Information on Radiation Dose in Medical Exposures at UPMC Whitfield Hospital 2024.

Introduction

The use of ionizing radiation in medical imaging is critical for diagnosis and treatment planning. However, it is essential to manage radiation exposure effectively to minimize risks to patients while ensuring high-quality diagnostic information. As per the requirements of Statutory Instrument 256 (2018) regarding the documentation of radiation doses in medical report, UPMC Whitfield's current Radiology Information System (RIS) and Picture Archiving and Communication System (PACS) do not provide functionality for detailed dose tracking and reporting directly within the system. This limitation necessitates alternative solutions to ensure that radiation dose information is accessible to both healthcare professionals and patients.

To address this gap, the report footer directs the referrer and/ or patients to the UPMC Whitfield Hospital webpage. This resource includes comprehensive information on average radiation doses for various modalities and examinations, allowing for informed decision-making and enhanced patient education regarding the potential risks and benefits of radiological procedures.

Justification

Justification refers to the principle that any medical exposure to radiation must provide a net benefit to the patient. However, even small radiation doses are not entirely without risk. In radiology, all radiological investigations must be justified in advance by ensuring that:

- Each imaging procedure is necessary for the patient's care.
- The clinical benefits outweigh the risks associated with radiation exposure.

Prior to conducting any radiological examination, the referrer should assess the clinical indications and consider alternative non-radiation-based diagnostic methods whenever possible.

Optimisation

Optimization is the process of ensuring that the radiation dose is kept as low as reasonably achievable (ALARA) while still achieving the required diagnostic quality. The legislation introduces the concept of diagnostic reference levels (DRLs). These levels are based on dose data for a range of commonly requested procedures collected from a large number of Irish hospitals, and are regularly updated. UPMC Whitfield has developed a set of local DRLs for a range of standard examinations, and monitoring of performance against these levels is an important component of dose optimisation in our department.

Key elements include:

- Technical Factors: Adjusting machine settings to achieve the best possible image quality with the lowest dose.
- Protocols: Developing and adhering to standard operating procedures for each type of examination to ensure consistency and safety.
- Training: Ensuring that radiology staff are well-trained in dose management and aware of the latest best practices.

Continuous quality improvement processes are implemented to monitor and enhance radiation dose management practices.

Radiation Dose Management

Radiation dose management is crucial for patient safety and effective service delivery. The main objectives include:

- Patient Safety: Minimising unnecessary radiation exposure reduces the potential risk of radiation-induced conditions.
- Regulatory Compliance: Adhering to HIQA and other regulatory standards ensures the organisation meets legal and ethical obligations.
- Public Trust: Demonstrating a commitment to safety and quality in radiological practices fosters trust between patients and healthcare providers.

Accessing Radiation Dose Information

Healthcare providers can access the average radiation dose information through the following link, UPMC Whitfield Hospital Radiation Dose Information: https://upmc.ie/services/radiology.
This resource provides valuable insights into radiation doses associated with different examinations, helping to ensure that patients receive appropriate care with minimal radiation exposure.

Conclusion

Adhering to the principles of justification, optimisation, and effective radiation dose management is essential in radiology. By leveraging available resources, including the UPMC Whitfield Hospital webpage, we can enhance patient safety and care while navigating the current limitations of our systems. Continuous monitoring and improvement in our practices will help us achieve the highest standards in radiological imaging.

Radiation doses received during medical procedures as per HSE guidelines: https://www.hse.ie/eng/about/who/acute-hospitals-division/radiation-protection/radiation-doses-received-during-medical-procedures/

Dose Bands for typical adult examinations: https://www.hse.ie/eng/about/who/acute-hospitals-division/radiation-protection/nrpc%20risk%20table%20adults%20.pdf On display in UPMC Radiology Department Patient waiting areas for patient information and reference.

Patient Information: **FORM-XRAY-050 Radiation Information Leaflet and Consent – Radiological Examination**
The above Consent form is reviewed and signed by all patients attending UPMC Whitfield Hospital for radiological examinations in advance of their procedure.

HSE.ie: radiation doses received during medical procedures

X-ray or DEXA

One x-ray or DEXA (bone density scan) has a very low dose of radiation.

They all use a radiation dose of less than 1 mSv.

There is almost no risk.

CT scans

The risks associated with a CT scan will vary depending on the radiation dose used. The dose used depends on the area of the body involved and the type of CT that's done.

Here are some examples to help explain this.

