



Conclusion: This study proposes a method to evaluate lifetime effective risk of radiation-induced cancer from screening mammography in order to compare different mammography screening programmes. Work will be extended to assess the repeatability of results for a single machine and also across a range of mammography machines.

Radiation protection and quality assurance

P182 CR mammography image uniformity

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The detector uniformity measurement has historically been a part of prescribed mammographic QA programmes[1]. Many mammography units using CR under are beyond the 10% remedial level for this test, as carried out according to national guidance[2]. Direct digital mammographic systems on the other hand, exhibit very good uniformity.

The objectives of the project were to:

- Explore factors affecting CR uniformity
- Identify whether the current uniformity test gives useful information on a CR system
- Compare the remedial findings with any clinical issues reported
- Ascertain whether the current remedial level used in this test is appropriate for CR systems.

Various factors affecting image uniformity were identified, but the main finding was that beam uniformity was very close to the tolerance without adding any non-uniformity from the rest of the system.

Discussions at a national meeting found that if this test resulted in even a few percent non-uniformity for digital systems, the Medical Physics service would recommend flat-fielding calibration. For CR mammography, 8-19% non-uniformity is an expected finding. Therefore the published remedial level is not being used for this test. With no clinical issues reported from any of our CR centres, it is questionable whether 10% is relevant to today's image display systems. The author questions whether the published tolerance needs to be revised to separate tolerances for CR and digital imaging systems.

[1] NHSBSP report 0604 version 3 (2009), IPEM report 89 (2005), European guidelines for quality assurance 4th edition, IPEM report 32 vii (2010) [2] NHSBSP report 0604 version 3 (2009)

P183 Medical student awareness of radiation legislation and exposure - a quality improvement project

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Aims: Doctors requesting imaging have a legal obligation to comply with The Ionising Radiation (Medical Exposure) Regulations (IRMER). This is endorsed by guidelines from the Royal College of Radiologists (RCR) and the GMC. However, studies show postgraduate knowledge of radiation protection is poor and few receive undergraduate training. We aim to assess knowledge of radiation legislation and exposure amongst medical students and to suggest how education could be improved.

Methods: An anonymised questionnaire, developed from RCR AuditLive, was completed by third year students. Formalised departmental teaching was then undertaken. Students were educated on IRMER regulations and current RCR advice on image requesting. They were then asked to complete a post study questionnaire.

Results: 31 students completed the pre intervention questionnaire (response rate 100%). Only 10% had prior teaching on radiation exposure and 77% were not aware of national legislation about radiation. The mean score for a) dose estimation and b) risk of malignancy from exposure to common radiological procedures was 11% and 23% respectively. A post intervention questionnaire (response rate 97%) showed that student's mean score rose to 62% ($p < 0.001$) for dose estimation and 87% ($p < 0.001$) for risk of malignancy. 100% found the teaching a useful experience.



Conclusion: These results highlight a lack of knowledge about radiation exposure and their risks among current medical undergraduates. Formalised departmental teaching can improve awareness and is popular amongst students. As future medical practitioners they will be better able to inform their patients of relative risks of investigations and help them avoid unnecessary exposure.

P184 Emergency department appendicular radiography referrals: do they meet IR(ME)R requirements?

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Aims/objectives: Radiology requests are essential communication tools between the clinician and radiology. This study investigated IR(ME)R 2000 adequacy of appendicular X-ray requests to establish if rotational junior doctors changed request compliance compared with their placement start and following teaching/practical experience?

Content: 393 medical and non-medical referrals for Emergency Department appendicular plain radiography examinations during February and June 2014 were evaluated by reporting radiographers. Referral analysis asked whether trauma, mechanism of injury (MOI), specific site of concern and clinical question featured in requests. Clinical portal history details were compared with the request. This established if projections obtained or report content required change.

Relevance/impact: IR(ME)R requirements are not being met. This investigation establishes areas of weakness and whether in-house education is sufficient or requires change to have an impact.

Outcomes: 81% of staff was included in both months. Rotational doctors and nurse referrers made most requests. Doctors results overall showed no significant change however, consultant compliance almost doubled; Staff grade doctors improved inclusion of a clinical question and specifying site of concern. Junior doctors results decreased in most areas. Nurses included more MOI and Band 5 nurse referrers also included more trauma details.

Clinical history on portal was absent 39%; when available, 62% and 53% respectively matched requests with incorrect projections possible 6% of examinations.

Discussion: Referring staff require education on the requirements of IR(ME)R as radiographers follow protocol and reporters adjust interpretation to enhance patient pathway.

