



MSK POSTER PRESENTATIONS

P001 SPECT/CT spine – Correlation to MR and effects on management outcome

Leon Lau; Thomas Rogers; John Cain; Teik Chooi Oh

Lancashire Teaching Hospitals NHS Trust

We present our local experience of a Tertiary Neurosurgical and Nuclear Medicine referral centre. We identified 98 patients with SPECT/CT spinal bone scans over an 18-month period. In over 90% the indication was back pain, not helped/cause identified on other imaging, with remainder due to lesions picked up on other imaging modality. 86% had positive findings, endplate changes being commonest followed by facet arthropathy. In 10% unexpected sacroiliac joint pathology was identified. We compared SPECT/CT findings to previous MR imaging, quantifying if findings were present on MR, compared to new diagnosis. Negative SPECT/CT helped guide management towards Pain Service. A quarter of patients had appropriate surgery after corroborating SPECT/CT with MR findings. Over 10% had injections, mostly therapeutic, some diagnostic. 5 went on to have discogram. Overall, 56% patients had a management change based on SPECT/CT findings. In 11% of cases SPECT/CT results not used to guide management. Used appropriately, SPECT/CT can be a valuable tool to problem-solve and help guide management in the majority of difficult or equivocal cases.

P002 Radiography for knee trauma – Clinical audit to ascertain compliance with the Ottawa Knee Rule

Joseph Dillon-Hearne

King's College Hospital

Objectives: Clinical audit to ascertain the proportion of traumatic knee x-ray requests that conform to the Ottawa Knee Rules (OKR), as per RCR and NICE guidelines.

Methods: A&E X-ray requests from King's College Hospital (KCH) were collected retrospectively from a nine-month period and coded to ascertain their conformity with the OKR. (n=1248).

Results: Initially 73% of referrals for patients presenting with traumatic knee injuries were compliant with the OKR, well below the guidelines of 95%. Two phases of interventions were implemented. The first consisted of posters around A&E and talks to A&E staff. A re-audit at this stage showed compliance improved to 81% (n=634). The second phase interventions consisted of altering the referral process to positively encourage referrers to comply with the OKR. A re-audit after this stage showed compliance rose to 99% (n=728).

Conclusions: By combining education, awareness, and workflow management compliance with the OKR was improved to the extend the Trust is now in line with RCR and NICE guidelines.

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P003 Adequacy of clinical information provided by emergency department staff with reference to the Ottawa ankle rules for traumatic ankle pain in a district general

James Ross; Tim Slade; Nicholas Ridley

Great Western Hospitals NHS Foundation Trust

Background: The reported incidence of ankle fracture in patients presenting to the emergency department is relatively low (15%) but despite this the majority undergo radiography (Dowling, 2009). The Ottawa ankle rules (OAR) have been validated as an effective and highly specific tool to rule out ankle fracture without the need for x-ray (Bachman, 2003; Pascale, 2016). We aimed to evaluate the adequacy of clinical information provided on x-ray requests for traumatic ankle pain with reference to the Ottawa ankle rules in our district general emergency department.

Method: 100 consecutive requests from the emergency department of our DGH were reviewed to assess adequacy of the clinical information provided. The standard is that 100% of x-ray requests should satisfy the OAR. The radiologist report was viewed to assess incidence of fracture identified on plain film.



Results: The audit found that only 21% of requests provided adequate clinical information that satisfied the (OAR). The incidence of fracture was only 18%.

Conclusion: This audit highlights the need for education to improve adequacy of clinical information provided on x-ray requests with reference to the OAR. We have addressed this through introduction of information posters placed in key clinical areas around the department explaining the OAR and their utility. This will be re-audited post intervention to look for significant improvement, with further measures introduced if necessary. This is important to reduce the number of unnecessary radiographs in order to save clinical time, reduce cost, and reduce radiation exposure.

