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## *Editorial*

### Effects of Low-Level Radiation Exposure: Does It Need Our Renewed Efforts for Conclusion?

The effect of low-level radiation (low dose LD and low dose rate LDR) has always been controversial and sometimes emotive as well. There are opinions and some data that support the varied concepts, from radiation hormesis to the Linear No Threshold (LNT) model of dose-effect relationship for low-level radiation. Naturally, the data regarding the effects of low doses come under prying eyes due to inherent infirmities in such data. Some voices advocate the existence of a threshold dose for the induction of cancer due to low radiation doses. This controversy regarding the effects of low doses of radiation has received a fillip lately by a presidential executive order from the President of the US on 23rd May 2025 for the reform of the Nuclear Regulatory Commission (NRC).[1] NRC authorises civil nuclear reactors in the US. The White House order explains that within 25 years preceding 1978, the US authorised 133 civil nuclear reactors at 81 power plants, while within the last 48 years, from 1978 onwards, the NRC has authorised only a fraction of the previous numbers. The communication states that the NRC utilises the LNT model (and As Low As Reasonably Achievable ALARA standard), which lacks a sound scientific basis and arrives at irrational results, such as requiring the nuclear plants to protect against radiation below naturally occurring levels. While the presidential order has the context of licensing nuclear reactors, it has brought the old conundrum of the effects of low-level radiation to the fore.

In 2018, the National Council on Radiation Protection and Measurements (NCRP) published a Commentary No. 27 on "Implications of recent epidemiologic studies for the linear non-threshold model and radiation protection", and examined 29 epidemiological studies involving LD (less than 100 mGy) and LDR (less than 5 mGy per hour) of low Linear Energy Transfer (LET) radiation events which were published within the last 10 years (2006-2017) to address the appropriateness of application of LNT model to radiation induced cancer (which included total solid cancer, leukemia, breast cancer, thyroid cancer, heritable effects and a few non-malignant conditions) for radiation protection purposes. The review concluded that many (if not all) studies concurred with the LNT model, especially for solid cancer and leukemia. The study underlined the fact that the possible risk from LD/LDR is small and uncertain, and it may not be possible to prove or disprove the validity of LNT model. Nevertheless, it supported the LNT model for the solid cancers. A paper re-examined the studies included in NCRP Commentary No. 27, and supported the conclusion of the validity of the LNT model for 16 out of 22 studies for solid cancers and 17 out of 20 studies of leukemia.[2] However, there could be some analysis of these studies that present a slightly deviated conclusion. For example, one paper examines six studies (two Hiroshima Nagasaki studies, two medical and two nuclear worker studies included in Commentary No. 27) and asserts that they may be high-dose and dose-rate events. It concludes that there is no cancer risk below 100 mGy in these six studies.[3]

All these developments spur us to strive more to clear the dilemma of low-dose and low-dose rate radiation effects.

[1]https://www.whitehouse.gov/presidential-actions/2025/05/ordering-the-reform-of-the-nuclear-regulatory-commission/

[2]Michael Hauptmann, Robert D Daniels et al. Epidemiological studies of low-dose ionising radiation and cancer: Summary bias assessment and meta-analysis. J Natl Cancer Inst Monogr, 2020, (56), 188-200.

[3]K Chaplin. NCRP claims six studies support LNT but they show no effect to at least 100 mGy. Dose-Response: An international journal, 2025, 23(2), 1-11.

*Pratik Kumar*

# TOTAL SKIN ELECTRON THERAPY (TSET): OUR DOSIMETRIC EXPERIENCE

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## Introduction

Total Skin Electron Therapy (TSET) has been employed for over five decades in the management of Cutaneous T-cell Lymphomas (CTCL). Mycosis fungoides, a subtype of CTCL, frequently manifests as red rash of large parts of the patient's skin. Electron irradiation of the skin surface represents an efficacious treatment modality. TSET administration can be executed via translational or large field techniques, the latter being more prevalent. Challenges associated with whole-body skin irradiation, such as dose inhomogeneity, are mitigated through in-vivo dosimetry and subsequent dose escalation in specific areas.[1]

## Measurement Technique

### Determination Energy

The nature of the electron beam is that when it passes through the collimation system and the phantom, the beam energy degrades as illustrated in the Figure-1.

