Virtual Conference on Radiation Applications in Medicine

On the occasion of

**IDMP and IDoR**

During

7 – 8 November 2021

Organized by

Departments of Radiation Oncology and Radio Diagnosis
Christian Medical College and Hospital Ludhiana

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Christian Medical College
Ludhiana, Punjab, India

ਮੈਡਿਕਲ ਡੀਪਿਵਾਕਾਮਕਾਰੀ
Dear Colleagues and Friends,

Greetings from Ludhiana.

On the occasion of the International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR), the Departments of Radiation Oncology and Radio Diagnosis, Christian Medical College and Hospital Ludhiana is organizing a two day scientific event ‘Conference on Radiation Applications in Medicine’ during 7- 8 November 2021 at CMC and Hospital Ludhiana.

Contribution of radiological sciences especially medical physics in healthcare is multi-dimensional. The recent advancements in medical physics be it in Radio Diagnosis, Radiotherapy, Nuclear Medicine and various fields specially using radiation has made tremendous sprints. To recognise this, 7 November, birthday of Madam Marie Curie is celebrated as International Day of Medical Physics (IDMP) since 2013. Discovery of X- rays on 8 November 1895 by German physicist Prof Wilhelm Roentgen has revolutionised the medical diagnosis and treatment. The anniversary of this discovery is celebrated around the world as IDoR in recognition of the remarkable contributions made by radiological imaging and radiological treatment to health care, and the role of radiation professionals in providing quality care to patients.

IDMP and IDoR celebrated each year is building greater awareness of the radiological research, diagnosis and treatment contributing to safe and effective patient care. These celebrations are intended for the promotion of the subject of radiation therapy, medical physics and radiology globally, increasing the visibility of the profession and outreach to fellow professionals and general public. The theme of this years IDMP celebrations is ‘Communicating the Role of Medical Physicists to the Public’.

Various scientific, social and awareness activities are being organized by the department of Radiation Oncology and Radio Diagnosis, to commemorate the role of radiation professionals in medicine and the Organizing Committee, wholeheartedly welcomes you all to this scientific bonanza, be a part and add to the legacy of healing, medical education and research at the ‘Manchester’ of India.

Prof Jaineet Sachdeva  
Prof & Head, Radiation Oncology

Prof Subhash Singla  
Prof & Head, Radiology
The Christian Medical College & Hospital in Ludhiana was established in 1894. From the time of its inception, the Christian Medical College & Hospital has pledged itself to the service of the nation, her halls oft echoing its founder’s refrain, “My Work is for a King”. This motto underscores the philosophy of this premier institute which has been at the nation’s service ever since. Young and old, rich and poor, high born or low born, of all faiths, the hospital has worked for all and endeavoured to give each living soul service of the best standard.

Scores of young Indians have trained in its schools of medicine, dentistry, physiotherapy and nursing, and all who leave CMC&H, take with them the same burden and privilege, to serve this vast nation to the best of their abilities. So at Christian Medical College & Hospital, be it in the traditional healing touch of the doctor, to the latest innovation in imaging, treatment, clinical, surgical or technological expertise, the vein of service still run true. Service to each as to a king remains our goal and vision.

“Lord, do with me what you will, only use me in the service of others”
– Dame Edith Mary Brown (Founder CMC & H)

Upholding this spirit, this year, Departments of Radiation Oncology and Radio Diagnosis is celebrating the birthday of Madam Marie Curie on 7 November and the discovery of X-rays by Prof WC Roentgen on 8 November by holding a two days scientific event ‘Conference on Radiation Applications in Medicine’. The scientific programme will include talks and teaching sessions by eminent speakers in the field of radiation oncology, radiology, medical physics and radiation technologies.

A poster competition will be held for students and young professionals to promote awareness of applications of radiation in medicine and the role of different radiation professionals in healthcare.

To encourage young radiation professionals, we invite abstracts in areas of research related to applications of radiation in medicine for our young investigator session. Abstracts should be prepared in IMRaD format not more than 300 words in Times New Roman font size 12. Selected abstracts will be considered for best paper awards.

A hearty welcome to each one of you to celebrate this virtual academic feast in CMC Ludhiana. Hope you will enjoy this learning experience....
Message from the Director

Dear Colleagues & friends

I extend my heartiest congratulations to the Departments of Radiotherapy & Radiodiagnosis for organizing this virtual conference on Radiation Applications in Medicine. This conference has been organized on the birthday of Marie Curie, also the International day of Medical Physics & International Day of Radiology for commemorating the discovery of X-rays on the 8 of November, 1895 by Prof Wilhelm Roentgen, just one year after CMC was established. Both discoveries revolutionized our approach to our patients and since then progress has been made in both disciplines by leaps and bounds.

The uses of radiation in our lives has multiplied many fold and it has developed as an integral part of the practice of medicine. More than 50% of cancer patients need radiation as a treatment modality at some point in their disease course.

Christian Medical College has always been in the forefront of innovations and has been providing dedicated service to the nation for the last 127 years. It has a rich legacy of healing, medical education and research. The Department of Radiotherapy was established in 1938 and has been imparting postgraduate training since 1991. They also have an active teaching programme for Radiation Technologists since early 60’s and have >100 alumni working in responsible positions in various centres in India and abroad. I congratulate them on their Pearl jubilee celebrations and wish them all the best in the future.

I hope that there will be active participation by all of you in this virtual event. Hope the academic feast will be thought provoking and will lead to better understanding and close collaboration of different disciplines, ensuring better patient outcomes.

Hope you enjoy the conference

With best wishes

Dr William Bhatti
Director, CMC & Hospital,
Ludhiana
Message from the Principal

It gives me an immense pleasure to note that the departments of Radiation Oncology and Radio diagnosis are hosting a two-day virtual conference on Radiation Applications in Medicine on 7th and 8th November 2021. The focus is to celebrate the International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR) in remembrance of the birthday of Madam Marie Curie and the discovery of X-rays respectively.

The academic excellence of an institute flourishes with scientific conferences and symposiums where the experience and expertise of the speakers are shared in scientific deliberations. Radiation, be it X-rays or nuclear radiations are extensively used for various diagnosis and treatment procedures in medicine from the time they were discovered and kept on widening the areas of application. The treatment of cancer with various advanced radiological modalities has revolutionized the treatment outcome, life span and quality of life of the patients.

Christian Medical College Ludhiana has been always in the forefront to avail the best diagnostic and treatment facilities to treat patients. The teaching and training program for radiotherapy technologists in CMC Ludhiana dates to early 1960’s and the MD Radiation Oncology program at the institute is completing 30 years. I laud the efforts of the departments of Radiation Oncology and Radio Diagnosis for coming with an event this large scale to commemorate the Pearl Jubilee celebrations on the occasion of IDMP and IDoR. The scientific schedule shows that no stone has been left unturned and no topic related to the medical applications of radiation has been missed by the organizing committee and stalwarts in the field are delivering talks.

My sincere wishes to the organizing committee, faculty, and delegates for an enriching academic experience.

Dr Jeyaraj Durai Pandian MD DM FRACP FRCP FESO FWSO FNAMS
Principal (Dean) and Professor of Neurology
Christian Medical College
Ludhiana, Punjab, India 141008
Vice-President, World Stroke Organisation
President, Indian Stroke Association, Chair, Asian Stroke Advisory Panel
President, Asia Pacific Stroke Conference, Chennai 2021
9 October 2021

To,
Dr Mary Joan
Christian Medical College and Hospital
Ludhiana, Punjab, India

Dear Dr. Joan,
I am delighted to note that the departments of Radiation Oncology and Radio-diagnosis of CMC Ludhiana are jointly celebrating the International Day of Medical Physics (IDMP) and International Day of Radiology (IDR) on 7-8 Nov 2021 by organizing a “Conference on Radiation Applications in Medicine”.

At the outset let me thank the leadership of both departments Prof. Sachdeva and Prof. Singla for this initiative which is very appropriate.

We in IOMP are happy to note the interest different countries take in organizing scientific events for IDMP and the joint events with IDR are all the more appreciable. It is very thoughtful and fitting of Dr. Joan, a medical physicist professional to act as a catalyst and play the role.

I believe your event will be able to communicate the role medical physicists play for the welfare of patients. Radiation is the common tool we all use. The right amount of radiation, for the right purpose and delivered or used in a right manner to achieve clinical purpose is what that creates the need for medical physicists expertise in both therapy and diagnosis.

While thanking all involved in organizing this event, I congratulate CMC Ludhiana and wish the deliberations great success.

Yours sincerely,

Madan M Rehani
President, IOMP
Dear delegates and participants,

Accept greetings and best wishes from AFOMP on International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR).

I am delighted to note that a virtual conference on “Radiation applications in medicine” is being organized by the departments of Radiation Oncology and Radio Diagnosis, Christian Medical College and Hospital Ludhiana during 7-8 November 2021 to commemorate the IDMP and IDoR.

The Christian Medical College and Hospital Ludhiana, established in 1894 has played a pivotal role in standardizing quality medical education and providing best treatment facilities to the people irrespective of their financial and social background. I am happy to note that the department of Radiation Oncology completed 30 years in teaching and training of Radiation Oncologists and, radiotherapy technologists are trained from CMC Ludhiana for more than half a century.

We all are aware that the implementation of recent technological advances in imaging and treatment modalities using radiation has brought opportunities as well as challenges for health professionals. The practice of medical physics has made tremendous sprints and gained irreplaceable significance to all radiation applications in medicine. This conference offers a virtual forum for the medical radiation professionals of radiation oncology, diagnostic radiology, and nuclear medicine to come forward, showcase their professional competencies and share your invaluable experiences for improving the practice of radiation in various disciplines of medicine. It is also a great opportunity to understand and acknowledge and to get acknowledged for the respective roles each one holds in providing the best healthcare.

I give my greetings and good wishes to all the distinguished delegates participating in the virtual conference and wish the conference all the success. Let me also urge the participants of this conference not only be confined with the challenges at their own field of specialization but take it as a moral responsibility to be proactive and enthusiastic in learning about the contemporary cutting-edge technology in all aspects of radiation applications in medicine.

I would like to congratulate the organizers for taking up this additional responsibility to organize such a conference in this challenging pandemic times.

Wishing you all, a fruitful conference and continued success in all your professional endeavors.

Arun Chougule

Prof Arun Chougule
President- AFOMP
Chair- ETC and accreditation board, IOMP
Sr Professor Radiological Physics
SMS Medical College and Hospitals
Jaipur, Rajasthan
arunchougule11@gmail.com
Message

At the outset I would like to congratulate the staffs of the Department of Radiation Oncology, Christian Medical College, Ludhiana as well as the administration of the CMC, Ludhiana for completing 30 years of the Post Graduate teaching programme (MD Radiation Oncology). This is one of the important milestones in the history of CMC, Ludhiana which will be cherished by one and all. I was informed that the alumni of this programme are holding senior positions in various medical institutions in India and abroad and contributing significantly in building up the cancer care infrastructure. My best wishes to all those who are working tirelessly for this noble cause.

I would like to thank the Departments of Radiation Oncology and Radio-Diagnosis, CMC, Ludhiana for holding the scientific event under the title “Conference on Radiation Applications in Medicine” on 7th and 8th November this year. These days are historical for the radiological sciences (7th November is the birthday of Madam Curie which is also celebrated as International Day of Medical Physics and 8th November is the day of discovery of X-rays by Prof Roentgen which is celebrated as International Day of Radiology) and we must celebrate with full enthusiasm.

As you all may be aware that the theme of the IDMP-2021 is communicating the role of medical physicists to the society. I am hopeful that scientific programme of the conference will be modulated to meet this objective and the medical physicists will be known to all as a professional who contributes significantly in the medical uses of ionizing radiation. The safe and effective use of ionizing radiation depends on the skill of the professional and technology of the radiation sources and the equipment. Medical Physicists are the professionals who know precisely the capability and limitations of the diagnostic and therapeutic equipment and hence their services are highly useful for the welfare of the patients. Medical uses of ionizing radiation is a team work. I urge all the radiation professionals to work in coordination with each other which will help in enhancing the precision and efficiency of the medical radiation procedure.

Finally, I congratulate the organizing team for holding this scientific event and wish the conference a grand success.

With kind regards,

Dr. S. D. Sharma
President, AMPI
Email: president@ampi.org.in
Chairman, NC-AMPI

Secretary, NC-AMPI

Dear delegate and participants,

Warm greetings!!!

On behalf of the Northern Chapter of Association of Medical Physicist of India (NC-AMPI), we would like to cordially welcome you to celebrate this valued moment all together. It is our pleasure to send best wishes for this virtual conference with theme “Radiation Application in Medicine” on the occasion of “International Day of Medical Physics” and “International Day Radiography” during 7th - 8th November 2021. This year, we are happy to note that the Department of Radiation Oncology & Radio-diagnosis of Christian Medical College Ludhiana is organising two day virtual conference along with the celebration of this occasion. The said event is being supported by NCAMPI, IOMP, AFOMP, SCMPUR, ARTT, NZAROI, IRIA, NMPAI and many more. Through scientific program, we hope this virtual conference is going to provide an excellent opportunity to exchange and update our knowledge in the field of medical physics.

We congratulate the organisers and participants of the conference and looking forward to seeing you all during this event.

Best wishes

Dr. A K Srivastava

Dr. R K Bisht
It is my privilege and honor to note that Department of Radiation Oncology and Radio diagnosis of Christian Medical College & Hospital, Ludhiana is holding the International Day of Medical Physics (IDMP) and Radiology (IDOR) during 7-8 November 2021 to recognize the birth anniversary of Madame Marie Curie on 7th November and the discovery of X-rays by German physicist Prof Wilhelm Roentgen on 8th November, which has revolutionized medical diagnosis and therapy. The theme of this CME is “Radiation Applications in Medicine” under the dynamic leadership of Prof Jaminee Sachdeva (Prof & Head, Radiation Oncology) and Prof Subhash Singla (Prof & Head, Radio Diagnosis). This event will provide an opportunity to the medical fraternity both the stalwarts and the young students to exchange information and ideas to help in further development of patient care in the field of radiation oncology and radio diagnosis.