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P004 Short-term intra- and inter-operator precision errors of radiofrequency echographic multispectrometry bone density measurements at the lumbar spine using the Echolight scanner

Ntokoza Khumalo; Andisha Kazimi; Afrah Almutairi; Maryan Abdulle; Mohammed Asiri; Jonathan Fulford; W David Strain; Karen Knapp

University of Exeter

Background: The Echolight is a new type of quantitative ultrasound scanner using radiofrequency echographic multispectrometry (REMS) to perform measurements at the clinically important fragility fracture sites of the lumbar spine and femoral neck using a hand-held probe. The aim of this study was to explore the intra- and inter-operator precision errors associated with REMS measurements at the lumbar spine.

Method: 32 participants were recruited who underwent REMS measurements at the lumbar spine using the Echolight (Lecce, Italy). The four operators were trained and had some practice sessions prior to conducting the study. Duplicate measurements were made by a single operator with repositioning between measurements. Additional operators undertook further duplicate measurements. The root mean square standard deviation (RMDS) and root mean square coefficient of variation (RMSCV%) were calculated for the intra- and inter-operator results.

Results: Participants' mean age was 27.9y (± 9.7) and their mean body mass index was 26.7kg/m² (± 7.3). Intra-operator and inter-operator precision errors ranged from RMSCV% (RMDS) 1.0% (0.01) to 6.5% (0.07) and 1.0% (0.01) to 6.6% (0.07) respectively. The worst precision errors were at L2. Some vertebrae were not captured on both scans for all patients, thus reducing the data contributing to these results. Combined L1-4 results were 1.9% for intra- and 1.9% for inter-operator precision errors.

Conclusion: These results demonstrate good precision errors, particularly when considering the combined L1-4 results. Inter-operator precision errors were not significantly greater than the intra-operator results suggesting that with adequate training different operators can produce repeatable results.

P005 Dual energy x-ray absorptiometry: The accuracy of measurements with increasing body fat on the GE lunar prodigy and the GE lunar iDXA: An in-vitro study

Jemma Elliott¹; Dana Williams¹; Philippa Graham-Black¹; Katie Whitehead¹; Rosemary James²; Saeed Alqahtani¹; Karen Knapp¹

¹University of Exeter; ²Musgrove Park Hospital

Background: Obesity in the population is growing and dual energy x-ray absorptiometry (DXA) scanners are used in a wide range of patients. There is evidence of larger precision errors with increasing obesity^[1], but much less information on the accuracy of measurements in obese populations. The aim of this in-vitro study was to explore the impact of increasing body mass on DXA measurements at the lumbar spine.

Method: A PBU-50 phantom (Kyoto Kagaku, Japan) was scanned five times on a GE Lunar Prodigy and a GE Lunar iDXA (Bedford, UK) with repositioning between each scan on standard and thick mode. Fat and lean tissue layers^[2] were added to increase the phantom size and mimic the following body mass indexes (BMIs): 18.3kg/m², 29kg/m², 38kg/m², 42kg/m², 46kg/m². Data were analysed using percentage change and a one-way ANOVA.

Results: There were BMD reductions on the Prodigy of up to 7.7% for BMIs of 38kg/m² and above on standard mode and reductions of 0.5 to 6.3% for thick mode, with this greatest difference for the 46kg/m² phantom ($p < 0.001$). The iDXA standard mode BMD reduced between 0.2% to 5.7%, with the greatest reduction for the 29kg/m² phantom ($p < 0.05$). A similar pattern was seen for the thick mode, with reductions of 3.8% to 6.1% ($p < 0.001$).

Conclusion: These results demonstrate that changes in fat and lean tissue mass in this phantom-based experiment yield small, but significant differences in BMD. This in-vitro study supports the clinical evidence of large weight changes having an impact on BMD.