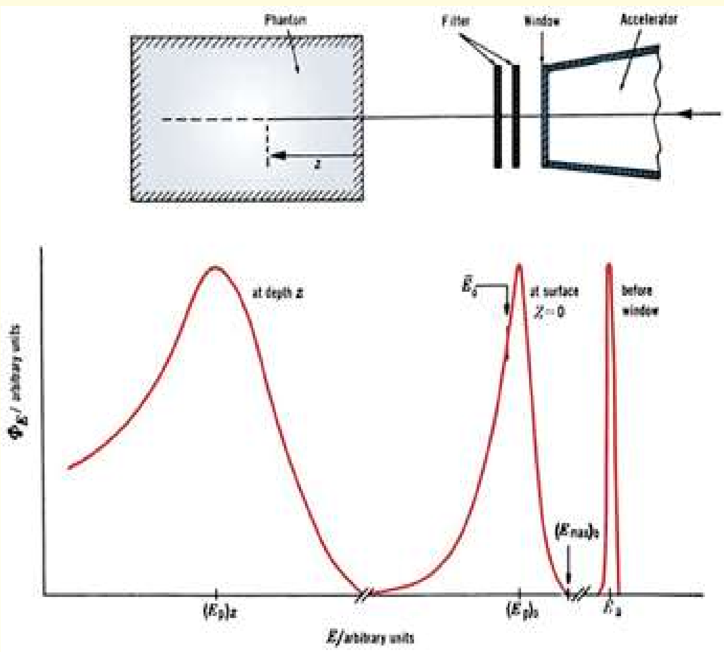


Figure 1: Energy Degradation of electron- The electron energy profile gets wider as it passes through the collimation system and the phantom [From ICRU. Radiation dosimetry: electrons with initial energies between 1 and 50 MeV. Report No. 21. Washington, DC: International Commission on Radiation Units and Measurements, 1972, as cited in "The Physics of Radiation Therapy" by FM Khan]

As the treatment is delivered at extended SSD, it is important to find the energy at the treatment SSD. The Percentage Depth Dose(PDD) was measured at 3.5 m and the probable energy found from PDD at 3.5m calculated using the formula $E_{p,0}=1.95R_p+0.48$.

Where $E_{p,0}$= Probableenergy measure at depth 0.

$R_p$= Practical range measured from PDD curve.

The Energy of 6 MeV electron delivered was3.9 MeV at 3.5 m. $R_{50}$ found was0.9cm and $R_p$ was 1.7 cm. The PDD curve of 6 MeV electron is given in Figure-2.

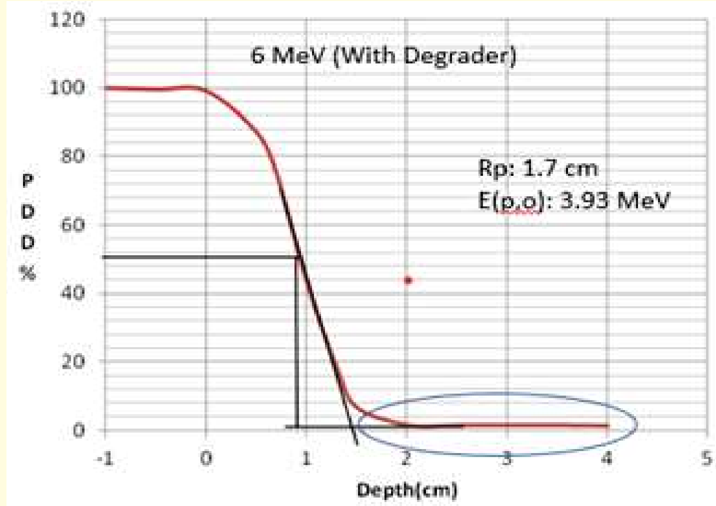


Figure 2: Percentage Depth Dose measured with degrader at 3.5 m from Isocentre

All the measurements were made with acrylic scatterer of 1 cm thickness to achieve wider angular spread of dose distribution at patient surface and a distance of 20 cm maintained between the scatterer and the measurements. All the measurements were made using the Perspex slab phantoms and Plane parallel plate chamber (PPC40, IBA).

### Dose Rate Determination

The dose to water for the beam quality Q was measure using the formula given below.

$D_{w,Q}=MR\times N_{D,w,} \times K_{qq0} \times K_{tp} \times K_s \times K_{pol}$

Where,

MR = Meter Reading

$N_{D,w}$= Chamber calibration Factor

$K_{qq0}$= Beam Quality Correction Factor

$K_{tp}$= Temperature and Pressure Correction Factor

$K_s$= Saturation Correction Factor

$K_{pol}$= Polarity Correction Factor

The beam energy measured was close to 4 MeV the corresponding $K_{qq0}$ was used for the dose estimation.

The MU found to deliver 1 Gy was found using the dose rate estimated.

### Hinge angle determination

The single field of 90° or 270° will have forward directed x-ray contamination. Hence the field is split into two as shown in Figure-3.

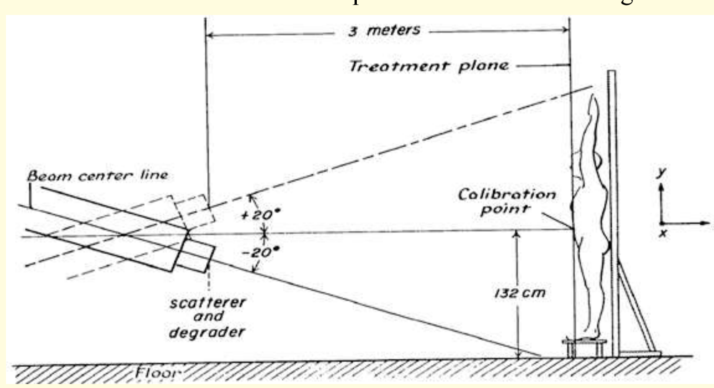


Figure 3: Hinge Angle-Explains the central axis of beam goes away from the body [AAPM report no 23, TG-30 Total skin electron therapy: technique and dosimetry]

The hinge angle determination is crucial and depends on the bunker dimension. Moreover, the two angled fields will have improved uniformity than single field. The hinge angle would vary from 15° to 20°. The accurate hinge angle will be the one which provides the same meter reading of true gantry angle. In our institute the hinge angle found was 17 ° for the treatment distance of 3.5 m.

