Skeletal reporting by radiographers

Diagnostic accuracy in the interpretation of radiographs of the axial skeleton during post graduate training

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Introduction

• A chronic shortage of consultant radiologists and growth in demand for radiology services represent a persistent challenge for the National Health Service (NHS) (NHS Benchmarking Network, 2019).

• In February 2016 three quarters of acute NHS trusts had a backlog of unreported studies; the bulk of which were plain radiographs with ~ 177,000 waiting over 4 weeks for a clinical report (RCR, 2016).

• Clinical reporting by appropriately trained radiographs is an established role extension in the UK (CoR, 2013).

• Reporting radiographers have been shown to reduce backlog and improve report turnaround times with no loss of quality (Snaith et al, 2015).

Aim and method

• Aim: to audit of 1000 axial examinations double reported by 2 trainee reporting radiographers and 2 consultant radiologists.

• Radiographs included patients referred from A&E, OP, IP and GP sources.

• The radiologist's report provided the reference standard and was compared with the radiographer's to assess agreement.

• Sensitivity, specificity and accuracy rates were calculated over the audit period.

• A&E vs non- A&E referrals were compared, errors classified and error cases were reviewed and learning points highlighted.

Results

• Of the total 1000 examinations, 915 reports were in complete agreement with the radiologist's report and the remaining 85 required review.

• The overall combined radiographer accuracy, sensitivity and specificity averaged across the audit period were 96.2%, 95.2% and 97.84% respectively. Results for each period can be seen in Fig. 1.

• Performance measures were compared for A&E and non A&E referrals (Fig. 2).

• Errors were classified as False Positive (FP) or False Negative (FN) (Fig. 3), and reviewed to maximise learning; 3 examples are outlined below (A,B and C).

• All errors were reflected upon,15 of which affected patient management (Table 1).

