Radiographer reporting in emergency departments – a literature review

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Abstract Radiographer reporting is an ongoing issue in radiology departments worldwide, and is accompanied by some complex and controversial themes. In this article, ten studies examining the accuracy of radiographer reporting are compared and considered. The ability of a radiographer to discriminate abnormal radiographs and, in addition, to identify such abnormalities, is investigated. Any biases detected in the studies are noted. Discussion leads to the conclusion that with training, radiographers are able to provide reports similar in accuracy to radiologists. Radiographer reporting is a theme that has been noted in departments throughout the last century; however, the issue has become more prevalent since the early 1980s. The term ‘radiographer reporting’ is used in many instances, but generally refers to a situation where a radiographer is required to give a professional opinion on a radiograph. This may include a radiographer being required to identify examinations where any abnormality is noted on a radiograph, such as radiographer abnormality detection systems (RADS) and specially trained radiographers writing a full report on the examination, as a radiologist would. There are considerable advantages to such a system, and to a lesser degree, disadvantages. Various studies have been conducted to investigate the efficacy of radiographer reporting systems, looking specifically at the radiographers’ abilities to determine and identify any abnormality demonstrated. In addition, studies have been performed to distinguish whether special training can improve results in either of these categories.

Radiographer abnormality detection systems are used worldwide, with some countries implementing and embracing full systems and training for their radiographers in both the public and private sectors. Perhaps the most well known form of radiographer reporting is the ‘Red Dot System’ (RDS), which was created in London in 1981 and is now used in over 150 hospitals throughout the UK.\textsuperscript{1} The RDS was devised following the discharge of a patient with a fractured neck of femur by a casualty officer, which the radiographer had actually identified.\textsuperscript{1} The RDS requires radiographers to flag cases where an abnormality is noted, possibly preventing other professionals missing these abnormalities. Compared with many hospitals overseas, Australia has been slow to trial RADS and has yet to put into operation any specific system.

Benefits and disadvantages of radiographer reporting

There are numerous benefits and advantages of radiographer reporting systems, which are commonly listed in most studies on this topic, however few authors record many of the disadvantages. Each of the articles examined mentioned the benefit to the patient and the reduced risk of missed abnormalities, thus preventing misdiagnosis. This is particularly true for patients being treated by junior doctors with less experience in radiographic interpretation.\textsuperscript{2} In addition, the ability of systems such as the Red Dot System to speed up processing of patients through busy emergency departments is further beneficial to the patient.\textsuperscript{1} Such systems may also provide assistance to emergency department staff in rural practices or after-hours clinics, where a radiologist may not always be available.\textsuperscript{2} The observed benefit of RADS to doctors is the possibility of learning from experienced radiographers and thus being at reduced risk of litigation.\textsuperscript{1}

Three decades ago, it was stated that radiographers contributing to reporting would not only relieve the workload of radiologists, but also increase their own job satisfaction.\textsuperscript{1} This is reflected by Field-Boden\textsuperscript{2} who stated that radiographers benefited from the RDS with ‘enhanced professional status’. An improved relationship between emergency department staff and radiographers under such systems has also been noticed.\textsuperscript{1} Furthermore, studies have found that when a radiographer had to provide a diagnosis from their own films, the quality of their images improved.\textsuperscript{2}

Orames\textsuperscript{4} and Hall, Jane and Egan\textsuperscript{4} both mention concerns that emergency department doctors may ultimately end up relying too heavily on the opinion of radiographers. There is also the trepidation that delegation of reporting may confuse patients if radiologists, radiographers and nurses can all issue reports. In addition, if reporting by specially selected and trained radiographers were to be implemented, a division between radiographers who report and those who don’t could develop. Other concerns in this situation are staffing shortages, financial issues and difficulties for the radiographers in combining these extra duties with their normal work.

Each of the reviewed authors was in support of a system such as the RDS, however Robinson\textsuperscript{5} was the only author to list its limitations. Robinson\textsuperscript{5} highlighted that the RDS was only used to distinguish between normal and abnormal, giving no indication of significance or severity of abnormalities. Thus, this system can supplement a radiologists report but not replace it and as the system is informal, quality standards cannot be set or monitored.

Field-Boden\textsuperscript{2} notes the attitudes and misconceptions of health staff when discussing limitations of radiographer reporting.
Table 1 Results of different studies measuring the accuracy of radiographers and/or emergency department doctors in identifying abnormal radiographs