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P006 Multimodality imaging of greater trochanter lesions

Devanshi Jimulia¹; Siddharth Thaker²; Chrsitine Azzopardi¹; Rajesh Botchu¹

¹Royal Orthopaedic Hospital; ²Kettering General Hospital

Greater trochanter lesions are relatively uncommon. They can be divided into traumatic such avulsion fractures, infective including tuberculosis or inflammatory and neoplastic, including primary and secondary (metastatic) osseous lesions using a diagnostic sieve. Neoplastic lesions involving this region, depend on patient's age, include benign (e.g. simple or aneurysmal bone cyst, enchondroma), locally aggressive (e.g. Giant cell tumour, chondroblastoma, eosinophilic granuloma), malignant (e.g. osteosarcoma, chondrosarcoma, metastases). Although imaging of greater trochanter lesions, including radiographs and MRI, remains critical in narrowing down differential diagnosis, image-guided biopsy is the mainstay for their final histological diagnosis and subsequent management.

P007 MRI improvements and its role in Pars interarticularis injury

Pamela Tonietti; Nazmin Begum

Fortius Clinic

Medical imaging plays an important role in the diagnosis and monitoring of PARS fractures in young athletes. A pars stress fracture is the most common cause of lower back pain in elite athletes. As the use of plain radiography is no longer used at the elite level due to its poor sensitivity, CT has become the gold standard. It provides an excellent resolution and high contrast between bone and soft tissue and it allows detection of changes associated with pars injury. However, CT of the spine is a very high radiation dose. MRI is another modality of imaging used but it will depend on the stage of the injury and the sequences used. Routine sequences as T1/T2 AX weighted are not sensitive to detect the injury. However recent improvements in gradient sequences and the use of an isotropic 3D T1 VIBE has shown to be useful in the detection of pars fractures due to the sensitivity and specificity close to CT. One of the most important roles in radiography is justification for any imaging examination based on clinical indication, which includes the utilisation of the ALARP principles. This offers patients first-hand quality imaging to investigate PARS defects, which now can include 3D MRI VIBE scanning. In this paper, we will outline that MRI VIBE is an excellent tool to define and monitor PARS defects using the application of 3D MRI sequences.

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P008 Intervertebral disc sequestration: MR imaging patterns of posterior fragment migration

Stavroula Theodorou¹; Daphne Theodorou²; Yousuke Kakitsubata³; Evaggelos Papanastasiou¹; Ioannis Gelalis¹

¹University Hospital of Ioannina, Greece; ²General Hospital of Ioannina, Greece; ³Miyazaki Konan Hospital

Background: In the herniated intervertebral disc, the nucleus pulposus may maintain its connection with the parent disc, or become completely separate from the donor disc, forming a sequestered disc.

Purpose: Although sequestered disc fragments typically migrate in the anterior epidural space, posterior disc migration can become a source of severe clinical symptoms and signs. We will discuss the clinical and MR imaging findings of dorsal disc herniation, featuring epidural (posterior and anterior) and intradural migration of the sequestered lumbar disc. Clinical diagnosis of posteriorly migrated disc fragments can be puzzling as epidural disc material may need to be differentiated from a multitude of abnormalities associated with pain and neurologic deficit including infection, tumor, trauma, degenerative disease changes, and iatrogenic conditions. MR imaging can readily depict intracanalicular mass lesions with compression of the spinal cord, and may demonstrate the precise anatomic site of abnormal lodged extra- or intra- dural disc fragments after administration of contrast material. A tract-like structure connecting the sequestered disc with the posterior epidural lesion may be seen, pointing to the exact route of migration of the disc fragment. Surgical removal of the sequestered fragment is required to recover motosensory function of the lower extremities.

Summary: Clinical symptoms of dorsal disc herniation are similar to those of other causes of lumbar pain, radiculopathy or cauda equina syndrome. In the absence of a visible disc herniation, radiologists need to scrutinize the epidural (posterior and anterior) space as well as the cord for abnormal migrated disc fragments.