## Dose Uniformity

AAPM-TG-30 recommends a vertical uniformity of 8% and horizontal uniformity of 4% for the TSET treatment.[2] The uniformity was measured at various vertical points at the interval of 25cm using PPC-40 chamber. The measured profile has been shown in Figure 4.

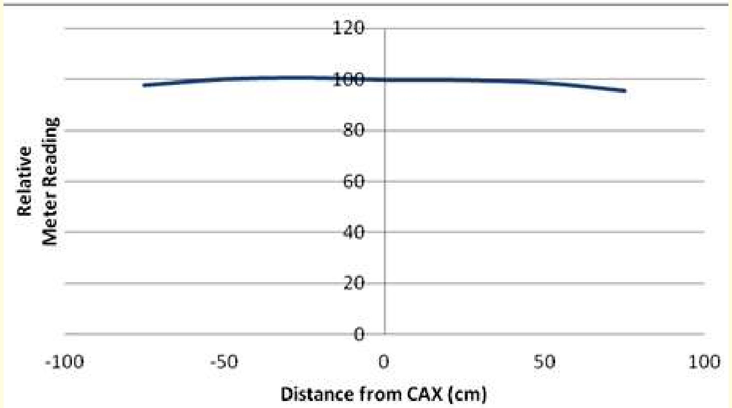


Figure 4: Uniformity measurement across vertical column

### Patient Set-up

The treatment was delivered in Varian-2300 C/D (Varian Medical Systems, Palo Alto, CA). The patient's total height and umbilicus height will be taken for the measurements as the umbilicus is calibration point. The patient's standing platform height will be designed in such a way to make the iso center fall on the umbilicus.

The patient treatment was delivered using Modified Stanford Technique as shown in Figure 5.

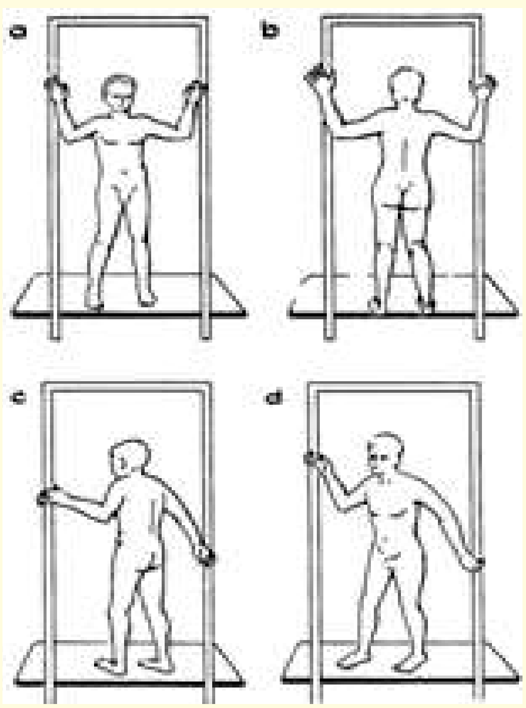


Figure 5: The modified standard technique. a-Anterior position, b-posterior position, c-posterior oblique, d-anterior oblique [AAPM report no-23,Total skin electron therapy: technique and dosimetry, TG-30]

In this technique the patient takes the treatment Anterior and two posterior obliques on day-1 and posterior and two anterior obliques on day-2 to have the dose distributed throughout the body. The patient positions on different days are shown in figure 5.

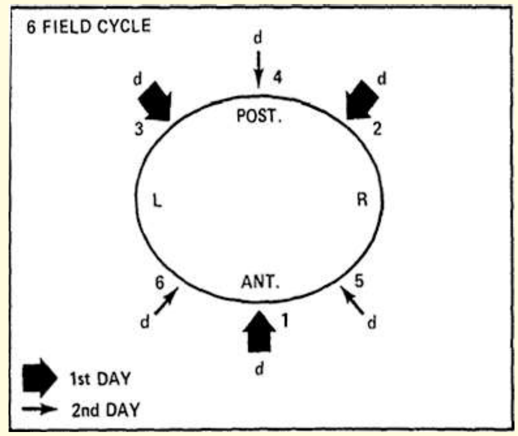


Figure 6: Treatment positions on day 1 and day 2 [AAPM report no 23, Total skin electron therapy: technique and dosimetry, TG-30]

The dose prescribed was 36Gy/20# treated for 9 weeks. A special collimator called HDTSEe (High Dose Rate Total Skin Electron mode) used for the treatment which delivers 6 MeV electron in high dose rate. (Figure 7).

