SCMPCR

South Asia Centre for Medical Physics and Cancer Research

SCMPCR Newsletter

July 2019 | Volume 1, Issue 2

A Project of Alo-BT

MOTTO: Quality Education and Health Science for Patient Benefit

Inside this issue

Prof. Dr. Golam Abu Zakaria

Chairman's Message

"I am very happy that the South Asia Centre for Medical Physics and Cancer Research (SCMPCR) will publish the 2nd issue of its newsletter. I am convinced that the newsletter will mirror the current stand and future development of medical physics in the South Asian region. I thank the editors for the excellent team work and hope for a continous improvement of the newsletter covering all aspects of medical physics in future"

Editor's Note

Dear Readers,

One of the best ways of developing the skill of medical physics among the physicists and researchers in the South Asia region is by sharing the knowledge and experience with others. Apart from publishing own reports and event, the SCMPCR Newsletter provides you with an opportunity to sharing your findings, thoughts and ideas which would assist others to learn similar experiences. This second issue of this year takes you into the different reading environment where SCMPCR reports, medical physics activites in the South Asia region and few scientific articles are included.

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Hands-on Workshop on Commissioning of a Linear Accelerator: Basic and Advanced Treatment Techniques

The South Asia Centre for Medical Physics and Cancer Research (SCMPCR) is a non-profit global health organization that believes all cancer patients deserve access to the best treatment, care, and support. It is a forum for all cancer professionals of the South Asian countries to improve educational and professional cooperation. To increase the qualification of medical physicists, SCMPCR has arranged their 4th hands-on workshop entitled "Commissioning of a Linear Accelerator: Basic and Advanced Treatment Techniques" held on 7th to 9th March 2019 at SCMPCR training room and Square Hospital Ltd. The workshop was organized to develop theoretical knowledge and latest clinical experience of absolute and relative dosimetry of high energy photon and electron beams by the Smart Scan (Automated and guided beam commissioning).

There were 17 participants in this workshop and they were invited form South Asia region (Bangladesh, Nepal, Sri Lanka, India). The trainers participated in this workshop were, Ms. Chingyu Lee (Application specialist, IBA, Taiwan), Mr. Sakthichelvam Rajamanickam (Customer Service Specialist, IBA, India), Prof. Dr. Goalm Abu Zakaria (Chairman and Chief Medical Physicist, Gummersbach Hospital, University of Cologne, Germany) and Prof. Dr. Hasin Anupama Azhari (Chairman and Professor of the Dept. of Medical Physics and Biomedical Engineering, Gono Bishwabidyalay, Savar, Dhaka). The co-organizers are, Square Hospitals Ltd, Gono Bishwabidyalay (University), Bangladesh Cancer Society and Bangladesh Society of Radiation Oncologist. The workshop was accredited by the European Board for Accreditation in Medical Physics (EBAMP) as a CPD program.

The Workshop started on 7th March 2019 with the welcome speech by Prof. Zakaria, Ms. Lee, Mr. Rajamanickam, Prof. Azhari and Mr. Sam Chen (Area Sales Manager, IBA Dosimetry) at SCMPCR training room. After this welcome session, the scientific session was conducted by Ms. Lee with the lecture on LINAC commissioning and continued by Prof. Zakaria with the lecture on absolute and relative dosimetry. After the lunch break at SCMPCR, the inaugural session for the training was arranged at Square Hospitals Ltd. The inaugural session was interactive and well organized. After the inaugural session, the scientific session was resumed by Ms. Lee with the new lecture to introduce the Smart Scan. The practical session of Absolute dosimetry of photon and electron beam with Smart Scan was conducted by Ms. Lee and Mr. Rajamanickam. Day 1 closed with that hands-on practical session at Square Hospital.

Whole day 2 of the workshop was allocated only for the practical sessions at Square Hospital on relative dosimetry of photon beam with Smart Scan (Setup, Scanning, Pitfalls), input the commissioning data into the treatment planning system and relative dosimetry of electron beam with the Smart Scan (Setup, Scanning, Pitfalls) conducted by Ms. Lee, Mr. Rajamanickam

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The inaugural ceremony of SCMPCR workshop.

Trainee and trainers participated in the workshop.

Hands-on session on absolute dosimetry of photon and electron beam with smart scan.

Continued from page 1

The inaugural ceremony of SCMPCR workshop.

Trainee participated in the final exam.

Crest distribution to the trainers.

Ceritificate distribution to the trainees.

and Mr. Chen. To make the practical session more informative the participants were divided into two groups. Besides, a QA discussion session was arranged for both groups for the practical training query. After the practical session participants, trainers, SCMPCR staffs and SCMPCR members were enjoyed Bangladeshi food (Gala Dinner) at KPR Restaurant in Dhaka.

Day 3 started with the lecture of "Overview of advanced treatment techniques" by Prof. Zakaria at SCMPCR training room. Moreover, the workshop facilitated an open question and answer session which gave participants the opportunity to ask a question to the trainers about commissioning a Linac with the Smart Scan and each trainer shared their views and experiences with the participants. An examination and feedback of the participants were taken by SCMPCR examination committee as per the guideline of EBAMP. At the closing ceremony of the workshop, certificates were distributed to the participants, travel awards were announced and mementos were given to the trainers by Prof. Zakaria for their dedicated services to make the workshop successful.

At the end, all the foreign participants have visited the Department of Medical Physics and Biomedical Engineering, Gono Bishwabidyalay after the closing ceremony of the workshop. Besides, a short tour was arranged by SCMPCR for all of the foreign participants of the workshop. It was an excellent Hands-on workshop and all the participants have expressed their gratitude to SCMPCR for arranging this type of training. They have also expressed their interest in attending similar hands-on workshop carried by SCMPCR in the near future. Finally, they have stated that their skill was improved by attending the workshop and it will help them to carry out their work on return, which was the ultimate goal of this event.

