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"Every step start with a single step"

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Table Of Contents

Introduction

Activities

Collaboration Activities

Sharing from staff

Sharing from students

Research activities

Closing

Welcome message

Head of Medical Physics Profession

En. Nik Mohamad Hazmi Bin Haji Nik Hussein

Assalamualaikum wrt. wbt. and Best Wishes
Alhamdulillah, for the first time, I was able to express my greetings. Welcome to the Medical Physics Profession's inaugural bulletin.
First and foremost, I'd like to make a speech.
I'd like to thank Medical Physicists from Ministry of Health for entrusting me with the leadership of the Medical Physics profession. In addition, I'd like to thank the members of the "Medical Physics" Bulletin for their efforts to promote the Medical Physics profession in Malaysia's Ministry of Health through this bulletin's publishing.

Looking back on the history of Medical Physics and fighting for its survival and advancement at Malaysia's Ministry of Health. Insha'Allah, numerous events like conferences, lectures, family days, and others have been organized to foster professional networks while also enshrining the profession throughout this period, beginning with the sacred day. Such activities are crucial to the long-term viability of the profession. Following a ministerial meeting, it is developed at the national and international levels.

In recent years, I witnessed a significant increase of Medical Physicist who evolve themselves by pursuing their masters and Post Doctoral studies to upgrade themselves and to develop the medical physics profession in Malaysia. Kudos to them as our aim to make Malaysia as one of the established countries for medical physics professional in the South Asian region and international.

Finally, I'd like to take this chance to thank you once more. I should like to take this opportunity to express my appreciation to Dr. Prema Devi Chellayah for the enthusiasm and. assistance, she gave to the original initiative to lead this project. Thank you to the members of the Bulletin Committee Members and article writers who took part.

" BERGERAK UNTUK DIKENALI, TANPA GERAK TANDANYA MATI "

" TERUS ZAHIRKAN ILMU BAGI MEMERTABATKAN PENGETAHUAN FIZIK DIPESADA DUNIA "

Welcome message

Editor 1

Dr Prema Devi Chellayah

"Do what you can with what you have, where you are."

It is a pleasure to welcome you to the Ministry of Health's Medical Physics Bulletin's first issue. The Medical Physics Bulletin Task Force, Ministry of Health Malaysia, put significant efforts into this bulletin. Everyone who works as a medical physicist is quite busy completing their individual activities at their respective workplace. Nevertheless, our medical physicist agreed to contribute to the development and dissemination of medical physics bulletins in either the hospital, the State's Department of Health, or the Ministry of Health's Radiation Surveillance.

It is hoped that with this publication, anything disclosed in the form of a publication can be referred to by the medical physicists in the Ministry of Health and its communities in general.

In order to interact, update, collaborate, network, and communicate with one another, this bulletin was created. I want to express my gratitude to everyone who helped make these accomplishments possible in whatever manner.

In closing, I kindly ask all of our medical physicists, interns, colleagues, and lecturers to continue developing intra-agency cooperation. This communication would increase the public's and other medical staff members' awareness of the medical physics profession and its day-to-day activities.

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"Have no fear of perfection; you'll never reach it."
Marie Curie

Welcome message

Editor 2

Puan Mahzom binti Pahwanchek

Assalamualaikum and Salam Sejahtera.

It is a pleasure to welcome you to our first publication of the Medical Physics Bulletin. This bulletin provides information on the activities that have been done by medical physicists throughout Malaysia. The bulletin also contains articles written by students in the medical physics course. This Medical Physics bulletin was created with the intention of providing a space for us to connect, update, and communicate with each other. Last but not least, I want to thank the writers, which consists of staff and students, for their invaluable and incessant contributions to writing articles. Without you, our Medical Physics bulletin would have been quite thin. I also would like to thank everyone who has contributed in any way to this year's achievements.

"Opportunities don't happen. You create them."
Chris Crosser

Total Body Irradiation In Department Of Radiotherapy & Oncology, Sabah Women & Children Hospital

Total body irradiation (TBI) is an irradiation technique that allows the delivery of a homogenous radiation dose to the entire patient's body as part of the conditioning regimen for bone marrow transplantation (BMT) [1]. Three paediatric patients underwent TBI from 2019 to 2021 in the Department of Radiotherapy and Oncology, Sabah Women and Children Hospital (SWACH). Being the only centre that is capable of executing this technique in the region, adequate training and a standard operating procedure have been well established to maintain SWACH's readiness to carry out the technique.

We have chosen Varian Clinac iX as the main modality for the TBI. Technical parameters were fixed for irradiation, such as a standard 40 × 40 cm2 bilateral open field with a 6 MV photon beam, a 450 collimator angle, and a source-to-axis distance (SAD) of 438 cm. The linear accelerator (linac) was commissioned for TBI through the data collection of tissue maximum ratio (TMR), spoiler factor, output factor, and tray transmission factor in order to necessitate a manual dose calculation. All those variables were measured using a solid water phantom of various thicknesses, a Farmer-type ion chamber, an 8 mm thick Perspex screen that acts as a beam spoiler, and a set of IBA In-Vivo dosimetry diodes. As the aim of TBI is to distribute a homogenous dose to all parts of the patient's body, a variety of lead compensator thicknesses were utilised to manually modulate the beam intensity as the incident beam enters through an irregular surface of the patient's body, mainly the head, neck, chest, waist, and knee. To further enhance the intention, the beam spoiler was used to increase the dose in the build-up region.

Quality assurance (QA) was done intensively to ensure the safe and accurate use of radiation for the patient. The In-Vivo diodes are absolute necessities in the QA procedure to cross-check the absorbed dose during irradiation in real-time. It was said that a significant dose decrease towards the field edge will likely happen as a common flattening filter serves its purpose by flattening the field only through two principal planes [3]. Since the linac is used with the collimator rotated and the patient positioned on a diagonal axis of the beam, the beam flatness is an important aspect that needs to be taken into account for TBI technique. Hence, as part of the QA, beam flatness was measured at 438 cm SAD using a linear array of diodes attached to the beam spoiler with a gap of 10 cm each.

A semi-foetal patient positioning technique designed by Khan et al. was adapted because it provides the most comfort and suitability for paediatric patients [1]. By doing so, we face no issue in ensuring all of the patient's body is inside the beam, as the patient can lie comfortably with the back supported, both legs half-collapsed, and the arms crossed above the chest. The patient setup is recorded in terms of distances measured from the umbilicus by a pendulum attached to the ceiling to indicate the isocenter at the extended SAD. The room laser also helps to position the patient's sagittal axis at a right angle to the beam's central axis. By referring to the field light shadow at the regions of the head, neck, chest, waist, and knees, the lead sheet will be placed on the TBI tray mounted on the gantry to compensate for the dose at said regions. Before the irradiation could begin, the diodes were placed as an entrance dose measurement on the non-shadow regions to verify dose in real-time, thus enabling us to manually switch different lead compensator thicknesses.

As we progress towards a well-established centre for TBI technique, challenges seem inevitable. Equipped with only two linacs, we have to specially dedicate only one of them so that the usual treatment can be catered for. The TBI technique takes up to 30 minutes to an hour per session before any other treatment can resume. This results in a more packed treatment schedule during any week with TBI. Speaking on the technical aspect of TBI, patient positioning varies gradually towards the end of the treatment, resulting in a higher deviation of dose recorded by the diodes. This is normally due to the skin itchiness experienced by most of the patients throughout the session, which makes them unable to maintain a fixed position during irradiation. In addition, diode sensitivity calibration followed by leakage measurement shall be performed periodically every three months due to unstable output readings.

As the saying goes, "small steps can lead to big changes". This inspires us to make a little progress in delivering the TBI technique through a classic manual dose calculation. But not for long, as in the future, we are looking forward to implementing a more advanced delivery of TBI, such as intensity-modulated radiation therapy (IMRT) and volumetric arc therapy (VMAT).

By SWACH Physicists: Mr. Ronald bin Jerneh, Mr. Awangku Nazrin B. Mohd. Dain, Mrs. Nuridayu Bt. Mohd. Sapiee,Msk Nur Aini Suraya Bt Abdul Samad, Mr. Muhammad Amir Hamzah Bin Ibrahim, Ms. Siti Nor Aliffah Binti Mustaffa and Ms. Kimberly Nicola Jiun

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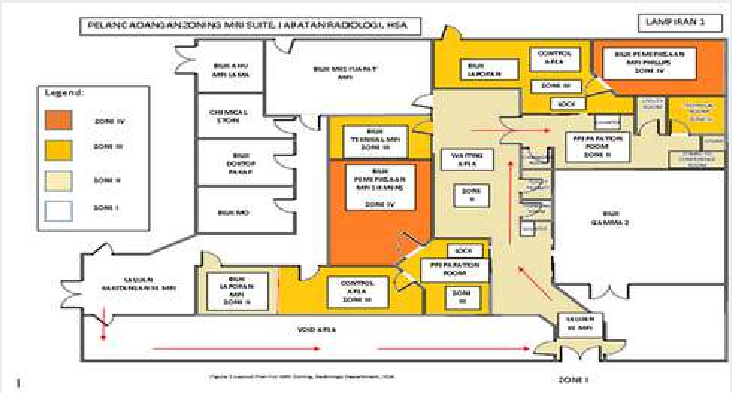
MRI Initiative Program In Hospital Sultanah Aminah, Johor Bahru

Hospital Sultanah Aminah had its first MRI installed at the end of the 1990s. It has been replaced twice since then. The 2nd and 3rd machines run simultaneously for about 8 months before the maintenance fee for the 2nd expires in December 2021. Having two machines and complying with MR safety requirements is a challenge when there are constraints in layout that affect the ideal workflow as well as the limitations of trained human resources. It’s been 20 years since the world's first fatal MRI incident in New York, which killed 6-year-old Michael Colombini when the oxygen tank pulled into the MRI bore, crushing his skull. In 2002, the American College of Radiology (ACR) published its first set of MRI guidelines as a response to the tragic event. Interest in the safety of MRI soared and has become the subject of research since. Delfino et al. reviewed reports of MR adverse events that occurred between January 1st, 2008, and December 31st, 2017, and observed more than 1,500 incidents, which include thermal, mechanical, projectile, and acoustic adverse events. In October 2021, a carbon copy of the Colombini accident occurred in South Korea, killing a 62-year-old man. It still occurs even after decades of effort to prevent this kind of event. Locally scarce data on MR safety-related incidents is available, and no Malaysian guideline or recommendation on MRI safety has been produced yet.

In 2019 and 2020, we had two unfortunate MR incidents: a thermal second-degree burn and a projectile infusion pump. In the later incident, the doctor in charge accidentally brought the infusion pump while giving sedation, which luckily did not hit the patient. The technician and staff managed to remove the infusion pump that was attached to the front part of the gantry without needing to quench the machine. Those near-miss incidents are what catalyse the MR Safety programme in our hospital.

Our new Head of Radiology Department at Hospital Sultanah Aminah, Dr. Norliza Othman, has initiated this MRI Safety Programme for Radiology Staff. The first meeting was held in April 2021 to set up the MRI Safety syllabus, plan the accreditation programme, and revise the SOP following the international standard. This programme was championed by Dr. Hazrini Abdullah and rolled out by the physicists and the MRI Safety Committee.

Under this initiative we have created MRI Safety Policy and MRI Safety Accreditation program for Radiology Department, HSAJB. The main component of MRI Safety Policy is about access control to the magnetic environment, screening patient, others and equipment. For access control we revised the zoning for MRI suite in Radiology Department following as suggested by the committee and advice from the state medical physicist. Zone I is the free access area for the patient and relative before entering MRI environment. Zone II typically, a patient waiting area, supervised by clinical staff, but readily accessible to public. Zone III is the restricted area to screened MRI patient and screened personnel only. Zone IV is the room containing MRI scanner only can be enter by direct supervision of trained MRI personnel and screened MRI patient.



