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Editorial

Proposed Changes in Higher Education in Country: Implication for Medical Physics Education

The current era is aptly termed as era of rapid change and for that matter, it may be called as an era of rapid advancement in technology & technique, policy & perception, commitment & compensation and materials & methods in almost all walks of life. The change was never as fast as it had been in recent time. In such a milieu of tumult it is easy to be unsettled if we lose the anchoring of rational vision. Higher education in general and medical education in particular is in the throes of such developmental change in our country at present. Education in Medical Physics in India has seen dramatic increase in number of courses started in recent past but has shown the sign of settlement up to certain extent now as many of them face bleak future. Ministry of Human Resource Development is set to embark upon reforms in higher education by setting up a higher education regulator. Accreditation of the educational programmes and the institutions is likely to be pursued vigorously in higher education. Even evaluation of faculties and their research papers published in journals is on the anvil. It is in this scenario we must push for quality in medical physics education in India as well. After all, an able and committed Medical Physicist is an asset for the institute, association and the country. AMPI, for the first time, will have a Executive committee for three years period coinciding the tenure of CMPI (College of Medical Physics) which already has three years term. This may give significant advantages to these bodies to pursue their respective goals synergistically and co-ordinate with each other to make useful changes. The youngsters who now make a majority of AMPI members are traditionally restless but full of energy and ideas. The challenges faced by them maybe different from the difficulties faced by the experienced ones. There may be different scenario and obstacles encountered by different types of groups in the field of medical physics. If we keep the goal of maximum good for maximum people in mind, we may be able to sort out our course of action. Probably active and sustained coordination with AERB, UGC, MHRD, MHFW and the proposed National Medical Commission may bring some cherished changes in the profession and professional qualities. However, we all medical physicists must keep refreshing that enthusiastic commitment to profession, patient and public through our occupation is one of the corner-stone of our careers and only our hard work may help us in achieving the excellence as well as job satisfaction. Innovation and new ideas in the research arena is very important and our youth must be encouraged to take up challenges in that direction. The changes envisaged in higher education must spur us to initiate changes in medical physics education.

This issue of MPG has one such article which has a good initiative in the form of a case report. Uncommon but important anecdote must attract our attention and MPG will encourage such keen observations.

AMPI and MPG extend their warm wishes for the upcoming year 2018 !!!

Pratik Kumar

HIGH PRECISION RADIOTHERAPY TREATMENT PLANNING COMPARISON OF VARIOUS MODALITIES FROM LINEAR ACCELERATOR AND HI-ART TOMOTHERAPY IN MALIGNANT PLURAL MESOTHELIOMA – A CASE STUDY

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Introduction

Malignant plural mesothelioma (MPM) an uncommon cancer which characteristically starts in the linings of body cavity like pleura and has been associated with asbestos exposure. MPM usually in advanced stages invades the diaphragm, mediastinal fat pericardium, heart and lung parenchyma. It is a deadly disease to treat worldwide, with the median overall survival ranging between 9 and 17 months, irrespective of stage 1. In the past, surgery and chemotherapy were more commonly used for treatment of MPM than radiotherapy (RT), due to the limitations of technique. Multimodality treatment offers the most optimal chance for effective outcomes.

As a part of adjuvant RT whole of the left pleural lining along with mesdiastinal nodal area was the target. Since the patient has a large volume at left chest which needs radiotherapy and right lung needs to be spared. So it was challenging to achieve the radiation dose constraints safely. The intent of the treatment was radical. This study aimed to compare six treatment techniques with LA and Tomotherapy. In LA based treatment techniques 3-dimensional conformal radiotherapy (3DCRT), sliding- window IMRT, Rapid Arc was planned while in Tomotherapy, Tomo-direct 3DCRT, Tomo-direct IMRT and TomoHelical (IMRT) were planned. All these radiotherapy plans were critically evaluated for target dose coverage while simultaneously achieving least doses to the OARs and completing the treatment with least monitor units and thus faster treatments.

Materials and Methods

Case summary and Imaging

A 58 years old male patient with MM was enrolled in this study. Diagnosis of MM was made on histopathology and patient received neoadjuvant chemotherapy followed by extrapleural pneumonectomy with medistinal dissection. Specimen of extrapleural pneumonectomy showed disease extending in mediastinal fat with positive margins along with mediastinal nodal positivity. For the radiotherapy planning, post surgery simulation was done on 4-dimensional computed tomography (4DCT) simulator (16 slice, GE LightSpeed, USA) with patient in supine position over the vacloc immobilization device. Free breathing images were acquired with contrast followed by 4DCT scans with 2.5 mm slice width. Treatment plans were created for the various treatment techniques mentioned below that can be delivered with Linac and Tomotherapy. The prescription dose was 50 Gy in 25 fractions for all the plans.

Linac-based Treatment planning

Linac based 3DCRT plan (Technique A) consisted of two parallel opposed isocentric beams (Anterior-posterior and posterior-anterior) with 6MV X-rays from Trilogy linac (Varian Medical Systems, USA) with gantry angles of 0^0 degree and 180^0 degree. 120 Multileaf collimator (MLC) leaves with 5mm leaf width at the isocenter were used to conform the tumor shape. Appropriate wedges were used as per requirement to get the homogeneous dose distribution in the PTV. The calculation algorithm used was anisotropic analytical algorithm (AAA) with calculation grid size as 2.5 mm x 2.5 mm. Seven-field coplanar sliding window SW-IMRT (Technique B) for Trilogy was generated with 6MV X-rays and optimized with "beamlet mode" for more than 400 iterations followed by final dose calculation performed using analytical anisotropic algorithm (AAA). Technique C consisted 6 MV X-rays linac-based Rapid arc plan with two coplanar half arcs, one with beam on gantries rotating from 179 to 0 (CCW) and other from 0 to 179 (CW). Collimator angle was +/- 30^0 for arc planning to minimize the MLC tongue and groove effect. Progressive Resolution Optimizer (PRO-III) was used for optimization of the plan.