Feedback From the Trainee

I am very grateful to the organizing committee of SCMPCR to give me this opportunity to attend the international workshop as delegate. The workshop was organized very well. Not only theoretical part but also practical demonstration on commissioning of linear accelerator and small field dosimetry helped me a lot to improve my current knowledge. The faculties were excellent. And the local hospitality was great. Once again thanks to the organizing committee to organize such a great successful workshop. Wish you all the best. And looking forward for the invitation to fourth coming events.

Samar Mandal
Medical Physicist
Tata Medical Center, Kolkata
India

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Feedback From the Trainer

Gabrielle Ching-Yu Lee
Application Specialist, Asia
IBA Dosimetry

IBA Dosimetry was much honored to support the very first hands-on workshop with SCMPCR in Dhaka, Bangladesh during the 7th-9th March 2019. We felt the great passion from the SCMPCR in improving the medical physics education for medical physicists and other cancer-related personals in South Asia.

More than 30 medical physicists from six South Asia Countries attended this workshop. The hands-on experience with IBA revolutionary solution of relative dosimetry - SMARTSCAN® received great feedbacks. The intuitive and user-friendly interface allows participants to set up scanning queue easily and efficiently. Users found the commissioning process with SMARTSCAN® was highly efficient with its automation features; the full guidance and real-time data-monitoring functions along the procedure assure the highest quality of their measurement with the minimum time consumed. All participants stated that they have good confidence and understanding of relative dosimetry measurements after the workshop, even for whom at a basic or intermediate familiarity with Commissioning a LINAC or annual QA.

We felt positive about the workshop outcome and were enthusiastic about future collaboration. Thanks to all who support and participate in accomplished this workshop. Hope this really helps our Asian physicists to develop themselves and serve South Asia people under the field of radiation safety and quality of cancer patient treatment.

Celebration of World Cancer Day 2019

World cancer day takes place every year on February 4 around the world to save millions of preventable deaths by raising awareness & education about cancer and convince the governments & individuals to take action against the cancer disease. World Cancer Day 2019 highlighted the need for urgent action to increase early stage cancer detection, screening, and diagnosis. SCMPCR organizes training, awareness, screening and self-group programs in a regular interval since 2018. On world cancer day 2019, SCMPCR have organized an awareness campaign and a free breast cancer screening program that arranged at the Jahangirnagar University School and College, Dhaka in cooperation with Bangladesh Public Health Forum and the Department of Public Health and Informatics of the Jahangirnagar University.

A lecture on "Early detection of breast cancer" and a rally (left) were arranged by the SCMPCR. After these awareness activities, the breast cancer screening was conducted by a doctor and a nurse. A free health check-up of breast cancer and initial consultation were offered for all the 200 participants (top).

Report of Global Health Catalyst Summit

Md. Jobairul Islam, Rashed Al Amin, Golam Abu Zakaria

South Asia Center for Medical Physics and Cancer Research, Dhaka, Bangladesh

The Global Health Catalyst (GHC) summit is a premier yearly event at Harvard with satellite conferences in Europe and Africa dedicated to catalyzing high impact international collaborations and initiatives to eliminate global health disparities, with main focus on cancer and other non-communicable diseases.

Since 2015, the yearly summits are part of a series of high impact initiatives of the Harvard Global Health Catalyst funded by the Brigham and Women's Hospital, Dana-Farber Cancer Institute, and seed-funding from the Radcliffe Institute for Advanced Studies at Harvard University and recently a growing number of partner Institutions, including, industry, funding agencies and diaspora organizations dedicated to global health and development.

This year Global Health Catalyst Summit was organized by Harvard Medical School, Boston, USA. The participants have come from all over the world. Harvard Global Health Catalyst (2019) invited three participants from South Asia Centre for Medical Physics and Cancer Research (SCMPCR). Prof. Dr. Golam Abu Zakaria (Chairman of SCMPCR), Mr. Rashed Al Amin (Coordinator of SCMPCR), Mr. Jobairul Islam (Communication officer of SCMPCR) attened in the 2019 Harvard Global Health Catalyst. The participants discussed about the collaboration of SCMPCR and GHC, and both parties agreed to make the collaboration of SCMPCR and GHC. The summit was well organized, and the participants were learned a lot from the summit. The description of the 2019 Harvard Global Health Catalyst summit programs is summarized below.

Day 1 started with a welcome and opening addresses. Dr. Wilfred Ngwa (Director, Harvard Global Health Catalyst), Dr. Daphne Haas Kogan (Professor and Chair, Brigham and Women's Hospital, Dana-Farber Cancer Institute, Harvard Medical School) and Dr. Laurie Glimcher (President, Dana-Farber Cancer Institute) discussed about the past and present status and future plan of the Harvard Global Health Catalyst. This session was held great promise with distinctive sessions like Sports and Mental Health, Religion & Global Health, and Dissemination & Research Training.

Global Health Catalyst Summit organizers with the ambassadors.

Session 1 consisted of closing the Cancer Divide: Educational Session. This session address the message from the President of Union for International Cancer Control UICC, Influence of medical journals on global cancer control, African Cancer Coalition: a collaboration to harmonize cancer treatment guidelines for Sub-Saharan Africa, Addressing global cancer disparities through team science and global strategies in cancer control: from data to implementation.

Session 2 was for Government leaders session (How government leaders can support global health/development) where the ambassadors presented the African cancer statistics and work plan.

Session 3 represented increasing access to quality cancer treatment. This session consisted of examples of Scientific approaches and collaborations, clinical trial using immunotherapy to boost the abscopal effect and repurposed drugs to increase access to treatment, Nigeria- Ondo State project, The African Access Initiative (AAI): Building capacity and driving access for prioritized cancer medicines, Bangladesh and South Asia: Results of medical physics training. Day 1 closed with Welcome/Awards dinner at Yawkey Dining Pavilion.

Presentation of Prof. Dr. Golam Abu Zakaria at GHC Summit.