The organizing committee has left no stone unturned to make the conference a grand success and they need to be congratulated for their efforts. This meet, I trust, will be a new milestone of Continuous Medical Education and hospitality. I convey my greetings and good wishes to all the distinguished delegates participating in the conference and wish them a very useful and cheerful time.

I wish the organizers all the success in their endeavors.
Dr. Rajesh Vashistha

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**Message**

**President**
Dr. Rajesh Vashistha
Medical Advisor and Associate Director
Radiation Oncology
Max Superspeciality Hospital Bathinda
I am delighted to note that the departments of Radiation Oncology and Radio Diagnosis, Christian Medical College and Hospital Ludhiana is organizing a virtual conference on Radiation Applications in Medicine during 7-8 November 2021 to celebrate the International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR).

November 7th, Madam Marie Curie's birthday, has been celebrated as International Medical Physics Day (IDMP) since 2013. The anniversary of the discovery of X-rays on 8 November 1895 by German physicist Prof Wilhelm Roentgen is celebrated around the world as IDoR. The theme of this year's IDMP celebrations is "Communicating the Role of Medical Physicists to the Public". It is very appropriate, in these times of the pandemic, to have a virtual conference bringing together all radiation professionals in medicine to discuss and connect with each other about their respective roles in efficient patient care.

I congratulate the departments of Radiation Oncology and Radio Diagnostics for taking up this initiative and wish Dr. Mary Joan and the whole team all the best. I wish this conference a great success and greetings of IDMP and IDoR to all.

Dr. Golam Abu Zakaria

Prof. of Clinical Engineering, Anhalt University of Applied Sciences, Köthen, Germany
Founder and Chairman, South Asia Centre for Medical Physics and Cancer Research (SCMPCR) Vice Chair, Accreditation Committee, International Organization for Medical Physics (IOMP)
Chair, Accreditation Committee AC2, International Medical Physics Certification Board (IMPCB)
Rajnath K Jaiswar

President, Nuclear Medicine Physicists Association of India (NMPAI)

Scientific Officer
Dept. of Nuclear Medicine & PET-CT
Bombay Hospital & MRC,
Mumbai, Maharashtra, INDIA

MESSAGE

It gives me an immense pleasure to know that Dept. of Radiation Oncology and Radio Diagnosis, Christian Medical College and Hospital Ludhiana is organizing a Virtual event ‘Conference on Radiation Applications in Medicine’ during 7-8 November 2021 at CMC and Hospital Ludhiana, on the occasion of the International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR).

The application of Radiological Sciences especially Medical Physics in healthcare is multi-dimensional. The current developments of in Radio Diagnosis, Radiotherapy, Nuclear Medicine and various fields specially using radiation has made tremendous sprints. The involvement of radiological science in radiological imaging and radiological treatment to health care is incredible.

This event is a great opportunity for all professionals and students associated with the Radiation profession to discuss the advancement in their field at greater extent. I hope the scientific presentations, discussions and academic deliberations will help to broaden perspective.

I wish the event a great success.

(Rajnath Jaiswar)
Message

I am privileged and feel delighted to welcome all the delegates of International Virtual conference on the occasion of International Day of Medical Physics (IDMP) and the National Day of Radiology (IDOR), the department of Radiation Oncology and Radio-diagnosis, Christian Medical College, Ludhiana hospital, for organizing a two-day scientific event of radiation application in medicine on 7th & 8th November at CMC Ludhiana.

I would like to congratulate the Organizing Secretaries for conducting this virtual conference during this pandemic conditions. I wish him all success for this conference.

(Ajeet Singh)
President
ARTTI
MESSAGE

Christian Medical College and Hospital Ludhiana is known for education and training, which attracts students and professional from all states of India and other countries. It has been the seat of knowledge for many years. On the occasion of International Day of Medical Physics (IDMP) and the International Day of Radiology (IDoR), the department of Radiation Oncology and Radio Diagnosis is jointly organizing a ‘Virtual conference on Radiation Applications in Medicine’ at Christian Medical College and Hospital Ludhiana, on 7-8 November 2021. I cordially welcome all delegates and experts, to the extravaganza in the field of radiation.

These field of medicine have seen rapid technological development for almost 3 decades now. There is growing and increasing demand for specialization in these both fields. Therefor there is a rising need for all professionals who are skilled, enthusiastic, knowledgeable, committed and sensitive. It is need of the hour to maintain this sustained growth and strive to further the profession by conducting educative courses, workshops, seminars and conferences.

I am sure all professional (Radiation Oncologists, Medical Physicist and Radiation Therapist) attending this conference will gain from the scientific sessions, discussions and pay their own path towards a successful profession.

I thank aa the organizing secretary and the scientific committee for their continued efforts toward making this conference a success.

Rakesh Kaul
Chief Radiation Therapist
Department Of Radiation Oncology
Max cancer centre, Saket, New Delhi, India
Dear All,

Greetings!

I am glad and happy to know that the virtual conference on Radiation applications in Medicine has organised on 7 & 8th of Nov 2021 by Dept of Radiation Oncology and Radiology of CMC Ludhiana.

Radiation Oncology is an integral part of the multidisciplinary management of various solid tumor cancer. The Radiotherapy is very much of a technology-driven treatment modality in the management of cancer. RT techniques have changed significantly over the past few decades, thanks to improvements in engineering and computing. Significant changes happened involved in the various aspects of the treatment including imaging, delineation of the tumour and organs at risk, treatment planning and finally image-guidance for accurate tumour localisation before and during treatment delivery. The technological developments that have revolutionised its clinical use, but This discipline is in multifaceted nature that makes it an interface between physics, chemistry, biology and medicine. Only by exploring all these aspects will be able to produce individualised radiation therapy with better target delineation, avoidance of normal tissue and better prediction of treatment response.

I hope this scientific platform will provide immense insights into these areas.

I am sure this meeting will provide an effective opportunity for sharing and updating the latest developments of multi-disciplinary methods in the field of Radiation Oncology Technology.

I would also like to take this opportunity congratulate Dr. Mary Joan and the entire organising team and the faculty of CMC Ludhiana for taking up the effort of putting up an excellent scientific program for good learning and interaction with your colleagues, peers and experts from diverse areas.

Let me wish the whole program a grand success.

Thanking You,
Dr. G. Rijju.
PRESIDENT
Society of Nuclear Medicine - INDIA
Southern Chapter (SNMI-SC).
Dr Jaineet Sachdeva,
Professor and Head,
Department of Radiotherapy,
Christian Medical College & Hospital,
Ludhiana Pb India

Dear Prof Sachdeva,

We are delighted to learn that Departments of Radiotherapy and Radio diagnosis are jointly organizing a Virtual Conference on Radiation Applications in Medicine on November 7 & 8, 2021. It is an honored privilege to be associated with the same.

The Departments of Radiotherapy and Radio diagnosis are traditionally integrated since the discovery of Roentgen rays and Radium 125 years ago. Rapid developments in therapeutic and diagnostic areas necessitated in depth study and practice of these 2 disciplines in their individual capacities. In last half decade, computers brought them together again by facilitating Image Guided Radiotherapy whether it is Ultrasound, X rays, Computed Tomography or Magnetic Resonance Imaging. We sincerely wish this conference to highlight these aspects.

Further, the academic program in Department of Radiotherapy over 3 decades exhibited a continuous training of postgraduates which are now about 50 in number and all occupying responsible positions in India and abroad serving their patients and offering training to new incumbents, is a proud moment. I will like to add that CMC&H was the 1st Institute in the country to train Radiation therapy technologists in mid 60s and their number is in 3 figures and they have equally shared the ambassadorship of the institution.

While wishing the conference a success, I will also like to congratulate the Alumni and their peers & wish them a bright future and zeal to serve their discipline and Alma mater.

Thanks a lot for extending me this opportunity to be amongst you all,

Manmohan K Mahajan,
Retd. Professor of Radiotherapy,
Christian Medical College Ludhiana (1977-2013) &
Ex Director, Advanced Cancer Institute, Bathinda
(A Constituent College of Baba Farid University of Health Sciences, Faridkot, Pb.) 2014-2019.
World Radiography Day is an annual event held on 8th November every year to celebrate the anniversary of discovery of x-rays by W.C. Roentgen on 8th November 1895 and is recognised by the International Society of Radiographers and Radiological Technologists (ISRRT).

Radiology is an essential part of diagnostic treatment services in caring for patients to spread awareness about the importance of radiology in medical science, World Radiology Day is celebrated.

Radiologists have a very significant role to play in primary care of the patients. The techniques are not just about medical fields, they are a beautiful combination of medicine, technology, scientific principles and artistic skills. It is the key to identify what’s wrong with the internal functions of your body.

Radiographers can use the day to promote radiography as a career, as a vital contribution to modern healthcare and to increase public awareness of diagnostic imaging and radiation therapy.

Dr. Subhash Singla
HOD, Radio Diagnosis
CMC & Hospital Ludhiana
Virtual Conference on Radiation Applications in Medicine
7-8 November 2021
On the occasion of
International Day of Medical Physics & International Day of Radiology
Organized by
Departments of Radiation Oncology and Radio Diagnosis
Christian Medical College and Hospital Ludhiana

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Dr. William Bhatti
Director
CMC & Hospital Ludhiana

Patron
Dr. Jeyaraj Pandian
Principal
CMC & Hospital Ludhiana

Organizing Chairman
Dr. Subhash Singla
HOD, Radio Diagnosis
CMC & Hospital Ludhiana

Organizing Chairperson
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HOD, Radiation Oncology
CMC & Hospital Ludhiana

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MESSAGE

It is with immense pleasure that I welcome each and every one of you attending the virtual conference on Radiation Applications in Medicine. It is my proud privilege to host this conference in a year wherein we, at CMC are celebrating 30 years of the start of our MD programme in the discipline of Radiotherapy. We are probably one of the oldest Radiotherapy Departments in the country, completing 83 years of service to the country this year, having been established in 1938.

In the last two decades, radiation has been used in innovative ways to diagnose and treat patients and has come a long way since Roentgen discovered X-rays. Little would he have imagined its myriad uses a century later. However, it is important to use it judiciously, so that we have maximum gain with minimum harm. We want to mark the anniversary of Roentgen’s discovery to recognize the remarkable contribution made by radiological imaging & treatment to health care.

We also aim to build greater awareness of radiological research, diagnosis and treatment to commemorate the role of radiation personnel in health care. This conference is unique in its concept that it brings all facets of the team, including radiation technologists, radiographers, Radiologists, Radiation Oncologists, and medical physicists on a common platform so that we can better collaborate and understand each other to deliver quality health care to our patients.

We hope that this academic feast is going to act as a bridge and bring us together with greater understanding of our unique collaboration with one another. It will also be an opportunity to catch up with our associates, past, present and future. The organizing committee has been working hard to ensure that all of you have a very enjoyable time attending this conference.

Once again, I welcome you all to this scientific bonanza.

With best wishes,

Dr Jaineet Sachdeva
Prof & Head
Dept. of Radiation Oncology
CMC & Hospital
Ludhiana
Greetings!

I am delighted to be the Chairperson - Scientific Committee for this academic conclave on “Radiation Applications in Medicine” to celebrate the International Day of Medical Physics on the 7th of November which is to commemorate the birthday of Madam Marie Curie and the International Day of Radiology which is an annual event promoting the role of medical imaging in modern healthcare coinciding with the anniversary of Sir Wilhelm Conrad Roentgen’s discovery of X-rays.

From the crude beginnings of Roentgen’s discovery of x-rays more than 125 years ago which was a transformative moment in the history of medicine, it has evolved to be of pervasive and routine use in medicine. Be it diagnostic radiology or nuclear medicine or radiation therapy it has all evolved into advanced techniques, and are now regarded as essential tools across all branches and specialties of medicine.

Ionizing radiation is considered as a double-edged sword possessing inherent properties of being able to provide benefits as well as potential harm. Hence its use within medical practice makes an informed judgment regarding the risk/benefit ratio mandatory. This necessitates not only medical knowledge, but also an understanding of radiation itself.

Efforts have been put in to cover all aspects of radiation applications in medicine be it diagnostic or therapeutic and in line with the theme of IDMP-2021 highlighting the role of medical physicists to the society. The scientific program is designed to highlight team work and the role played by the Medical Physicist, Technologist and the Radiation Oncologist in executing perfect treatment plan.

At this point, I would also like to congratulate Dr Mary Joan, organizing secretary for her initiative, untiring efforts and hard work in making this conference a reality.

Welcome all delegates to this scientific forum and wish you all a happy learning!!

Dr. Pamela Alice Jeyaraj M.B.S., M.D., F.P.M., FICRO
Professor, Department of Radiation Oncology
Faculty, Medical Education Unit
Christian Medical College & Hospital,
Ludhiana.
FROM THE ORGANIZING SECRETARY’S DESK

Greetings!!!

It gives me immense pleasure to welcome you all to the two-day international virtual scientific programme, Conference on Radiation Applications in Medicine organized by the departments of Radiation Oncology and Radio Diagnosis, Christian Medical College and Hospital Ludhiana, Punjab from 7th to 8th November 2021 on the occasion of International Day of Medical Physics (IDMP) and International Day of Radiology (IDoR).

IOMP launched the International Day of Medical Physics (IDMP) on the birthday of Madame Marie Curie with the purpose of motivating the organization of activities 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 on the 7th day of November 2013, where various academic and teaching institutes showcased the contributions of medical physicists to healthcare globally.

The theme of this year’s IDMP celebrations is ‘Communicating the Role of Medical Physicists to the Public’. The rapidly evolving applications of physics in medicine and the ongoing pandemic 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 applications of radiation 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 this virtual conference amidst the pandemic. A hearty welcome to all of you to celebrate the International Day of Medical Physics and the International Day of Radiology with this virtual scientific fiesta.
I am happy to be a part of the organizing team as a joint organizing secretary for the virtual conference on “Radiation Applications in Medicine” at Christian Medical College & Hospital, Ludhiana. A conference souvenir and abstract book is published on this occasion.