Tomotherapy based treatment planning

Tomotherapy (Tomotherapy Inc., Madison, WI, USA) based plans were created using Tomoplan treatment planning platform (v 4.2.3.9) using 6 MV X-rays. For beam modulation, a 64-leaf binary MLC was used with a leaf width of 6.25 mm projected at the isocentre (85 cm). Longitudinal aperture size of 1.05 cm, 2.5 cm and 5.02 cm are available for planning. In this study, the aperture size of 5.02 cm was used for all the plans created with Tomoplan TPS.

Technique D consisted of tomo-direct 3DCRT with 6MV X-rays. The beams were placed anteriorly (0^0) and posteriorly (180^0). The field width used in the plan was 5.02 cm. The pitch was 0.3 for the planning. The collapsed convolution superposition algorithm was used for calculations and the calculation grid used was 2.5 mm x 2.5 mm. Technique E consisted of tomo-direct IMRT plan with static gantry angles 0^0 and 180^0. Directional block was used for spinal cord so as to restrict the entry dose to it. The MLCs modulation was used to achieve the goal. The pitch and the modulation factor was 0.3 and 2.0 respectively. Once initial parameters are set for a particular plan, a full beamlet dose calculation was run followed by more than 400 optimization iterations allowing for full convergence of the cost function. For final dose calculation, collapsed convolution superposition algorithm was used. Technique F consisted of tomo-helical (IMRT) plan which utilizes more degree of freedom for gantry rotation to modulate the intensity. The field width used was 5.02 cm. The pitch and the modulation factor was 0.3 and 2.0 respectively.

Plan evaluation

The goal for all the plans was to achieve the 95% isodose coverage to the 95% of the PTV. V95%, V107%, homogeneity index (HI) and conformity index (CI) were evaluated for the PTV. V95% was defined as the volume of the PTV receiving 95% of the perception dose. V107% indicated the hotspot area. The homogeneity index was calculated as HI= D5%/D95% where D5% and D95% represents the dose received by 5% and 95% of the PTV volume. The conformity index was calculated as CI= VPTVref/ VPTV where VPTVref represents volume of PTV covered with reference dose or higher. CI95% and CI50% both were estimated. A higher CI value ranging from 0 to 1 represents better conformity. For the dosimetry evaluation of different techniques the parameters as follows: Dmax ,Dmean (the mean dose to an organ), V5Gy ,V10Gy , V20Gy were calculated for OARs. The planning time for each technique with the monitor units were also recorded and discussed.

Results

The treatment of malignant pleural mesothelioma with radiation therapy has always been a technical challenge. The optimal treatment technique with photons remains undefined. For this case, the treatment was delivered with RapidArc after critical evaluation of the plan parameters and considering other technical parameters like low monitor units, quicker treatments etc.

Figure 1 and 2 show isodose distribution in axial and coronal view for Linac and Tomotherapy based treatment techniques for sections respectively. Table 1 shows plan evaluation parameters for PTV from the DVH for six techniques.

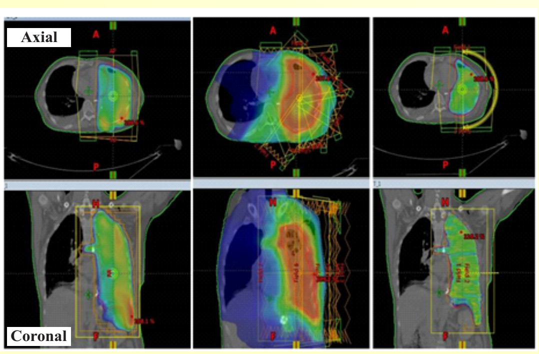
Table 1: Plan evaluation parameters for PTV from the DVH for six techniques.

Parameters	Linac-3DCRT (A)	Linac-IMRT (B)	Linac-Rapidarc (C)	Tomo-Direct 3DCRT (D)	Tomo-Direct IMRT (E)	Tomo-Helical IMRT (F)
$CI_{95\%}$	0.994	0.998	0.988	0.999	0.9881	0.9993
$CI_{50\%}$	0.999	0.999	0.9999	1.0	0.9982	1.0
HI	1.084	1.058	1.099	1.04	1.075	1.03
Isodose Volume of 107% (cc)	60.98	0.44	2.0	6.3	22.7	Nil

CI: Conformity Index : HI: homogeneity Index, 3DCRT: Three dimensional conformal radiotherapy, IMRT: Intensity modulated radiotherapy

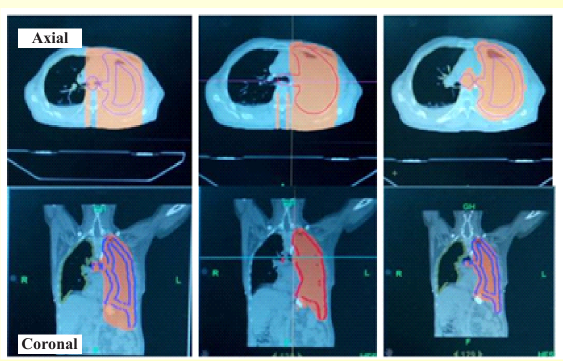
As per the requirements of dose volume parameters and constraints given, all five techniques from B to F achieved the criteria of no volume received 45 Gy. Linac 3DCRT technique (A) showed the maximum dose to spine as 53.35 Gy to 0.5 CC volume. Mean right lung (contralateral) dose was less than 5 Gy for Rapid Arc (C). The clinically acceptable dose to the contralateral (right) lung was that V20Gy should be as low as 8% of the volume.

