Conference on Radiation in Health Care (CRHC 2021)

26 - 27 April 2021

On the occasion of

International Medical Physics Week

26 - 30 April 2021

Organized by

Department of Radiological Physics
SMS Medical College and Hospitals, Jaipur

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ERS
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Neusoft
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DDD
Diagnostic

CONTENT

1. Conference Theme

2. Messages

3. Committees

4. Scientific Schedule

5. Acknowledging Support

6. Abstracts

7. About Rajasthan


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INSTRUMENTS

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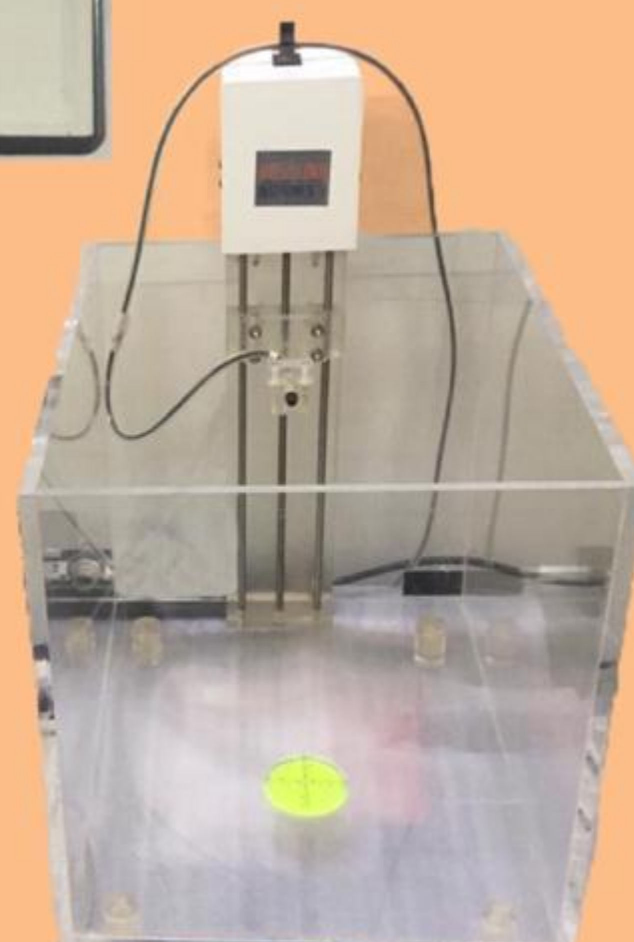

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Conference on Radiation in Health Care (CRHC 2021)

26 - 27 April 2021

On the occasion of

International Medical Physics Week

26 - 30 April 2021

Organized by

Department of Radiological Physics
SMS Medical College and Hospitals, Jaipur

WELCOME

Dear Colleagues,

Greetings from Jaipur, Pink City of India.

On the occasion of the International Medical Physics Week (IMPW), the Department of Radiological Physics, SMS Medical College and Hospitals Jaipur is organizing a two day virtual scientific event 'Conference on Radiation in Health Care (CRHC 2021) during 26- 27 April 2021.

IOMP launched the International Medical Physics Week (IMPW) similar to the International Day of Medical Physics (IDMP) with the purpose to motivate organization of activities in a defined week that result in the promotion of the subject of medical physics globally, increasing the visibility of the profession and outreach to fellow professionals and general public. The theme of this years celebrations is **'Communicating the Role of Medical Physicists to the Public'**.

The various scientific, social and awareness activities planned to commemorate the role of Physics in Medicine has turned only into virtual activities because of the pandemic. The Organizing Committee, wholeheartedly welcome you all to this scientific bonanza. A hearty welcome to each one of you to CRHC 2021. Hope you will have a pleasant and heartening virtual experience and fond memories to cherish….

Prof Arun Chougule
Organizing Chairman

Dr Mary Joan
Organizing Secretary

Contribution of Medical Physics in healthcare is multi-dimensional and it has improved the healthcare tremendously. The recent advancements in Medical Physics may it be in Radiodiagnosis, Radiotherapy, Nuclear Medicine and various fields specially using radiation has made monumental sprints. To bring over it and recognize the contribution of Medical Physics to healthcare, International Organization for Medical Physics (IOMP) has started to celebrate 7th November, the birthday of Madam Marie Curie as International Day of Medical Physics (IDMP) since 2013. However, it was thought that a week devoted to the contributions of medical physicists to healthcare to be celebrated as International Medical Physics Week (IMPW). For the first time, it was celebrated from 11th -15th May 2020, where various academic and teaching institutes showcased the contributions of medical physicists to healthcare globally.

This year, Department of Radiological Physics, SMS Medical College and Hospitals, Jaipur, India is celebrating this mega event in Jaipur. The scientific programme will include talks and teaching sessions by eminent speakers in the field of medical physics. Virtual seminars/ teaching sessions will be organized in the various post graduate science colleges, engineering colleges, medical universities, nursing colleges, etc. depicting the medical physicist's role in various medical and radiation fields like different diagnostic departments, radiotherapy, radiation safety, research etc.

To encourage and promote the young and early career medical physicists and scientists, an young investigator session is arranged, for which abstracts are invited in areas of research related to medical physics practice. Two awards each for Best Poster and Best Oral are awaiting the best presenters.

IOMP launched the International Medical Physics Week (IMPW) similar to the International Day of Medical Physics (IDMP) with the purpose to motivate organization of activities in a defined week that result in the promotion of the subject of medical physics globally, increasing the visibility of the profession and outreach to fellow professionals and general public. For the first time, it was celebrated from 11 - 15 May 2020, where various academic and teaching institutes showcased the contributions of medical physicists to healthcare globally.

The theme of this years celebrations is 'Communicating the Role of Medical Physicists to the Public'.

This year, Department of Radiological Physics, SMS Medical College and Hospitals, Jaipur, India is celebrating IMPW in Jaipur by organizing various scientific, social and awareness activities to commemorate the role of Physics in Medicine.

The first in line is the Conference on Radiation in Health Care (CRHC 2021) during 26 - 27 April 2021. The scientific programme will include talks and teaching sessions by eminent speakers in the field of medical physics and radiological sciences. An awareness rally to reach out to the fellow healthcare professionals and general public about the role of medical physicists in healthcare is also scheduled. To encourage and promote the young and early career medical physicists and scientists, an young investigator session is arranged and the best works will be acknowledged with awards. The various applications of radiation in different walks of daily life will be showcased in an exhibition.

Following CRHC 2021, seminars/ teaching sessions will be organized in the various post graduate science colleges, engineering colleges, medical universities, nursing colleges, etc. depicting the medical physicist's role in various medical and radiation fields like different diagnostic departments, radiotherapy, radiation safety, research etc.

MESSAGES

INTERNATIONAL UNION FOR PHYSICAL AND ENGINEERING SCIENCES IN MEDICINE

Union member of the International Science Council

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http://www.iupesm.org

IMPW 2021 Message from Prof James Goh, IUPESM President

I want to first of all, congratulate Prof Arun Choulule and his organising committee from the Department of Radiological Physics, SMS Medical College & Hospital for bringing to us this 2-day virtual scientific event "Conference on Radiation in Healthcare (CRHC 2021)" and to mark the International Medical Physicists Week (IMPW) celebration.

I am extremely pleased that the theme of this year's celebration is 'Communicating the Role of Medical Physicists to the Public'. For too long the contributions of Medical Physicists have been hidden from the public. I believe this is an opportune time to bring the excellent work of the Medical Physicists to the forefront. Particularly in this season of the COVID-19 pandemic where Medical Physicists had to develop innovative strategies to be effective first respondents to deal with the challenges brought about by the unpredictable and unprecedented pandemic. When one considers the disruption to the clinical workflow and associated complexities related to patient care. Medical Physicists must grapple with safety and continue to provide excellence in clinical delivery and patient care. It is my hope that this conference will highlight the crucial "frontline "roles of Medical Physicists.

Lastly, to further propagate this effort I would like to invite you to participate in the IUPESM World Congress on Medical Physics and Biomedical Engineering (IUPESM WC2022) which will be held from 12 – 17 June 2022 in Sands Expo® and Convention Centre, Marina Bay Sands, Singapore. Visit: www.iupesm2022.org

My best wishes to all participants and happy conferencing.

Prof James Goh
President, International Union of Physical and Engineering Sciences in Medicine (IUPESM)
Website: www.iupesm.org

MESSAGES

INTERNATIONAL ORGANIZATION FOR MEDICAL PHYSICS (IOMP)

Member of the International Union of Physical and Engineering Sciences in Medicine
(Union Member of the International Council for Science)

www.iomp.org

20th April 2021

Prof. Arun Chougule &
Dr. Mary Joan
SMS Medical College & Hospital
Jaipur, India.

Dear Dr. Chougule and Dr. Joan,

I am delighted to note that the Department of Radiological Physics, SMS Medical College & Hospital is organizing two days virtual scientific event "Conference on Radiation in Healthcare (CRHC 2021)" on 26th and 27th April 2021 to mark International Medical Physics Week (IMPW 2021) celebration.

Your department has been in the forefront in organizing activities to celebrate IMPW and also International Day of Medical Physics (IDMP) every year. I wish to congratulate you for your active participation despite challenging time due to COVID-19.

Creating awareness is a perpetual need that every profession has to strive to meet, and your actions will make a meaningful contribution.

On behalf of IOMP, I wish the deliberations great success and thank the organizing team for the hard work during the challenging time.

With best regards,

Madan M. Rehani
President, IOMP

Sally Hawking, IOMP Administrative Secretary
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MESSAGES

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Dated: 22-04-2021

Message

It is a matter of great pleasure that a virtual scientific event is organized by the Department of Radiological Physics, SMS Medical College & Hospital (SMSMCH) on 26th and 27th April, 2021 to celebrate International Medical Physics Week (IMPW 2021).

Contribution of Medical Physics in healthcare is multi-dimensional and it has improved the healthcare tremendously. The recent advancements in Medical Physics may it be in Radiodiagnosis, Radiotherapy, Nuclear Medicine and various fields specially using radiation has made monumental sprints. To encourage and promote the young and early career scientists, a young investigator session is arranged. Distinguished National and International experts are appropriately invited by the organizers to share their vast experiences in this emerging field. It will be a time of intellectual simulation and an opportunity where participants discuss advances with pioneers in the field and share views and experiences on a virtual platform, as due to COVID-19 pandemic in person meetings cannot happen. This will be a unique chance for students, faculty and staff involved in radiation medicine to pick up new tips, upgrade and fine tune skills to do better in patient care.

I wish this virtual event a great success. Happy IMPW 2021.

Dr. Raja BabuPanwar
(Vice-Chancellor)

Prof Arun Chougule
Organising Chairman
CRHC 2021

MESSAGES

Dr. Sudhir Bhandari
M.D., DNB, MNAMS.
FRCP (London), FRCP (Edinburgh)
Fellow American College of Endocrinology (FACE)
• **Senior Professor, Department of Medicine**
S.M.S. Hospital, Jaipur-302004 (Rajasthan)

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9829078844, 9414078844

MESSAGE

I am glad that the **Department of Radiological Physics**, SMS Medical College & Hospital (SMSMCH) is organizing virtual **scientific event on 26th and 27th April, 2021 to mark International Medical Physics Week (IMPW 2021) celebration during 26th April to 30th April 2021.** The theme of this years IMPW celebration is 'Communicating the Role of Medical Physicists to the Public'. This two day virtual scientific event is organized with aim for popularizing the medical physics profession among other colleagues in various fields as also among public.

It is well known that the discovery of X-rays in 1895 by famous physicist Prof. W. C. Roentgen and subsequently discovery of radioactivity in 1896 by Madam Marie Curie has revolutionized medical diagnostics and treatment of various diseases. With the extensive use of radiation in medicine many advanced technologies evolved. Any advancement in technology brings with it additional responsibility on us for its efficient and effective use. Medical physics plays an important role to serve the desired purpose during the diagnosis and treatment of diseases in healthcare facility.

I am pleased that several eminent National & International speakers from the field of medical physics will be delivering lectures and sharing their experience with participants. I am sure that deliberations during this scientific event will enrich the knowledge of the participants and also help in exploring new avenues in the ever growing need for disease diagnosis and therapeutics. It is pity that due to COVID19 pandemic you cannot in person participates in this meeting which has denied us the opportunity to host you at Jaipur, city famous for its hospitality.

I express my best wishes to all the participants of this event and hope that the pandemic will be over soon and you will get the opportunity to visit Jaipur and opportunity for us to host.

(Dr. Sudhir Bhandari)

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E-mail : drs_bhandari@yahoo.com • Tel. : 0141-2710234, 2710434

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Dean & PHOD
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Prof. Tae Suk Suh

Message

It is my proud privilege and great pleasure to welcome you all to the International Conference on Radiation in Health Care CRHC 2021organized by the Department of Radiological Physics, SMS Medical College and Hospitals, Jaipur on 26th and 27th April 2021.

IOMP launched the International Medical Physics Week (IMPW) similar to the International Day of Medical Physics (IDMP) with the purpose to motivate organization of activities in a defined week that result in the promotion of the subject of medical physics globally, increasing the visibility of the profession and outreach to fellow professionals and general public. The theme of this year's celebrations is '**Communicating the Role of Medical Physicists to the Public**'.

The various scientific, social and awareness activities planned to commemorate the role of Physics in Medicine has turned only into virtual activities because of the pandemic. We have a keynote address, plenary talk, special address and a meet the expert session in addition to the 18 invited talks and 12 proffered oral and poster presentations each. An expert line of speakers from around the world are gathered here on the virtual platform to share their views and experience on diverse professional issues and their resolution. This will be a unique platform for all radiation professionals from different domains of radiation physics, radiation biology, radiation dosimetry and clinical medical applications to get together, know each other and appreciate and acknowledge the contributions of each domain. I take this opportunity to sincerely thank each and every one of you who spared the valuable time to actively participate in this conference enhancing the scientific exactitude of each other.

We have been very efficiently planning the radiation treatment for cancer patients, corroborating quality assurance of equipment and procedural protocols, researching on new diagnostic and treatment modalities, ensuring radiation protection and safety of patients and personnel in various streams of healthcare. It is the need of the hour to raise the professional profile of medical physics and we have tried to bring light to the current issues and how to resolve them.

I am confident that CRHC 2021 will prove to be a milestone for the medical physics community and help us all in developing ourselves as indispensable healthcare professionals.

I thank the IOMP, AFOMP and AMPI for their support in organizing this conference along with RUHS, SCMPCR, NPCIL Kota, AMD Jaipur, IARP and ISRB. A word of thanks to our trade partners, without whom this conference couldn't be arranged as beautiful as it is.

The Organizing Committee, wholeheartedly welcome you all to this scientific bonanza. Wishing you all a fruitful and rewarding conference and continued success in all your professional endeavors. A hearty greeting on the occasion of the International Medical Physics Week.

Prof. Dr. Arun Chougule
Organizing Chairman CRHC 2021
President AFOMP
Chair ETC& Accreditation Board, IOMP
Senior Professor and Head
Department of Radiological Physics
SMS Medical College and Hospitals
Jaipur, Rajasthan, India

MESSAGES

CONFERENCE ON RADIATION IN HEALTH CARE (CRHC 2021)

26-27 April 2021

On the occasion of

INTERNATIONAL MEDICAL PHYSICS WEEK

Organized by

Department of Radiological Physics

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Vice Chancellor
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FROM THE ORGANIZING SECRETARY'S DESK

Greetings!!!

It gives me immense pleasure to welcome you all to the two days international virtual scientific programme, Conference on Radiation in Health Care CRHC 2021 organized by the department of Radiological Physics, SMS Medical College and Hospitals Jaipur Rajasthan on 26th and 27th April 2021 on the occasion of International Medical Physics Week (IMPW) celebrated from 26th to 30th April 2021 .

IOMP launched the International Medical Physics Week (IMPW) similar to the International Day of Medical Physics (IDMP) with the purpose to motivate organization of activities in a defined week that result in the promotion of the subject of medical physics globally, increasing the visibility of the profession and outreach to fellow professionals and general public. For the first time, it was celebrated from 11-15 May 2020, where various academic and teaching institutes showcased the contributions of medical physicists to healthcare globally.

The theme of this years celebrations and CRHC 2021 is 'Communicating the Role of Medical Physicists to the Public'. The rapidly evolving applications of physics in medicine and the current pandemic all over the world demands new set of skills as well as outlooks to meet the challenges efficiently and successfully. This conference offers a forum for sharing your invaluable experiences for improving the practice of Medical Physics and an opportunity to listen to a number of great people holding and practicing high ideas in life as well as profession.

I would like to extend my heartfelt thanks to each and everyone of you for your warm responses, strong support and exuberant enthusiasm towards CRHC 2021 amidst the pandemic. A hearty welcome to all of you to celebrate the International Medical Physics Week and the scientific fiesta CRHC 2021.