Figure 7: HDTSe collimator

### In-vivo dosimetry

The in-vivo dosimetry was performed using both the OSLD and MOSFET at various points on the patient including the umbilicus(calibration point), Vertex, Armpit, Inguinal and foot to know the dose values. If the dose measured was found to be less, the area will be boosted locally. For all our patients the calibration point dose was found to be less than 5 % difference. The dose details are mentioned in Table 1.

**Table 1: in-vivo dosimetry**

| Region of measurement | Measured Dose(cGy) |
|---|---|
| Calibration Point* | 198.99 |
| At Vertex (Scalp) | 219.73 |
| 5 cm anterior to Vertex | 235.23 |
| 5 cm posterior to Vertex | 236.68 |
| 5 cm left to Vertex | 204.73 |
| 5 cm right to Vertex | 224.94 |
| Rt sole | 61.65 |
| Lt Sole | 79.65 |
| Arm Pits* | 249.2 |
| Inner Thighs* | 216.0 |

A Patient required scalp and sole boost. The scalp boost was delivered with gantry 270° and couch 90°. The MU was calculated manually for the prescription. The sole boost was delivered with the feet kept in tray filled with water to reduce the exposure to the other part of feet and gantry kept at 180°. Figure-8 show the measurement setup.Figure-9 shows the treatment setup of sole boost.

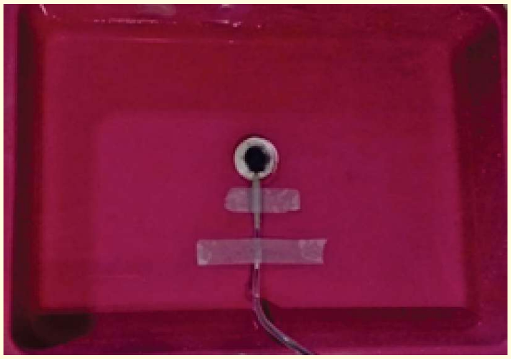

Figure 8: Sole boost measurement setup. The chamber kept upside down as the treatment was delivered at Gantry 180°.

Figure 9: Sole boost Treatment setup

## Patient Shielding

The patient's nail was shielded using bolus and lead in such a way that bolus facing the beam and lead close to the nail. The purpose of bolus to degrade the energy of electron and lead is to absorb Bremsstrahlung radiation. The eye shielding was done using lead goggles.

## Conclusion

It is important to consider the dosimetric characteristics of TSET for each patient and for different treatment setups.The beam characteristics such as beam energy, dose rate, hinge angle, dose uniformity are all measured with high accuracy. Every department has to perform the dosimetry for their own set-up.

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# SCIENTIFIC AND MANAGERIAL ISSUES RELATING TO COBALT TREATMENTS FOR CANCER PATIENTS IN INDIAN SCENARIO


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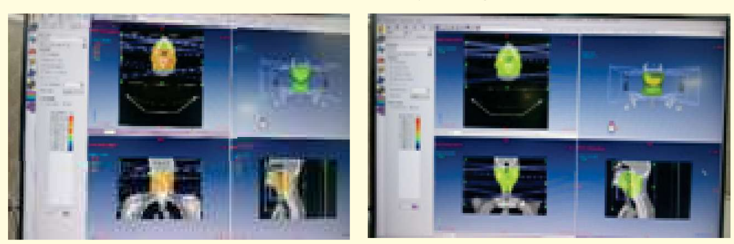
## Introduction

As a senior medical physicist and teacher in medical physics profession with long experience in government, non-government, Christian missionary and Oman MOH, I have been constantly perusing the economic, and optimal use of radiotherapy resources. Panacea Medical Technologies (PMT) Ltd an Indian Medical Equipment Manufacturer is manufacturing high end telecobalt machines and low energy linear accelerators, based on the need to support Indian hospitals[1,2,3,4]. Based on the priority and clinical applications, a group of senior radiation oncology experts, going through efficacy of tele-cobalt for treatment of large number of cancer patients, have indicated two important points. 1) There is no deficiency on cobalt beam in terms of clinical efficacy and radiobiological effects, vis-à-vis high energy linear accelerator photons. 2) If multi-leaf facility (MLC) for covering irregular tumor volumes, and also reduce the dose to risk organs, they will be able to use the high tech telecobalt machines efficiently, and cost-effectively[5]. Adhering to these recommendations, PMT took research and developmental efforts and manufactured high accuracy model O-ring telecobalt machines[6,7,8]. 3 numbers Bhabhatron 3i machines were installed, 2 in Karnataka and 1 in Tamilnadu states in South India, and their technical specifications and efficacies were outlined in scientific communications[9,10]. This new model Bh 3i [9,10]is designed to deliver precise, conformal, image guidance based 3 D Conformal Radiation Therapy (3D CRT), Field in Field (FIF) Intensity Modulated RT, mixing of FIF multiple fields and ARC plans. They can generate superior sparing of normal tissue, develop good homogeneity in treated volumes, with on-line image guidance. Though they were installed around June, 2024, in 2 out of the 3 centres, either clinical treatments have not started or interrupted more than 3months. Also, they are outside one year warranty period and licenses for operation came to end. Another observation was made nationally. In many institutions they have telecobalt machines, with good dose rate output at normal treatment distance (NTD) at 80 cms, but seldom used for more number of patients, which amounts to wastage of Curie-Hours (CH). There are two reasons, 1) Higher revenues generated from linear accelerator 2) Patients are subjected to special techniques like intensity modulation RT (IMRT) or volume optimised treatments, when they do not require such special type of treatments. This trend is followed in public funded institutions also. As a general tendency, the availability of High End RT machines make an attitude that even for simple treatments they overload linear accelerators. With experience during 2016-2025, Ravichandran et al highlighted the efficacy of telecobalt machines, to provide better dose delivery suitable for head and neck tumors in radical RT[11].This pilot study data led to a randomised clinical trial of 7 fractions/wk compared with 5 fractions/wk, and it was found that patients tolerated well 70 Gy, 5 wks at 2 Gy/fr, which is first report to be communicated (unpublished data), enhancing Biologically Effective Dose (BED tumor) enhanced by as high as 19%.