Day 2 started with the Global Radiation Oncology scientific session. This session-consisted of intraoperative radiotherapy for

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glioblastoma, radiation planning assistant – fully automated radiotherapy planning for clinics with limited resources, hypofractionated radiotherapy for prostate cancer: the best option for global health and low-cost technology for image-guided photodynamic therapy treatment of oral cancer in resource-limited settings.

Session 2 represented global surgery, global clinical oncology and religion and global health scientific session. This session consisted of standardizing geriatric surgery in challenged regions, perspective on surgical oncology care in Rwanda, PredictCARE: personalized complication risk prediction tool, association of the A313G polymorphism in the GSTP1 gene with leucopenia in breast cancer patients during the cyclophosphamide and doxorubicin combined, coordinating faith-based care among under-served communities, Neo-Spirituals on the battlefield of the mind: protest songs as catalysts for the restoration of mental health and healing for African communities and religion's role in the treatment of chronic pain.

Session 3 consisted of a collaboration session: Artificial Intelligence and Global Health: The world's premier comprehensive cancer centre in the cloud (C4) and the editor speech from different publications.

Session 4 represented global radiology and cancer prevention scientific session. This session further consisted of conventional nuclear medicine procedures and positron emission tomography in staging and diagnosis of patients with malignant diseases in the Republic of North Macedonia, The landscape of diagnostic radiology in the LMIC, virtual education and E-learning solutions in global radiology, approach and methods of prevention and control of cervical cancer screening in North Macedonia and prevention and treatment of cervical cancer in Cameroon.

Day 2 closed with collaboration networking dinner and advocacy evening at Yawkey Dining Pavilion.

Day 3 started with the phytomedicines, and medical cannabis versus opioids session and young ambassadors session. This session consisted of evidence-base medical cannabis and other phytomedicines and Honorable Audley Shaw.

Global Health Catalyst Summit young ambassadors.

Participants of Summit with Bangladeshi participants.

Session 2 and Session 3 represented the oral presentation across different disciplines. A huge number of participants (Medical Physicists, Radiation Oncologist, Researcher, Academic, Company representative) joined from all over the world. In parallel with this session, poster session takes place at Yawkey Dining Pavilion. During the summit, there was beside collaboration meetings to start new collaborations involving global health stake holders, government leaders, industry, religious leaders, diaspora business leaders, and others.

Day 3 closeed after announcement of new collaborations and awards for new collaborations by Dr. Wilfred Ngwa.

Electronic Brachytherapy

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Brachytherapy (BT) is a form of radiotherapy treatment which involves use of sealed radioactive sources that delivers a high dose of radiation inside or very close to the cancer tissues. It is extensively used in the treatment of brain, eye, base of tongue, floor of mouth, tongue, oropharynx, lip, nasopharynx, trachea, esophagus, breast, cervix, endometrium, prostate, rectum, skin, sarcoma and many other treatment sites. Brachytherapy can be used alone or in conjunction with conventional external beam radiotherapy. Based on the type of sources, brachytherapy can be classified as radionuclide and Electronic Brachytherapy (eBT).

Electronic Brachytherapy (eBT), also called contact radiotherapy, is a cancer treatment technique using low energy X-Rays (50 keV) generated by X-Ray tubes which are placed in close contact with the treated lesions These devices utilize a miniaturized X-ray source to deliver radiation at relatively high dose rates to the target volume. eBT eliminates some of the accidents related to radionuclide brachytherapy such as loss of sources, radiation leakage in off state, transportation accidents and radioactive waste. It finds wide applications in the treatment of cancers including skin, breast, endometrium, cervix and spinal metastasis. Beside its medical benefit, the potential major advantages of treatment by eBT are the drastic decrease in patient discomfort and treatment cost. eBT is a promising technology of the future and could potentially replace radionuclide brachytherapy. In the current situation, there are six types of electronics brachytherapy machines available in the market. They are Intrabeam (Zeiss), Xoft (iCAD), Papillon (Ariane), PhotoelectricTherapy (Xstrahl), Esteya (Elekta) and SRT100 (Sensus Healthcare).

The INTRABEAM system, provided by Carl Zeiss Surgical (Oberkochen, Germany), consists of the user terminal (the graphic interface between user and control console); the control console, which controls the XRS(x-ray source)4; quality assurance (QA) equipment; and the XRS4.

Additionally, a support stand and different spherical applicators are commercially available for partial breast treatment. The XRS 4 itself consists of an electron gun, which emits electrons; the accelerating unit, which accelerates the electrons to a maximum of 50 kV; and two pairs of bending magnets, which guide the electron beam through a 10-cm-long field-free drift tube (probe) to the gold target, where bremsstrahlung is generated . To check the delivered dose to the patient, the XRS 4 also includes an internal radiation monitor (IRM) that counts the backscattered photons. During the QA procedure, which has to be performed before every treatment, the IRM rate of the source (the number of counts per second with a straight probe) is cross-checked with a calibrated ion chamber. During patient treatment, this IRM rate is checked as well. If there is a small difference (less than ± 10%) between the value determined during QA and the value determined during patient treatment (caused, for example, by a bended "probe"), the precalculated treatment time is corrected online to ensure the correct treatment dose.