Dr Mary Joan
Organizing Secretary CRHC 2021
Assistant Professor
Department of Radiological Physics
SMS Medical College and Hospitals, Jaipur

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SCIENTIFIC PROGRAMME

Day 1 Time (IST)	*Scientific Programme* April 26th, 2021 (Monday)
10.00AM - 10.15AM	**Inaugural Ceremony**
10.15AM - 10.30AM	**(IMPW Messages from President IOMP, AFOMP)**
10.30AM - 11.00AM	**Session I**: **Keynote Address** **Shri NK Pushpakar , Site Director, NPCIL, Rawatbhata, Kota**
11:00 AM- 01:00 PM	**Session II: Advancements in the use of radiation in health care** **I-1:** Challenges in medical radiation protection: **Prof Madan Rehani, USA** **I-2:** Expanding the medical physicist curricular and professional programme to include Artificial Intelligence: **Prof G A Zakaria, Germany** **I-3:** Going public – raising the profile of the profession within and outside healthcare: **Prof Carmel Caruana, Malta** **I-4:** Radiation Safety Assessment of Advanced Radiotherapy Equipment: **Prof S D Sharma, Mumbai** **T-1:** Recent advances in dosimetry for radiotherapy: **Mr Karan Bhateja PTW**
01.00PM-02.15PM	**Session III: Advanced therapeutic radiological procedures** **I-5:** Expanding Roles of Medical Physicists in Precision Oncology: **Dr Chai Hong Yeong, Malaysia** **I-6:** Medical Physicist in ensuring Quality assured proton beam therapy to patients: **Dr Dayananda Sharma, Chennai** **I-7:** Artificial Intelligence applications in Intensity Modulated Proton therapy: **Dr K Ganapathy, Chennai**
02.15PM-02.45PM	**Lunch Break**
02.45PM-04.50PM	**Session IV: Radiation protection and dosimetry in radiotherapy, radiology and nuclear medicine** **I-8:** Role of artificial intelligence in medical imaging: **Dr A K Shukla, Lucknow** **I-9:** Responsibilities of Health Professionals in Nuclear Medicine: **Dr Pankaj Tandon, Mumbai** **I-10:** Diagnostics and Therapeutics procedures of Nuclear Medicine for benefits of patients: **Dr J K Bhagat, Jaipur** **I-11:** Quantification in Nuclear Medicine: **Dr Subhash Kheruka, Lucknow** **I-12:** Ultrasound images based radiomics: **Dr Xiance Jin, China**
04.50PM-06.00PM	**Session V: Best Poster Session** **PP-1:** Radiation Safety In Interventional Radiology: **Aadil Shafi, Srinagar** **PP-2:** Comparison of flattened and unflattened X-ray beams Out-of- field dose measurements using Ionization chamber and MOSFET detector: **Gokul Raj, Bikaner** **PP-3:** Installation, commissioning and clinical implementation of truebeam linear accelerator in regional cancer center,Bikaner, Rajasthan: **Sai Sangeeth Raj R, Bikaner** **PP-4:** The retrospective dosimetric audit of stereotactic body radiotherapy (SBRT) patients treated over last 10 years: **Sinjini Sengupta, Kolkata** **PP-5:** Design and Demonstration of a Wireless Radiation Detector Robot: **Tonmoynath, Bangladesh** **PP-6:** Enhanced Radio Sensitization: An Approach Based on Nanoparticles and Modified Quantum Dots: **Dr Vandana Nunia, Jaipur** **PP-7:** Study to evaluate the dosimetric impact of different medium in Left Side Breast IMRT plans using Monaco treatment planning system: **Dr V P Pandey, Bhopal** **PP-8:** Validation of Monaco TPS for an ELEKTA synergy MLCi2: using Gamma index for Elekta Fullpackage beams: **Dr V P Pandey, Bhopal** **PP-9:** Beam Modeling in Commercial Treatment Planning System for IMRT and VMAT performance with an Elekta MLCi2 Multileaf Collimator: **Dr V P Pandey, Bhopal** **PP-10:** Impact of Covid-19 outbreak on radiotherapy of cancer patients: Institutional experiences: **Dr V P Pandey, Bhopal** **PP-11:** Comparison of dosimetric parameters between Rapid Arc and IMRT plans in Nasopharyngeal carcinoma Patients: **Dr Yaman Patidar, Bikaner** **PP-12:** Medical Applications of Radiation and Medical Physics in Biology Guided Radiation Therapy : **Shriram A Rajurkar, Mumbai**

SCIENTIFIC PROGRAMME

Day 2 Time (IST)	Scientific Programme April 27th, 2021 (Tuesday)
10.00AM-10.45AM	**Meet the Expert session L1 : Radiation Safety, Surveillance, Prevention, Preparedness and Response to Exigency' with emphasis on Radiation Technology / Nuclear Medicine usage** **Dr. S. Murali, BARC, Mumbai, India**
10.45AM-11.30AM	**Plenary Session: Role of medical physicists in the optimal use of radiation in medicine** **Prof Madan Rehani, President IOMP**
11.30AM-12.15PM	**Special Address: Management of Radiological emergencies in public domain and Role of Emergency Response Centers** **Dr B Rammohan Reddy, Atomic Mineral Directorate Jaipur**
12.15PM-01.30PM	**Session VI: Medical Physics in Healthcare** **I-13:** Medical Physics Contribution to Women's Health and Radiation Safety / Patient Radiation Protection: **Prof Hasin Anupama Azhari, Bangladesh** **I-14:** The Roles of Medical Physicist in Radiation Oncology Cancer Treatment: **Dr V Subramani, New Delhi** **I-15:** Retrospective Dosimetry for Medical Management: **Dr Pradeep Narayan, Jodhpur**
01.30PM-02.00PM	**Lunch**
2.00PM-04.00PM	**Session VII: Best paper session** **OP-1:** Dosimetrical Comparison of Ca left breast treatment plans using three different algorithms in CMS Xio TPS: an institutional study: **Balbir Singh**, **Bhatinda** **OP-2:** Dosimetric analysis and clinical outcome of brachial plexus as an organ-at-risk in head-and- neck cancer patients treated with intensity –modulated radiotherapy: **Dr Beena Sen, Bikaner** **OP-3:** Retrospective Analysis Of Treatment Time Calculation Accuracy Between TPS And Manual Method And Source Strength Verification For 13 Hdr Ir-192 Sources In Flexitron Brachytherapy Unit: A Single Institute Experience: **Gurbir Kaur, Chandigarh** **OP-4:** Study of doses in build-up region for 6MV photon beam from Varian Clinac 600C: **Mamta Mahur, New Delhi** **OP-5:** Evaluation Of Effect Of Contrast Medium On Treatment Modalities Planned With Different Photon Beam Energies: **Manindra Bhushan, New Delhi** **OP-6:** Gamma Index Analysis For Analytic Anisotropic Algorithm (AAA) And Acuros XB Algorithm (Axb) Using In-House Develop Heterogeneous Thorax Phantom: **Priyusha Bagdare, Mumbai** **OP-7:** Quantifying the cardiac Planning Risk volume using real time Cone Beam Computed Tomography images to avoid cardiac toxicities in Breast Radiotherapy: **Radhika Jain, New Delhi** **OP-8:** Monte Carlo simulation of Lung SBRT plans using PRIMO Monte Carlo Code and its validation against Acuros ® XB: **Sarin B, Thiruvananthapuram** **OP-9:** Feasibility and efficacy of CDR-VMAT technique in radiotherapy practice: A dosimetric comparison with the intensity modulated radiation therapy for five cancer sites: **Varsha Raghunathji Gedam, New Delhi** **OP-10:** Investigation of tube voltage dependence on CT Number and its effect on dose Calculation algorithms using Thorax Phantom in Monaco Treatment Planning System for External Beam Radiation Therapy: **Dr V P Pandey, Bhopal** **OP-11:** Does field fixed optimization yield a better intensity modulation for Hippocampal avoidance whole-brain radiotherapy?: **Vysakh R, Calicut** **OP-12:** The role of CT Scan in diagnosis of COVID 19 : **Rajesh Jangir ,Jaipur**
04.00PM-05.15PM	**Session VIII: Current issues and way forward** **I-16:** The impact of Covid-19 on medical physics practices in Africa: **Prof Christoph Trauernicht, S Africa** **I-17:** Nurturing a global initiative in medical physics leadership and mentoring: **Dr Aik Hao Ng Malaysia** **I-18:** Main achievements of the International Union for Physical and Engineering Sciences in Medicine (IUPESM) for the profession – a summary of 40 years progress: **Prof. Slavik Tabakov, Vice-President IUPESM**
05.15PM-05.30PM	**Valedictory Function**

ABSTRACTS

KEYNOTE ADDRESS

न्यूक्लियर पॉवर कार्पोरेशन ऑफ इंडिया लिमिटेड
NUCLEAR POWER CORPORATION OF INDIA LIMITED
)भारत सरकार का उद्यम ((A Government of India Enterprise)
रावतभाटा राजस्थान साइट Rawatbhata Rajasthan Site
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Date : April 22, 2021

CONFERENCE ON RADIATION IN HEALTH CARE (CRHC-2021)

As you all know that nuclear radiation is an inevitable, omnipresent and indispensable in modern day society. Mankind has been exposed to natural radiation background due to natural radioactivity in earth crust and cosmic radiations.

The radiation technology has wide range applications in industry including radiography, gamma scanning of process equipment, use of tracers to study sediment transport at ports and harbours, flow measurements, pigging of buried pipelines, isotope hydrology and water resource management, radiation processing and nucleonic gauging. In agriculture for genetic mutation of crop resulting in improved yield, better characteristics or disease resistance.

Non-ionising and ionising both types of radiation are being used widely in Health Care for diagnostic and therapeutic purpose. Health care has been one of the thrust activities of Department of Atomic Energy (DAE). DAE has played a pivotal role in radioisotope and radiopharmaceutical production, supply, safe transport and final disposal of the spent radiation sources.

Board of Radiation & Isotope Technology (BRIT) supplies radiopharmaceuticals and allied products to Nuclear Medicine Centres in the country. Technetium-99m (Tc-99m) is the main workhorse of diagnostic nuclear medicine practice. Iodine-131, as sodium iodide, is used for diagnosis and treatment of thyroid disorders. Radioimmunoassay (RIA) is an important medical application of radioisotopes. BRIT also supplied ^{177}Lu-DOTA-TATE injection for the treatment of neuroendocrine tumors and therapeutic products such ^{153}Sm, ^{177}Lu and ^{32}P for bone pain palliation.

The Radiation Medicine Centre (RMC) of Bhabha Atomic Research Centre (BARC) in Mumbai, has become the nucleus for the growth of nuclear medicine in the country. Similarly, Tata Memorial Centre (TMC), a fully autonomous aided institution of DAE, provides comprehensive treatment for cancer and allied diseases and is one of the best radiation oncology centres in the country.

Bhabhatron was developed by DAE to meet the demand for affordable tele-Cobalt machines. Compared to any imported unit, the indigenous machine is cheaper and superior in features.

Recently, Cs-137 sources using recovered radioactive Cs-137 from the nuclear spent fuel has been prepared. These sources are to be used in blood irradiators.

The increase use of radiation and radioisotopes warrants large number of radiation source procurement, transportation, their use and storage. AERB had developed and implemented a state of art e-Governance system; e-LORA (e-Licensing of Radiation Applications).

The Nuclear Power Corporations of India limited (NPCIL) a subsidiary of DAE is engaged in design, construction, operation and decommissioning of nuclear power plants. Presently, in its operational fleet it has Boiling Water Reactors (BWR), CANDU type Pressured Heavy Water Reactor (PHWR), Indigenous 220 MWe PHWRs and Indigenous 540 MWe PHWR, 1000 MWe Pressured Water Reactor(PWR), one indigenous 700 MWe PHWR. Further, NPCIL is extending its fleet by constructing 10 PHWR Reactors of 700 MWe in fleet mode and other imported PWRs on turnkey basis.

Rawatbhata Rajasthan Site (RR Site); a Mega Nuclear site, has distinction of having the vintage first CANDU type PHWRs; of 100 and 200 MWe (Unit-1&2) respectively, indigenous 220 MWe PHWRs i.e. Unit-3,4,5&6) and the latest indigenously designed scaled up PHWR of 700 MWe (i.e. Unit-7&8); which are under final stages of construction. The site also has Cobalt Facility engaged in production of Co-60 radioisotope for industrial and medical use. In addition, there is Heavy Water Production plant (HWP), Nuclear Fuel Complex (NFC) under construction and Centralised Waste Management Facility (CWMF) for managing radioactive waste generated at RR Site.

RR site, NPCIL is engaged in various societal activities, the most important in Health Care is production of Radioisotope Cobalt-60. The Cobalt 60 isotope is produced by irradiating Co-59 loaded in Absorber rods in power reactors. Post irradiation in reactors, these absorbers rods are sent to Cobalt facility for recovery of Co-60 and preparation of Co-60 sources for industrials and medical use.

The NPCIL RR site is having well-structured AERB approved nuclear emergency preparedness and response plan. The plan is practiced and checked for its efficacy at regular intervals.

NPCIL has more than 540 reactor years of operating experience. We have always adopted and retrofitted state of art technologies for upgrading nuclear safety. It had successfully implemented the lessons learned from various nuclear incidents and accidents.

Environmental Survey labs (ESLs), an independent agency is monitoring environment continuously for radiological impact assessment due to operation of nuclear power plants. I am pleased to inform that the reports of ESL confirm that the nuclear power plants are operated in professional and safe manner and has no impact on the environment. ESL also plays role of first responder for handling radiation emergencies in offsite domain.

(Narendra Kumar Pushpakar)
Outstanding Scientist &
Site Director
Rawatbhata Rajasthan Site

INVITED SPEAKER

Challenges in medical radiation protection

Madan M. Rehani
Massachusetts General Hospital, USA

Going by the analogy of existing virus and pandemic, characterize the problem and ten develop solution to the problem. With that when it comes to medical radiation protection, imaging examinations using ionizing radiation have been receiving wide attention in recent years. One needs to assess the magnitude of the problem and thus know how safe are patients undergoing various imaging exams, namely computed tomography (CT), fluoroscopic guided interventions (FGI), nuclear imaging studies in particular hybrid imaging and imaging for radiotherapy. All these contribute significantly to radiation dose and radiation risks, more so, if performed many times during a short period. CT has remained the most important imaging modality in medical practice not only because of the useful information that it provides but also because of its patient friendliness as compared to magnetic resonance imaging (MRI). One cannot imagine modern medicine without CT and thus it has indispensable role. There have been reports from time to time raising radiation risk concerns associated with CT. They have helped to make CT safer as the dose for a defined level of diagnostic information has gone down substantially. A large number of publications have assessed how a different technologies or techniques have helped to reduce the dose in a single CT exam to maintain the same level of noise in the image or how and how much dose reduction could be achieved for the same CT exam. However, a series of papers published in 2020 covering data of 3.2 million patients undergoing CT exams in 344 hospitals in 20 countries have shown that 0.64% to 3.4% of the patients undergoing CT exams reach the cumulative effective dose (CED) of ≥ 100 mSv in 1 to 5 years period. The papers estimated that about 0.9 million patients probably reach a CED ≥ 100 mSv every year globally through recurrent CT exams alone. About every fifth patient who was exposed to more than 100 mSv in this study was ≤ 50 years old. Further, these papers identified patients in this cohort who are < 40 years of age and with no malignant disease.

Another paper reported that total number of patients with CED ≥100 mSv for all 35 OECD countries combined in a 5-year period is around 2.5 million (2,493,685) in a population of 1.2 billion (1,176,641,900), i.e., 0.21% of the population. Yet another recent paper covering data of nearly 4 million patients from up to 279 hospitals showed that 1 out of every 125 patients (0.8%) received 50 mSv or more from a single CT exam and 0.03% (3 out of 10,000) with ≥ 100 mSv in a single day only from CT exam. Further, a paper reviewing all the interventional procedures at a major hospital for the past 9 years showed that 4% had CED of more than 100 mSv and the median value of the CED in this cohort was 177 mSv. The majority (about 90%) of patients had their procedures within 12 months, and 10.7 % were under 40 years of age. All these results indicate that we are in an unprecedented era, perhaps never witnessed before since the discovery of X-rays. While high patient dose is a known enemy to be kept in mind, new observations pose a new challenge. In the past high patient doses for tissue injuries (deterministic effects) have received significant attention whereas the need currently is for stochastic risks. The talk summarizes several challenges that we face today to make patients safer and provides a glimpse of solutions that are on the horizon.

INVITED SPEAKER

Expanding the medical physicist curricular and professional programme to include Artificial Intelligence

F. Zanca, I. Hernandez-Giron, M. Avanzo, G. Guidi, W. Crijns, O. Diaz, G.C. Kagadis, O. Rampado, P.I. Lønne, S. Ken, N. Colgan, H. Zaidi, G.A. Zakaria, M. Kortesniemi
Working Group (WG) Artificial Intelligence (AI), The European Federation of Organisations for Medical Physics (EFOMP)

A pilot online international survey with AI-specific questions was prepared and distributed among the Medical Physicists (MPs) community. 219 participants from 31 countries provided their answers and the majority of them (88%) agreed with the statements "MPs need specific training on AI" and (80%) with the statement "I strongly believe that AI should be part of the MPs curriculum". That survey clearly mentioned the importance of AI for MPs. That is why, we attempted to provide a guideline curriculum related to Artificial Intelligence (AI), for education and training of European MPs. This curriculum is the first created guideline expanding the current educational framework for MPs in Europe. Our curriculum consists of two levels viz. basic and advanced. The learning outcomes of training are presented as knowledge, skills and competences (KSC) approach. For the Basic section, KSCs were stratified in four subsections: (1) Medical imaging analysis and AI Basics; (2) Implementation of AI applications in clinical practice; (3) Big data and enterprise imaging, and (4) Quality, Regulatory and Ethical Issues of AI processes. For the Advanced section, a common block was proposed. That should be further elaborated by each subspecialty core curriculum. MPs must be prepared to face the transformational technology by updating their training and education programs. But there is currently a lack of courses and workshops that are really tailored to the MPs needs. Within the aims of the European Federation of Organizations for Medical Physics (EFOMP), this kind of education could be imparted within the European School of Medical Physics Expert (ESMPE) course modules. MPs' expertise and tasks have focused on overall concepts of quality, optimization, research and development of new analytical techniques.

We also aimed at developing a curriculum which is in line with the Bologna Declaration, and the recommendations from the European Parliament and the council of 23 April 2008, on the establishment of the European qualifications' framework for lifelong learning. The advanced knowledge and competences required to develop in-house AI-software are considered out of scope for the present curriculum. It is obvious that the field of AI is driving a major transformation in the present time and also in the future, which makes it challenging to envision how fast some of our tasks as MPs will have to change and adapt.

INVITED SPEAKER

Going public – raising the profile of the profession within and outside healthcare

Carmel J. Caruana
PhD FIPEM Medical Physics
Faculty of Health Sciences University of Malta.

Medical Physicists are excellent scientific leaders; however the same cannot be said of their strategic leadership skills. One of the essential components of a strategic plan for any profession is a good marketing and publicity plan. Essentially it's no good being excellent scientists and healthcare professionals and having excellent knowledge, skills and competences if nobody knows about it! We need a plan to market and publicise the profession among the following target groups: the general public, patients, other healthcare professions, health policy makers, hospital governance boards, potential future students. In this presentation we will discuss some ways of doing this.

Modular Phantom for High-Precision Radiotherapy treatment & SRS/SBRT QA

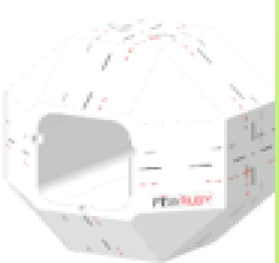
Karan Bhateja

1. Introduction

The process of radiation therapy from patient imaging to the radiation at the linear accelerator (linac) requires seamless integration of multiple system components. Any errors that occur within any system components could affect the quality of the treatment plan delivered and hence the patient's clinical outcome. Therefore, stringent tests are designed and carried out either at regular intervals or on a patient-to-patient basis aiming at detecting these errors before and during the treatment. There exist several guidelines, which recommend quality assurance (QA) protocols for specific system components, like TG 142 for linac, TG 179 for CT based IGRT workflow, AAPM practical guideline for treatment planning system, and TG 218 for patient-specific plan verification.

