Learning from Discrepancies Meetings - What we’ve learned from Musculoskeletal Diagnostic Errors in 2014

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Purpose

Regular discrepancy meetings are universally implemented as part of quality assurance programmes in radiology departments in the UK. The Royal College of Radiologists (RCR) has published standards detailing how to utilize the meetings as a tool for shared learning and to minimize patient harm. The purpose of this presentation is to detail some of the trends and highlight lessons learned during 2014 from musculoskeletal imaging errors discussed at our departmental discrepancy meetings.
Methods and Materials

Our institution utilizes an anonymous, form-based method to forward cases to the discrepancies meeting. Forms are collected by the meeting conductor and discussed with attendees following the monthly clinical governance meeting. Forms are analysed to establish trends and collate key learning points to share with the department.

For each case, the imaging study type, study date, date of detection of the abnormality, and details of the discrepancy were recorded, and the diagnostic difficulty and potential clinical impact of the error was agreed in discussion at the discrepancy meeting.

A modified classification system of that described by Renfrew et. al. (1997) was used and each discrepancy classed as:

- Perceptual discrepancy (including true misses, errors as a result of satisfaction of search or an abnormality not detected outside the area of concern or at the edge of the film)
- Cognitive discrepancy (including false positives, discrepancies due to lack of knowledge or faulty reasoning where an abnormality was detected but put down to an incorrect cause)
- Communication error (including a discrepancy due to a poor report or a message not conveyed to the clinical team)
- Poor clinical information provided
- Previous/other imaging not reviewed
- Complications of a procedure

If one form detailed two investigations with errors identified, then this was analysed as two separate cases. Similarly if there was a study with two discrepancies identified, this was considered as two separate cases.
Results

During 2014, seven discrepancy meetings were held. A total of 88 cases were discussed with 48 of these related to musculoskeletal radiology (55%).

The time interval from when the error was made to when the discrepancy was identified ranged from 0-363 days with an average of 32 days and median of eight days.

Almost all (47, 98%) the musculoskeletal discrepancies were identified on plain radiography apart from one case where spinal metastases were missed on a CT of the abdomen and pelvis. Where the discrepancy occurred on plain film and was not recognised on a subsequent plain film, the correct diagnosis was then made on MRI in 11 cases and on CT in five cases. Four out of the six triquetral fractures were identified subsequent on MRI.

The most common type of musculoskeletal error was a perceptual discrepancy (34, 71%) Fig. 1 on page 6. 28 of these were missed fractures, four missed dislocations and three missed metastases. Three of these perceptual discrepancies were due to satisfaction of search and two due to the abnormality being outside the area of interest or at the edge of the film Fig. 2 on page 6.

There were nine cognitive discrepancies Fig. 3 on page 7 including four overcalls, and one discrepancy due to lack of knowledge where the features of humeral head avascular necrosis were not recognised. Faulty reasoning accounted for four cognitive discrepancies as follows:

- Lipohaemarthrosis reported as an effusion
- Bilateral femoral avascular necrosis called degenerative change
- Subtalar dislocation was not recognised and only a displaced bone fragment recognised as being abnormal
- Triquetral fracture was called a lunate fracture

Wrist fractures were the most commonly missed fractures (13/34) and of these there were six triquetral fractures and three distal radial fractures Fig. 5 on page 8. Data from discrepancy meetings in 2013 showed that tibial plateau and scaphoid fractures were the most commonly missed, 6 and 10 cases respectively, but in the current year these reduced to zero and three respectively.

30 (63%) cases had a diagnostic difficulty scored as easy and 27 (56%) had no or only a minor potential clinical effect of the patient Fig. 6 on page 9. Four errors were
considered serious or potentially fatal and these included a shoulder film and a humerus film where a humeral head metastasis was missed, a missed fractured scaphoid on a wrist film and a missed thoracic spine metastasis on a thoracic spine film. All of these four discrepancies were given a diagnostic difficulty of moderate.

Duty of Candour legislation became active in the latter part of 2014. We considered that 8 cases would have needed to invoke a Duty of Candour process.

A selection of cases from the discrepancy meetings has been included (Fig 8 - 25.
Fig. 1: Classification of musculoskeletal discrepancies

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Fig. 2: Perceptual discrepancy

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Fig. 3: Cognitive discrepancy
Fig. 4: Type of each discrepancy
**Fig. 5:** Discrepancy according to the type of film on which it was identified

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**Fig. 6:** Level of diagnostic difficulty and potential clinical effect on patient

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Fig. 7: Number of discrepancies reported per month

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Fig. 8: Perceptual error with a severe potential clinical effect on the patient. A lucent lesion with cortical loss in the right humeral humeral head (arrow) was not identified on a shoulder radiograph and then again on a humerus radiograph 56 days later. The patient presented with shoulder pain and a history of breast cancer. An MRI of the shoulder (coronal T1 shown here) was then performed 111 days after the initial radiograph and identified the metastasis.

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**Fig. 9:** Perceptual error were the 4th metacarpal fracture was not recognised. The fracture was identified on follow-up MRI (sagittal STIR shown here) 3 days later. Marrow oedema and the cortical break are demonstrated.

