ORIGINAL ARTICLE

FREQUENCY OF COMMON CAUSES OF REJECTED/ REPEATED CHEST X–RAYS IN RADIOLOGY DEPARTMENT OF A TEACHING HOSPITAL

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ABSTRACT

Background: The employment of reject analysis as part of overall Quality Assurance (QA) programs in clinical radiography and radiology services in the evaluation of image quality is a well established practice. In this study we emphasize upon the common causes of rejected / repeated chest X-rays in order to provide relevant information that would help achieve sound reduction in radiation exposure and cost as well as develop acceptable image quality.

Material & Methods: The study design is cross sectional. This study was conducted at Radiology Department of Peshawar Institute Of Medical Sciences from 1st January 2015 to 1st June 2015 during which 1200 chest X -rays were reported. Those X-rays which were rejected / repeated were analyzed to know the frequency of various causes of rejection / repetition. The data was analyzed using statistical package SPSS version 10.

Results: From 1st Jan 2015 to 1st June 2015 1200 chest X-rays were performed at Peshawar Institute Of Medical Sciences using Toshiba 100mAs/150kv latest computed radiography system. The total number of X-rays repeated were 58 making the reject rate 4.8%. X-rays rejected due to overexposure were 48.8%, 37.9% due to underexposure, 6.9% due to faulty positioning, 6.9% due to patient movement and 3% due to artifacts.

Conclusion: Rejected / repeated X-rays are a common problem in every radiology department .In this study we identify that the commonest cause for chest X-ray repetition is exposure problems followed by faulty positioning, patient movement and artifacts. These problems are faced mainly due to poor technical skill with an element of inattentiveness or due to suboptimal X-ray machine performance which can be avoided by using proper radiological techniques and regular quality assurance programs in every radiology department.

KEYWORDS: Artifacts; Radiation Exposure; X-rays.

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INTRODUCTION

Optimization in X-ray imaging in order to reduce patient doses during diagnostic X-ray examinations is a complex process given the high level of image quality required.[1] It is not uncommon to encounter patients undergo repeat X-ray examinations after their initial X-rays are rejected for poor image quality there by subjecting them to excess radiation exposure and avoidable extra cost.[2] The greatest cause of film rejects include underexposure 38%, overexposure 28.5%, positioning errors 25%[3] followed by equipment faults 19.06%.[4] Improper exposure is the commonest cause for rejection and repetition.[5]

Some Radiologist, unfortunately, are not concerned about the extra dose administered as a result of repeat X-rays and do not express a desire to lower the radiation dose as described by the ALARA (As Low As Reasonably Achievable) concept.[6] Optimum usefulness of radiographs increase when hospital investigation protocol is followed and clinical information is provided.[7] Total reject rate is number of images thrown out divided by the number of images taken in a specified period of time; it is also possible to consider the retake rate (or repeat rate) as the percentage of images that have been retaken due to error or a poor image quality.[8]

Repeat examination accounts for nearly one third of high cost radiology examination and represents an increasing proportion of such examinations.[9] Most repeat examinations are initiated

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clinically without a recommendation by a radiologist. Results of reject analysis are used to plan for training needs and prepare clinical presentation targeting staff weaknesses.[10]

Rejection and repetition of x-rays is inevitable in almost every Radiology Department. This study identified the common causes for rejection/ repetition of the very commonly performed chest X-ray examinations and emphasizes on the need to overcome these causes in order to save extra cost, radiation and time which is part and parcel of these repeated X-rays.

MATERIAL AND METHODS

This study was conducted in Peshawar institute of medical sciences from 1st January 2015 to 1st June 2015 during which 1200 chest X-rays were performed in the institute using Toshiba 100mAs/150 kv latest computed radiography system. Those chest X-rays which were rejected as they failed to provide the necessary detail and were asked to be repeated by an expert radiologist having experience of at least 10 years were analyzed for various causes of rejection and to calculate the overall reject rate. The data was analyzed using statistical package SPSS version 10. Mean + standard deviation was computed for numeric variables like age. Frequency and percentage were computed for categorical variables like overexposure, underexposure, fault in positioning, artifacts and patient movement. All results were presented in the form of tables.