Fig. 1
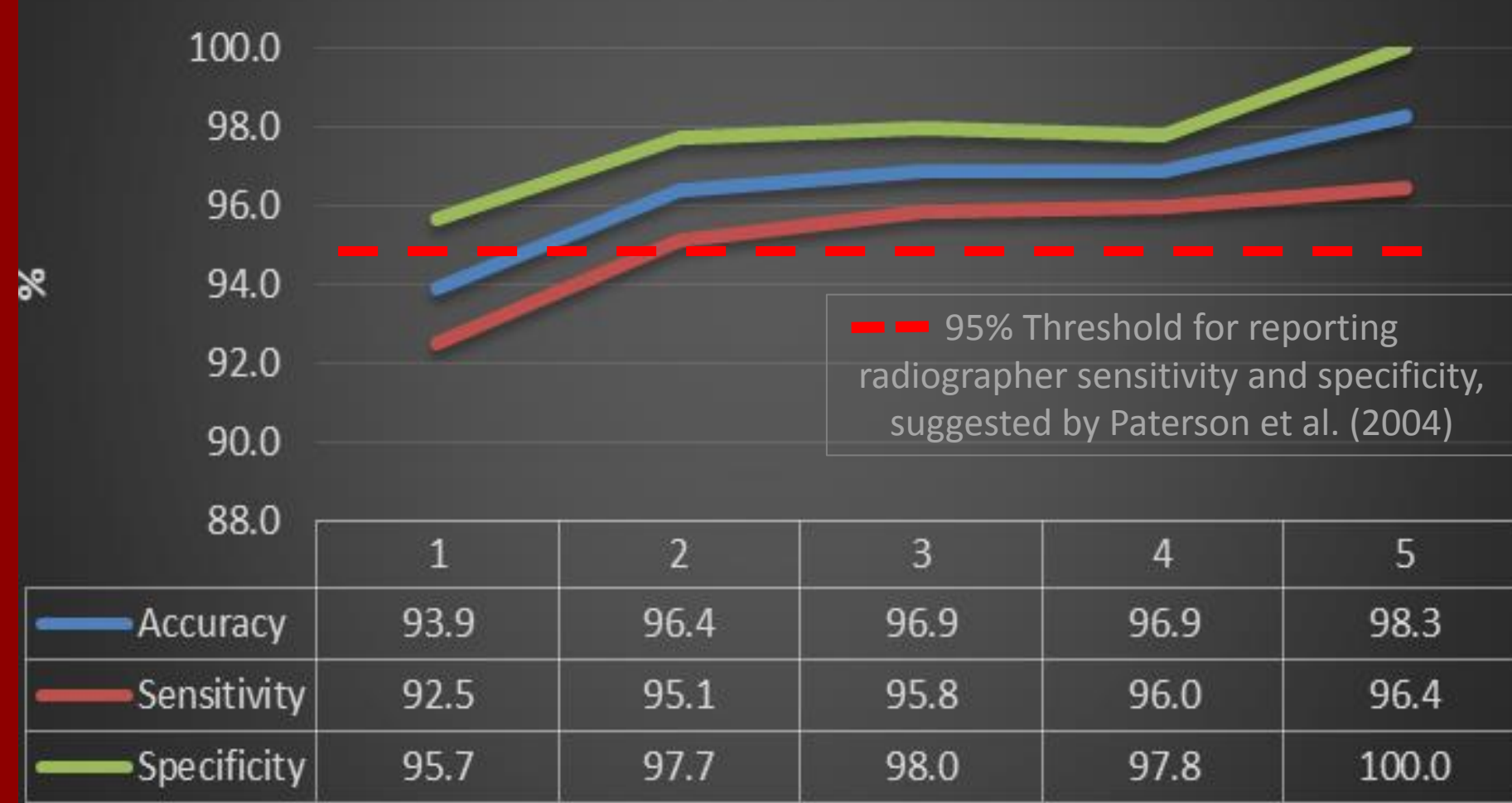

Combined accuracy, sensitivity and specificity by period

95% Threshold for reporting radiographer sensitivity and specificity, suggested by Paterson et al. (2004)

	1	2	3	4	5
Accuracy	93.9	96.4	96.9	96.9	98.3
Sensitivity	92.5	95.1	95.8	96.0	96.4
Specificity	95.7	97.7	98.0	97.8	100.0

Fig 2

A&E vs Non-A&E: Accuracy, sensitivity and specificity
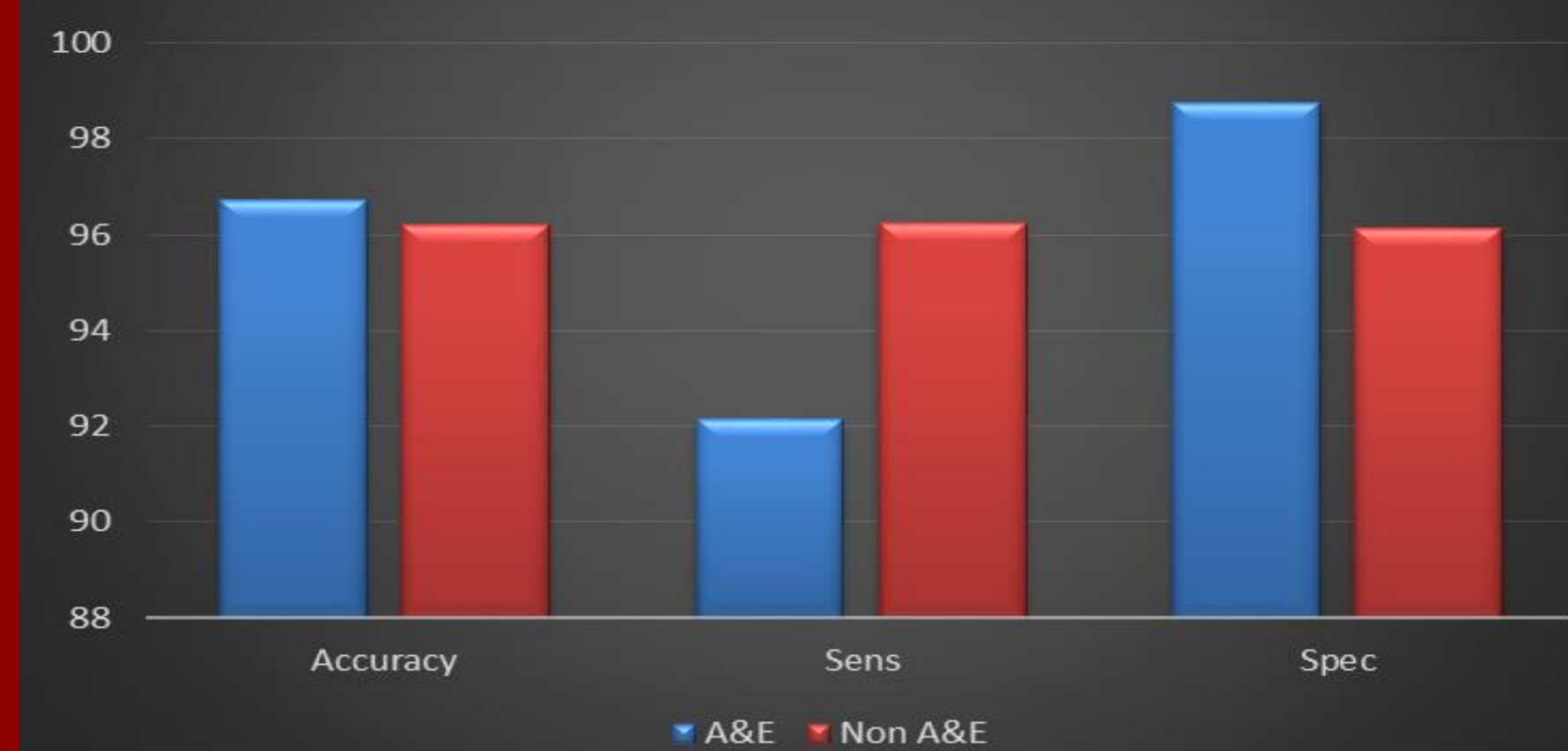
Fig 3

