrist or chest badges while handling radionuclides, and TLD badges falling onto contaminated work surfaces. Non-genuine cases often resulted from lapses in radiation safety practices, improper badge handling, or unintended exposure beyond routine clinical procedures. Figure 1 shows measures to prevent genuine and non-genuine exposure cases. Conclusion: There is a critical need for strengthening radiation safety culture through regular training, strict enforcement of operational protocols, and improved oversight of dosimeter usage. Importantly, facilities can proactively minimize such incidents by setting internal investigation thresholds below 10 mSv and implementing timely independent reviews. Such measures would not only reduce false alarms but also improve overall compliance and worker safety.

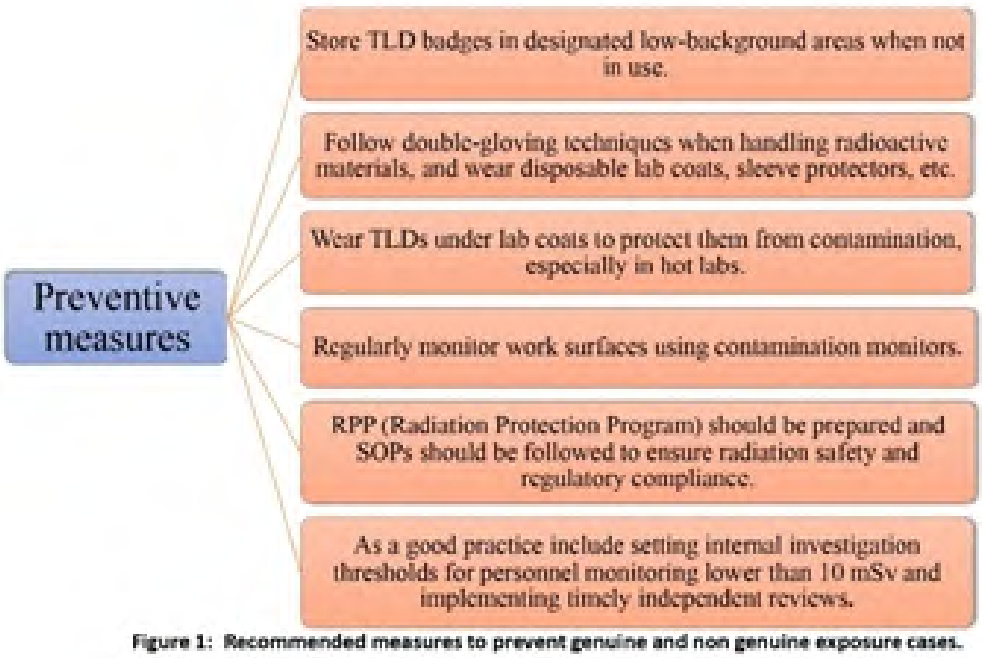


Figure 1: Recommended measures to prevent genuine and non genuine exposure cases.

Poster ID: 136

Title: Observation of inadequate shielding in newly constructed radiotherapy installations during assessment of radiological survey data

Author Names: Pramod Kumar Dixit, Smriti Sharma, G. Sahani , P. K. Dash Sharma

Full Abstract:

Introduction and objective: Radiotherapy facilities use various radiation sources that require installations with adequate shielding to protect radiation workers and the public. Such installation shall be designed with adequate shielding and to be constructed with due approval from AERB. Upon completion, a radiological protection survey is conducted to verify shielding adequacy. Recently, during assessment of the radiological protection survey data and regulatory inspection, AERB has observed unacceptable radiation levels in some cases. This abstract outlines the causes of these issues and required preventive measures. Materials and Methods: During the review of radiological protection survey data of one radiotherapy facility, it was observed that in spite of construction as per approved plan, the estimated weekly dose was exceeding the planned dose limit on the external surface of the primary wall(s). Despite of having identical distances from the isocenter and equal wall thicknesses, the radiation level on the external surfaces of both primary walls differed significantly. This clearly indicates the deficiencies in the construction material/quality of construction in achieving desired density. In another instance, during regulatory inspection, AERB official(s) noticed a high radiation level (~2000 µSv/hr) at certain points on the primary wall. Review of the initial survey records showed no such readings had been recorded earlier. Another radiological protection survey using smaller grid size identified the exact location of high radiation level and drilling at that point uncovered an air gap of about 5 cm in diameter. Due to small size of the air gap and larger grid size, it was missed in the initial survey. Results and Discussions Based on investigation of all the above cases, it was noticed that the employer/licensee had not ensured adequate supervision of quality control during construction, resulting in elevated radiation levels. As a result, AERB issued a circular to institutions, advising them to maintain construction quality and to conduct comprehensive radiological protection surveys using small grid sizes. It is also worth noting that, AERB has observed instances where the weekly dose estimations by radiotherapy facilities are incorrect due to not appropriately analysing the instantaneous dose rate by using correct unit for radiation level, workloads, use factors and occupancy factors. Conclusion Poor quality control during construction of radiotherapy installation can lead to radiation protection issues, increased financial costs and delays in obtaining regulatory approvals. Employer/Licensee should ascertain the quality control during construction of the installation and analyse instantaneous dose rate appropriately for weekly dose estimation.