(a) (b)

Figure 1: (a) H & N Co-60 parallel opposed fields (Uncompensated) with hot spot Neck, (b) H & N Co-60 with MLC Multiple Segmented Fields (FIF-5Pairs) Homogenous dose

By manually forward planned 5 pairs of opposing fields in Head and Neck contour, in newly developed Bhabhatron 3i, it is possible to extend this technique for the benefit of many institutions where MLC provision is available. As higher reimbursements on treatments from Government Agencies are available, more patients are treated by High energy Linear Accelerators, and sudden drop in statistics in telecobalt machines, even in our own centre at CCHRC, Silchar. In Silchar Medical College Hospital (SMCH) they decommissioned cobalt machine, closing the radiation therapy department; with the inception of a True Beam linac in the same campus under Assam Cancer Care Foundation (ACCF). Roughly about 45 True Beam Varian High Energy linear accelerators are available in Assam state, where there is meagre Human Resources (HR) of Radiation Oncology Specialists, Senior Medical Physicists, Radiological Safety Officers, Radiotherapy technologists (RTT), and supporting imaging facilities. Many hospitals in Assam having telecobalt machines, treat only less number of patients. In the above scenario a few scientific and logistic facts are highlighted. Interaction of photons converted to corpuscular radiations (absorption process and linear energy transfer) is almost identical with linac and cobalt machines. 6 MV Linac photon has mean energy around 1.20 MeV at the exit of accelerator tube, and around 1.70 MeV after flattening filter. Scientific Details on cobalt and 6 MV beam qualities are highlighted in Table 1.

**Table 1: Comparison of Cobalt and 6MV Photons**

1. Absorbed dose to the soft tissue is delivered to the tumor or irradiated volume by Absorption Coefficient ($\mu_{en}/\rho$) which is 0.992 for Cobalt photon and 0.991 for 6 MV photons. (Absorption there is no difference).
2. Mean energy transfer to electrons is 588 KeV for Cobalt photons, and 742KeV for 1.5 MeV, and 1060 KeV for 2.0MeV, only at the first interaction. As the photon beam travels, they will undergo multiple interactions and die down. Except for larger depth of electron equilibrium (build up of dose) and 4% per cm reduction of intensity/cm depth for 6MV; 5% per cm reduction in intensity/cm depth for Co-60, does not change any biological advantage, because both are classified as LOW LET radiations (5.2Kev/µm).
3. Cobalt-60, 1.25MeV, Compton Effect 99.9%, Pair Production<0.1%; 6MV (Mean Energy 1.70 MeV) Compton Effect 98.4%, Pair Production 1.6% , is likely to give increase in absorbed doses in bones.
4. Cobalt machine operated at 80 cm SSD, and Linac is operated at 100cm FSD, gives a change of 4.3% increase by inverse square law and penetration increases by 10% on intensity at 10cm depth. When input intensity is adjusted per cGy dose, there is no biological extra advantage in tumor kill.
5. Physics with Monte Carlo methods showed that mean energy of 6 MV linac beam is 1.70 MeV not different from cobalt (1.17, 1.33 MeV). (see Table 2).
6. When sophisticated delivery of dose to volumes are planned in Linear Accelerators, qualities in planning, reproducibility in execution, delivery stringent are the requirements. Infrastructure, team work shall be well organized for obtaining correct outcomes.