To perform integrated tests of the entire treatment chain, a new modular phantom (**RUBY, PTW Freiburg, Germany**) has been designed as a universal QA solution i.e., phantom, inserts, detectors from one single source, which supports the latest radiotherapy treatment techniques, including SRS, SBRT, SGRT, Varian Halcyon™ and Elekta Unity.

2. Phantom

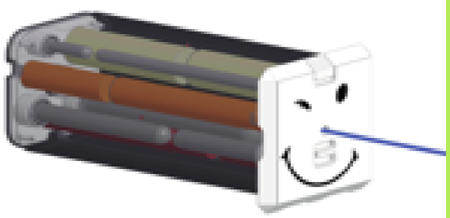


The RUBY is a modular polystyrene phantom consisting of a base body and five modular inserts. The phantom's surface has three sets of markers: **black lines** indicate the center of the phantom base; **Gray lines** for translational misalignment; **Red lines** for a combination of translational and rotational misalignment. The rotational misalignment can be achieved with a tilted base plate.
The functionality of each insert is described in the following.

2.1. LINAC QA Insert

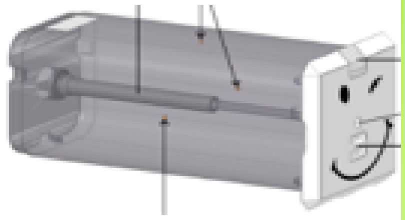
The Linac QA insert consists of four bone equivalent cylinders distributed in all spatial directions to provide sufficient data for CBCT / EPID image registration. A ceramic ball of 8 mm in diameter at the center allows the performance of a Winston–Lutz test. The insert assures the seamless integration between on-board imaging systems, robotic couches, and image registration algorithms.

2.2. System QA Insert (End – to – End testing)



This contains three tubes (1 cm, 1.5 cm, and 2.5 cm diameter) filled with an MRI visible liquid and three additional tubes – lung equivalent material (3 cm diameter), bone equivalent material (1.8 cm diameter), and brain equivalent material (2.2 cm diameter). Different detectors can be inserted allowing point dose measurements at the center of the phantom. All structures are positioned around the detector, and in addition, the structures are interrupted at different positions to enable 3D image registration.

2.3. SRS Patient QA – Point dose method

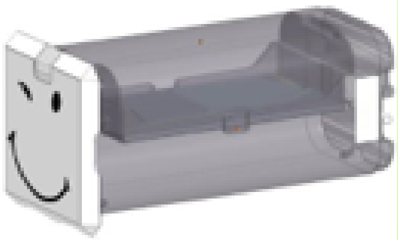


The insert is a homogeneous polystyrene insert in which a detector can be inserted for point dose measurement at the center of the phantom. The insert is compatible with different detector types such as The PinPoint 3D (type 31022) ionization chamber; microdiamond (type

60019) detector; microSilicon (type 60023) etc. with Gold – standard M – type connector end.

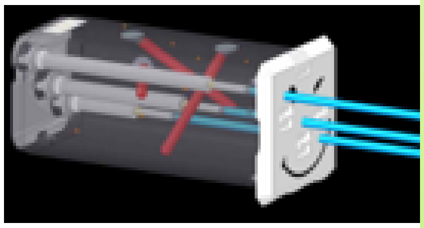
2.4. SRS Patient QA – Film based measurements

This allows its usage in measurement-based patient-specific plan verification, including non-coplanar treatments, with high-resolution radio chromic films. This allows two-dimensional dose verification of treatment plans of any Gantry angle without re-positioning. The design of the insert when combined with base phantom permits the film to be positioned at different planes such as coronal, transversal, sagittal.



2.5. MultiMet Insert for Multiple metastasis

To perform the quality assurance of irradiation of multiple metastases with one iso centre or non-iso – centric treatment, with or without couch rotation. It enables the positioning of three detectors at different positions having longitudinal spacing of 12 cm; lateral of 6 cm and vertical of 5 cm from each other. The embedded three bone equivalent cylinders enable compatibility with IGRT systems and provides contrast for positioning using kV imaging.



Conflict of interest

½ Karan Bhateja (Asst. Manager) is an employee of PTW Dosimetry India.

Radiation Safety Assessment of Advanced Radiotherapy Equipment

Sunil Dutt Sharma, PhD
Radiological Physics & Advisory Division, Bhabha Atomic Research Centre, CT&CRS

A variety of advanced equipment are in use in radiotherapy for precise and localised dose delivery to the tumour. Majority of these equipment is electron linear accelerator based radiation generators (e.g. advanced standard medical electron linear accelerator, tomotherapy unit, cyber knife) while some of them are isotope based radiation generators (e.g. gamma knife, view ray). As we all know the main objectivres of the radiation safety is to provide adequate protection and safety to the public, professional, patient and environment. The safety assessment goals of radiotherapy equipment also fulfill this criteria.

In general, the safety aspect is classified into two categories, namely, built-in safety and operational safety. For radiation safety assessment of radiotherapy equipment, we always focus on built-in safety aspects through the evaluation of design safety features. The design safety features of a given radiotherapy equipment depends on a number of parameters including the method of radiation beam generation. For example, for acceleartor based system, the radiation beam is available only when the system is energised. Accordingly, radiation safety related tests are prescribed and conducted in beam on condition only. However, in the case of isotopic source based radiation generator, the radiation safety related tests are prescribed and conducted both for beam on and beam off conditions. In addition, the tests realted to design safety features are prescribed for different modalities and capabilities of a given equipment. For example, if it is required to carry out radiation safety assessment of a multi-modality standard medical electron linear accelerator which has the capability of treatment delivery by various radiotherapy techniques including 3DCRT, IMRT, IGRT, VMAT, and SRS/SRT/SBRT, the test parameters are grouped according to the use of the equipment and the radiation safety assessments are conducted accordingly.

INVITED SPEAKER

The available radiotherapy (RT) equipment are broadly grouped as standard RT equipment and specialised RT equipment. The generaric radiation safety test parameters such as leakage radiation from the head of the equipment and transmission through the secondary/tertiary collimator systems are almost similar for these two category of the equipment. However, specific radiation safety test parameters are different for the two category of the equipment. Accordingly, the specific radiation safety test parameters are prescribed for each type of the specialised RT equipment. For example, the specific radiation sfaety related tests for 6 MV standard LINAC will be somewhat different from the specific radiation safety related tests for cyber knife and tomotherapy units which also generates 6 MV x-rays for treatment delivery. This difference is due to the difference in design of collimator systems and the beam apertures used for the treatments.

Similarly, in case of RT equipment which generates radiation beam through isotopic sources, the generic radiation safety related tests are almost similar. However, specific radiation sfaety related tests depend on the type of the equipment whether standard or specilised. For example, the specific radiation safety test parameters of an avanced standard telecobalt machine with multileaf collimator are different from specialised telecobalt machine, gamma knife, and super specialised telecobalt machine, view ray. This difference is quite obvious considering the clinical use of the equipment.

In summary, radiation safety assessement of a radiotherapy equipment depends of its design capability and clinical use. Built-in safety features generally give importance to patient safety besides the safety of radiation professionals.

INVITED SPEAKER

Expanding Roles of Medical Physicists in Precision Oncology

Chai Hong Yeong
School of Medicine, Faculty of Health and Medical Sciences
Taylor's University, Malaysia
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In 2015, the President of the United States, Mr. Barack Obama announced a research initiative that aims to accelerate progress towards precision medicine. The mission is to enable a new era of medicine through research, technology and policies that empower patients, researchers and providers to work together toward development of individualized treatments. The concept of precision medicine is not new, but the prospect of applying this concept has been dramatically improved by the multidisciplinary efforts in omics studies (eg. genomics, proteomics, metabolomics), molecular imaging, functional imaging, anatomical imaging, as well as big data analysis (computing). Cancers are the leading causes of death worldwide and the incidence increases as the population ages. It is therefore a primary target in precision medicine to show near-term impact. The branch of precision medicine that relates to cancer treatment is referred to as "precision oncology". This talk aims to share some updates on personalized cancer treatment, with the focus on targeted therapies, theranostics (therapy + diagnostics) and radioimmunotherapy. We encourage researchers from multi disciplines to attend and contribute their ideas in cancer research.

Precision medicine, oncology, personalised treatment, theranostics, radioimmunotherapy, targeted therapy

Medical physicist in ensuring quality assured proton therapy in patient

Dayananda Shamurailatpam PhD
Head department of Medical Physics, Apollo Proton Cancer Centre, Chennai.

Proton beam therapy (PBT), especially using spot scanning technique (SST), is increasingly adopted as a superior radiotherapy technique, owing to its distinct Bragg peak characteristics and radiobiological benefit. Besides the technical complexities involved in PBT, the sensitivity of proton beam parameters, especially the proton range on numerous physical, clinical and radio-biological parameters, however, possess numerous challenges during various phases of the treatment planning and delivery process. Medical Physicist plays a crucial role in developing standard operating procedures (SOPs), mitigating the uncertainties and ensuring that the potential benefit of PBT is imparted to the needy patients for better clinical outcome and improve quality of life. Although the underlying principles of precise delivery of radiation dose safely to the patient remains similar to that of high precision radiotherapy employing X-rays, there are additional challenges specific to proton, which need to be addressed systematically employing relevant protocols, formalisms, algorithms and choice of detectors and measuring equipment.

Characterization of the proton delivery system (PDS) and clinical commissioning is probably the most important step prior to patient treatment and need to be carried out with highest possible accuracy for precise and safe delivery of dose to patient. The commissioning of PT facility with poor quality and incorrectly measured or extrapolated beam data can results in systematic error in dose delivery which subsequently may lead to erroneous patient treatments and radiation incidents or accidents. Clinical commissioning of a new PT facility demands the characterisation of the PDS in accordance with the beam delivery technique and requirement by the treatment planning system (TPS). A core team of medical physicist lead by an experienced senior medical physicist having in-depth knowledge of PBT and practical experience of PDS is primarily responsible for accurate commissioning of PBT. Auditing the chain of PBT workflow by an external medical physicist expertise in PBT and/or participating in an international audit programme would further enhance the confidence of precise delivery of dose safety to patient.

Although the treatment simulation and planning process of PBT is similar to any form of modern high precision X-ray therapy, PBT planning demands a meticulous approach to each stage of the planning process due to the fact that proton or any charge particle is vulnerable to range uncertainty. The influence of the a) Hounsfield unit (HU) to relative stopping power calibration, b) presence of range perturbing medium such as surgical implants, dental fillings, air cavities, change of patient anatomy, c) variation of radiobiological effectiveness (RBE) with linear energy transfer (LET) etc. should be considered during the planning process. The medical physicist(s) specialized in clinical treatment planning are responsible for ensuring the accuracy of modelled dose distribution though a) validation by taking in to account of all possible clinical complexities and variables of PDS, b) appropriate choice of optimization algorithm and technique, and c) mitigation of various proton specific uncertainties.

The treatment planning of PBT especially with SST, which enable intensity modulated proton therapy (IMPT) involves complex iterative optimization of multiple proton energy staking with several thousand spots, their positions, spacing, and weights to achieve a highly conformal dose to the tumor. The intricacy of the proton spot intensity map (SIM) per energy layer, thus created in the TPS, also varies depending on the type of the optimization technique. In addition to the periodic quality assurance (QA) carried out to ensure that PDS performed within the baseline data generated during commissioning, successful implementation of IMPT also demands pre-treatment patient-specific quality assurance (PSQA) to verify that each patient's planned dose is safely delivered within the required accuracy. Medical Physicist specialized in performing the PSQA of IMPT plans ensured that planned dose in TPS is delivered on the PDS and hence on the patient. Medical Physicist are also actively engaged in research to enhance the quality and efficacy of patient treatment using PBT.

Artificial Intelligence applications in Intensity Modulated Proton Therapy

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I. Introduction:
Artificial Intelligence (AI), is a broad concept of converting computers and machines in to smart devices by imparting cognitive features like learning, interpreting and finding out solutions to new challenges. The emergence of AI in the recent past has been influencing change in many clinical specialties; most relevantly in intensity modulated proton therapy (IMPT) - the one driven by enormous digital data, sophisticated computer applications, and state-of-the-art treatment machines. The applications of AI in IMPT can be categorized mainly in to treatment planning, quality assurance, and adaptive radiotherapy.

II. Synthetic DE-CT:

Treatment planning in IMPT requires appropriate conversion of Hounsfield Units (HU) in computed tomography (CT) images to the corresponding stopping power ratio (SPR). Current approaches employed to convert SPR values from HU numbers have got various limitations. Dual-energy CT images can be used to directly estimate the voxel-wise SPR, because of its ability to reconstruct electron density and effective atomic number. Issues related to high cost, noise and artifacts in DE-CTs have fueled research in AI to generate synthetic DE-CT (sDECT) images from SE-CT than opting for an actual DE-CT. A machine learning algorithm called residual attention generative adversarial network (GAN) has been explored to generate sDECT and derive SPR from it for dose calculation in IMPT1.

III. MR only planning:

Magnetic resonance imaging (MRI) only treatment planning is a concept being investigated in IMPT - as it can achieve accurate delineation of tumor and critical structures, spare patients from CT radiation exposure, and avoid registration errors between CT and MR images. Since MRI signals are not directly linked to HU numbers, AI algorithms like convolutional neural network (CNN) and 3D dense cycle-GAN are being explored to generate synthetic CT (sCT) from MRI for dose calculation in IMPT of abdomen, pelvic and brain sCTs.

III. IMPT dose calculation:

AI applications have been explored to calculate the total dose distribution in IMPT from spot parameters. Algorithms are also used to improve the dose calculation accuracy by predicting Monte Carlo (MC) dose distributions from the inputs of analytical pencil beam (PB) dose and patient CT images. Nomura et al. proposed a convolutional neural network (3D-CNN) based method to calculate the dose distribution of each proton spot from variable spot data (initial beam energy, spot weight and position). Neishabouri et al. designed a model based on Long-Short Term Memory (LSTM) networks to calculate the dose for each pencil beam on a phantom data and on lung patient images - both exhibiting high inhomogeneities.

IV. Adaptive proton therapy:

AI related research works are also explored in the area of adaptive proton therapy to convert cone beam CT (CBCT) to CT and to map SPR from CBCT. Kurz et al. evaluated the performance of using a cycle-GAN to convert CBCT images into sCTs in proton therapy. A study by Thummerer et al. have shown that CBCT-based synthetic CTs created by U-Net variant had a higher image similarity to planning CTs images than MR-based sCTs. Harms et al. proposed a method to directly map the SPR from CBCT.

V. IMPT patient specific QA:

Trained ML models have been adopted in patient specific QA of IMPT to predict errors in pencil beam scanning treatment delivery by using treatment plan spot parameters and delivery log files as inputs.

VI. Conclusion:

AI methods have great potential to improve the accuracy and efficiency of treatment workflow in IMPT. However, these applications have to be evaluated for a wide variety treatment sites and patient data prior to clinical implementation.

INVITED SPEAKER

Role Of Artificial Intelligence In Medical Imaging

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INTRODUCTION:
The idea to use artificial intelligence for algorithm-based analysis of chest X-ray medical images has emerged in the horizons of healthcare to address the impending problems associated with Covid-19 patients. Importantly the World Health Organisation WHO has also issued guidance in this regard in its June 2020 briefing of which states that in the Indian scenario the chest X-ray medical imaging assumes increased importance as it is a very commonly used diagnostic tool which is available in every part of the country including very remote rural areas of India. The chest X-ray imaging is considered as a front-line basic diagnostic tool for the detection of pulmonary disorders. It can therefore be conceptualized to make use of AI-based medical screening of Chest X-ray images in symptomatic as well as non-symptomatic/ suspected cases of Covid-19 to not only predict the AI diagnostic score for the presence or absence of pulmonary abnormalities caused by Covid-19 but also to make diagnostic use when RT-PCR is either not available or results are delayed. The AI-based scores can also be used to help to decide the patients with moderate symptoms whether they require hospital admissions or can be considered for home isolation.
EMERGING TRENDS:

In this current time crisis, the world has entered into an ongoing war against second or even third wave of Covid-19 pandemic and ever-increasing number of infected cases has posed the biggest challenge to the scientific community in the history of mankind. Although home made vaccine has already come into use through mass vaccination in a phased manner, the strain of novel virus was first detected in Wuhan China in December 2019, and as of now, more than million cases have been reported to be detected in more than 190 countries around the globe resulting into more than 0.90 million deaths worldwide.

The huge influx of the suspected cases has already exceeded the available capacity, and now there is a big challenge to do testing and then adequately treat the detected cases so as to minimize the mortality and mitigate the increasing trends and flatten the curve in a quickest possible time period. While preventive measures would help, to a large extent, it is equally important to undertake extensive research to provide an effective tool for rapid medical screening of suspected cases and hence the present project is proposed. It would address the problem of rapid and quick screening as well as to identify the factors which might be impacting the severity and variability so as to help optimally utilizing the resource e. g. whether in all likelihood a given patient would require extensive isolation/ventilator support/ICU care or the patient can be predicted to be a low-risk patient and would recover without any extensive isolation/ICU care

CONCLUSIONS:

1.Clinical observations of confirmed Covid-19 cases suggest that genetic factors may influence Covid-19 disease susceptibility, but these factors remain largely unknown in the Indian population as there has been no scientific study conducted till date looking at this aspect of Covid-19 disease in India. Some of the findings in the European population clearly demonstrate a possible association between host genetic factors and susceptibility and severity of the Covid-19 disease. The more knowledge we have on the host genetic factors influencing Covid-19 susceptibility, the better we will be able to determine the clinical efficacy of potential treatments and deciding on treatment options for patients.

2.Emerging technologies are set to play an important role in our response to the Covid-19 pandemic and focused data sets, and artificial intelligence-powered search tools are a way forward for the unprecedented challenges that the Covid-19 pandemic has created for the medical and clinical diagnostic community. The fight against Covid-19 can be supported by a number of Covid-19 focused databases and artificial intelligence-based initiatives aimed at assessing dissemination of the disease, aiding in detection and diagnosis, minimizing the spread of the disease, and facilitating and accelerating research globally.