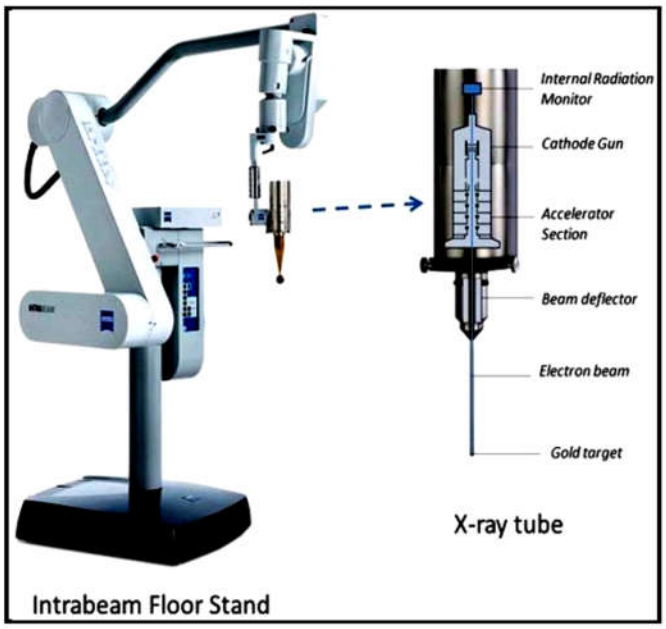

Figure1: The intrabeam system

The Xoft® Axxent® system (iCADInac., Nashua, New Hamphire, USA) is a miniature XRay tube integrated with a cooling sheath into a multi-lumen catheter, first released in 2006. The position of the source may be stepped along the length of the catheter, as for a high dose rate (HDR) radioactive source. Unlike the INTRABEAM® system, Xoft® sources have a limited lifetime of about 3 hours or 10 treatments. However, the dose rate is higher and the depth dose falls off less steeply. Source strength is verified using an internal well chamber before each treatment. Balloon catheters are used to treat early stage breast cancer with IORT. Dose distributions are similar to the MammoSite® balloon catheter (Cytec Industries Inc., Mountain View, California, USA) used with iridium-192 (^{192}Ir) HDR sources. Multiple studies have described the dosimetric characteristics for different applicators.

The Esteya® eBT system (Elekta AB-Nucletron, Stockholm, Sweden) is a mobile collimated miniature X-Ray source released in late 2013 and designed specifically for treatment of skin lesions. Surface applicators with a flattening filter are used to give a dose distribution similar to the Valencia ^{192}Ir HDR applicator, produced by the same manufacturer. The tube current is varied to give an approximately constant treatment time. The dosimetry of the unit has been described by Garcia-Martinez et al. They found that the flatness and symmetry of the system were within 5 %, along with a sharper penumbra and shallower depth dose than the Valencia or Leipzig HDR applicators (Elekta AB-Nucletron).

Photoelectric therapy (Xstrahl Ltd, Camberley, UK) is a new product launched in late 2014, also aimed at treating skin lesions. This system is a compact ultra light mobile unit with built-in cooling, easy-to-shape collimation and flattening filters to give a

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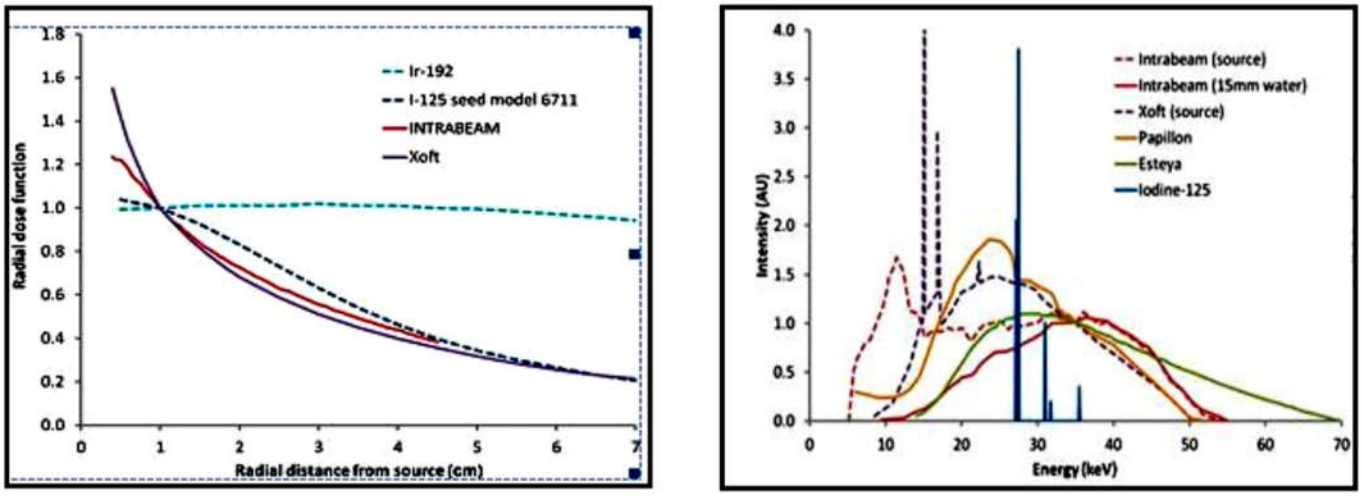

Figure 2: (Left) photon energy spectra of different eBT devices normalized to the value at 35 keV(except for iodine-125). (Right) Radial dose functions normalized to the value at 1 cm distance. Data collected from different sources and presented in the review article of D.J Eaton.

uniform dose profile. Finally, the SRT-100™ (Sensus Healthcare, Boca Raton, Florida, USA) is another mobile collimated low-kilovoltage unit specifically aimed at treating skin lesions, but with focus-to-skin distance (FSD) and field sizes comparable to a standard kilovoltage therapy unit, such as the Xstrahl 100 or 150 series. This device is an example of the overlap between conventional superficial units and eBT devices.

eBT is currently used to treat cancers of breast, skin, keloids, spinal metastasis, GI, endometrium, cervix, and rectum. Some of the existing eBT systems such as Esteya and Photoelectric Therapy are limited to small skin cancers due to their specific design. The papillon+, intrabeam, Xoft and SRT-100 eBT systems are also used in the treatment of skin cancers. Most of these systems use a small flattening filter to flatten the beam for the treatment of skin cancers. Most of these systems use a small flattening filter to flatten the beam for the treatment of skin cancers.

Several studies have demonstrated that these systems result in lower toxicity provide excellent cosmesis and easy to use. The ever-growing technological advancements have led to the development of a miniaturized X-ray tube and this has been explored for various treatment sites. eBT is a promising technology that has more potential to replace the existing radionuclide-based brachytherapy procedures. One of the limiting factors that impede the use of eBT for interstitial application is the source dimension. However, it is highly anticipated that the design of miniaturized X-ray tube closer to the dimension of an Ir-192 wire is not too far away, and the new era of electronic eBT has just begun.