**Table 2: Composition of 6 MV Linac X-Ray Beam**

| No. | Method | 6 MV Linac Photons Spectral Distribution | Remarks |
|---|---|---|---|
| 1 | By using copper absorbers, energy response function and Laplace transform analysis[6]. | 1.7 MeV -100%, 2.5 MeV-70%, 3.0 MeV-50%, 3.6 MeV -30% 4.0 MeV-10% and no detectable energy > 4.6 MeV. | Mean $\mu_{en}/\rho$ $_{Copper}$ = 0.04443 cm$^2$/g (1.7 MeV). $\mu_{en}/\rho_{Copper}$ for 6 MeV mono-energetic beam = 0.0318 cm$^2$/g. Clinac 2300, 6 MV beam, copper target, copper FF, tungsten primary collimator, and jaws. Results extendable to M/s Varian linac models Clinac 2100, 1800, 21 Ex, 23 Ex. |
| 2 | Monte Carlo computational results yielded following results[7] | 1.67 MeV (at d=0), 1.86 MeV (d=20 cm). 3 x 3 cm$^2$ field. 1.47 MeV(at d=0), 1.27 MeV (d=20 cm). 10x10 cm$^2$ field. 1.21 MeV(at d=0), 0.694 MeV (d=20 cm). 40x40 cm$^2$ field. | |
| 4 | Small field 6MV XRay spectrum | 1.20MeV mean energy of XRay photons for small fields at 1.5cm deep | |

## Comparison of Cost per cGy

With rough estimates of input costs and running costs, approximately it will be about a factor of 4-5 in terms of cost/cGy for high energy linac compared to telecobalt cost/cGy. Hospital will be therefore overburdened if linac only used and Telecobalt is not used for treatments, despite collection of revenues. Earnings appears to be more but actual revenues shall be expressed against the input expenditure per annum to keep the infrastructure. If cobalt machine also is functional to full capacity, then definitely that revenue will help in maintaining partially the linac. This point is not looked at by the administration.

## Inputs required for Running cobalt machine

Telecobalt total load is 2 KVA, but routine operational loads are operation of 1/4HP motors for gantry movements, and patient treatment table up and down, and smaller DC motors with low voltage for table top movements. Source ON-OFF is done by 9V solenoid valves two numbers, and air compressor becomes On for 5 minutes twice an hour. No great amount of Electricity Board (EB) power is used for cobalt machine. Cobalt source emission is by radioactive decay and no heat exchange (Exothermic) takes place during treatments. Except room cooling requirement for patient comfort, as such there is no running costs. Once Source loaded, it comes for around 10 years. We have estimated in the department, that the actual cost is aroundRs 25,000/- per patient for 30 fractions. At the rate of 40-50 patients/day RT, initial machine cost, Source cost, and staff salaries for 10 number of different catagories could be easily managed. From collected revenues, budget for new cobalt source after 8-9 years could be planned.

Telecobalt machine: INR 6 Lakhs Per annum. Estimated Spares: INR 2 Lakhs Per annum.

## Running High Energy Linac

Linear accelerator, machine in OFF condition 2 KVA (Standby), 15 KVA during machine kept “on” during day time, and Mode up/Beam ON 42 KVA, power requirement. Battery Banks are supporting such requirements throughout the day; Diesel Generator support switching Over during ASEB supply issues, and this is mandatory.

42 KVA = 42KWatts = 42 KJoule/h. Mechanical Eq.of Heat = W=JH Value of J = 4.2 Joules/cal. 42 KiloJoules/h x(1/4.2) = 1 KiloCalorie/h = 1000 Calorie/h.
Because Air Density is 0.001293 gm/cm$^3$ heating of the ambient air is one of the important effect when the patient is treated.

Therefore, Linac develops lot of heating inside the room, and the whole structure is Cooled including the Accelerator Tube, Wave Guides and systems like Modulator, Pulse Forming Network capacitors, Thyratron valves etc. Minimum 6-8 Air Changes for total volume of air inside treatment room, and machine rooms; Chiller kept outside continuously dissipate heat during beam ON. Centralized Air Conditioning and other infrastructure makes approximately 8m x 8m x8m = 512 m$^3$ volume of air to be displaced for 8 times per hour is lot of load on the central Air conditioning System.

## Yearly Maintenance-True Beam Linac

(a) CMCCost of the High energy Linac (b)Maintainence of TPS and Onco Info system (c) On Board Imaging System, Maintenance (d) Peripheral Costs of Annual Maintenance Central AC, Chiller. Altogether INR 50-60 Lakhs.

## Discussion on Number of Patients in Linac Per Day

International and National guidelines indicate appointments for treatments @ 4-5 patients per hour normal plans, and about 3 patients/hour for treatments with Radiation Oncologist's supervision and image guidance special techniques. Therefore in 12 hours also they can treat only 60 patients/day. In most of the private centres, including CCHRC, total statistics per day exceed 90-100 per day. This clearly shows that there may be compromise on quality, and unnecessarily the procedures are hurried up. Morning QA and Warm up time, Pre RT Patient QA times also are included in total hours. This also highlights that radical special plans and simple plan patients are added in numbers. For reimbursement cost escalation, IMRT, VMAT special plans are executed for patients who does not deserve such special plans. When overloading of linac takes place, the risk increases for its break down, resulting in tool-down time introduced by lack of planning. Department become answerable to Admin, and also patient care suffers for deserving patients. If there is free slots available for patients, deserving special plans patients could be taken up for treatment immediately. There is a practice in radiation oncology departments to say that linacs will give more cure for the patients (because plans are more sophisticated, computer managed), and who really does not need linac treatments also get misled.