Responsibilities of Health Professional in Nuclear Medicine

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Nuclear medicine is a specialized area of medicine that uses very small amounts of radioactive materials, or radiopharmaceuticals, to examine organ function and structure. Nuclear medicine imaging is a combination of many different disciplines. These include chemistry, physics, mathematics, computer technology, and medicine. This branch of medicine is often used to help diagnose and treat abnormalities very early in the progression of a disease, such as thyroid cancer. Though, there are many diagnostic techniques currently available, nuclear medicine uniquely provides information about both the structure and function of virtually every major organ system within the body. It is this ability to characterize and quantify physiologic function which separates nuclear medicine from other imaging modalities, such as X-ray. Nuclear medicine procedures are safe, they involve little or no patient discomfort and do not require the use of anaesthesia.

The nuclear medicine technologist/physicist is a highly specialized health care professional in nuclear medicine who looks at how the body functions in order to help in diagnosis and treatment of a range of conditions and diseases. They prepare and administer small amounts of radioactive substances called radiopharmaceuticals, as well as other medications, to patients for diagnosis and treatments. These health care professional are recognised by the national regulatory authority of our country i.e. Atomic Energy Regulatory Board (AERB) and considered as the backbone of nuclear medicine.
Nuclear medicine technologists may also operate Computed Tomography (CT) and Magnetic Resonance Imaging (MRI) scanners that are used in conjunction with nuclear medicine procedures. The important responsibilities include

- Putting the patient at ease, obtaining pertinent history, describing the procedure and answering the patient's questions.
- Administering radiopharmaceuticals and medications for patient imaging and therapeutic procedures.
- Monitoring the patient's physical condition during the course of the procedure.
- Processing data and enhancing digital images using advanced computer technology.
- Providing images, data analysis and patient information for diagnostic interpretation or therapeutic procedures.
- Evaluating images to determine the technical quality and calibration of instrumentation.
- Evaluating new protocols.
- Prepare performance specifications for equipment with regard to radiation protection.
- Participate in the continuing review of the nuclear medicine practice's resources (including budget, equipment and staffing), operations, policies and procedures.
- Carry out acceptance testing and commissioning of equipment.
- Design, implement and supervise QA procedures.
- Supervise equipment maintenance.
- Be responsible for calibration of equipment and dosemeters.
- Perform patient dose assessment.
- Participate in optimization of imaging protocols.
- Participate in the investigation and evaluation of incidents and accidents.

Apart from the above, if approved as RSO, they also have the primary responsibility for ensuring overall radiological protection of patients, and to:

- Ensure that each medical exposure is justified in consultation with the referring physician;
- Ensure that the exposure of patients is the minimum required to achieve the intended objective, taking into account the relevant guidance levels for medical exposure;
- Establish optimized protocols for diagnostic and therapeutic procedures, in consultation with the nuclear medicine physician;

- Provide criteria to manage the examination of pregnant women, paediatric patients, medico-legal procedures, occupational health examinations and medical and biomedical research;
- Contribute to the radiation protection training programme.
- Evaluate any radiation incident or accident from a medical point of view and report to AERB.

Nuclear medicine will continue to be a field at the forefront of modern clinical medicine and technological development because of the development of new radiopharmaceuticals for diagnostic and therapeutic purposes, promising research and development of cancer-detecting and cancer-killing agents, such as genetically engineered antibodies and the expanding clinical use of exciting new technology known as Positron Emission Tomography (PET), which provides new and unique means of studying biochemistry and metabolism within living tissues

INVITED SPEAKER

Diagnostics and Therapeutic Procedures of Nuclear Medicine for benefits of Patients

Dr Subhash Chand Kheruka
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"Nuclear technology can help save lives. As one of the tools used in the human health area, nuclear medicine can be harnessed for a variety of techniques to diagnose and treat diseases."
- IAEA Vol. 2.6.1 Annals/face sheets

Nuclear medicine is a field of medicine that uses a trace amount of radioactive substances for the diagnosis and treatment of many health conditions such as certain types of cancer, and neurological and heart diseases.Nuclear medicine is a medical specialty that involves the application of radionuclides as unsealed sources. Radioisotopes are most frequently attached to drugs to form radiopharmaceuticals that travel to a specific organ or tissue in the body.

Benefits of Nuclear Medicine
Nuclear medicine is a safe, painless, and cost-effective way of gathering information that may otherwise be unavailable or require a more expensive and risky diagnostic test. One unique aspect of a nuclear medicine test is its extreme sensitivity to abnormalities in an organ's structure or function. As an integral part of patient care, nuclear medicine is used in the diagnosis, management, treatment and prevention of serious disease. Nuclear medicine imaging procedures often identify abnormalities very early in the progression of a disease long before some medical problems are apparent with other diagnostic tests. This early detection allows a disease to be treated early in its course when there may be a better prognosis.
Although nuclear medicine is commonly used for diagnostic purposes, it also has valuable therapeutic applications such as treatment of hyperthyroidism, thyroid cancer, blood imbalances, and any bony pain from certain types of cancer.

Abstracts

INVITED SPEAKER

Radioisotopes/Radiopharmaceuticals

Some radioisotopes that decay with alpha or beta radiation are used for treating diseases such as cancer. Others that decay with gamma or positron radiation are used in conjunction with powerful medical scanners and cameras to take images of processes and structures inside the body for disease diagnosis. In medicine, two of the most commonly used radioisotopes are technetium-99m and iodine-131.

The gamma emitting technetium-99m is mainly used to image the skeleton and heart, but also to image the brain, thyroid, lungs, liver, spleen, kidney, gallbladder, bone marrow, and infections, as well as for other specialized medical studies. Iodine-131 is widely used to treat overfunctioning thyroid glands and thyroid cancer, and to image the thyroid. Radioisotopes are also used for medical research to study normal and abnormal functioning of organs and systems.

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Scintigraphy/SPECT

Scintigraphy, a two-dimensional imaging process, is a diagnostic technique in nuclear medicine. Taken internally, the radiotracer emits gamma radiation that is captured by external detectors, known as gamma cameras, to form twodimensional images for medical assessment. Clinical images can also be acquired at multiple angles creating a replica of the body's cross section, a technique called single photon emission computed tomography (SPECT). SPECT systems use a rotating gamma camera to obtain images of the distribution of the radiopharmaceutical within the patient's body from different angles. This technique is particularly valuable because of its unique ability to precisely locate the abnormality in the body through a three-dimensional (3D) image of the distribution of the radiopharmaceutical.

PET-CT Imaging

Positron emission tomography (PET), especially valuable in the detection and management of cancer, works in the same way as SPECT, but uses radioisotopes that generally decay faster and produce two rays that move in opposite directions. The special configuration of a PET system enables a 3D reconstruction of the distribution of the radiopharmaceutical. The nuclear medicine 3D images can be superimposed, using software or hybrid cameras, on images from modalities such as computed tomography (CT) or magnetic resonance imaging to highlight the part of the body in which the radiopharmaceutical is concentrated. This practice is often referred to as image fusion or co-registration, for example SPECT/CT and PET/CT. Fusion imaging techniques in nuclear medicine provide information about anatomy and function. The combination of anatomical and functional information, provided by the hybrid imaging systems, increases the sensitivity and specificity of medical examinations, particularly in difficult cases. Overall usage of nuclear medicine procedures is expanding rapidly mainly due to the improvement of medical devices and the production of an ever increasing number of specific radiotracers, which allows the visualization of more diseases.

Abstracts

INVITED SPEAKER

Therapeutics

The administration of a radionuclide to destroy targeted cells is calledradiometabolic therapy. Radionuclide therapies are widely used in theprevent recurrence through spreading of loose cancerous cells which can lead to metastatic cancer, all malignant tumour cells must be completely destroyed. In nuclear medicine therapy, the radiopharmaceuticals emit ionizing radiation that travels only a short distance in the body, thereby minimizing unwanted side effects and damage to other organs or nearby structures.

Ensuring Safety

Ensuring safety when using nuclear medicine, Apprehensions about radiation exposure are common among the public, but nuclear medicine procedures are safe. Moreover, these procedures are relatively painless and free of side effects. The benefits definitely outweigh the risks. Medical staff follow strict rules and are trained to ensure the safety of those patients who are given radioisotopes for diagnostic or therapeutic purposes. Referral guidelines to guide the proper selection and application of medical images should be used by the medical doctors involved in patient management. The two general principles of radiation protection — justification and optimization — are applicable for medical radiological procedures:

Justification of medical exposure entails weighing the diagnostic or therapeutic benefits of exposure against the potential for harm, and taking into account the benefits and risks of available alternative techniques that do not involve ionizing radiation exposure.

Optimization of protection and safety in diagnostic and interventional medical exposure entails keeping the exposure of patients to the minimum necessary to achieve the required diagnostic or interventional objective. Dose limits do not apply to medical exposure, as they may limit the benefits for the patient.

Keywords: Radiotracer, PET, Molecular Imaging, Justification, Optimization etc.

Quantification in Nuclear Medicine

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The purpose of this task is to review the state of the art in image quantification and provide a background for medical physicists and physicians who wish to quantify activity distributions of radiopharmaceuticals used in nuclear medicine.

Nuclear medicine images can be used for either detection, such as identifying perfusion defects, or quantification, like estimating ejection fraction, standardized uptake values (SUVs) or organ absorbed dose. Obtaining images that are suitable for quantifications often requires additional processing compared to use for visual interpretation. This additional processing often improves the resolution and contrast and reduced artefacts. These improvements in the image will use to translate directly to improved performance on detection tasks. For example attenuation correction methods for cardiac single photon emission computed tomography (SPECT) has improved detection of myocardial perfusion defects and also providing images which are quantitatively more accurate.

Many current applications that involve quantification of nuclear medicine images use relative quantification only. These applications often involve ratios of image intensity values. Computing relative values from images that have been processed to provide improved quantification will result in reduced spatial variance and patient dependence, even for applications where relative quantification is sufficient. Another advantage of using images that are quantitative in an absolute sense is to provide improved consistency. For example, some diagnostic procedures involve the use of diagnostic thresholds derived from normal databases; absolute quantification in creation and use of these databases will ensure that reference values derived from databases are consistent across centres, imaging equipment and time, and are independent of patient variability.

In addition to improve image quality and relative quantification, there are several applications of nuclear medicine that require images should be quantitatively accurate.

Two such increasingly important applications are targeted radiotherapy treatment planning and advanced kinetic analysis. Achieving absolute quantification requires appropriate equipment, software and human resources. The level of these requirements depends on the imaging task. For example, quantifying activity in a tumour in the lungs requires more sophisticated resources than quantifying whole body activity.

However, there are a number of physical, patient, and technical factors that limit the quantitative reliability of nuclear medicine images. There have been a large number of improvements in instrumentation, including the development of hybrid single-photon emission computed tomography/computed tomography and PET/computed tomography systems, and reconstruction methods, including the use of statistical iterative reconstruction methods, which have substantially improved the ability to obtain reliable quantitative information from planar, single-photon emission computed tomography, and PET images.

Abstracts

INVITED SPEAKER

Ultrasound images based radiomics for early prediction and protection of cervical cancer

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Cervical cancer is the fourth most common causes of cancer-related death among women in the developed countries, and the second in the developing countries. Ultrasonography is universally recognized as a convenient and reasonable price method to help clinician to detect and diagnosis of cervix cancer in clinically. Only the accuracy and reproducibility of the interpretations of ultrasound images are often relied on the skill of the ultrasonographer, which leads to the limitation of interobserver variability. Therefore, computer aided or objective evaluation markers from radiomics features based on ultrasound images are imperatively needed. The purpose of the series studies is to, on the basis of previous research, with the help of machine learning and deep learning techniques, 1) to explore the big data cleaning standard of ultrasound images to improve the quality and consistency of ultrasound images. 2) to explore the automatic segmentation technology of cervical cancer tumor target based on ultrasound and the automatic extraction technology of radiological features by using deep learning technology, to improve the quality of radiological features, and 3) to explore the automatic diagnosis and treatment assistant system of cervical cancer based on ultrasound radiological features and related clinical characteristic parameters. to improve the level of individual diagnosis and treatment of cervical cancer and improve the survival and quality of life of patients.

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Radiation Safety, Surveillance, Prevention, Preparedness and Response to Exigency': Emphasis on Radiation Technology / Nuclear Medicine usage

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1. Introduction
The area of interest is effect of ionizing radiation, it's surveillance and safety of personnel and environment. The natural radiation background which leads to chronic human exposure of all age groups, does not result as radiation induced effects in any clinically distinguishable form. Exposure to ionizing radiation is expressed in units – Gray, an absorbed dose of 1 J/Kg of matter. With knowledge on the type of ionizing radiation, suitable modifying factors for effect of radiation (WR), cellular effects (WT), the equivalent dose and effective dose to human system is estimated in dosimetric quantity – Sievert for living cellular matter. The radiation applications for human use in medical field are designed for enhancing the beneficial effects.
2. Radiation Technology
Radiation technology and radioactive material as radio-isotopes are widely used in applications such as medicine, industry, agriculture, research and also in nuclear power production. Safety features are incorporated in designing stage itself to minimize radiation hazard during normal operations. Also the preparedness and various response protocol has been developed and deployed to minimize the consequences during any abnormal event. Though there is a myth prevailing on ionizing radiation linked to the exposure of public, but the epidemiological studies have not indicated any genetic effects or other hazardous health effects attributable to radiation exposure. Radiation technology / nuclear medicine is widely used in diagnostic, therapeutic uses in Medical applications, Radio-pharmaceuticals, Nuclear medicines, X – rays, treatment using brachy-therapy and tele-therapy, gamma knife are few such widely known medical uses of radiation. Cancer treatment using gamma exposure is widely used for terminally ill patients and nuclear medicines find usage in palliative cure. Governing safety aspects during the use of nuclear medicine both for the care giver and comforter have been evolved. The Quality Assurance programs have mandated on the tools / use of Nuclear Medicine which ensures that safety is accorded top priority.

3. Nuclear Medicines

Radio-isotopes are generated by neutron bombardment during irradiations (induced nuclear reactions: activation products) at operating nuclear reactors. Irradiation of selected targets at nuclear reactor leads to neutron reactions, generation of some activation products and radioisotopes used in various applications are obtained from the operations of nuclear reactors. Some radio isotopes are generated at the accelerators also. Such target materials (stable isotopes) are irradiated for specified time duration to produce such radio-isotopes, which after radio-chemical processing are used as nuclear medicines or tools of radiation technology. Operation of nuclear reactors and accelerators lead to production of radio-isotopes that are used in the diagnostic, therapeutic applications. 18F, 99Mo, 131I, 154Sm, 177Lu are few such radio-isotopes used in nuclear medicines while, 60Co, 192Ir and 137Cs as gamma emitting radioisotopes find use in irradiators for sterilization of medical products, cancer therapy and medical exposures. Uses of these radio-isotopes for their applications in medicine, with built-in radiological safety, shielding and transportation mechanism have resulted in more benefits than the marginal radiation hazard. Due to this, the applications of radiation in medical arena have been ever increasing.

4. Safety Surveillance in Nuclear Medicine Application

Accelerators, nuclear reactors and radiological facilities established to process the radio-pharmaceuticals for use in the field of medical applications are set up consequent to their approval for commissioning from National regulatory body viz., Atomic Energy Regulatory Board (AERB). The annual dose limits are specified by AERB for the various kind of personnel at the facility – Medicos/Para-medical staff, RSO/Radiation Safety personnel, Technicians, Comforters etc and also for the members of public in the vicinity due to radiological operations at and discharges from the facility, which is in line with the ICRP dose limits. AERB oversees on the safe handling operations at these facilities ensuring the protection of workers, public and the environment. The end users of radiation technology can make use of radio-isotopes, applications in the field of Medicine, only after peer review of safety systems, manuals and verification on the availability of trained set of radiation safety / operating personnel, after commissioning clearance is issued by AERB.

Abstracts

INVITED SPEAKER

The identified (Ex: 18F, 131I of indented amount of radioactivity) radio-pharmaceuticals are orally / IV administered by medicos in presence of Radiological Safety Officer (RSO) for nuclear imaging, diagnostic purposes. Such low toxic chemicals as radio-pharmaceuticals have short radio-half life, gets eliminated from human system quickly. The patient on monitoring when the radiological risk is found less, is discharged from the nuclear medicine centre, with necessary follow-up. The gamma emitting radio isotopes for cancer treatment are kept under well shielded manner. Based on estimation and quality assurance programmes, the sources are implanted at identified parts of the human subject for desired exposure in suitable time-period to suppress the malignant growth of the cancerous cells. The tele-therapy machine Bhabhatron developed by the department is designed to administer pencil beam of focused gamma radiation exposure to the desired malignant tissue, ensuring that the adjacent tissues are not subjected to any extra risk of radiation exposure. AERB ensures safety during operation, transportation of radiation consignments and also during handling of radioactive waste, with its stringent regulatory review, periodic inspection and licensing RSO as radiation safety / protection personnel with their mandate to provide periodic reports of normal operations and in case of any abnormal events. The exposure to public around the radiation and nuclear facilities due to these environmental releases is a very small fraction (< 5 %) of the annual exposure limits set by AERB and is negligible to cause any health hazards to be found in public domain. There has been no reported incident of human life loss attributable to Radiation Emergency from the Indian nuclear reactors, for the past 60 years of operations.

5. Radiation Exigency

Though the radiation safety is prioritized and ensured during operations at facilities using radiation technology at a nuclear medicine centre, any abnormal situation can't be ruled out, arising out of failure of safety systems, human error or combination of both as the cause of initiating an accident. The abnormal situation at the facility is termed as the 'Radiation Exigency'. The radiological events where the radio-isotopes are used for medical applications could lead to accidental situations during handling, transport or inadvertent loss of regulatory control over the radiation sources. Such radiological emergencies which could happen even in the public domain, have marginally higher probability of occurrence.

Abstracts

INVITED SPEAKER

Range of potential radiation exigency scenario is enormous, extends from a minor exigency arising out of machine / human error or both, radiological impact could be confined to a smaller area to a major exigency involving large inadvertent exposure due to fallen / stuck / spilled radioactive (radiological) source. There are over 150 cases in this area, reported over the last few years. Planning to mitigate the consequences of potential exigency scenario is carried out during the pre-commissioning stage of any proposed nuclear medicine facility. Prior to the approval for commissioning of nuclear medicine facility, a document on 'Plan for Response to Radiation Exigency' is mandated by AERB. Based on the plan there has to be demonstrated capability on Preparedness for Response to Radiation Exigency with technical capability, resources, systems / tools, gadgets, procedures, quality assurance tools and identified human capacity resource.