The theme chosen for conference is of wide topical interest. On behalf of the organizing committee I would like to thank all the eminent speakers, guests and participants who have been with us for the 2 days. This event is meant to update the knowledge on the theme and working skills of our colleagues working in the field of Radiation Oncology as well as in Radio diagnosis.

CMC & Hospital Ludhiana (Punjab) is one of the premier Medical Colleges in India established in 1894.

The conference programme encompasses about many sessions including talks, Poster presentation and panel discussion covering the topic.

I extend my warm welcome to all our participants from everywhere in India and abroad. Hoping all gets maximum benefit from this grand event in our hospital. Many thanks to the endorsers, sponsors and to our organizing team and colleagues for spending time and effort to make this conference a grand success.

Manjinder Dhanoa
Joint Organizing Secretary
Virtual Conference on Radiation Applications in Medicine
7-8 November 2021
On the occasion of
International Day of Medical Physics & International Day of Radiology
Organized by
Departments of Radiation Oncology and Radio Diagnosis
Christian Medical College and Hospital Ludhiana

Patron
Dr. William Bhatti
Director
CMC & Hospital Ludhiana

Patron
Dr. Jeyaraj Pandian
Principal
CMC & Hospital Ludhiana

Organizing Chairman
Dr. Subhash Singla
HOD, Radio Diagnosis
CMC & Hospital Ludhiana

Organizing Chairperson
Dr. Jaineet Sachdeva
HOD, Radiation Oncology
CMC & Hospital Ludhiana

I am pleased to offer a warm welcome to all delegates to this virtual conference on “Radiation Applications in Medicine” on the 7th – 8th November 2021 at Christian Medical College & Hospital, Ludhiana. Our main objective in organizing this conference is to highlight the importance of working together as a team. Radiation technologists, Physicists, and Oncologists should synergize to attain positive outcome. I would like to congratulate Dr. Mary Joan, Organizing Secretary for making this interesting and excellent conference possible. We look forward to your presence at this virtual event which is being organized for helping each one of us grow.

TEAMWORK

Coming together is a beginning
Keeping together is progress
Working together is success.

Dr Preety Negi
Associate Professor
Dept. of Radiation Oncology
CMC & Hospital
Ludhiana
Greetings from Ludhiana!

Christian Medical College and Hospital Ludhiana was founded in 1894 by Dame Edith Mary Brown as a center for outreach for those in need and this has played a large part in the culture of education and training provided at our center. In the more than 125 years since the founding of our institution, CMC Ludhiana has striven to be a center for academic excellence as well as a center for developing caring and compassionate doctors. Thus it is with great pride and deepest pleasure that I, on behalf of the organizing committee, greet our respected teachers, our distinguished chief guest and honored patron, our reputed speakers, judges and panelists, and our most welcome participants and delegates to this exciting “Virtual Conference on Radiation Applications in Medicine” organized at our center on the 7th and 8th of November 2021 on the occasion of the International Day of Medical Physics and International Day of Radiology. It is my firm belief that this conference will offer a cornucopia of knowledge. It is always a valuable experience to be able to learn from those who have shown excellence in their respective fields and it is our pleasure to host so many distinguished teachers and doctors. I hope that each and everyone of you will find value in your attendance and that when you arise from this table, you will be satisfied by the banquet of wisdom, experience and learning on offer.

My work is for a King.

Dr Abraham Puliyelil Abraham
Organizing Committee
Assistant Professor
Department of Radiation Oncology
Christian Medical College and Hospital Ludhiana
Messages from the Organising Team

Glad that I’ve the opportunity to pen down something here. A third year resident at this esteemed institution, CMC is a personification of knowledge and surely this conference would add more sparkles to this glittering institution. I welcome all the participants in this fiesta of knowledge.

- Dr Bhanu Vashishtha
  Resident Third Year
  Dept. of Radiation Oncology

It’s my pleasure to be part of the organizing team. I believe this conference will open new vista of knowledge for radiation application in medicine. We extend our heartfelt welcome to all the individuals participating in the conference.

- Dr Varinda
  Resident Second Year
  Dept. of Radiation Oncology
Messages from the Organising Team

It is with heartfelt delight that I extend my warm welcome to all. I believe through this conference we will be able to reflect upon our common goal to work together to deliver Quality healthcare to our patients like we have for the past decades and this endeavor will improve our individual and collective knowledge for the betterment of medicine.

- Dr Arshdeep Kaur
  Resident Second Year
  Dept. of Radiation Oncology

I am delighted to welcome you all to Virtual CMC conference. I hope that the spirit of this conference will make each and everyone of us be a leader within our own sphere of influence and commit to pragmatic action to accelerate the personal development leading to a better society. A heartful thanks to everyone for their invaluable contribution.

- Dr Harleen Kaur
  Resident Second Year
  Dept. of Radiation Oncology
Conference Committees

Organising Committee

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Dr Pamela Jeyaraj  
Dr Preety Negi  
Dr Mary Joan  
Dr Abraham P A  
Ms Manjinder Dhanoa  
Dr Bhanu Vashistha  
Dr Arshdeep Kaur  
Dr Harleen Garcha  
Dr Varinda  
Mr Sher Singh  
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Dr Anjali Susan  
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Dr Roshan Philip  
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Dr Jaineet Sachdeva  
Dr Mary Joan  
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Dr Arshdeep Kaur  
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Dr Manoj Gupta  
Dr R K Bisht  
Dr Kamlesh Passi  
Dr Rakesh Kapoor  
Dr Deepak Abrol
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<td>Time (IST)</td>
<td>November 7th, 2021 (Sunday)</td>
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<tr>
<td>10.00AM - 10.30AM</td>
<td>Inaugural Ceremony</td>
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<td>10.30AM - 10.40AM</td>
<td>Session I: (IDMP Messages from President IOMP, AFOMP)</td>
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<tr>
<td>10:40 AM - 12:30 PM</td>
<td>Session II: Dr Jaineet Sachdeva, Dr Kamlesh Passi</td>
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<tr>
<td>I-1: Medical Physicists are Indispensable Dr S D Sharma BARC Mumbai</td>
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<td>I-2: Hadron Therapy Dr Dayananda Sharma Apollo Proton Center Chennai</td>
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<td>I-3: Radiation ablation for cardiac arrhythmias Dr D N Sharma AIIMS New Delhi</td>
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<td>I-4: Extracorporeal RT to bone for Osteosarcoma Dr Aswin Kumar RCC Thiruvananthapuram</td>
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<td>T-1: The Modular software platform for all Patient QA – VERIQA C Narmada PTW Dosimetry India</td>
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<td>12.30PM-02.10PM</td>
<td>Session III: Dr Subhash Singla, Dr Pamela Jeyaraj, Dr Roshan Philip</td>
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<td>I-5: Artificial Intelligence applications in Intensity Modulated Proton therapy Dr Ganapathi K Apollo Proton Center Chennai</td>
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<td>I-6: Brachytherapy in the era of precision radiotherapy Dr Bhavana Rai, PGI Chandigarh</td>
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<td>I-7: Shining girls – dark stories Mr Rakesh Kaul Max Superspeciality Hospital New Delhi</td>
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<td>T-2: Knowledge based planning features in Eclipse TPS Mr Purushothaman K Varian Medical Systems</td>
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<td>02.10PM-02.30PM</td>
<td>Lunch Break</td>
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<td>02.30PM-03.30PM</td>
<td>Session IV: Best Poster Session (Judges: Dr A K Shukla, Dr I M Aggrawal, Dr Ajay Srivastava)</td>
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<td>PP-1: Management of treatment delivery to cancer patients in Radiation Oncology department during Covid -19 Pandemic: Pandemic preparedness plan in Radiation Oncology, PPP-RO Aijaz Ahmad Khan Srinagar</td>
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<td>PP-2: Intra Luminal Radio Therapy Arputha Anumanth Raj Noida</td>
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<td>PP-3: LINAC based Stereotactic Radiation Therapy with Varian High definition MLC for Brain metastases: a Dosimetric study David Ayyavu Noida</td>
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<td>PP-4: Measurement of Out-of-field dose for flattened and unflattened X-ray beams using Ionization chamber and MOSFET detector Gokulraj A Bikaner</td>
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<td>PP-5: The Correlation between Dose Homogeneity Index and Target Volume in Intracavitary brachytherapy treatment plans Gupreet Kaur Faridkot</td>
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<td>PP-6: Dosimetric characterization of Radiation risk to eye, nose, parotid and thyroid gland in dental intraoral radiography Ogundade O F Nigeria</td>
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<td>PP-7: Effect of Human Tissue Composition on Dose Distribution for Low and High-energy Photon Emitting Sources Using GATE v8.2 Lahcen Ait-Mlouk Morocco</td>
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<td>PP-8: A comparative dosimetric study of field in field and IMRT techniques in the treatment of breast cancer Meenu Stephen P S Bangalore</td>
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<td>PP-9: A Study of Radiopharmaceuticals Dispenser System in Nuclear Medicine Field Noorfatin Aida Baharul Amin Malaysia</td>
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<td>PP-10: Decommissioning of Teletherapy Machine and Transport of Decayed Teletherapy Source Priya Saini Jaipur</td>
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<td>PP-11: Radiation Protection in Diagnostic Radiology Samarpita Halder Kolkata</td>
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<td>03.30PM-04.30PM</td>
<td>Session V: Dr Preety Negi, Dr Harish Gambrir, Dr Dimple Bhatia</td>
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<td>P-1 : Design and development of QA device for verification of prescription dose in single channel HDR vaginal brachytherapy applications Dr Challappalli Srinivas KMC Mangalore</td>
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<td>P-2 : QA of CT Simulator Dr Ramesh Desai, Shreji Medical Cyclotron, IMT Manesar</td>
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<td>P-3 : Comparative Study of Breast Radiation Therapy in Prone Position using Prone Breast Board couch Versus Supine Position Mr Prakash Umbarkar Hinduja Hospital Mumbai</td>
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<td>P-4 : The Role of the Radiotherapy Technologist in Prospective Evaluation of Quality of Life Scores in Patients of Head-Neck Cancer on Radical Chemoradiotherapy Mr Debojyoti Dhar Tata Cancer Hospital Andra Pradesh</td>
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<td>04.30PM-06.00PM</td>
<td>Session IV: Dr Mary Joan, Mrs Manjinder Dhanooa</td>
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<td>I-8 : The Physics of SBRT for moving targets Dr Raghavendra Holla, Ruby Hall Clinic Pune</td>
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<td>I-9 : Treatment of AVM: Radiotherapist’s perspective Mr Deepak Kumar King Hamad University Bahrain</td>
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<td>I-10: Virtual Environment Radiation Therapy (VERT): A virtual reality linear accelerator that brings treatment room to the classroom Mr Subramanya Betageri Bellevue College USA</td>
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Day 2
Scientific Programme
November 8th, 2021
(Monday)

10.00AM-11.45AM
Session VI: Dr Subhash Singla, Dr Anjali Susan
I-11: Medical Physicists - Challenges as Health Professional Dr Arun Chougule AFOMP President
I-12: IDoR Symposium:
Interventional Radiology in CMC Ludhiana Dr Vivek Agarwal and Dr Amit Batra
I-13: MR Principles - An Overview Dr S Panneer Selvam SRIHER Chennai
I-14: Artificial Intelligence: Way ahead for Radiology Mr Mukesh Jain SMSMC Jaipur

11.45PM-01.30PM
Session VII: Dr Pamela Jeyaraj, Dr Abraham P Abraham, Dr Jerin Kuruvilla
I-15: Are oncology patients getting high radiation doses from CT and PET/CT exams? Dr M Rehani IOMP President
I-16: Roles and Responsibilities of Nuclear Medicine Physicists in the Practice of Nuclear Medicine Dr Pankaj Tandon AERB Mumbai
I-17: Role of PET based RT planning Dr Rijju G KIMS Thiruvanantapuram
I-18: Establishing a new cancer center-Pearls and Perils Dr Rakesh Kapoor HBCHR Mullanpur&Sangrur

01.30PM-02.00PM
Lunch Break

02.00PM-03.00PM
Session VII: Best paper session (Judges: Dr Arun Chougule, Dr Kamlesh Passi, Dr VK Dangwal)
OP-1: Radiobiological modelling of radiation induced acute skin toxicity (dermatitis): a single institutional study of breast carcinoma Balbir Singh AIIMS Bhatinda
OP-3: The penumbra width determination of a single beam and 192 beams of Gamma Knife PerfexionTM based on Monte Carlo simulation J Junios Indonesia
OP-4: Dosimetric Comparison between Intensity modulated radiotherapy versus volumetric modulated arc therapy treatment plans for Breast Cancer Mahfuzur Rahman Bangladesh
OP-5: Low Dose Total Skin Electron Beam Therapy for the treatment of Mycosis Fungoids: Case Report of a young female Misba Hamid SKIMS Srinagar
OP-6: Compositional analysis of ex-vivo atherosclerotic plaque by Electron microscopy and contrast enhanced Dual Energy CT images to detect type of plaque Dr Susama Rani Mandal PGIMS Rohtak
OP-7: Comparison of Treatment Plans in Breast Cancer Radiotherapy. An In-Vivo Phantom Dosimetry Study Sushma Poojar KMIO Bangalore

03.00PM-04.30PM
Session VIII:
Panel Discussion: 'Extends of the frontiers of Medical Physics in Diagnostic Radiology, Nuclear Medicine and Radiotherapy: Current Issues and Way Forward'.
Dr Arun Chougule SMS Jaipur (Moderator)
Dr GK Rath AIIMS New Delhi Dr S D Sharma BARC Mumbai
Dr Sanjay Sharma AIIMS Delhi Dr Rajesh Vashistha Max Bhatinda
Dr A K Shukla PGIMS Lucknow Dr Pratik Kumar AIIMS Delhi
Dr G Sahani AERB Mumbai Dr Lalit Agarwal BHU Varanasi
Mr Gurvinder Singh Wadhawan RGCI Delhi Dr P K Dash Sharma AERB Mumbai

04.30PM-05.00PM
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Invited Talks
Medical Physicists are Indispensable

Sunil Dutt Sharma

Radiological Physics & Advisory Division, Bhabha Atomic Research Centre, CT&CRS, Anushaktinagar, Mumbai 400094

Abstract

Medical applications of ionizing radiation requires the services of a variety of individuals and professionals and indeed it is the best example of a multidisciplinary approach. Medical physicists are one of the important members of this multidisciplinary team. However, there are misnomer that medical physicists are just an assisting professional who contribute something technically as far the medical use (radio-diagnosis, radiotherapy, unsealed isotope based imaging and therapy and the associated radiation protection and safety) of ionizing radiation is concerned. But the fact is far away from this misnomer and it is required to brought to the notice of all about the proficiency, skill and utility of medical physicists in clinical set ups. To start with the argument it is simple to ask a few questions - (i) who are the medical physicists? (ii) what are their education, training and skills, and (iii) what they do in case of imaging and treatment of patients? For answers to these questions we need not run through various literature and books rather refer two IOMP policy statements and bring the relevant statements here which will justify the title of this presentation. Answer to the first question is Medical Physicists are professionals with education and specialist training in the concepts and techniques of applying physics in medicine and they work in clinical, academic or research institutions. While working in clinical environment, medical physicists are health professionals, with education and specialist training in the concepts and techniques of applying physics in medicine, competent to practice independently in one or more of the specialties of medical physics (IOMP Policy Statement No. 1, 2020; www.iomp.org).