The MRI Safety Checklist was also reviewed to ensure the safety of individuals and patients before entering the MRI Examination Room. Two different screening forms, one for patients and one for other individuals, were created. This checklist provides questions to identify potential problems relative to an MRI procedure or the MRI environment. Screening for other individuals is done using a Google Form, and every individual needs to be screened before he or she is allowed to enter Zone III and Zone IV. The implementation of appropriate policies and procedures to screen a patient for an MRI examination or an individual before permitting entry into an MRI environment is a vital aspect of a facility’s MRI safety programme and, if conducted properly, will prevent problems, accidents, and injuries.

There are three types of major magnetic fields in the MRI suite: static magnetic field, radiofrequency field, and gradient field, each with a potential safety risk. Potentially dangerous magnetic field interactions can occur when ferromagnetic materials are exposed to the static magnetic field. 3 The issues regarding the interaction between a device and the static magnetic field of an MR system include attraction, deflection, and torque. 3 The interaction with the static magnetic field can cause injuries to the patient or individual and/or MR facility personnel and physicians, as well as damage to the device. Interaction with the RF electromagnetic fields can result in heating of the device, its associated components (e.g., lead wires), and/or surrounding tissues (e.g., burns). 3 While not very common, thermal burns can occur, especially in patients who are sedated during the scan. 1 Tattoos and permanent cosmetics realised with iron oxide or other metal-based pigments can cause reactions or adverse events, including first- and second-degree local burns. 1 Gradient fields with rapid switching may cause peripheral nerve stimulation, implant heating, and noise greater than 100 dB. The noise produced during MRI scanning can cause hearing damage.


Figure 1: Common waiting area

A Pilot MRI Safety Accreditation programme was implemented this year, resulting in syllabuses for non-MRI Personnel and MRI Personnel. Non-MRI personnel in the Radiology Department must be trained at least Level 1 for MRI Safety Accreditation. MRI Personnel and medical officers must obtain Level 2 of training. However, for senior MRI Personnel, the Medical Director of MRI Safety, the MRI Safety Officer, MRI Safety Committee members, and radiologists, they must achieve level 3 of accreditation.

Video training material was sent via email to all the participants. The participant is divided to Level 1, Level 2 and Level 3. After participants have completed the syllabus, they need to send attendant form via goggle form as a proof of attendant. Subsequently, they need to go through the second part of the accreditation program ie. Attend simulation.

Figure 2: Entrance to 2nd MRI Machine Zone III

Figure 3: Entrance door to 3rd MRI Machine Zone III

For the simulation of MRI Safety, participants are divided into three groups. The simulation is done simultaneously with two facilitators for each group. The participant is given a scenario for each station and needs to role-play according to the situation given. Each group will rotate through all stations. All participants need to pass the simulation. If they fail in simulation, they need to repeat simulation again in another session. We are offering four days of simulation this year.

The last part of the accreditation programme is a quiz. Different set of MCQ questions for each level. Those who pass the quiz will get MRI Safety Accreditation certification according to the level attempted. This accreditation programme is a yearly one and will be reviewed next year for improvement, impact, and effectiveness.

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The First MyoSPECT Cardiac Imaging Apparatus installed in Asia and Penang Hospital

By
Dr Prema Devi Chellayah, Senior Medical Physicist, Department of Nuclear Medicine, Penang Hospital

The Nuclear Medicine Department in Penang Hospital, which is currently headed by Dr. Fadizlah Hamzah, is the second-oldest department in Malaysia after Hospital Kuala Lumpur. MyoSPECT for dedicated cardiac imaging was installed in this department last year, in December 2021, via a replacement true maintenance project by Edgenta Mediserve in collaboration with the Engineering Division, Ministry of Health Malaysia. This is the first MyoSPECT cardiac imaging system installed in Asia and Malaysia.

Figure 1: Test and Commisoning of MYOSPECT by Team Nuclear Medicine, Penang Hospital

Figure 2: MYOSPECT Gamma Camera in Asia and Penang Hospital

As the number of challenging cardiac patient cases grows in Malaysia, there's a real need for cardiac-specific imaging solutions. This is why our Nuclear Medicine team at Penang General Hospital aimed for MyoSPECTTM, a cardiac-dedicated SPECT that is designed and engineered from the inside out to accurately see the feature in every heartbeat. MyoSPECT combines an exclusive stationary detector complete with a CZT module design and delivers two attenuation compensation solutions. It also has automated motion correction on XelerisTM and absolute myocardial blood flow readings.

MyoSPECT was designed with the same focused attention to the heart that defines the entire practise of cardiology. With extended field-of-view processing and a more capable table that's also wider, it comfortably accommodates all patients, large and small, with a complete picture of their hearts.

The excellent energy and spatial resolution of our CZT detector technology are at the heart of every MyoSPECT image. CZT is also incredibly compact, which allowed us to pair it with a novel multi-pinhole collimator design, creating a tomographic imaging arc of the heart with motionless detectors, so every detector is focused on the heart simultaneously. Also, MyoSPECT ES3 comes with nine detectors, so we can choose the level of performance to meet the needs of our practise.

MyoSPECT includes SPECT Flow, which combines dynamic acquisition on MyoSPECT with CFR and absolute myocardial blood flow. MyoSPECT analyses blood flow with absolute clarity. External CT can be used for attenuation correction.

The one-day rest and stress protocol takes 3 minutes for a high-dose cardiac scan (the one-day protocol). Meanwhile, for a low dose (2-day protocol), rest takes 8 minutes and a stress scan takes 5 minutes. These procedures can be done in a shorter time compared to the conventional method using a SPECT gamma camera, which takes 30-35 minutes for both protocols. MyoSPECT imaging has reduced the time of scan for both the 1-day and 2-day protocols. This allowed our Nuclear Medicine team to perform more cardiac imaging.

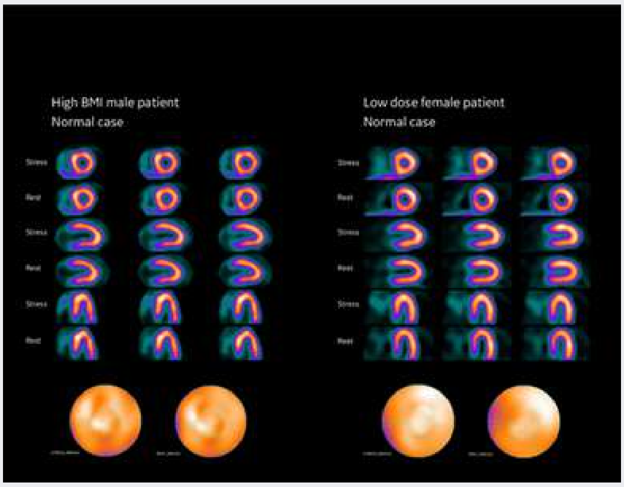

Figure 3 : Shows the images of high BMI patient normal case and the low dose female patient

Reference: https://www.gehealthcare.com/-/jssmedia/gehc/us/files/products/molecular-resonance-imaging/myospect/myospect_product_brochure_mi__glob_jb17519xx.pdf?rev=-1

The Daily And Weekly Quality Control Of Bone Densitometry (radiology)

By
Khairul Mardhiah binti Abu Hasan Ashari
Internship Trainee (USM), March 2021 – July 2021

Dual-energy X-ray absorptiometry (DXA or DEXA) is a scan that is used to determine the density of bone to assess its strength. It is a standard method for diagnosing osteoporosis. DXA works by sending two low-dose X-rays, which are absorbed differently by bones and soft tissues. The density profiles from these X-rays are used to calculate the bone mineral density (BMD). The lower the density, the greater the risk. For the maintenance of the consistency of BMD measurement, the QC of BMD measurement is essential. When I was positioned in the Radiology Department at Hospital Pulau Pinang, I was assigned to do the Daily and Weekly QC under supervision. Accordingly, the QC of BMD measurement using DXA is performed to minimise the error range of precision and accuracy. In the QC of a device, it is very important to detect whether the BMD value has changed because the BMD could be changed depending on the device's condition. To evaluate the accuracy of a DXA, a daily calibration measurement, according to the manufacturer's instructions, is performed using a standard phantom supplied with the system.

The procedure for daily QC starts with checking the table scan area and the runner area for articles that might interfere with table movement. In the QDR main menu, click on the Daily QC button.

Figure 1 Hologic APEX Software

When the table motion is complete, place the Spine Phantom on the table at the position indicated by laser cross.

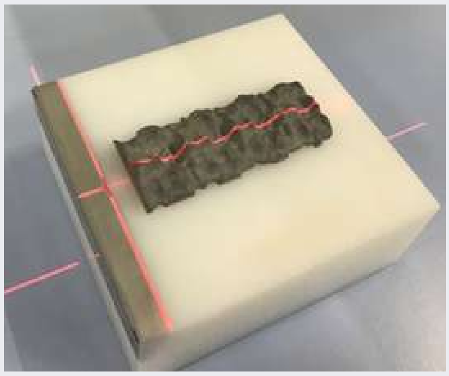

Figure 2 Spine Phantom

The procedure for the weekly QC is to check that the table scan area and runner area are clear of articles that might interfere with table movement. This is an automatic procedure called "Table Top Radiographic Uniformity". No biography needs to be created. To examine the result, the Global SD for a High Air and a Low Air should not exceed 2.0. In closing, precision error knowledge is critical in clinical practise to provide accurate diagnosis and management because it distinguishes between actual changes in Area, BMC, and BMD and random variability in the measuring technique.

Press "Continue" to start the automatic scan/analyzer QC procedure. Before scanning the phantom, the system will perform a self-test. The test will take approximately 30 seconds. When finished, a "Pass System Test" message will flash on the screen. If the automatic system test fails, the system displays a message stating the test failed and information on how to correct the error. Upon successful completion of the system test, the system runs AutoQC. When Auto QC has been completed, a window appears, giving either a passed or failed message. To analyse the result, the QC plot should be reviewed for Area, bone mineral content (BMC), and bone mineral density (BMD). The coefficient of variation (CV) for BMD should be at or below 0.60 percent, and the CV for BMC should be at or below 0.80 percent. The Weekly QC for DXA, which is the Uniformity table test, should be performed once per week, on the same day that the tissue bar is scanned. This test is performed only on Hologic systems with whole-body scanning software.

HYBRID IMAGING MODALITIES IN NUCLEAR MEDICINE: PET/CT & SPECT/CT (nuclear medicine)

By
Mirza Karmila Binti Zainol
Internship Trainee (USM), May 2022 – July 2022

Since the 1990s, hybrid imaging has enabled the intrinsic merging of functional and anatomical picture information using software and hardware image fusion.

Medical imaging has grown rapidly since the discovery of X-Rays by Roentgen in 1895. Therefore, many medical imaging modalities have been developed and established. It is very clear that medical imaging has become established as having an important role in patient management, and especially radiologic diagnosis however it potentially harmful to the body. The non-invasive imaging modalities such as Computed Tomography (CT), Positron Emission Tomography (PET), Single Photon Emission Computed Tomography (SPECT), Magnetic Resonance Imaging (MRI) and others have contributed by providing the details of image. Due to better localization and precision of scintigraphic results, hybrid imaging techniques such as SPECT/CT and PET/CT have been developed in the past several decades.

