

P-141 Pictorial review CT head soft tissue normal variant pitfalls

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Intended learning outcomes - To recognise the varied neurological appearances of soft tissue normal variants with the brain. Highlighting the importance of differentiation of normal and variant anatomy from the pitfalls of misdiagnosing a pathological condition

Content -Pictorial review of 12 common examples of neuroradiological normal variant conditions of the brain, including cerebellum, ventricles, and calvarium.Relevance -There are an increase of radiographers taking up CT Head Reporting courses throughout the country due to the increased workload of CT departments and NHS funding of stroke units in district general hospitals

Outcomes - To increase reporting radiographers and CT radiographers knowledge and learning of cerebral anatomy and variants.

Discussion - The differentiation of a normal anatomical variant tends to come from experienced recognition of established patterns of variation from either empirical visual assessment or evidence based research material that allow the reduction of false-positive findings and reduce unnecessary additional diagnostic imaging.

Patient dose measurement and management**P-142 The incidence of contrast induced nephropathy in EVAR procedures**

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Contrast media is often used in imaging and non-invasive procedures such as endovascular aneurysmal repair to enhance an image profile. The most commonly used contrast media have previously been gadolinium and iodinated contrast media.

Contrast induced nephropathy is the most frequently used term to describe kidney injury seen after exposure to iodinated contrast media. It has been defined as increase in serum creatinine by 44micromols or >25% serum creatinine rise above baseline within 48 hours after contrast administration. (ESUR guidelines 2007)

Aim: To assess the comorbidities of each patient and to find the optimal amount of contrast that should be administered to a patient to prevent contrast induced nephropathy, whilst also providing an adequate image.

Method: We have carried out a retrospective audit of 50 EVAR procedures carried out from April 2012 to February 2013, assessing how much contrast media was used in each patient. We have also collected data for the pre-procedure and post-procedure eGFR and serum creatinine levels to assess whether any of the patients suffered from acute contrast induced nephropathy. Results showed that people with existing comorbidities were more prone to developing CIN.

P-143 Audit of radiation dose from CT KUB examinations at Nottingham University Hospitals

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There has been an exponential increase in the use of CT KUB over the past decade. This is of particular concern in the population scanned as patients are generally young and often repeated stone formers requiring multiple scans. This study compares the radiation dose of locally performed adult CT KUB examinations with the national standard, with an aim to optimising patient dose.

A prospective analysis was undertaken of all adult CT KUB doses performed over a two month period at Nottingham University Hospitals (NUH). Five CT scanners were included and the dose length product (DLP) obtained for each patient scanned. The mean DLP for each scanner was calculated and converted to an effective dose to compare to the national standard.

In total 199 scans were performed with a mean patient age of 47 years old. There was a difference in mean effective dose for each scanner, with older scanners giving a dose above the national average and approximately twice the radiation dose when compared to the newer scanners. Overall the mean effective dose for adult CT KUB examinations at NUH was below the national average.

In order to optimise patient dose, we are now comparing the different scanners by testing with standardised Perspex phantoms. Changes will then be made to the CT KUB protocols to optimise noise to signal ratio and patient dose. A re-audit of patient dose is due to be undertaken in early 2013.

P-144 An analysis of cardiothoracic patient radiation doses recorded in RIS

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Aim: To analyse retrospective patient dose data contained within a radiology information system and investigate the practicality of using this to replace prospective paper audits.

Method: RIS data was extracted consisting of 44,225 records from a specialist cardiothoracic hospital. Analysis was carried out using the fields relating to the radiation exposure including the dose type and quantity. These records could be further broken down by the equipment used, examination date and radiographic operator. Data was compared to results from traditional prospective audits.

