

## CTPA PROTOCOL OPTIMISATION AUDIT: CHALLENGES OF DOSE REDUCTION WITH MAINTAINED IMAGE QUALITY

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### **Abstract**

The aim of the audit was to assess CT pulmonary angiogram dose and image quality in a large teaching hospital (Royal Infirmary of Edinburgh). Random patients undergoing chest CT during a one-week period were analysed.

DLP (dose length product), patient size and objective quality parameters (contrast to noise ratio and signal to noise ratio on standardised levels) were recorded as well as a subjective image quality evaluation carried out independently by three specialist cardiothoracic consultant radiologists.

The average CTPA DLP was significantly higher than both local and national DRLs (559 mGycm vs. 300 mGycm and 400 mGycm, respectively). This triggered an investigation, supported by the medical physics department. An equivalent assessment was carried out on a same size cohort in a different tertiary health care centre (Western General Hospital), as well as a comparison with dose audits carried out retrospectively at RIE, WGH and two other NHS Lothian hospitals (St John's Livingston and Royal Victoria Kirkcaldy).

Moreover, experimental tests using anthropomorphic chest phantoms were performed, using different scan parameters.

In light of the above analysis, two of the scanner settings for CTPA were modified, i.e. the SureExposure pre-set was changed to "low dose" noise level, quantified with standard deviation (SD) of 19, and the minimum amperage setting lowered from 80 mA to 40mA.

A second cohort of patients using the new protocol was subsequently audited at RIE, showing a reduction of average DLP (359 mGycm), while the image quality was preserved.

**Keywords:** CT pulmonary angiography, dose reduction, image quality, DLP, multi-centre audit

## Errors within the chest region: anatomical based checklist derived from discrepancy meeting database

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### Background

Discrepancy meetings are an integral part of continued professional development. Error types have been classified and but specific patterns of anatomical sites of error have not been previously evaluated in a systematic fashion. We set out to interrogate a large discrepancy meeting database with the aim of deriving a short "checklist" of specific anatomical review areas where errors occur commonly.

### Methods

A discrepancy meeting database from a single centre was retrospectively reviewed from a period covering 5 years. Errors were classified by type, modality, body system and specific anatomical location. Frequency of anatomical location within the chest region were then analysed to derive common anatomical locations of errors.

### Results

There were 561 errors in 477 examinations, of which 99 errors occurred in the chest region. Fifty eight of the errors occurred in CT examinations, 39 in plain radiographs and an error each in MRI and fluoroscopic examinations. 92 errors were observational where 68 were false negatives, 18 were misclassification and 6 were false positives. In CT examinations, we commonly missed pulmonary nodules (14), bone lesions (10) and pulmonary thromboembolism (10). Missed pathology in chest radiographs were pulmonary nodules (15), bone lesions (9) and mediastinal masses (5). The missed pulmonary nodules ranged in size from 2 to 64mm. Commonly errors occurred in the lung bases on CT, lung apices on chest radiographs, vasculature tree, bone and mediastinum.

### Conclusion

Brief, targeted review of common anatomical sites error using evidence-based review area checklists has the potential to maximize the use of the limited time available to the reporting radiologist.

## **Teaching from every angle: imaging education using online case-based teaching and 3D technologies.**

**Scottish Radiology Society AGM 2016**

*DAJ Smith, JB Jones, University of Edinburgh*

**PURPOSE:** As access to imaging increases, radiologists have increasing opportunities to engage in undergraduate and postgraduate teaching. Current imaging teaching and the potential of innovative online approaches and novel technologies were assessed.

**METHOD:** Final year students and new doctors in Edinburgh were surveyed on their radiology exposure and use in practice. Targeted case-based Radiopaedia playlists were designed for students addressing curriculum topics in surgery, neurosciences and orthopaedics, followed by teaching sessions with a radiologist. Normal skeletal anatomy was viewed and manipulated on a touch-sensitive 3D imaging table (Sectra) with further discussion on common and important fractures. Collaborative programmes for postgraduates have also been developed covering local policies (NG tube placement) to international audiences (FRCR rapids practice).

**RESULTS:** Four in five Foundation doctors used imaging every day however 20 of 120 respondents claimed to have received no dedicated undergraduate radiology teaching. When it did happen, teaching from radiologists was highly valued. Our undergraduate sessions were highly rated (4.65 in a 1 to 5 scale) with similar local feedback from post-graduates. The 3D imaging table used to relate anatomy to imaging and pathology was highlighted, and students valued the opportunity to go through imaging on a case-by-case basis.

**CONCLUSION:** Interactive anatomy teaching from radiologists in early undergraduate placements can act as a good introduction to clinical imaging, which is valued by students and Foundation doctors. Tailored teaching on Radiopaedia is also popular across all groups with many versatile uses, a growing online reach and a global collaborative team of radiologists and radiographers.