PET is widely employed in everyday life due to its capacity to provide molecular information, which is primarily used for non-invasive identification of tumours and metastases, as well as detecting the effect of cancer therapy. PET scans, on the other hand, lack comprehensive anatomical information and hence benefit from fusion with morphological image information from CT. As a result, PET/CT systems, oncological PET scans have primarily been performed as combined PET/CT, which has been shown to have a higher diagnostic value than single PET or CT imaging in a variety of clinical reasons. It has been explored in the evaluation of various malignancies such as solitary pulmonary nodules, non-small cell lung carcinoma, lymphoma, melanoma, breast cancer, and colorectal cancer.

PET/CT using Fluorodeoxyglucose [18F] (FDG) appears to give useful information in the staging and monitoring of various cancers. FDG-PET is becoming more widely used in the assessment of head and neck cancer, both for early staging and for restaging patients following treatment and has been shown to be preferable to both CT and MRI in the assessment of head and neck cancer. FDG is a radioactive tracer derivative of glucose that is absorbed by metabolically active tumour cells via facilitated transport comparable to glucose.

Blankespoor and colleagues have presented a hybrid imaging modality SPECT/CT design in 1996, which included a clinical SPECT gamma camera in combination with a clinical single-slice CT. In fact, the attenuation, which reduces the number of photons received by the gamma camera, is a primary cause of poor image quality in SPECT images. The advantages of using CT for attenuation correction include reduced noise, no SPECT influence on CT data, and no need to replace transmission sources. In this new era, a hybrid of non-invasive imaging (SPECT/CT) has largely replaced SPECT-only imaging with the availability of CT-based attenuation. Other innovations in SPECT and CT are expected as a result of enhanced data processing and collection.

In conclusion, PET/CT and SPECT/CT were introduced in the last decade as the first procedures capable of simultaneously obtaining information on structural and molecular abnormalities induced by disease. Soon after the introduction of these techniques, a lot of data on the better diagnostic utility of these hybrid imaging technologies, particularly in oncology, was collected and published. The capacity of fused data to reach a final diagnosis of lesions by merging their morphologic and functional properties reflects its improved diagnostic accuracy.

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Management Of Ct Brain Examination Dose Exceeding DRL Value In Radiology Department

By
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Medicla Physicist
Radiology Department, Hospital Sultanah Aminah

DRL is the dose reference level for each procedure to determine whether the patient dose is underexposure or overexposure. From the International Commission on Radiological Protection (ICRP), DRL is a form of investigation level of patient dose or administered activity (amount of radioactive material) for a specified procedure used in medical imaging to indicate whether, in routine conditions, the patient dose or administered activity is unusually high or low for that procedure.

In the Radiology Department, the percentage of adult plain CT Brain examinations Where Dose Length Product (DLP) exceeds the Malaysian Diagnostic Reference Level (DRL) is one indicator for the Quality Assurance Programme in Radiology. The method used for monitoring this indicator is that the dose for CT Brain must be recorded and monitored every day. Data from up to five consecutive Adult Plain CT Brain examinations shall be collected daily, including the DLP value. At the end of the year, a report shall be sent to the State Health Department before or on January 31 every year to meet the current requirements of the Ministry of Health Malaysia. The Standard for the percentage of CT Brain examinations where the dose length product (DLP) exceeds the Malaysian Reference Level is 10% of the DRL values.

If your values are above DRL, there is a more urgent need to investigate whether simple changes can be made to the imaging settings selected for an examination in order to reduce values of radiation dose quantities while still providing the required clinical information (1). In our experience, there are two main reasons why DLP is valued more than DRL. The first factor is exposure. factors. It could be clarified by the value of CTDIvol. If the CTDI volume is high, the exposure factors must be reduced. One of the easiest ways to reduce dose is by reducing exposure time. But the image quality also needs to be evaluated simultaneously to determine whether it is still of good quality or has been degraded. The dose reduction needs to be done gradually to ensure good image quality is maintained. The second factor that affects DLP value more than DRL is the scan length of the examination. It could be evaluated with the scan length value for each examination. The normal scan length for CT brain is 14 cm to 16 cm. If it is more than 16 cm, it could be considered more than the region of interest, which extends from the base of the skull or vertex. To prevent this from happening, radiographers must be trained or retrained to do proper collimation and limit the scan length to only the region of interest. Extended fields or scan lengths must be forbidden.

If your values are below DRL, the image must be monitored to determine whether it has sufficient image quality. If the image quality is poor, the exposure factors need to increase to get the best image quality while still being below the DRL value. There must be a balance between image quality and dose. Continuous monitoring of the CT Brain DLP value is good for maintaining good image quality with optimal doses in the Radiology Department.

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CO-ACADEMIC CARNIVAL 2022

by
Hawariyen Binti Saad
Medical Physicist
Department of Nuclear Medicine, Hospital Pulau Pinang

A Co-Academic Carnival 2022 programme took place on November 26 at Form Six College Haji Zainal Abidin, Jalan Hamilton, 11600 Pulau Pinang. Students from Form Six C around the State of Pulau Pinang attended this programme. Medical Radiation Surveillance Surveillance Division from the Ministry of Health Malaysia, Medical Radiation Surveillance Surveillance Division from Pulau Pinang Health State Department, Persatuan Pegawai Sains Fizik Kementerian Kesihatan Malaysia (PERFEKS), and Radiation Protection Committee members from Hospital Pulau Pinang and Hospital Seberang Jaya collaborated on this programme. The main objective of this programme was to give students general exposure to the medical physics profession in Malaysia. Besides that, the other objectives were to increase awareness and exposure to ionising radiation that was used, especially in medicine, and to promote the application of radiation protection to the public.

Mr. Zainuddin Bin Yasak@Yusof, Senior Principal Assistant Director from the Radiation Surveillance Branch, Pulau Pinang Health State Department, gave the programme's opening address first. The second session, on an introduction to the topic of medical physics, was given by Mr. Nik Mohamed Hazmi, Head of the Medical Physics Profession at the Hospital Kuala Lumpur. The third speaker was Dr. Prema Devi Chellayah, Medical Physics, Nuclear Medicine Department, Hospital Pulau Pinang. She was asked to inform students and instructors about STEM opportunities both inside and outside of Malaysia by discussing the use of radiation in medicine. At the end of each lecture, quizzes were given to the pupils, and the top scorers got prizes like goody bags.

Figure 1: Speech by Mr Nik, Head of Medical Physics Profession, Ministry of Health Malaysia

The form Six Students volunteered to demonstrate how to use personal protective equipment (PPE). This exercise was carried out to help people understand better how to protect themselves in the event of a radiation mishap. PPE is used to protect workers from radioactive material contamination. The Nuclear Medicine Department, Hospital Pulau Pinang, and the Medical Radiation Surveillance Division of the Ministry of Health Malaysia all had booths set up during this session where students and teachers could stop by to learn more.

Figure 2: Quiz contest

Figure 3:Prize giving ceremony for the quiz contest

Figure 4: Demonstration of PPE by the participants

Figure 5: Radiation Protection Equipment from the Nuclear medicine Department by Mr.Hizwan, Senior Medical Physicist, HPP

Radiation Protection Equipment (RPE) Integrity Check (Radiology)

By
Nur Aina Najwa binti Mohamad Feriza
Internship Trainee (USM), March 2021 – July 2021

According to the International Atomic Energy Agency (IAEA), radiation protection is defined as the protection of people from the harmful effects of exposure to ionising radiation and the means for achieving this. Exposure to ionising radiation can be external or internal to one's body. Hence, radiation protection is a concern for patients, staff, and the public exposed to ionising radiation due to its aftereffects and risk (deterministic and stochastic effects). The purpose of radiation protection is to provide an appropriate level of protection for human beings and to reduce unnecessary radiation exposure, which minimises the harmful effects of ionising radiation. In radiation protection, the ALARA (As Low As Reasonably Achievable) principle is practised. This principle states that even if it is a small dose, if receiving that dose has no direct benefit, people should try to avoid it. In ALARA, three basic protective measures, which are time, distance, and shielding, are taken.

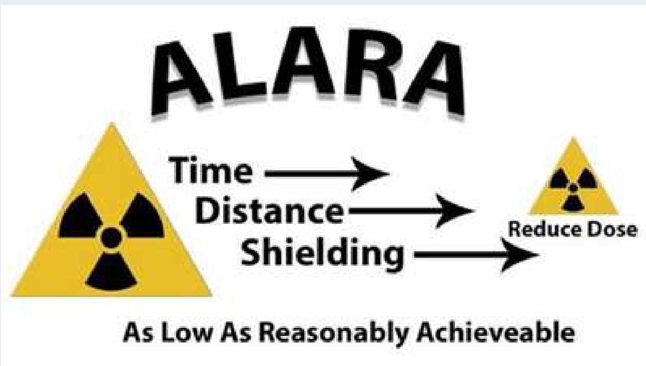

Figure 1 : ALARA

Radiation protection equipment (RPE) is part of personal protective equipment (PPE), which is a category of objects designed to act as shields for an individual person who wears it from hazards (ionising radiation). From time to time, the condition of RPE may degrade, causing them to not function at their optimum performance. So, to check and maintain their performance, an RPE Integrity Check is performed.

Figure 2 : RPE

RPE Integrity Check is an annual test done on the RPE made of protective lead and lead-equivalent (Pbeq) materials (lead gown, lead apron, lead vest, lead skirt, thyroid shield, gonadal shield). The objective of this test is to assure that RPE provides optimal protection to workers, patients, and the public involved in environments exposed to ionising radiation. During my internship period at Penang General Hospital, I had a chance to take part in and do the RPE Integrity Check hands-on. This test is performed by the physicists (Radiation Protection Committee) of the Radiology Department during the weekends in the months of March and April. RPE involved are from the Radiology Department, Cardiology Department (Invasive Cardiac Lab, ICL), Operation Theatre, ACC Operation Theatre, Endoscopy Unit (ERCP), Urology Department (ESWL), and Paediatric Dental HPP. All the RPE were physically and radiographically examined for defects that include tears, perforation, thinning creases, lumps, separation from seams, cracks, and leakage.

The procedure started with a physical inspection of the RPE. In physical inspection, RPE is laid on a flat surface, which is the patient's table. Then, physicists will visually check all the seams as well as the outer and inner covers of RPE for any visible damage by touching the surface of RPE. Also, the belt and fastening device are checked. Then, the procedure continued with radiographical inspection. In radiographic inspection, a CT Scan is used to check for defects periodically from the time of purchase. The use of a CT scan is preferable for this test as it is fast and provides a detailed image of the defects. Plus, multiple RPEs can be inspected with one scan. Through CT scanning, a topogram scan, which examines the entire RPE, is performed. From there, any breaks in the lead lining of RPE are inspected, and the results are recorded. The RPE is categorised as pass or fail. To pass, there should be no breaks in the lead lining (area near the critical organ) of the RPE. If present, RPE should be replaced.

Figures show the lead gown tests in the radiology department

Pass RPE

Fail RPE

Radiation Awareness Week 2023 in Hospital Pulau Pinang

By
Nurul Aqilah binti Abdul Malik, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

According to the World Nuclear Association, radioisotope demand is rising at a rate of up to 5% annually, and there are approximately 40 million nuclear medicine procedures conducted annually [1]. And with that, radiation safety has advanced over the past few decades into a distinctive and sophisticated system of concepts, rules, and techniques for the prevention and regulation of radiological hazards in order to deal with these expanding radiation and nuclear practises.

As a part of one of the leading nuclear medicine departments in the northern peninsula of Malaysia, the Medical Physics Team of Department of the Nuclear Medicine, Hospital Pulau Pinang (HPP) held a whole-week programme known as Radiation Awareness Week from June 19th, 2023, until June 23rd, 2023. The objective of the programme is to raise awareness and knowledge of radiation hazards among the healthcare staff of the department in order to safeguard themselves and their patients from harmful consequences.