Error classification

FN 73% FP 27%
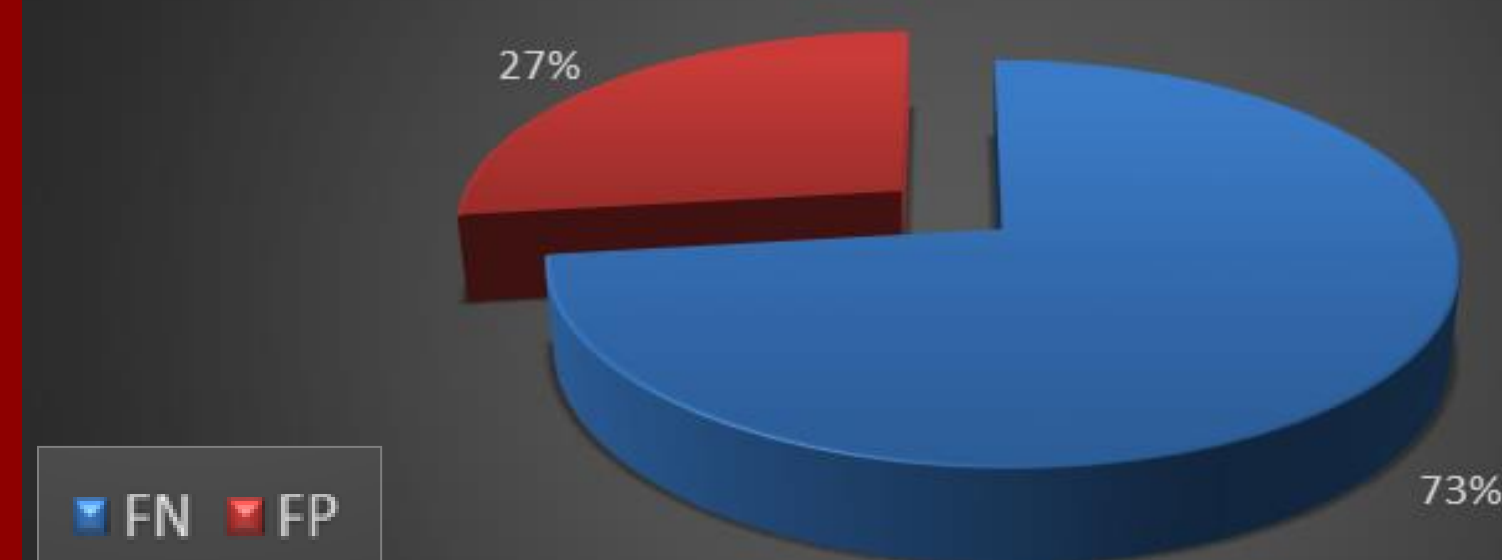
Reflective practice (illustrative)