Design and Fabrication of Human Bone (Pelvis) by using 3D Printer

by Rana Mitra

Three-dimensional (3D) printing is an additive manufacturing technique, which allows the fabrication of patient-specific scaffolds with high structural complexity and design flexibility, and gains growing attention. Human bone is very essential for medical study and research. However, human bone preservation is a complex and costly process and the preserved bone erosive with time. The Department of Medical Physics and Biomedical Engineering, Gono Bishwabidyalay, Dhaka has designed and fabricated human bone (Pelvis) by Poly lactic acid (PLA) material with same geometry and anatomical structure by 3D printer. The anatomical structure and geometry of Pelvis has been collected from CT data. The bone was designed by AutoCAD 3D by using CT data. After comparing designed bone with original bone, designed bone is converted to Stereo-lithographic file by a slicing software (breaks the model surface in slices) and then fabricated by a 3D printer. However, the fabricated bone is exactly similar to the real bone with same anatomical structure and geometry. 3D printed human bones is cheap, long lasting and environmentally safe. This 3D printed bone enhances the medical study and research by its degrading behaviour.

Figure : Fabricated Bone.

Feasibility of Tc-99m as a Targeted Tumour Therapeutic Agent

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Targeted tumor-therapy is a special type of radiotherapy technique that uses drug labeled radioactive isotopes which decay ionizing particle to eradicate or kill cancerous cell. A high dose of radiation is delivered to cancerous cells under a well-controlled process to bring heavy damages while sparing normal cells. Growth and replication of cancerous cells are faster than that of normal cells. When such rapidly growing cells are exposed to radiation, it makes small breaks are in the helical structure of DNA inside the cells and keeps them from further growing, dividing and eventually terminates their function.

Targeted tumor therapy was originally developed using the advantage of energetic electrons from emitting isotopes[1]. Commonly used particle emitting radioisotopes are I-131, P-32 and Sr-89. However, it has been found that when treating micro-metastases, deposition doses of particles were less effective as the higher energetic particles can easily spread out exceeding the regions of micro-metastases and bring damages the normal healthy cells in the neighborhood[2]. Henceforth, particles with short energy delivering ranges and higher energy deposition can be identified as an alternative for the therapy of small-size cancers.

Auger electrons are emitted either by electronic capture or internal conversion from the well-known radionuclides such as Ga-67, Tc-99m, In-111, I-123, I-125 and Tl-201[3]. For many years, the significance of Auger electrons was left unnoticed as the energy carried away by them is negligible when compared to the total energy released during the decay of a radionuclide. Biological consequences of auger emitters have been studied over the past few years and it has been identified that Auger emitters have a potential for utilizing in diagnosis and in therapy[4,5,6]. It was also reported that the cell killing effect of particle of H-3 decay and Auger electron of I-125 decay is almost identical. Moreover, the decay of I-125 is about 10 times more effective than that of H-3 at a level of 37% survival. Extreme short ranges in matter (nanometers to a few micrometers), intermediate linear-energy-transfer (LET), and higher radio-toxicity are some of the significant properties that enable Auger electron emitting radionuclides to be used as therapy agents.

Figure 1 shows the tumor tissue penetration ranges of internal radiotherapy for auger electrons (0.1-2keV, <1μm), α (5-8MeV, 50-80μm range) and β (0.1-2.2MeV, 1-10mm range) radiation emitters. β particles have large ranges than some cell diameters in a tissue which leads to under irradiate the targeted tumour cells. In addition it brings a significant damage to healthy cells[2]. Figure 2 illustrates the interactions of ionizing radiations on the scale of DNA. Auger-emitter triggers cluster of ionization events than α and β. As a solution for this limitation in β particle-based radiotherapy, Auger electrons are proposed as they possess the ability to deposit a higher energy within few hundred nanometer ranges in tissues[1].

Tc-99m is being widely used as an imaging agent for various applications. Recently it is also considered for therapeutic applications in micro-meta states. Tc-99m is identified as a low-energy Auger electron emitter and it possess all the favorable characteristics of a therapeutic agent such as short half-life, stable

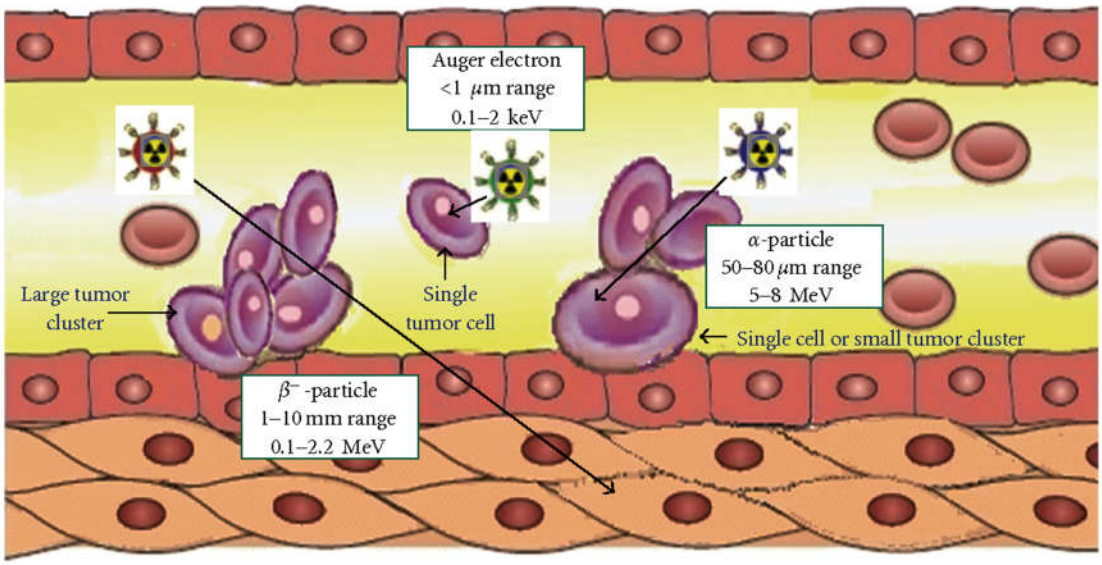

Figure 1: Interactions of ionizing radiations on the scale of DNA.(Courtesy of Thomas Tunningley,ANU)

