REJECT RATE OF RADIOGRAPHIC FILMS AT RASHEED SHEKONI TEACHING HOSPITAL, DUTSE, JIGAWA, NIGERIA

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ARTICLE INFO	ABSTRACT

Background: It is not uncommon to encounter patients undergo repeat x-ray examinations after their initial x-rays are rejected for poor image quality thereby subjecting them to excess radiation exposure and unavoidable extra cost. The introduction of reject film analysis as part of Quality Assurance (QA) program in clinical radiography and radiology practice in the evaluation of image quality is a well-established practice.

Objective: To determine the reject rate in conventional radiology procedures, the causes and commonly repeated projections.

Method: The study, prospective in design was conducted over a period of five months; January to May, 2019 using a multipurpose-designed data capture sheet. Films collected were sorted out in order of film sizes and examination types. Reject rate was measured for x-ray department across all plain x-ray films examinations using a structured format on which relevant data for reject films were recorded by a Radiologist and a senior Radiographer.

Result: The reject rate was 10% and the causes were: under exposure (12.1%), over Exposure (10.9%), artifacts (17.9%), positioning error (15.2%), motional blurring (41.2%), fog (0.3%) and others (2.4%) with chest radiographs being the most frequently rejected (20.9% and 28.9%) of adult and pediatric chests respectively. The most frequently rejected film size was 24 x 30cm (35.8%) while the most frequent causes of film rejects were motional blurring and artefacts (41.2% and 17.9%).

Conclusion: The study showed the importance of a QA program in order to deliver high-quality health service to patients.

INTRODUCTION

Medical imaging provides valuable information with regards to normal and diseased anatomy that can occur within the human body. One of the important goals in radiography is to obtain the best diagnostic information by delivering the least radiation dose to the patient and in accordance with the general health needs of the individual patient [1].

Additional source of radiation exposure to patients can be from repeat studies due to poor image quality resulting from suboptimal techniques of

either positioning or processing which are discovered by reporting radiologists or sorting radiographers in a typical radiology department [2].

Being aware of the harmful effects of radiation, it is necessary to keep the total exposure level as low as consistent with other requirements of practice. All exposures to ionizing radiation needs to be justified and optimized in terms of the benefit and risks and in consonance with the ALARA principles [3].

Reject film is an x ray film that is considered useless and discarded based on the recommendations of the international atomic energy agency and reject rate is defined as the number of films rejected from a certain department as scrap expressed as a percentage of the total film used[4,5].

The Conference of Radiographic Control Programme Directorate (CRCPD'S) Committee on Quality Assurance (QA) recommends a higher reject rate of 10% [6].

Film reject analysis is a planned and systematic action necessary to provide adequate confidence that a product or service will satisfy the given requirements for quality of image or radiograph and the objectives is to minimize patient exposure, cost reduction, high throughput, better image quality, identifying main errors, putting measures to reduce them and provides information for teaching and research [6, 7].

Reject/repeat film analysis is a sort of subjective evaluation of image quality where images judged to be of poor quality are categorized according to cause and its employment in the evaluation of image quality is an important component of quality assurance programs. It is a useful and well-established method for quality control in diagnostic radiology and provides valuable information about the efficacy of a department [8].

Accurate assessment of radiographic film repeats and documentation of the reasons for the repeats are accepted as adequate criteria for quality assurance in radiography, since strict application of quality assurance programme is not available in most institutions in the developing countries. A radiology department can be considered to be performing optimally in quality assurance if radiographic film repeats and rejects are completely avoided or are reduced to the minimum[9].

Several previous studies on the reject film analysis reveals reasons for the rejected film, rate of the rejected films, with some sharing more light on the likely cost implications of the repeat examinations as well as the possibilities of radiation over exposure to the affected patients with some of the studies offering solutions for solving of these problems [10,11,12].

The main aim of the study was to determine the rate at which radiographic films are rejected at Rasheed Shekoni Teaching Hospital (RSTH). To also determine the projections that are commonly repeated, the most common causes of repeat rate and their percentages, the cost of the rejected films during the period of the study and to suggest possible ways of minimizing the reject rate, if found to be high.

MATERIALS AND METHODS

It is a prospective cross-sectional study conducted at Rasheed Shekoni Teaching Hospital, a tertiary health care facility and as well as referral Centre for primary and secondary health care providers in Jigawa state. This research was conducted over a period of 5months after obtaining ethical clearance from the Hospital's research and ethics committee, using a sample size was 326.Inclusion criteria was all rejected radiographs done in the study area and during the study period.

Exclusion criteria included radiographs not done within the study area and outside the study period, digital radiographs and all radiographs having good diagnostic image quality.Non probability sampling technique was used with a data collection sheet filled by a senior radiographer into the various rejection categories.Data analysis was done using Microsoft excel and was represented with tables, frequency distribution and bar chart.

