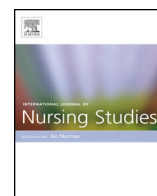




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The accuracy of adult limb radiograph interpretation by emergency nurse practitioners: A prospective comparative study



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ABSTRACT

Background: One of the extensions to practice for the emergency nurse practitioner role is to appropriately order and interpret radiographs in the emergency department.

Objective: The aim of the study was to compare the accuracy in interpreting isolated adult limb radiographs between emergency nurse practitioners and emergency physicians.

Design: A prospective comparative study was undertaken.

Setting: Emergency department in a large metropolitan hospital.

Participants: 200 adult patients with isolated limb injuries were consented.

Methods: Six emergency nurse practitioners and ten emergency physicians participated. One emergency physician and emergency nurse practitioner independently clinically assessed each patient, determined the need for radiograph and separately recorded their interpretation of the radiograph as either definite fracture, no fracture or possible fracture. A single consultant radiologist reviewed each radiograph and their interpretation was seen as the gold standard. The sensitivity and specificity of emergency physicians and emergency nurse practitioners were calculated. To measure the level of agreement between the two-clinician groups, the weighted Kappa statistic was used.

Results: The sensitivity for the emergency nurse practitioners was 91% and 88% for the emergency physicians. The specificity for the emergency nurse practitioners was 85% and for the emergency physicians 91%. The weighted Kappa on the presence of a fracture between the emergency nurse practitioners and emergency physicians was 0.83.

Conclusions: This study validates the clinical and diagnostic skills of emergency nurse practitioners assessed in the interpretation of isolated adult limb injury radiographs.

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What is already known about the topic?

- The scope of practice for nurses working in emergency departments and minor injuries units includes the

assessment and treatment of those presenting with isolated limb injuries which often involves ordering and interpreting radiographs.

- Previous research reported results in nurses' radiographic interpretation skills when compared with junior and senior hospital doctors with marked variation in the results.
- There is a paucity of studies benchmarking emergency nurse practitioners against emergency consultants.

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What this paper adds

- Emergency nurse practitioners have a comparable ability to order and interpret isolated adult limb radiographs as their emergency consultant physician colleagues.
- Emergency nurse practitioners demonstrated a high level of accuracy in interpreting isolated limb radiographs compared to emergency consultants.
- This study validates the clinical and diagnostic skills of the assessed emergency nurse practitioners in the interpretation of isolated adult limb injury radiographs.

1. Introduction

The role of the emergency nurse practitioner within the emergency department (ED) was primarily introduced to address the long waiting times especially for patients with minor injuries (Lee and Jennings, 2006). Since the introduction of the emergency nurse practitioner role within the state of Victoria, Australia in 2004; both metropolitan and rural hospitals have employed emergency nurse practitioners and nurse practitioner candidates. In Australia, those wishing to become nurse practitioners must be educated to Masters level and are known as candidates or transitional practitioners until they are endorsed as nurse practitioners (a legislatively protected title). Research has demonstrated acceptance and understanding of the emergency nurse practitioner role by emergency nurses and physicians alike (Lee et al., 2007), significant results comparing the emergency nurse practitioner with the traditional medical model in terms of waiting and treatment times (Jennings et al., 2008) and a high level of patient satisfaction with nurses working in a nurse practitioner role (Jennings et al., 2009). The results confirmed earlier findings from US and UK studies where the role has been established for several decades (Barr et al., 2000; Carter and Chochinov, 2007; Cooper et al., 2002). Although these data provide important information about the emergency nurse practitioner role, they do not examine clinical quality indicators of performance such as ordering and interpreting diagnostic tests.

Physicians have traditionally carried out radiographic interpretation but since emergency nurse practitioner implementation in Australia a decade ago, the role of ordering and interpreting radiographs is within the nurse practitioner scope of practice. Several papers have reported accuracy of X-ray interpretation amongst clinicians and results are favourable with similar levels of accuracy in X-ray interpretation reported between emergency nurses and doctors (Benger, 2002; Derksen et al., 2006; Freij et al., 1996; Hardy and Barrett, 2004; Sakr et al., 1999). However the approach of comparing nurses' abilities with medical colleagues is not without its problems. Hardy and Barrett cautiously warn on the marked variation observed in Senior House Officers (SHOs – usually 2nd or 3rd year junior doctors) interpretation of radiographs and concluded that a similar ability to interpret radiographs does not imply satisfactory ability (Hardy and Barrett, 2003). Indeed one study observed that inexperienced SHOs failed to detect injuries in 68% of radiographs compared to fracture detection error rate of

20% of senior registrars or consultants (McLauchlan et al., 1997).

Some research has focused on the sensitivity, specificity and accuracy of radiograph interpretation amongst clinicians (Benger, 2002; McLauchlan et al., 1997; Overton-Brown and Anthony 1998; Sakr et al., 1999; Tachakra et al., 2002). Others have examined the sensitivity (number of patients correctly diagnosed with a fracture; true positives) and specificity (number of patients correctly identified as having a radiograph with no fracture; true negatives) of clinicians' X-ray interpretation skills (Benger, 2002; Overton-Brown and Anthony 1998; Sakr et al., 1999). Benger (2002) examined 300 patients and reported 26 false positives and four false negatives with a sensitivity of 96% and specificity of 87%. Overton-Brown and Anthony (1998) reported similar levels of sensitivity and specificity in their review of 50 trauma radiographs. In a literature review examining the effectiveness of nurses to order and interpret radiographs, low rates of false negatives and false positives were reported. However these studies were not specifically examining emergency nurse practitioners but different levels of emergency nurses (Free et al., 2009). Tachakra et al. (2002) demonstrated accuracy of 97.8% for emergency nurse practitioners, 98.8% for emergency physicians and 98.7% for consultant radiologists. The sensitivity and specificity for emergency nurse practitioners were 95.6% and 98.7% respectively compared to 98.1% and 99% for emergency physicians. The authors commented on their inability to perform ROC analysis or Kappa statistics due to the study design. Overall, the research describes a favourable result in nurses working in advanced roles and emergency nurse practitioners' accuracy of X-ray interpretation when compared with their medical colleagues. The sensitivity and specificity of radiographers in interpreting X-rays in clinical practice have also been described with one paper using systematic review data reporting plain radiograph sensitivity by radiographers of 93% and specificity of 98% (Brealey et al., 2009). The radiograph is a useful diagnostic tool and a clinician's competence to accurately identify abnormal pathology is paramount as this subsequently guides clinical management decisions. With the wider implementation of emergency nurse practitioners, it is therefore appropriate to examine the level of agreement and compare the sensitivity and specificity between emergency nurse practitioners and emergency physicians and the gold standard consultant radiologist in interpreting isolated limb radiographs.

2. Methods

The Alfred Emergency and Trauma Centre is one of two adult level one trauma centres in Victoria, Australia. Annual attendances have increased by 17% over the last three years, and in 2011; 56,073 attendances were recorded with an admission rate of 30%. The centre has eight critical care beds (four resuscitation beds and four trauma beds), 18 general cubicles, 18 short stay beds and six non-acute/fast track beds. Emergency nurse practitioners are geographically located in the fast track area and are rostered from 07.00 to 23.30 seven days a week. The

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