6. Preparedness and Response to Radiation Exigency

The increasing use of radiation technology has led the Department of Atomic Energy (DAE), India, to strengthen its Preparedness and Response to any potential radiation emergency involving nuclear medicine / radio-pharmaceuticals. In India, AERB is the national regulatory body, regulates all such facilities as per its regulatory framework in line with international codes / guides.

7. Conclusions

With radiological safety accorded priority risk assessment, indicate that no health effects are attributable to low radiation that were observed among the workers in nuclear medicine care givers, comforters or any other member of the population due to normal functions of nuclear medicine hospital facility. The hazard due to radiation is much smaller compared to the prevailing benefits of medical diagnostic and therapeutic applications. By the use of proper safe procedures and following the regulatory guidelines, radiation can be used as a gainful tool to the advantage of humankind. The preparedness and response to radiation exigency has been evolved over the past decades, with establishment of procedures, monitoring systems, available trained resource personnel (human capacity), preparedness and response aspects has been strengthened to meet future requirements.

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Abstracts

INVITED SPEAKER

Management of Radiological emergencies in public domain and Role of Emergency Response Centers

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Radiation is an inevitable part of the nature and so is radioactivity. It affects both living and non-living things. With the breakthrough discovery of X-rays by Roentgen in 1895 and of radioactivity by Henri Becquerel in 1896, the knowledge of radiation got completely revolutionized and some radiations have enough energy to ionize the materials they pass through. Such radiations are called ionizing radiations, include X-rays, alpha, beta, gamma-rays, neutrons, protons and many more cosmic particles that are bombarded earth's atmosphere incessantly. Man-made radioactivity also came into being with the discovery of Irene Joliot-Curie and Frederic Joliot-Curie in 1934. Ionizing radiations do have harmful effects. These aspects of radiations and radioactive materials necessitate good understanding of the concepts of radiation protection and control, monitoring the use of radioactive materials for the wellbeing of the humankind is essential. In spite of the various regulations and safety measures, accidents still may happen leading to radiological and nuclear emergencies.

Radiation Emergency Response Centers have the vital role to meet the challenges posed by nuclear/radiological threats and prepared to tackle the emergency situation in order to safeguard the general public from their hazardous effect. In India, Department of Atomic Energy (DAE) is the nodal agency for providing technical inputs and advices to civil authorities for preparedness and response to nuclear and radiological emergencies in public domain. A total of 25 Radiation Emergency Response Centers (RERCs) have been established to cater to the need of the entire country. RERC, Jaipur has been in operation since its inception in 2004 and is in the office premises of the Atomic Minerals Directorate for Exploration and Research (AMD), Western Region, Pratap Nagar, Jaipur. The Nodal RERC, located at BARC, Mumbai coordinates with other RERC's.

The management of response to the radiological emergency is a very broad aspect which includes location/detection of a missing/orphaned radioactive sources (unshielded or shielded), accident involving radioactive consignment during transport, accident in a radiation facility/ radiochemical lab, etc.

The prime objectives of the Radiation Emergency Response Centers are:

- To provide technical assistance to the State administration in case of radiological/nuclear emergencies.
- To reduce the risk of the consequences of the accident at its source.
- To prevent the deterministic health effects (Early deaths and injuries) by taking actions before or shortly after exposure and by keeping radiation doses to the public individuals and emergency workers below the thresholds.
- To reduce the risk of stochastic health effects (cancer and severe hereditary effects) by implementing protective actions in accordance with guidelines of AERB/IAEA.

RERC, Jaipur was involved in management of a number of suspected radiological incidents that includes retrieval of radioactive sources in Rajasthan University, checking of smuggled consignments suspected to be radioactive, checking the use of dirty bombs in the serial bomb blasts at Pink City, Jaipur, checking and taking control of the jewelry export consignment that had radioactive materials, busting the gang involved in illicit trafficking of suspected radioactive materials.

Medical Physics: Women's Health and Radiation Safety

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The discovery of X-rays, natural radioactivity and ionizing radiation has played an important role in numerous fields in modern continuous scientific and technological developments. Applications of ionizing radiation are growing in industry, agriculture, medicine and many other fields of research, benefiting humanity. Contributions of medical physics for the occupational workers especially for women, s health in terms of radiation safety have been discussed here. The FDA recommends that imaging professionals follow optimization, justification, two principles of radiation protection of patients developed by the International Commission on Radiological Protection (ICRP). Iinternationals consensus was achieved for the IAEA safety standards (BSS) through the IAEA SAFETY SERIES, which adopted and documented for medical, public and occupational exposures as well as the special needs for the safety of women medical physicists with child bearing incidence. Six major relevant international organizations: FAO, IAEA, ILO, the OECD Nuclear Energy Agency (OECD/NEA), Pan American Health Organization (PAHO) and WHO are the initiator for these activities. A safety culture should be developed that governs the attitudes and behavior in relation to protection and safety of all individuals and organizations dealing with sources of radiation with special consideration to pregnant women. The unintended exposure of the women (reproductive age/preconception/ child bearing age) during radiodiagnostic and radiotherapeutic procedure as well as to make awareness to public regarding women's health as a patient /worker is important for "building community" for radiation protection. New researches can be adopted in monitoring radiation exposure, the challenges of measuring the health impact of low doses of radiation, the changing role of the medical center radiation safety officer, and organizational issues in ensuring effective radiation safety practices. Protection and safety should be ensured by sound management and good engineering, quality assurance, training and qualification of personnel, comprehensive safety assessments and attention to lessons learned from experience and research.

Abstracts

INVITED SPEAKER

The Role of Medical Physicist in Radiation Oncology Cancer Treatment

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Medical Physics is a branch of applied physics that uses physics principles, methods and techniques in the prevention, diagnosis and treatment of human diseases. Medical physics may further be classified into a number of sub-fields (specialties), including Radiation Oncology Medical Physics, Diagnostics Radiology Physics, Nuclear Medicine Physics and Health Physics or Radiation Protection Physics. Medical Physicist is a professional who have studied and trained in the specialty of medical physics. The Medical Physicist who have trained and specialized in the field of Radiation Oncology is called as Radiation Oncology Medical Physicist (ROMP). The main purpose of ROMP is to ensure the safe and effective use of radiation to cancer patients. The Medical Physicist has many roles in the clinical practice, education and training, research and development, quality management and professional development in radiation oncology cancer treatment.

The patient treatment outcome depends mainly on the accuracy of + 5% prescription dose delivery which is mainly driven by the practice of medical physicist who develop, commission and implement the equipment and technology for the routine clinical use. The medical physicist was started mandatorily employing in the hospital environment soon after the discovery of X-rays, radioactivity and radium and its clinical use for the patients.

The Radiation Oncology Medical Physicist (ROMP) plays many different vital roles in the cancer management not only in the treatment, but also in the education and training for all radiation professionals and also in conducting independent and collaborative radiation research work in relevance to cancer treatment. The ROMP roles will be as practioner-cum-clinical physics and technology consultant, teacher, trainer, researcher and manager.

As a clinical physics and technology consultant, they practice and give consultation on physical aspects and technical standards in the clinical use of technologies such as (i) radiation modeling and simulation technology (ii) radiation dosimetry technology (iii) medical imaging technology (iv) image registration and fusion technology (v) radiation treatment planning technology (vi) radiation treatment delivery technology (vii) treatment verification in-room image guidance technology (viii) oncology information technology (ix) artificial intelligence technology (x) Omics technology. They also act as a manager in radiation safety and quality assurance of radiation sources and equipment management, as a teacher and trainer in education and training for all radiation professionals and as researcher in the development and implementation of newer technologies for translational cancer research in the clinic.

The roles in quality management of radiation cancer treatment includes (i) setting up of radiotherapy program, (ii) planning and selection of equipment and staffing (iii) budget plan and quotation evaluation (iv) project management from construction to implementation (v) staff evaluation and management (vi) new clinical program development (vii) radiation safety committee and regulatory compliance (viii) cost-effective delivery service in imaging and therapy equipment procurement, utilization and maintenance. They play challenging roles and bigger responsibilities in radiation therapy.

The Medical Physicist also play an important professional development role in the development of human resource or workforce, development of certification and accreditation program, development of policy statement and practice guidelines and establishment of independent division or department.

There are significant benefits from the role of Medical Physicist in cancer treatment that are ranging from the procurement and utilization of high cost equipment, quality in radiation treatment to patients, lesser waiting time for radiotherapy new patients, regulatory compliance requirements, radiation risks to patients, personnel and public, cost effective and equipment maintenance, better teaching and training of future radiation professionals and innovations and quality research and development in the treatment of cancer.

INVITED SPEAKER

The medical physics is a translational physical science in medicine. The application of medical physics is a major and indispensable role in radiation medicine. The ROMP plays important role in the technology development and translating it into the clinical practice. The ROMP evolves from clinical scientist to specialist, teacher, researcher and manager. The ROMP involves in the clinical process of optimization, adaptation and personalization in cancer therapy, which result in the improvement of quality and safety of clinical practice which in turn improves diagnosis and treatments and saves lives of all patients who receive the radiation treatment.

The role of ROMP is the master of roster in deciding the patient outcome in cancer treatment. The ROMP play different roles such as foundational role in education and training of radiation professionals, critical role in clinical practice, major role in radiation research and technology and technique development and implementation, statutory role in radiation safety and quality management as a specialist, teacher, researcher and manager in radiation cancer treatment.

Communicating Medical Physicist roles to the public" is an essential for professional development, sustainability and visibility.

Abstracts

INVITED SPEAKER

***Nurturing a Global Initiative in Medical Physics Leadership and Mentoring**,*

Aik Hao Ng

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With the rapidly change in medicine and evolvement of the technology, medical physicist must be open to change and keep abreast to the current development. The medical physicist cannot stagnate and must face the challenges with the right attitudes. This may pose a challenge especially for a young medical physicist who has limited access to adequate career development opportunities. This presentation aims to report on the establishment of the “Medical Physics: Leadership and Mentoring Programme” and its development so far. The objectives of the programme are to develop leadership roles among young medical physicists, and to provide guidance and support for young medical physicists by creating an atmosphere of openness where meaningful communication and trust can exist. This pioneer programme is establishing partnership of interested junior and senior medical physicists to provide supports in their studies, career and life in general. It also helps to identify their strengths, needs, values and potential in order to realise their aspirations. Since its formation in 2016, the programme has expanded and kept growing to offer a platform for the young medical physicists to equip with leadership values. The group applies an e-mentoring method, which offers an innovative way of mentoring despite of geographic constraint. Teleconferences have also been organised to enable the mentors to share their experiences with mentees. Throughout its 4 years of operation, the group has accomplished four important achievements: worldwide professional network establishment, teleconference sessions with guest mentors, scientific collaborations and publications as well as information dissemination. A questionnaire survey among the mentees shows that the majority of them agreed that this programme has been beneficial in their career pathway. There is a need to further strengthen and expand the programme to become a more structured programme. We hope to reach out to more mentees globally and encourage more volunteers to join us in mentoring.

INVITED SPEAKER

The impact of Covid-19 on medical physics practices in Africa

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Senior Lecturer – Stellenbosch University
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Introduction:
Africa is the world's second largest and second most populous continent. The first case of Covid-19 was confirmed in Egypt on 14 February 2020 and to date there have been about 4.5 million confirmed cases and around 120.000 Covid-19-related deaths in Africa, with over one third of the caseload in South Africa.
Method and Materials:
A survey was sent to various centres in Africa requesting information on staffing, the environment, radiotherapy equipment, patient related issued and education changes during the Covid-19 pandemic. Additional information was obtained from articles in the newsletter of the Federation of African Medical Physics Organizations.
Results:
Most sites placed medical physics staff in a shift system. Most sites had screening stations at the entrance, but only 16.7% of sites had dedicated radiotherapy equipment to treat Covid-19 patients. The patient flow was adjusted in 75% of sites. Only 50% of sites had facilities for staff to work virtually or remotely and remote patient follow-up was only possible in 58.3% of sites. All sites promoted physical distancing and frequent handwashing or sanitizing. The use of masks is compulsory in some countries. Various centres introduced hypo-fractionated radiotherapy regimes to reduce the number of fractions, and thus the number of patient visits to the centre. One South African centre reduced the number of intensity-modulated radiation therapy (IMRT) and volumetric modulated arc therapy (VMAT) cases in favour of more patients being treated with three-dimensional conformal radiation therapy (3D-CRT), resulting in a drastic reduction in the amount of time needed for patient-specific quality assurance (QA). Logistical issues often hampered the import and use of radionuclides and radiopharmaceuticals. Some medical physicists in the region offered advice and did risk assessments for the safe use of mobile X-ray units in temporary field hospitals. Some hospitals took advantage of the pandemic to motivate for the purchase of digital X-ray imaging systems.

Work-from-home tasks for medical physicists included:

- Treatment planning support
- Treatment plan checks and independent monitor unit verification
- Weekly checks (if the records were kept electronically)
- Updating policies and procedures
- Writing and submission of research papers
- Online continuing professional development (CPD) activities
- Preparing lectures
- Presenting online lectures

Discussion and Conclusion:

Various medical physics staff members across the region have contracted Covid-19, to the best of my knowledge none with fatal consequences.

The role of the specialist vs. generalist medical physicist needs some review after the pandemic. A specialist medical physicist with a very specific skills' set must be on site when such a specialized procedure is performed; this may negate a potential benefit of having staff rostered in non-overlapping shifts to reduce the spread of Covid-19. In most cases the shift system was abandoned after a few months, as it was not sustainable without a drop in staff output.

The pandemic has highlighted severe weaknesses in hospital IT infrastructures. Remote network access was often not possible, either due to bad internet connectivity, restrictive IT policies or network that are not set up properly. This can be used to motivate for an improvement in the hospital IT services. In Africa many sites still use screen-film radiography, which also does not lend itself to remote access.

It was found that online teaching offers a great alternative to face-to-face teaching, but is not recommended as the predominant teaching mode.

INVITED SPEAKER

Main achievements of the International Union for Physical and Engineering Sciences in Medicine (IUPESM) for the profession – a summary of 40 years progress

Prof. Slavik Tabakov,
King's College London, Vice-President IUPESM

IUPESM (the International Union for Physical and Engineering Sciences in Medicine) is a Union of the International Organization for Medical Physics (IOMP) with the International Federation for Medical and Biological Engineering (IFMBE). IUPESM has been created in 1980 with the main aim to achieve and sustain the international recognition of both scientific fields – medical physics and biomedical engineering.

The presentation describes the path through which IUPESM becomes a full member of ICSU – the International Council of Scientific Unions - the oldest scientific non-governmental organisation in the world. IUPESM has achieved this in 1999, becoming the 27th Scientific Union member of ICSU. Recently ICSU merged with the International Social Science Council (ISSC) and both formed the International Science Council (ISC). IUPESM is automatically a member of ISC, together with the Scientific Academies of almost all countries in the world. Currently ISC has 122 multi-disciplinary National Scientific Members, Associates and Observers representing 142 countries and 31 international, disciplinary Scientific Unions and 22 Scientific Associates.

One of the consequence of the formation of the IUPESM and the membership to ICSU was the organisation of regular World Congresses on Medical Physics and Biomedical Engineering. IUPESM accepted the first joint meeting of the International Conferences of Medical Physics and of Biomedical Engineering as its first World Congress – this being in Jerusalem 1979. After this every 3 years the two sister professions have a World Congress. Due to the Covid pandemic the WC2021 in Singapore was moved to 2022.

The next major achievement of IUPESM was the recognition of both professional occupations (of medical physicists and biomedical engineers) by the International Labour Organization (ILO) in Geneva. It was through ILO, that the professional occupations could be included in the International Standard Classification of Occupations (ISCO). Finally, after many discussions, ILO decided to align the two professions with science and engineering and a Note was added to clarify their position in relation to other health professions. Thus both professional occupations were included in ISCO-08, which came in force in 2012 - medical physicists are listed under Unit Group 2111, and biomedical engineers under Unit Group 2149. To celebrate this achievement IOMP established in 2013 the International Day of Medical Physics (IDMP) – 7th November (the birthday of Maria Sklodowska Curie). Now it is celebrated globally, together with the further added International Medical Physics Week.
These recognitions could only be achieved by a joint Union of the two professions, which together can overcome the relatively small number of specialists in each one. To celebrate its 40th anniversary IUPESM established in 2020 a Fellowship scheme. Currently IUPESM represents about 150,000 medical physicists and biomedical engineers from over 100 countries.

Prof. Slavik Tabakov, PhD, Dr h.c., FIPEM, FHEA, FIOMP, FIUPESM, Past-President of IOMP (2015-2018) is the current Vice -President of IUPESM (2018-2020). He is officer of the Union since 2009. He is an active contributor to the international development of medical physics for over 30 years. He works at King's College Hospital and King's College London, UK, since 1991, being the Founding Director of MSc Clinical Sciences (Medical Physics), MSc Clinical Sciences (Clinical Engineering), and MSc Medical Engineering and Physics. He is also Co-Director of the International College on Medical Physics at ICTP, Trieste, Italy. Prof Tabakov has led 7 international projects, which developed the first e-learning in medical physics, the first educational website in the profession, the first Medical Physics Dictionary (translated to 32 languages) and the first e-Encyclopaedia of Medical Physics (www.emitel2.eu). Prof Tabakov is Founding Co-Editor in Chief of the IOMP Journal Medical Physics International. He has advised the development of 15 MSc courses in various countries. Among his many awards are the EU Award for Education – the Leonardo Da Vinci Award, the Honorary membership of the Indian Association of Medical Physics, the IOMP Harold Johns Medal for Excellence in Teaching and International Education Leadership.

Abstracts

BEST POSTER

Radiation Safety In Interventional Radiology

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Interventional radiology procedure are targeted therapeutic procedure that can be performed on any body system and are a minimally invasive alternative to open or laparoscopic surgery.
However, as with any procedure that uses ionizing radiation, risks are involved for the patient and the personnel performing the procedure with the most common injury to patient being skin damage and the most common injury to personnel being cataracts .Along with traditional radiation protection methods, medical staff can take additional steps during these procedure to limit the dose to themselves and patient

There is growing concern regarding the radiation dose delivered during interventional procedures, particularly in view of the increasing frequency and complexity of these techniques .This paper reviews the radiation dose, levels currently encountered in interventional procedures, the consequent risks to operate and patient and the dose reduction that may be achieved by employing a rigorous approach to radiation protection. Many interventional radiology procedure use radiation the level of risks will depend on the type of procedure some use very little radiation, while complex procedure use more in general, the health risks from radiation exposure are not major concern when compared to the benefits of the procedure use more in general health risks from radiation exposure are not major concern are not major concern when compared to the benefits of the procedure use more in general,. Health risks from radiation exposure are not a major concern when compared to the benefits of the procedure. Some procedure requires substantial use of radiation. However these procedures frequently save lives. The amount of radiation used depends on the complexity of the procedure. Again, the risks associated with the radiation. However, these procedures frequently save lives. The amount of radiation used depends on the complexity of the procedure.