Poster ID: 137

Title: Development of Personal Monitoring Dose Reporting System based on FRAPPE framework

Author Names: Dr Annex E H, Ashitha M K, Alma Peter, Amala N Kumar, Dr Debnarayan Dutta, Aadilakshmi S Menon, Sankaran Narayanan

Full Abstract:

INTRODUCTION AND OBJECTIVE: Radiation safety and Personal Monitoring System (PMS) data base management is especially important in hospitals, which handles higher number of PMS badges for its radiation workers/professionals. Developing such database is crucial for tracking, managing, and reporting the personal radiation dose received by the occupational workers. Keeping all the data like dose received, training attended, and trend analysis of the department and individual facilitates the preventive measures to reduce the exposure by timely follow up training. This demands an electronic recording and auditing system to handle enormous quantities of data. MATERIALS AND METHODS: FRAPPE framework-based interface developed for the management of PMS service in the institute. Developed in collaboration with the Information Technology (IT) department. This interface works in the server based and multiple user access is allowed for data entry and management. Initial data entry can be done by manual or database integration. Details of the workers are cross-checked and added to the data like UID (Aadhar number, Name, Mobile number, etc.). Server OS: Linux (Ubuntu LTS recommended; also compatible with Debian-based distributions). Client OS: Windows, macOS, Linux, Android, iOS. Hardware requirement is one which supports the OS (CPU: Quad-core processor 2.0 GHz+ - RAM: 8 GB minimum of 16 GB recommended for larger datasets). Faster data entry is possible with the bar code scanner to input the incoming badge details. Dose report from the PMS service providers can be uploaded to the system to generate customized reports. The training details of the radiation workers (introductory/refresher) also integrated. RESULTS AND DISCUSSION: The reports can be generated in departmental basis, Individual basis, exposure limit basis, as required in the institution for the auditing of the different agencies like NABH. Multiple user interface with admin/local users will facilitate data handlining safe and secure. With this system intimating the users for PMS related updates periodically. Automatically alerting the worker dose directly to his/her mobile/e-mail to meet the regulatory requirement. CONCLUSION: With this system monitoring and reporting of the PMS is easy to handle. As a part of development mobile apps and integrating with hospital database to keep the radiation worker dose with the employ id/UID. To ensure data security in transit and at-rest database encryption is also implimented. KEYWORDS: Personal Monitoring Device, Radiation Safety, FRAPPE, Data Management.

Poster ID: 138

Title: Regulatory Framework for Radiation Safety in Medical Applications: A Comprehensive Analysis of Patient and Staff Safety.

Author Names: Dr. Dipak Anant Bauskar, Dr. Surendra Singh Rathod, Dr. Rupali Shyam Jamode, Pratibha Dipak Bauskar

Full Abstract:

Introduction and Objective: The use of radiation in medical applications has revolutionized healthcare, enabling diagnosis and treatment of various medical conditions. However, radiation exposure poses significant risks to patients and staff, understanding the need for a robust regulatory framework to ensure safety. It will give a comprehensive analysis of the legal framework in India strives to create a culture of safety in medical applications of radiation, balancing the benefits of radiation-based diagnosis and therapy with the need to protect both patients and staff from its potential harms. Material and Methods: The Atomic Energy Act, 1962 provides the legal framework for the development, control, and use of atomic energy in India for peaceful purposes. The Atomic Energy (Radiation Protection) Rules, 2004, enacted under the 1962 Act, specifically address radiation safety. This presentation will study the existing laws, regulations, and guidelines related to radiation safety, including those set forth by national and international authorities such as the Atomic Energy Regulatory Board (AERB), International Commission on Radiological Protection (ICRP), and International Atomic Energy Agency (IAEA). Results and Discussion: 1. Patient Safety: Radiation protection measures for patients, informed consent, and liability for radiation-related harm. 2. Staff Safety: The framework mandates use of preventive measures, personnel monitoring, working hours and adherence to dose limits to protect healthcare professionals from radiation hazards. 3. Constitutional remedies in India: All individuals can utilize constitutional provisions like Article 32 (for fundamental rights) and Article 226 (for other legal rights) to approach the High Courts or Supreme Court for relief. 4. Best Practices: Strategies for optimizing radiation safety, including quality assurance, quality control, and radiation safety training. Conclusion: This more elaborate version provides a detailed overview of the regulatory framework and best practices in radiation safety, highlighting the importance of protecting both patients and staff in medical applications involving radiation. The Indian Constitution guarantees fundamental rights to all citizens, including the right to life and personal liberty (Article 21). The Universal Declaration of Human Rights (1948) emphasizes the fundamental dignity and equality of all human beings. Keywords: ARTICLE 32, ARTICLE 226, UDHR, AERB, IAEA, ICRP

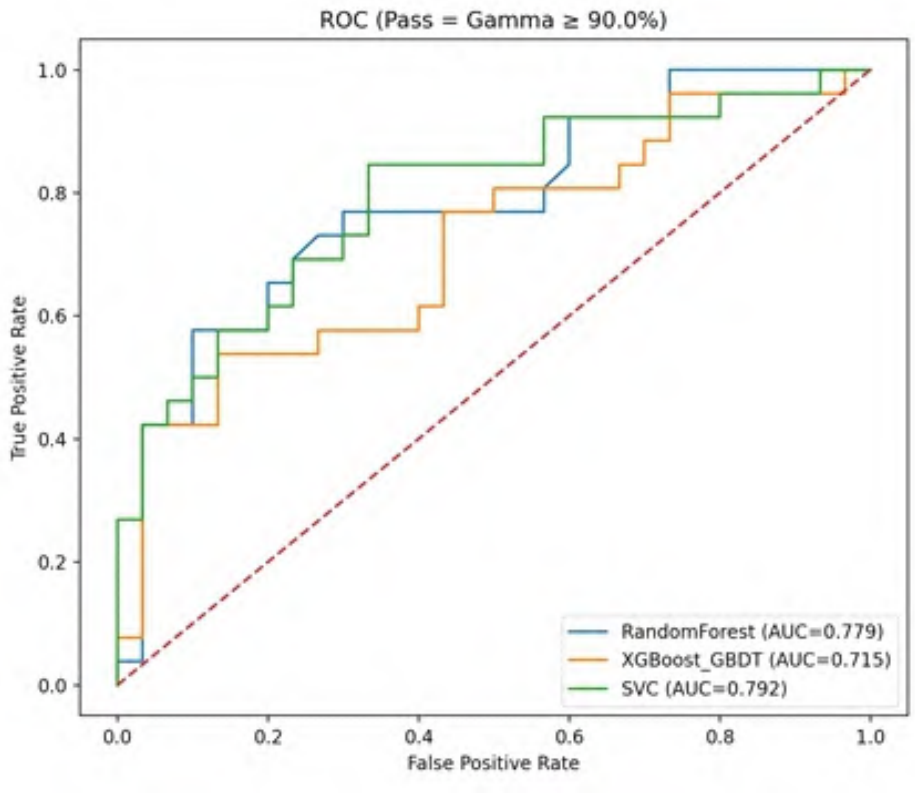
Poster ID: 139

Title: Exploring the Feasibility of Radiomics Based Patient Specific QA Using Three Different Machine Learning models

Author Names: Mr. Suvankar Das, Dr. B Paul Ravindran, Dr. A Robert Xavier

Full Abstract:

Introduction and Objective: Patient-specific quality assurance (QA) plays an important role in ensuring the accuracy and safety of advanced radiotherapy techniques such as Volumetric Modulated Arc Therapy (VMAT). Traditional QA methods can be time consuming and resource intensive. Radiomics is large number of quantitative features extracted from medical images which captures underlying patterns and characteristics which are not easily visible by the human eye. This study aims to investigate the feasibility of using radiomic features extracted from predicted dose image as predictors of the gamma passing rate (GPR) in VMAT treatment plans. By analyzing these features through various machine learning models, the study aims to establish a predictive approach that can support or possibly reduce the need for traditional QA procedures. Materials and Methods: A total of 106 radiomic features were extracted from 280 predicted dose images of VMAT plans using PyRadiomics and it was cross verified with 3D Slicer. Local gamma passing rates were calculated from EPID images for each field of the selected VMAT plans using a 3%/2mm criterion, as per the AAPM TG-218 guideline. The top 10 most significant radiomic features were selected using Random Forest (RF), Gradient Boosting Decision Tree (GBDT) and Support Vector Regression (SVR) algorithms. The union of the selected features was then used to train machine learning models for QA prediction outcomes. The performance of these models was evaluated using various statistical metrics, and regression analysis was also performed to assess predictive accuracy. Results and Discussions: The performance of the three machine learning models, RF, GBDT, and SVR was evaluated using multiple statistical metrics. The coefficient of determination (R^2) values obtained for RF, GBDT, and SVR were 0.24, 0.17, and 0.25, respectively. The Mean Absolute Error (MAE) values were 1.65 for RF, 1.71 for GBDT, and 1.64 for SVR, while the Root Mean Square Error (RMSE) values were 1.90, 1.97, and 1.88, respectively. Furthermore, the Area Under the Curve (AUC) values derived from classification analysis were 0.779 for RF, 0.715 for GBDT, and 0.792 for SVC as shown in figure. Conclusion: This feasibility study assessed the potential of using radiomic features from predicted dose images with machine learning to predict GPR in VMAT plans. All three models showed moderate AUCs (0.715–0.792) but low R^2 values (0.17–0.25), indicating limited accuracy. Future work will focus on improving model accuracy through more comprehensive feature sets, ensemble methods, and feature selection optimization using more robust algorithms.



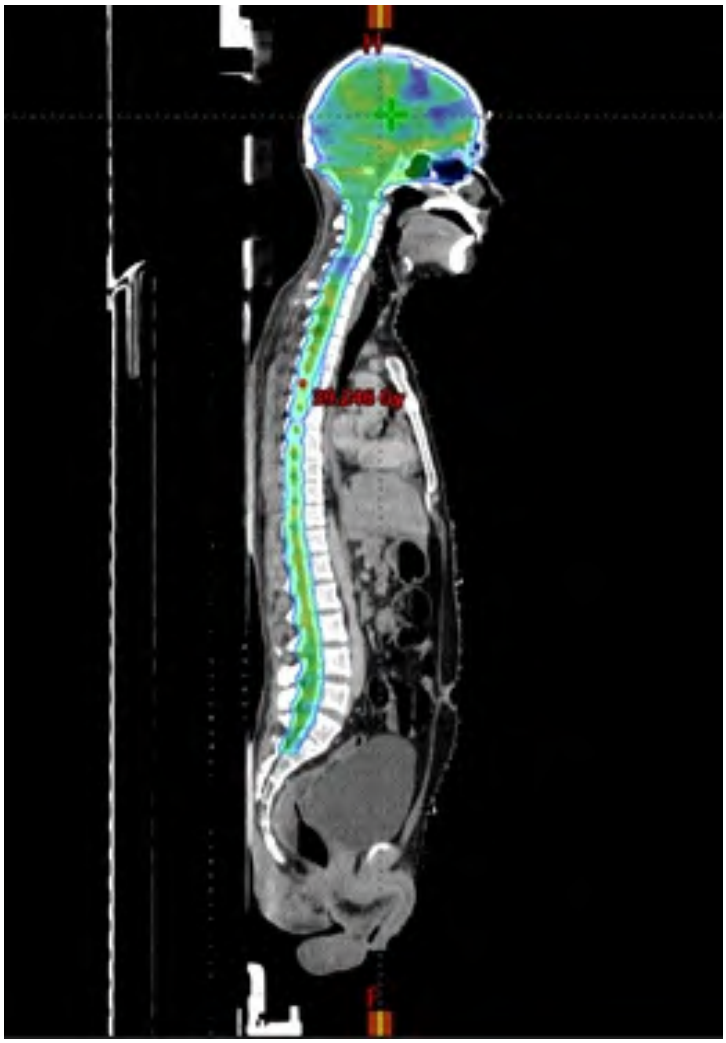
Poster ID: 140

Title: Utilizing First-Generation Halcyon for VMAT-Based Craniospinal Irradiation in a Medulloblastoma Case

Author Names: Souvik Kar, Dr. Souvik Ghosh, Dr. Avik Mandal, Dr Apurba Kabasi

Full Abstract:

Clinical Background Craniospinal irradiation (CSI) is integral to the treatment of medulloblastoma, especially in high-risk patients with residual disease. A 25-year-old male diagnosed with WHO Grade IV medulloblastoma underwent postoperative imaging revealing >1.5 cm residual tumor, warranting definitive CSI as part of multimodal therapy. Planning Approach Treatment was delivered using VMAT with a first-generation Halcyon linear accelerator. Due to field size limitations (28 cm), a four-isocenter Rapid Arc plan was developed. Dose prescription was Phase 1 – 36 Gy in 20 fractions: Phase 2 – 19.8 Gy in 11 fractions, employing auto-feathered junctions, alternating collimator angles, and a supine setup for enhanced patient comfort. It is easier to deliver a CSI plan using a first-generation Halcyon LINAC than with a conventional C-arm LINAC, due to its simplified workflow, faster imaging, and automated setup capabilities. Dosimetric Outcomes Excellent target coverage was achieved (D95: 97.64%, CI: 1.09), with acceptable homogeneity and OAR sparing. Beam-on time was under 15 minutes. Simulated setup errors (±3 mm) resulted in junction dose variation within ±10%, demonstrating robust dose delivery and setup reproducibility. Conclusion This case highlights the feasibility of delivering high-quality CSI using a first-generation Halcyon system. With careful planning and daily MV-CBCT guidance, Halcyon offers an efficient, patient-friendly alternative for CSI, even in complex, multi-isocenter scenarios.



Poster ID: 141

Title: An evaluation of dosimetric and delivery efficiency in SBRT lumbar spine metastatic cancer using three different techniques.

Author Names: Rushikesh, Soumya N.m, Annex E.h, Debnarayan Dutta

Full Abstract:

INTRODUCTION AND OBJECTIVE: Stereotactic Body Radiation Therapy (SBRT) has become an established treatment modality for spinal metastases, offering highly conformal dose delivery with steep dose gradients to spare surrounding critical organs. The aim of the study is to evaluate and compare the dosimetric performance and delivery efficiency of three stereotactic body radiation therapy (SBRT) techniques for lumbar spine metastases: CyberKnife (CK), Helical Tomotherapy with dynamic jaws (HT-D), and with fixed jaws (HT-F) MATERIALS AND METHODS: A retrospective analysis was conducted on 10 patients with lumbar spine metastases who underwent SBRT. All patients received 22Gy in two fractions. The patients were simulated using CT and MRI to facilitate accurate delineation of the gross tumor volume (GTV), clinical target volume (CTV), planning target volume (PTV) and organs at risk (OARs). Treatment plans were generated using Ray-tracing algorithm for CK, and the Convolution superposition algorithm for HT-D and HT-F techniques in Accuray Precision Treatment Planning System. The primary planning objective was to maximize PTV coverage while maintaining the OAR's dose within tolerance limits. Dosimetric evaluation included assessment of PTV coverage, Homogeneity Index (HI), Conformity Index (CI), new Conformity Index (nCI), Gradient Index (GI), and Efficiency metrices which includes Treatment time (TT) per fraction, Monitor Units (MU) per fraction and Gamma analysis. RESULTS AND DISCUSSION: The CK plans showed significantly higher PTV coverage with increased hot spots compared to HT-D and HT-F. The GI was highest in CK, indicating a sharper dose fall-off. CK also had the longest treatment time and highest MU per fraction. The low-dose spill within the patient is comparable across the cases and HI, CI, nCI and OAR's sparing were found to be comparable in both CK and Helical Tomotherapy (HT-D, HT-F). CONCLUSION: Both CyberKnife (CK), and Helical Tomotherapy (HT) plans achieved conformal PTV coverage, with comparable dosimetric outcomes in terms of homogeneity index, conformity index, gradient index, OAR sparing, and low-dose spillage. Hence Tomotherapy makes an efficient alternative for stereotactic radiotherapy of the lumbar spine cases. KEYWORDS: Stereotactic body radiation therapy (SBRT), Organ at risk (OAR), Helical Tomotherapy (HT), Computed Tomography (CT), Magnetic Resonance Imaging (MRI)

Poster ID: 142

Title: A dosimetric evaluation and comparison of Point A and volume based HDR intracavitary brachytherapy

Author Names:

Full Abstract:

