Accuracy of Nuclear Medicine Technologist Reporting on Bone Scintigraphy: A Case Study from Sudan

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Abstract: The expansion of the reporting role of a radiologic technologist (radiographer) has been necessary over the past four decades in order to deliver and to expand clinical imaging services. In developing countries, radiologic technologist reporting has become a requirement when a shortage exists in medical staff. The objective of this study was to assess the accuracy of bone scintigraphy reporting from a nuclear medicine technologist in comparison with that of a nuclear medicine physician as the reference standard. This study comprised a statistical assessment of nuclear medicine technologist (NMT) reporting on 100 bone scans in comparison with nuclear medicine physician reporting as a reference standard. The study was carried out at the National Cancer Institute, University of Gezira, Sudan. The NMT started reporting on bone scans after he successfully completed a formal training course in nuclear medicine clinical reporting, delivered by Salford University, through a continuous professional development program. This study revealed that the accuracy, specificity, and sensitivity of nuclear medicine technologist reporting were 97.4%, 95.8%, and 97%, respectively, when compared to that of a nuclear medicine physician. This study provides evidence that the reporting of nuclear medicine technologists on bone scintigraphy is accurate if they are exposed to formal training in nuclear medicine image reporting.
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Introduction

The necessity for expanding health care services has been a main factor in the development of a role for the radiographer in reporting since the 1970s (Swinburne, 1971). The United Kingdom (UK), Australia, and the USA have shown a trend towards extending the role of the radiographer (technologist) in practice (Smith, 2002; Swinburne, 1971; Robinson and Jackson, 1996; Price, 2001; Brayley, 2000; Cook et al, 2004; and Williams et al, 2004).

The UK is considered the first country to initiate a role for the radiographer in reporting, and this was carried out according to the suggestion of the British of Radiologists Council, which stated that radiographers could report on radiographic images (Swinburne, 1971; Price, 2001). Swinburne stated that the radiographer-reporting role would reduce the radiologic service workload and increase job satisfaction (Swinburne, 1971).

The starting point in the radiographic reporting process is the "red dot" system, whereby radiographers mark abnormal radiological examinations with a "red dot" to alert radiologists to a potential pathology (Cheyne et al, 1987). Many published studies showed a strong correlation between radiographer "red dot" results and radiologist reports (Kleeman and Egan, 1999; Haiart and Henderson, 1991; Sonnex, Tasker, and Coulden, 2001).

The delegation of radiologists to an experienced radiographer was the first step in the radiologic technologist (radiographer) reporting process, as reported by the Royal College of Radiologists (RCR) and the College of Radiographers (CCR) (RCR, 1995; COR, 1997). This delegation was officially supported in a joint statement by the ROR and the COR (RCR and COR, 1998). According to the joint statement, the delegated radiographer must receive adequate training and be competent before delegation can occur (RCR and COR, 1998).

Nuclear medicine technologists of varying ability level have been involved in reporting on nuclear medicine radiograph in routine nuclear medicine image procedures, such as thyroid, bone, lung, and renal scans (Hogg, 1993; Simon and Cowel, 2002; Welsh et al, 2005; Salih, 2014).

In spite of the early beginning and development of radiographic education in Sudan, a very limited number of studies regarding reporting has come from this region, particularly sub-Saharan African countries. The purpose of this study was to assess the accuracy of NMTs reporting on bone scans in comparison with that of a nuclear physician as the reference standard.

Methods

This study was conducted at the Department of Nuclear Medicine at the National Cancer Institute,

University of Gezira, Sudan, in 2008. The study involved 100 bone scans.

The NMT who was responsible for bone scan reporting was trained in Sudan, South Africa, and in the UK. He had 10 years of radiographic experience and had a M.Sc. degree in nuclear medicine technology at the time that the study was performed. Further, he was awarded post-graduate certification in nuclear medicine reporting by Salford University, UK, during the period from March 2007 to December 2007. The nuclear medicine technologist reported on the bone scans included in this study after he successfully completed formal training in nuclear medicine reporting.