Outcomes: Excluding those records where no dose information was expected to be recorded, 8.0% of records were recorded as having no dose. There were also significant numbers of examinations recorded with extremely high and low doses. A visual inspection of the dose value histograms showed that there was uneven distribution of these values at either end of the range and therefore median dose values proved to be an unreliable indicator of average patient dose. Filtering the data to exclude points outside two standard deviations gave mean values that were comparable to those obtained in prospective audits. Further filters based on the number of data points and standard error enabled derivation of local diagnostic reference levels (LDRLs).

Conclusion: There were no systemic patterns found in the entry of anomalous data. With filtering, RIS data may be used to audit patient radiation doses and a number of LDRLs have been set for a wide range of cardiothoracic procedures.

P-145 Investigation on the influence of dose minimization management on the PET image quality

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Purpose: The study aims to prove that a reasonable-to-excellent PET image could be achieved via a low-dosed of 18F-FDG injected.

Methods: This is a retrospective analysis of 50 oncology patients who were injected with an average of 332.27 ± 34.08 MBq of 18F-FDG for PET/CT whole body examination. Patients were divided into 2 groups based on total activity of 18F-FDG injected: less than 333 MBq (305.24 ± 11.87 MBq) (group 1) and more than 333 MBq (366.67 ± 17.73 MBq) (group 2). Multiple Image Projection (MIP) PET images were scored visually by two qualified nuclear radiologists using a three-point scoring scale (poor, reasonable and excellent). The agreement between radiologists was analysed using kappa measure of agreement (K). The coefficient of variance (COV) was measured in a right lobe of liver to quantify noise. The prediction on reasonable-to-excellent PET image by the total activity of 18F-FDG injected was analysed using a Chi-squared test (χ^2). A p value of < 0.05 was considered significant.

Result: Agreement on PET image scoring was substantial, with a kappa value of 0.760. The prediction of the PET image quality adopting the low-dosed 18F-FDG injected has been found to be significant ($p < 0.05$). However, higher noise is observed at low activity injected which may not hamper the overall quality of image yield.

Conclusion: A reasonable-to-excellent PET image quality could be achieved by administration of low-dosed of 18F-FDG technique. Nevertheless, improvement in the routine protocols would obviate the loss in image quality when dose < 333 MBq is used.

P-146 The effects of CT dose reduction software and patient body mass index on total CT dose

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Purpose: To evaluate the effect of using adaptive statistical iterative reconstruction (ASIR) technology on CT dose levels and to investigate the degree of CT dose variation with body mass index (BMI).

Method: Over a period of 1 week, 241 patients (128 female, 113 male; mean BMI 27.2) underwent 64-slice multidetector CT scanning (at 40% ASIR) and data was obtained for BMI and total CT dose.

Results: For patients with a normal BMI (20 – 25) the mean CT dose levels were all below the traditionally recommended dose ranges (CT head 0.8 mSv (recommended 1 – 2 mSv), CT abdomen / pelvis 5.5 mSv (8 – 14), CT chest / abdomen / pelvis 8.9 mSv (13 – 18) and CT chest 2.2 mSv (5 – 7)).

The largest data set was the CT abdomen / pelvis group, which demonstrated a very strong correlation between total CT dose and patient BMI ($R^2 = 0.85$) and showed a greater than 10-fold increase in total CT dose between the BMI groups of BMI < 20 and BMI > 40 (2.9 vs. 34.8 mSv, $p < 0.05$). This pattern of dose increase was echoed for the CT chest / abdomen / pelvis group (5.3 vs. 31.8 mSv, $p < 0.05$), CTPA + CT chest group (1.8 vs. 9.3 mSv, $p < 0.05$) and CT KUB group (1.2 vs. 8.2 mSv, $p < 0.05$).

Conclusion: CT doses are lowered with the introduction of statistical iterative reconstruction technology. However, there is a huge variation in total CT dose with patient BMI, highlighting the need for BMI-specific CT dose tables and scanning protocols.

P-147 Dose comparison between CT urography and traditional IV urography

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Aim: To compare the doses between CT urography (CTU) and IV urography (IVU)

Content: Our poster will present the results of a retrospective radiation dose comparison between 50 consecutive CTUs and 50 consecutive IVUs.