Head, chest or abdomen CT scan

CT scans of the head, chest or abdomen involve a radiation dose of less than 10 mSv.

The radiation risk is minimal to very low.

CT-TAP and PET-CT scans

A CT-TAP scan is a scan of the thorax, abdomen and pelvis. A PET-CT scan shows how your body's cells are working. They both involve a radiation dose of more than 10 mSv.

The radiation risk is low.

Nuclear medicine

If you have a nuclear medicine scan, your radiation risk is low.

But you should minimise your contact with other people. This is because you may be radioactive for at least 24 hours so you could expose people near you to radiation.

It is important to follow the advice you get when going home from the hospital.

Interventional radiology

The risk associated with interventional radiology procedures varies but it is low to moderate.

The level of risk depends on:

- the area of body exposed to radiation
- the type of procedure performed
- how long the procedure took

Interventional cardiology

The risk associated with interventional cardiology procedures varies.

The radiation risk is low to moderate.

The level of risk depends on the:

- the type of procedure performed
- how long the procedure took

Radiotherapy

The aim of radiotherapy treatment is to deliver as much radiation as possible to kill the diseased tissue while limiting the damage to healthy tissue.

Radiotherapy treatment is different for every patient. The radiation dose you get depends on the type of cancer you have and where you have it. Your radiotherapy team will explain how many radiation doses you will get.

Your radiation oncologist prescribes the radiotherapy dose. Treatment is usually given over the course of several sessions for a set time. In some cases, a single radiation dose is prescribed. You may also need diagnostic imaging procedures such as CT scans or x-rays. This will be part of your radiotherapy care plan.

The lifetime risks associated with radiotherapy treatment will vary. Talk to your radiotherapy team for more information.

Dose bands for typical adult examinations (iRefer/ESR/ACR)

	NON IONISING RADIATION	☢ NEGLIGIBLE RISK	☢☢ MINIMAL RISK	☢☢☢ VERY LOW RISK	☢☢☢☢ LOW RISK	☢☢☢☢☢ MODERATE RISK Adapted from ACR/ESR referral guidelines to reflect certain procedures that may occasionally have a higher associated Radiation Dose than 30mSv
Examples (RCR,2017)	MRI US	Chest X-Ray Limb X-Ray Lumbar spine X-Ray Mammography	IVU Nuclear Medicine: Bone-scan CT Head	CT Chest CT abdomen	CT Thorax Abdomen Pelvis. Some Interventional cases Some Nuclear Medicine scans Some PET/CT scans	CTA Chest/Abdo/Pelvis with contrast. Interventional Radiology e.g. Transjugular Intrahepatic Portosystemic Shunt (TIPS)
Comparison to background radiation (4.00 mSv per year in Ireland RPII, 2014)	No known radiation risk	A few days worth	A few weeks worth	A few years worth	5-10 years worth	7.5 – 25 years worth
Lifetime additional Potential Risk of cancer/exam (RCR, 2017) (NCRI, 2017)	No known radiation risk	Less than 1 in 20,000 chance of causing cancer	1 in 20,000 to 1 in 4,000 chance of causing cancer	1 in 4,000 to 1 in 2,000 chance of causing cancer	Less than 1 in 2000 chance of causing cancer	1 in 1,000 to 1 in 500
Typical effective doses (RCR, 2017)	0	0-1 mSv	1-5 mSv	5-10 mSv	10+ 29mSv	30mSv to 100mSv
Examples of Effective Doses (RCR, 2017)	0	Limbs < 0.01mSv Chest: 0.015mSv T-spine: 0.4mSv L-spine: 0.6mSv	Bone-scan: 3mSv Barium enema: 2.2mSv	CT chest: 6.6 mSv CT abdomen: 5.6 mSv	CT Thorax Abdomen Pelvis: 10mSv Whole body PET/ CT: 18mSv	TIPS: 70MSv
National DRL examples (HIQA, 2021)		Chest PA: 0.16 Gy.cm² T-spine (AP & Lat): 3 Gy.cm² L-spine(AP & Lat): 4.3 Gy.cm²	99m Tc Bone-scan: 600MBq Barium enema: 21 Gy.cm²	CT Thorax: 310 mGy.cm CT abdo/pelvis: 556 mGy.cm	CT Thorax Abdomen Pelvis: 770 mGy.cm Whole body PET/ CT: 380MBq (injected activity) + 770 mGy.cm CT TAP	(TIPS)/ Portal Hypertension: 186 Gy.cm²
Equivalent Chest X-Ray (RCR, 2017)	0	1 to 100	100 to 200	200 to 400	400 to 1200 +	2,000 to 6000+
Transatlantic Flight (One way) (1 transatlantic flight=0.08mSv, Public Health England, 2011)	0	0 -12.5	12.5 - 62.5	62.5 -125	125+	375-1,200