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year of study</th>
<th>Cases used</th>
<th>n cases</th>
<th>% accuracy of radiographers</th>
<th>% accuracy of emergency department doctors</th>
</tr>
</thead>
<tbody>
<tr>
<td>de Lacey et al.</td>
<td>1985</td>
<td>All casualty</td>
<td>531</td>
<td>–</td>
<td>83</td>
</tr>
<tr>
<td>Berman et al.</td>
<td>1985</td>
<td>All casualty</td>
<td>1496</td>
<td>87</td>
<td>89</td>
</tr>
<tr>
<td>Gleadhill et al.</td>
<td>–</td>
<td>All casualty</td>
<td>5463</td>
<td>–</td>
<td>95</td>
</tr>
<tr>
<td>Renwick et al.</td>
<td>1991</td>
<td>All casualty</td>
<td>3994</td>
<td>87</td>
<td>–</td>
</tr>
<tr>
<td>Hughes et al.</td>
<td>–</td>
<td>Chest radiographs</td>
<td>484</td>
<td>86</td>
<td>–</td>
</tr>
<tr>
<td>Orames</td>
<td>1997</td>
<td>All casualty</td>
<td>736</td>
<td>87</td>
<td>90</td>
</tr>
<tr>
<td>Hall, Jane &amp; Egan</td>
<td>1999</td>
<td>Selected cases</td>
<td>940</td>
<td>91</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 2 Results studies measuring radiographer accuracy in writing reports on radiographs following relevant training

<table>
<thead>
<tr>
<th>Author(s)</th>
<th>Year of study</th>
<th>Cases used</th>
<th>% accuracy of radiographers</th>
</tr>
</thead>
<tbody>
<tr>
<td>Robinson</td>
<td>1996</td>
<td>Casualty</td>
<td>88.2</td>
</tr>
<tr>
<td>Loughran</td>
<td>1994</td>
<td>Query fractured extremities</td>
<td>95</td>
</tr>
<tr>
<td>Cook, Oliver &amp; Ramsay</td>
<td>2004</td>
<td>Casualty musculo-skeletal only</td>
<td>98.5</td>
</tr>
</tbody>
</table>

Radiographers may feel threatened or experience increased pressure, while radiologists may feel threatened by radiographers advancing into areas previously considered their own. Some radiographers experienced the perception that it is was not their job to report on films, or if they were required to undertake this extra work they expected to be paid at a higher wage. Smith observed that radiographers believed they were not allowed to pass opinions of films.

**Effectiveness of radiographer’s ability to distinguish abnormalities**

The results of key studies measuring radiographers’ accuracy in identifying abnormalities on radiographs are quite similar. Table 1 demonstrates the results of these studies. There are some small differences observed in some relationships, including the ratios of false negatives to false positives and the relationship between accuracy and the experience of the radiographer.

A series of studies by Hall, Jane and Egan measured the ability of radiographers to detect abnormal radiographs, and in the final study, their ability to provide a provisional diagnosis. Only emergency department patients were used and unlike most other studies, this one included computer tomography and ultrasound examinations. Also unlike other studies, the cases used had a relatively high abnormality rate with a total of 52%. The average result of three separate studies resulted in a 91.2% accuracy in determining abnormal radiographs.

**Radiographer's ability to report/name pathology**

Some of the reviewed studies went further in their examination in noting how accurate radiographers were at identifying an abnormality once it was noticed. Throughout journal articles, there is confusion between the actual results of identifying the abnormality on film and naming the actual pathology. They are often classed together and compared, however, it is should be remembered that two different aspects are being measured. Table 2 shows the results of three studies in which radiographers received specific training prior to becoming a reporting radiographer, and their accuracy at reporting on radiographs was measured.

In a month-long study in Sydney, by Orames, untrained radiographers were able to diagnose patients with 87% accuracy. Inaccuracies were classified by body region. It was noted that radiographers had 79% accuracy in diagnosing chest pathologies and 98% accuracy in diagnosis in the spine region. Emergency doctors were also tested, resulting in an overall 89.8% accuracy. However, while radiographers returned the survey for 736 examination regions, emergency doctors only complied for 106 patients. This is identified as a major limitation of the study due to the comparison being ‘small scale’.

Orames compares the results of this study to that of others, noting others have higher radiographer accuracy. A study by Renwick showed 90.6% accuracy, however, this study had a far lower rate of chest examinations. Various studies have identified that radiographers are not as accurate in diagnosing chest pathologies, possibly due to the more complex anatomy and wider differential diagnosis. Therefore, studies comprised of fewer chest examinations, will result in higher overall accuracy. Hall, Jane and Egan identified that 51% of all examinations were of the chest, and these resulted in only 79% accuracy in provisional diagnosis.

Another study by Hall, Jane and Egan also tested the ability of untrained radiographers, once an abnormality was identified, to determine what the pathology actually was. The accuracy of their provisional diagnoses was 85%.

In one study, a Radiographer Opinion Form (ROF) was used where radiographers indicated first, if there was an abnormality, to determine what the pathology actually was. The accuracy of their provisional diagnoses was 85%. Participation was voluntary and concern was voiced over the time taken to fill in the form plus the added responsibility. Unlike other studies where all radiographers were involved, only 26 out of 34 employees in this department participated in the study. Radiographers were assigned a code, which was known only to them and an independent observer (not the researchers). Participants varied in age and
level of education. The overall accuracy of the radiographers was calculated at 93.0%.

While many studies compare the accuracy of emergency department doctors and radiographers, few actually evaluate whether the same abnormalities were missed by both professionals. Smith identified a study by Berman et al. (1985) where radiographers missed 4.5% of abnormalities and emergency doctors missed 4.2% of abnormalities. Only 2.3% of the abnormalities were missed by both. This demonstrates that, even if radiographers are slightly less accurate in recognising abnormalities than emergency doctors, they may pick up different ones, therefore still reducing the overall number of misdiagnosed patients.