Relevance: CT urography has largely replaced the IVU in the investigation of haematuria and other urinary tract pathology. In our centre CTU is performed as 3-phase examination which means a high radiation dose compared to an IVU series which normally involves 5-7 radiographs of the abdomen.

Outcomes: 50 consecutive CTUs and IVUs were reviewed and the dose information recorded from the radiology information system. The number of radiographs in the IVU series ranged from 2 – 11, the average number of radiographs was 5.3. There were five 2-phase CTU examinations and forty-five 3-phase CTU examinations. The mean dose from CTU was 24.6mSv, median dose 20.0mSv and the standard deviation 13.5mSv. The mean dose from IVU was 5.1mSv, median dose 4.3mSv and the standard deviation 3.0mSv.

Discussion: CTU is a high dose study (average: 24.6mSv), almost five times the dose of an IVU (average 5.1mSv). CTU has advantages in terms of increased sensitivity and the ability to pick up non-urinary tract causes of pain however we must be able to justify the increased dose. Using lower dose CTU techniques such as a biphasic injection protocol or omitting the plain scan can reduce doses and this is something we are exploring in our centre following these results.

P-148 Is adequate information being given for rejected CT requests?

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Background: It is essential that clinicians requesting CT scans supply radiologists with sufficient information to assess the urgency, relevance and context of the scan. Rejected scan requests can lead to delay in diagnosis, poor patient satisfaction and inefficiencies.

Aims: To establish if reasons for rejections are appropriately communicated back to requesting clinicians with guidance given on 1) reasons for rejection and 2) contact details of radiologist 3) to evaluate if those patients who were rejected subsequently had a CT scan.

Method: Retrospective study of all rejected CT requests at our institution during April 2012. All data was collected from CRIS, Radiology information system.

Results: There were 104 rejected requests. 6% stated no reason for rejection. 66% of rejected CT requests provided contact information. 35% of rejected scans were not indicated according to clinical history provided and of these 64% had no further imaging requested. 21% were rejected due to lack of clinical information, 16% because other modalities were advised, and 15% required further discussion with a radiologist. Overall 50% of rejected requests had no further requests for scans.

Conclusion: Radiologists who vet scans need to be aware of the need to effectively communicate reasons for rejection and provide guidance and training to clinicians on the indications for CT scans but also how to better investigate a patient. In turn clinicians must supply sufficient clinical information to allow radiologists to understand the needs of the scan and more importantly to report its findings so they are clinically relevant.

P-149 Low dose CTPA; the death of perfusion imaging?

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The aim of the audit was to optimise low dose techniques for CTPAs using current dose saving software.

There are currently two methods used to establish the presence of pulmonary emboli; Computed Tomography (CT) and Nuclear Medicine (NM). NM can only offer a probability of emboli by demonstrating filling defects. CTPA is the gold standard that visualises emboli.

CT is a high dose examination. With its increase in use, manufacturers of CT have sought to optimise dose reduction techniques including iterative reconstruction (IR) and kV modulation.

We currently use a Siemens 128 AS+ which has been upgraded with SAFIRE (IR) and CARE kV (kV dose modulation) and mA dose modulation.

Retrospective audits were completed, comparing patient dose before and after these packages were installed.

4 Separate cohorts were analysed. All involved consecutive patients for CTPA.

Group 1	scanned at 100kv
Group 2	scanned with CARE kV
Group 3	scanned with CARE kV and SAFIRE
Group 4	scanned at 80kV <80kg, 100kv >80kg

All 4 groups of patients had diagnostic quality CTPA scans.

Conclusion : Using SAFIRE and CARE kV we have now optimised images whilst reducing doses to an average of 1.3mSv. This suggests that NM, with an average dose of 2.3mSv, should only be used when CT is unavailable. Further dose reductions may be possible using model based software. We are continuing to audit.