Answer to the second question is - Medical physicists posses competency in their discipline by obtaining the appropriate educational qualification and clinical competency training in one or more specialties of medical physics (IOMP Policy Statement No. 2, 2010; www.iomp.org). During their education, medical physicists are required to study various aspects of physics/radiation physics, mathematics including statistics and numerical methods, biology/radiation biology, electronics and instrumentation, radiation detectors and dosimetry methods, technology of radiation equipment and sources, physics of medical imaging and radiotherapy including treatment planning, and associated radiation protection and safety. On successful completion of the academic components, medical physicists are required to undergo clinical training for obtaining competency in one or more specialties of medical physics. After comprehensive academic exposure and clinical training, they become a competent and skilled professional who can’t be replaced by any other professionals.

Answer to the third question is also available in IOMP policy statement number 1 where it is clearly indicated that Medical physicists are mainly involved with the application of medical physics principles and techniques for treatment and diagnosis of human disorders, illnesses and...
disabilities, and the protection of the patients, staff and members of the public from ionizing and non-ionizing radiation hazards (IOMP Policy Statement No. 1). On interpretation of the role and responsibilities specified in the IOMP policy statement number 1, it is easy to conclude that medical physicists are competent enough to provide clinical service, management, education, and research and development. Specifically, medical physicists are involved in development of equipment, sources, detectors and imaging and therapeutic methods as researcher. They also contribute in technical/physical and clinical evaluation of the emerging technology and techniques (e.g. participates in clinical trials and evaluation of safety and efficacy of new equipment). Medical physicists have complete knowledge of analyzing the clinical data and predicting the outcome through mathematical approaches. Many a time they are entrusted with the task of managing the Department/Institution/ Clinical practice. In addition, medical physicists also contribute in education and training of almost all the professionals involved with medical applications of radiation including service engineers.

In summary, medical physicists are thoroughly educated and practically trained professionals who contribute as researcher/developer, clinical service provider, manager, radiation safety expert, radiation dosimetry expert and educator. It is impossible to replace/dispose off such an important professional who are thought to be a complete package in itself.

*****
Radiation Ablation for Cardiac Arrhythmias

Dr. D.N. Sharma
Professor & Head, Department of Radiation Oncology
Dr BRAIRCH and NCI Jhajjar
All India Institute of Medical Sciences, New Delhi

Worldwide, cardiac arrhythmias cause significant cardiac morbidity and mortality. Ventricular tachycardia (VT) is a common arrhythmia defined as 3 or more heartbeats in a row, at a rate of more than 100-120 beats per minute. If VT lasts for more than a few seconds at a time, it can become life-threatening. Most common symptoms are dizziness, lightheadedness, palpitations, shortness of breath or chest pain, fainting, unconsciousness or cardiac arrest and death. Ventricular tachycardia (VT), which most commonly occurs in patients with structural heart disease, can be associated with an increased risk of sudden death. Scar-related VT is an important cause of sudden death and morbidity in patients with heart disease. Myocardial infarction, non ischemic cardiomyopathies, are a common source of scarring. Recurrent episodes of VT are common, and placement of an implantable cardioverter-defibrillator (ICD) is usually indicated. ICDs provide effective termination of VTs but ICD shocks decrease quality of life and increase the risk of heart-failure-related hospitalization and death.

Antiarrhythmic medicines and catheter ablation can decrease VT recurrence rates, but both have adverse effects and limited efficacy. Radiofrequency (RF) ablation remains the standard therapy for the drug-refractory VT, but the results are less than ideal, especially in the non-ischemic cardiomyopathy population. The main limitation of catheter ablation is the difficulty in localizing VT substrate and accessibility to catheters. This problem is frequent in patients with VT caused by non-ischemic dilated cardiomyopathies, since the scars producing VT are usually intramural or subepicardial in location along the base of the left ventricle and septum.

Patients with VT who have failed standard therapy (medicines, invasive catheter ablation) have limited options, with one-year survival below 20%. Ablation of the VT substrate by stereotactic radiation therapy is a potential cure in such patients as this is non-invasive and associated with minimal procedural complications. Recently conducted certain trials, though with limited data, have shown encouraging results with few complications.

Stereotactic radiotherapy with photon beams (x-rays or gamma rays) was originally described to treat brain lesions and has become accepted treatment for several extra-cranial tumors. Noninvasive cardiac imaging methods, such as cardiac magnetic resonance imaging (MRI) and computed tomography (CT), help to identify and localize myocardial scar that may have an abnormal electrical substrate causing VT. The use of multielectrode body surface electrocardiography to create a cardiac image (electrocardiographic imaging)3 in combination with standard cardiac imaging can identify in a noninvasive manner both myocardial scar and the arrhythmogenic region from which ventricular arrhythmias arise. With the use of this technique, it is theoretically possible to develop a totally noninvasive method for ablation of ventricular tachycardia if the imaging is combined with similarly noninvasive ablative techniques. Once the target area is identified, SBRT precisely and accurately delivers high, ablative dose of radiation (25-35 Gy in single fraction) to this VT producing area with minimal risk of damage to adjoining normal tissues.
Before SBRT treatment, patients are taken up for a planning CT scan, which includes immobilization of the entire body from thorax to legs with the use of a vacuum-assisted device and acquisition of a respiration-correlated CT scan (four-dimensional CT) to assess the sum total of cardiac and pulmonary motion. Myocardial perfusion imaging is also performed for identifying the myocardial infarct or scar area. CT scan images are transferred online to the RT treatment planning system (TPS). The scarred area or the gross target area (GTV) is delineated using slice by slice contouring. An additional safety margin of 5 mm is added for treatment planning to create a planning target volume (PTV), which accounts for any residual uncertainties in patient setup, motion, and delivery. Similarly all the adjoining normal organs like lungs, esophagus, spinal cord etc. are also delineated.

The SBRT radiation treatment plan is generated in the TPS to deliver a total dose of 24 Gy in a single fraction to the PTV with a goal of achieving maximal dose coverage while avoiding a dose in excess of calculated dose constraints to surrounding organs.

References


Clinical profile and Treatment Outcome of Extra Corporeal Irradiation for Malignant Bone Tumours

Dr Aswin Kumar MD DipNB
Additional Professor, Department of Radiation Oncology, Regional Cancer Centre, Thiruvananthapuram

Surgery is an important component of curative therapy in malignant bone tumours. Limb salvage surgery has become the standard practice as opposed to amputation. Though mega prosthesis is a preferred choice, there are obvious disadvantages like cost, ready availability and adjustments for growing bones. Extracorporeal radiation therapy (ECRT) consists of en-bloc removal of the affected bone with tumour, irradiating it extracorporeally with a single fraction of 50 Gy, and re-implanting it. ECRT could be an attractive alternative to implants in limb salvage surgery because of its cost effectiveness, ready availability, precise anatomic fit and bone stock preservation. Retrospective review was carried out on those patients who underwent limb salvage procedure (ECRT or implant as part of multimodal treatment for Ewing’s sarcoma and osteosarcoma) at Regional Cancer Centre, Thiruvananthapuram between January 2011, and December 2015. Demographic data, complications and oncological outcomes were analyzed. Other seminal experiences with ECRT will be discussed.
Artificial Intelligence applications in Intensity Modulated Proton Therapy

Dr. K. Ganapathy
Senior Medical Physicist, Apollo Proton Cancer Centre

I. Introduction:
Artificial Intelligence (AI), is a broad concept of converting computers and machines into smart devices by imparting cognitive features like learning, interpreting and finding 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 IMPT. 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
Brachytherapy in the era of precision radiotherapy

Dr Bhavana Rai

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The history of brachytherapy dates back to the early 20th century when the discovery of radium led to the development of a new modality for cancer treatment. The next few years saw the development of various radium techniques and dosage systems that were proposed calculate the doses to the tumor. Over the subsequent decades rapid developments in the external beam radiotherapy and the radiation hazard concerns associated with radium exposure led to a decline in its interest and utilization. Nevertheless the distinct dosimetric and therapeutic advantage of brachytherapy prompted the exploration of alternate brachytherapy sources such as Cesium-137, Cobalt-60, Iodine-125 and Iridium-192.

Akin to the phenomenal development in the understanding, concept and technology of external beam radiotherapy techniques, significant developments in brachytherapy techniques and planning has resurfaced the interest and its indications for utilization as an integral component of cancer treatment. The development of computerized systems along with high dose rate brachytherapy machines using miniaturized radioactive sources facilitates delivery of high dose, hypo fractionated brachytherapy. The use of sectional imaging and image based adaptive brachytherapy techniques provide highly conformal dose distribution to the target volumes that, can be achieved by optimizing and sculpting the doses to various risk adaptive volumes thus providing an opportunity for dose escalation as well as sparing the normal tissues.

What makes brachytherapy unique and superior to the most conformal EBRT techniques is the focal high dose distributions with steep dose gradients causing rapid dose fall-off, thus sparing the adjacent normal tissues. The large dose per fraction received by the tumor in a short time provides a radiobiologic advantage for tumor control. Additionally, contrary to the large margins required to account for the uncertainties in EBRT, set-up margins are not required in brachytherapy as the sources are placed within the target volume.

The use of image guided adaptive brachytherapy has shown improved include clinical outcomes in various sites like prostate cancer, breast cancer and cervical cancer and is now the standard of care where indicated. Brachytherapy continues to play a sheet anchor role in therapeutic management of cancer.
Treatment of AVM: Radiotherapy Perspective:

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Arteriovenous malformations (AVMs) represent an uncommon disease of the central nervous system with important clinical implications. Arteriovenous malformations are localized in the meninges and brain parenchyma of the cerebral hemispheres and brainstem, as well as the spinal cord, may also occur, AVMs of the brain are diverse lesions that vary widely in location, size and complexity. These lesions require proper evaluation, diagnostic workup, and consideration for treatment based upon a variety of factors, including age, size, location, and drainage pattern.

Endovascular embolization is routinely used preoperatively to eliminate bleeding aneurysms or deep, surgically inaccessible feeding arteries.

AVMs have been treated successfully with focused radiation therapy on Gamma Knife, Cyber Knife or on Linac Accelerator.

AVMs which are surgically are treated by Stereotactic Radio-surgery (SRS & FSRS). In which we deliver higher ablative dose of radiation in a single session for (SRS) and in a limited number of fractions for FSRS. High dose delivery forces us to keep margin of errors for both these Stereotactic techniques significantly smaller than the conventional Radiotherapy.

AVMs have been treated successfully with focused radiation therapy. The Gamma Knife and Linac Accelerator are radiation therapy instruments that deliver several beams of radiation to a precise target. AVMs that are located in surgically inaccessible areas of the brain. Stereotactic Radio-surgery (SRS & FSRS) are specialized treatment techniques in Radiotherapy and is used to deliver higher ablative dose of radiation in a single session for (SRS) and in a limited number of fractions for FSRS. High dose delivery forces us to keep margin of errors for both these Stereotactic techniques significantly smaller than the conventional Radiotherapy. Even small inaccuracy can lead to under treatment of tumor or severe over dose to adjacent normal tissues. To ensure accurate and quality treatment it is important to assess the accuracy of the treatment delivery by designated team of Radiation Oncologist, Medical Physicist and Radiation Therapist. To achieve the objective patient is immobilized using frameless head mask along with mask fixation system (BRAIN LABTM) for treating brain lesions by SRS and FSRS. We have taken 20 patients for the study using Stereotactic Radiation techniques. So our emphasis was on proper immobilization on CT Simulator and its reproducibility on all treatment days on Novalis Tx linear accelerator.
In order to achieve treatment accuracy we used X-ray verification by Exac-Trac imaging modality by applying 6D shifts followed by cone beam computed tomography (CBCT) imaging which is most commonly used modality as image guidance tool for accurate treatment. Images are acquired before and during treatment delivery (Snap Verification) and the required shifts are applied so as to achieve treatment accuracy less than 1mm.

To reduce setup errors during treatment QA of the Novalis Tx linear Accelerator are being performed on regular basis which includes WINSON LUTZ test hidden target and OBI cube test phantom to ensure the mechanical and Radiation Iso-centre and Image Guidance within the accuracy of ±1mm.

Treatment options for AVMs are correspondingly complex. The blood vessels within the AVM degenerate and the adjacent tissue may be scarred as well. This procedure can be used to obliterate.

Complete elimination of an AVM is required to protect patients from future hemorrhage.
Virtual Environment Radiation Therapy (VERT): A virtual reality linear accelerator that brings the treatment room to the classroom.