A made in China x – ray machine (GE Hualun Medical System, model 5129406, manufactured in June, 2008) coupled with a made in Italy processor (Europrotex SRL) and radiographic cassettes of varying sizes were used to expose the different parts of the body during the study period. The exposed radiographs were processed using a manual processing procedure. The radiographs were thereafter dried and viewed on a radiographic viewing box.

The criteria set for the rejected films were due to Underexposure, Overexposure, Positioning error, fog, Motional blurring, Artifacts and others.

Reject rate (%) = (number of rejected films/total number of films used) X 100 [5].

RESULTS
TABLE 1: PERCENTAGE DISTRIBUTION OF CAUSES OF REJECT

Reasons	No. of Rejected Films	%
Overexposure	36	10.9
Underexposure	40	12.1%
Positioning Error	50	15.2%
Fog	1	0.3%
Motional blurring	136	41.2%
Artifacts	59	17.9%
Others	8	2.4%
Total	**330**	**100%**

During the study period, a total of 3,300 films were exposed during the research period on conventional Radiographic examinations. Out of these films 330 were rejected or wasted, this gives the overall reject rate of 10% (of rejected radiographs), as shown below.

TABLE 2: Overall reject rate in percentage

Duration	Total films reject	Total films used	Reject rate
5 Months	330	3,300	10%

Reject rate (%) = (number of rejected films/total number of films used) x 100
Reject rate (%) = 330/3300 x 100
Reject rate = 10%.

Table 3: Percentage distribution of Rejected films according to the body parts/examination

Body parts/exam	No. of rejected Radiographs	Percentages
Skull and sinuses	17	5.2%
Shoulder	1	0.3%
Upper	22	6.6%
Adult chest	69	20.9%
Paediatric chest	95	28.9%
Abdomen	12	3.6%
Pelvis and Hips	7	2.1%
Vertebral spines	26	7.9%
Lower limbs	11	3.3%
HSG	39	11.8%
IVU	17	5.2%
RUG	5	1.5%
Barium Studies	9	2.7%
Total	**330**	**100%**

TABLE 4: Rejection rate according to film sizes and cost of rejected films

Film Size	No. of Rejected Films	Percentages	Cost per Film	Total
35 X 43cm	99	30.0%	#380	#37,620
35 x 35cm	43	13.0%	#350	#15,050
30 x 40cm	70	21.2%	#320	#22,400
24 x 30cm	118	35.8%	#260	#30,680
Total	**330**	**100.0%**	**#1,310**	**#105,750**

DISCUSSION
In this study the reject rate was found to be 10% (table 2), which is by far greater than the laid down world health organization criteria of 5%. However, conference of radiographic control program directorate (CRCPD'S) committee on quality assurance (QA) recommended a higher reject rate of 10% in a standard radiology department [13]. This study has shown the reasons for the rejection of radiographs as well as the factors responsible for producing poor radiographs or suboptimal images. Pediatric chest had the highest frequency of ninety five (95) rejected films (28.9%), which is similar to the findings of some researcher [14]. This is followed by adult chest with sixty-nine (69) rejected films given (20.9%) of the total rejected radiographs. This is due to lack of immobilization devices and patient's condition. These patients are mostly unable to be kept properly in an erect postero-anterior position which finally resulted in suboptimal radiograph.

The most common causes of rejection (table 1) according to the reasons during this study was motional blurring, artefacts and positioning errors. These finding equally corresponded to some articles reviewed [15, 16]. Furthermore, during this study it was found that the film size being frequently rejected was 24 x 30cm with one hundred and eight (118) films (table 4). This could

have result from the lack of immobilization devices especially in paediatric cases and use of cassettes with sub optimum intensifying screens.

Reject film analysis is an important part of quality assurance program in a radiology department providing effective radiography services that ensures reduction in the factors responsible for rejects and thus to reduce the cost, workload and radiation exposure to patients and personnel [17].

Radiographs of diagnostic value show optimum definition and good image contrast, however maximum sharpness is obtained when movement, geometric and photographic blurring are kept uniformly low. A higher repeat rate reflects a serious fault in the equipment, technique or processing and this results in increase patient dose [13,14].

The overall reject rate of 10% is within normal limits according to the recommendation of CRCPD (5-10%), however motional blurring, artefacts and positioning errors were the bulk of the reasons for reject.

CONCLUSION
The overall reject rate of 10% is within normal limits according to the recommendation of CRCPD (5-10%), however motional blurring, artefacts and positioning errors were the bulk of the reasons for reject. Chest examination was found to be the most frequent examination to be repeated and 24x30cm films were the most frequently used film. Technical faults from human and machine are also implicated in film rejection.

We also recommend that film reject/repeat analysis programme (RAP) should be conducted quarterly and the department should have a quality assurance (QA) team that will conduct quality (QC) control programme.

Conflict of Interest: None

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