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Assessment of X-ray Film Reject Rate in Two Tertiary Healthcare Institutions in Northeastern Nigeria

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Abstracts:
Background: Film reject analysis has been used as a quality indicator about the efficiency of radiology services and the basis for quality control and education for the radiographers. Furthermore, it gives an indication of the sources of radiographic errors thereby reducing unnecessary radiation dose to the patient population and also highlights areas where improvement can be made.
Objective: To establish the rate of reject films between two tertiary healthcare institutions in Northern Nigeria.
Methods: A Comparative, prospective and cross sectional study was conducted involving rejected x-ray films within a period of three months, from February to April, 2015. This was done in two tertiary Institutions; University of Maiduguri Teaching Hospital (UMTH) and Federal Neuro Psychiatric Hospital (FNPH) Maiduguri, Nigeria. Rejected films were retrieved weekly based on the criteria recommended by international Atomic Energy Agency (IAEA). This was recorded on a data capture form with the help of an experienced Radiographer. The rejected films were then classified according to different body regions/anatomical site and reasons for the rejection. Frequency and percentage were generated for each of these variables. This was done using SPSS software version 19.0.
Results: The overall reject rate was 26.04% in 8476 exposed films. The reject rate for UMTH and FNPH were 29.89% in 5626 and 18.4% in 2841 exposed films respectively. Underexposure was the most common reason for reject in both hospitals amounting to 28.4% (n=463) and 38.7% (n=230) for hospital UMTH and FNPH respectively. With regards to the anatomical site, chest radiographs were the most commonly rejected radiographs in both hospital, UMTH (35.52, n=579) and FNPH (45%, n=268).
Conclusion: The overall reject rate is higher than the international acceptable limit. The reject rate for UMTH was higher than that of FNPH. The reject rates for the individual institutions were far above the international acceptable limits and also higher than the ones previously established in the respective institutions. Underexposure was the commonest reason for reject while chest radiograph was the most predominant anatomical site being rejected in both institutions.

Keywords: *Radiograph, reject rate, image quality*

1. Introduction

Reject film analysis is a sort of subjective evaluation of image quality where images judged to be of poor quality are categorized according to cause (Jabbari, Zeinali, and Rehmatzehad, 2011). It serves as a link between a department's quality assurance efforts and the consistency of its image quality. Quality assurance is a planned and systematic action necessary to provide adequate confidence that a structure, system or a component will consistently produce adequate diagnostic information with minimum exposure of both patient and personnel (WHO, 1982). 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 (Yousef et al. 2013).

In radiology, it is imperative to produce good quality images that can provide adequate information about the patient condition while keeping the radiation dose to the patients to a minimum. Several factors such as positioning error, artifacts and choice of wrong exposure factors affect image quality which in most cases, if accepted, leads to inaccuracies in diagnosis and false positive diagnosis regarding the patient condition. Thus, poor quality Radiographs are often rejected and subsequently request for a repeat.

Therefore, it is not uncommon to encounter patients undergo repeat x-ray examinations after their initial x-rays are rejected for poor image quality. However, this has a wide range of consequences such as increased total radiation to the patients and the radiographers. It was reported in several literatures that increased in radiation dose leads to potential health hazards such as radiation injuries, erythema, radiation toxicity and even death. It was also revealed that conditions such as cancer are likely to occur even at low doses.

Furthermore, increase in repeat rate affects adversely the cost-cutting measure of the department by increasing films and processing chemicals wastage, increase in patients' waiting time and decreased patient throughput. Also, it increases the wear and tear of the equipment due to increase in frequent use.

Now days, patients are becoming more aware and wary of these implications most especially the aspect of increase patients dose as most of them are now aware that procedure involving ionizing radiation poses some potential risk to their health. Thus the issue of repeat is becoming critical and many patients now demand to be informed and have begun to question the need for another round of exposure or repeat.

This creates a situation which necessitates the need to set up an acceptable threshold reject rate and explore causes of reject and repeat of x-ray examination (Yousef et al. 2013). In view of this, Conference of Radiation Control Programme Directors recommended that the overall reject rate should be less than 10% (CRCPD, 2009). Owing to this development, several researchers have explored the rate of reject with associated common causes at various institutions in Nigeria and several other countries (Zewdneh et al, 2008; Tabari and Garba, 2009; Nwobi et. al, 2011; Teferi et al, 2012). The one previously done in these intuitions revealed that reject rate was on the high side (Nwobi et al., 2011; Yusuf, 2013). Thus, the aim of this research work is to re-evaluate and compare the reject rate between these two tertiary healthcare institutions.

2. Materials and Methods

A comparative, prospective and cross-sectional study was conducted involving all conventional X-ray films used at UMTH and FNPH within a period of three (3) months from February - April 2015. The rejected radiographs were retrieved on weekly basis and reviewed by two experienced Radiographers. Radiographs with poor quality that could affect the accuracy of the diagnosis were considered as rejected films. All radiographs other than these were accepted, interpreted and used for the patient's management. The overall reject rate as well as for the individual institution were established using formula in equation 1 below.