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P009 A service evaluation of MRI lumbar spine scans within a community-based diagnostic setting

Darren Hudson

InHealth

Background: InHealth has provided direct access to MRI within primary care across London for many years. With the ongoing demand for imaging, resources need to be managed whilst still maintaining patient relevant outcomes. This is a service evaluation of lumbar spine MRI scans within a community-based diagnostic setting. It aims to provide a review of current service usage, provide comparison between referrer type, review appropriateness of referrals being made, and the potential relevance of report outcomes. It provides insight into adherence to, and relevance of, guidelines in managing lower back pain and how access to community-based diagnostics could be better supported.

Method: Records on patient referrals booked over an 18-month period were extracted for trend analysis over time, between commissioning groups and referrer type. A randomised purposive sample was taken for more detailed analysis of each referral and radiological report. Data extracted provided information on demographics and prevalence of clinical presentation and report observations.

Results: There is significant variation in referral numbers seen across commissioning groups and in the proportion of non-medical referrals, suggesting differences in practice worth further exploration. Assessment against defined referral criteria was made, as well as judgement of report relevance against clinical indications. Lack of information was an important area highlighted in the review.

Conclusion: There was no difference in referral justification or report outcome seen between referral type. Patient age and associated leg symptoms were significant factors, and improved referral content would help adherence to guidelines and report relevance. Strategies to support improvements were outlined.

P010 Segmental neurofibromatosis of the upper extremity: MR imaging findings

Stavroula Theodorou¹; Daphne Theodorou²; Evangelos Papanastasiou¹; Vasilios Gogos¹; Georgios Georgiadis²; Ioannis Gelalis¹

¹University Hospital of Ioannina, Greece; ²General Hospital of Ioannina, Greece

Background: Segmental neurofibromatosis (NF) is a rare variant of NF manifest with multiple neurofibromas limited to a single body part.

Purpose: We present the clinical and MR findings in a patient with segmental NF of the upper extremity to call attention to this challenging diagnosis. Lesions in segmental NF do not cross the midline and are not manifest with the typical clinical features of NF type-1. Typically, segmental NF occurs in the trunk and head region, with only a few cases reported in the upper extremity. A 35-year-old woman presented with multiple, large and painless subcutaneous masses in the dorsal and volar aspect of left arm and the volar aspect of the hand over the thumb and index finger. Past medical/family history was unremarkable. Mass lesions were not associated with any skin changes, including freckling. MRI of the brain was normal. MRI of upper extremity revealed numerous, well-defined nodular lesions that had intermediate T1- and high T2-weighted signal intensity. Prominent enhancement of the mass lesions was seen after the i.v. administration of a gadolinium compound. The nodules were fusiform and intimately related to different peripheral nerves. Because the lesion in the index finger compromised function, surgical resection was pursued. Histopathology confirmed diagnosis of neurofibroma. Due to the multiplicity of lesions, clinical absence of symptoms, and a high rate for recurrence treatment was nonsurgical.

Summary: Radiologists should be aware of the imaging findings of segmental NF, a subset of NF that is not associated with systemic disease.

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P011 Scope and indications of lumbar spine radiography for lower back pain in the South West

Philippa Peters-Cheale; Lucy Hoade; Christine Heales; Karen Knapp

University of Exeter

Background: An RCR report in 2016 highlighted that radiology services are "on their knees"^[1]. Whilst urgent action has been called for in terms of addressing workforce and equipment shortfalls, other avenues to alleviate the burden on imaging departments need to be considered. The aim of this study is to explore referral information and clinical indications for lumbar spine projection radiography.

Method: Data on lumbar spine radiography within a 12-month period (2017-2018) were collected from one NHS Trust. Information collected included referral information. A pilot of 400 cases was undertaken to delineate appropriate categories for referral criteria. This identified 21 discrete categories encompassing neurological, inflammatory, oncological, trauma, surgical, atraumatic fracture etc. Once established, two coders categorised 100 examinations each, comparison of their data yielded agreement of 0.71 using Kappa. They then categorised the entire data set.