FIgure 1: Promotional poster for Radiation Awareness Week 2023, Nuclear Medicine Department, HPP

Various interactive and interesting activities were approached by the Medical Physics Team alongside the internship students from School of Physics, and University SScience Malaysia (USM) Pulau Pinang to accomplish the aim of the programme. Interactive videos and infographics had been blasted throughout the week via the messaging platform to increase awareness of the importance of personal dosimeters among the staff. The videos can be accessed by clicking the link: https://shorturl.at/krE24.

One of the activities that had been held was a talk on the Introduction to Personnel Monitoring Devices that was given by one of the internship students from USM Pulau Pinang, Nurul Aqilah binti Abdul Malik. The talk was also a part of the Continuous Physics and Pharmacy Education (CPPE) and was available to join by physicists and pharmacists from hospitals all around Malaysia. In the talk, I emphasized the basic principle of operation of monitoring devices that are available in facilities that involve radiation, such as the optically stimulated luminescence dosimeter (OSLD), the thermoluminescence dosimeter (TLD), and the RPL. At the end of her talk, a gentle reminder was given to all the participants to always wear their own personal dosimeter according to the Atomic Energy Licencing Act of 1984 (Act 304) and the Basic Safety Radiation Protection (BSRP) 2010 Regulations.

The online quiz was held on Thursday and opened to the whole department, and its purpose was to measure whether the main objectives of the programme were accomplished or not. A prize-giving ceremony was held for quiz winners as a part of the closing ceremony for Radiation Awareness Week.

FIgure 2: Dr. Fazilah handed prize to the winners, the champion for Online Quiz activity.

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New Technology in Radiology Department - 3D Mammogram tomosynthesis screening (Radiology)

By
Wan Nur Qhairunnisa Binti Wan Ahmad Kamal, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

In order to provide the best image to help medical officers diagnose the condition of patients related to breasts, the HPP radiology department has installed the latest Hologic 3D mammography system. 3D mammography, also known as tomosynthesis or 3D breast imaging, is an advanced technology in the fight against breast cancer that allows doctors to examine breast tissue one layer at a time. This modality uses high-powered computing to convert digital breast images into a stack of very thin layers for radiologists to review, providing a more comfortable mammography experience for patients and an enhanced workflow for technologists. Hologic also discovered how sharper images and smarter technologies continue to help find invasive cancers regardless of age or breast density.

This new modality is designed to be the fastest, highest-resolution breast tomosynthesis system ever. Hologic 3DMS matches the unrivalled performance of Genius 3D Mammography, which is more accurate than conventional 2D mammograms, detecting 20%–65% more invasive breast cancers. Breakthrough improvements transform the patient's experience without compromising speed or accuracy. [1]

In March 2023, the Radiology Department of HPP has decided to install this new advanced mammogram screening modality. Users, including physicists and radiologic technologists, have been through the commissioning process to study the operation of this 3D mammography system. The development and improvement of this screening technology received a great response from all radiology department residents.

Figure 1. Hologic 3Dimensions mammography system

The Hologic 3D Mammography System has been built with lots of benefits. It gives better visibility; it has been designed to improve the visibility of fine details for greater diagnostic confidence. More importantly, it is more comfortable, as it has been clinically proven to deliver a more comfortable mammogram. This improves the patient's experience with a curved compression surface that mirrors the shape of the breast for more even compression. Other than that, this modality is more efficient compared to conventional, digital, and 2-dimensional mammography systems. It enables technologists to conduct fast, efficient exams and accelerate reading time to streamline workflow.

	Advantages	Disadvantages
2D Imaging	• Good diagnostic • Lower prices • Lower maintenance cost	• More false positives • Less sensitivity
3D Imaging	• Both 2D and 3D imaging • Improve image quality	• Higher price • Higher maintenance cost

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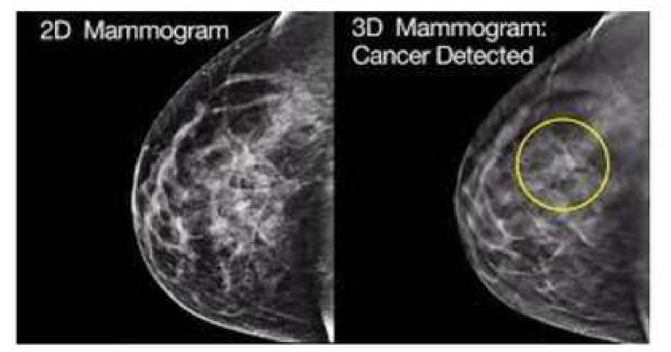


Figure 2. 2D mammogram vs 3D mammogram images

4th Penang Radiation Protection Day 2023

By
Keng Qing Le, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

On June 7, 2023, a meaningful event, "4th Penang Radiation Protection Day 2023," was held at Auditorium Dewan Sri Pinang. The event is organised by the Penang State Level Radiation Protection Programme Committee with assistance from Penang General Hospital. All radiation workers working in the private and government sectors are invited to join the event.

The objective of the event is to provide exposure to all radiation workers under the Atomic Energy Licencing Act 1984 (Act 304) and the latest regulations. The organiser also aims to provide knowledge to the participants on radiological emergency preparedness and standard operating procedures when handling accidents related to radiation and to encourage good work practises among radiation workers.

The event begins with a talk about "Protection for Radiation Workers" by Mr. Mohd Nathir B. Mohd Kamari from the Medical Radiation Surveillance Division, Ministry of Health Malaysia. Then, the event is officiated by YBrs. Dr. Fazilah Binti Shaik Allaudin, Penang State Health Director, with a welcoming speech, followed by an opening gimmick by a group of USM medical physics students undergoing an internship in Penang General Hospital.

After the opening ceremony, the event continues with a presentation by Dr. Cheng Ming Hann, Head of Emergency and Trauma Department, Penang General Hospital, about the "Emergency Response Team for Radiation Disaster.".

Next, Mr. Nuzaihan B. Abu Hassan, Senior Assistant Fire Superintendent from the Fire and Rescue Department of Malaysia, also shared on "Preparedness for Radiation Accidents." He shared about the devices available in the department and the radiation safety procedures practised when handling emergency cases during his sharing session.

Another talk session on "Biological Effects of Ionising Radiation" was presented by Dr. Sakinah Bt Suardi, Senior Lecturer, School of Physics, Universiti Sains Malaysia.

The event ended with a talk on "Civil Servant Anti-Corruption" by Mr. Mazlan B. Haja Maideen, Assistant Superintendent, Suruhanjaya Pencegahan Rasuah Malaysia, SPRM Pulau Pinang.

Figure 2: Group photo with all participants

Figure 1: Opening gimmick

“I hope that all medical workers can care about aspects of radiation protection and always apply the principle of radiation protection throughout their performance of duties as a health worker.”
– YBrs.Dr. Fazilah Binti Shaik Allaudin-

From Classroom to Clinical Practice: Unveiling Internship Experiences and Research Partnerships in Medical Physics at MOH Hospital

By
Dr Nursakinah Suardi
Senior Lecturer Medical Physics, Universiti Sains Malayisa

Internship programmes and research partnerships are integral to the journey of aspiring medical physicists, providing them with valuable opportunities to bridge the gap between classroom learning and real-world clinical practise. Hospitals under the Ministry of Health (MOH) are dedicated to providing valuable internship opportunities to students that allow them to apply their theoretical knowledge in a practical setting.

During their internships at MOH Hospital, students are assigned to various departments, such as the Radiology Department, Radiotherapy Department, and Nuclear Medicine Department. Working alongside experienced professionals, they actively participate in gaining hands-on experience and a deeper understanding of the crucial role medical physicists play in ensuring the accuracy and safety of diagnostic and therapeutic procedures. These internships serve as a stepping stone for students to gain practical experience and prepare themselves for the dynamic world of medical physics.

Moreover, collaborations between MOH Hospital and educational institutions, like Universiti Sains Malaysia (USM), foster research partnerships that further enrich students experiences. Through these collaborations, students have the opportunity to engage in meaningful research projects. They work closely with medical physicists, exploring innovative solutions and contributing to the advancement of medical physics.

By participating in research projects, students expand their knowledge, refine their analytical skills, and gain insights into cutting-edge technologies and advancements in the field. These research partnerships offer them a platform to apply their theoretical knowledge and contribute to the broader medical physics community.

In conclusion, the internship programme for medical physics students in hospitals is a crucial component of their education and career development. The collaboration between MOH and USM in research activities enhances the field of medical physics and contributes to advancements in healthcare. The Ministry of Health's commitment to providing internship opportunities and promoting collaboration with educational institutions demonstrates its dedication to nurturing the next generation of medical physicists.

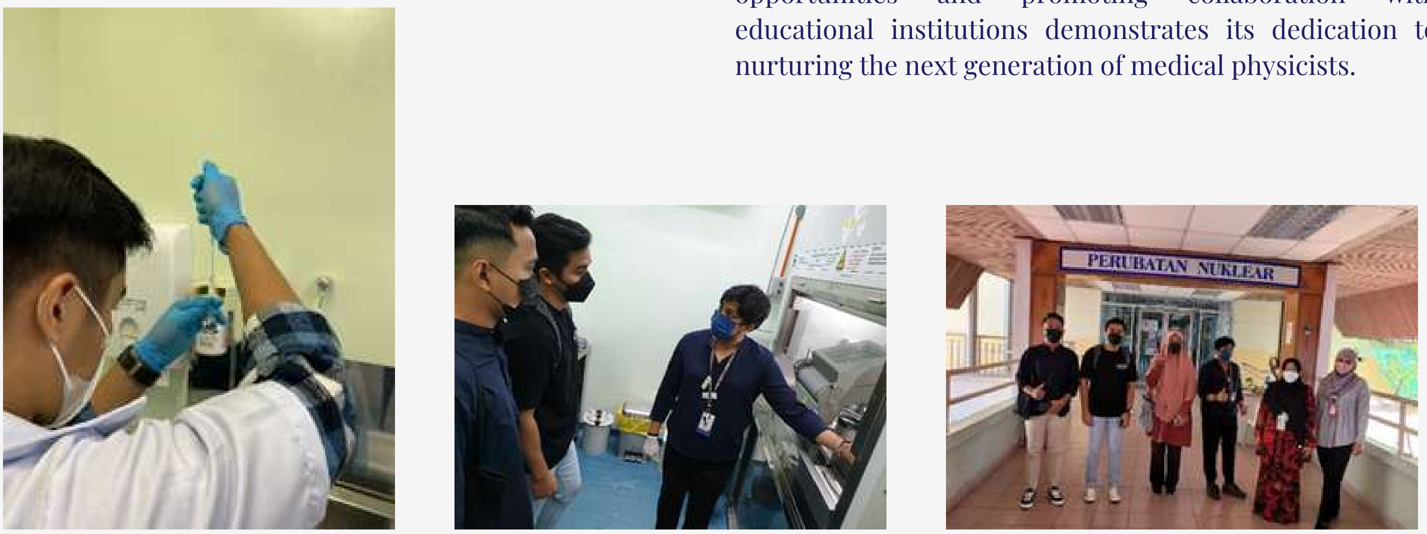


Figure 1: Research collaboration between USM-HPP for a final year project.