1.title A DOSIMETRIC EVALUATION AND COMPARISON OF POINT A AND VOLUME BASED HDR INTRACAVITARY BRACHYTHERAPY. 2.Introduction and Objective High dose rate HDR intracavitary brachytherapy is the treatment for cervical cancer. Traditionally treatment planning for this approach has been based on point A prescription. However, with advancements in imaging and 3D treatment planning volume-based plan has emerged. The objectives of the thesis are to evaluate and compare two different plans, Point A prescription plan and Volume based HDR Intracavitary Brachytherapy plan in cervical carcinoma. Comparison is with the help of different dosimetric parameters related to the HR-CTV (Target), Bladder and Rectum (OARs). 3.materials and method 30 patients with large tumor volume who received CT image-based point A treatment planning method were replanned to volume-based planning using a treatment planning system for this study. The patient was given a 7 Gy per fraction total 21Gy in 3 fractions is considered for this study. The dose to organ at risk (OARs), bladder, rectum and intermediate clinical target volume (IR-CTV) was compared between both point A based plan and volume based (volume optimization) treatment plan 4.results and discussion The total mean doses of intermediate-CTV D90 and D80 is 15.64 and 19.03 for volume optimization show significantly higher than point A based plan (12.82and 16.14). The OAR doses 0.2cc bladder and 2cc bladder (18.64 and 15.72) for volume optimization plan shows significantly lower than point A based plan (25.12 and 19.87) also the OAR doses 0.2cc rectum and 2cc rectum (17.82 and 14.63) for volume optimization shows significantly lower than point based plan(21.05 and 16.48). volume-based plans for our study have better coverage of CTV D90 and D80 doses than point A based plan and OARs doses are lower than point A based plan. The results achieved from this study indicates that the volume-based plan can be considered efficient plan as it provides better sparing of the OAR (organ at risk) while maintaining the adequate coverage in tumor volume (CTV). Volume-based plans for our study have better coverage of CTV D90 and D80 doses than point A based plan and OARs doses are lower than point A based plan. 5.conclusion T his study demonstrates that volume optimization-based plan can reduce organ at risk (OAR) doses and also get better tumor coverage than point A based plan in large volume lesion. Keywords: intracavitary brachytherapy, volume-optimization, point A, organ at risk, Intermediate CTV.

Dosimetric parameters	TOTAL DOSES OF 3 FRACTIONS	
	Point A based Mean±SD	volume based Mean±SD
CTV-D_{90}	12.82±4.21	15.64±4.98
CTV-D_{80}	16.14±4.35	19.03±4.67
Bladder 0.2cc	25.12±5.83	18.64±3.72
Bladder 2cc	19.87±3.95	15.72±2.89
Rectum 0.2cc	21.05±4.12	17.82±3.45
Rectum 2cc	16.48±2.76	14.63±2.31

Poster ID: 143

Title: Preliminary Dosimetric Comparison of Deep Inspiratory Breath-Hold and Free Breathing Techniques in Left Breast Cancer Radiotherapy: A Pilot Study at NCRI Hospital

Author Names: Swati Mitra, Soniya Pandey, Varsha Rani, Sabinur Sultana, Esaprobahini Dey, Soumik Gain, Avishek Pal, Dr. Alok Kumar

Full Abstract:

Objective: The aim of this study is to evaluate the dosimetric benefits of the deep inspiratory breath-hold (DIBH) technique compared to free breathing (FB) in postoperative radiotherapy for left sided breast cancer patients treated at NCRI Hospital. Specifically, the study focuses on dose reduction to critical organs at risk (OARs) such as the heart, the ipsilateral lung, the contralateral lung and the contralateral breast, while maintaining optimal planning target volume (PTV) coverage. Methods: Twenty early-stage left breast cancer patients treated at NCRI Hospital were included in this preliminary analysis. All patients underwent two CT simulation scans FB and DIBH, after breast-conserving surgery. DIBH setup and monitoring were performed using C-RAD's Surface-Guided Radiotherapy (SGRT) system to ensure reproducible breath-hold positions. Treatment planning for both breathing conditions was carried out on the Elekta Monaco treatment planning system using identical beam geometry and optimization constraints. PTV dose coverage and OAR doses (heart & left lung) were compared between the two techniques. Dosimetric parameters analysed including heart volume, mean heart dose (Dmean), heart V20, mean left lung dose (Dmean), left lung V20, and PTV D95. Mean ± standard deviation (SD) and relative changes between FB and DIBH were calculated. Results: DIBH achieved a substantial reduction in cardiac dose metrics. The mean heart Dmean decreased from 502.66 ± 173.65 cGy (FB) 334.42 ± 72.82cGy (DIBH), with a 33.5% reduction and a P-value of 0.0001043. Heart V20 reduced by ~75.45%, from 3.30 ± 2.00 to 0.81 ± 0.62, with a P-value of 0.00000759. Left lung Dmean by 5.25%, from 981.87 ± 97.22 to 930.34 ± 97.25 (P = 0.002478) and left lung V20 by 5.7%, from 18.46 ± 2.85 to 17.41 ± 2.75 (P = 0.05127). Target coverage (PTV D95) remained comparable between FB and DIBH. Conclusion: This pilot study demonstrates that the DIBH technique substantially reduces cardiac exposure and modestly decreases pulmonary doses in left-sided breast cancer radiotherapy without compromising target coverage. The results support the routine clinical implementation of DIBH at NCRI Hospital for eligible patients.