In the study by Orames there were 40 false positives and 32 false negatives. Smith and Younger also found a relatively high number of false positives in their study. Other studies were inconsistent with this, where the numbers of false positives and false negatives were similar. A higher rate of false positives can be attributed to a radiographer being cautious, possibly preferring to call any unsure diagnosis positive (abnormal) to decrease the risk of missed abnormalities. There is also some discrepancy between articles, as Orames claimed Renwick’s study (1991) to have a higher rate of false negatives, while Smith claimed Renwick’s study to have a higher rate of false positives.

A correlation is reported between a radiographer’s experience or seniority, and the accuracy in their identifying abnormalities. As most radiographers have no formal training in image interpretation, a great deal of their knowledge is gained through experience and ‘pattern recognition’, which may explain this correlation. However, other studies reported there was no correlation between experience and accuracy. Some studies excluded radiographers with little experience from their studies (reflecting their concern for this to be true) or did not record the age of the radiographers participating. Only one study investigated a relationship between radiographer qualification and accuracy, and no correlation was found.

Radiographer diagnosis accuracy with training

There have been many studies that investigate whether the accuracy of a radiographer’s provisional diagnosis can improve with training. In 1970, Sheft investigated training radiographers in the interpretation of chest radiographs. On completion, the radiographers were comparable in accuracy to radiologists. Loughran reported that after six months of training radiographers accuracy in reporting fractures increased from 81.1% to 95.9%. Reed comments on a study where, at the end of a training program, radiographer’s sensitivity was 95.9% and specificity 96.6% which is comparable to radiologists and another where after 9 weeks of training the radiographer accuracy increased to 100%.

Biases in studies

It was noted in the Smith and Younger research study that some radiographers were only completing Radiographer Opinion Forms for examinations for which they were most sure of, however for various reasons nothing was done to overcome this problem. This creates a bias possibly resulting in higher accuracy rates than are truly correct. In the study by Orames, it was emergency doctors who were selective in returning surveys, making comparison between them and radiographers difficult. While no other studies mentioned a selection bias like this it is quite likely to have occurred.

The opinion of the radiologists, in all studies, was considered the ‘gold standard’. Only a few articles mentioned or discussed the fact radiologists are not 100% accurate as assumed. De Lacey claimed that radiologists were inaccurate 4% of the time and equivocal 1% of the time. Cook, Oliver and Ramsay even report that of the 540 cases in their study, in two cases the radiographer identified abnormalities, which the radiologist had missed with one considered clinically significant.

Only one study considered the possibility that both the radiologist and radiographer could be wrong in their diagnosis. While unlikely, this may influence the results. Orames was the only author to identify bias due to the radiographers’ awareness of the aim of the study, as this was unavoidable. The tendency of radiographers to try harder in this situation is noted. This situation is similar for most studies of this nature.

When a complete comparison of studies is done, all variables need to be considered. For example, some studies only included plain film radiographs of emergency patients while other studies may include other modalities such ultrasound and CT. These details need to be taken into account.

Medico-legal issues and AIR stance

Most articles address medical-legal issues in regards to patient care, as this seems to be a major concern in the area. Emphasis is placed on the fact that the final decision is made by the doctors, and they can choose to ignore the radiographer’s opinion if they decide to. Smith and Younger even recommend that a ‘medico-legal disclaimer’ be included on a radiographer opinion form.

A case of a radiographer being sued for giving their opinion could not be found, while a radiographer being sued for not giving their opinion where the findings are medically significant is quite comprehensible. The Code of Professional Conduct for the Australian Institute of Radiography states: ‘radiographers, recognising their responsibility to the patient, should alert medically significant findings to the medical personal responsible for the patients treatment, and at their request may provide an opinion that lies within the radiographer’s knowledge and expertise.’

The general opinion from radiographers in Australia seems to be that they are not allowed to pass opinions on films. The inaccuracy of this opinion is discussed in various articles, with Field-Boden quoting the Australian Institute of Radiography: ‘it shall not constitute a ground for expulsion if in the absence of a radiologist a member under certain circumstances and at the request of the person authorising the procedure shall describe to such person the appearances seen on an x-ray examination to an extend as may be necessary to assist him in making a diagnosis.’

Conclusion

Despite biases and different methods of testing, the general trend of results is the same. Research shows that radiographers can identify abnormalities on radiographs with accuracy similar to that of emergency department doctors. It has also been shown that with special selection and training, radiographers can actually report on abnormalities doctors, radiographers and most importantly patients have been demonstrated with the implementation of radiographer abnormality detection systems with no major implications. If a ‘red dot’ type system is easy to introduce, shows positive results and better patient care it seems imprudent not to implement it. This should be only the first step towards radiographer reporting in emergency
departments. With appropriate training radiographers could take on a larger role, thus improving job satisfaction, reducing radiologist workload, and above all else improving patient care.

References