Examining the effect of an educational poster on the knowledge of lateral elbow radiograph repositioning in radiographers

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Abstract

Background: This study aimed to evaluate the knowledge, attitudes and practices of South Australian radiographers regarding lateral elbow repositioning and to determine whether an educational poster could improve repositioning knowledge.

Method: The study was undertaken in four stages. Stage one involved the development of a pre-post survey to explore radiographer knowledge, attitude and practices surrounding lateral elbow radiograph repositioning. Stage two involved the development of an educational poster. Stage three was a pilot validity study. 3 participants were involved in testing the validity and test-retest reliability of the survey and the poster. Stage four involved the distribution of surveys to two radiography departments in South Australia on two occasions, the pre-survey initially and then the post-survey two weeks after the distribution of the poster. 6 complete data sets were analysed.

Results: The pilot validity study ensured the test-retest reliability of the survey was strong (p=0.629). It was determined that an educational poster made no significant difference to the knowledge of lateral elbow x-ray repositioning among radiographers (p=0.253). It was indicated that this result was not due to familiarity with the pre-survey questions (p=0.171). Thematic analysis of the open discussion questions found that most participants found the poster helpful but did not consider repositioning to be difficult. The introduction of the poster did not increase image repeat rate and the poster was used moderately over the study length.

Conclusion: As this study was unable to determine whether a poster could improve the knowledge of lateral elbow repositioning among radiographers, further research will be needed.

Keywords: Education; Lateral elbow; Poster; Radiography; X-ray

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Background

The elbow is one of the most commonly dislocated and fractured joints in children and the second most dislocated joint in adults [1,2,3]. As a result, radiological examination requests of the elbow are frequent. In conventional radiography, most elbow examinations consist of an anterior-posterior, oblique and lateral projection. The basic patient (adult) positioning for a lateral elbow radiograph requires the patient’s elbow to be flexed at 90° on the table/image receptor, with the elbow and shoulder on the same horizontal plane and the wrist slightly raised in the lateral position [4,5,6].

The definitive feature of a true lateral elbow radiograph is the formation of three concentric circles formed from the distal humeral anatomy; consisting of the lateral border of the trochlea, capitellum and medial border of the trochlea [4,7,8] (Figure 1).

![Figure 1: A lateral elbow radiograph outlining the three concentric circles of the distal humerus (Image courtesy of principal researcher)](image)

The lateral elbow radiograph is the “most critical image to obtain after acute trauma” [9] as it is the only projection in the elbow series to provide the posterior fat pad sign - a radiographic indication of a joint effusion [10]. Studies have shown that in 75% [11] and 76% [12] of patients, joint effusions present on radiographs are able to determine the presence of an occult fracture when there is no other radiographic evidence of injury. As most treatment decisions are made from the lateral radiograph, repeating the projection is worth the effort if true elbow laterality hasn’t been achieved [13].

A firm understanding of repositioning techniques will reduce time, potentially promote the effective use of resources, increase patient confidence in the radiographer and reduce cumulative radiation dose through fewer x-ray repeats. It is therefore evident that lateral elbow radiography education is imperative to improve radiographer performance and patient outcomes.

A narrative review conducted on the 10th January 2017 revealed that there is limited literature on the effectiveness of radiography education and the knowledge level of lateral elbow repositioning in radiographers. This study aimed to develop and test an educational poster on lateral elbow repositioning for radiographers in a general radiography department. If proven successful, this resource could be implemented in radiography departments across the country, with potential for future resources to be developed to improve knowledge in other areas of radiography.

Methodology

The completion of this study was undertaken in 4 stages:

1. Survey development
2. Poster development
3. Pilot validity study
4. Pre-post interventional study

Stage 1: Survey Development

A survey was designed to measure lateral elbow repositioning efficiency in radiographers and explore radiographer knowledge. The primary tool used to measure repositioning knowledge was a set of nine multiple choice questions in which the participants were required to determine the correct repositioning action required to correct each lateral elbow image. An additional nine images were included in the post-intervention survey (total 18), preventing the respondent from reproducing an answer based on image recall. Numerous open discussion questions were included in both the pre-survey and post-survey to gain a deeper insight into the radiographer’s knowledge, attitudes and practices of lateral elbow repositioning and to provide feedback on the survey and poster.

Stage 2: Poster Development

Stage 2 involved the development of an educational poster to be used as the intervention in the pre-post study in stage 4. The poster was designed as a quick, ‘how –to’ practical skills reference guide to be used by clinicians, therefore no theory regarding repositioning was included. The poster aimed for the radiographer to match the mispositioning error of their own image with the one displayed on the poster and use the corresponding corrective arm movements provided.

Stage 3: Pilot Validity Study

The pilot validity study was conducted to assess the response process validity and content validity of the poster and pre-and post-surveys and to determine the test-retest reliability of the pre-and post-surveys. The individuals selected to participate in the pilot validity study were “experts” in the field of radiography.