Poster ID: 144

Title: National Survey on use of EPID based dosimetry systems

Author Names: Raghavendra Hajare, Debasish Sahoo, Shanmukhappa Kaginelli, Rohit Vadgaonkar, Umesh Mahantshetty

Full Abstract:

Introduction and objective: Patient-specific quality assurance (PSQA) can be performed with various devices, each having its own advantages and disadvantages. There is a need for a robust device capable of performing PSQA as well as other machine quality assurance (QA) tests. This study aims to assess the current prevalence of EPID-based dosimetry systems in Indian radiotherapy centers, identify the range of QA tasks supported by EPID systems and their effectiveness in clinical implementation, and explore the future potential and barriers to wider adoption of EPID-based dosimetry in India. Methods and Materials: A survey consisting of 35 multiple-choice questions was designed in four sections covering treatment techniques, EPID system availability, EPID dosimetry practices, alternative detectors, and future expansion challenges. The questionnaire was reviewed by two senior medical physicists and refined after institutional scientific discussion. Following ethics approval, the survey was distributed online via Google Forms to medical physicists across India. Only one response per institution was allowed, with reminders sent to non-responders. Data collection occurred from February to August 2025, and duplicate responses were excluded from the final analysis. Results: A total of 198 responses were received from 380 institutions, with a response rate of 52.1%. Among these, 73% of institutions currently use EPID-based dosimetry systems. Of these users, 40.1% rely on EPID for daily QA, and 38% of institutions use EPID for more than 75% of their total QA workflow. The primary tasks performed using EPID systems include PSQA for IMRT (100%), periodic machine QA (61.1%), PSQA for SRT/SBRT (45.9%), machine commissioning (19.7%), and in-vivo dosimetry (10.8%). Among institutions not currently using EPID due to non-availability, 86.2% expressed willingness to adopt it for PSQA in the future. Major challenges in implementing EPID dosimetry were software limitations (36.7%) and maintenance and calibration issues (35.8%). After adopting EPID dosimetry, 78.3% of institutions observed improvements compared to conventional detectors. Additionally, 93% of institutions believed that EPID dosimetry implementation would reduce physicist workload through automated software and resource optimization. Conclusion: This study reveals widespread use of EPID dosimetry for quality assurance in India. Its implementation offers advantages including reduced setup time, cost-effectiveness, automation, and integration with treatment planning systems over conventional detectors. However, issues such as software limitations and the need for affordable or free resources remain barriers to wider adoption.

Poster ID: 145

Title: Feasibility Study of Offline Adaptive Radiation Therapy Using Retrospective CBCT Data in Radiotherapy Patients

Author Names: Shubham Singla, Dr. Shefali Kanwar, Dr. Anil Goel, Sourab Shyleshan

Full Abstract:

Introduction and Objective: Anatomical changes during radiation therapy can affect target coverage and the exposure of organs at risk (OAR), thereby impacting treatment efficacy and safety. This study aims to investigate the feasibility of offline adaptive radiation therapy by analyzing retrospective CBCT data to evaluate whether changes in OAR and target volumes in radiotherapy patients are statistically significant, guiding adaptive planning decisions. Materials and Methods: A retrospective CBCT analysis was conducted on 30 plus radiotherapy patients. Weekly CBCT scans were collected throughout the treatment course. Changes in OAR and target volumes were quantified using the SyngoVia auto-contour system by Siemens. Statistical significance of volume changes was assessed using paired t-tests on retrospective treatment planning system (TPS) plans. Results and Discussions:

The analysis revealed site-specific variations in OAR and target volumes. Statistically significant changes were observed in certain cases of most pelvic cases, indicating the necessity for adaptive planning. When changes were insignificant, adaptive planning could be safely omitted in most breast cases. This approach allows devising a thumb rule for reviewing patient treatment at specific intervals tailored to each site. Conclusion: Offline adaptive radiation therapy using retrospective CBCT data is feasible and can optimize treatment by identifying patients who would benefit from adaptive replanning. Implementing site-specific review guidelines may improve treatment efficiency and outcomes in radiotherapy.