All six techniques achieved this clinical condition but rapid arc (C) and tomo direct IMRT (E) achieved this volume as minimal as 0.4cc and 0.3 cc respectively. V10Gy was less than 5% for techniques A, C, D and E. V10Gy for Linac based IMRT and Tomo Helical IMRT was 29% and 32% respectively. V5Gy was 95% for Linac based IMRT (B) and 79% for Tomotherapy Helical IMRT (F). For Rapid arc plan (C), V5Gy was 35% and acceptable. As it was left sided tumor, achieving minimum dose to heart was difficult. Mean dose to heart was less than 34 Gy with all the techniques. Mean dose to ipsilateral kidney (right) was less than 5 Gy with all the techniques. Mean dose to liver was less than 10 Gy with all the techniques except 16 Gy with Tomo helical IMRT (F). Mean dose to trachea was less than 25 Gy with all the techniques. Single planner did the treatment planning and this planning time is from contour validations to the fine tuning of the plan. Both Eclipse and Tomoplan TPS had different workflow and the features. Rapid Arc plan (two partial arcs) was delivered in 100 seconds with 471 monitor units. Monitor units for Tomotherapy based plans were more than 4000 and this could be alarming towards the probability of second cancers incidence.



Linac3DCRT (A) LinacIMRT (B) LinacRapidArc (C)

Figure 1: Isodose distribution for Linac based treatment techniques for axial and coronal sections.



TomoDirect3DCRT (D) Tomo Direct3DCRTIMART (E) Tomo Helical IMRT (F)

Figure 2: Isodose distribution for Tomotherapy based treatment techniques for axial and coronal sections.

For all plans, 95 % PTVs received at least 95 % of the prescribed dose. All the plans could achieve the acceptable conformity in terms of CI95% and CI50%. CI95% and CI50% for all the plans was almost unity. Homogeneity index was the best in Tomo helical IMRT (F) while linac IMRT (B) and Tomo Direct 3DCRT (D) had homogeneity index close to Tomo helical IMRT plan (F). There was no significant difference in CI, HI values but there was significant difference in V107% values. However isodose volume (V107%) was nil for tomohelical plan while it was 2.0 cc for rapid arc plan. The location of this V107% was not in the vicinity of any OAR and hence was clinically acceptable. For linac based 3DCRT, this volume was around 61 cc and spread uniformly from anterior to posterior. Table 2 shows dosimetric comparison for the OARs with six techniques.

Table 2: Dosimetric comparison for the OARs with six techniques.

Structure	Parameters	Linac-3DCRT (A)	Linac-IMRT (B)	Linac-Rapidarc (C)	Tomo-Direct 3DCRT (D)	Tomo-Direct IMRT (E)	Tomo Helical IMRT (F)
Spinal cord	D_{MAX} (Gy)	53.35	42.36	32.77	42.65	31	28.58
	V_{5Gy} (%)	47.5	68.4	68.23	32	21	70
	V_{10Gy}(%)	11.25	64.8	47.2	24	15.6	59
	V_{20Gy}(%)	8	44	8	18	10	13
Right lung	D_{MAX} (Gy)	47.47	44.12	46.01	54.93	39.67	41.11
	D_{MEAN} (Gy)	2.07	8.83	4.98	2.56	1.67	8.65
	V_{5Gy}(%)	3.5	95	35	6	2.4	79
	V_{10Gy}(%)	1.63	29	4.6	3.3	.98	32
	V_{20Gy}(%)	0.87	1.12	0.4	1.5	0.3	2.2
Heart	D_{MAX} (Gy)	52.19	53.38	54.82	61.11	53.84	51.87
	D_{MEAN} (Gy)	24.1	26.8	17.04	28.11	20.15	33.4
	V_{5Gy}(%)	64.2	100	85	73	56	100
	V_{10Gy}(%)	52	88.5	43.6	64	45.6	100
	V_{20Gy}(%)	46.3	52	27.4	56.6	39	81
Right kidney	D_{MAX} (Gy)	2.47	11.17	11.85	2.03	1.68	12.93
	D_{MEAN} (Gy)	0.76	4.78	4.2	0.93	0.78	3.8
	V_{5Gy}(%)	0	51	33.59	0	0	25
	V_{10Gy}(%)	0	0.7	0.44	0	0	0.59
	V_{20Gy}(%)	0	0	0	0	0	0
Left kidney	D_{MAX} (Gy)	52.65	51.19	53.53	51.23	52.14	51.75
	D_{MEAN} (Gy)	26.63	22.67	21.1	39.54	30.7	30.11
	V_{5Gy}(%)	67	63	69.83	99.2	92.5	97
	V_{10Gy}(%)	60	58	63	96	86.8	88
	V_{20Gy}(%)	52	54	48.3	87.5	72	71
Spleen	D_{MAX} (Gy)	53.73	52.61	54.65	53.05	53.6	51.61
	D_{MEAN} (Gy)	49.8	33.97	22.81	51.22	46.27	39.33
	V_{5Gy}(%)	100	100	96.8	100	100	100
	V_{10Gy}(%)	100	97	70.3	100	100	100
	V_{20Gy}(%)	99	83	42.5	100	100	95
Stomach	D_{MAX} (Gy)	52	50.07	51.28	54.35	51.86	50.89
	D_{MEAN} (Gy)	12.5	9.42	6.7	18.1	13.52	14.56
	V_{5Gy}(%)	34.3	49.5	40.9	45.6	41	62
	V_{10Gy}(%)	31	34	20.58	42	36.4	47
	V_{20Gy}(%)	24.5	18.4	8.8	36.7	29	30
Liver	D_{MAX} (Gy)	51.15	51.88	52.52	55.87	54.32	51.01
	D_{MEAN} (Gy)	2.76	8.34	8.19	2.66	2.22	16.01
	V_{5Gy}(%)	6.2	73	66.4	4	3.6	91
	V_{10Gy}(%)	4.5	25	25.6	2.8	2.8	77
	V_{20Gy}(%)	3.4	4	4.17	2.8	2	25
Trachea	D_{MAX} (Gy)	42.66	31.76	27.69	43.18	38.32	36.24
	D_{MEAN} (Gy)	7.18	15.32	14.14	9.67	9.52	23
	V_{5Gy}(%)	65.2	85	86.8	39	38	100
	V_{10Gy}(%)	14.6	78	80.4	29	28.5	94
	V_{20Gy}(%)	5	26	12.34	19	18.6	71.5