Stage 4: Pre-post interventional study

A purposive sampling strategy was used, which selected participants who met the inclusion criteria for the study [14]. The population consisted of qualified South Australian radiographers who were currently employed at either the Royal Adelaide Hospital (RAH) or the Repatriation Hospital at Daw Park (REPAT). Eligible participants received a hard copy of the pre-intervention survey. The participants were asked to have no assistance when completing the survey. The poster was then displayed in the general radiography viewing area. After two weeks, the participants received a hard copy of the post-intervention survey and a hard-copy of the poster. The participants were encouraged to use the poster when completing the post-intervention survey.
Data analysis was conducted using a two-tailed paired t-test, allowing for the relationship in both directions to be assessed. Small effect size (20%) was assessed by comparing the individual results of the pre-and post-intervention surveys.

**Results**

**Stage 1: Survey Development**

Changes made to the survey were based on feedback during the cognitive interview portion of the pilot validity study which lead to improved clarity and reduced the ambiguity of the survey.

**Stage 2: Poster Development**

The poster was modified based on feedback from the cognitive interview portion of the pilot validity study. The feedback primarily aimed at increasing the readability and clarity of the poster. The final copy of the poster was displayed below in Figure 2.

![Figure 2: Final copy of poster used in pre-post study](image)

**Stage 3: Pilot Validity Study**

Ideas raised during the cognitive interview and in the feedback sheets were used to inform the changes made to the poster and survey. The discussion focused on pathology, the hand position in the survey images and the different types of repositioning techniques that radiographers use.

The test-retest reliability of the survey ensured that the correlation between the pre and post surveys were considered strong (p=0.629), ensuring that the pre-intervention survey was a reliable control baseline used for the basis of comparison with the post-intervention survey [15].

**Stage 4: Pre-post study**

There were a total of 11 participants that responded to the pre-intervention survey. Only 6 complete datasets of pre-and post-survey responses were obtained, which were included for analysis.
Discussion

As previously mentioned, the use of the poster did not produce a statistically significant improvement on the knowledge of lateral elbow repositioning among radiographers. This result may be due to the low sample size and needs to be interpreted with caution. Majority of the participants stated they did use the poster, however these instances did not exceed two times throughout the two-week intervention period. This may be due to the relatively low occurrence of elbow x-rays available, which was estimated as less than 4-6 times a week (based on the demographic question), and the opportunities available to repeat an image. Even though all participants rated their self-perceived knowledge of lateral elbow x-ray repositioning as good, the majority of the participants stated the poster did help them to reposition clinically. This indicates that some radiographers may benefit from the implementation of the poster into the general department.

All participants could accurately describe the patient positioning for a lateral elbow radiograph; previously described in the introduction. This indicates a strong base knowledge of clinical elbow imaging. The majority of the participants indicated that they had previously used at least some of the repositioning techniques displayed in the poster. One radiographer who did not previously use the techniques outlined in the poster struggled to incorporate their previous repositioning techniques with that displayed in the poster and consequently did not use the poster during the two-week intervention period. This indicates that the poster may be more difficult to understand for individuals who have never used the Compass technique before and further education may be required for these individuals.

Limitations

Sample size

The sample size of complete data sets was 6 participants. Paired t-test calculations were still performed; however, it was not surprising that the result was not statistically significant (p=0.253). The small sample size was unavoidable due to the time constraints of the study, loss of follow up and issues with recruitment mentioned above. It is noted that the use of this small sample size may increase the risk of a type II error and that the study has falsely accepted the null hypothesis in which the poster doesn’t improve the knowledge of lateral elbow radiograph repositioning in radiographers.

Maturation bias

The total length of the study was six weeks. It is possible that changes to the participants’ knowledge could occur over time. The pre-survey may prompt the participants to research this area further and mindful clinical imaging could result in natural knowledge progression. This limitation was noted during the initial planning of this study, however it was determined it was impractical to monitor and control the participants’ interests and learning during the course of this study. The use of a control group may have reduced the maturation bias in this study.

Recommendations for further research

Due to the small sample size, it would be appropriate to consider this study as a pilot study. This paves the way for a larger scale study to be performed to improve the statistical power, generalisability and reproducibility of the results. If the study were to be conducted again, it would be useful to implement the research at multiple sites, including regional, rural, public and private areas. The use of electronic surveys could make the study available to more sites across the country and help gain a diverse range of responses.

It would also be beneficial to reduce the length of each survey. This will improve the manageability of the results, ensuring that all questions can be appropriately analysed, and will reduce the completion time of the survey, boosting participant engagement. The reliability of the survey should also be completed with a larger group of expert radiographers to ensure the survey is an appropriate control, particularly if no participant control group is used. Lastly, the completion of the surveys needs to be controlled. The time taken to complete the survey and the conditions in which they are taken needs to be controlled to ensure the participants are not using other resources to assist them. This ensures that changes between the surveys are due to the poster only. It may be possible to complete the surveys during a meeting or lecture, in which all participants are completing the survey at the same time under test conditions.
Conclusion

This study aimed to investigate the knowledge of lateral elbow repositioning among radiographers and whether an educational poster could improve this knowledge. It was determined that a poster was not effective at improving the knowledge of lateral elbow repositioning among radiographers. It was found that the introduction of an intervention does not result in an increase in the number of image repeats likely to be taken. A low pre-survey score indicates that repositioning lateral elbow radiographs is still a challenging area among radiographers. While all the participants have a good understanding of patient positioning, some participants struggled with elbow anatomy.

The small sample size reduces the statistical power and reproducibility of the results and numerous biases were introduced into the research. It is therefore unclear whether the results of the pre-post survey demonstrate that the intervention was inadequate.

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References