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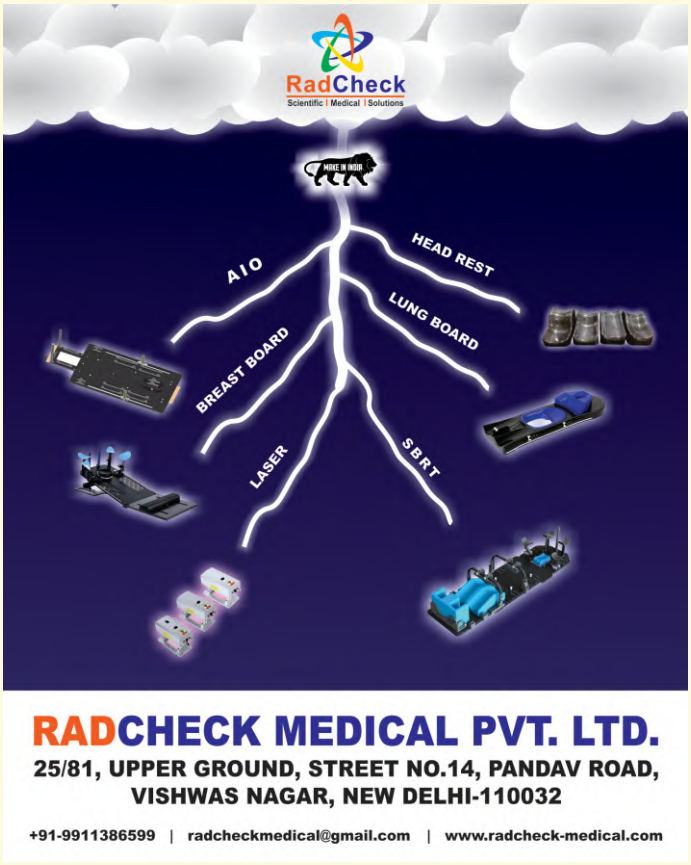

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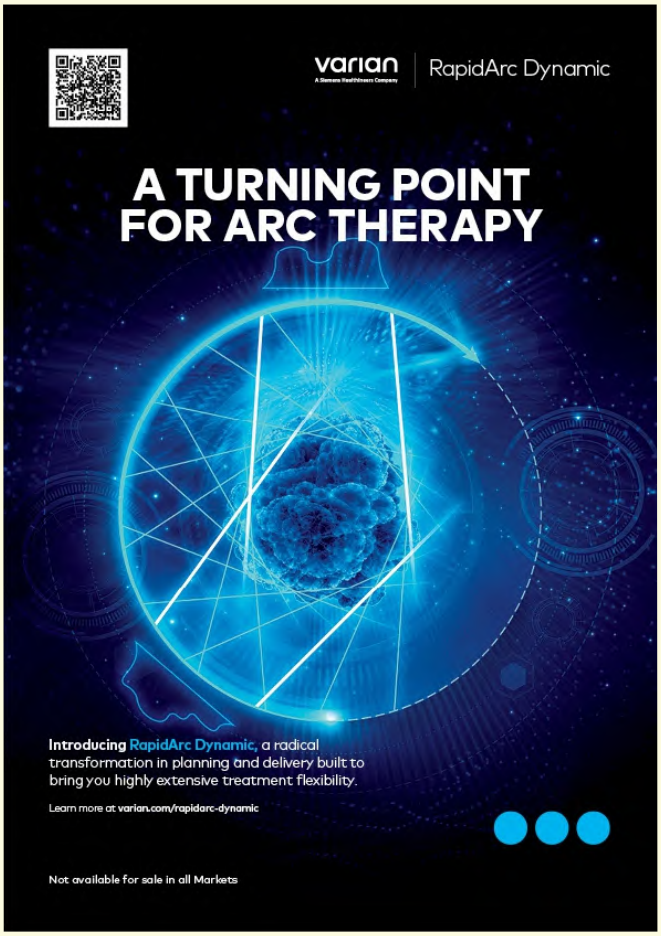

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