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Fig. 10: Perceptual error where a fracture of the patella (arrows) was not identified on initial knee radiographs. CT (sagittal reformat) was performed the same day and showed the fracture clearly.

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Fig. 11: Perceptual error showing a fracture through the waist of the scaphoid that was not recognised on initial plain films. A scaphoid series was performed 11 later after the patient was referred to fracture clinic and demonstrated the fracture again but displaced. If no fracture is identified on a wrist radiograph the radiologist should suggest scaphoid films if a scaphoid fracture is suspected.
**Fig. 12:** Perceptual error demonstrating a triquetral fracture (arrows) that was not identified on the wrist radiograph. MRI 17 days later shows the fracture line on sagittal T1 and marrow oedema.

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**Fig. 13:** Perceptual error in a patient with a suspected left hip fracture. The left inferior and superior (arrow) pubic rami fractures were not recognised on the initial plain film but identified on MRI the same day (coronal T1 seen here).

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Fig. 14: Perceptual error (satisfaction of search) where the lateral malleolar fracture was reported but not the medial malleolar fracture (arrow). The discrepancy was identified on the same day.

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**Fig. 15:** Perceptual error on a knee radiograph were both fibula head (arrow) and Segond fractures (arrowhead) were missed. These were identified on CT the following day. Follow up MRI shows associated complete ACL and PCL tears.

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**Fig. 16:** Perceptual error of a missed ACJ dislocation on a shoulder radiograph. The discrepancy was identified on MRI 46 days later.

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Fig. 17: Perceptual error (satisfaction of search) where the 4th metacarpal fracture was reported but not the 4th and 5th CMC joint dislocation where there is loss of joint space demonstrated on the initial film (arrows). This was identified on CT 28 days later.

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Fig. 18: Perceptual error (satisfaction of search) where the right distal radial fracture was reported but the undisplaced distal ulna (arrow) fracture was not. The discrepancy was identified the following day on follow up plain film.

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**Fig. 19:** Cognitive error due to faulty reasoning. The plain film film of the left ankle were recognised as abnormal and a fracture fragment was reported. However the lateral subtalar dislocation (arrow) was not reported. The subtalar dislocation was reported on plain film the following day.

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Fig. 20: Cognitive error due to faulty reasoning where this pelvis radiograph was reported as left hip degenerative change but is in fact bilateral AVN, worse on the left. MRI (coronal STIR shown here) 60 days later shows a double line sign and femoral head collapse. Early AVN is seen on the right.

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Fig. 21: Cognitive error due to faulty reasoning on a knee radiograph where a lipohaemarthrosis was interpreted as an effusion. Follow up CT (coronal reformat shown here) performed 4 days later confirmed the presence of a lipohaemarthrosis as a consequence of a lateral tibial plateau fracture.

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Fig. 22: Perceptual error in a child with an ankle injury. There is a Salter Harris 2 fracture (arrow) of the distal fibula which was missed but identified on a fracture clinic follow up film 8 days later.

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Fig. 23: Perceptual error on a foot radiograph where a Lis Franc injury (arrows) not picked up on plain film but identified on CT 2 days later.

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Fig. 24: Discrepancy due to previous imaging not being reviewed that had a severe potential clinical effect on the patient where diffuse infiltration of the thoracic spine with
metastases was not identified. Had this been compared to previous imaging the change in bone density would have been more easily recognised. MRI (sagittal T1 shown here) was performed the following day as the patient had neurological deficit. There is diffuse infiltration of the imaged spine with relative sparing of C1-C4 and compression of the spinal cord at the mid-thoracic spine.

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Fig. 25: Overcall on an abdominal radiograph where old left inferior and superior pubic rami fractures (arrows) where reported as fibrous dysplasia. The discrepancy was found on CT 7 days later.

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Conclusion

Error is intrinsic in radiology. The daily error rate in radiology has been estimated to be between 3.5-4% and approximately 30% if considering only examinations which have confirmed abnormalities. The cases presented to our discrepancy meetings are prone to selection bias and are not a true representation of the types of discrepancy or the error rate that occurs during day-to-day practice.

The commonest error type in our meetings was perceptual (71%) which correlates with the findings of Renfrew et. al. who showed that perceptual errors made up 71% of the errors in the 182 cases they reviewed (42% due to true missed findings, 22% due to satisfaction of search and 7% due to the abnormality being out of the area of interest on the study). The most common musculoskeletal errors presented to our 2014 discrepancy meetings were wrist fractures, with triquetral fractures being the commonest group within these. We noted that the data from our institution during the preceding year (2013) showed that tibial plateau fractures and scaphoid fractures were the most frequently missed fractures, which was not reflected in the data from 2014. This may suggest that discrepancy meetings resulted in learning which may have reduced the incidence of tibial plateau and scaphoid fracture misses.

Since, in addition, most (30, 63%) misses were considered of low diagnostic difficulty, we feel that training strategies directed at commonly missed diagnoses may be valuable in significantly reducing errors. To that end, a summary of discrepancy meeting findings with examples of the commonest misses was made available to all reporting radiologists. In addition a training module with a checklist system for wrist radiographs is being developed.

With the introduction of the Duty of Candour, a number of identified discrepancies may fall within the scope of legislation due to 'moderate harm' having occurred. Our discrepancy meeting forms have been modified to include this issue.
References

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