*Paediatric patients vary in size-dose and risk will vary significantly from those to adults

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Patient Information

UPMC | WHITFIELD HOSPITAL

RADIATION INFORMATION LEAFLET AND CONSENT – Radiological Examination

About X-rays and Radiation

Every day, we are exposed to natural sources of radiation such as the sun, the earth and some gases in the air. This is known as background radiation. Radiation energy can also be created artificially in a variety of sources such as microwave ovens, ultraviolet lamps, X-ray machines and radioactive sources. It is measured in units of millisieverts (mSv). On average, each person in Ireland gets 3.5 millisieverts (mSv) of ionising radiation each year from natural sources.

Radiation Risk

Exposure to large amounts of radiation is not advisable. There is no direct evidence that low exposures to radiation are harmful, but it considered prudent to limit exposure to the lowest amount possible. Hospital staff strive to keep radiation levels as low as reasonably achievable. View the following table to put radiation exposure levels into perspective:

Radiological Examination	Effective Dose in mSv	Level of Risk	Comparison to background radiation (3.5mSv)	Lifetime potential risk of causing cancer/exam	Equivalent dose to Transatlantic Flights
DEXA (whole body)	0.01 mSv	Negligible Risk	A few days	< 1 in 20,000	0-12.5
XR Limbs	< .01 mSv				
XR Chest	0.015 mSv				
XR Thoracic Spine	0.4 mSv				
XR Lumbar Spine	0.6 mSv				
XR Pelvis	0.29 mSv				
CT Head	1-5 mSv	Minimal Risk	A few weeks	1 in 20,000 to 1 in 4,000	12.5-62.5
CT Chest	6.6 mSv	Very Low Risk	A few years	1 in 4,000 to 1 in 2,000	62.5-125
CT Abdomen	5.6 mSv				
CT TAP	10 mSv	Low Risk	5-10 years	<1 in 2,000	125+
PET CT Whole Body	18 mSv				

Table 1*: Risk/benefit communication tool,* IIRRT, 2020 and *Information on Patient Radiation Doses, Ireland,* MERU, 2013.

Radiation in Healthcare

Radiation is used in X-ray, CT, PET CT, DEXA, Fluoroscopy and Theatre imaging. These involve the controlled use of ionising radiation to acquire detailed images of your anatomy. These exams can play a key role in your diagnosis and treatment pathway. All medical exposures to radiation are justified in advance of the procedure. Procedures are deemed justified if the benefit to the patient is greater than the risk of radiation. The justification assessment is completed by your doctor and radiographer/ radiologist.

Further precautions

If you have had an X-ray and/or CT in the recent past, please inform a staff member to ensure that tests are not duplicated unnecessarily. If you are within 12-55 years and have childbearing capacity, hospital staff must consider the possibility that you may be pregnant. If you are unsure whether you are pregnant or not, please mention this to the radiographer before the start of your X-ray.

Patient Consent to proceed with examination:			
Name:		DOB:	__/__/____
Exam:		Weight:	kg
Sign:		Date:	__/__/____

For Official Use Only (Time Out of Exam): (Tick upon completion)

Paused, (Patient ID, Justification, LMP)	
Anatomy (Correct site, side, marker)	
User checks (Correct protocol, Radiation Safety)	
System & Settings (Correct Patient/Exam, AEC)	
Exposure (ALARA. Additional views, DRL)	
Draw to a Close (Image quality, PACS, RIS closure/ Report Priority)	

Radiographer Initial: _____ Date: ___/___/___

References:

HIQA: Regulation of Medical Exposure to Ionising Radiation, 2024.
https://www.hiqa.ie/areas-we-work/ionising-radiation/regulation-medical-exposure-ionising-radiation

HSE: Radiation doses received during medical procedures as per HSE guidelines:
https://www.hse.ie/eng/about/who/acute-hospitals-division/radiation-protection/radiation-doses-received-during-medical-procedures/

FORM-XRAY-050 Radiation Information Leaflet and Consent – Radiological Examination, 2024.
UPMC Radiology Department – Document Portal.