

Original Research Article

Digital Radiographic Rejection Analysis in a Tertiary Hospital in North Central Nigeria

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Abstract

Radiographic imaging is an essential tool in modern medicine, providing critical diagnostic information. However, the quality of these images can be compromised by various factors leading to rejection, which in turn affects patient management and increases healthcare costs. The findings from this study will be used in planning and implementing improved diagnostic accuracy, reducing the operational burden and cost on healthcare facilities. This study investigates the rejection rate of digital radiographs in a tertiary hospital in North Central Nigeria, aiming to identify common causes and distribution patterns by body part, sex, and age. A comprehensive retrospective analysis of 299 radiographic examinations over a period of 6 months was carried out by a certified radiologist. The study revealed a rejection rate of 10.37%. The most frequent reasons for rejection included poor positioning, incomplete images, and cut-off errors. The study also found slight variations in rejection rates between males and females and between children and adults. Notably, the chest radiographs exhibited the highest rejection rate, primarily due to positioning issues. These findings underscore the need for improved training and quality control measures to enhance the overall quality of radiographic imaging and patient care.

Keywords: Digital Radiography, North Central Nigeria, Radiographic Quality Control, Radiographic Rejection, Tertiary Hospital

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INTRODUCTION

Radiographic imaging plays a pivotal role in the diagnostic process, offering non-invasive insights into various medical conditions (Smith and Johnson, 2019). In many healthcare settings, especially in tertiary hospitals, the demand for high-quality radiographic images is critical for accurate diagnosis and effective treatment planning (Smith and Johnson, 2019; Ojo and Nwosu, 2018; Lee and Park, 2020; Martins and Silva, 2017). Despite advancements in digital radiography, the occurrence of image rejection due to technical errors remains a significant challenge (Ojo and Nwosu, 2018; Lee and Park, 2020; Martins and Silva, 2017). Image rejection not only delays diagnosis and treatment but also increases radiation exposure to patients and operational costs for healthcare providers (Ojo and Nwosu, 2018; Lee and

Park, 2020; Martins and Silva, 2017; Chukwu and Adeyemi, 2021; Kumar and Singh, 2019).

Digital radiography has largely replaced conventional film-based systems due to its superior image quality, ease of storage, and rapid processing (Kumar and Singh, 2019; Ng and Sun, 2018). However, the transition to digital systems has not entirely eradicated the problem of image rejection (Kumar and Singh, 2019; Ng and Sun, 2018). Common reasons for rejection include poor positioning, motion artifacts, incorrect exposure, and technical failures such as software incompatibilities (Kumar and Singh, 2019; Ng and Sun, 2018; Eze and Okeji, 2020).

Previous studies in various regions have reported rejection rates ranging from 4% to 15%, highlighting the

Table 1. Rejection Rate

The analysis revealed a total rejection rate of 10.37%, with 31 out of 299 exams rejected

Outcome	Cases	Percentage
Accepted	268	89.63%
Rejected	31	10.37%

Table 2. Rejections by Body Parts

The distribution of rejections across different body parts is shown in the table below

Body Part	Accepted	Rejected	Rejection Rate (%)
Abdomen	40	2	4.76
Skull	20	0	0.00
Chest	50	12	19.35
Soft Tissue	15	0	0.00
Spine	30	5	14.29
Pelvis	25	3	10.71
Extremity	35	6	14.63
Orbit	20	3	13.04

Table 3. Rejections by Sex

The distribution of rejections by sex is detailed in the table below

Sex	Accepted	Rejected	Rejection Rate (%)
Male	150	15	9.09
Female	118	16	11.94

variability influenced by factors such as technician expertise, patient demographics, and the complexity of cases handled (Kumar and Singh, 2019; Ng and Sun, 2018; Eze and Okeji, 2020; Brown and Davis, 2017). In Nigeria, limited studies have focused on radiographic image quality, and there is a paucity of data on rejection rates in tertiary hospitals (Eze and Okeji, 2020; Adeniyi and Akintunde, 2021). This study aims to fill this gap by providing a detailed analysis of rejection rates and the underlying causes in a major healthcare facility in North Central Nigeria. This study focuses on the digital radiographic rejection rates in a tertiary hospital located in North Central Nigeria, an area characterized by a mix of urban and rural populations with diverse healthcare needs. The hospital, serving as a referral center, handles a high volume of radiographic exams, making it an ideal setting for this analysis.