B E S T P O S T E R

Comparison of flattened and unflattened X-ray beams Out-of-field dose measurements using Ionization chamber and MOSFET detector

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AIM:

Accurate knowledge about Out-of-filed dose is essential in the view of adverse long term effects. The purpose of this study is to compare the Out-of- field dose associated with Flattened and Unflattened X-ray beams using MOSFET and Ion Chamber dosimeters.

Material and methods:

All the measurements were performed for the 6MV flattened and unflattened photon beams of a Varian TrueBeam SVC Linac (Varian Medical Systems, Palo Alto, US) in Solid water Phantom 30 x 60 x 20 cm3 (width x length x depth) with an Exradin A12 ionization chamber (Standard Imaging, Inc. USA) and Mobile MOSFET (Best Medical Canada Ltd. Canada).The measurements were carried out-of-field sizes ranging from 5cmx5cm, 10cmx10cm and 15cmx15cm at the depth of dmax, 5cm and 10cm and from the field edge up to 30cm.

Results:

The out of field dose for both the 6MV flattened and unflattened (6FFF) photon beams were found to decrease with increasing distance from the radiation field edge and the decreasing field size. It is also observed that dose increases with field size due to increase in scatter radiation.

Conclusion:

From the measurement its concluded that unflattened 6MV beam associated with lesser out-of-field dose which in turn will reduce the adverse long term effects in non target organs, Which is main concern with the flattened IMRT, SRS & SRT treatment. Further MOSFET measurements are comparable with ion chamber. Also it has a compact construction, provides instant readout makes it suitable for out-of-field dose measurement.

Abstracts

BEST POSTER

Design and Demonstration of a Wireless Radiation Detector Robot

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Gono Biswabidyalay (University). Savar, Dhaka, Bangladesh.

Introduction:

This paper presents design, development of a remotely operated preliminary measurements results using the wireless robot. One of the best employments of wireless mobile robot is to detect radiation values to facilitate the experts in rescue operation in case of pernicious radiation disaster. The live diagnostic tool performs task to help identify the most effective strategy to manage unfortunate accidents. The robot has a wireless bandwidth limited to 300mbps. Thus, this method is an economic setup suitable for indicating low radiation in small campuses. We developed the device that helps in detecting obstacles in their way thus operating smoothly. Multiple sensors (gas, temperature, metal etc. are also packed with in this robot. This system comprises an Android based application.

Materials & Methods:

In this robot we used Web cam, Wheel, Motor, Motor driver, Arduino mega, Raspberry pi B+, Battery-11.1 V, Charger-3 cell, Router, Radiation detector sensor, Temperature sensor, Gas sensor, Mine/metal detector sensor, Power bank, Ultrasonic sensor, Buzzer. This device sensors help to detect radiation and informed technician through a buzzer according to the radiation detected. All materials of robot was set part by part and attached a webcam. After completing this setting, a four wheels driver robot has been made. This robot was be able to move everywhere and controlled by mobile app. When this robot would be sent in a radioactive area, it will measure radiation in the (such as university, medical centers and low radiation environment) area and send information and image. This robot also will be able to detect gas, temperature, metal or mine.

Abstracts

B E S T P O S T E R

Conclusion:

The device was constructed using fewer components to make the device simple, low cost and cozy with very good features. It can be concluded that the device would be useful for any places were radiation measurements, gas detection, metal detection, temperature and humidity measurements are needed. And in future high range wireless module can be used for farther up gradation.

BEST POSTER

Installation, Commissioning And Clinical Implementation Of Truebeam Linear Accelerator In Regional Cancer Center, Bikaner, Rajasthan

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INTRODUCTION

The scope of this study is to address the installation and commissioning of High end Linear Accelerator (Make: Varian Medical Systems, Model: True Beam SVC) at Acharya Tulsi Regional Cancer Centre, Bikaner, Rajasthan, India. Additionally, this study also describes the beam modelling of Photon and Electron beams of the same accelerator in Eclipse TPS (V15.6) for Anisotropic Analytical Algorithm and Electron Monte Carlo respectively.

MATERIALS AND METHODS

In this study, procurement of Varian True Beam (SN3701) Linear Accelerator, design, construction, and layout of bunker were discussed. The Acceptance and Commissioning tests were performed for Photon (6MV, 6MV FFF, 10 MV, 10 MV FFF, and 15 MV) and Electron (6MeV, 9 MeV, 12 MeV, 15 MeV, and 18 MeV) energies and Multileaf Collimator (MLC). The depth dose and beam profile measurements were done with Radiation Field Analyzer (RFA), 0.65cc and 0.13cc Ionization chambers. The output and output factor measurements were carried out using diode detectors and dose 1 electrometer. Radiation protection surveys, photon and neutron leakage measurements were done by using neutron detector, and pressurized ion chamber based survey meter. The procedure for those QA tests was also discussed.

RESULT

The layout was approved by AERB and the unit was checked for type approval to ensure its on-time delivery. Subsequently, approvals and NOC for equipment procurement were obtained. The equipment receipt was intimated to AERB. Necessary documents for customs clearance were given to the vendor for its clearance. After installation the commissioning approval was obtained. The radiation protection survey was performed and found the results were safe from radiation safety standpoint. The necessary quality assurance tests were performed for obtaining the license for medical usage.

CONCLUSION

All the data collection and testing were performed under international practices and guidelines. The quality assurance test fulfilled the acceptance criteria set by AERB and IEC. The machine was Licensed for clinical usage on 24-07-2020.

B E S T P O S T E R

Retrospective Dosimetric Analysis Of Stereotactic Body Radiotherapy (SBRT)patients Treated Over Last 10 Years

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AIMS: This study analyse the retrospective dosimetric audit of stereotactic body radiotherapy (SBRT) patients treated over last 10 years

Methods: Over a decade, 31 SBRT patients were identified for liver and lung cancer. Dosimetric data for these patients were extracted from the record and verification system , Eclipse-Aria (Varian Medical System , Polo Alto, CA). Dose to Tumour (planning target volume) were taken to evaluate OAR's(critical organs)receiving dose ,Total Gantry angle/MU were delivered in each case, to find IMRT factor

Results: For 3# plans OAR receiving dose as Heart is getting max 20.99Gy(limit is max 30Gy),<15cc is 19.62Gy(limit is 24Gy),spinal cord max 15.17Gy(limit is 21.9Gy),<0.35cc is 13.91 Gy(limit is 18Gy) ,skin max 27.44Gy(limit is 33Gy),<10cc 18.14Gy(limit is 30Gy) ,Trachea max 15.23Gy(limit 30Gy),<4cc is 10 Gy(limit is 15Gy),Esophagus max 15.65Gy(limit is 25.2Gy),<5cc 12.42 Gy(limit is 17.7Gy),Ribs max 62.27Gy(limit is 36.9 Gy),<1cc 60.29 Gy(limit is 28.8Gy),right and left lung volume to spare are 2.66 and 1.15 Gy(limit is 12.4 Gy for both). For 5# plans OAR receiving dose as Heart is getting max 30.58Gy(limit is max 38Gy),<15cc is 20.82Gy(limit is 32Gy),spinal cord max 23.31Gy(limit is 30Gy),<0.35cc is 22.53 Gy(limit is 23Gy) ,skin max 30.13Gy(limit is 39.5Gy),<10cc 21.95Gy(limit is 36.5Gy) ,Trachea max 29.47Gy(limit 46Gy),<4cc is 14.86 Gy(limit is 16.5Gy),Esophagus max 28.84Gy(limit is 35Gy),<5cc 15.13 Gy(limit is 19.5Gy),Ribs max 65.15Gy(limit is 43 Gy),<1cc 63.98 Gy(limit is 35Gy),right and left lung volume to spare are 1.16 and 2.29 Gy(limit is 13.5 Gy for both).our analysis shows that critical organs near tumour are achieving dose which is within limit according to RTOG protocol and TG 101.Ribs are getting more than the limit value for all cases. it shows the in most of the cases using four full arc or half arc beam uniform dost distribution can be achieved. IMRT factors varies for the 3# plans within 2.32-2.94,4# plans 2.19-4.24,5# plans 2.43-3.93. and we can get C.I, H.I, I.D, IMRT factor for all SBRT patient's plan.

B E S T P O S T E R

Abstracts

Conclusions: We conclude that to get limiting dose of critical organs minimum four full arc or half arc beam are needed. Sometime arc no is 5 or 6 also to get uniform dose distribution. Delivered dose in cGy is always more than calculated MU from TPS. Heart, Spinal Cord, Trachea, oesophagus, right lung, left lung, kidney these critical organs achieve the dose within limit while treating SBRT technique. Ribs are not achieving the dose within limit in the plans.

Keywords: Dosimetric audit, limiting dose, critical organs, Gantry angle, total MU

BEST POSTER

Study to evaluate the dosimetric impact of different medium in Left Side Breast IMRT plans using Monaco treatment planning system

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Abstract

Background: To evaluate the dosimetric differences between absorbed dose to water (Dw) and absorbed dose to medium (Dm) in Monte Carlo (MC)-based calculations used for left side breast radiation therapy.

Materials and Methods: Total twenty-two left sided breast treated malignancies are analyzed retrospectively. All of them are planned by Monaco treatment planning system (version 5.11.02) with Monte Carlo (MC) algorithm and XVMC dose calculation engine, calculated & reviewed on absorbed dose to medium (Dm) calculations and treated on Elekta Versa HD with agility 160 multileaf collimator LINAC. With all identical parameter absorbed dose to water (Dw) treatment plan is created and all dosimetric parameters are compared with absorbed dose to medium (Dm) calculations for target volumes (PTVs) and organs at risk such as Left and Right Lungs, Spinal cord, Esophagus, Heart and contralateral Breast.

Results: We see that the mean percentage differences between Dm and Dw dose volume parameters in PTV50Gy (range 0.02 to 1.58), PTV40Gy (range 0.001 to 2.21) is small and same is observed for the OARs (range 0.12 to 2.08) except spinal cord. For spinal cord max dose, the differences are around 3.13 ± 1.48.

Conclusion: PTV and most of the OARs remains less affected with respect to Dm or Dw dose calculation methods, care should be taken when clinical treatment plan has the spinal cord max dose is near to the limit of acceptance.

Keywords: TPS, Monte Carlo, Dose-to-water, Dose-to-medium, Radiotherapy.

BEST POSTER

Validation of Monaco TPS for an ELEKTA synergy MLCi2: using Gamma index for Elekta Fullpackage beams.

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3 Part Consult Company, Casablanca, Morocco

Abstract

Intensity modulated radiotherapy (IMRT) is an advance technique of radiotherapy. The clinical implementation of IMRT requires special quality assurance (QA) procedures for Multileaf collimator (MLC).

The relationship between the MLC and delivered dose was controlled by test beams called Full package QA provided by the manufactory Elekta, this package was carried out to refine the modeling of MLC to establish a QA protocol.

In order to study how the modifications of the parameters of the treatment planning system (TPS) affect the calculations of the delivered dose distributions, we introduced different plans proposed by the Full Package QA in the TPS and we compared their dose distribution to the dose distribution measured obtained from Elekta Synergy MLCi2 in myQA Patient (IBA, Germany).

All the Full Package QA beams, IMRT / VMAT treatment plans for different locations were calculated in Monaco 5.11 TPS using 3mm grid and 0.5 % per control point statistical uncertainty, and verified on the machine using the gamma index analysis tool.

A majority of the beams showed a gamma pass rate greater than 95% based on 3% DD and 3mm DTA.

Our results show the importance of gamma analysis method to predict the quality of dose calculation, and we demonstrate that the Full package QA can be integrated into an IMRT quality assurance programme.

Keywords: Monaco TPS, Elekta MLCi 2, IMRT, VMAT.

B E S T P O S T E R

Beam Modeling in Commercial Treatment Planning System for IMRT and VMAT performance with an Elekta MLCi2 Multileaf Collimator

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Abstract

Introduction: Linear accelerator multileaf collimator requires to be tested with best possible quality assurance tools and accordingly treatment planning system input with the data for appropriate modelling of MLC. Dose calculation is effected due to multileaf collimator (MLC) modelling, especially when using the high standard techniques of treatment like intensity modulated radiation therapy (IMRT) or VMAT.

Materials & Methods: An MLCi2 (Elekta Inc.) multileaf collimator is verified by 2D detector matrix (IBA dosimetry, Germany) using the quality assurance kit Express QA & AAPM 119 test package. The standard plan in QA mode is made in TPS and delivered under medical linear accelerator like pre treatment verification. The measured and calculated fluence is compared and accordingly the Gamma analysis done.

Results: Express QA tests & AAPM Clinical cases fields showed a great agreement with TPS calculations with 3% DD and 3 mm DTA Gamma criteria. The open field 10x10 Cm2 and 20x20 Cm2 found to be passed with 100% results for 3% &3mm criteria. 3ABUT test helped in setting the leaf offset value from default 0.0mm to 0.15mm. FourL test provides adjustment in leaf transmission value and leaf groove width from 0.012 to 0.0073 and 1.0mm to 0.7mm respectively. The TG 119 H&N and Prostate clinical cases passed with more than 95% for set criteria (3%DD&3mm). The absolute point dose measurement agreement was found to be more than 97%.

Conclusion: This study confirmed that the appropriate MLC check before starting IMRT and VMAT in clinic and even after any repair is required thorough quality assurance check using Express QA and TG 119 package. Small changes in the MLC parameters like leaf offset and transmission etc in the TPS model can cause large changes in the calculated dose. Atleast annually Express QA test is recommended to be performed by every user to confirm the status of changed MLC parameters in due course of time.

Keywords: MLC, Elekta MLCi 2, Monaco, Beam Modeling, VMAT, IMRT, Matrixx IBA, MonteCarlo.

BEST POSTER

Impact of Covid-19 outbreak on radiotherapy of cancer patients: Institutional experiences

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Abstract

Introduction: The novel corona virus pandemic caused a dilemma into healthcare to facilitate the best possible management with safe practices. Radiotherapy treatment may include the radical and palliative intent(s) which should be given as early as possible to provide relief to patients. Cancer patients are already at increased risk of infection due to lack of immunity power. Different centres have developed institutional policy to combat the COVID-19 without breaking the radiotherapy treatment services.

Materials and Methods: The administrative department of the institutes released the protocols and strategies for effective management of patients undergoing radiotherapy treatment. Head of department summons online meeting for implementation of effective strategy to provide unhindered services to patients and safe practices amongst staff.

Results: Effective measures were taken to decrease the risk of contamination amongst staff and patients. Proper staffing rotation with reduced strength, use of personal protective kits, remote consultation, hypofractionation, radiotherapy treatment schedule management, online meetings, scheduled corona testing of the patients, attendants, sensitisation of units, use of mask and regular hand wash practices were key aspects of strategies during pandemic. Time to attend per patient for treatment was increased due to the inclusion of appropriate safety guidelines prescribed by management committee.

Conclusion: The remedial solutions assisted in maintaining the balance in work and effectively implementing the plans for radiotherapy treatments. The physical presence and contact duration was reduced for better outcomes. This practice ultimately helps in reducing the spread of infection amongst staff, patients and attendants.

Keywords: Radiotherapy department, COVID-19 Pandemic, Patient Management, Hypo fractionation.

BEST POSTER

Comparison of dosimetric parameters between Rapid Arc and IMRT plans in Nasopharyngeal carcinoma patients.

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S.P.M.C Bikaner

ABSTRACT
Head and neck cancers are one of the common malignancies in Indian population. It's entity , nasopharyngeal carcinoma is among the aggressive malignancies with its location and spread near very critical structures . Thus requires a highly conformal radiotherapy delivery techniques.

PURPOSE : The aim of the study was to dosimetrically evaluate and to compare Intensity modulated radiation therapy (IMRT) plans and RAPID ARC plans for irradiation of nasopharyngeal carcinoma.

Material and method
A retrospective study was done on 10 nasopharyngeal carcinoma patients , who were treated with Radiotherapy at ATRCTRI Bikaner. Radiotherapy was delivered by IMRT technique (Total of 70 Gy in 33 fractions) . Same patients were now planned on Rapid arc technique . Dosimetric comparison was done in terms of PTV coverage , OAR dose , conformity index , homogeneity index .

Result
PTV coverage was similar with both the plans . Homogeneity index was higher for IMRT plans 0.1208+/- 0.020 compared to 0.1158 +/- 0.018 0.2 for Rapid arc plans (statistically insignificant).The Rapid arc plans achieved slightly better conformity 0.972+/-0.09 , whereas 1.02+/-0.12 for IMRT plans.
Rapid arc achieved better results for OAR , statistically significant for Brainstem (54.4 +/-10.4 Gy for IMRT and 49.7+/-4.2 Gy for RAPID ARC , Lens (RT lens received 10.55+/- 5.8 Gy by IMRT and for RAPID ARC plans were 6.12+/-6.1 Gy , left lens received) , optic nerves (Right and Left optic nerve received 41.80 and 40.0 Gy for IMRT PLANS and 28.5 and 29.8 Gy for RAPID SRC PLANS . However the gains were statistically insignificant for spinal cord and vestibulocochlear nerve . No major difference was found for Right and left parotid between both the arms.

BEST POSTER

Medical Applications Of Radiation And Medical Physics In Biology Guided Radiation Therapy.