Figure 2: Internship students at Penang General Hospital and National Cancer Institute

DDIR Educational Trip & Corporate Social Responsibility 2023 -Hospital Pulau Pinang-

By
Asst. Prof. Dr. Norhanna Sohaimi
Dept. of Diagnostic Imaging & Radiotherapy
Kulliyyah of Allied Health Sciences
International Islamic University Malaysia

On 17th – 19th June 2023, 28 students (Year 3), Programme of Bachelor of Medical Imaging (Honours), Kulliyyah of Allied Health Sciences, International Islamic University Malaysia (IIUM), Kuantan, Pahang had an educational trip and community engagement named; DDIR Educational Trip and Corporate Social Responsibility (CSR) 2023 at Hospital Pulau Pinang. The programme was successfully carried out with the approval and cooperation from the hospital management especially Office of Director, Public Relation Office, Department of Nuclear Medicine and Department of Cardiology. The main objective of this programme was to ensure an inclusive and equitable quality education for the students besides community engagement.

During the educational visit, we received a very warm welcome from the Head and staff of the Nuclear Medicine Department. Head of Department, Dr. Fadzilah binti Hamzah, briefed us on all aspects of the department including history, development, staff, and departments' services. After the briefing session, we were split into small groups and taken to different sections of the department to see the facilities there. The session was a pleasant and memorable experience for us as Dr. Fadzilah and her team provided us with an excellent tour and explanation about nuclear medicine; SPECT-CT, PET-CT, Hot Lab, Iodine Ward etc. Via this programme, the students reinforced their experiential and contextual learning by exposing themselves to the different imaging modalities in other clinical settings which are attaining the programme objectives.

Other than that, this trip also has given the opportunity for the students to get involved with the Corporate Social Responsibility (CSR) Programme by doing the mural decoration at the Department of Cardiology. Head of Department, Dato' Dr. Mohamed Jahangir bin Abdul Wahab and his team are very supportive in providing us privilege (space and assistance) to accomplish this task. We feel grateful and blessed because we were able to complete the mural successfully within a short and sweet time; one and half days. This activity granted new experience to the students as well as bringing out their hidden talent and inner creativity.

In conclusion, as advisor for this programme and representative of my department and university, I would like to express our utmost gratitude to Hospital Pulau Pinang for your support and assistance in realising this programme. I could say that this programme leaves a great impact for the students as it enriched their knowledge and experience as well as widened the perspectives of education and life which are in line with IIUM Sejahtera Academic Framework: Humanising Education for Rahmatan lil 'Alamin.

A REMARKABLE 21-DAYS

By
Afina Zainodin, Medical Physicist, Mount Miriam Cancer Hospital

One can only imagine the job scope of a nuclear medicine physicist until they experience it themselves. The roles and responsibilities of the physicist in nuclear medicine are diverse and demanding, including dosimetry, radiation safety, quality assurance, and equipment management. To be clinically qualified to practise in a nuclear medicine facility, the medical physics professional must have experience in a wide range of situations and be able to make professional judgements. To gain competency, the new medical physicist needs to go through a structured training programme that ensures the widest possible range of relevant experiences.

For me, 21 days of the training session at Department of Nuclear Medicine, Hospital Pulau Pinang, have already passed. I have participated actively in theoretical and practical training. Lectures and hands-on activities in radiation protection and safety, legislation, instrumentation facilities, and radioactive source management were delivered by the Nuclear Medicine team of physicists, technologists, and pharmacists. Throughout the 21 days, I have learned it is important for physicists to apply their knowledge of physics and technology in order to establish, implement, and monitor processes that allow optimal diagnosis and treatment, taking into account the radiation protection of personnel and patients. Progressively, with each module, I experienced a paradigm shift, justifying my decisions on a scientific basis while accounting for individual scenarios. I offer my admiration and gratitude to them all for their attentiveness to my learning and training needs.

The experience has not been without difficulty, but that has made it more worthwhile. I have grown and learned along the way, both at a professional and personal level. I have no doubt that the training will lay the foundation for my nuclear medicine practise.

Figure 1: Lectures on radiation safety

Figure 2: Hands-on practices

Nuclear Medicine Technologist 21 Days Certificate Programme From The Technologist Point of View

By
M Jayandhi Mohanan, Nuclear Medicine Technologist, Mount Miriam Cancer Hospital

A nuclear medicine technologist is a highly specialised health care professional who works closely with the nuclear medicine physician.

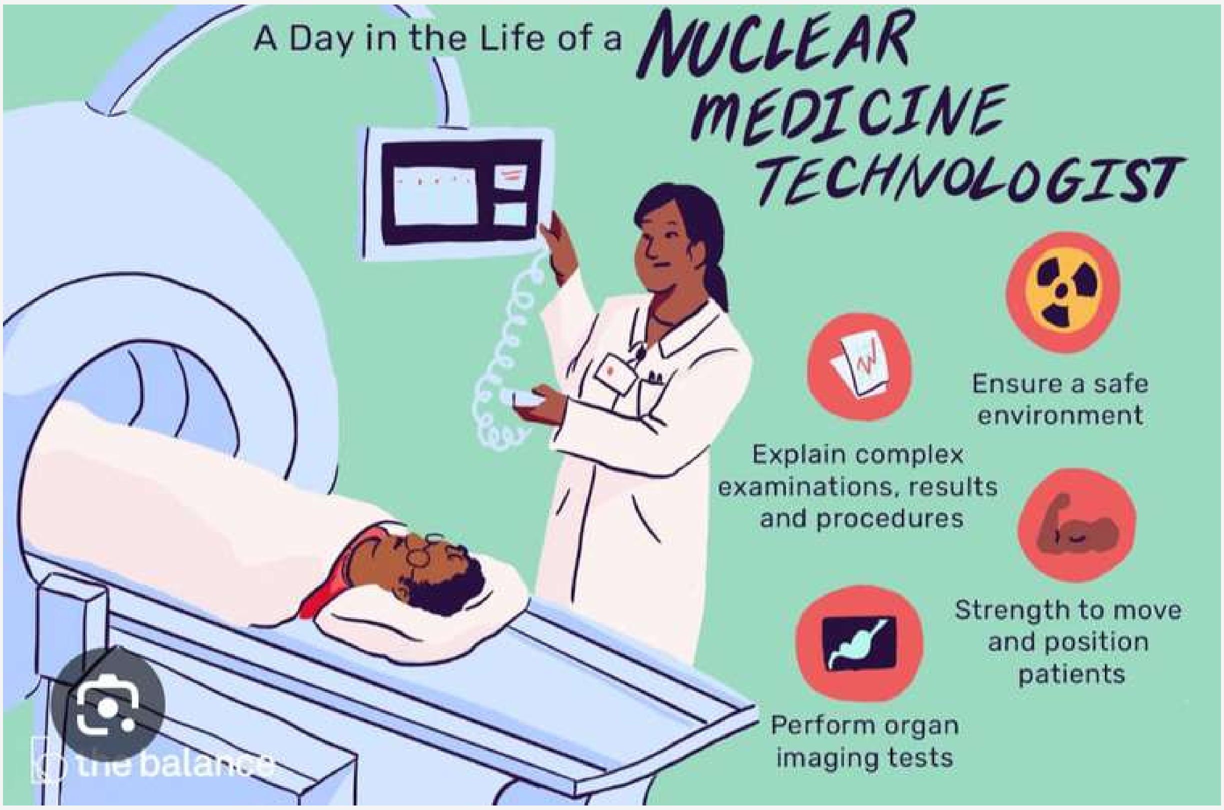
In Hospital Pulau Pinang, the Nuclear Medicine Technologist 21-Day Certificate Programme has been established since 2018. This programme provides training to prepare nuclear technologists for radiopharmaceutical injection and the use of highly technical cameras and computers in a clinical setting.

If you work as a radiographer, medical assistant, have a degree in health science, are a registered nurse, want to change careers, or want to specialise in nuclear medicine, you might be a wonderful fit for this career pathway. This training focuses on developing fundamental nuclear medicine technology skills in a classroom and clinical environment.

In this programme, there is an opportunity to learn to administer radioactive material and use imaging technology to create diagnostic images.

Furthermore, this programme mainly focuses on delivering high-quality educational programmes and services that provide the knowledge, skills, cultural awareness, and attitude needed to experience a prosperous and rewarding life.

As a new learner of nuclear medicine, I have learned a lot throughout this training programme. I have learned about types of radioisotopes, preparation of radiopharmaceuticals, special consideration for sealed and unsealed radioactive sources, radioactive source storage and security, procedures for handling incidents and accidents, waste disposal, transportation, and documentation. Overall, the programme was so meaningful and useful for me to become a part of the service as a technologist.



Lecturer Point of View

Assoc. Prof. Dr. Noramaliza Mohd Noor,

Assoc. Prof. Dr. Noramaliza Mohd Noor, also known as Nora, began her career as an academician in the Department of Radiology, Faculty of Medicine and Health Science at UPM in 2012. She obtained her Bachelor of Science (Medical Physics) and Master of Science (Medical Physics) degrees from Universiti Sains Malaysia. She then pursued her Ph.D. in Radiotherapy Dosimetry at the University of Surrey in the United Kingdom.

She has more than 10 years of experience as a medical physics lecturer for the Master in Medicine (Radiology) program, training over 20 radiologists in the country. She is regularly invited to give a series of lectures on Radiation Protection at the Malaysia Nuclear Agency, Radiation Biology at the Department of Biomedical Sciences, and Radioactive Waste Management at the Department of Environmental and Occupational Health at UPM. Nora also contributes to teaching QAP and physics instrumentation topics to the students of the Advanced Diploma Course in Emergency Imaging and Trauma at the Training Institute of the Ministry of Health Malaysia, Sungai Buloh since 2022. Besides that, in the same year, she has also been appointed as an Academic Coordinator by the Malaysia Nuclear Agency to coordinate the IAEA-Malaysia Postgraduate Educational Course in Radiation Protection and the Safety of Radiation Sources for the Asian region. Earlier this year, she contributed her expertise as a voluntary lecturer for the Insta Executive Programme Framework for International Educators by IAEA-INSTA, delivering lectures on radiation in health.

Noramaliza is an active researcher in the field of Medical Physics, as evidenced by her involvement in over 14 grants (totalling approximately 1 million RM) from government and industries, where she serves as the principal investigator. She has published more than 70 articles in high-impact journals from reputable publishers such as Pergamon, Elsevier, and the Institute of Physics, UK. Additionally, she holds two patents and one copyright. Nora has mentored postgraduate students at the MSc and Ph.D. levels, with four successfully graduating with Ph.D. degrees and one with an MSc degree under her primary supervision. Moreover, she has co-supervised thirteen postgraduates who have successfully graduated. Due to her expertise in radiation dosimetry, she has examined over 10 Ph.D. and MSc theses as both an internal and external examiner. Nora has received significant recognition from her peers as a Journal Reviewer and Managing Editor. She has also collaborated with international universities/institutions and industries, as evidenced by her involvement in more than five consultancy projects worth 100,000 RM.

One of her impactful research projects was the Smart Optical Fibres for Passive Dosimetry in Space (SOFPADS), which was successfully conducted in the International Space Station (ISS) in collaboration with the Japanese Aerospace Exploration Agency (JAXA), the National Aeronautics and Space Administration (NASA), and the Malaysia Space Agency (MYSA). In 2021, Nora was appointed as an alternate project counterpart to lead the Malaysian technical cooperation project (MAL 9019) for the establishment of the Radiotherapy Audit and Intercomparison network, worth Euro 175k.

Currently, she holds the position of head of the Medical Physics Unit and serves as a Radiation Protection Officer at the Hospital Sultan Abdul Aziz Shah, (HSAAS) Universiti Putra Malaysia. As a registered Medical Physicist (MP) under the Malaysian Allied Health Professions Council (MAHPC) and elected as a member of the ethics and practice committee for MAHPC to represent MP profession, Nora has made significant clinical and research contributions in collaboration with the Ministry of Health in various areas related to diagnostic radiology, nuclear medicine, and radiation safety. As a member of the Steering Committee for the Implementation of the Quality Assurance Program (QAP) in Nuclear Medicine Services at the National Level, she has played a crucial role in ensuring the establishment and implementation of robust quality assurance measures in nuclear medicine facilities across the country. Her expertise and involvement have helped improve the overall quality and safety standards in the field of nuclear medicine.