OARs: Organs at Risks, D_{MAX}: Maximum dose, D_{MEAN}: Mean dose, V_{5Gy}: Volume receiving doses of 5 Gy or more, V_{10Gy}: Volume receiving doses of 10 Gy or more, V_{20Gy}: Volume receiving doses of 20 Gy or more, 3DCRT: Three dimensional conformal radiotherapy, IMRT: Intensity modulated radiotherapy

Discussion

Escalation of the dose to the pleural cavity and PET/CT-positive areas in patients with unresectable malignant pleural mesothelioma (MPM) using helical tomotherapy (HT) was studied [2]. Authors reported the average contralateral lung dose less than 8 Gy. In our study, the mean right lung dose for Linac IMRT (B) and Tomotherapy helical IMRT (F) was slightly higher and it was 8.83 Gy and 8.65 Gy respectively. However, it was less than 5 Gy with linac based Rapid Arc plan. The impact of increasing experience with intensity-modulated radiation therapy (IMRT) after extrapleural pneumonectomy (EPP) for malignant pleural mesothelioma (MPM) was reported[3]. They used 9-11 beams for treatment planning. They concluded that with the increasing experience, the mean dose to the contraleteral dose was minimal. In our study, 7 coplanar beams were used for planning purpose. Lesser the beam had the advantage of sparing the contralateral lung and other OARs. Recent reports from institutions have demonstrated that with greater experience, IMRT can be delivered safely to malignant pleural mesothelioma[4] with minimal mean dose to lung. We observed that the mean dose to the contraleteral lung with linac based IMRT plan (B) and with Tomo-Helical IMRT plan (F) were 8.83 Gy and 8.65 Gy respectively. The pilot study[5] investigated the feasibility of using volumetric-modulated arc therapy (VMAT) for malignant pleural mesothelioma (MPM) and compared VMAT to static field IMRT for five patients. They used 7 fields with static segments for IMRT plan with approximately 900 monitor units. In our study the monitor units were slightly higher (1259 MU) with sliding window IMRT due to high intensity modulation used. Their VMAT plan generated around 670 MU while our Linac-Rapid Arc plan (B) generated 471 MU. A study[6] evaluated the efficacy and safety of volumetric modulated arc therapy (VMAT) after extrapleural pneumonectomy (EPP) in patients with malignant pleural mesothelioma (MPM). The median follow-up period was 11 months. In our study, the patient had a followup after 12 months with locally controlled disease. Comparative planning of six patients for IMRT and VMAT was performed and reported[7]. They observed that the best VMAT plans were obtained with two partial arcs. VMAT seems currently the most suitable technique for the treatment of MPM. In our study, Rapid Arc plan with two partial arcs were used for the planning and found optimal. A planning study[8] was performed to evaluate RapidArc (RA), a volumetric modulated arc technique, on malignant pleuralmesothelioma. The benchmark was conventional fixed-field intensity-modulated radiotherapy (IMRT). All plans were optimized for 15-MV photon beams. They concluded that RA demonstrated compared with conventional IMRT, similar target coverage and better dose sparing to the organs at risks. The number of MUs and the time required to deliver a 2-Gy fraction were much lower for RA, allowing the possibility to incorporate this technique in the treatment options for mesothelioma patients. Our results were similar to this study and found Rapid Arc plan optimal for faster delivery with no compromise on PTV coverage and doses to OARs. A study[9] was performed to compare 2 adaptive radiotherapy strategies with helical tomotherapy for a patient having mesothelioma with mediastinal nodes. Intensity modulated radiotherapy (step-and-shoot IMRT) and 3D conformal radiotherapy (3DCRT) plans for the patient were generated and compared. The step-and-shoot IMRT plan was better in sparing healthy tissue but did not provide target coverage as well as the helical tomotherapy plan. In our study, the low dose volume was a critical issue for a helical tomotherapy plan.