P-150 Dose audit of gastro-endoscopic services

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Aims - The aim was to reduce the average aquired patient dose recieved by patients who are undergoing E.R.C.P. procedures, without compromising on the high diagnostic quality of the images produced.

Content - An audit was carried out in January 2012 which compared screening time, dose, and image quality between the equipment previously used for E.R.C.P.'s and the newley installed equipment. Although it showed a decrease in screening time, and an obvious improvement in image quality, a significant dose increase was noted. Dose reduction methods and were introduced, and a re-audit was carried out 10 months later.

This audit resulted in us seeing screening time staying roughly the same, and image quality remaining very high, yet resulted in a dramatic decrease in average patient acquired dose.

Relevance / Impact - As E.R.C.P. procedures are a common procedure undergone by many patients, by reducing dose, and performing the procedure in as few sessions as possible, this can only be of benefit to the patients.

Outcomes - The January audit showed a decrease in screening time of 16%, with an increase in dose of 21%.

The re-audit gave the results of screening time increasing by just 1%, yet average patient acquired dose decreasing by 41% as a result of the methods introduced. Diagnostic image quality remained unchanged.

Discussion - Although dose has been dramatically reduced, I believe that it is possible to reduce it further, without affecting the quality of the imaging, or the care or treatment that the patient will receive.

Computer assisted detection/diagnosis and image perception

P-151 Triple phase pancreatic MDCT scanning- pros and pitfalls

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Key Learning Objectives. Awareness of the advantages of triple phase pancreatic scanning for lesions but an increased awareness that increased sensitivity for small tumors requires adjunct imaging.

Description. Triple phase MDCT is used for evaluating pancreatic lesions since it increases the sensitivity and specificity of lesion identification. However, in a collection of cases presenting with pancreatic lesions, the triple phase pancreatic scans were reviewed. A number of lesions were difficult to detect even despite the triple phase CT and subsequently required adjunct imaging such as MRI or endoscopic ultrasound for lesion identification. This impacts on the patient outcome if early treatment is instigated.

Conclusion. Triple phase CT has been quoted to have sensitivity of around 80% in the literature, but clinicians need to pursue non detection with additional tests in patients where malignancy is strongly suspected..

P-152 Low-dose versus high-dose CT acquisition on a PET/CT system for lesion detection: a free-response receiver operating characteristic study

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Aim: To determine whether significant differences in lesion detection performance exist between a diagnostic quality CT (DQCT) acquisition and a CT attenuation correction (CTAC) acquisition within an anthropomorphic chest phantom.

Method: An anthropomorphic chest phantom containing a range of sizes and densities of simulated lesions was scanned on the GE Discovery VCT 64 slice PET/CT using low (42mA, 0.5s rotation) and diagnostic quality (293mA, 0.5s rotation) CT acquisition protocols. No phantom movement occurred between acquisitions to ensure that lesion positions remained the same on each set of images. Scanning produced 184 cases (47 abnormal cases containing 59 lesions; 45 normal cases), these were evaluated by 10 observers using ROCView. A free-response receiver operating characteristic method was used, this allowed observers to localise and score multiple decision sites. Decision sites were classified using an acceptance radius. The jackknife alternative free-response receiver operating characteristic (JAFROC) figure of merit (FOM) was used for significance testing. A difference would be considered significant at $p < 0.05$.

Results: A significant difference in lesion detection was seen ($p = 0.01$) in favour of the DQCT acquisition. The JAFROC FOM for the CTAC and DQCT acquisitions were 0.781 and 0.848 respectively.

Conclusion: For accurate lesion detection in an anthropomorphic chest phantom there is a diagnostic advantage in using a high-dose CT acquisition. Further work would evaluate the potential for optimisation of this high-dose acquisition. Questions are also raised over the value of acquiring an attenuation map at 42mA, if this could be provided by a much lower dose acquisition.