Mr Subramanya Betageri
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I have been using the Virtual Environment Radiation Therapy (VERT) – the flight simulator for linacs, to teach theoretical concepts through the acquisition of clinical skills in a safe environment to our radiation therapy students at Bellevue College Washington State, United States. The VERT delivers tremendous benefits for the student, tutor, clinic staff, and the patient.

The VERT benefits include training in cross-sectional anatomy, illustrating complex theoretical concepts and principles of radiation therapy, radiation physics; dosimetry; treatment planning; radiation safety, and protection. The VERT helps students to visualize 3D structures, dose, CT, and beams. The VERT allows students to learn off-line CBCT matching, MRI, PET, and CT fusion visualization. You may deliberately insert errors into setup, treatment plans, output calibrations, quality control checks to see if students can identify the errors. The VERT enhances decision-making skills through critical thinking, reasoning, and problem-solving. One of the most significant advantages of the VERT is that it provides a safe, non-pressured environment to practice setup and technique.

The VERT made my job easy to teach and illustrate some of the most challenging concepts and principles in radiation therapy such as radiation dose tolerance (TD 5/5), organs at risk (OAR), beam divergence inside the patient body, specifically at the treatment volume, morning Linac QA, monthly Linac output/dose rate calibration to my students in an engaging way. The VERT is a blessing in disguise for me to bring the treatment room to the classroom to make my classes are interactive and hands-on learning experience for the students. My students can now connect the concepts to clinical practice and recognize the value of the cognitive domain that enhances affective and psychomotor domains that are needed for a competent and safe radiation therapy practice with compassion and empathy.
Medical physicists- Challenges as Health Professionals

Prof Arun Chougule, PhD, FAMS

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President AFOMP

Medical Physics is one of the most challenging and rewarding application of physics to human health care programme and is mainly concerned with use of ionizing radiation in diagnosis, therapy, and research in health care. Medical physicists are involved with the increasingly complex application of ionizing radiation in diagnosis, therapy, and research in health care. As health professionals working in clinical environments [1], medical physicists must be competent at a wide variety of tasks, and so must undergo education in a well-structured clinical training program. As per the UNSCEAR2008 [2] report, over 3.6 billion diagnostic radiological procedures, 33.5 million nuclear medicine procedures and 5.1 million radiotherapy treatment courses takes place across the world every year and it is estimated that there is increment of over 30% in radiological procedures in last 10 years and estimated over 4.7 billion radiological procedures per year. Within manmade radiation the application of radiation in healthcare is the largest contributor of radiation to the population. To cope with the challenges of radiation safety and, quality assurance, more and more clinically qualified medical physicists [CQMP] are required and the services provided by CQMP are mandated by International Basic Safety Standards-BSS of IAEA [3]. To cope with the growing need of CQMP, there is a special requirement for the education and training of medical physicists which has led to the opening of numerous educational programs around the world as well as in India. First medical physics education [MPE] program in India was started at BARC in 1962 and today we have 24 institutions/Universities providing the MPE.

Further, International Atomic Energy Agency [IAEA] is proactively working and helping its member countries in fostering the status of medical physics in radiation medicine through multiple initiatives of technical and cooperation projects and publication of important documents like IAEA Human Health Series No. 25- Roles and Responsibilities, and Education and Training Requirements for CQMP, published by IAEA in 2013 [4] and endorsed by IOMP and American Association of Physicists in Medicine (AAPM). The document defines appropriately and unequivocally the roles and responsibilities of CQMP in the different specialties of medical physics and recommends minimum requirements for their academic education and clinical training, including recommendations for their accreditation, certification, and registration, along with continuing professional development. A CQMP is therefore one who has successfully completed an appropriate academic postgraduate medical physics degree and has successfully undergone an appropriate clinical residency training programme in a chosen speciality or subfield of medical physics. Furthermore, the International Basic Safety Standards, General Safety Requirements Part 3 - IAEA IBS516 [3] defines a medical physicist as “A health professional with specialist education and training in the concepts and techniques of applying physics in medicine and competent to practice independently in one or more of the subfields (specialities) of medical physics”. In 2012 the IAEA, co-sponsored by WHO, held the “International Conference on Radiation Protection in Medicine: Setting the Scene for the Next Decade” in Bonn, Germany. The specific outcome of this conference was the published document “Joint position statement by the IAEA and WHO – Bonn call for action” [5] where some actions were identified as being essential for the strengthening of radiation protection in medicine. Regarding the strengthening of radiation safety culture in health care, Action 8f: states that: “Work towards recognition of medical physics as an independent profession in health care, with radiation protection responsibilities”. For improving Medical Physics in the Asia and Pacific region through Education and Training, the IAEA launched a four-year technical cooperation (TC) programme regional project in 2014 [6]. These IAEA projects contributed directly to increasing the number of clinical training programmes in this region through the establishment of an IAEA e-learning platform called - Advanced Medical Physics Learning Environment (AMPLE).
Basic Principles of MRI – An Overview

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INTRODUCTION: Magnetic resonance imaging is one of the most remarkable diagnostic technologies available today. The images of the human bodies obtained by this modality are far superior to all the other methods of imaging. MRI resembles C.T. equipment but working principles differ. Aim of this lecture is to give a brief idea about the complicated basic principles of MRI, in a simple way.

BASIC TYPES OF MAGNETS:

PERMANENT MAGNET – composed of atoms and molecules which behaves like tiny magnets aligned in one direction to produce a net magnetization.

ELECTRO MAGNET – results when a current send through a wire.

RESISTIVE MAGNET – made up of coils of wire around a frame work through which current is passed to produce magnetic field.

SUPER CONDUCTING MAGNET - the wire is wound in a helical coil and to create strong electro magnetic field large current is necessary. Because of resistance in the wire the current will produce heat and hence large current will result in dissipation of magnetic field through heat loss. Hence extremely cold system is required
• This is done with a help of cryogens like liquid helium (4K)

PRINCIPLES: The Hydrogen nucleus is the MR active nucleus used in clinical MRI. It is used because it is very abundant in the human body.

The laws of electromagnetism state that a magnetic field is created when a charged particle moves. The hydrogen nucleus contains one positively charged proton that spins, i.e., it moves. Thus the proton had its own magnetic field and it can be seen as a little bar magnet.

The magnet of each hydrogen nucleus has a north and a south pole of equal strength. The north/south axis of each nucleus is represented by a magnetic moment. The magnetic moment of each nucleus has vector properties, i.e., it has size and direction and is denoted by an arrow.

The direction of the the vector designates the direction of the magnetic moment, and the length of the vector designates the size of the magnetic moment.
When we put the protons into external magnetic field – the protons being little magnets align themselves in the external magnetic field like a compass needle in the magnetic field of earth.

The aligned protons move around in a certain way and this type of movement is called PRECESSION. The speed of the precession is called as PRECESSIONAL FREQUENCY, which is directly proportional to the external magnetic field strength.

\[ f \propto M \]

**Larmour Equation**  \[ f = g \cdot M \]

\( f \) = Frequency in Revolution/sec, \( M \) = Magnetic field strength, \( g \) = Gyromagnetic ratio

The precessional frequency of hydrogen protons for various field strength are given below:

- 0.5 Tesla – 21.3 MHz
- 1.0 Tesla – 42.6 MHz
- 1.5 Tesla – 63.9 MHz

**RADIO FREQUENCY PULSE**: A short burst of electro magnetic waves is applied which is called a Radio Frequency Pulse. The purpose of the RF pulse is to disturb the protons, which are peacefully precessing in the alignment with the external magnetic field. This RF pulse causes longitudinal magnetization to decrease and establishes a new transversal magnetization.

**RESONANCE**: The protons can pick some energy from the Radio wave only when the frequency of the externally applied RF pulse is equal to the protons processional frequency. This phenomenon is called Resonance.

**RELAXATION**: Is the process that occurs after terminating the RF pulse in which the physical changes that were caused by the RF pulse to the state they were in prior to the application to the pulse.
When the RF pulse is switched off, longitudinal magnetization increases again, this longitudinal relaxation is described by a time constant $T_1$ – the longitudinal relaxation time. Transverse magnetization decreases and disappears; this transverse relaxation is described by time constant $T_2$ – the transverse relaxation time.

Longitudinal and transversal relaxation are different independent process.

$T_1$ is longer than $T_2$. (2 to 10 times).

In biological terms, $T_1$ is about 300 to 2000 msec

$T_2$ is about 30 to 150 msec

**PULSE CYCLES:** A pulse cycle is a repeating unit, which is composed of a series of one or more RF pulses with a measurement of one or more MR signals. A pulse sequence is a series of pulse cycles.

TR is a time interval between two successive pulse cycles, it is usually measured in milliseconds. TR stands for “Time to Repeat”, for it represents the time between pulse cycle repetitions.
TE is the time interval from one pulse (or a series of pulses in a complicated pulse cycle) to the measurements of MR signals. It is also measured in milliseconds. TE stands for time to echo.

The application of RF pulse causes energy to be input to the patient. The measurement of the signal constitutes the reflection or echo of this energy back to us.

T1 and T2 refers to TISSUE PROPERTIES.

TR and TE refers to EQUIPMENT PARAMETERS.

**T1 & T2 WEIGHTING**

**T1 weighted image** is the one in which the intensity contrast between any two tissues in an image is mainly due to the T1 relaxation properties of the tissues.

For a T1 Weighting : Short TR & Short TE is used
To diminish T2 : TE is short (10 TO 25ms)
To not to diminish T1 : TR is short (250 to 600ms).

To produce a T1 weighted image, we use a short TE to eliminate the effect of T2 and a short TR in order not to eliminate the effect of T1

**T2 Weighted image** is the one in which the intensity contrast between any two tissues in an image is mainly due to T2 relaxation properties of the tissues.

For a T2 weighting : Long TR & Long TE is used
To diminish T1 : TR is long (>2000 ms)
To not to diminish T2 : TE is long (>60ms)

To produce a T2 weighted image, we use a long TR to eliminate the effect of T1 and a long TE in order not to eliminate the effect of T2

**A proton density image** is a one which the intensity contrast between any two tissues in an image is mainly due to the density of the protons of the tissues.

For a proton density weighting : Long TR & short TE is used
To diminish T2 : TE is short
To diminish T1 : TR is long

To produce a Proton Density image, we use a long TR to eliminate the effect of T1 and a Short TE to eliminate the effect of T2
Trade Talks
The Modular Software Platform for Comprehensive Patient QA - Streamlining workflows based on proven technology

C. Narmada, Chief Physicist & Application Specialist

PTW Dosimetry India

1. Introduction:

Independent dose/MU check plays a vital role in quality assurance for patient plans. While AAPM Task Group (TG) 71 and 114 laid the foundation for the secondary check, the latest TG 219 reviews the existing algorithms for secondary TPS, giving the recommendations on the clinical implementation and describing the testing and periodic QA of the secondary MU/dose calculation programs. Secondary TPS is now a needed requirement for every RT department. PTW’s VERIQA is a modular software, one platform that offers from visualization to verification and reporting, built on future-proof client-server architecture.

2. One single Platform solution:

- Takes the workflow efficiency to the next level of Automated workflows with streamlined operations
- Precise and fast Monte Carlo dose calculation with well-established SciMoCa Monte Carlo algorithm that automatically evaluates the treatment plans in 3D.
- Specific verification requirements are fulfilled – from independent dose calculations over in-vivo and log file dose to phantom-based measurements with Octavius 4D.

2.1 Visualisation - RT View

- Access, Visualize and compare patient specific plan verification with RT View, a full featured easy to use DICOM Viewer.
- Visualize CTs, MRIs and PET-CTs.
- Generate DRRs and field Projections.
- Compare multiple treatment plans side by side.
- Calculate, compare and export absolute and normalised dose volume histograms.
- Review plan approvals and customise report templates.
2.2. Evaluation – RT Evaluate

- Evaluate treatment plans using image registration, dose accumulation and contouring tools.
- Plans can further be analysed with comprehensive 3D-gamma and DVH analysis.
- Comprehensive set of contouring functionalities – from manual painting tools and ROI algebra to semi and fully automatic contouring.
- Advanced plan visualisation and evaluation including rigid and deformable image registration, dose summation and 3D gamma analysis.

2.3. Pre-treatment Verification – RT Monte Carlo 3D

- Monte Carlo techniques are the gold standard for dose calculation in RT and VERIQA. RT Monte Carlo 3D calculates using the well-known and clinically proven SciMoCa algorithm.
- Calculations are automated, very accurate and are ready in few minutes.
- Triggered by the transfer of treatment plans to VERIQA, RT Monte Carlo 3D knows what to do and takes care of all the tasks from calculation and evaluation to notification and documentation.
Knowledge Based Planning Features in Eclipse TPS

Purushothaman K
Product Specialist

Varian Medical System International Pvt Ltd

In Radiotherapy workflow, creating a comprehensive treatment plan can be complicated as well as time consuming. Inconsistencies between plans can arise when clinicians manually create versions of different treatment types. By providing access to pre-configured plan models, Rapidplan™ can allow clinics to reduce variability in treatment planning to achieve greater consistency, efficiency and quality in patient care. Rapidplan is designed to enable clinicians to streamline the planning process by using shared clinical knowledge embedded in the supplied plan models. Additionally, clinics may create rapidplan models to reflect preferred treatment methodologies and protocols. Rapidplan provides estimates dose volume histograms that may be used as a guideline and starting point for IMRT and VMAT. Rapidplan uses the dose and patient anatomy information from existing plans to estimate the dose distribution in new patients based on their contoured anatomy.
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Management of treatment delivery to cancer patients in Radiation Oncology department during Covid-19 Pandemic: Pandemic preparedness plan in Radiation Oncology, PPP-RO

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Abstract

Objective: This study aims to analyze the Covid 19 pandemic effect on the cancer patients being treated for radiation therapy and devise a pandemic preparedness plan for the Radiation Oncology department and the hospital staff catering to these cancer patients.

Methods: This study was conducted in a tertiary care hospital to devise and explore strategic management of radiotherapy in the Covid-19 pandemic. All the methods that lead to an optimized treatment were adopted, minimizing the risk of Covid-19 infection to both staffs as well as patients.