RESULTS

From 1st Jan 2015 to 1st June 2015 1200 chest X-rays were performed at Peshawar Institute Of Medical Sciences using Toshiba 100mAs/150kv latest computed radiography system. The total number of X-rays repeated were 58 making the reject rate 4.8%. X-rays rejected due to overexposure were 48.8% (table 2), 37.9% due to underexposure(table 3), 6.9% due to faulty positioning(table 4), 6.9% due to patient movement (table 5) and 3% due to artifacts(table 6). The highest repeat rate was observed in young patients between 1 to 10 years of age (24.1%) followed by old patients above 60 years of age (17.2%) as has been shown in table 1.

Table 1: Age wise distribution of repeat x-rays

Age of the patients	no of repeated x-rays	percentage
1-10 Year	14	24.1%
11-20 Year	9	15.5%
21-30 Year	8	13.7%
31-40 Year	6	10.3%
41-50 Year	4	6.89%
51-60 Year	7	12.0%
Above 60 years	10	17.2%
Total	58	100%

Table 2: Over exposure distribution

Over exposure	Frequency	Percentage
Yes	26	44.8%
No	32	55.2%
Total	58	100%

Table 3: Under exposure distribution

Under exposure	Frequency	Percentage
Yes	22	37.9%
No	36	62.1%
Total	58	100%

Table 4: Faulty positioning distribution

Faulty positioning	Frequency	Percentage
Yes	4	6.9%
No	54	93.1%
Total	58	100%

Table 5: Patient movement distribution

Patient movement	Frequency	Percentage
Yes	4	6.9%
No	54	93.1%
Total	58	100%

Table 6: Artifacts distribution

Artifacts	Frequency	Percentage
Yes	2	3.4%
No	56	96.6%
Total	58	100%

DISCUSSION

Accurate exposure is a key factor for good quality films as has been discussed by a large number of international studies including the study conducted by Ching W.[11] An over exposed film is too black while an underexposed film is too soft so that important detail can be lost as a result of over as well as underexposure. In our study we identified that the commonest cause for chest X-ray rejection is overexposure(44.8%) followed by underexposure(37.9%) which is comparable to the study results of the study conducted by Daniel Z et al[2] .To a lesser extent X-rays are rejected as a result of factors like

improper positioning(6.9%), patient motion(6.9%) and artifacts(3.4%).These results are comparable to the results of study conducted by Sniureviciute M et al[1].

Improper exposure can be avoided by choosing the exposure factors (kvp and mAs) carefully according to the thickness of the patient and by further improving image quality by doing careful processing of the film on the monitor.

Improper positioning can be easily avoided by remaining focused during positioning of the patient and by keeping in mind the exact indication for which the X-ray has been advised. To avoid patient movement during X-ray it is important that the patient is instructed and counseled properly and informed about unwanted repetition in case of poor quality film. In case of children at times it is necessary that an adult accompanies the child during X-ray preferably the mother.

Artifacts can again be easily avoided by following the proper protocols and by doing regular quality assurance tests. In our study we found that overexposure followed by underexposure and to a lesser extent patient motion are the primary factors for rejected chest X-rays. The reason for these could be suboptimal X-ray machine performance, poor technical skill with an added component of inattentiveness resulting in these poor quality unacceptable films. The overall reject rate is however, within the acceptable range.

CONCLUSION

Rejected / repeated X-rays are a common problem in every radiology department .In this study we identify that the commonest cause for chest X-ray repetition is exposure problems followed by faulty positioning, patient movement and artifacts. These problems are faced mainly due to poor technical skill with an element of inattentiveness or due to suboptimal X-ray machine performance which can be avoided by using proper radiological techniques and regular quality assurance programs in every radiology department.

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CONFLICT OF INTEREST
Authors declare no conflict of interest.
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AUTHORS' CONTRIBUTION

Conception and Design:	SK, ZS
Data collection, analysis & interpretation:	SK, ZS, MZZ, JK
Manuscript writing:	SK, MZZ, JK