Reject Rate (%) = $\frac{Numberofrejectedfilmsx100}{Totalnumberoffilmused}$ ---------- equation 1

The rejected films were further categorized according to the common causes for the reject based on the recommendations given by International Atomic Energy Agency (IAEA). These includes; over exposure, under exposure, positioning error, processing fault and others. Frequency and percentage for each of these variables alongside the anatomical site were generated and tabulated. This was done using SPSS version 19.0.

3. Results

An overall total of 8,467 films were used during the study period, 5626 and 2841 from UMTH and FNPH respectively. The total number of films rejected was 2,225, 1630 from UMTH and 595 from FNPH. The overall reject rate was 26.04%. The individual reject rate was 29.89% and18.40% for UMTH and FNPH respectively (Table1).

Underexposure was the highest reason for rejection of Radiographs in both hospitals amounting to 28.40% (n=463) for UMTH and 38.70% (n=230) for FNPH. On the other hand, chest Radiographs were the most commonly rejected films in the two institutions. The value at UMTH stands at 35.52% (n=579) while for FNPH was 45% (n=268) (Table 1)

Institutions	Reject Rate (%)	Total number of films Used	Total number of films Accepted	Total number of films rejected
UMTH	29.89	5626	3996(70.11%)	1630 (29.89%)
FNPH	18.40	2841	2246 (81.60%)	595 (18.40%)

Table 1: Frequency Distribution of Rejected and Accepted films in both Hospitals

Reason for Reject	Over Exposure		Under Exposure		Positioning		Others*		Total
Anatomical Region/Institution	UMTH	FNPH	UMTH	FNPH	UMTH	FNPH	UMTH	FNPH	UMTH/FNPH
Upper extremity	26	6	5	7	5	4	23	5	59/22
Lower extremity	23	17	25	11	17	2	13	9	78/39
Pelvis and hips	31	8	25	9	45	4	13	4	114/25
Vertebral column	113	13	149	54	128	15	32	22	422/104
Thorax and upper airways	148	41	183	108	122	18	165	109	618/276
Skull	36	13	19	8	28	4	24	10	107/35
Sinuses and facial bones	21	8	12	12	29	12	14	5	76/37
Abdomen	53	11	45	21	45	0	13	25	156/57
Total	451	117	463	230	419	59	297	189	1630/595

Table 2: Frequency Distribution of the causes for reject based on anatomical site
**others include poor inspiration, cut off, artifacts and fog*

4. Discussion

In diagnostic radiography, the major goal is to produce good quality images that can provide sufficient information to answer a clinical question while keeping radiation dose as low as reasonably achievable. This is often difficult as there are so many technical factors that can adversely affect image quality and ultimately compromise the accuracy of the diagnosis. This necessitates for a repeat in most cases. Now days, many departments have incorporated film reject analysis as part of their quality assurance to explore their reject rate and these two Hospitals are no exception.

In this study, the overall reject rate was 26.04% while the reject rate for the individual Hospitals 29.89% and 18.40% for UMTH and FNPH respectively. These values were far above the international acceptable limit of 5% by WHO and 10% by CRCPD (Zewdneh, Tereri, and Admassie, 2008). Also, this reject rate is higher than that obtained from previous studies conducted in the same Hospitals; UMTH (24.40%) (Audu, 2011) and FNPH (19.06%) (Yusuf, 2013). This rise in the reject rate in recent years could be due to ever increasing number of patients being attended to, due to insurgency as the two hospitals reside in Northeastern Nigeria where most activities of the dreaded Boko Haram sects is at its peak. Increase in patients' throughput due the insurgency could lead the radiographers to hasten their work in order to decongest the department which in turn could result in giving less attention to some essential details required for the procedure. This could lead to increase in number of poor quality images and ultimately number of rejected films

The common causes of film rejection found in this study include underexposure, overexposure and positioning errors. These findings agree with the findings of Nwobi et al, (2011) that overexposure; underexposure and positioning errors were the most frequently occurring reasons for rejection. These errors are occurring may be due to poorly supervised interns, radiographers, excessive workload, misalignment and frequent light beam bulb faulty in both Hospitals.

In the distribution of rejected films according to anatomical site, it is noted that radiographs of the thorax and upper airways (most commonly chest radiographs) have the highest percentage of reject in both hospitals. This is also in keeping with the findings of Nwobi et al., (2011) and Tabari & Garba I. (2009). This could be due to the fact that majority of the requested examinations that are coming to the hospitals were chest x-rays. In addition, these patients with chest condition often present with difficulty in breathing and thus find it difficult to cooperate for the examination.

5. Conclusion

The overall reject rate is higher than the international acceptable limit. The reject rate for UMTH was higher than that of FNPH. The reject rates for the individual institutions were far above the international acceptable limits and also higher than the ones previously established in the respective institutions. Underexposure was the commonest reason for reject while chest radiograph was the most predominant anatomical site being rejected in both institutions.

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