Furthermore, as a member of the Steering Committee for the Medical Radiation Exposure Study for the Development of the Malaysian Diagnostic Reference Level (DRL) in the Nuclear Medicine Service, Nora has contributed to the development of guidelines and reference levels for medical radiation exposure. Her work in this committee has been instrumental in setting appropriate radiation dose limits and ensuring patient safety in nuclear medicine procedures.

In addition to her committee roles, Nora has also actively participated in the Development Standard Operating Procedure (SOP) Committee for Maternal and Fetal Dose Estimation in Nuclear Medicine. Through this committee, she has contributed to the development of standardized procedures for estimating radiation doses in pregnant patients and their unborn children, ensuring that they receive optimal care and minimizing potential risks.

Noramaliza's collaboration with the Ministry of Health has extended beyond committee work. Her expertise in radiation protection and dosimetry has been valuable in the development of the Radiation Protection Officer Certification Program (Medical), where she serves as a member of the Working Group Committee. Her contributions have helped shape the curriculum and standards for certifying radiation protection officers, further enhancing radiation safety practices in medical facilities.

Additionally, as a member of the Working Group Committee for the Development of the Site Security Plan Program at the Malaysian Ministry of Health Level, Nora has been involved in the development of comprehensive security plans for healthcare facilities. Her contributions have aimed to ensure the protection of radioactive materials, equipment, and personnel, thereby safeguarding public health and preventing unauthorized access or misuse.

Noramaliza's collaboration with the Ministry of Health reflects her dedication and expertise in the field of medical physics and radiation safety. Her contributions have had a positive impact on the development and implementation of quality assurance programs, reference levels, dose estimation procedures, radiation protection officer certification, and site security plans within the healthcare system. Through her active involvement, she continues to make significant contributions to the advancement of radiology, nuclear medicine services, and radiation safety practices in Malaysia.

Nora during her participated in the Development Standard Operating Procedure (SOP) Committee for Maternal and Fetal Dose Estimation in Nuclear Medicine at Cameron Highland.

Nora with students of the Advanced Diploma Course in Emergency Imaging and Trauma, Ministry of Health (MOH)

Nora as a PGEC academic coordinator with PGEC-18 participants during their visit to Hospital Sultan Abdul Aziz Shah, UPM

Nora with working Group Committees during the development of the Radiation Protection Officer Certification Program (Medical) retreat at Avillion, Port Dickson.

Working as a New Medical Physicist, HPP

By
Nur Dalila Binti Mansor, Medical Physicist, Department of, Nuclear Medicine, Hospital Pulau Pinang

My name is Nur Dalila Binti Mansor. Universiti Malaya in Kuala Lumpur is where I received my degree. I finished in 2010 with a degree in science (physics). I have experience in a variety of industries. As a Medical Physicist, I began a new profession at Hospital Pulau Pinang (HPP) in the Nuclear Medicine Department in May 2020. For the time being, I was ecstatic about this new path and eagerly anticipating the challenges and thrills that lay ahead.

In my view, the role of Medical Physicists in the Nuclear Medicine Department is quite challenging. We are working closely with a medical officer, radiographer, technologist, and nurses. We provide supervision of radiation safety for the radiation workers. We also have to maintain and calibrate the medical equipment so that the radiation produced is accurate and functioning at its optimal levels. We must be very proactive and alert to all medical procedures involving ionising radiation, the security of radioactive materials, radiation safety, and the quality assurance of diagnostic equipment. We are responsible for ensuring radiation doses given to the patients are safe and effective in achieving their intended diagnostic or therapeutic purposes as prescribed by the medical officer in accordance with the ALARA principle.

Semi-Annually QC for SPECT-CT

In fact, the years 2020 and 2021 will not soon be forgotten. Despite the difficulties the COVID-19 pandemic has put us all through, I can count myself fortunate since shortly after I join HPP, we begin a Replacement Through Maintenance (RTM) project that involves replacing the outdated PET-CT with a new one. After installation, there is a lot of quality control and calibration to do. And right now, we're working on another RTM project to upgrade the cardiac dedicated machine and replace the outdated gamma camera. September 2021 will mark the commencement of this new endeavour.

I would like to take this opportunity to thank all of the senior medical physicists who have been really helpful to me, especially with the daily, weekly, monthly, quarterly, semi-annually, and annual tasks that need to be completed. I'll be prepared to work without supervision on common tasks like QC for gamma cameras, SPECT-CTs, and PET-CTs in just a few months. Additionally, I have experience doing wipe test area monitoring, receiving radioactive (Tc-99m, I-131, and F-18), decay tank area monitoring, disposing of radioactive waste, weekly quality control for survey metres, daily dose calibrators, and well counter monitoring.

Last but not least, medical physicists act as "frontliners" in the battle against radiation to protect the environment from dangerous radiation. To be effective radiation protectors, medical physicists must comprehend radiation protection. When working in this field, you must be familiar with radiation safety.

Replacement Through Maintenance (RTM) project for PET-CT, 2020

Future of Medical Physicist in Malaysia

By
Ts Dr Prema Devi Chellayah, Senior Medical Physicist, Department of, Nuclear Medicine,
Hospital Pulau Pinang
prema_devi@moh.gov.my

Hi, my name is Prema, and I currently work in the Department of Nuclear Medicine as a Senior Scientific Officer (Medical Physicist). The field of medical physics is still an emerging field in Malaysia, but over the past 20 years, we have witnessed an upward trajectory. In Malaysia, there are now 349 medical physicists (including government and private hospitals), or one for every 100,000 residents. Among the countries of Southeast Asia, this ratio came in second. 36% of medical physicists work in radiation oncology, 15% in diagnostic radiology, and 8% in nuclear medicine, while 41% work in regulatory or licencing organisations and academic or research institutions. (J.H.D. Wong et al.)

The Malaysian parliament presented the Allied Health Profession Act (ACT 774) in 2016, which stipulates that all active allied health professionals, including medical physicists, must obtain a practising certificate and fulfil the Continuous Professional Development (CPD) requirement of 30 points annually. A well-established residency programme or Clinically Qualified Medical Physicists (CQMP) programme, for instance, exists in nations like Thailand, Indonesia, Australia, the United Kingdom, and the European Union. As a result, Malaysia should seriously consider developing a recognised programme to allow for the practise of clinical medical physics in the relevant domains as per international standards.

We require a professional organisation with a comprehensive, recognised educational programme, such as the AMPLE programme offered by the International Atomic Energy Agency (IAEA), for the establishment of the medical physics profession in Malaysia. As a result, as an IAEA member state, the Ministry of Health of Malaysia intends to implement and utilise the CQMP programme.

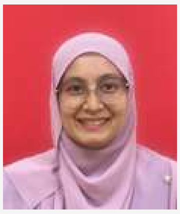
Furthermore, I would like to talk about my experiences as a scientist and researcher while I was a student in the UK and EU. The departments of medical physics have been created in the hospitals of the UK and EU nations. For instance, the Medical Physics Department at the Queen Elizabeth Birmingham Hospital is overseen by prominent physicist Professor Dr. Stuart Green. The hospital has three key departments: radiology, nuclear medicine, and radiotherapy. When it comes to applying physics in medicine, the Department of Medical Physics is crucial. To guarantee that magnetic resonance imaging (MRI), CT, PET-CT, SPECT-CT, and other x-ray modalities are performed safely, a team of experts provides radiation protection, radioactive management, assurance of quality, and serves as an advisory board.

With the experience, I would like to see and be a part of medical physicists to ensure that we progress by implementing CQMP for medical physicists and introducing a medical physics department in the hospital, which has the three key departments. As scientists, together we hope to grow and develop the medical physics profession and our country to achieve international standards and success.

Strive not to be a success, but rather to be of value

Albert Einstein

PHD JOURNEY



By
Fatin Nadhirah binti A Halim

My PhD journey began in early 2019. Commencing with the initial stages of the reading process, the progression towards the preparation of a defence proposal, followed by the subsequent attainment of ethical approval at both the university and ministry of health phases, tends to span a duration of approximately one year. The study received ethical approval from the Medical Ethics and Research Committee, Ministry of Health Malaysia, as well as the Research Ethics Committee, Universiti Sains Malaysia, in December 2019.

The data collection process began at the beginning of January 2020. However, when the COVID-19 pandemic occurred and began in March 2020, the study had to be delayed because the country was under Movement Control Order at the time. The study resumed in August 2020, but the number of study subjects who met the study criteria was limited. Hence, it is imperative to ensure the ongoing continuation of the data collection process until a satisfactory sample size is achieved. The duration of the data collection spanned approximately one year.

Everyone's journey is unique, but thanks to God and the unending prayers of my mother, mother-in-law, and father, I was able to complete my studies. Not to be forgotten is my late father-in-law, who has always provided inspiration and words of encouragement for me to continue on my journey. The journey was filled with an overwhelming feeling of joy, leaving no room for any semblance of regret to permeate its essence.

I consider myself extremely fortunate because, throughout my studies, I received complete support from the head of my department, Dr. Fadzilah binti Hamzah, the chief medical physicist, Mr. Mohd Hizwan bin Mohd Yahya, and all of my colleagues, particularly two nuclear medicine technologists, Mr. Muhammad Wafiuddin Firdaus Bin Othman and Mr. Cornilius Bin Hachara, who always provided excellent cooperation.

I am incredibly grateful for the exceptional guidance and consistent support provided by my esteemed supervisor, Dr. Mohd Syahir bin Mansor. His invaluable assistance played a pivotal role in closely monitoring the progress of this study, ultimately leading to its successful completion. I am filled with immense gratitude for the never-failing and continuous financial support that I have been fortunate enough to receive from the Ministry of Health throughout the years.

I cannot express how thankful I am for the unwavering support and love that my husband, Adi Izhar bin Che Ani, has provided throughout my journey towards completing my PhD. Thank you for always being there for me when life gets tough. I am deeply grateful for the presence of my two incredible children, Hana Sofia and Muhammad Haziq. I extend my heartfelt appreciation for the inspiration they bring to my life. May their path be illuminated with knowledge, and may they continue to thrive and succeed in their pursuit of learning.

I am constantly filled with gratitude for the boundless wonders of knowledge. Each new piece of knowledge serves as a gentle reminder that the vast expanse of wisdom is infinite and ever-expanding. It is genuinely amazing to acknowledge that the more we look into the depths of understanding, the more we become aware of the vastness that lies beyond what we know. It is truly remarkable how having a PhD does not necessarily equate to being exceptional in every field. The process of learning never ends. It is a lengthy road to the moment of our death.

Remember, the key to living your best life is to never stop learning and expanding your knowledge. Not only does it empower you, but it also allows you to make a positive impact on others. Always keep in mind that knowledge is power, but it is what you do with that power that truly matters. So, let's keep growing, sharing, and making a difference together!

Dose Calibrator Constancy Test

Nuclear Medicine Department, Hospital Pulau Pinang

By
NUR SYAHIIRAH BINTI MOHAMAD MOKHTAR
INTERNSHIP STUDENT USM

WHAT IS DOSE CALIBRATOR?