Results: From March 2020 to March 2021, 1346 cancer patients were treated in our hospital, out of which 50 patients who had Covid-19 like symptoms were advised to go for RT-PCR Covid-19 screening during treatment, and among them, 10 patients were declared positive for Covid-19, rest declared negative. The treatment of the Covid-19 patients was suspended till they came negative for Covid-19 and responded well to the rest course of radiation therapy. Two Covid-19 positive patients expired before the completion of treatment. The treatment regime of 940 patients was altered to avoid the duration of exposure to Covid-19 in the hospital, keeping in view the type and aggressiveness of the tumor. Also, the treatment of 16 patients with lung carcinoma was deferred to prevent Radiation-induced pneumonia, making them susceptible to Covid-19 infection. They were put on alternative systemic therapies during the deferred period to justify the benefit vs. risk ratio.

Conclusion: Following the principle of Radiotherapy i.e. “exert all the efforts to retain the planned irradiation schedule” to avoid disease progression we have made all efforts to achieve this goal and successfully delivering radiation therapy to cancer patients during the pandemic. Various recommendations issued worldwide by reputed agencies to manage the radiotherapeutic treatment were adopted initially. Later, we have designed a Covid pandemic preparedness plan for radiation oncology, which could be a handy help to the institutions catering for the most vulnerable class of patients – patients fighting cancer.

Keywords: Covid-19, Pandemic, Cancer, Radiation Therapy, Triage, Hypofractionation, Ethics, Management, pandemic preparedness plan for Radiation Oncology-PPP-RO
Introduction: Intra Luminal Radiotherapy or ILRT is a technique in brachytherapy used to escalate the dose to luminal organs like oesophagus after external beam radiotherapy. This study aims at explaining the technique in a simple manner so that brachytherapy can also be extended to sites apart from intracavitary treatments.

Methods: The luminal catheter is inserted inside the rice tube of the patient by the oncologist. A cone beam CT is done using the onboard imager of Varian Truebeam STx. The DICOM image acquired is sent to Eclipse TPS 13.0.33. PTV is drawn by the oncologist for planning. Source loading and the dwell timing is done accordingly by the Medical Physicists to give 5Gy to the PTV. After the plan approval by oncologist, the luminal catheter is connected to GammaMed Plus iX for the treatment execution which houses Iridium 192 source.

Results: The results show the PTV has been covered by 100% isodose line adequately. The dose optimisation is done by normalising the dose coverage by the normalisation line at a distance of 5 to 10mm as the case may be. The dose coverage is cross checked by the 3D dose distribution window.

Discussion: The added advantage of the brachytherapy is that high dose to the PTV and the low dose to the surrounding normal tissue was able to achieve because of the rapid fall-off of the dose from the Iridium source. This simple treatment method is highly useful in dose escalation in intra luminal treatments.
LINAC based Stereotactic Radiation Therapy with Varian High definition MLC for Brain metastases: A Dosimetric study

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Aim: The purpose of this study was to evaluate the dosimetric parameters of volumetric modulated arc based stereotactic radiotherapy treatment plans for patients with brain metastases.

Materials and Methods: Ten patients with brain mets were immobilized using stereotaxy mask. They were subject to multimodality imaging (magnetic resonance and computed tomography) to contour target and organs at risk. Volumetric modulated arc therapy (VMAT) based stereotactic plans were optimized in Eclipse (V11) treatment planning system (TPS) using progressive resolution optimizer-II and final dose calculations were performed using analytical anisotropic algorithm with 2.5 mm grid resolution. All patients were treated with 6MV beam in Varian Trilogy machine (with HD MLC) with VMAT(2 coplaner arcs) based planning. 3 patients were prescribed dose of 25Gy in 5 fractions, 6 patient treated with 30Gy in 5 fractions and one patient treated with single fraction in 18Gy. Treatment planning was performed to achieve at least 99% of PTV volume (D99) receives 100% of prescription dose, while dose to OAR's were kept below the tolerance limits. The plan evaluation was based on DVH parameters (conformal index (CI) and homogeneity index (HI) and Paddick conformity Index (PCI). The dose fall off, Gradient Index and dose of organs at risk (OAR) and healthy brain tissues adjacent to the PTV were analyzed.

Results: VMAT plans provided complete PTV coverage with mean conformity index of 0.94±0.09 and PCI of 0.86±0.07 and HI of 1.12±0.02. The dose fall parameters in terms of GI is 0.71±0.17 and 3 mm fall off for (80% equivalent radius-60% equivalent radius) and 1 cm fall off for (80% equivalent radius-40% equivalent radius). Normal brain doses were found below tolerance limit.

Conclusions: VMAT planning in SRT is efficient enough to improve the dosimetric indices of target and healthy brain tissues.
Measurement of Out-of-field dose for flattened and unflattened X-ray beams using Ionization chamber and MOSFET detector


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AIM: Accurate knowledge about Out-of-field 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.
THE CORRELATION BETWEEN DOSE HOMOGENEITY INDEX AND TARGET VOLUME IN INTRACAVITARY BRACHYTHERAPY TREATMENT PLANS

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Aim: To calculate and compare dose homogeneity index with target volume of 3D intracavitary brachytherapy plans.

Introduction: The main aim of the radiotherapy is to deliver maximum dose to the target volume homogeneously while delivering minimum dose to the surrounding normal tissues. However in case of brachytherapy treatment dose distribution is not homogeneous as very high radiation dose gradient in the vicinity of the radiation source. Since dose homogeneity index (DHI) is one of the objective tools to assess the treatment plans so by using such a tool, choice can be make in favour of a plan which provide maximum target coverage homogeneously and protects normal healthy tissues at the same time. In this study, DHI was calculated for each patient and an attempt was made to analyze the association between DHI and target volume.

Material and Methods: Forty Five treatment plans of intracavitary brachytherapy generated using Oncentra Master Plan Treatment planning System was analyzed. The dose prescription point was Manchester point A for all the plans. DHI was defined as the ratio of the target volume which receives a dose in the range of 1.0 to 1.5 times of the reference dose to the volume of the target that receives a dose equal to or greater than the reference dose and was calculated for all these patients by using below formula suggested by Meertens H et al for brachytherapy:

\[ DHI = \frac{\text{TVD}_{\text{ref}} - \text{TV1.5D}_{\text{ref}}}{\text{TVD}_{\text{ref}}} \]

The patients were then divided into six groups according to volume of target. The data then analyzed to find out the relationship between DHI and target volume.

Results and Discussion: The minimum, maximum and mean value of DHI for all the patients is 0.0045, 0.4998 and 0.2389 respectively. The minimum and maximum value of DHI was seen for target volume of 19.99 cc and 37.32 cc respectively.

When target volume data was analyzed, volume of the target varied from 15.41 cc to 44.32 cc, with average value of 30.5 cc. The patients were divided into six groups based on target volume and mean DHI was shown in the table below:

<table>
<thead>
<tr>
<th>Target volume (cc)</th>
<th>Number of patients</th>
<th>Mean HI</th>
</tr>
</thead>
<tbody>
<tr>
<td>15-20</td>
<td>7</td>
<td>0.127</td>
</tr>
<tr>
<td>20-25</td>
<td>5</td>
<td>0.175</td>
</tr>
<tr>
<td>25-30</td>
<td>10</td>
<td>0.242</td>
</tr>
<tr>
<td>30-35</td>
<td>6</td>
<td>0.249</td>
</tr>
<tr>
<td>35-40</td>
<td>10</td>
<td>0.295</td>
</tr>
<tr>
<td>40-45</td>
<td>7</td>
<td>0.303</td>
</tr>
</tbody>
</table>

- When analyzed in detail, the lowest value of DHI (best homogeneity) was seen in the group having lowest target volume i.e., 15cc to 20cc. On the other side, the highest DHI was seen in last group i.e., 40cc to 45cc. These observations suggest that homogeneity was worsening as target volume increases. Further future study with more number of patients can confirm our results.

- Key words: Dose, homogeneity, index, brachytherapy, target volume.
Effect of Human Tissue Composition on Dose Distribution for Low and High-energy Photon Emitting Sources Using GATE v8.2

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3Moulay Ismail University, Faculty of Sciences, Department of Chemistry, Meknes, Morocco.

Abstract

In this present study, the $^{125}$I and $^{60}$Co brachytherapy sources were simulated with GEANT4 Application for Emission Tomography (GATE v8.2) Monte Carlo code. The Monte Carlo dose was calculated in the prostate, soft tissue, lung, breast, adipose tissue and in water phantom. The effect of tissue-equivalent material on dose distribution was investigate for low-energy source model IsoSeed$^{\text{I25}}$.S06 and for high-energy brachytherapy source model Co0.A86. In addition, the percentage difference and the relative dose between different tissues and water-equivalent material were calculated in a single geometry. As a results, the dose distributions in various tissues are different than in water. The differences depend on the brachytherapy source, the type of tissue, as well as the distance from the source. It is established that the $^{125}$I source is most sensitive to variations in biological tissue compositions while $^{60}$Co is least sensitive to human tissues composition. The results of GATE Monte Carlo simulations were presented in tabulated and graphical formats. Our results are in good agreement with the reference data sets.

Keywords: GATE V8.2; Brachytherapy; Low and High-energy source; tissue; dose distribution;

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A COMPARATIVE DOSIMETRIC STUDY OF FIELD IN FIELD AND IMRT TECHNIQUES IN THE TREATMENT OF BREAST CANCER

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Aim: The present study is aimed at comparing the planning and delivery efficiency between three-dimensional radiotherapy (3D-CRT), 3DCRT and intensity modulated radiotherapy.

Materials and methods: Treatment plans of 20 patients with left sided breast cancer and 5 right sided breast Cancer was used for this study. The 25 patients who had breast conservative surgery received a prescribed dose of 50Gy in 25 fractions to the whole breast. FiF plans , IMRT and 3DCRT plans were compared for doses in the planning target volume (PTV), the dose homogeneity index (HI), conformity index(CI), conformation number (CN), dose to the ipsilateral lung ,dose to the left and right breast irradiation, and the monitor unit counts (MU) required for treatment. Averaged values were compared using Student’s t-test. In the 3DCRT technique , the beam arrangement consist of two parallel opposed tangential beams with dynamic wedges.The FiF plans were created by combining two open fields with three to four tangential beam directions. Five beam angles (3 MT&2 LT) were chosen to create IMRT plans and were inversely optimized.

Results: The HI,CI and CN were similar for 3DCRT and FiF, whereas the IMRT plans had better conformity index and homogeneity index and conformation number. The low-dose volumes (V_{10}) in the heart and lungs were larger in IMRT than in the other techniques. The mean dose to the ipsilateral lung was higher with FiF and 3DCRT than with IMRT. The heart dose in the case of right breast irradiation is negligible in all three techniques. In the current study, the relative volume of contra lateral breast receiving low dose (16Gy) was significantly lower for the FiF and 3DCRT plans than for the IMRT plan. Although 3DCRT and FiF technique required fewer monitor units (MU) to deliver a given dose, compared with IMRT.

Conclusion: The 3DCRT technique without field-in-field though is simple to plan results in higher maximum dose to the target. The IMRT technique for breast radiotherapy enables significantly better dose distribution in the PTV. It reduces the dose to the critical organs. However the FiF technique is simple and efficient planning technique for breast irradiation. It significantly reduces the doses in low dose regions and it requires lesser planning time.
A Study of Radiopharmaceuticals Dispenser System in Nuclear Medicine Field

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Corresponding Author: ¹, ²*

Abstract

The manual dispensing technique of the radiopharmaceutical in nuclear medicine involves manual withdrawal of activity from an elution vial, from a combination of the syringe and elution vial activities, and preparation of individual radiopharmaceutical doses to patients. Current evolution in the fields of control engineering and industrial automation has been driven by a revived interest in automatic methods of radiopharmaceutical activity measurements in nuclear medicine. The main aim of this study is to review the work of dispensing radiopharmaceutical using both conventional and automated procedures by comparing between centres or type of automated systems used. The radiation burden to extremities of nuclear medicine personnel during preparation and dispensing of the radiopharmaceutical using manual and automated dispensing systems was also studied in this paper. It is reported that radiation doses to both the fingertip and the finger base of nuclear medicine personnel that prepares the radiopharmaceuticals in a radionuclide dispensary are likely to receive high doses and may even exceed the dose limit if the radiation protection principle is not well implemented. Therefore, a critical analysis of the distribution of dose across the extremities of nuclear medicine personnel using both manual and automated dispensing systems was performed in this study. The contribution to the dose of the automated system significantly reduces the radiation dose to extremities using an automated dispensing system.
Decommissioning of Teletherapy Machine and Transport of Decayed Teletherapy Source

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**Introduction:** Radioactive Cobalt-60 teletherapy machines find a prominent place in radiation therapy departments in India. The first teletherapy cobalt machine in SMS hospital (Picker Advance Tele Cobalt (ATC) C/9) was installed in 1995. The initial activity of the cobalt source was 333 TBq (9000 Ci). This machine has provided the treatment of about 800 patients per year and worked for a period of 24 years (1995-2019). The source was replaced by 148.5 RMM (6841.39 Ci) source in 2008. The source output became lesser than 50 cGy/hr in March 2019, and the decommissioning of the machine was considered as the company was not providing services anymore. This study describes the planning of decommissioning of the teletherapy machine and transport of the Cobalt-60 source for disposal and personnel dose measurements during the procedure.

**Materials and Methods:** Decommissioning of the cobalt machine began with preparation of a plan and its submission for approval by competent national authority. The plan has foreseen all necessary steps, which were considered as appropriate to perform this process in a safe manner and with minimum expenses. The technical documents of the installation and the functioning of the machine as well a short description of the main characteristics of the cobalt source were prepared with the same goal.

The decommissioning of the machine began with removal of the collimator from the gantry and alignment of the source container with the treatment head. Radiation survey of the source head was performed before the source transfer operation by AERB certified decommissioning engineers. Necessary advices were given to the team to maintain safe distance from the container to maintain the dose levels minimum (ALARA). Then decayed source was unloaded in shielded container (flask SI No 112) and was kept in another outer container (type B (U) package).