The NMT involved in the study described the features of each bone scan, indicated whether the radiographs were normal or abnormal.

The nuclear medicine technologist's report was compared to the nuclear medicine physician's report, and the results were tabulated and analyzed.

Formal ethics approval was not required because the personal information of the participants was not accessed, and access to the nuclear medicine bone scans was obtained from and the clinical history was acquired from the patient request form.

Results

Table 1. Nuclear medicine technologist (radiographer) bone scan reporting as measured against the reference standard

Condition positive (P) according to the reference standard n = 76	Condition negative (N) according to the reference standard n = 24
True positive (TP) = 74	**True negative (TN) = 23**
False positive (FP) = 2	**False negative (FN) = 1**

Table 2. Sensitivity, specificity, and accuracy of the bone scan reports from the nuclear medicine technologist as measured against the reference standard

Sensitivity	Specificity	Accuracy
$\frac{TP}{P}$	$\frac{TN}{N}$	$\frac{TP + TN}{TP + TN + FP + FN}$
(74/76) = 97.4	(23/24) = 95.8	$\frac{74+23}{74+23+2+1}$ = 97%

The nuclear medicine technologist reported on 100 bone scans, and these reports were subsequently compared with those from the nuclear medicine physician. The accuracy, specificity, and sensitivity of the reports from the nuclear medicine technologist were 97.4%, 95.8%, and 97%, respectively, compared to those of the nuclear medicine physician (Table 1 and Table 2).

Discussion:

The results of this study showed a high accuracy (97%) of NMT report on bone scan compared to the reporting of a nuclear medicine physician as the reference standard (Table 1). This finding is supported by many experts in nuclear medicine and general radiographers, such as Hogg, Ware, and Parkin, who all showed that radiographers are competent reporters. In "Radiographer reporting: a vision paper", the College of Radiographers suggested that the wider development of radiographers in a reporting role will bring enormous benefits to the patient (Hogg, 1993; Ware, 1995; Parkin 1996).

Further, the results reported herein are in agreement with those of a study that was performed by Robinson, in which two radiographers commenced reporting of emergency imaging examinations in parallel with radiologists. An analysis of over 500 cases showed no significant difference in their accuracy compared to those of the radiologists (Robinson, 1996).

The results of this study are in agreement with those of a meta-analysis performed by Brealey et al, which showed that radiographers compared well to the reference standard, with a sensitivity of 92.6% and a specificity of 97.7% for reporting plain films (Brealey et al, 2005). Finally, a recently published study from Sudan, which compared the reporting of a nuclear medicine radiographer on thyroid scans with that of nuclear medicine physician reports as the gold standard, yielded results that strongly agree with the results reported herein (Salih, 2014).

The published data and the literature suggest that UK, Australia, and South Africa-based radiographers have comparable results for accurate and effective reporting of radiographs (Cook et al, 2004; Imelda, 2006). Regardless of the differences between the health systems in different countries, radiographers in Sudan could be effectively used in a similar manner as a clinical tool to provide an informed opinion and to reduce the workload of the radiologists in areas that have a shortage of radiologists, particularly rural areas (Ferraioli and Meloni, 2010; Kawooya, 2012).

Image reporting and interpretation by radiologic technologists will become a requirement in the future in order to meet the needs for delivering and expanding radiology services (CoR, 1997). However, formal training courses involving

image interpretation should be developed and implemented to ensure quality service (Hardy, 2008; Salih, 2014). To make this type of role extension for radiographers a reality, a more cooperative approach between radiographer professional organizations, health professional councils, universities, and legislation authorities must be developed (Cook et al, 2004; Imelda, 2006).

Conclusion

The results from the bone scan reports of a NMT showed a high level of accuracy compared to the reference standard. NMT image reporting can be beneficial to the health care system, particularly in developing countries that have a shortage of trained medical staff. However, formal education and training courses are required to improve service and to ensure safe practice.

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