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Could musculo-skeletal radiograph interpretation by radiographers be a source of support to Australian medical interns: A quantitative evaluation☆

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ABSTRACT

Introduction: Public expectations regarding access to the emergency department (ED) challenges providers and policy makers with finite resources being stretched beyond capacity. To enable education of a greater numbers of doctors the format of the medical internship in Australia has changed and assumes that sufficient supervision is provided to interns to enable image interpretation skills development. Furthermore this assumes that appropriate foundational skills are established during undergraduate education.
Methods: A mixed methods approach using a convenience, self selecting sample population of radiographers and final year medical students was adopted. The study measured the interpretive ability of final year medical students and radiographers in musculo-skeletal trauma (MSK) plain radiographic images. An image test bank based upon radiologist consensual agreement was corrected for prevalence and bias. Performance across a range of measurements was completed and compared for statistical significance using Mann–Whitney U.
Results: Results were divided to enable analysis across age ranges and types of skeletal presentation. Radiographer performance was better numerically and demonstrated statistically significant difference in several areas.
Conclusion: Radiographers have the knowledge base to assist junior doctors to clinically interpret the musculo-skeletal radiographic image. To meet the requirements of AMC and the Medical Board of Australia (MBA), a tailored clinically based educational system could be developed and provided by an accredited radiographer. Australian radiographers could also be employed to provide a safety net to avoid misinterpretation, such as seen in the UK commenting system, operating as an interprofessional team.

Introduction

Public expectations regarding access to the emergency department (ED) continue to challenge providers and policy makers.[1] Finite resources are being stretched beyond capacity in a climate that requires health networks to provide its employees with work schedules compatible with a work-life balance.[2–6] Not only are more health professionals required, but services that are the backbone of the health system such as radiology, are experiencing well documented system failures. Recent reports in the Australian media have revealed that radiology report turnaround times can be significantly below expectations with significant potential for pathology to be missed and patient care compromised.[7–9] This situation has further ramifications for those who require ongoing training from radiologists such as junior doctors completing an internship.

The medical internship format in Australia has recently changed. Previously an 8 week ED placement within all internships was

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expected. Owing to the further pressure on available placement experience, defined as 'terms' by the Australian Medical Council (AMC), the ED experience in medium/large hospitals has been substituted by small hospitals or GP led emergency service placements.[10] Consequently the period in ED that was a prime focus for plain radiograph interpretation has been reduced. Instead of interns interpreting a finite number of images to prove their level of skill, the assessment process relies on mentors attesting candidate competence.[11]

However this approach assumes that sufficient supervision can be provided to interns as they develop image interpretation skills and that foundational skills have been established during the undergraduate period which may not be the case.[12–14] Currently radiology teaching in Australian undergraduate medical curricula averages 85 h.[12] Furthermore, when medical students receive radiology teaching it is not generally provided by radiologists, particularly in the clinical setting, with the result of an ongoing undervaluation of the specialty.[15]

The current situation has the potential to adversely impact upon patient safety. With specialist medical practitioner resources stretched to capacity, and acknowledged problems in providing intern education,[16–21] the question needs to be asked: who amongst the allied health team is best positioned to provide support to medical interns as they develop interpretation skills in musculo-skeletal (MSK) trauma images?

In Australia radiographers are trained and recruited in sufficient numbers except in Queensland, Victoria and Tasmania.[22,23] As such it is proposed that radiographers are an underutilised group of health practitioners, who have the appropriate educational and performance background to provide supportive guidance in MSK image interpretation to junior doctors during their internship. This paper reports on a study that was designed to evaluate image interpretation performance by final year medical students compared with experienced radiographers in Victoria, Australia. It is proposed radiographers perform at a standard such that could provide reliable inter-professional image interpretive support in MSK trauma during the medical internship period.

Method

Ethics clearance was applied for and granted via the Monash University Research and Ethics Committee (MUREC). A mixed methods approach using a convenience, self selecting sample population of radiographers and final year medical students was adopted.

This paper reports the baseline quantitative aspect of a larger study measuring the ability of final year medical students and radiographers to interpret MSK trauma plain radiographic images.

Participant recruitment

Experienced radiographers (over 2 years qualified) working in the State of Victoria were invited to participate in this study. Addresses were obtained with permission from the public component of the then Medical Radiation Practitioners Board of Victoria website (now defunct), for radiographers registered on the general portion of the register, who were contacted after ethics approval was obtained. At least 10 radiographers were sought to meet the phase III level study requirement.[24] To meet selection criteria radiographers were asked if they participated in ED radiography of adults and children as a regular component to their work activity and if they were interested in joining the project. 439 recruitment posters were mailed to listed registrants. Those interested contacted a third party administrator who confirmed inclusion criteria were met using a recruitment survey. Final year medical students were invited to participate using the recruitment poster approach through e-mail via their Learning Management System, Moodle©. This was also followed up by the third party administrator for anonymity reasons.

Test tool

Quantitative evaluation was achieved using an image test bank, the content of which was consensually agreed by three of four consultant radiologists from a Melbourne tertiary health network. A library of 435 patients containing 650 radiographic examinations was identified by randomly selecting ED referred studies from the radiology archive of a tertiary referral hospital. Using the average injury incidence of 14.2/10,000/year described by Bucholz et al.,[25] a period prevalence of injury of 16.13% was calculated as demonstrated in equation (1). The number of images required for test generation was calculated by the formula[26] in equation (2).

Equation 1 Period prevalence calculation

$$\begin{aligned}\text{Prevalence} &= \frac{\text{Incidence}}{\text{Population}} \times 100 \\ &= \frac{14.2/10000/\text{year}}{880000} \times 100 \\ &= \frac{14.2}{88} \times 100 \\ &= 16.13\%\end{aligned} \tag{1}$$

Equation 2 Calculation of images required for the test with 95% confidence and 0.05 precision[26]

$$\begin{aligned}&n = \frac{Z^2 P(1-P)}{d^2} \\ &Z = \text{constant for confidence level} \\ &= 1.96 \text{ for 95\% Confidence interval} \\ &\text{d} = \text{precision} = 5\% = 0.05 \\ &\text{P} = \text{prevalence presented as decimal of 1} \\ &n = 208.8\end{aligned} \tag{2}$$

Based on calculations from Daniel cited by Naing[26] using the calculated period prevalence of injury in equation (1), an image description test was constructed. This ensured each body area as identified by Bucholz et al.[25] was proportionately represented. The image selection process is illustrated in Fig. 1. Table 1 shows the final breakdown of the image test bank content. The qualitative responses via a questionnaire revealed radiographers felt their ability to interpret complex axial and paediatric examinations would be lower than the radiologists. As such the generated image interpretation data was divided into test results for all examinations, appendicular only images and adult only images. In this way it was possible to establish whether a difference was observed and radiographers can provide reliable professional support for all trauma MSK plain images.

209 images were finally selected to account for conjoint examinations amongst case files with 61 being abnormal and 148 normal. This represents 16.13% injury prevalence from the body areas identified by Bucholz et al.[25] or 29.2% of images consensually agreed as demonstrating abnormal findings. In this way whole patient presentations were still available for selection i.e. examinations were not removed from a case, and body areas as defined