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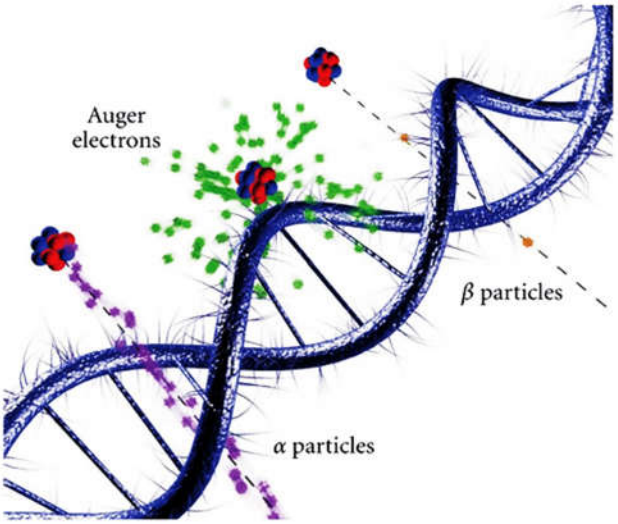

Figure 2: Tumor tissue of penetration range of auger electron, and radiation (Milenic et al 2004).

nuclide daughter, good availability, low energy electrons from 0.9keV to 1.5keV with very short range, ability to handle from an in situ generator with high specific activity, ability to be used in imaging which helps for therapy monitoring & disease follow-up and economic viability[3].

Tc-99m decays mainly by emitting gamma rays with a probability of 88%. The remaining 12% of Tc-99m decays occurs via the internal conversion which results in the ejection of high-speed internal conversion electrons. The vacancies created in internal orbit by the emission of the internal conversion create either characteristic x-ray photons or Auger electrons. The efficiency of radiotherapy for micro metastases is greatly increased by the low energy electrons emitted in the Tc-99m decay process. Tc-99m can be tagged or attached to a variety of pharmaceutical agents so that it can be used for the treatment of various parts of the human body.

The best range of electron energy for absorption in the cell is 9 to 22 keV which is the energy range of Auger electron. Tc-99m Auger electron dose is far greater than that of the internal conversion[1]. It shows the importance of dosimetry calculation of diagnostic Auger electron-emitting radioisotope, Tc-99m in a cellular scale and their applicability in treatment. In the study that we conducted to assess the feasibility of Tc-99m in radiotherapy, it was found that emission spectrum of Tc-99m contains higher number of internal conversion electrons which is significantly low in I-131 decay. Dose deposition of Tc-99m was concentrated vicinity of the isotope with a short range in the nucleus. Average energy depositions per decay per unit volume for Tc-99m inside the cell are 125% more than that of I-131. Consequently Tc-99m can be used as a potential candidate as a targeted tumour therapeutic agent in treating micro metastases with high radio toxicity while sparing normal tissue.

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An Overview of Recent Development of Radiotherapy Services in Nepal

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Nepal has progressed significantly in the field of radiotherapy services in last few years. Some hospitals and cancer centers have been able to introduce state of art technologies in external beam radiotherapy and brachytherapy. There was a large stagnancy in adapting new technologies and treatment techniques. However, hospitals from both public and private sectors put their best efforts to adapt modern technologies in radiotherapy. A brief overview of development of radiotherapy services in Nepal has been presented hereafter.

Nepal Cancer Hospital and Research Center (NCHRC)

A comprehensive cancer hospital is located in Lalitpur district. NCHRC brought TrueBeam (a medical linear accelerator) in clinical operation in 2016. The machine is further equipped with Eclipse Treatment Planning System, ARIA treatment and verification system etc. Since then, it is providing multiple treatment options in external beam radiotherapy. This includes Stereotactic Body Radiotherapy (SBRT), Stereotatic Radiosurgery (SRS), RapidArc, Image Guided Radiotherapy (IGRT), Intensity Modulated Radiotherapy (IMRT), including traditional 3 Dimensional Conventional Radiotherapy (3DCRT) and electron therapy. In addition, NCHRC has GammaMedplus iX afterloader for HDR Brachytherapy. NCHRC provides curative HDR Brachytherapy services for gyanecological malignancies with using central vagina and intracavitary applicators. At NCHRC, surface brachytherapy is being performed on regular basis. Seven clinicians, three medical physicists, six technologist and four onconurses are working at the department.

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B. P. Koirala Memorial Cancer Hospital (BPKMCH)

The first national cancer center of its kind is located in Chitwan district. It has Telecobalt Elite 100 machine, Clinac 600 C/D and recently in the year 2018, Clinac 2300 C/D with Millienum 120 MLC for IMRT treatment delivery has added. And the center is equipped with Ximatron simulator, Eclipse TPS and ARIA record and Verification system. It is one of the centers in Nepal serving majority of the cancer patients in the country. The center also has Varisource HDR Brachytherapy.

Kathmandu Cancer Center (KCC)

It is located in Bhaktapur district, provides radiotherapy services with its modern linear accelerator (Elekta Synergy Platform) from Elekta, since 2016. It is a dual energy machine (4X, 6X and 15X photon energies & 4e, 6e, 8e, 10e, 12e and 15e electron energies) The synergy platform unit has MLCi2 (40 pairs, 1 cm leaf width; 40x40 cm^2 maximum field size. The machine is capable of performing modern treatment techniques like 3DCRT, IMRT, VMAT, TBI and DIBH. It is equipped with latest and sophisticated Monaco version 5.11 Treatment Planning system, one brachyvision system and 2 mim softwares for countering and plan evalutation. The center also has 16- slice CT Simulator from Tosiba, which is used for 3D CT simulation. Recently, KCC started HDR brachytherapy with machine from Varian Medical System. The machine was donated by Radiating Hope Group. In terms of radiotherapy staffing, 8 radiation oncologists, one radiologist, 4 physicists, five radiation technologists and 3 other supporting staffs are curently working there.