Results: Data for 2669 lumbar spine radiographs were obtained. Following data cleansing, 1781 were incorporated within the study. Reasons for exclusion were absence of clinical indications. Of the examinations reviewed 26% (n = 468) were referred with suspected fragility fracture; 24% (n = 437) for back pain; no neurological symptoms and 10% (n = 169) for back pain; neurological symptoms.

Conclusion: A significant proportion of individuals referred for lumbar spine projection radiography do not seem to fit within current NICE guidelines for the management of low back pain^[2]. Further work is needed to correlate these referrals with outcomes to ensure pathways are fit for purpose resulting in appropriate use of resources.

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P012 Missed fractures on x-ray by A & E doctors – Clinicians vs imaging

Maryam Paracha¹; Muhammad Afaq Saleem²; Asim Habib¹; Abdul Wahab Paracha³

¹Royal Albert Edward Infirmary; ²University Hospital Coventry & Warwickshire; ³Nevil Hall Hospital

Background: The diagnosis of an acute fracture is based upon appropriate imaging following an accurate history and a focused clinical examination. Fractures tend to be those high-risk diagnoses which when missed are among second highest payouts in legal proceedings. Missed fractures on radiological images form the majority of errors made in A & E.

Methods: We queried the database for missed fractures reported by radiologists from July 2019, through September 2019. Data collection was from the electronic reports of X rays and the interpretations done by A & E doctors.

Results: 49 patients were found to have missed x-ray pathologies. Notes were searched and assessed. Out of the 49 patient, 20 (40.9%) were found to be under 30 years of age and 29 (59.1%) were above 30 years. 53% of upper limb X rays, 28% lower limbs, 10% chest and 9% face fractures were missed. The data was further divided according to time and grade of clinician who saw patient in A & E. About 78% discrepancies were found in interpretations done at night vs 22% in morning. 30 (61.2%) patients were seen by ANPs, 12 (24.5) by SHOs, (10.2%) by ST3+ and 2 (4.1%) by consultants.

Conclusion: No harm was found to be done to patients as they were called back following the radiology reports. To reduce the number of missed orthopaedic injuries, emergency physicians should learn about the types of injuries that are missed most often, and be sure to check for them. There is ample evidence that double reading improves.

P013 Orthopaedic check x-ray audit: Do we document our findings?

Nida Mushtaq¹; Younus Zakaria²; Adil Mughees²

¹University Hospitals of North Midlands; ²Walsall Hospitals NHS Trust

Background: Every examination which utilizes ionizing radiation must be reported by a doctor trained for the purpose¹. However due to insufficient resources to support this service the responsibility for reporting some plain radiographs may be transferred. The aim of this audit was to assess the effectiveness of arrangements to transfer the responsibility for the reporting of 'check x-rays following arthroplasty surgery' to referring surgeons within the Orthopaedic department.

Method: 50 patients audited from February to April 2019 in the first cycle of the audit. 46 patients audited from May to June 2019 during the second cycle. Cases were from both from trauma and elective wards and collected using electronic records as well as case notes.

Results: Out of the 50 patients audited, our results showed that 68% (n=34) of these x-rays had no or insufficient documentation of clinical interpretation in the patient notes. Around 72% (n=36) of these images had a radiology report but 28% (n=14) of these images were not reported. Following this cycle, the orthopaedic department were informed regarding the importance of documenting clinical interpretation of check x-rays. Following our interventions we saw a 51% improvement in documentation.

Conclusion: It is important for the orthopaedic team to ensure the findings check x-rays are clearly documented in the clinical notes as this can be a legal issue if there are post-operative complications related to the prosthesis following discharge. A statement such as 'Satisfactory appearances of joint prosthesis on check X-ray/radiograph, no peri-prosthetic fracture noted' was recommended.