## Ferumoxytol MR angiography: a new tool to provide high quality imaging in patients with advanced renal failure.

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### Purpose:

Gadolinium-based contrast for MRA in patients with renal failure are avoided due to the potential risk of nephrogenic systemic fibrosis. Alternative imaging methods also have drawbacks, eg. radiation from CT. Ferumoxytol is an ultrasmall superparamagnetic iron oxide compound, designed to be a MRI contrast agent. We are developing Ferumoxytol MRA (FeMRA) as an alternative to current imaging.

### Methods and materials:

Patients with a clinical indication for imaging are offered FeMRA as an alternative to any other planned imaging test. This is performed using a similar protocol to our usual local MRA, with repeated sequences to allow optimal dose calculation. The scans are reported by radiologists with a vascular interest, discussed with the multi-disciplinary team and used to plan the patient's management (angioplasty, surgery etc.)

### Results:

48 patients have had FeMRA. It has planned renal transplantation, assessed for potential angioplasty sites in claudicants, planned renal artery stenting and assessed failing fistulae. Non-vascular applications have been explored by design (assessment of a renal cyst) and by coincidence (incidental renal tumour.) The only case in which imaging quality was suboptimal was one in which the patient could not comply with breath holding.

### Conclusion:

FeMRA has huge potential in the renal failure population. We have begun to deliver a service and optimised dosing with this new agent. A formal non-inferiority comparison study is soon to commence to take this novel imaging method forward.

**Title:**

MR-Eye: The role of high resolution microscopy coil MRI (MCMRI) for the assessment of the orbit and peri-orbital structures.

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**Abstract:**

MCMRI allows high resolution imaging of the orbits, aiding pre-operative decision making based on lesion involvement of critical structures. In this educational presentation the audience will:

- Become familiar with the technique used for MCMRI of the orbits
- Appreciate the anatomy of the orbits as demonstrated on MCMRI
- Understand the added benefit MCMRI provides for surgical planning
- Appreciate the appearances of various vascular, benign and neoplastic lesions and through these cases highlight important learning points
- Identify the pearls and pitfalls of the technique

Anne Hollman Submission

Title: The Consent Process for Image Guided Biopsies at the Borders General Hospital

Dr Tom Blankenstein, Dr David Fraser, Dr Simon McGurk  
ST5 Clinical Radiology

Introduction

Patients have a fundamental right to self determination. In order for the competent patient to give consent they must have sufficient information on which to base their choice to go ahead with an investigation or treatment. The need for this is based on established legal principles and professional standards. This is particularly important in the field of radiology when performing image guided procedures such as biopsies. This project set out to establish if the consent process for image guided biopsies met the legal and professional requirements.

Methods

An initial audit was performed to assess the rate of documented evidence of consent and on the rate that specific risks were documented in patients undergoing image guided biopsy in our department. Following the initial cycle, an updated consent form was introduced and the process was changed, with the intention of improving the documentation of the consent process. A second audit cycle was the carried out.

Results

Documented evidence of consent was found in 76% of cases in cycle 1, and 91% of cases in cycle 2. Specific risks were documented in 20% of cases in cycle 1, and 91% of cases in cycle 2.

Conclusion

The consent process documentation was substandard in our department. After the first cycle, a significant improvement was observed, but almost 10% of cases still fell below the required standard. A third audit cycle is planned following a period of re-education and review.

# **Appropriate use of CT pulmonary angiography in suspected acute pulmonary embolism. Do clinicians apply risk stratification methods before requesting?**

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**Background:** Computed tomography pulmonary angiogram (CTPA) is the investigation of choice in patients with a high clinical suspicion of suspected pulmonary embolism (PE) and in those with pre-existing pulmonary disease (1,2). The Royal College of Radiologists (RCR) and British Thoracic Society (BTS) guidelines recommend that patients with a low/intermediate clinical probability and negative D-dimer do not need CTPA to exclude PE (1,2).

**Method:** A retrospective study of all the inpatient CTPA scans that were conducted over the six-month period of February to August 2016 were reviewed at University Hospital, Ayr. Primary aim was to determine the rate of positive inpatient CTPA findings. Secondary aims included monitoring of the use of D-dimer rule and the calculation of Wells/Geneva Score in stratifying the risk of PE.

**Result.** Of the total of 342-inpatient CTPA scans, only 11% (n=38) were positive for PE. An initial probability score was available in only 10% (n=33) of the total 342 scan requests. 12% (n=4) of these 33 scans with a calculated score (3 moderate, 1 high on Wells score) were positive for PE. D-dimer result was available in only 44% (n=149) of the total scan requests.

**Conclusion:** In the current study, CTPA scans was positive for PE in only 11 % cases compared to the acceptable findings of between 15.4 and 37.4% at the regional centres (3). There was poor utilisation of D-dimer rule and risk stratification of suspected PE using Wells/Geneva Score by the requesting clinicians before submitting the request for CTPA.

**Word count 245.**

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