Bhaktapur Cancer Hospital (BCH)

It is a 150 bedded comprehensive cancer hospital run by Nepal Cancer Relief Society which is located in Bhaktapur district, has been treating 100 patients a day with Co-60 machine from Cirus company since 1999. It also has 6-channel Nucletron brachy with Ir-192 source, which treats five patients daily. Moreover, dual energy (photon 6MV and 15MV, electron 6, 9, 12 and 15 MeV) Clinac-iX with millineium 120 mlc and portal imaging, which is capable of IMRT dose delivery and verification is being installed at the hospital. The center is equipped with Eclipse 15.6 and Oncentra TPS and ARIA record and verification system. It will be brought in clinical operation by first week of August, 2019. Currently, three physicists are working at the hospital, and there is diversity of qualification and training of these physicists.

Nepalese Academy of Medical Sciences (NAMS)

It is located in Kathmandu, will soon install Radixact tomotherapy machine for conformal and IMRT radiotherapy of cancer patients. Previously it had Telecobalt T780C, which provided radiotherapy services for almost two decades. It is now decommissioned. NAMS also has microselectron HDR Brachytherapy with Oncentra TPS.

B &C teaching hospital

It provides multidisciplinary health services and is located in Jhapa district, will install Truebeam machine and HDR Brachytherapy this year. With its clinical operating cancer patients from eastern part of Nepal will get easy access for radiotherapy services.

Sushil Koirala Cancer Hospital

It is located in Nepalgunj is in the process of purchasing Brachytherapy and External Beam radiotherapy machines anytime soon.

Manipal Teaching Hospital

It is located in Pokhara, with Siemens Primus Linac equipped with a simulator provided radiotherapy services for almost a decade, however, radiotherapy services there is now halted.

Om Hospital and Research Center

It is located in Kathmandu, was providing HDR Brachytherapy services with Varian GammaMed machine with Ir- 192 source for almost half a decade, which is now stopped.

Summary

As the number of radiotherapy centers is increasing, the demand of professionals is also increased. Therefore, there is growing need for better knowledge and skills in the field for each level of staffs working in radiotherapy department. In this regard, South Asia Center for Medical Physics and Cancer Research (SCMPCR) could be crucial for supporting and advancing the development of radiation oncology services in Nepal. Moreover, there shall be clear guidelines from government authority for operation of radiotherapy services. In addition, the geographical distribution of these centers in not even, and mostly concentrated in Kathmandu valley. So there is difficulty in getting radiotherapy services for patients coming from far off from these centers. Radiotherapy centers shall be extended to other parts of the country.

The first National Workshop on Radiological Sciences

Ramalka Kasige, Mahesha Jayakody, J.Jeyasugiththan

Department of Nuclear Science, University of Colombo, Sri Lanka

Introducing a serious of workshops on Radiological Sciences is mainly aimed to support the Radiographers and Physicists worked at the radiology departments in both government and private hospitals to update their knowledge on current modern technology and procedures. This is also aimed to support the radiology community in Sri Lanka to achieve a better diagnostic imaging services to the local population by understanding the new concepts and implementing of standards of medical imaging. Moreover, this workshop helps the radiation worker to upgrade the skills on medical radiation risks aspect.

In such an endeavor, the first one-day national workshop on radiological sciences was successfully conducted by the Department of Nuclear Science of the University of Colombo on 2nd of March 2019 at the Thinnai hotel in Jaffna. A group of 60 participants including junior Radiologists, Radiographers, Physicist and Students were participated the event. This workshop was organized by the Department of Nuclear Science of the University of Colombo in collaboration with Education, Training and Research Unit, Ministry of Health, Nutrition and Indigenous Medicine and with the support of Medquipment Ltd.

The workshop was inaugurated by Dr Umashankar Muthukumarasamy Sharma, Deputy Regional Director of Health Service (RDHS), Jaffna and Dr K Vignarooban, Head, Department of Physics of University of Jaffna also graced the occasion. It was chaired by Dr. Manuja Lamabadusuriya, Head of the Department of Nuclear Science, Faculty of Science, University of Colombo and Coordinated by Dr. J. Jeyasugiththan, Senior Lecturer, Department of Nuclear Science, Faculty of Science, University of Colombo. Further he was served as organizing secretary and the founder of this series of workshop.

The workshop consisted of several sessions including a lecture series and a panel discussion. The session was initiated with an introductory lecture on radiation detection by former Associate Professor of University of Colombo Mrs Palee Mahawatte. It was then followed by a series of lectures on areas of radiological applications, its technological advancement in diagnostic purposes, role of radiology in cancer care and safe use of radiology by Dr. Janaka Wansapura, Sinior Lecturer of University of Colombo, Dr. Anton Jenil, Consultant Radiologist, District General Hospital Killinochchi, Dr. Chrishanthi Rajasooriyar, Consultant Clinical Oncologist, Teaching Hospital Jaffna, Ms. Jivendra Wickramasinghe, Lecturer, University of Colombo, Dr. J. Jeyasugiththan and Mr. S.Senthuran, General Manager of the Medquipment Ltd. There were continuing discussions in between the lectures. The participants took keen interest in discussions and understanding the practical implications of good practices as well as new technologies.

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The panel discussion was the fundamental segment in the workshop moderated by Dr Manuja Lamabadusuriya. It was an interactive discussion between the participants and the panelists as many interesting questions were brought up for discussion. Most of the questions were convergent on the safety of a radiation worker, calibrating instruments and the quality of imaging in x-rays and CT scans. The panel discussion concluded with the remarks made by the final panelist giving the session a solid ending. Many suggestions for the future workshops were brought up by the participants as well as the experts in the field who attended the workshop. As suggested future workshops would address the research gaps, future academic and research opportunities, career prospects, radiation safety and practical problems that arise in technological settings related to radiological sciences.