Conclusion

The treatment of malignant pleural mesothelioma with radiation therapy has always been a technical challenge. It is an uncommon disease. Hence the dosimetric data for only one patient is reported. The optimal treatment technique with photons remains undefined despite of various treatment techniques available at present. Every technique has its pros and cons. Treatment planning for malignant Mesothelioma at our centre was carried out with six techniques from linac and Tomotherapy. Among six techniques, linac based Rapid Arc plan (technique C) was dosimetrically and technically advantageous with respect to PTV coverage, dose homogeneity and doses to OARs. Faster treatment time had an advantage to minimise the intrafraction organ motion.

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RH-DEM 0517

Designed for Radiotherapy measurements. Its operation is simple, using a single button to start/stop and reset the measurement. The quantity measured is charge, with a built-in precision digital timer which helps to measure the signal current also.

Specifications

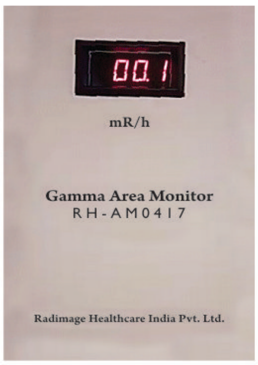
Electrometer	RH-DEM0517
Charge Ranges	Three ranges, pC, nC &mC Selectable from the front panel
Display	4½ digit LCD
(i)pC range	0-19999pC
Resolution	1pC
(ii) nC range	0-199.99nC
Resolution	0.01nC
(iii) mC range	0-19.999 mC

30 cm³ Phantom

0.6cc Farmer Type Ion Chamber

Brachytherapy Well Chamber

Extension Cable



Gamma Area Monitor (Ion Chamber Based)

RH-AM 0417

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Specifications

Detector	Hermetically sealed Air Equivalent Ionisation chamber
Range	0-200mR/h (Higher ranges are available on demand) Flickering display in case of over range. No Fall back on over load.
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RH-LM 0817

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COUNCIL OF IONIZING RADIATION MEASUREMENTS AND STANDARDS (CIRMS) 2017 MEETING AT NIST, MD, U.S.A.

Dr. Ganesan Ramanathan, Ex-BARC, NPL(UK), NIST(US), ARPANSA(Australia), Amritha University Medical Physics, Kochi and Emeritus Professor, Bharathiar University, Coimbatore.

The Council of Ionizing Radiation Measurements and Standards (CIRMS) is an independent, non-profit council that draws together experts in north America, Canada, south America and the United Kingdom involved in all aspects of ionizing radiation to discuss, analyze and review the developments in the field. The meeting is held every year for the last 25 years as a public forum attended by physicists and students from the major U.S. universities and cancer hospitals at the National Institute of Standards and Technology where I worked as a Guest Researcher during 2007-2008. I became a member of the council and I attended the meetings. Later, after shifting to Australia I started attending the meetings in 2014-2016 sponsored by the Australian Radiation Protection and Nuclear Safety Agency where I worked as a senior radiation scientist. The 2017 meeting held during March 27-29, 2017 is the silver jubilee meeting which I missed as I was migrating back to India. The technical forum this year consisted of oral and poster presentations and three parallel working group sessions that address measurement and standards' needs in (a) Medical applications (diagnostic, therapy and nuclear medicine), (b) Radiation Protection and Homeland security and (c) Industrial applications and Materials Effects. I have compiled the presentations given during the medical applications sessions and listed them with links by clicking which will take to the corresponding presentations.

1. Calibration Standards from NIST using Secondary Laboratories as an Example, Dr. Larry DeWerd, University of Wisconsin Madison http://cirms.org/pdf/cirms2017/DeWerd_cirms17_Calibration_Standards.pdf
2. Aerrow: A Probe-Format Graphite Calorimeter for Use as a Local Absorbed Dose Standard for High-Energy Photon Beams in The Clinical Environment, James Renaud – McGill University, Canada http://cirms.org/pdf/cirms2017/cirms17%20Renaud.pdf
3. Measuring Radiation Dose Through the Detection of Radiation-Induced Acoustic Waves, Susannah Hickling– McGill University, Canada http://cirms.org/pdf/cirms2017/cirms17%20Hickling.pdf
4. Dose Distribution Measurements of a New Directional Pd-103 Low-dose Rate Brachytherapy Source, Manik Aima – University of Wisconsin – Madison http://cirms.org/pdf/cirms2017/cirms17%20Aima.pdf
5. Development of standards for alpha emitting radionuclides for nuclear medicine, John Keightley, NPL Radioactivity Group http://cirms.org/pdf/cirms2017/MWG-Session-I-John-Keitley-20170329.pdf
6. Realistic Simulation of Radionuclide Sources in EGSnrc: A predictive model of the Vinten Ionization Chamber, Reid Townson, NRC Canada http://cirms.org/pdf/cirms2017/MWG-Session-I-Read-Townson-Rev-20170330.pdf
7. From Level Scheme To Diagnosis Nuclear Data And The Development Of Standards For Quantitative Medical Imaging, Brian Zimmerman, NIST http://cirms.org/pdf/cirms2017/MWG_Session_I_Zimmerman.pdf
8. Advances in Preclinical IGRT Commissioning and Quality Assurance, Paul De Jean, Image-Guided Systems http://cirms.org/pdf/cirms2017/MWG-Session-II-Paul-Dejean-Revised-20170404.pdf
9. Current Status of Radiobiology Dosimetry, Wesley Culberson, University of Wisconsin-Madison http://cirms.org/pdf/cirms2017/MWG-Session-II-Wesley-Culberson-Revised-20170330.pdf
10. Quantitative Imaging, Dr. Edward F. Jackson, University of Wisconsin Madison http://cirms.org/pdf/cirms2017/Jackson_cirms17.pdf
11. EQUINA™: A CT Scanner Designed by and for Veterinarians, Regina Fulkerson,Asto CT http://cirms.org/pdf/cirms2017/MWG-Session-III-Fulkerson-Regina-Rev-20170404.pdf
12. Why Cone Beam CT Can Make 3D the Standard of Care in Extremity Imaging, Stuti Singh, CurveBeam LLC http://cirms.org/pdf/cirms2017/MWG-Session-III-Stuti-Singh-Rev-20170404.pdf
13. Multi-Ion Analysis of RBE using the Microdosimetric Kinetic Model, Michael Butkus, Yale School of Medicine http://cirms.org/pdf/cirms2017/MWG-Session-IV-Michael-Butkus-Rev-20170412.pdf