A dose calibrator is generally a gas-filled cylinder with a well in the centre of the ionisation chamber into which the radioactivity is placed. It is used to measure the ionising radiation exposure of a given radioisotope. In Nuclear Medicine, it is used to measure the amount of radioactivity of a radionuclide before injection into a patient. These ionisation chamber radiation detectors are typically filled with highly pressurised Argon [18-Ar] gas, compressed to around 20 atmospheres, and are able to measure activities from 3.7 kBq to 740 MBq.

USM Trainee is handling the radioactive source

The typical radioisotope calibrator contains an ionisation chamber, a high-voltage power supply, an electronic amplifier, and a display unit on which one can select the radioisotope to be calibrated. The ionisation chamber is cylindrical in shape and is used to measure the total amount of ionisation produced by the sample to be calibrated. The ionisation chamber contains Argon gas under high pressure, often 20–30 atm, and the hermetically sealed chamber contains two electrodes with an electric potential between them. When the vial or syringe containing the radionuclide is placed into the chamber, the Argon is ionised, the ion pairs migrate towards the anode and cathode, and an electrical current flows between them. This current is proportional to the activity of the measured radioisotope. The magnitude of this current is usually very small (on the microampere level), even if large amounts of activity are present. A device called an electrometer, designed for quantifying very small electric currents, is used, and its output is displayed in either mCi or MBq. This measurement is used to calculate the dose contained in the syringe.

The dose calibrator function is based on a number of parameters. Most important are the activity, the energy level of the photons, and whether particulate emitters (e.g., beta particles) are being calibrated. It also depends on the court geometry, such as the size and position of the source, and attenuation. Because of this dependence, the amplification factor of the circuitry must be set separately for each radionuclide. In contrast to gamma cameras, a radionuclide is not measured on a particular peak, but all (X-ray and gamma) photons contribute to the measurement of the activity. Most dose calibrators have pre-programmed selection keys for the proper amplification of certain radionuclides. In addition, an arbitrary setting may be selected. The manufacturer provides a list of radionuclides and their associated settings. The calibration has been performed at the factory for a particular source geometry (syringe) in a certain position.

Fume Hood that contains ionizing chamber

Atomlab 300 Dose Calibrator

<u>CONSTANCY TEST PURPOSE</u>

Constancy means reproducibility when measuring the same source over a period of time with decay correction. This test is performed at installation and daily purposely to measure instrument precision and is designed to show that reproducible readings are obtained day after day on all the various isotope settings that are likely to be used.

<u>FREQUENCY</u>

It is recommended that the checks be thoroughly incorporated into routine operations so that their ongoing performance is guaranteed. For the constancy test, it is preferably performed daily before the patient dose is administered.

<u>MATERIALS</u>

The materials required for conducting the test are:

1. Atomlab 200 and Atomlab 300
2. Radioactive sources (Cs-137 and Co-60)
3. Tweezers

Example of sealed sources

PROCEDURES

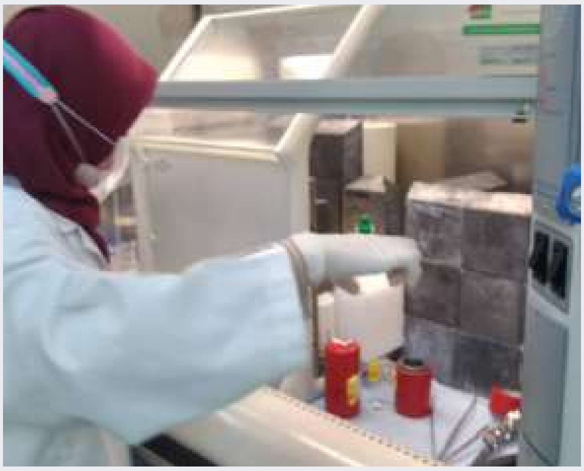
1. Press the zero background (Bkgnd) button.
2. When the display zeroes, the unit has automatically adjusted for the background. When the light of the Bkgnd button is off, place each reference source in the dose calibrator using the appropriate dose calibrator setting (i.e., use the Cs-137 setting to assay Cs-137).
3. Record the activity reading of the constancy source in the spreadsheet and plot the ratio of the decay-corrected result in a graph.

ACTION THRESHOLD

Compare the measurement observed to the calculated activity of the source, and if the measurement exceeds 5% of what was predicted, investigate potential sources of errors (patients in the area, exposed sources, use of the wrong isotope or setting). If the constancy result is determined to be greater than 10% of what was predicted, suspend the use of the instrument and repair or replace the dose calibrator.

Physicist is demonstrating on how to place the radioactive source in the dose calibrator

One of USM Trainee is placing the radioactive source using tweezer into the dose calibrator cylinder



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Advances of technologies in cardiac nuclear imaging using PET-CT

By
Muhammad Faiz Bin Zulkpeli
Internship Trainee (USM), May 2022 – July 2022

For the safe and non-invasive nuclear imaging procedure, a smidgen of radioactive material is used to obtain images of the inside organs and structures of your body. Specifically, nuclear heart scanning, or cardiac imaging, is a term used for scanning to detect heart disease. Coronary artery disease can be identified and evaluated using cardiac nuclear medicine. Additionally, it is used to assess cardiomyopathy and spot any potential cardiac damage caused by radiation or chemotherapy by providing images of the distribution of blood flow to the heart muscle and can be used to visualise the function of the heart.

Radiotracers are molecules "labelled" with a small amount of radioactive material that can be received through an injection, or orally by swallowing it or inhaling it as a gas, depending on the examination procedure. Through a vein, a tracer enters the patient's circulation until it reaches the patient's heart, where it will emit gamma rays, which are energetic particles that are like X-rays. Outside of the patient's body, specialised gamma cameras pick up the gamma rays and use them to generate images of the heart and related organs.

A patient is then scanned using either a PET/CT or SPECT machine, depending on the radioactive chemical administered. To create unique perspectives, several imaging facilities combine computed tomography (CT) scans with nuclear medicine images (PET or SPECT). Doctors refer to this as co-registration or image fusion. The doctor may combine and analyse data from two distinct exams into one picture by using image fusion. This results in more accurate information for diagnosis and treatment. Both tests can be performed simultaneously using single-photon emission CT (SPECT/CT) and positron emission tomography CT (PET/CT) devices.

Recently, several new technologies for PET have become accessible for nuclear medicine scans compared to when PET/CT emerged a little more than a decade ago, when many of its limitations were like those faced by individual PET and CT. This article reviews the advances of PET scans in the assessment of cardiac disease. PET utilises intrinsic tissue properties as the source of image contrast, enhancing integrative biology and enabling early detection and precise illness diagnosis.

Advances in PET Technology include 3-D PET imaging, Time of flight, and hybrid systems. Initially, lead or tungsten septa were used to separate the rings of detectors in PET detector arrays, which were designed to encourage the detection of only in-plane coincident events. This method decreased the frequency of random coincidence occurrences that might happen independently or because of photon dispersion. Similar to how SPECT camera collimators lower counts, PET imaging septa do the same, which lowers the sensitivity of PET. It has become possible to remove the septa to capture all the coincidence occurrences inside three dimensions, improving sensitivity by 5-7 times due to the implementation of newer crystals like lutetium oxyorthosilicate and accurate scatter correction algorithms. The timing difference between a photon striking one detector and a second photon from the same annihilation event hitting a different detector may be measured by the coincidence electronics in modern PET scanners with TOF electronics. The location of the annihilation event along the coincidence ray between the two detectors is estimated using that time difference multiplied by the speed of light. As a result, TOF scanners have higher spatial resolution and can localise an annihilation event to a significantly narrower directed ray than traditional PET scanners.

Due to the motion of the heart during contraction and the chest while breathing, this advancement has not yet been used in cardiac imaging. However, compared to typical non-TOF PET systems, the picture quality of cardiac studies collected on TOF systems might gradually increase with the introduction of respiratory gating and freeze-motion algorithms. Nowadays, PET is used together with CT, which is known as a hybrid system. The capability of hybrid PET/CT angiography to detect functionally relevant lesions seems to increase the specificity of PET alone. The detection of coronary lesions requiring revascularization as determined by invasive coronary angiography and flow wire evaluation had a sensitivity of 90% and a specificity of 98% in a study of 25 patients with CAD using PET stress/rest perfusion imaging and CT angiography.

In conclusion, the improvement of PET/CT really has a big impact on nuclear medical imaging and treatment, and the use of this hybrid modality is expected to grow in the coming years, particularly in radiation oncology, which comprises most of the volume of PET/CT imaging.

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Waste Management in Nuclear Medicine Department, Hospital Pulau Pinang

By
Mariah Izzaty Binti Romzi, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

According to the Atomic Energy Licencing (Radioactive Waste Management) Regulations 2011 [1], radioactive waste means a substance or article that contains or is contaminated with radionuclides at activity concentrations or activity greater than clearance levels and for which there is no use unforeseen. The ALARA principle must be followed when managing radioactive wastes so that radiation exposure to people is as low as reasonably achievable and below established limits. This Standard Operating Procedure (SOP) is intended to ensure that radioactive waste generated for medical purposes is handled in accordance with the regulations (2). This procedure is applicable to radioactive waste with a very short half-life, a short half-life, and a long half-life (more than 100 days). In Hospital Pulau Pinang, it is the medical physicist's responsibility to manage radioactive waste in the Nuclear Medicine Department. It is required to wear personal protective equipment such as a lab coat and gloves when handling the radioactive waste. Other equipment that is used in managing radioactive waste is a calibrated survey metre and an inventory form in which the dose rate of the radioactive waste will be recorded. Firstly, radioactive measurements on the bag's surface are required for dose rate measurement. The bag's surface dose rate must not exceed 5 Sv/hr at the surface. The medical physicist is responsible for ensuring that all radioactive wastes are separated and stored in a waste room that is clearly marked with appropriate warning signs. If the dose rate exceeds the permissible level, the waste bag must be marked with a red sticker and kept inside the Waste Room for decay. In this department, there are two waste rooms. One that is named general waste room is specialised in radioactive waste for which radionuclides have a short half-life, such as Tc-99m (Technetium-99m) and F-18 (fluorine-18). The other waste room is the Iodine Waste Room, which, as its name suggests, is specialised in radioactive waste that contains I-131 (Iodine-131). I-131 radioactive waste has its own waste room as it has a longer half-life.

Figure 1: Iodine Waste Room

Figure 1 shows the waste room, which stored radioactive waste containing I-131 radionuclides. Before storing waste for decay, each waste bin or bag must be securely sealed. The medical physicist must place the label on the waste bin, and the label must include the bag number, location (in this case, radioiodine ward number), state of waste, disposed date, and the name of the medical physicist in charge.
The radioactive waste must be stored for up to ten half-lives. The dose rate must be measured after 10 half-lives before being sent as non-radioactive waste. However, the medical physicist, on the other hand, must monitor the dose rate on a regular basis, which is usually done every week. It is possible to store radioactive material until its activity has decayed to negligible levels, after which it can be disposed of as non-radioactive waste.

Figure 2: Radioactive waste measurement

Figure 2 shows the radioactive measurements on the bag's surface using a calibrated survey metre, which is required for dose rate measurement. The dose rate for the radioactive waste to be sent out must not exceed 5 Sv/hr at the surface.

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HPP Straw Innovation Reduce Staff Exposure

By
Aida Nazurah Binti Abu Bakar, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

The Nuclear Medicine Department at HPP introduced an innovative design for Iodine-131 patient dispensing. The idea was introduced by the NUTECH group from HPP in 2015. The group consists of eight members, including Dr. Fadzilah Binti Hamzah, En. Ahmad Akmal Bin Esa, En. Mohd Hizwan Bin Yahya, En. Amir Firdaus Bin Abd Aziz, Pn. Norsuraya Binti Abd Jabbar, Pn. Fatin Nadhirah Binti A Halim, Pn. Noor Azwani Binti Lazim, and En. Abdul Mohsin Bin Shuib.