Optimising Resources and efficient use of telecobalt machines to the full capacity will justify the total emitted radiations (Curie Hours) of cobalt source. Post graduate centres for Radiation Oncology training should continue to impart knowledge on the use of cobalt RT efficiently helping more patient population. Radiation Oncology professionals should give final verdict whether Indian Atomic Energy authorities continue to produce high intensity cobalt sources (>200 RMM) and Indian Manufacturers of Cobalt machines shall continue further manufacture of more machines. There shall not be conflicts of interests that cobalt machines continue to stay, but seldom used in reality.

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## HELLO FOLKS

# THE SEEDS WE GROW: THE ENDURING LEGACY OF A LIFETIME IN SERVICE


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Fellow colleagues and readers of this article, As I look back on my time at the AIIMS, initially as a PhD student (1973–1976) and later as a faculty member (1988–2001), a wave of nostalgia sweeps through. Despite many challenges, we nurtured the field of diagnostic medical physics and earned WHO Collaborating Center status in Imaging Technology and Radiation Protection in 1997. We built a vibrant training hub, welcoming trainees from across the globe. This journey taught me that the true measure of a professional life is not just the visible harvest of achievements, but the seeds we plant,ideas, programs, and people that take root and flourish long after we move on. Across more than four decades at AIIMS, IAEA, MGH/Harvard, the International Organization for Medical Physics (IOMP), and the International Commission on Radiological Protection (ICRP), I have witnessed how these seeds, some carefully cultivated, others unexpectedly blossoming continue to grow, inspire, and make an impact across borders and generations. One of my greatest joys has been seeing the interventional cardiologists I trained in radiation protection now carrying that torch in their own countries. They are leading training programs, publishing on radiation doses and injuries, setting diagnostic reference levels (DRLs), and ensuring that patient safety stays at the forefront.

### Creating Leaders and Building Capacity

One of my missions was to create leaders of tomorrow, those who could replace me and us. When I joined IAEA, we had a handful of experts that were used in IAEA training programs on medical radiation protection. I gave opportunity to about a hundred professionals and left behind dozens of experts who have not only been taken as experts in IAEA activities but many of them got appointed at the IAEA as staff. Many are at leadership position in their respective countries.

### Transforming Global Practice: The IAEA's RPOP and IOMP

It is pleasing to see that the RPOP (Radiation Protection of Patients) website that I created became a top resource in the field and has maintained that status all these years after I left the IAEA. RPOP is one of the nearly 100 Units in IAEA under 6 departments. Every department has 3-5 Divisions and then each Division has 3-5 Sections and each Section may have 3-5 Units. Yet RPOP website tops accesses over Departments, what to say of Divisions. Every single day, I used to see how many visits to RPOP website occurred yesterday and compare with visits to Divisions and departmental website with the hope to beat them some day. The Google search optimization that we did, and variety of actions undertaken brought us to where we are today. It provides a credible go to resource for all in the world.

When I compare number of publications on patient radiation doses in PubMed now from Asia, Africa etc., with those in the same region before 2005 when we initiated a series of projects through IAEA and set the ball rolling in many developing countries, it is nothing less than feel of a father seeing his children graduating with high scores and he patting his back smilingly. Likewise, the number radiologists and clinical colleagues who are now active in radiation protection versus those in 2001 when IAEA established RPOP Unit, is amazing. We in IAEA envisioned momentum among medical professionals in radiation protection and now you see large number of campaigns headed by radiologists starting with Image gently, Image Wisely, EuroSafe, Afrosafe, Asiasafe, Latinsafe, Arabsafe and several national campaigns. Of course, radiation incidents in 2008 acted as catalyst. For many years, the mailing list of the International Organization of

Medical Physics (IOMP) consisted of contact points of around 80 national member countries and that meant about 250-300 contacts. The communication we sent was hardly being forwarded to individual members in many countries. I decided to reach out to grassroots and thus started webinars in 2020 and that added to mailing list which now goes over 50,000. The award of CME credit through an independent Board that we created was very helpful. Also, I established International Medical Physics Week in 2020.

### Research and innovation at MGH and Harvard

At Massachusetts General Hospital and Harvard Medical School, I have valued the culture of clinically driven innovation. It has been a great pleasure working with inventor Eric Silver. I believe that the medical X-ray machines of future will all have the monochromatic X-rays source which will reduce patient doses substantially as compared to what we have now and improve image quality too. I hope to see this happen during my lifetime. The momentum we have created through large scale studies covering millions of patients from hundreds of hospitals on cumulative radiation doses will survive opposition and create safer imaging for millions of such patients who are receiving very high doses. We are in unprecedented era where professionals tend to believe that patient doses have been reduced substantially-they of course are, but at the same time they have been increased substantially for some individual exams which most professionals donot know. Our research on high cumulative doses despite use of justification and optimization in the best possible manner have provided impetus to deployment of innovative approaches and review of principles and recommendations on radiation protection.