THREE CHEERS !!!

Dr Raj Kishore Bisht, Medical Physicist, Department of Neurosurgery, AIIMS, New Delhi was awarded Ph.D. by AIIMS New Delhi in July 2017. The title of his thesis was “Dosimetric evaluation and optimization of fractionated stereotactic radiosurgery”. Congrats !!!

Dr Teerthraj Verma, Assistant Professor of Medical Physics, Deptt. of Radiotherapy, KGMU, Lucknow was awarded best oral paper at the Annual conference of Association of Medical Physicists of India (Northern Chapter) held at GTB Hospital New Delhi during 25th -26th February 2017. Congrats!!!

WHO's WHERE?

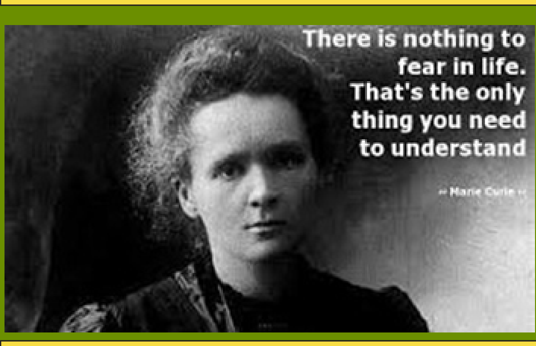
Shri Anil Kumar Maurya has joined Moti Lal Nehru Medical College, Allahabad in September 2016 as Faculty, Radiological Physics & RSO. Earlier he served Deptt. of Radiotherapy, SGPGIMS, Lucknow for more than 11 years.

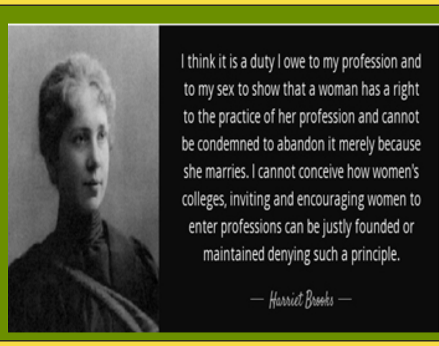
INTERNATIONAL DAY OF MEDICAL PHYSICS

(7th November 2017)

Theme : Medical Physics: Providing a holistic approach to women patients and women staff safety in radiation medicine

Dr. Arun Chougule
Sr. Prof & Head, Department of Radiological Physics
SMS Medical College and Hospital, Jaipur



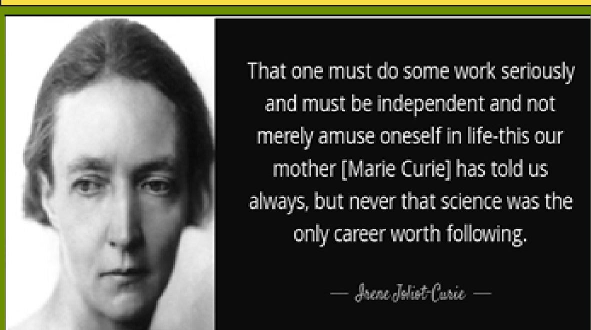


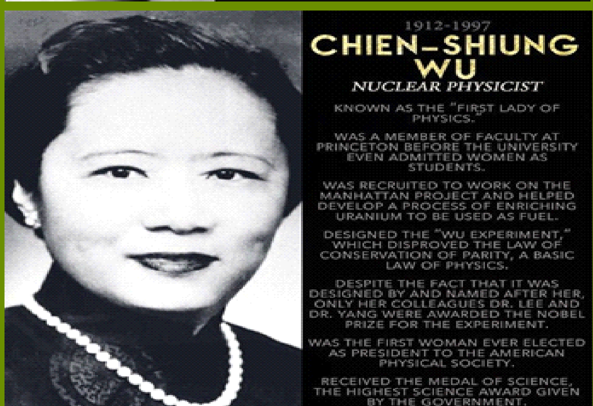
"We must have perseverance and above all confidence in ourselves. We must believe that we are gifted for something and that this thing must be attained."

— Marie Curie

The International Organization for Medical Physics (IOMP) has very appropriately selected 7th November to celebrate the International Day of Medical Physics (IDMP), this day is a testimony of very an important date in the history of Medical Physics, as on "7th November" in 1867, great scientist Maria Sktodowska-Curie was born in Poland. She had discovered the phenomena of Radioactivity, which has opened gates of Physics to Medicine and with this field of Medical Physics has born. Marie Curie was the only scientist to win Nobel Prizes in multiple scientific disciplines (Physics & Chemistry) in the history of Nobel prizes. She is a winner of the Nobel Prize in Physics in 1903.