A radiation survey was done in a matrix format of the all sides of this package. Radiation level was measured at 1 m and 5 cm distance from the surface of package. Then a swipe test was also performed to check the surface contamination on the surface of source head after unloaded the source. To measure the personnel doses, pocket dosimeter, TLD badge and OSLDs were used. This all operations were done on 4th November, 2019. The decommissioned source was packed as per regulatory requirements and will be transported for disposal to BRIT, Kota on receipt of transport permission from AERB.

**Result & Conclusions:** The dose received by the personnel was measured by the pocket dosimeter, TLD badge and OSLD. The pocket dosimeter being an active dosimeter gives instantaneous reading received by the personnel. The maximum dose received by the source decommissioning engineers (0.03mSv). The same was informed to the regulatory board through source transfer report. Radiation level was measured 2.3mR/hr around wheel after removing the collimator.

Maximum radiation level on the surface of the package was found 6.0 mR/hr and maximum radiation level at 1 m from the external surface of the package was found 0.83 mR/hr. On the basis of transport index value, source was kept in category yellow-II. The development of the new concepts and practices in the field of the decommissioning includes the preparation and approval of a decommissioning plan, the actual decommissioning operations as well the safe management of the waste arising from the decommissioning process. Such plans need to be developed for each facility with radiation sources.
RADIATION PROTECTION IN DIAGNOSTIC RADIOLOGY
SAMARPITA HALDER, JUNIOR RADIOGRAPHER, INSTITUTE OF NEURO SCIENCE KOLKATA

WHY PROTECTION IS NECESSARY?

The Harm of X-rays

- X-rays hit an atom, knocking off electrons to create an ion
- Ions cause unnatural chemical reactions inside cells
- Charge can break DNA chains
- Cells with broken strands of DNA will die or develop a mutation
- Can cause various diseases or even cancer

MAXIMUM EFFECTIVE DOSE

Principles of Radiation Protection

- Justification: whether benefit of use of radiation outweighs the risk
- Optimization: if exposure justified, then keep it as low as reasonably achievable (ALARA)
- Dose Limits: exposures should be within the prescribed dose limits

DIAGNOSTIC BENEFITS OF X-RAY SCANS SIGNIFICANTLY OUTWEIGH THE RISK

ATTENTION TO INVERSE SQUARE LAW

Doubling your distance from an X-ray source decreases your dose by a factor of 4.

OUR AIM

- As low as reasonably achievable

ALARA

Time Distance Shielding

As Low As Reasonably Achievable

Increasing radiation

Decreasing image quality

PERSONAL PROTECTIVE EQUIPMENT

FOR STAFF:

- Adequate distance from X-ray machine and control panel
- Use apron and gloves of 0.3 mm lead equivalent
- Lead apron should be worn when positioning the patient
- Time 1/2: aprons to be used
- Monitoring of radiation exposure every month

PATIENT SAFETY

CAUTION

IF YOU ARE PREGNANT OR THINK YOU MIGHT BE PREGNANT, TELL THE X-RAY TECHNOLOGIST BEFORE HAVING AN X-RAY COMPLETED

RADIATION SHIELDING X-RAY ROOM

Secondary protective barrier

Leakage radiation

Leakage radiation

Scattered radiation

Primary protective barrier

Leakage radiation

Useful beam housing
Reditux
Rituximab Injection 100, 500 mg

Myezum
Bortezomib for injection 2 mg

Right Choice... first time

Dr. Reddy's
Proferred Talks
Design and development of a QA device for verification of prescription dose in a single-channel HDR vaginal cylinder brachytherapy applications.

Challapalli Srinivas, Dilson Lobo, Sourjya Banerjee, Athiyamaan M S, Johan Sunny Kilikunnannel

Departments of Radiation Oncology, Kasturba Medical College (A Constituent Institution of Manipal Academy of Higher Education: Deemed to be University), Mangalore-575001, Karnataka State, India

ABSTRACT

Endometrial carcinoma is one of the most common malignancies arising in the female genital tract. Intracavitary brachytherapy (vaginal cuff irradiation) may be given alone or with external beam irradiation in these patients [1] as post op adjuvant therapy based on pathological risk factors. It is reported that if the vaginal cuff is not irradiated properly with the prescription radiation dose, there are possibilities of recurrence along the vaginal wall.

Majority of this type of treatments are carried out with a single channel vaginal cylinder (83.2%) due to its simplicity and resources compared to the use of colpostats or vaginal molds. These cylinders are available in various diameters (usually from 2.0 to 4.0 cm) and lengths to match the inner vaginal deficiency, are often used to deliver a brachytherapy dose to the vaginal apex and upper vagina or the entire vaginal surface. Dose prescription usually is given either on to the surface or at 0.5cm from the surface of cylinder with a treatment length depending upon the vaginal cuff. Dose calculations are performed using brachytherapy treatment planning system (TPS) having optimization tools and selected dwell positions of source along the treatment length. Modern TPS has options to generate dose interest points that could be generated along surface or 0.5cm from the surface of cylinder where prescription dose will be normalized to these points using optimization tools available. Dwell times at respective active dwell positions of source along the channel will be calculated by the TPS using point dose optimization tool and dose distribution will be given by the system.

The calculated dose distributions at prescription distance must be evaluated carefully by some methods. In this direction, radiochromic film has been used in dosimetry brachytherapy and many researchers have made attempts over the last decade to use this film to make specific measurements or to verify the TG43-based source model data generated in Monte Carlo. [2-4] Radiochromic film of new age i.e. GafChromic EBT3 film (ISP Advanced Materials, New Jersey, USA) has been successfully demonstrated for use in brachytherapy applications [5-8]. In this study, a tool is designed to verify the uniformity of prescribed radiation dose in single channel vaginal cuff brachytherapy HDR applications using EBT3 film.
References


QA of CT SIMULATOR
Dr Ramesh Desai
MCF, Shreeji Imaging and Diagnostic Centre, IMT Manesar, Gurgaon

AIMS: - QA programme (policy and procedure) were written at the time of installation and after Commissioning Tests of CT Simulator purchased under the grant of IAEA in Malta (Europe).

EQUIPMENTS: - ODI jig (laser QA tool); Stainless steel ruler ; tape; laser QA device (for example Wilke phantom ); noninvasive device for Generator test (kVp meter); CT chamber, Graph paper; Spirit level; 70 Kg Weigh for the loading test of the table etc.

RESULTS AND DISCUSSION: - Our finding is that CT Simulator scan is, in many respects, similar to conventional diagnostic scans. The primary differences are the requirements for patient positioning and immobilization, treatment specific scan protocols, often increased scan limits, use of contrast, placement of localization marks on the patient skin, and some other special considerations.

Procedure for following parameters is discussed

I. Geometric accuracy
   • Positioning lasers
   • Movements of mechanical components (alignments)

II. Imaging performance
   • CT number accuracy
   • Image noise
   • In plane spatial integrity
   • field uniformity
   • Spatial resolution
   • Contrast resolution

III. Safety of patients
    • Radiation dose to patient
COMPARATIVE STUDY OF BREAST RADIATION THERAPY IN PRONE POSITION USING PRONE BREAST BOARD COUCH VERSUS SUPINE POSITION


Department of Radiation Oncology, P.D. Hinduja National Hospital, Mahim, Mumbai – 400016

Purpose/Objective(s): To compare setup error, dosimetric parameters and average treatment time between the prone position and supine position in breast radiotherapy.

Materials/Methods: For this study, 12 patients underwent CT-simulation, one in supine position with Deep inspiration breath hold (DIBH) and one in the free breathing prone position. Before planning CT simulation, radio-opaque wire was used to delineate clinically palpable breast tissue with the patient in supine position. For free breathing prone CT planning, patients were positioned on pivotal prone breast couch from Varian medical system. CT data (GE medical system, USA) were acquired without contrast for the both the scans (2.5 mm slices, C6 to below the diaphragm). Both scans were performed in one CT planning session, with the patient dismounting the couch between scans. Radiation beam plan for supine DIBH and free breathing prone were created for comparison of dosimetric parameters. Within 1 week after the simulation visit, patients undergo radiation therapy either in the supine position with DIBH or in the prone position daily for 15-20 consecutive days as per physician’s prescription. The dose prescription was 42.7 Gy dose to the whole breast and 10 Gy dose to tumour bed at ICRU prescription point, centrally located in the PTV at intersection of beam axes.

Dose-volume histograms were used to quantify the differences in doses in the OAR, namely, mean heart dose, mean lung dose & percentage volume of lung receiving 20 Gy (V20). Systematic & random errors were measured for both the treatment position (supine & prone). The time needed for patient setup, acquisition of imaging, the beam time, and length of the whole treatment were also recorded.

All the 12 study patients were in treated in prone position. To compare the treatment time required for prone position and supine position the average treatment time of these 12 patients were compared with that of a different set of 12 patients who were actually treated with supine DIBH.

Results: Average mean heart dose for supine & prone positions were 3.61 Gy & 3.37 Gy respectively. The average mean lung dose for supine & prone position were 9.38 Gy, & 1.76 Gy. The mean lung V20 was 16.33 % in supine position and 1.34 % in prone position.

Conclusions: A comparison of the setup precision position between prone position and DIBH in the same patient showed no significant differences in random and systematic errors. Mean lung dose and lung V20 were reduced when patients were treated in prone position. The treatment time was longer in prone position and can probably be attributed to the more repositioning needs.
The Role of the Radiotherapy Technologist in Prospective Evaluation of Quality of Life Scores in Patients of Head-Neck Cancer on Radical Chemoradiotherapy

Debojoyti Dhar

Tata Cancer Hospital, Andhra Pradesh, India

Introduction: Cancer and its subsequent treatment may cause physical, emotional, and psychological difficulties for individuals. Quality of life (QOL) indices are as important as the traditional end points of overall survival, disease free survival & tumor response in cancer management. QOL is particularly relevant for patients with head & neck cancer, because social interaction & emotional expression depend to a great extent on the structural & functional integrity of the head & neck region.

Methods & materials: Total 33 head & neck squamous cell cancer patients who received radical Chemoradiotherapy were consented and prospectively assessed for quality of life score using European Organization for Research & Treatment of Cancer (EORTC) core Questionnaires version 3(QLQ-C30) and the EORTC QLQ- H&N35, in any one of three languages (English, Hindi, Bengali). The score was assessed thrice for each patient, before start of radical treatment, just after completion of radical treatment and at the time of first follow up. Follow up QOL score has not been incorporated in this report.

Results: There was significant deterioration at treatment completion in emotional function, social function , insomnia, appetite, nausea/vomiting, pain, swallowing, dry mouth, sticky saliva, taste sensation, cough, speech, feeling ill, social contact, social eating & using painkiller. There were significant changes in Emotional Function (mean 71.21 vs 79.04, p=.04, 95%CI -15.53- -.11), Social Function (mean 81.81vs90.90, p=.05, 95%CI-18.20- -.02), Insomnia(mean 22.61vs32.14, p=.03, 95%CI-18.03- -1.01), Appetite (mean 34.52vs60.71, p=0.001, 95%CI-40.84- -11.53) & for Nausea/Vomiting (mean 6.79vs24.69, p=.002, 95%CI-28.55--7.25).

Conclusion & Discussion: In accordance with our prospective study of quality of life of patients head & neck cancer, we found there were no deterioration of physical & role function & finally it is remarkable that there was no significant change of global health.

This prospective study demonstrates short term deterioration of functional as well as symptomatic scale on the other side we also wanted to seems here, the important role of radiotherapy technologist in quality of life of cancer patients. We thought every radiotherapy technologist should a positive part to collect the EORTC C-30 & EORTC H&N35 QOL questionnaire before & also at the day of completion.

Rt technologist is only the person patients come contact his/her daily. A psychological, emotional and also somatic support from part of Radiotherapy will increased the confidence & courage of the patients for fighting against the disease. A complete support can be given to the patient by the technologist in the field of psychological, emotional & somatic discomfort.
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Oral Presentations
RADIOBIOLOGICAL MODELLING OF RADIATION INDUCED ACUTE SKIN TOXICITY (DERMATITIS): A SINGLE INSTITUTIONAL STUDY OF BREAST CARCINOMA

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Abstract

Purpose: To calculate the likelihood of normal tissue complication by estimating the fitting parameters of the sigmoidal dose response (SDR) curve of radiation-induced acute dermatitis in breast cancer patients treated with intensity modulated radiation treatment (IMRT).

Material and Method: Twenty five breast cancer patients were enrolled to model the SDR curve for acute dermatitis. The patients acute radiation induced (ARI) skin toxicity were assessed weekly, and their scores were determined using the common terminology criterion adverse events (CTCAE) version 5.0. The radiobiological parameters n, m, TD₅₀, and γ₅₀ were derived using the fitted SDR curve obtained from breast cancer patient’s clinical data.

Results: ARI dermatitis toxicity in carcinoma of breast patients was calculated for the end point of acute dermatitis. The n, m, TD₅₀, and γ₅₀ parameters from the SDR curve of Grade-1 and Grade-2 acute dermatitis are found to be 0.03, 0.04, 28.65 ± 1.43 (CI 95%), 1.02 and 0.026, 0.028, 38.65 ± 1.93 (CI 95%), 1.01 respectively.

Conclusion: This research presents the fitting parameters for NTCP calculation of grade-1 and grade-2 acute radiation induced skin toxicity in breast cancer for the dermatitis end point. The presented nomograms of volume vs. complication and dose versus complication assist radiation oncologists in establishing the limiting dose to reduce acute toxicities for different grades of acute dermatitis in breast cancer patients.

Key words: NTCP, Dermatitis, CTCAE, Acute Radiation Toxicity
Title: The influence of overall treatment time in TCP & NTCP model based predictions for squamous cell carcinoma of head & neck cancer treatment plans

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Aim & Objective: The present study demonstrating the influence of overall treatment time while predicting TCP & NTCP for conventional, moderately hypofractionated and accelerated fractionation schedules in head & neck patients’ treatment plans.