| Table 1. Errors affecting patient management	Radiographer	No. of occurrences
Missed facial bones #	1 and 2	4 (2 and 2 respectively)
Missed multiple myeloma	2	1
Missed linear atelectasis	1	1
Overcalled osteoporotic fractures	1 and 2	2 (1 and 1 respectively)
Missed possible osteoporotic fractures	1 and 2	3 (2 and 1 respectively)
Marked undercall degenerative changes (mild-severe)	1	1
Failure to recommend further imaging (sternal #)	2	1
Overcall metastases	1 and 2	2 (1 and 1 respectively)

A

False negative (undercall) – spondylosis

Error class: FN (Misinterpretation)

Learning points:

• Frequent inter and intra observer disagreement in radiological interpretation of cervical OA (Kettler et al, 2006).

• Kellgren et al's (1963) classification system is longstanding and has excellent inter-observer reliability (Cote et al, 1997).


B
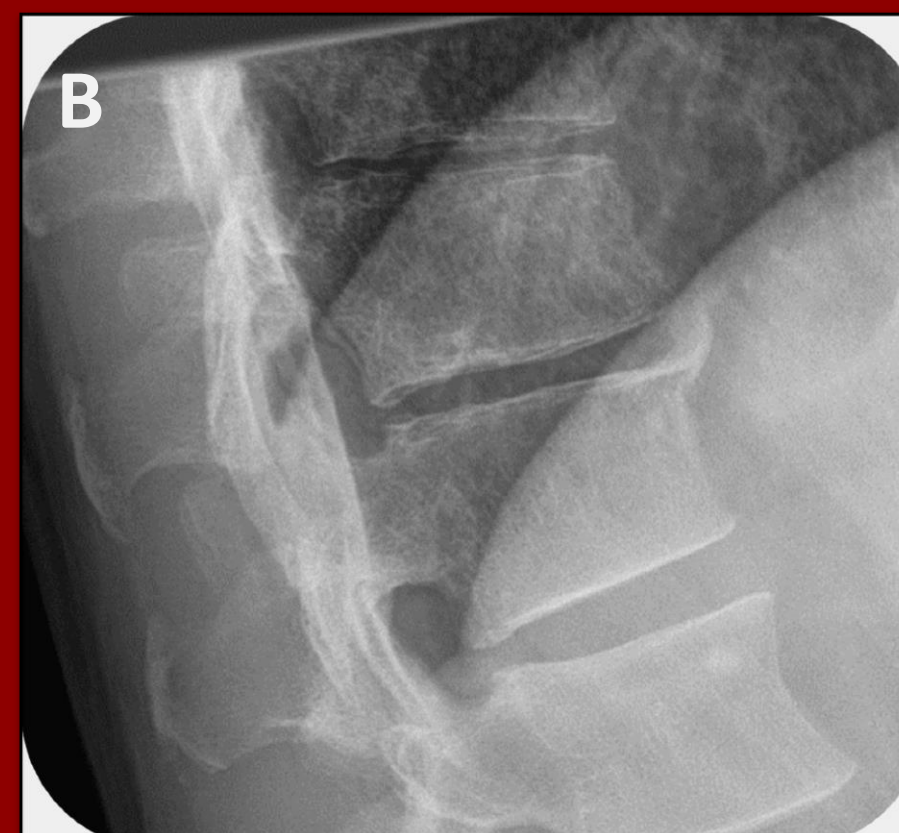
False positive (overcall) – T12 fracture

Error class: FP (Lack of knowledge)

Learning points:

• Normal wedging can commonly be seen in the lower spine between T8 and T12 (Bhatia and Bowen, 2007).