IOMP has declared this day 7th November as International Day of Medical Physics (IDMP) to commemorate the contribution of this great scientist in the field of Medical Physics. Since from Then IDMP is successfully and widely celebrated worldwide on every 7th November. This year, we are celebrating 150th birth anniversary of Marie Curie. So, this year IOMP has appropriately chosen the theme of IDMP day as **"Medical Physics: Providing a holistic approach to women patients and women staff safety in radiation medicine"** to recognize and appreciate the contribution of women in Medical Physics.





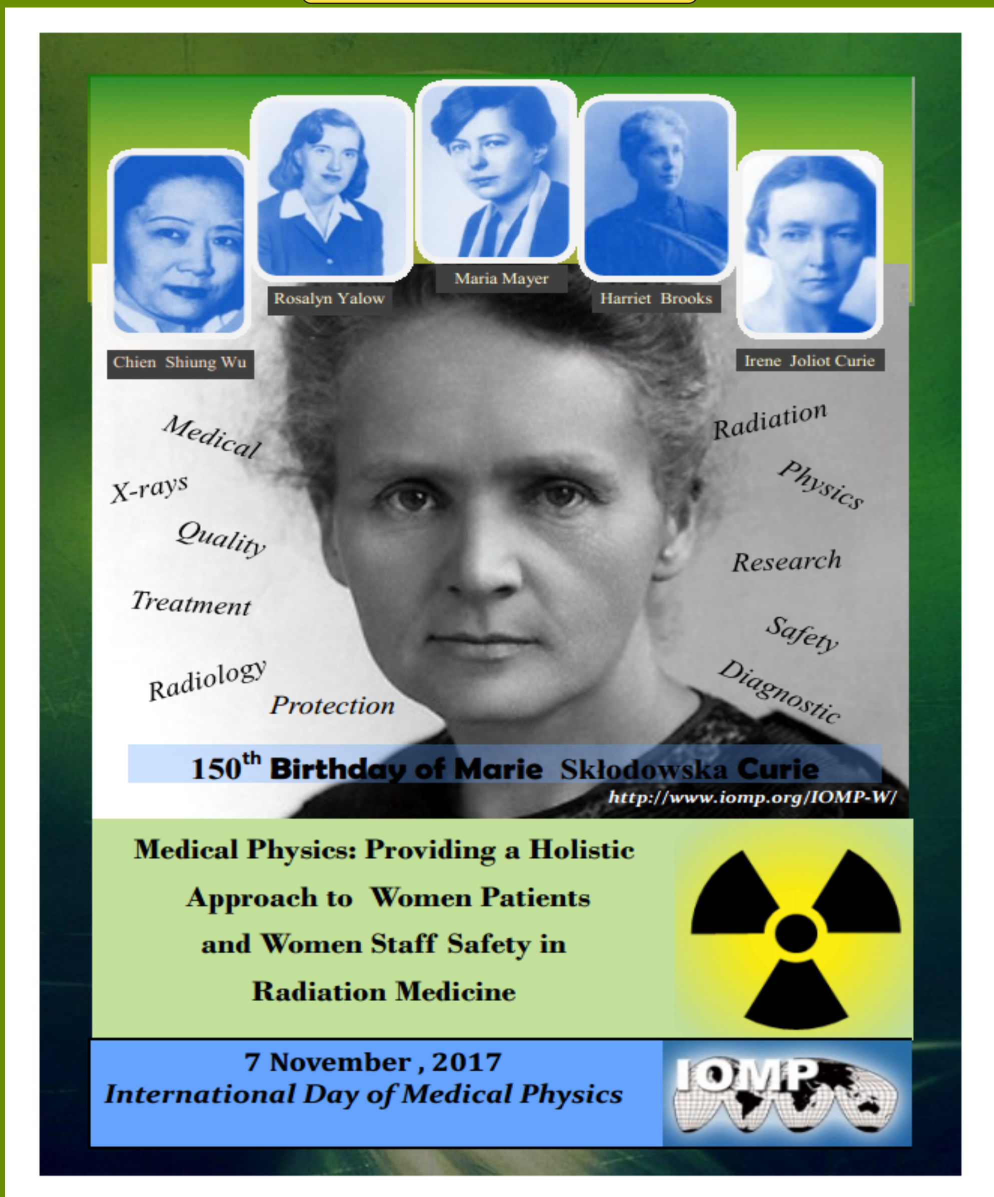
Women have played an important role in every walk of life including creation, advancement and application of Medical Physics. As a frontier science, Medical Physics is less likely to be bound by society's norms and less subjected to be inherent glass ceiling limiting women participation. Women such as **Marie Curie, Harriet Brook, Maria Mayer, Irene Curie, Chien Shiung Wu** and many others helped break through that ceiling and their contribution to Medical Physics and healthcare are worth observing and appreciation.

Today, field of Medical physics is touching new horizons in every possible dimension as use of Radiation in Medicine is increasing day by day .Now we cannot imagine field of Medicine without application of Medical Physics. With this, role of women in Medical physics is also increasing as it is increasing in every walk of life. But still there is a tremendous scope to enhance the role of women in medical physics and healthcare, as the participation or the number of women Medical physicist is still small. So with this year's theme of IDMP, which is fully based on women, a focus is planned on increasing participation of women in Medical Physics and on women radiation safety.