P186 Measurement uncertainties in diagnostic radiology QA testing

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Quality control on X-ray imaging systems involves making measurements of radiation quantities, for example radiation output or beam alignment using specialist testing equipment. Each measurement is compared to some expected value, or a baseline value to determine whether it is within tolerance. A report is prepared by medical physics staff that is sent to the radiology staff. It is important to ensure that the values reported to the customers together with the tolerances applied to these values are based on sound metrology.

National Physical Laboratory documentation was used to investigate the current method for assessing uncertainties. This method was used to create an educational presentation, an assessment tool and a spreadsheet to aid calculations. Within Diagnostic Radiology the tools were used to assess uncertainties across all modalities - radiography, fluoroscopy, CR, DR, CT, mammography, dental and specimen cabinets.

Sources and magnitudes of uncertainties for the input quantities of our calculations were determined. Uncertainties were assessed and combined using a standard summation in quadrature method.

Once we are aware of the measurement uncertainties, we have several choices of how to deal with them. We could accept the uncertainty, minimise it by measuring in a different way or using different equipment or report a different metric. Several worked examples are shown using the tools that were developed.

This work has informed improved testing, data analysis and reporting methods. We now have confidence in our measurements and our customers have reports that are consistent with the measurement techniques used.



P187 Radiology quality manager: Isn't it time you had one?

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Aims/objectives: Clinical governance (quality) is quite rightly increasing in importance in radiology departments. There is an increasing administrative workload as a result. This was impacting significantly upon the radiographer and radiologist who were the governance leads. We needed to find a solution. Due to the shortage of radiographers, the decision was made to create a specific administrative post of 'radiology quality manager'.

Content: The quality manager is crucial in ensuring effective delivery of clinical governance requirements, including effective implementation of policies, procedures and operational plans.

The role includes monitoring compliance of the quality performance indicators within the Radiology department. Complaints, incidents and concerns within the department need to be responded to appropriately and outcome measures implemented. The production of the audit plan, initiating audits in a timely manner and ensuring the learning outcomes are discussed and actions implemented is an important component of the post.

Relevance/impact: Safety is central to practice within the NHS. There is a significant administrative burden that goes with this. The development of a dedicated governance role in the department has significantly aided departmental governance and reduced pressure on clinical staff.

Outcomes: The most challenging role of the quality manager is to successfully develop and maintain a culture whereby clinical governance, quality and patients' safety becomes an integral part of Radiology processes.

Discussion: This has been a very successful appointment supporting busy medical staff in radiology. It is a solution that other departments may wish to emulate.

P188 Establishing a local CT dose reference level in a large hospital setting

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To establish a local CT diagnostic reference level (DRLs) in a large hospital (that uses 7 CT scanners) by collecting the radiation doses of the three most frequently performed CT examinations.

With the extensive use of CT scanners as a diagnostic tool but also the greatest potential for harm, some form of assessment is required to ensure that patient receives the lowest radiation dose possible. DRL will be the first step to ensure that variations in radiation dose for each CT scan across patients and facilities are consistent. Although DRL was recommended by ICRP in 1996, the only established DRL are from US and UK, which is not compatible to Asian context due to the difference in the body size. Thus, a local DRL would be preferred.

With availability of a local DRL, dose optimization can be achieved as it injects a form of stimulus for CT radiographers to observe and even boost their current practices for improvements in relation to radiation protection. DRLs can also be a form of quality control for optimizing scan performances on all of the CT scanners.

CT radiation dose data; CTDIvol and DLP of 10 average-sized patients from the three most commonly performed CT examinations were collected. Data of each category were calculated for the mean of CTDIvol and DLP value. The 75th percentile was used to calculate a local DRL for each of the three most commonly done CT examinations. The results obtained were then compared to US and UK DRL data.

P189 Are clinicians aware of referral criteria for medical exposures?: Legal obligations and practical considerations

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Norwich Radiology Academy

Aims/objectives: It is a legal requirement under IRMER for all radiology departments to supply clinicians with information about referral criteria and radiation doses. This audit was designed to assess the Norfolk and Norwich



University Hospital Trust's adherence to this statutory requirement. A possible link between access to such guidelines and awareness of radiation doses among clinicians was also assessed.

Content: The poster will outline how the information was obtained through an online survey with results displayed in a variety of graphs followed by analysis and discussion.

Relevance and impact: Most radiology departments are unaware of their obligations to provide clinicians with information about referral criteria and radiation doses. Lack of compliance could result in legal action under the Health and Safety Workers Act, and it might also lead to patient harm through inappropriate scans.

Outcome: Majority of clinicians at the Norfolk and Norwich University Hospital Trust were unaware of local or national radiology guidelines. A similar lack of knowledge of radiation doses of common investigations was also demonstrated.