• Findings indicative of genuine vertebral fracture;
 ❑ height loss exceeding 20%
 ❑ endplate deformities/lack of parallelism
 ❑ altered appearance c/w neighbouring vertebrae
 (Lenchik et al., p950, 2004).

C
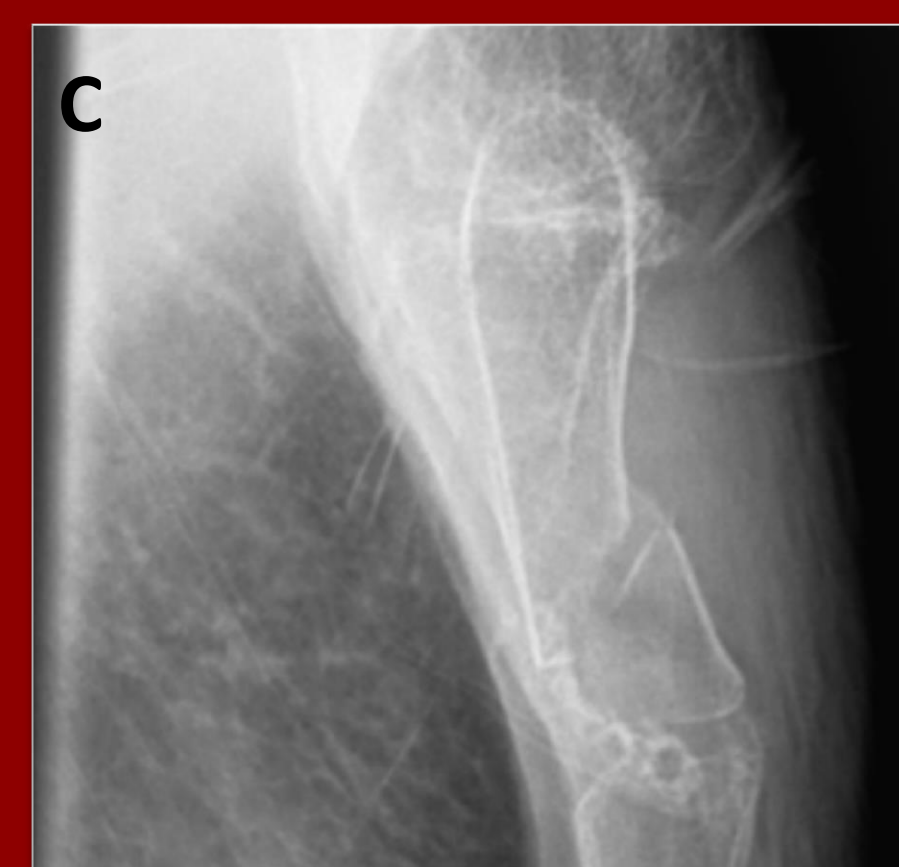
Failure to recommended further imaging

Error class: FN (Lack of knowledge)

Learning points:

• The fracture was detected but report failed to advise further investigation with CT.

• Sternal fractures commonly associated with serious, potentially life threatening conditions (Scheyerer, 2013).

• CT is indicated when injuries of the chest or spine are suspected (RCR, 2012).

Limitations

• Inter-observer variation is common in clinical reporting (Robinson et al.,1999).

• Double reporting may introduce 'determinism' if report is read first (Brady et al., 2012).

• Intra-observer variability bias: inconsistency in scoring may skew performance measures (Brealey et al, 2002).

Acknowledgements

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Conclusion

• Combined performance measures in final reporting period: Accuracy 98.3%, sensitivity 96.4% and specificity 100%.

• Above 'threshold' criteria (see Figure.1) suggested by Paterson et al. (2004) and surpasses the 92.6% sensitivity and 97.7% specificity performance indices from the literature (Brealey et al., 2005).

• No significant difference in accuracy between A&E and Non A&E referrals.

• Key errors reviewed and reflected upon in order to reduce error reoccurrence and minimise the degree of harm to the patient (Pinto et al., 2012).