This year's theme is to promote, motivate participation of women in Medical Physics as well as increasing awareness of radiation safety among the women. Special concern and focus is given to women radiation safety at the child bearing age for both women radiation worker and women patients because of potential radiation hazards associated to this particular span of life. There is nothing to be afraid, only right working practices and proper knowledge is required to minimize these risks.

This year, we wish you all, especially women medical physicist a very happy **International day of Medical Physics.**

IDMP POSTER



TeamBest® Theratronics ASIA

MOSFET Dosimetry | Patient Dose Verification

mobileMOSFET
Wireless Dose Verification System

The mobileMOSFET Dose Verification System (TN-RD-70-W) takes MOSFET dosimetry to the next level.

The mobileMOSFET is a portable, easy to use, seamlessly integrated system that simplifies dosimetry and minimizes QA time, making it ideal for a busy radiotherapy center. For example, one Reader Module can be easily shared between multiple treatment rooms (with LAN connections and additional transceivers).

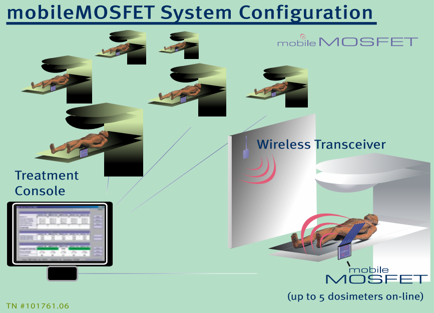
This new wireless system is entirely software driven, allowing for remote control of one or more systems from a PC. The system consists of Remote Monitoring Dose Verification Software, wall-mounted Bluetooth™ Wireless Transciever, and a small Reader Module that acts as a channel between the MOSFET and software, and provides a final dose report for patient records. Up to five MOSFETs or one Linear 5ive Array can be plugged into one module. This provides easy mobility within the treatment room. The PC is on-line with the Reader Module and dose is obtained in real-time.

MOSFET dosimeters are small, light-weight, unobtrusive, and versatile. Pictures above show the small size of the microMOSFET, a high-sensitivity MOSFET being used to measure scatter dose to the thyroid, and the Linear 5ive Array for use in brachytherapy.

Applications

Routine in-vivo dosimetry
One or multiple field measurements
First dose; treatment plan verification
Brachytherapy
IMRT in vivo, QA and phantom work
Intracavitary measurement
IGRT/Tomotherapy
Radiology

mobileMOSFET System Configuration



Software features
- Interactive, 2-way on-line communication between a PC and the Reader Module
- Dose obtained in real-time
- Able to perform all dose data measurements with a few mouse clicks
- Calibration feature enables quick and easy calibration of the MOSFETs
- Capability to assign Calibration Factors, Correction Factors, and Target Dose to each MOSFET
- Final dose and percent deviation from target are automatically calculated
- Export to MS Excel, Word, PDF and/or text files
- Set interval read times to sample multiple doses during treatment (automatic or manual control)
- With multiple systems and transceivers, one PC can read MOSFETs in multiple treatment rooms simultaneously
- Patient records can be saved/imported and printed and are password protected
- Final dose report provided

The MOSFET dosimeter
- One dosimeter/calibration factor for all photon and electron modalities
- Isotropic (±2% for 360°)
- Active region of 0.2 x 0.2 mm
- Permits pinpoint measurement without patient shielding
- Dose rate and temperature independent
- Unobtrusive in procedures
- Lightweight and flexible
- Multiple dosimeter capability with one Reader
- Standard MOSFET is 2.5 mm wide
- microMOSFET is 1 mm wide
- Linear 5ive Array – 5 dose points on one flex

Hardware features
- Bluetooth™ transceiver (wall mounted)
- Small Reader Module (17.8 cm x 15.9 cm x 4.2 cm)
- Wireless (up to 10 meters), portable, and mobile
- Contains reader, Bluetooth transceiver, dual bias supply settings (high and standard), ports for five MOSFETs, and a port for one Linear 5ive Array
- One Reader Module can be used for 1-5 MOSFETs or one Linear 5ive Array
- Battery operated (rechargeable; >20 hours of typical use)
- Built-in quick smart charger (<3 hours)
- Software supports up to 8 Readers and 40 MOSFETs simultaneously
- Portability between multiple treatment rooms

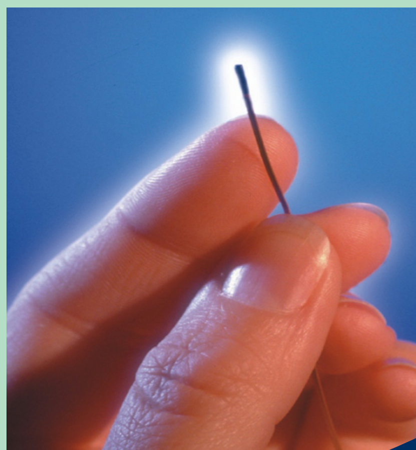
Dose	BIAS SUPPLY	
	Standard	High
200 cGy	<2%	<0.8%
100 cGy	<3%	<1.2%
20 cGy	<8%	<3%

System Dose-to-Dose Reproducibility at 1σ

MOSFET Sensitivity
Under Full Build-up:
- *1 mV/cGy on standard bias*
- *2.7 mV/cGy on high sensitivity bias*

Higher sensitivities available
Under X-ray Energies:
- *9 mV/R on high sensitivity bias*

Dose Points
1 - 5 on-line
(Up to 40 on-line with additional Reader Modules and transceivers)



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