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P014 Atypical femoral fracture: A case study

Vicky Ballard

Brighton and Sussex University Hospitals

Atypical femoral fractures are an insufficiency/stress type of fracture. Bisphosphonate therapy has a known association with these atypical stress-fracture patterns, and should be a primary consideration in elderly female patients presenting with weeks/months history of thigh/groin pain. This medication is used for prophylaxis and treatment of osteoporosis, Paget's disease and bone metastases/multiple myeloma. Prolonged bisphosphonate is considered to suppress bone remodelling, which



leads microdamage that would normally be repaired but is inhibited, thus increasing skeletal fragility. The initial radiographic features are subtle with only cortical thickening and possible breaking of the lateral femoral cortex. Patients with pain and early stress reaction should be considered for prophylactic nailing and all patients with an atypical femoral fracture should have their contralateral femur imaged as these findings are commonly bilateral. Recognition of the early radiographic findings, along with the clinical presentation and medication history, allows for early intervention (prior to fracture) which has a huge positive impact on patient outcome which will be demonstrated using a case study.

P015 Imaging modalities in the diagnosis of cervical spine tuberculosis

Sarah Dawson

Barts Health NHS Trust

TB is an infective disease caused by Mycobacterium Tuberculosis and spread airborne in those with pulmonary TB. Spinal TB accounts for 15% of extra pulmonary TB. C-Spine TB is relatively uncommon, accounting for approximately 10% of cases, but is the most complex. Infection begins in the subchondral bone and spreads slowly to intervertebral disc spaces from adjacent vertebral bodies (VBs). Typical symptoms include loss of neck mobility and point tenderness, neurological deficit - particularly in lower c-spine involvement, and can eventually progress into tetraplegia. The progression of spinal TB is slow, with patients unlikely to present until there is pain, deformity or neurology in the further progressed stages.^[1-4]

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P016 Not all wounds are visible – Stay calm and see through the x-ray

Maryam Paracha¹; Asim Habib¹; Afaq Saleem²; Kainat Tahir³; Abdul Wahab Paracha⁴

¹Royal Albert Edward Infirmary; ²University Hospital of Coventry & Warwickshire; ³The Pennine Acute Hospitals; ⁴Nevil Hall Hospital

Background: Plain radiographs are commonly ordered for patients who arrive in the emergency department (ED), and interpretation of those radiographs is critical. Clinicians are prone to make wrong radiological evaluations due to off hours and long busy varying shift work patterns which lead to poor concentration and chronic fatigue.

Purpose: To emphasise the importance of checking what is not obvious. The poster will highlight the use of a systemic approach and two views as a simple aid to increase the conspicuity of fracture.

Summary: A Pictorial view outlining an interesting case that presented to A & E, along with tips for clinicians to educate them regarding subtle or radiologically occult fractures on plain radiographs.

P017 The appropriateness of x-ray lumbar spine referrals made by general practitioners: A retrospective review

Claire Bradley; Lisa Field

Mid Yorkshire Trust

Background: NICE guidelines for the management of lower back pain in adult's 2016, state x-ray imaging for low back pain should not be routinely offered, without specialist opinion or suspicion of serious underlying pathology. Inappropriate imaging is associated with ionising radiation risks and places burdens on imaging departments with little diagnostic yield in determining causation for the initial complaint.

Method: Referral and radiology report data on General Practitioner lumbar spine imaging referrals from one month was collected and retrospectively reviewed. Each referral was compared against NICE guidelines. The referral details were also recorded for identification of common themes. All results were compared against a previous retrospective review of lumbar spine referrals performed after the updated guidelines were published in 2016. Results A total of 138 exams were identified (mean age 61.5, range 12-91), compared with 222 exams (mean age 62, range 16-88) from the 2016 review. Referrals included 3 querying disc protrusion which cannot be diagnosed on x-ray, and 24 for osteoarthritis. The percentage of "unclear" referrals reduced from 27% previously to 22%. In total 43% of referrals did not reference the length of time the patient had experienced back pain.

Conclusion: Lumbar imaging referrals have dropped considerably since 2016 due to reinforcement of new referral criteria being communicated from the radiology department to referrers, resulting in more awareness of the guideline. However, some referrals still did not meet the NICE criteria. There is room for improvement, through improved training for referrers and staff justifying examinations.

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