### Shaping international standards: my journey with the ICRP

Being part of the ICRP, an honor I first received in 1997 has been one of the most meaningful chapters of my journey. Initially unaware of how ICRP functioned, I soon realized its profound global influence. I was humbled to be made chair of a Task Group at my very first meeting in Oxford, and it was especially satisfying to see the document I prepared in one year become Annals of ICRP Publication 87. This set a precedent for future contributions that resulted in further landmark publications (Annals of ICRP 102, 117, 129), which have remained among the top five bestsellers for years. I am deeply honored to have been made an Emeritus Member for life and further humbled that ICRP has established the ICRP Madan Rehani Award in my name — a source of pride and inspiration for Indian colleagues.

### A grateful reflection

Lastly, I wish to express my gratitude to the many co-workers and colleagues who shared in this journey. It is gratifying to see Professor Pratik Kumar now managing the Medical Physics Unit at AIIMS, and to witness the continuing vibrancy of the Northern Chapter of the AMPI. To the medical physics community in India and beyond: may your efforts grow strong and your contributions endure. Please know that I am always here, ready to lend a hand if you need it.

### Conclusion: the seeds continue to grow

As I reflect on this journey from AIIMS to shaping international practice through the IAEA, IOMP, MGH, and ICRP, IUPESM, I see clearly that the seeds we plant matter more than the titles we hold or the accolades we earn. These seeds, ideas, mentorship, programs, and unwavering commitment to patient safety have grown into a robust forest of global impact. My hope is that this forest will continue to thrive, offering shade and inspiration to those who come after. Let us all keep planting seeds, nurturing them with dedication and compassion, and trusting that they will bloom into a legacy that transcends our lifetimes.

## THREE CHEERS

**Dr Anoop Kumar Srivastava** has been promoted as Professor of Medical Physics, Department of Radiation Oncology, Dr Ram Manohar Lohia Institute of Medical Sciences, Lucknow in July 2025. Congrats!

## THREE CHEERS

**Dr Gopishankar N.**, Assoc. Professor, Radiation Oncology (Medical Physics) received First Prize on the eve of AIIMS Annual Research Day 2025 for the development of three medical devices which are, an apparatus for verification of radiosurgery by film dosimetry, 3D printed template for brachytherapy and 3D printed improved ion chamber insert for radiosurgery. He was also awarded the ICMR-DHR fellowship for two months at the Univ. of Minnesota, Minneapolis, USA on the topic "fluorescent immobilization mask for in-situ radiation dosimetry of head-neck RT by Cherenkov lights". Congrats!

## THREE CHEERS

**Dr. Bharath Pandu**, Sr Medical Physicist, Deptt. of Radiotherapy, Bangalore Baptist Hospital has been awarded Ph.D. degree by Karunya Institute of Technology and Sciences, Coimbatore in July 2025. The title of his thesis was **"Dosimetric investigation of plan quality in advanced radiotherapy techniques: Validation and feasibility in clinical implementation".** Congrats!!

## THREE CHEERS

**Prof. Arun Chougule**, Jaipur was appointed as Chairman, Vice Chancellor Selection Committee by Hon'ble Governor of Rajasthan and Chancellor of Rajasthan University of Health Sciences. He has also been awarded the prestigious IUPESM Fellowship by the International Union for Physical and Engineering Sciences in Medicine. Congratulations!!

## RESULT OF SHORT VIDEO CONTEST

Medical Physics Gazette organized a short video contest on the theme "Future of Medical Physics" in July 2025. The competition was open for Indian medical physicists. We received, in total, 13 entries. The top seven contestants with their average percentile score are below:

| | |
|---|---|
| **Ms. Jomol Thomas, Manipal** | **: 92.6** |
| **Ms. Geetanshu Mehta, Chandigarh** | **: 90.9** |
| **Mr. Deepak Mahor, Delhi** | **: 88.4** |
| **Dr. Challapalli Srinivas, Manipal** (Co-Creators: **Ms. Fathima Shada** and **Ms. Pooja MS**) | **: 88** |
| **Mr. Hisham Hameed, Kolhapur** | **: 81.7** |
| **Ms. Sindhuja Sakthi, Hyderabad** (Co-Creator: **Ms. S. Soundarya**) | **: 79.6** |
| **Mr. Saran Raj, Tirupati** | **: 77.9** |

Seven referees judged all entries anonymously on a scale of 100 for originality, focus, vision, presentation and duration. We express our gratitude to the following reviewers: **Dr Richa Sharma**, Faridabad; **Dr. Mohini Manav**, Meerut; **Dr. Nirmal K. Painuly**, Lucknow; **Mr. Avadhoot Sutar**, Mumbai; **Dr. Mary Joan**, Ludhiana; **Dr. V.S. Santosh**, Alappcezha; and **Dr. Mourougan S**, Puducherry.

**Ms. Jomol Thomas** receives **FIRST PRIZE** of Rs. 4000/- and **Ms. Geetanshu Mehta** claims **SECOND PRIZE** of Rs. 3000/- sponsored by **M/S Smart Medical Solutions**, Chennai.