Methods: The proposed study separated in two parts. In first part we assumed four fractionation schedules for demonstration, conventional fractionation schedule (CFS) (70Gy/35 #), fractionation schedule 1 (66Gy/30#), fractionation schedule 2 (60Gy/24#) & fractionation schedule 2 (55Gy/20#). Four independent volumetric modulated arc treatment plans were generated for four different fractionation schedules for 15 patients data set and therefore total 60 treatment plans. The treatment plan created for CFS is the reference plan for calculated TCP & NTCP comparison amongst the four plans. The rest three plans for each patient were created simply by changing the dose prescription for FS1, FS2 & FS3, means total dose and dose per fraction. In second scenario, conventional fractionation schedule (66Gy/33# with five fractions per week) compared against accelerated fractionation schedule (66Gy/33# with six fractions per week). The cumulative dose volume histogram (DVH) for all treatment plans generated in Eclipse (Palo Alto, California, USA) treatment planning system is an input for TCP/NTCP estimation by Niemierko EUD, Poisson model and LKB model. The TCP/NTCP calculated by in-house developed software using MATLAB (2016b) version. TCP & NTCP calculated in two different ways for tumor & oral mucosa and compared. In first case overall treatment time (OTT) in days incorporated and in second case not incorporated.

Result: It was statistically significant difference (p<0.05) between calculated TCP/NTCP in both moderately hypofractionated and accelerated fractionation schedules when considering OTT in days. It showed that when OTT in days not accounted, TCP & NTCP overestimated for tumor and oral mucosa respectively.

Conclusion: The application of TCP & NTCP should be cautiously use in case of altered fractionation schedules and inclusion of OTT in days for calculation is recommended.
THE PENUMBRA WIDTH DETERMINATION OF A SINGLE BEAM AND 192 BEAMS OF GAMMA KNIFE PERFEXION™ BASED ON MONTE CARLO SIMULATION

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\textsuperscript{d} Science and Engineering Faculty, Queensland University of Technology, Brisbane Qld, 4001, Australia.

ABSTRACT

Gamma Knife Perfexion™ delivers 192 Cobalt-60 sources to the focus point (isocenter), while a stereotactic frame holds the patient in place. In conformal techniques, the penumbra width, which results in out-of-field doses in normal tissue next to the tumor, must be properly predicted. The goal of this work was to use the EGSnrc/BEAMnrc Monte Carlo simulation code to calculate the penumbra widths of a single beam and 192 beams for various collimator sizes of the Gamma Knife Perfexion™ and compare the results to EBT3 film dosimetry data. The simulation of Gamma Knife Perfexion™ was carried out utilizing the Monte Carlo codes of EGSnrc/BEAMnrc. To investigate the physical penumbra width, single beam and 192 beam profiles were created using EGSnrc/DOSXYZnrc code EBT3 films put at the isocentre point in a spherical solid water phantom with a diameter of 160 mm (80-20 percent). According to the results, the single beam penumbra widths determined from simulation data for 4, 8, and 16 mm collimator diameters along the X-axis were 0.75, 0.77, and 0.92 mm, respectively. The simulation results for 192 beams were 2.61, 4.80, and 7.92 mm along the X-axis and 1.31, 1.60, and 1.91 mm along the Z-axis, respectively, whereas the film dosimetry values were 3.21, 4.90, and 8.00 mm along the X-axis and 1.22, 1.69, and 2.01 mm along the Z-axis. The variations in penumbra widths between observed and simulated values are within acceptable limits. For more precise readings in the penumbra area where the dose gradient is high, Monte Carlo simulation is recommended.

Keywords: Gamma Knife Perfexion™, Monte Carlo method, radiosurgery, physical penumbra, EBT3 film
DOSIMETRIC COMPARISON BETWEEN INTENSITY MODULATED RADIOTHERAPY VERSUS VOLUMETRIC MODULATED ARC THERAPY TREATMENT PLANS FOR BREAST CANCER

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Abstract

Purpose: This study compared the dosimetric characteristics of volumetric modulated arc therapy and intensity modulated radiotherapy techniques regarding target volume coverage and dose to heart, spinal cord, and lung for patients with breast cancer. We analyzed the dosimetric differences of plans in the treatment planning system between VMAT and IMRT in treating breast cancer.

Method and Materials: Treatment plans were analyzed for 10 patients. Patients were treated with a technique that concurrently combines IMRT beams and the VMAT technique. IMRT treatments are generated using 4 tangential fields IMRT and VMAT plans were made with one arcs fields for the same patients. IMRT and VMAT treatments plans were planned for 50 Gy in 25 fractions. All treatment plans were planned due to protocols & the patient’s condition. Comparative endpoints were dose homogeneity within PTV, target dose coverage, doses to the critical structures and number of monitor units, treatment delivery time. Both plans were optimized to Dose-volume histograms values.

Result: The IMRT & VMAT average mean heart dose was (cGy), V30 (%) and V33 (%) for the heart were 453.7±75.5, 0.85±0.06% and 0.19±0.017% by VMAT, and 421.7±48.6, 0.25%±0.11% and 0.016%±0.011% by IMRT, respectively. The left lung mean dose (cGy), V10 (%), V20 (%) were significantly reduced from 1459.5±36.99, 36.5%±0.96% and 19.1%±0.51% with VMAT to 1356.2±48.77, 35.7%±0.49% and 18.27%±0.64 with IMRT, respectively. The mean dose (Gy), 0.03 cc for the spinal cord were by 1 872.6 ± 25.64 cGy VMAT, and 872.6 ± 25.64 cGy by IMRT, respectively.

Conclusion: IMRT plans showed significantly higher mean dose coverage to the PTV and conformity, homogeneity Index better than the VMAT plans. The IMRT plans typically had more favorable dose characteristics to the lung, heart, spinal cord and body dose when compared with VMAT. The main important advantage of VMAT is MU & treatment delivery time better than IMRT.

Key words: Breast Cancer; Radiotherapy; VMAT; IMRT.
LOW DOSE TOTAL SKIN ELECTRON BEAM THERAPY FOR THE TREATMENT OF MYCOSIS FUNGOIDS: CASE REPORT OF A YOUNG FEMALE

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ABSTRACT

Introduction: Total skin electron beam therapy plays an important role in the treatment Mycosis Fungoids a low grade cutaneous T-cell lymphomas. Conventionally a dose of 30-36 Gy is delivered over 9 weeks yielding short-term remission of the disease manifestations, with irreversible hair loss and fertility issues. Especially when the patient is a young female 20 years of age, as the cosmesis plus ovarian function preservation matters a lot. In this study, we treated a 20-year-old female with a low dose Total Skin Electron Beam Therapy (TSEBT) of 20 Gy in five week’s time, to preserve her ovarian function as well as a short-term remission of cutaneous manifestations with minimal toxicity. Total Skin Electron Therapy Low dose regimen was tried for the first time at our clinic and has yielded better disease control and can be a promising therapeutic approach to treat Mycosis Fungoids in young patients.

Method: The patient was treated with modified Stanford technique with 6 dual fields in January 2020. A dose of 20 Gy in 10 cycles was delivered using the two sets of six fields of 4 MeV High dose total Skin Electrons (HDTSe). The organs at risk viz lens, the hand and toenail beds, and ovaries were shielded using 5mm thick cerrobend with 3 mm wax.

Results: The patient started showing regression in the skin lesions after the third cycle and the purities and discomfort due to the lesions were progressively decreasing. The Quality of life started getting better with each cycle and by the end of the fifth week, the patient was relieved of the symptoms by 80%. During the irradiation, the skin became excessively dry which was managed by tropical soothers and moisturizers. In vivo dosimetry using Gafchromic film was done and it showed a maximum dosimetric variation of ± 8% at the inner thighs and in the inner arms. At 12 months follow up the overall survival is 100% and the patient is having a disease control of 99% with ovarian function preserved. Alopecia too got resolved within five months post-irradiation.

Discussion: A low dose Total skin electron therapy regime for younger female patients to maintain ovarian function and keep some dose for future disease relapse is a better radiotherapeutic strategy that can be adopted clinically for the management of Mycosis fungiods as an alternative to conventional high dose total skin electron therapy to have lesser toxicities and other cosmetic and functional benefits.

Keywords: Mycosis fungoids, Total skin electron therapy, low dose regime, in vivo dosimetry

Graphical Abstract:
COMPOSITIONAL ANALYSIS OF EX-VIVO ATHEROSCLEROTIC PLAQUE BY ELECTRON MICROSCOPY AND CONTRAST ENHANCED DUAL ENERGY CT IMAGES TO DETECT TYPE OF PLAQUE.

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Objectives: 1. Analysis of atherosclerotic plaque samples by electron microscopy (Energy dispersive spectroscopy(EDS)) and Dual Energy CT

2. Comparing the efficacy of EDS and DECT with histopathological study.

Materials and Methods: Thirty two left anterior descending (LAD) coronary arteries were collected from autopsy heart specimens and divided into two groups. Group I includes 14 and group II includes 18 samples of LAD from autopsy specimens who died due to non cardiac cause and coronary heart diseases respectively. These LAD samples were initially scanned by DECT. Thereafter Hounsfield values (HU) were read from DECT images to get the electron density and effective atomic number of plaque using inversion algorithm. From each of the LAD samples multiple sections of about 3mm were cut and most representative sections were taken for EDS and histopathology analysis. Result of each were collected, compared and analyzed.

Results: In group I, DECT reported 2 samples as predominantly fibrotic, 12 as fibro-lipid. EDS showed atomic percentage (at%) of Carbon, Oxygen and Nitrogen were 66.7%, 20.1% and 12.9% respectively and heavy elements like Sodium, Phosphorous, Sulphur, Calcium and etc had combined average 0.166at%. Histopathology revealed that 2 samples were predominantly fibrotic and 12 were fibro-lipid plaque.

In group II, DECT reported 3 samples as fibro-lipid plaque and 17 as lipid rich. EDS showed C, O and N had 78.75%, 15.4% and 2.431 at% respectively and heavy elements had combined average of 0.3113 at%. Histopathology reported 2 samples were fibro-lipid and 16 were lipid rich.

DECT was 90.6% accurate (sensitivity(s)=0.83; precision(p)=1; correlation coefficient(r)=0.828). EDS analysis was 96.84% accurate (s=1; p=0.92; r =0.937).
Comparison of Treatment Plans in Breast Cancer Radiotherapy. An In-Vivo Phantom Dosimetry Study.

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ABSTRACT

Background: The purpose of this study is to evaluate the point dose in PTV and peripheral doses for four treatment techniques of breast cancer radiotherapy with two energies. The importance of low doses in left whole breast cancer caused by radiation treatment, the point dose of critical organs, which were not subjected to radiation treatment in breast cancer radiotherapy, was measured.

Material and Methods: Eleven different plans in four techniques (3DCRT, IMRT, VMAT and HYBRID) and two photon energies (6 FF and 6 FFF) were applied to Rando Alderson Phantom’s DICOM images. Thirteen organs were contoured in the treatment planning system and specified on the phantom. To measure the point dose in field and peripheral dose, two dosimeters nanoDot Optically stimulated luminescence dosimeter (OSLD) and GafChromic (EBT3) films were used to find the point dose of 24 locations in Rando Phantom treated with Elekta Versa HD™ linear accelerator. Measured and TPS calculated dose were compared.

Results: The point dose were measurement in Rando phantom for all eleven plans using OSLD and EBT3 films. A maximum dose difference measured with OSLD and EBT3 films were found to be -1.37% and 6.15% difference was observed between the target and TPS. Similarly, for OAR’s such as contralateral breast the difference was -1.11% and -4.62%, ipsilateral lung the difference was -1.29% and -13.39%, and for heart the difference was -1.15% and -9.12% was measured with OSLD and EBT3 films respectively.

Conclusions: It was found that the point dose measured with OSLD had less difference when compared to EBT3 films irrespective of locations. Especially in peripheral OSLD shows superior than EBT3. This study found that the OSLD is more suitable for peripheral dose measurements.

Keywords: Flattening filter beam, Flattening filter free beam, Optically stimulated luminescence dosimeter, GafChromic films, Treatment planning system.
The present question is whether all the medical physicists trained by various universities/institutions fulfil these expectations? Whether the medical physicists trained by different universities/institutions are competent enough to discharge the duty of unsupervised clinical medical physicists? To access and standardise the medical physics education and profession, accreditation of medical physics education program and certification of individual medical physicist is essential. To help member state to establish the certification and registration of medical physicists as health professional IAEA has brought out Training Course Series TCS 71 document in February 2021 on “Guidelines on certification of Clinically Qualified Medical Physicists, this document is endorsed by IOMP and IMPCB [7].

Furthermore, medical physics is a rapidly growing area needing a high degree of knowledge and professional competency due to the rise in complexity of treatment procedures, increasing access to medical technology, and the requirement of coordination between the disciplines of medicine, physics, and biomedical engineering. The unprecedented surge in medical physics competency in the last 2-3 decades is due to the implementation of specialized physics intensive procedures such as particle therapy, image guided & intra operative radiotherapy, advanced imaging, and nuclear medicine techniques. In this scenario to handle this new technology era the quantity of qualified medical physicists needs to be in consonance with the competency needed. There is a special requirement for education and training of medical physicists which led to the opening of numerous educational programs around the world. However, the training and educational curriculum needs to be tuned with the requirement to produce the competent QOMP not for the present but also for the future needs. Furthermore, the major outcome of the academic programme is to provide the students with a thorough grounding in medical physics, critical thinking, scientific rigor, and adequate professional ethics, to facilitate the integration of the graduates in a healthcare profession, where the benefit of the patient is at the centre of all activities. Medical physics is facing significant changes, particularly with quick development of biological sciences, more complex research requiring interdisciplinary teams and strong need for translational research. The changes towards personalized medicine are opening new avenues for medical physicists like molecular imaging and extending beyond radiation therapy. To prepare medical physicists for the future, education and training should be properly adjusted including more basic non-physical sciences, particularly biology, more imaging, especially molecular imaging, and with more interdisciplinary and translational research components. The details are discussed in this communication.

References
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