A student radiographer's accuracy in 'red-dotting' appendicular skeletal radiographs: Clinical Audit

Cesar Martin Rodriguez, Student of Diagnostic Radiography BSc (Hons)

Background

Clinical audit is a method to systematically evaluate and monitor the level of care in order to implement changes when necessary. Post-registration in Health Care Professional Council (HCPC), and as part of the continuing professional development and training, radiographers are required to be able to prove the quality of their exercise by evidence-based reviews through clinical audit self-assessments (HCPC, 2013).

The 'red-dot' system is used by radiographers working in A&E to communicate suspected abnormalities on radiographs before the images are reported. This method provides an additional review of radiographs. This results in a decrease in their misinterpretation which potentially improves patient management (SoR, 2013). Accordingly, in 2006, The College of Radiographers established 'reporting and interpretation of radiographs' in undergraduate courses on which qualified radiographers must demonstrate their competence (SoR, 2013).

Aim

This audit targets the assessment of a third year student competence on red-dotting appendicular radiographs. As part of this audit, comparison of the student's red-dot skills on extremity radiographs between paediatrics and adults is carried out, in order to highlight more specifically if there is any further need of knowledge.

Standard

Accuracy 93% - Sensitivity 80% - Specificity 95%

Author/s	n	An	AC	SN	SP
Breatley et al.(2006)	1039	SK	90.9%	76.9%	95.6%
Brown & Leschke(2012)	3638	AP	93.5%	80.4%	98%
Coleman & Piper(2009)	20	AP	-	67%	80.5%
Piper & Paterson(2009)	20	AP	73.1%	69%	83%

Table 1. Evidences used to set the audit standard; An: Red-dotted anatomy AC= Accuracy, SN= Sensitivity, SP= Specificity, AP= Appendicular, SK= Whole skeleton

Sample

n= 149

All radiographs performed at the A&E Department of Salford Royal Hospital Foundation Trust (SRFT) over a 3-day period (October 2016) were retrospectively evaluated for inclusion in the sample:

- Identified 165 appendicular examinations.
- Exclusion of 16 examinations due to the absence of report on Computerised Radiology Information System (CRIS), inconclusive reports, or being follow-up radiographs.

Method

An audit tool for collecting data was designed using Microsoft Excel.

Using the Digital Radiography (DR) console in the A&E department:

(1) the sample was identified.
(2) the data of the examinations was collected.
(3) the radiographs were red-dotted.

The radiographs were red-dotted when they demonstrated fractures, dislocations, joint effusions, and foreign bodies in soft tissue. Comments were also included to state the type of injury identified and its anatomical location.

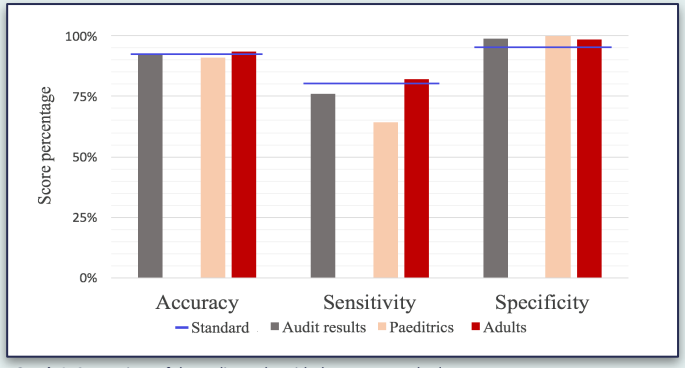
The student's red-dot performance was evaluated against radiologic reports extracted from CRIS. True/false positives/negatives were identified. Accuracy, sensitivity and specificity were also established for the whole sample as well as for paediatric and adult groups.

Results

	n	TP	TN	FP	FN	AC	SN	SP
Audit results	149	32	106	1	10	92.6%	**76.2%**	99%
Paediatrics	55	9	41	0	5	90.9%	**64.3%**	100%
Adults	94	23	65	1	5	93.6%	**82.1%**	98.5%

Table 2. Audit results; TP= true positive, TN= true negative, FP= false positive, FN= false negative

The data shows that the audit results in specificity were higher than the target standard for the overall sample (99%), the groups of adults (98%) and paediatrics (100%). While the score percentage in sensitivity is higher in the adult group (82.1%), it is below standard for whole sample (76.2%) and the paediatric group (64.3%) in particular (table 2, graph 1).



Graph 1. Comparison of the audit results with the target standard

Discussion/conclusion

Pre-graduation, the student's performance in red-dotting adults examinations shows a higher level of effectiveness in relation to the target standards. However, the sensitivity on paediatric examinations is substantially lower (64.3%), affecting negatively the overall sensitivity (76.2%) and accuracy score (92.6%). As a result of which, the student fails to meet the audit standards in sensitivity (table 2, graph 1).

The data suggests a lower level of knowledge on paediatric radiograph interpretation. These results may have also been influenced by: (1) a smaller sample size generating a greater impact from false negatives; (2) high prevalence of non-displaced fractures (table 3; image 1); and (3) low resolution screen of the DR console in comparison to the reporting monitors potentially hindering the identification of non-displaced fractures. The student has to overcome these potential difficulties to meet the standards.

Image 1. "Very subtle" torus fracture of distal radius

FN	Injury as stated in radiological report
3	Non-displaced fracture (in different anatomical areas).
1	"Minimally displaced" scaphoid fracture.
1	"Very subtle" torus fracture of distal radius (image 1) .

Table 3. False negatives in the paediatric group

Recommendations/Action plan

The student must improve in paediatric red-dotting in order to meet the standards. Before the re-audit is performed, the student will have to:

- Revise acute trauma injuries on paediatrics.
- Attend reporting session with reporting radiographers
- Complete 'Image interpretation' course on E-Learning for Healthcare (http://www.e-lfh.org.uk)

Re-audit for appendicular examination on paediatrics soon after graduation.
Complete re-audit in one year time.

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Keywords:

- Abnormality detection
- Extremities
- Image interpretation
- Sensitivity
- Specificity

Abstract

Aim: An audit was carried out to assess a 3rd year student radiographer's competence in red-dotting radiograph of extremities. This study also differentiates abnormality detection between adult and paediatric examinations.

Methodology: A evidence-based audit standard was selected (93% in accuracy, 80% in sensitivity, and 95% in sensitivity). An audit tool was designed for data collection. 149 appendicular x-ray examinations performed consecutively in the A&E department were red-dotted retrospectively. To determine the student performance, the red-dotted sample was compared against CRIS extracted radiological report references. True/False positive/negative were identified; accuracy, sensitivity and specificity percentages were calculated.

Results. This clinical audit presents an accuracy of 92.6%, sensitivity of 76.2%, and specificity of 99%. For the adult group, the accuracy, sensitivity and specificity are 93.6%, 82.1% and 98.5% respectively, whereas for the paediatric radiographs these are 90.9%, 64.3% and 100% respectively.

Recommendations/Action Plan: The current student's red-dot skills demonstrate a reduced performance in detecting abnormalities on paediatric radiographs. For the present clinical audit, the recommendations are: (1) Revision of acute trauma injuries on paediatrics, (2) attending reporting sessions, and (3) enrolment on an e-course on 'image interpretation'. Re-audit on paediatric radiographs must be carried out soon after student graduation to demonstrate competence on these examinations. Complete re-audit should be performed in a year time.