At the end of this event, each participant was awarded with a certificate to appreciate their presence at this remarkable occasion. Sometimes words or theories are not enough when it comes to radiation related issues. More or less creating awareness by providing expertise knowledge and practical solutions is one of the best ways to create a positive notion on this vivid subject area. The workshop aided the participants to develop a deeper understanding about radiological science and create new explorative and creative opportunities for many years beyond their career. The 2nd workshop will be arranged in Colombo by August 2020 decided by the organizing committee.

The Warrior Momma

By Julie Chessell

"Faith is the ability to see the invisible and believe in the incredible and this is what enables believers to receive what the masses think is impossible"
– Bob Proctor

From time to time as women, as a family, as a society, we look back and wonder what me may have missed. It is only then that we reflect on how we could have been so blind. If we had payed attention to the signs, if we didn't ignore what the universe was spelling out before our eyes, if we weren't so inclined to put ourselves at the bottom of priorities that encompass everyone else but ourselves. What IF's is the catch all phrase we seem to relish in and then blame ourselves for the outcome.

Cancer is universal. We have all experienced it in some way, shape or form. Cancer does not discriminate it comes in all forms, to all ages, to all ethnicities and to all economic backgrounds.

People all around the world are faced with that gut-wrenching moment where you can either lay down and let this ugly monster succumb you or you can make the courageous decision to tear this beast down.

Unfortunately, not everyone has that opportunity. That is why we need to share our journey's, to share experience, to contribute research, to be that vehicle for change. Let us all be that voice, to allow every member of humanity to receive the very best medical care globally available.

Welcome to Warrior Momma, an international platform to entrust all commonalities of women around the world.

Founded by Julie Chessell, Award Winning Author, successful Entrepreneur, highly sought-after Motivational Speaker, blogger, passionate Advocate and Registered Nurse from Ontario Canada, in 2018 after my son was diagnosed with Hepatoblastoma and need for a lifesaving Liver Transplant.

As a mom of three beautiful boys, a wife and a self-proclaimed perfectionist...I have learned that we as women cannot and should not be defined by our setbacks.... we WILL though however be defined by our comebacks...because that is the sweetest victory.

The vision at Warrior Momma is to empower and champion all women, regardless of what life throws our way. Strong and resilient, a community of women brought together to encourage and facilitate all our dreams.

As we work towards a common goal, we become unified. We all must come together collectively to raise our levels of conscious awareness to achieve partnerships for global health. We are called to come together to pool our knowledge, our resources, our contacts and most importantly our hearts. That should be the star that we are shooting for. To become more effective as a collaborative mind, to become more mindful of how we can achieve this. So, let's all brainstorm. We shouldn't let conditions or circumstance dictate the future of mankind because all humans are created equally.

We can become the heroes in others' lives. We are called to step up and be brave. We are encouraged to be vulnerable in the harsh arena of life, from our own devastating experiences to heal others. We are all here to provide a greater service, and in doing that, we all grow, we all get ahead.

We can never truly appreciate the time we have until it is taken away from us, or at least the possibility of it. Your mindset is everything. Being that positive light will come back to you tenfold. Live each day as if it were your last. Brighten someone else's day, take chances, and do not fall into the trap of "someday" or live for tomorrow. We all know that tomorrow is not guaranteed, and that someday is too short to build a lifetime of memories on. Memories, love, life are all built on the foundation of focusing on your present moment and truly savoring those moments with your loved ones. Live your life to leave a mark in this world. Carve your legacy, your imprint, and ensure that it's one to remember. Slow down and breathe, don't miss the cues that are right in front of you because you are too busy to notice them or care. Time is precious. Never take it for granted. I'm so humbled and grateful I didn't.

SOUTH ASIA CENTRE FOR MEDICAL PHYSICS AND CANCER RESEARCH

SCMPCR

(A Project of Alo Bhubon Trust)

The main objectives of SCMPCR

To organize awareness, prevention, and screening program for cancer disease;

To provide adequate training to all personnel associated with cancer treatment;

To establish the clinical residency training program for medical physicists;

To develop the infrastructure of e-learning and library;

To establishment Welfare home for poor cancer patients;

To build a self-help group for cancer patients;

To establish a team who will assist in the management and quality control (QC) procedure for the diagnostic radiology equipment in the districts levels;

"SCMPCR was established in 3rd July 2018 is comprised of a group of philanthropic personnel with representatives from different regions of South Asia to work on different projects. SCMPCR is an autonomous body, under Alo Bhubon Trust (Alo -BT) and accountable to its board of trustees/governors. It is a non-profit public partnership which will seek support from other sources. It shall work conjointly with various nationals and international organizations. Major activities of SCMPCR are: to produce skilled manpower, enhance health education and establish a welfare home for cancer patients"

MISSION

TO Achieve UNDP SDG-goal 3 & 4

OUR VISION

TO PROVIDE QUALITY SERVICES IN CANCER TREATMENT THROUGH TRAINING, EDUCATION INCLUDING E- LEARNING IN RADIOTHERAPY AND IMAGING DISCIPLINES.

GOALS OF SCMPCR

Major activities of SCMPCR are to produce skilled manpower, enhance health education and establish a welfare home for cancer patients.

UNDP SDG-goal 3 (Good Health & Well-being)

Awareness program for the mass people for different communicable and non-communicable diseases, especially for cancer patients.

UNDP SDG-goal 4 (Quality Education)

Arranging and conducting training programs to develop skilled manpower. It realizes the need to educate specially; women regarding the screening and prevention of cancer treatment under UNDP SDG-goal 4.

SCMPCR

PROJECT of ALO BHUBON TRUST (Alo-BT)

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OUR MOTTO

QUALITY EDUCATION AND HEALTH SCIENCE FOR PATIENT BENEFIT