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(Department of Radiation Oncology, HCG Borivali Cancer Centre, Mumbai)

In this article we shall discuss the applications of radiation of different kind for Diagnostic radiology, Therapeutic Radiation Oncology, Tracer Technique and BgRT. The variety of ionizing radiation sources are used for diagnostics as well as therapeutic purposes. Diagnostic Radiology is based on the principle of Photoelectric effect. Radiodiagnosis is the oldest of the medical applications of radiation. The applications of radiation generating equipment in diagnostic Radiology are X-Ray, Mammography, Computed Tomography, Dental Radiodiagnosis, Fluoroscopy, C-ARM. Radiation therapy is the branch of medicine in which ionization radiation is used to treat malignant tumour cell such as Cancer cell. The aim of radiation therapy is to delivered radiation more precisely to the tumour, while relatively limiting the dose to the surrounding normal tissues. X-Ray, Gamma Ray and particle such neutron, electron, proton are used to give radiation Treatment. Basically Radiation treatment is classified into two ways, Teletherapy and Brachytherapy. Teletherapy is the method of treatment in which source are kept at distance d from the target. Brachytherapy is the method of treatment in which sealed radioactive source are used to deliver radiation at short distance. Tracer technique is used in Nuclear Medicine. The field involving the clinical use of non-sealed radionuclide is referred as Nuclear Medicine. It is deals with the imaging of internal organs and evaluation of various physiological functions. Radiopharmaceuticals are used in tracer technique. Radiopharmaceutical is formed by the mixing of the radionuclide with compound to be labelled at room temperature.

BERGEN

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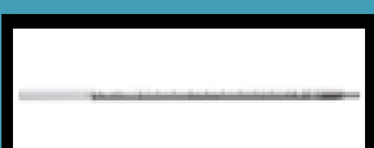
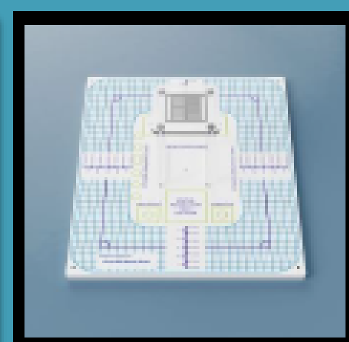
Our range of X-Ray Quality Assurance Tools and Radiation monitoring and safety products produced by our overseas Principals like M/s RTI Group, Sweden (www.rtigroup.com), M/s Pro Project, Poland (http://pro-project.pl) and others include the following

RTI Piranha Multi-Modality X-Ray Q.A. Meter



RTI CT Dose Profiler enabling measurement without limitation of beamwidth

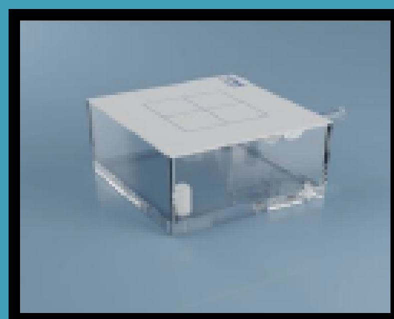
PRO CT Mini (CT Image Quality) Phantom



PRO R/F Basic Phantom

RTI Cobia X-Ray Q.A. meter for quick check

RTI Scatter Probe (A leakage and scatter detector in one)



Pro-Dose Small Stationery Water Phantom

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Pro Project, Poland

Personal Dosimeter

Bergen Healthcare Pvt. Ltd.

#305-306, Magnum House I, Karampura Commercial Complex, New Delhi –110015 (India)

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B E S T O R A L

Dosimetrical Comparison Of Ca Left Breast Treatment Plans Using Three Different Algorithms In Cms Xio Treatment Planning System: An Institutional Study

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Introduction:

Breast cancer is the most common malignancy among women and the second most commonly occurring cancer overall in the world. The most common treatment for breast cancer is conservative surgery with chemotherapy and radiotherapy. In radiation therapy tumor cells get damaged by using of high energy radiation and to reduce dose to the organ at risk. Algorithms play an important role for calculation and optimization of radiation dose and the aim of this study is to compare three different dose calculations algorithms superposition, convolution and fast superposition respectively in Xio treatment planning system for carcinoma of left breast patients using intensity modulated radiation therapy (IMRT) treatment planning technique.

Material and Method:

This is a retrospective study of ten patients of ca left breast for comparison of dosimetrical parameters of different OARs. The dose of 50.4 Gy in 28 fractions was prescribed to PTV. For every patient IMRT treatment plans were generated using photons beam of 6 MV in CMS Xio version 5.0 TPS for three different algorithms with mean coverage of PTV by 95% of the prescribed dose.

Results:

The percentage of maximum variation observed between three different algorithms for PTV 0.23% Dmean and 0.39% Dmax, 0.25% for conformity Index, 2.05% for homogeneity index, for heart Dmean 8.21%, V20 3.80% for ipsilateral lung and Dmax 10.09% for contralateral lung, for spinal cord was Dmax 2.33% and for esophagus Dmean 0.91.

Abstracts

B E S T O R A L

Conclusion:
From this study, use of different algorithms showed minor differences in the doses to OARs and target volume. Considerable precautions should be taken during evaluation of treatment plans, because choice of algorithm can affect the process of treatment planning as well as biological end point results.

Keywords: Algorithm, Dose volume histogram, conformity Index, homogeneity Index

B E S T O R A L

Dosimetric analysis and clinical outcome of brachial plexus as an organ-at-risk in head-and- neck cancer patients treated with intensity – modulated radiotherapy.

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PURPOSE: The purpose of this study was to evaluate the dose on brachial plexus (BP) in head-and- neck squamous cell carcinoma (HNSCC) treated with intensity –modulated radiotherapy (IMRT) and report incidence of radiation induced brachial plexopathy.

METHODS: A retrospective study done at ATRCTRI Bikaner, 10 patients of HNSCC treated with IMRT were included. No dosimetric constraints were applied for BP. Total dose of 44-70 Gy were given.

RESULTS: 10 patients were included and bilateral BP were analyzed. The mean of maximum (max.) dose at BP was 68.28Gy on ipsilateral side of disease , whereas on contralatral side of disease was 61.50Gy. Mean of BP volume was 7.5 cc. Patients receiving BP max. Dose >66Gy was 30% and >70Gy was 20%. Patients with T3/T4 category received higher dose than T1/T2 .Patients with higher nodal category, N2+ received higher dose than N0/N1.On median follow-up of 9 months no patients reported with sign and symptoms of brachial plexopathy.

CONCLUSION: More than third patients were received maximum tolerance dose at BP (>66Gy). On 16 month follow-up no patients had brachial plexopathy

KEYWORDS: Head-neck-squamous cell carcinoma, intensity- modulated radiotherapy, clinical outcome & dosimetric analysis.

BEST ORAL

Retrospective Analysis of treatment time calculation accuracy between TPS and manual method and source strength verification for 13 HDR Ir-192 sources in Flexitron Brachytherapy Unit: A single Institute experience.

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ABSTRACT

INTRODUCTION: Source strength measurement and verification during every source exchange in high dose rate (HDR) Brachytherapy 192Ir is primary part of quality assurance program as recommended by national regulatory body Atomic Energy Regulatory Board, Mumbai, India. The purpose of this study was to evaluate RAKR (in-house measurement) of 192Ir using re-entrant well-type ionization chamber with stated RAKR values as provided by the manufacturer in source certificate and to check the accuracy of the Oncentra treatment planning system calculation with manual method of computation at different intervals for 13 HDR Ir-192 sources. Lack of double check procedure can cause serious error in intended treatment delivery and to overcome these issues the QA procedures and their documentation plays vital role.

METHODS AND MATERIALS: We have retrospectively evaluate the in-house measured RAKR with the calibrated Standard Imaging HDR 1000 PLUS Well chamber /electrometer MAX 4000 for 13 HDR Ir192 sources with stated RAKR and the treatment time calculation accuracy of Oncentra TPS verified by using manual method of computation using TG-43 formalism.

RESULTS: The study shows, that the measured RAKR and stated RAKR were well within the tolerance limits set by the national regulatory body and international recommendations i.e. ±3 % for 13 HDR Ir192 sources. The accuracy verification of TPS treatment time calculation with manual calculation for single source as well as for multi-source lies within ±2%.

CONCLUSIONS: This study concludes that there is good agreement between in-house measured and vendor quoted values of RAKR which shows that the chamber has been stable to better than ±3 % and manual calculations shows agreement with the TPS outcome within ±2% for 13 HDR Ir192 sources. The manual method of computation works reliably and reassure the TPS functioning

BEST ORAL

Study of doses in build-up region for 6MV photon beam from Varian Clinac 600C

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(2) Army Hospital (R&R), Delhi. India.
(3) Sharda University, Greater Noida. India.

Introduction:
For the successful outcome of radiotherapy treatment, it is important to know the accuracy of measurement of doses delivered. But due to the existence of high dose gradient in the superficial region and nonexistence of charge particle equilibrium high amount of uncertainty is involved in the accurate measurement of doses in buildup region.This study aims to the assessment of surface doses in buildup region for 6MV photon beam from Varian Clinac 600 C linear accelerator using parallel plate ion chamber, Gafchromic films and Monte carlo simulation method.

Materials and Methods:
Measurements were performed using PPC05 parallel plate ionisation chamber from IBA Wellhofer and EBT3 gafchromic films at various depths in buildup region from 0cm to 2cm in solid water phantom at normal incidence of 6MV photon beam from Clinac 600C linear accelerator for different field sizes ranging from 5x5cm2 upto 20x20cm2 at SSD of 100cm. Monte carlo simulation of the linear accelerator was performed using PENELOPE based Monte carlo simulation software. Measured doses were compared with the simulated depth doses in buildup region for these field sizes.

Results and conclusion:
Comparative analysis of Monte carlo simulated depth doses in buildup region with the measured depth doses using parallel plate ionisation chamber and EBT3 Gafchromic films shows good agreement.

BEST ORAL

Evaluation of effect of contrast medium on treatment modalities planned with different photon beam energies

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Introduction: Routinely, the patient's planning scans are acquired after administration of iodinized contrast media but will be treated in absence of that. Similarly, high energy photons have better penetrating power. Hence, the aim of present study was to investigate the suitable photon beam energy in the presence of intravenous contrast medium.

Materials and methods: An indigenously made original-contrast (OC) phantom was used for the study along with two 'virtual' phantoms, mentioned as virtual-contrast (VC) and virtual-without-contrast (VWC) phantom were generated by assigning the Hounsfield Units (HU) to different structures. The structure set provided by recommendations of task group no. 119 (TG-119) of American Association of Physicist in Medicine (AAPM) was used for planning. Intensity-modulated (IMRT) and volumetric-modulated-arc (VMAT) plans were generated as per criteria of TG-119 protocol.

Results: Deviation of plans in VWC phantom with published studies for TG-119 recommendations was calculated. It was observed that the maximum dose to spinal cord was better with 6 mega-voltage (MV) in IMRT. The coverage of Prostate PTV (PR PTV) was similar with all the photon energies and was comparable with TG-119 (D95% > 75.6 Gy) except for original-contrast (OC) phantom using VMAT technique. Homogeneity-index (HI) was comparatively better for VMAT plans.

Discussion: Accuracy of treatment delivery depends on accurate dose computation. It was noted in our study that PTV coverage achieved in all the test cases was more than the limiting values and increased with higher photon energy. However, a little difference was observed with contrast-enhanced phantom images for target coverage which was in agreement with published literature.

Our study concluded that contrast CT images lower the dose to targets, so the treatment plans generated on such enhanced-CT images will be delivered with higher doses than evaluated. However, the overdose remains non-significant and not much sensitive to contrast media and photon energies.

BEST ORAL

Gamma index analysis for analytic anisotropic algorithm (AAA) and acuros XB algorithm (AXB) using in-house develop heterogeneous thorax phantom

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Mumbai

Gamma index analysis for analytic anisotropic algorithm (AAA) and acuros XB algorithm (AXB) using in-house develop heterogeneous thorax phantom

Abstract
Introduction: Phantoms are the surrogate medium which are used for the verification of accuracy of patient specific treatment plan and at the same time used as a tool to evaluate the efficiency of given algorithm. The current work aims to evaluate the performance of two mostly used algorithms namely anisotropic analytical algorithm (AAA) and acuros XB (AXB) on the basis of relative dosimetry performed on in-house developed heterogeneous thorax phantom (HTP) using an electronic portal imaging device (EPID).
Methods and Materials: To perform the relative dosimetry, contours at three different locations were drawn on HTP. Intensity modulated radiotherapy (IMRT) and volumetric modulated arc therapy (VMAT) plans using AAA and AXB algorithms were made on the delineated contours and the fluence at the EPID plane was calculated on TPS. Generated plans were exposed on linear accelerator (LA), and fluence at the same plane was measured on it. Omnipro software (IBA Dosimetry, Germany) was used to compare the two fluence. Gamma index passing criteria (dose-difference of 3% and distance-to-agreement of 3 mm) were used to evaluate the closeness between the calculated and measured fluence maps.
Results: The gamma values were found to be <1 for >99% of data set points for all the plans which indicates the good correlation between calculated and acquired dose fluence.
Discussions: Pretreatment patient specific absolute point dose measurement for AAA and AXB always show significant variation, as reported by many authors. However, in present study attempted has made to compare the results of relative dosimetry and insignificant difference were observed in the dose fluence calculated by using two algorithms.

Conclusion:

The gamma evaluation results indicate a strong correlation between planned and the measured fluence for both AAA and AXB. No significant difference in fluence measurement was found for the two algorithms.

Keywords: anisotropic analytical algorithm, acuros XB, electronic portal imaging device, heterogeneous thorax phantom, quality assurance

Abstracts

B E S T O R A L

Quantifying the cardiac Planning Risk volume using real time Cone Beam Computed Tomography images to avoid cardiac toxicities in Breast radiotherapy.

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3Amity University

Aim: Cardiac radiation is associated with cardiac toxicity in Breast Cases. To evaluate the Heart motion in left sided breast cases and to calculate Planning Risk volume associated with it.

Material and Methods: A total of 45 Left sided Breast cases were considered for which CT scans were performed using Deep Inspiration Breath Hold Technique. During the treatment the CBCT images for each patients was recorded along with the breathing pattern. The offline correction is taken into account and heart was contoured on CBCT images. Systematic (Σ), random (σ), and total random (σ(tot)=σ(2)+σ(resp)(2)) errors of the heart position were calculated and the difference in volume doses per day was also noted down. To calculate the PRV M(heart) = 1.3Σ-0.5σ(tot)) is used. All analysis were performed in left-right (LR), craniocaudal (CC), and anteroposterior (AP) directions with respect to both online and offline bony anatomy setup corrections. The PRV margin was validated by accumulating the dose to the heart based on the heart registrations and comparing the planned PRV D(max) to the accumulated heart D(max).

Results: After applying online correction, the displacement in heart during complete treatment was analysed and uncertainties were calculated .The mean and standard deviation for the cardiac motion of the whole treatment was as follows LR mean value is 0.165 and standard deviation is 0.53, craniocaudal mean value is 0.303 and standard deviation is 0.20, anterior posterior mean value is 0.236 and standard deviation is 0.356 and in Rotational direction mean value is 2.64 and standard deviation is 1.006. PRV margins for heart was calculated with the help of systematic and random errors.

Conclusion: Considerable cardiac position variability relative to the bony anatomy was observed in breast cancer patients. A PRV margin can be used during treatment planning to take these uncertainties into account.

BEST ORAL

Montecarlo simulation of Lung SBRT plans using PRIMO Monte Carlo Code and its validation against Acuros® XB.

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Purpose:

The purpose of this study is the independent dose verification of lung stereotactic body radiotherapy (SBRT) plans calculated using Acuros® XB algorithm against a Montecarlo (MC) dose simulation system PRIMO (PENELOPE-based program).

Materials and Methods:

Ten Non-Small Cell Lung Cancer (NSCLC) patients treated with volumetric modulated arc therapy (VMAT) were studied. PRIMO simulation software Version 0.3.64 was used in this study. The VMAT treatment plan generated in Varian Eclipse (treatment planning system) TPS with the Acuros®XB dose calculation algorithm has been imported and recalculated with PRIMO MC system for identical beam parameters and same number of monitor units. The full MC simulation of the linear accelerator Clinac®iX used in the study was carried out using PRIMO. The mean and maximum dose to planning target volume (PTV), dose received by 95% of PTV, conformity index (CI), gradient index (GI), and doses to the organs at risk (OARs) were recorded for comparison. The 3D dose distributions were compared using 3D global gamma pass rate with the acceptance criteria of 2%, 2 mm. Results were described as mean ± standard deviation (SD). The statistical significance of the differences was tested with Wilcoxon signed rank test with significant level $p < 0.05$.

Results:

The average statistical uncertainty in the dose calculation reported by PRIMO at two standard deviations was around 1% (range over all the simulations 0.99%–1.44%). Acuros®XB values agreed with PRIMO values within 2.35% ± 1.95% for all dosimetric parameters in all patients. There was no statistically significant difference ($p < 0.05$) for the mean and maximum dose to PTV, dose received by 95% of PTV, CI, GI and doses to OARs. The mean global gamma pass rate was 98 ± 1.64 %.

Conclusions:

The AXB-calculated dose distributions showed a good agreement in 3D gamma analysis and DVH comparison against the PRIMO MC simulation. This study shows that PRIMO MC model can be used as a TPS independent dose verification tool.

Keywords: Montecarlo, Acuros® XB, PRIMO, SBRT, VMAT

B E S T O R A L

Feasibility and efficacy of CDR-VMAT technique in radiotherapy practice: A dosimetric comparison with the intensity modulated radiation therapy for five cancer sites.

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Uttar Pradesh, India.

Introduction:
Intensity modulated radiation therapy (IMRT) technique is treatment of choice for nearly all type of cancer cases because of its advantage in PTV coverage and sparing Organ at Risk (OAR) over conventional therapy. The volumetric modulated arc therapy (VMAT) is being popular due to its dosimetric advantages, better tumour coverage, in sparing OAR, more conformed dose distribution, less monitor units, and shortest treatment delivery time. There is another technique which gives similar results as IMRT or VMAT and not required advanced machine or upgrading in hardware and software i.e. constant dose rate volumetric modulated arc therapy (CDR-VMAT). It can be done with conventional Linac with shortest treatment delivery time. So it is cost-effective.
Material and Method:
In this study, we included 60 cancer patients (12 patients for each sites) of five different tumour sites, brain, head and neck, oesophagus, lung, and prostate which were treated at our institute. We created a total of 120 plans, two plans for each patient, one plan for IMRT and one for CDR-VMAT by using the Monte Carlo algorithm on Monaco TPS version 5.11.01 for 6MV photon energy. A DVH analysis was used for dosimetric comparison for PTV coverage. Homogeneity Index (HI) and Conformity Index (CI) were calculated and compared. For evaluation of OAR, we compared the max doses, mean doses, and volume doses for all five sites. Monitor units (MU) and treatment delivery time was also compared.