Discussion: Lack of access to referral guidelines such as iRefer could explain the poor knowledge among clinicians of common radiological investigations, which might be impacting on patient care. Consequently an educational programme has been devised to address this issue. This includes promotion of current guidelines through Trust induction, emails and duty sessions. The effectiveness of this intervention will be re-audited in one year.

P190 Communicating risk in research involving ionising radiation

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There are many guidance documents relevant to ionising radiation used in medical research[1]. In the process of set-up for research involving the NHS, the application is reviewed by a research ethics committee, submitted to the competent authority and the NHS Trust sites involved, to obtain NHS Permission (R&D approval). Part of this review examines the articulation of radiation procedures and their risk, as described in the participant information.

The author describes the methodology of the radiation governance process for research, the various legislations and policies applicable to the context, and discusses the rationale behind articulating radiation exposures in the process of informed consent. Examples of proportionate, effective language describing ionising radiation in participant information are provided, as well as common mistakes in the chosen language of patient documentation.

[1] IR(ME)R 2000, The Medicines for Human Use (Clinical Trials) Regulations 2004, The Research Governance Framework for Health and Social Care 2nd Edition, Approval for research involving ionising radiation Version 2 September 2008

P191 Standardisation and optimisation of CT protocols using the Philips CT DoseRight 2.0 automatic exposure control system

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Given the increasing use of CT in the UK over the last 30 years, it is essential to ensure all imaging protocols are optimised to ensure radiation doses are as low as reasonably practicable, consistent with the intended clinical task. However, the additional complexity of modern CT equipment, with a range of 'dose saving' functions can make this task difficult to achieve in practice.

In our Trust, routine patient dose audits demonstrated clear differences between scanners for what were otherwise meant to be identical scan protocols. This was due to variations in CT protocol setup that were primarily due to drift in the setup of the CT Automatic Exposure Control on the Philips Brilliance DoseRight (version 2.0) systems. A simple technique that uses a uniform phantom to generate reference images for each clinical protocol has been developed, which has resulted in standardised and stable setup of all clinical protocols on four Brilliance scanners. This has been confirmed with subsequent patient dose audits. This technique has been extended to include matching imaging performance of these protocols to a Toshiba Aquilion 64, and the results of this exercise will be presented.



The results of this work have highlighted the importance of CT protocol harmonisation in a modern Radiology department to ensure both consistent image quality and radiation dose. Following this study, the average radiation dose for a range of CT examinations has been reduced without any negative impact on clinical image quality.

Other

P192 Non-destructive imaging: evaluation of archaeological dentition specimens

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Key learning objectives: To review the role of radiographic imaging techniques used in the non-destructive investigation of archaeological dental bone specimens. To illustrate, with examples, the utility of extra- and intraoral radiographic imaging techniques in the visualisation of the dentition and surrounding bone.

Description: Caries and other abnormalities on the exposed surfaces of the teeth in archeological specimens can be detected by visual inspection, but abnormalities concealed on the interproximal surfaces are more difficult to detect. Radiographic analysis can reveal; apical infection, periodontal status, presence and position of unerupted teeth and root morphology, and a detailed evaluation of apical cysts and other lesions within the alveolar bone. Differences in bone preservation state require suitable adjustment of imaging parameters and the capability of digital image capture utilising extra- and intraoral techniques is of great benefit here. Specifically, soil invasion into the medullary cavity can be missed during macroscopic examination, but will appear as an artefact on a digital radiographic image; similarly differences in decay and diagenesis of remains after death can be accurately visualised by radiographic imaging techniques and enhanced during post-imaging manipulation of the digital data.

Conclusion: Both extra- and intraoral imaging techniques are deemed more sensitive than conventional methods to evaluate the dentition from archaeological specimens. Both techniques are capable of producing images in a variety of planes and demonstrating anomalies on interproximal surfaces of teeth, which provide archaeologist's and osteologists with accurate information in relation to understandings about the way of life of the individual and cultures studied.

P193 Multiparametric MRI of anterior prostate cancer with histological correlation

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Multiparametric MRI has emerged as an important tool in the diagnosis of clinically significant prostate cancer. The addition of functional imaging - Diffusion Weighted Imaging and Dynamic Contrast Enhanced Imaging to T1 and T2-weighted imaging has improved prostate cancer detection rates. Targeted biopsy based on prebiopsy MRI-detected lesion improve detection rates, volume and grade of anterior prostate cancer compared to standard systematic biopsy.

We present a pictorial review of patterns of anterior prostate cancer detected on multiparametric MRI with histological confirmation obtained using Trans Rectal Ultrasound Guided targeted biopsy with cognitive registration.

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