Due to the increased number of patients, the risk of inhalation, radiation exposure, and contamination during liquid iodine dispensing increases, especially for the Nuclear Medicine Department staff in charge of preparing and dispensing high-activity radioiodine.

The problem was identified during dispensing when the lid of the lead tunnel containing high-activity radioiodine had to be opened and the parafilm used to close the vial had to be discarded, leading to unnecessary exposure for the officer in charge. Another problem arises when the patient consumes the liquid iodine, and the risk of possible contamination occurs because the patient is required to hold the straw due to imbalance and to avoid it from falling, and parts of the straw may be contaminated by the patient's saliva. Moreover, the officer in charge is required to add drinking water to rinse the residual iodine; however, the procedure needs to be done at a close distance from the radioiodine patient. This affects the officer in charge, with unnecessary exposure recorded at 100 mR/hr. When contamination occurs in an isolation room, the room has to be closed for a few days and is unable to be used, making it less cost-effective and reducing productivity.

This innovation aims to reduce the risk of inhalation and contamination and avoid unnecessary radiation exposure for workers involved in radioiodine dispensing. The product design includes a straw, parafilm, butterfly branula, and syringe.

This innovation has benefited the department by reducing operation costs by 99.99% since automated dispensers, which cost approximately RM90,000, are not installed. Furthermore, it also benefits the department by reducing human resources involved in dispensing procedures. This is because the accumulative dose from the whole dispensing procedure is reduced when this innovation is implemented. In addition, this innovation has saved operation time and increased workers' efficiency.

The innovation also won first place at Hari Kualiti Peringkat Hospital Pulau Pinang under the innovative group category.

Area Contamination Monitoring at Nuclear Medicine Department

By
Navanesan Pillai A/L Gopalakrishnan, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

What is Wipe Test?

A wipe test is a procedure used to assess the presence or amount of radioactive contamination on surfaces. It involves using a specialised wipe or swab to collect samples from surfaces such as floors, walls, or equipment in areas where radioactive materials are handled or stored, such as a nuclear medicine department. The result of the wipe test provides information on the level of contamination present, which is important for ensuring compliance with regulatory standards and maintaining a safe working environment. If the wipe test reveals elevated levels of contamination, appropriate decontamination measures can be taken to reduce the risk of radiation exposure.

Purpose of Wipe Test

- To monitor and control radiation exposure risks for workers and the surrounding environment.
- To ensure compliance with regulations that impose limits on the permissible levels of radioactive contamination.
- Emergency preparedness to respond effectively to any incidents involving radioactive materials.

Figure 1: Physicist preparing the swab samples to be analyzed using MCA.

Wipe Test Procedure

- Put on appropriate personal protective equipment, such as gloves and a lab coat, to ensure safety during the procedure.
- Identify the surfaces to be sampled in the controlled areas, such as benchwork, sinks, floors, fume hoods, or other areas where radioactive materials are handled or stored.
- Prepare the necessary equipment, including wipes or swabs and labelled containers for sample collection.
- Begin the wipe collection process by rubbing the designated area with moderate pressure, covering a defined surface area (10 x 10 cm2, HPP). If multiple surfaces are being sampled, use a fresh wipe for each surface to prevent cross-contamination.
- After wiping the surface, carefully place the wipe or swab into a clean, labelled sample container.
- Then, the samples will be sent to the laboratory to be analysed for radioactivity levels using suitable techniques such as gamma spectroscopy or liquid scintillating counting.
- At HPP, the analysis will be done using a multi-Channel Analyzer (MCA).
- The result obtained will be compared with the standard reading limit of a specific radioisotope in compliance with the Nuclear Regulatory Commission.

Figure 2: Wipe test tray designed by Medical Physicist at HPP

Reading Limit for Wipe Test

	I-131, I-125, In-111, P-32, Sr-89, Se-75	F-18, Tc-99m, I-123, Ti-201, Ga-67, Cr-51, Co-57, Lu-177
Control area, Bq/Cm^2	30	300

Controlled Areas at the Nuclear Medicine Department, HPP

Controlled areas are designated to ensure the safe handling and administration of radioactive materials used for diagnostic imaging and therapeutic procedures. Here are some controlled areas found in the nuclear medicine department, HPP:

- Injection Room
- Radioiodine ward
- Hot labs
- Dispensing Room
- Waste Storage

Figure 3: Physicist taking swab sample from fume hood.

Working Principle of MCA: Wipe Test

- The MCA is connected to a gamma-ray detector, which captures the gamma rays emitted from the radioactive materials on the surface being tested. The MCA records the energy of each detected gamma-ray event.
- The MCA uses its capabilities to accumulate and record the energy information from the detected gamma rays over a specific time period (60s, HPP). This data is processed to generate an energy spectrum, which is a histogram displaying the distribution of gamma-ray energies detected during the wipe test.
- By analysing the energy spectrum, the MCA can help identify the specific radioisotopes present in the sample. MCA compares the energies of the detected gamma rays to known energy signatures of various isotopes, aiding in the identification and quantification of the radioactive contamination.
- The MCA provides quantitative information about the levels of radioactive contamination on surfaces. This data can be compared to known calibration standards to estimate the amount of radioactive material present and assess whether it exceeds acceptable limits.

Figure 4: The samples placed in MCA to analyze for any contamination.

Hospital Pulau Pinang Medical Physics Internship: Programme Highlights and Learning Experiences

By
Alia Najwa Binti Isara, USM Internship Student, Nuclear Medicine Department, Hospital Pulau Pinang (HPP)

Hospital Pulau Pinang internship program aims to provide students with a comprehensive understanding of the field of medical physics and its vital role in healthcare. Through a series of interactive sessions, hands-on experiences, and expert-led discussions, interns will gain foundational knowledge and practical insights into the applications of physics in medicine.

Internship students in Hospital Pulau Pinang for 2023

Program Highlights:

1.Medical Physics Fundamentals.
During the first week of internship program, students received a comprehensive overview of the field of medical physics. We explored the diverse applications of medical physics in various aspects of healthcare, including diagnostics, treatment, and patient care. This will help the students to have a solid foundation in the subject.
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2. Diagnostic Imaging Techniques
Students learned about the essential role of medical physics in diagnostic imaging techniques such as X-ray, computed tomography (CT), magnetic resonance imaging (MRI), and ultrasound. We gained an understanding of how medical physicists contribute to image acquisition, interpretation, and the maintenance of image quality and patient safety.

3. Radiation Safety and Protection Training
Besides that, students were provided with in-depth training on radiation safety practises, including understanding radiation hazards, dose limits, and implementing safety measures in clinical settings. We gained an in-depth understanding of the potential hazards associated with ionising radiation and the importance of implementing robust safety measures in clinical settings.
We were exposed to topics such as radiation dose limits, exposure monitoring, and the use of shielding to protect patients, healthcare professionals, and the general public from radiation hazards. Students learned about the various methods and tools used in radiation safety, including dosimeters and radiation monitoring devices.
Through interactive sessions, case studies, and practical exercises, students developed the skills and knowledge necessary to assess and mitigate radiation risks in clinical environments. We learned how to implement safety protocols, ensure compliance with regulatory guidelines, and contribute to maintaining a safe working environment for both patients and healthcare professionals.
Overall, this component of the internship programme aims to equip students with a strong foundation in radiation safety and protection, ensuring they are well-prepared to apply best practises and uphold high standards of safety in their future careers as medical physicists.


Students collected RPL from nuclear medicine staff and these RPLs will be sent to AELB for monthly reading.


The students were given dose calibrator to observe the daily dose received so that it does not exceed 6


The students measured the waste decay at decay tank using survey meter under supervision of physicist.

4. Medical Instrumentation and Equipment

This component of the internship programme focuses on familiarising interns with the various medical devices and equipment utilised in the fields of diagnostic imaging, radiation therapy, and nuclear medicine. Students gained a comprehensive understanding of the design, functionality, and calibration of these instruments, which are essential for accurate and reliable healthcare practises.

Students explored the principles behind the operation of medical devices and equipment commonly used in diagnostic imaging, such as X-ray machines, CT scanners, MRI machines, and ultrasound devices. We learned about the specific components, mechanisms, and technologies employed in these instruments to generate high-quality images. Additionally, students gained insights into the factors influencing image quality, including image acquisition parameters and optimisation techniques.

Furthermore, students explored the instrumentation and equipment used in nuclear medicine, such as gamma cameras and PET scanners. We gained an understanding of the principles of nuclear medicine imaging, radiopharmaceutical administration, and the detectors and imaging systems employed to capture and interpret functional and molecular information.

5. Quality Assurance and Quality Control

In the field of medical physics, quality assurance and quality control play vital roles in maintaining accurate and safe healthcare practises. This aspect of the internship programme focuses on instilling in interns the significance of implementing rigorous quality assurance programmes and adhering to stringent quality control procedures.

Students learned about the various aspects of quality assurance, including equipment calibration, testing procedures, and routine performance checks. We gained insights into the methods used to ensure that medical devices and equipment are operating optimally and producing accurate results. This may involve participating in equipment testing and calibration exercises under the guidance of experienced medical physicists.

Furthermore, students understood the importance of equipment maintenance to prevent malfunctions and ensure consistent performance. We learned about the recommended maintenance schedules and procedures for different types of medical instrumentation and equipment. Students were also exposed to the documentation and record-keeping requirements associated with quality assurance and equipment maintenance.

By comprehending the significance of quality assurance and quality control in medical physics, interns will develop a strong foundation for ensuring the reliability, accuracy, and safety of medical equipment and procedures.

6. Team Bonding Activities during the internship 2023

Team bonding activities during an internship play a crucial role in fostering collaboration, building relationships, and enhancing communication among students and staff. These activities help create a positive and supportive work environment, which ultimately leads to increased productivity and a sense of belonging within the team. Here are some of the team-bonding activities that have been organised in the Nuclear Medicine Department:

Students need to come by 7.30am to conduct daily QC of SPECT/CT

Students performed daily QC of PET/CT under observation of physicist

Students performed daily QC of MyoSpect under supervision of physicist

Throughout the Ramadan month, the muslim students helped Surau Utama Society in preparing and delivering bubur lambuk for everyone around the hospital.

Nuclear Medicine Department organized rumah terbuka for Eid Mubarak.

Students were involved in opening gimmick ceremony for 4th Penang Radiation Protection Day that were held in Dewan Sri Pinang

Kejohanan Bowling PerSkan HPP 2023 was organized by Nuclear Medicine Department and were joined by all of the staff and students.

Research activities

- Estimation of Radiation Exposure from F-18 (FDG) PET/CT Procedure by Aida Nazurah Binti Abu Bakar, Mariah Izzaty Binti Romzi, Keng Qing Le

- Area Monitoring using OSL and Survey Meter in Controlled Areas in Nuclear Medicine Department, Hospital Pulau Pinang by Nur Ezzah Binti Mohd Zubir, Alia Najwa Binti Isara, Navanesan Pillai A/L Gopalakrishnan

- 3D Image-based Dose Validation in Iodine-131 SPECT/CT Phantom Studies by Nurul Aqilah Binti Abdul Malik, Wan Nur Qhairunnisa Binti Wan Ahmad Kamal,

Closing

Thank you!

We want to thank and express our gratitude to everyone who has been a part of my life and this journey. Every drop in the ocean counts, and I will never forget those who helped me in sailing through difficulties deserve a portion of this reward.

By Team Medical Physics Bulletin Task Group, Ministry of Health Malaysia

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Health is the greatest of human **blessings**. - Hippocrates