Result and Discussion:

On comparing two techniques, we found that the CDR-VMAT technique gives comparable or even better quality plan than IMRT in terms of PTV coverage and OAR sparing. Similar PTV coverage and comparable OAR parameters were found in both the technique for all five cancer sites. The CDR-VMAT plans were highly conformed as CI was found more than IMRT plans but not statistically significant. The shortest treatment delivery time is the main advantage of CDR-VMAT which reduces intrafractional position error and increases patient throughput with quality treatment. Due to these advantages and cost effectiveness CDR-VMAT technique can be a most promising treatment technique in radiotherapy practice in developing countries.

BEST ORAL

Does field fixed optimization yield a better intensity modulation for Hippocampal avoidance whole-brain radiotherapy?

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In Volumetric modulated arc therapy (VMAT), the treatment planning system (TPS) automatically fits the treatment field with the targets and creates the fluence pattern according to the inverse planning optimisation criterion. However, studies [1,2] have reported the dosimetric advantage of using fixed field optimisation techniques for intensity modulation. Hippocampal avoidance whole-brain radiotherapy (ha-WBRT) using VMAT has proved to be a very effective technique for preserving neurocognitive deficits of patients undergoing WBRT. This study evaluates the feasibility of using fixed field VMAT (f-VMAT) for ha-WBRT and compares it with the conventional VMAT (c-VMAT).
Both c-VMAT and f-VMAT plans were generated for eight patients who underwent ha-WBRT for brain metastasis with the same planning objectives according to RTOG 933 [3]. Different dosimetric and plan parameters were compared using a paired t-test ($p<0.05$). The delivery accuracy was checked using Dolphin 2D detector array and compass dosimetry.
All plans met the dosimetric constraints. The f-VMAT plans showed better target coverage with a higher average D98 (2474.25±300 cGy, p=0.046) and average V30Gy (93.45±2 %, p=0.0022). Better HI (0.32±0.08, p=0.0297) and CI values (0.78±0.02, p=0.0014) were found for f-VMAT plans. There was no statistically significant difference in the organ at risk doses. Though there was no significant difference in total MUs (p= 0.4038), the f-VMAT plans required a lesser modulation degree (3.4, p=0.0025) during optimisation. This difference in plan complexity was reflected in the delivery as the f-VMAT plans showed lesser gamma failure ($\gamma>1$) for patient structure (2.48%, p=0.0321) as well as for PTV (4.76%, p= 0.0329). Thus the field fixed optimization can be used to generate better intensity modulation for ha-WBRT.

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Abstracts

B E S T O R A L

Investigation of tube voltage dependence on CT Number and its effect on dose calculation algorithms using Thorax Phantom in Monaco Treatment Planning System for External Beam Radiation Therapy

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Abstract

Introduction: This study aimed to verify the impact of different computed tomography (CT) scanning protocols on Hounsfield unit (HU) and dose calculation algorithms with varying density materials.

Materials and Methods: CIRS Thorax phantom with different density material plugs was scanned at different tube voltages from Computed Tomography (CT) scanner and HU values were measured in TPS. Calibration curves of electron density at different tube voltages were plotted and used for dose calculation with different calculation algorithms at varying high energy megavoltage photon energies.

Results: Insignificant difference is obtained in electron density curves plotted at different tube voltages. The mean variation in HU values were found at different tube voltages for Bone, Lung and Water are 896.75(SD 95.18), -799.25 (SD 4.4) and -17.5(SD 0.44) respectively. The estimated p-values for change in Hu values were 0.089, 0.258 and 0.121 for bone, lung and water respectively.

Pencil Beam Convolution (PBC) and Collapsed Cone (CCC) algorithms shows the no significant dose difference i.e less than 1% variation and Monte Carlo shows maximum dose difference upto 6% for different density medium at different beam energies at varying KVp tube voltage values.

Conclusion: Third generation algorithms like Monte Carlo requires specific energy electron density calibration curve needs to be selected for calculation same as simulation KVp energy, else there may be probability of error in more than 6% dose difference in clinical situations only due to wrong selection of calibration curve.

Keywords: Hounsfield Unit, Monte Carlo, Pencil Beam Convolution, Collapsed Cone Convolution

BEST ORAL

The role of CT Scan in diagnosis of covid 19

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The group of pneumonia cases in Wuhan, China was first reported to the WHO Country Office in China on December 2019.This virus was named severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2) and the associated disease was named coronavirus disease 2019 (COVID-19).
The diagnosis of COVID-19 is confirmed by identification of viral RNA in reverse transcriptase polymerase chain reaction (RT-PCR). In settings where RT-PCR is not available or results are delayed or are initially negative in the presence of symptoms attributable to COVID-19, chest imaging has been considered as part of the diagnostic workup of patients with suspected COVID-19.
Chest CT has a relatively high sensitivity but a relatively low specificity and can be useful in patients with some pre-existing pulmonary diseases. However, the absence of radiological signs of pneumonia cannot completely exclude a viral infection.
The differential diagnoses and potential complications for each specific case (e.g. CT angiography for pulmonary thromboembolism, ultrasound for pleural effusions and heart conditions) should be considered when choosing imaging modality. Evaluated the diagnostic accuracy of chest radiography, chest CT and lung ultrasound in symptomatic patients with suspected COVID-19.
When choosing the imaging modalities, consider that Compared to chest CT, chest radiography appears to have lower sensitivity and might have higher specificity.
When performing chest CT, minimize radiation dose while maintaining diagnostic image quality low-dose CT protocols. The transfer of images for remote reporting (teleradiology) as needed (e.g. settings where radiologists are not available for on-site reporting) Monitor the impact of COVID-19-related chest imaging in different clinical scenarios on institutional and national resources (human and financial). Monitor the number of cases of COVID-19 infections among hospital staff attributable to COVID-19-related chest imaging.
Compare the results of COVID-19-related chest imaging with the results of RT-PCR. Monitor the impact of chest imaging on patient stratification into different COVID-19-related risk profiles.

BESTORAL

Preparation for CT Chest

The radiographers or radiological technologists performing chest CT should follow droplet and contact precautions. Consider implementing a containment zipper to separate the control area from the imaging room. Practice infection control in accordance with department policies and instructions from the committees responsible for hospital infectious disease control.

Consider all equipment in the imaging room as contaminated. CT gantry controls and contrast media injector control screen keys; they must be used with gloves. Avoid crowding and maintain the safety distance of at least 1 metre. Remove any radiopaque objects in the region of interest from the patient very carefully to prevent risk of infection transmission.

Ensure that single use CT couch paper cover is removed and disposed of into the corresponding bin according to hospital infection policy. The control panel integrated into the contrast media injector delivery device, which is located in the imaging room, may be covered with a disposable plastic cover.

When performing CT on patients confirmed with COVID-19, radiographers must follow the instructions and guidance of the hospital committee responsible for infectious disease control.

CT findings and disease severity

Patients with COVID-19 pneumonia may present with different disease severity, from mild to critical forms. CT findings described in the lung parenchyma of patients with COVID-19 are not specific, with a significant overlap with other diseases causing interstitial damage. The differential diagnosis of COVID-19 pneumonia from other forms of viral pneumonia requires a careful evaluation of all clinical information, radiological pattern, and exposure history. In this scenario, the implementation of Artificial Intelligence algorithms into radiologist workflow has shown promising results in improving diagnostic outcomes. Nevertheless, the use of chest CT as a screening test in low disease prevalence regions may lead to a high number of false positive results with further unnecessary downstream diagnostic testing.

During Covid-19 pandemic, CT may be used as a comprehensive, non-invasive imaging modality which allows for the evaluation of lung parenchyma, patency of pulmonary and coronary arteries and myocardial damage.

Rajasthan, state of northwestern India, located in the northwestern part of the Indian subcontinent. It is bounded to the north and northeast by the states of Punjab and Haryana, to the east and southeast by the states of Uttar Pradesh and Madhya Pradesh, to the southwest by the state of Gujarat, and to the west and northwest by the provinces of Sindh and Punjab in Pakistan. The capital city is Jaipur, in the east-central part of the state.

Rajasthan, meaning "The Abode of the Rajas," was formerly called Rajputana, "The Country of the Rajput's" (sons of rajas [princes]). Before 1947, when India achieved independence from British rule, it comprised some two dozen princely states and chiefships, the small British- administered province of Ajmer- Marwaha , and a few pockets of territory outside the main boundaries.

After 1947 the princely states and chiefships were integrated into India in stages, and the state took the name Rajasthan. It assumed its present form on November 1, 1956, when the States Reorganization Act came into force. Area 132,139 square miles (342,239 square km). Pop. (2011) 68,621,012.

HISTORY

Archaeological evidence indicates that early humans lived along the banks of the Banas River and its tributaries some 100,000 years ago. The Indus (Harappan) and post-Indus civilizations (3rd–2nd millennium BCE) are traceable at Kalibangan in northern Rajasthan, as well as at Ahar and Gilund, both near the city of Udaipur in the south. Pottery fragments at Kalibangan date to 2700 BCE. The discovery near Bairat (in north-central Rajasthan) of two rock inscriptions from the 3rd century BCE indicate that the area was at that time under the rule of Ashoka, the last great emperor of the Mauryan dynasty of India. The whole or parts of present-day Rajasthan were ruled by Bactrian (Indo-Greek) kings in the 2nd century BCE, the Shaka satraps (Scythians) from the 2nd to the 4th century CE, the Gupta dynasty from the early 4th to the late 6th century, the Hephthalites (Hunas) in the 6th century, and Harsha (Harshavardhana), a Rajput ruler, in the early 7th century.

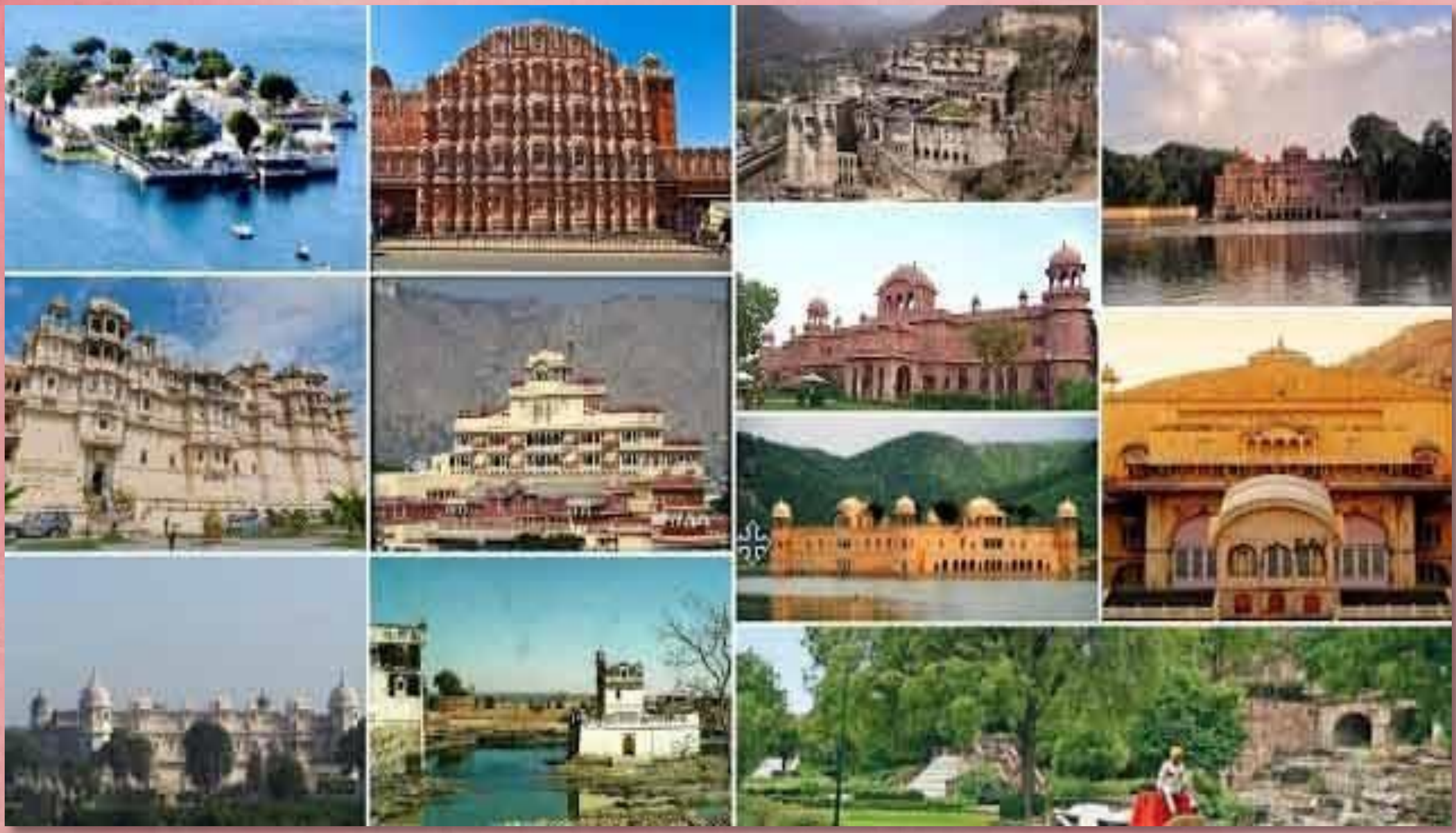
Several Rajput dynasties arose between the 7th and 11th centuries, including that of the Gurjara-Pratiharas, who kept the Arab invaders of the Sindh area (now in southeastern Pakistan) at bay. Under Bhoja I (or Mihira Bhoja; 836–885), the territory of the Gurjara-Pratiharas stretched from the foothills of the Himalayas southward to the Narmada River and from the lower Ganges (Ganga) River valley westward to Sindh. With the disintegration of that empire by the late 10th century, several rival Rajput clans came to power in Rajasthan. The Guhilas, feudal lords of the Pratiharas, asserted their independence in 940 and established control of the region around Mewar (present-day Udaipur). By the 11th century the Chauhans (Chahamanas), with their capital at Ajmer and later at Delhi, had emerged as the major power in the eastern region. In the following centuries other clans—such as the Kachwahas, Bhattis, and Rathors—succeeded in establishing independent kingdoms in the area.

The second of a series of encounters known as the Battles of Taraori (Tarain), fought near Delhi in 1192, initiated a new period in Rajasthan's history. Muḥammad Ghūrī's victory over a Rajput army under Prithviraja III not only led to the destruction of Rajput power in the Indo-Gangetic plain but also firmly established the Muslim presence in northern India.

Toward the end of the 16th century, the Mughal emperor Akbar was able to achieve, through diplomacy and military action, what his predecessors had been unable to accomplish by force alone. Akbar's son and successor, Jahāngīr (ruled 1605–27), as well as Jahāngīr's third son, the builder of the Taj Mahal in Agra (Uttar Pradesh), Shah Jahān (ruled 1628–58), were both born of Rajput mothers. Mughal-Rajput marriages continued until the early 18th century, bringing many Rajput states (along with their not insubstantial military resources) into the imperial fold without costly military subjugation. Furthermore, some Rajput rulers, such as Man Singh of Amber (Jaipur) and Jaswant Singh of Marwar (Jodhpur), served with loyalty and distinction in the imperial Mughal forces. Under Akbar the Rajput states of the region were grouped together under the Suba of Ajmer, an administrative unit of the Mughal Empire.

After the death of the emperor Aurangzeb in 1707, the Rajput state of Bharatpur was developed by a Jat (peasant caste) conqueror, but by 1803 most of the surrounding states paid tribute to the Maratha dynasties of west-central India. Later in the 19th century the British subdued the Marathas and, having established paramountcy in the region, organized the Rajput states into Rajputana province. The government of India was represented in Rajputana by a political officer, with the title of agent to the governor-general, who was also chief commissioner of the small British province of Ajmer-Merwara. Under him were residents and political agents who were accredited to the various states.

After India became independent in 1947, the princely states and chiefships of Rajputana were integrated by stages into a single entity. They were first grouped into small unions, such as the Matsya Union and the Rajasthan Union, which were merged with the remaining Rajput states to create Greater Rajasthan in 1949. When the new constitution of India came into force in 1950, the state of Rajasthan became an integral part of India. The Rajput princes—though retaining a recognition of their original title, some special privileges, and a privy purse—surrendered their political powers to the central government. When the States Reorganization Act was implemented in 1956, Rajasthan acquired the shape that it has today. The privileged status given to rulers of the former princely states was discontinued in 1970.



Literature

Rajasthan has a rich tradition of both oral narrative and written literature. The most-famous song is "Kurja," which tells the story of a woman who wishes to send a message to her absent husband by a kurja (a type of bird), who is promised a priceless reward for his service. In the literary tradition, Chand Bardai's epic poem Prithviraj Raso (or Chand Raisa), the earliest manuscript of which dates to the 12th century, is particularly notable.

Dance

The typical dance of Rajasthan is the ghoomar, which is performed on festive occasions by only women. Other well- known dances include the geer, which is performed by men and women; the panihari, a graceful dance for women; and the kacchi ghori, in which male dancers ride dummy horses. Performances of khyal, a type of dance-drama composed in verse with celebratory, historical, or romantic themes, is also widely popular.

Arts and Architecture

Rajasthan abounds in objects of antiquarian interest. Early Buddhist rock inscriptions and carvings are found in caves in the southeastern district of Jhalawar; the area around Ajmer has a number of mosques and Muslim tombs, the oldest of which dates to the end of the 12th century; and Bikaner, in the northwest, has a spectacular 15th-century Jain temple. Splendid princely palaces, many elaborately decorated with wall paintings, are scattered throughout the state; the palace at Udaipur is especially notable. Those and other historic structures (e.g., temples) are often within several historic Rajput hill forts, six of which—including those at Chittaurgarh, Jaipur, Jaisalmer, and Jhalawar—were collectively designated a UNESCO World Heritage site in 2013.

Festival

Cultural life in Rajasthan is characterized by numerous religious festivals. Among the most popular of those celebrations is the Gangaur festival, during which clay images of Mahadevi and Parvati (representing the benevolent aspects of the Hindu mother goddess) are worshipped by women of all castes for 15 days and are then taken out to be immersed in water. Another important festival, held at Pushkar near Ajmer, takes the form of a mixed religious festival and livestock fair; Hindu pilgrims come seeking salvation during the celebration, while farmers from all corners of the state bring their camels and cattle to show and sell. The tomb of the Sufi mystic Khwājah Muʿīn al-Dīn Chishtī at Ajmer is one of the most-sacred Muslim shrines in India. Hundreds of thousands of pilgrims, many from foreign countries, visit the shrine each year on the occasion of the saint's ʿurs (death anniversary).

PTW BEAMSCAN

PTW RUBY