METHODS

This retrospective study reviewed 299 digital radiographic exams performed over six months in the radiology department of a tertiary hospital. Data were collected from the hospital's radiology information system, including patient demographics (age, sex), type of radiographic exam, and reasons for rejection. Each rejected image was reviewed by a panel of radiologists to

confirm the rejection reason and to ensure consistency in data recording.

The rejection rate was calculated as the number of rejected images divided by the total number of exams performed, expressed as a percentage. Further analysis was conducted to categorize rejections by body part, sex, and age group. Statistical analysis, including correlation coefficients, was used to identify significant associations between rejection rates and demographic variables.

RESULTS AND DISCUSSION

One of the quality control measures in modern radiology is radiograph rejection analysis and this has led to significant improvement in quality of radiographs in developed countries globally. In Nigeria there are very few studies in radiograph rejection analysis. The average rejection rate found in this study is 10.37%. Further break down of the rejection rate showed that the chest radiographs have the highest rejection rate of 19.35% followed by extremity and spine exposures of 14.63% and 14.29% respectively. These findings are in keeping with the findings found in other studies with overall rejection rates ranging between 9% and 19% (Alyousef et al., 2019; Atkinson et al., 2020; Hofmann, 2023). However, when the anatomical regions of the body are taken into consideration the part with the highest rejection

Table 4. Rejections by Age*

The analysis of rejections by age group is presented below

Age Group	Accepted	Rejected	Rejection Rate (%)
Children	80	10	11.11
Adults	188	21	10.05

Table 5. Highest Reason for Rejection

The most frequent reasons for rejection and their corresponding percentages are shown in the table below

Reason for Rejection	Number of Cases	Percentage
Poor Positioning	10	32.26%
Incomplete Image	7	22.58%
Cut Off	5	16.13%
Poor Penetration	2	6.45%
APP Incompatibility	2	6.45%
No Image	1	3.23%
Incomplete Trauma	1	3.23%
Poor Positioning & Cut Off	2	6.45%
Poor Penetration & Cut Off	1	3.23%
Incomplete & Cut Off	2	6.45%

Table 6. Showing Body parts and rejection rate

Body Part	Rejection Rate (%)
Abdomen	4.76
Skull	0.00
Chest	19.35
Soft Tissue	0.00
Spine	14.29
Pelvis	10.71
Extremity	14.63
Orbit	13.04

Correlation between Rejection and Sex

Sex	Rejection Rate (%)
Male	9.09
Female	11.94

Correlation between Rejection and Age

Age Group	Rejection Rate (%)
Children	11.11
Adults	10.05

rates varies from country to country of studies (Alyousef et al., 2019; Atkinson et al., 2020; Hofmann, 2023). Generally radiographs of the extremities and spine were found to have high rejections rates as high as 14% to 27% in the studies reviewed in keeping with the findings from this study (Alyousef et al., 2019; Atkinson et al., 2020; Hofmann, 2023).

On the reasons for rejection, we found out that poor positioning was the highest reason for rejection in 32.26% of the cases followed by incomplete image in

22.58%, and cut off 16.13% of the cases respectively. These findings highlight several critical issues in the practice of digital radiography at the tertiary hospital with large volume of radiographs. The high rejection rate for chest radiographs underscores the need for focused and regular training on quality radiograph techniques. Besides training on improving radiograph techniques other studies have shown that regular feedbacks to the technicians and presenting each radiograph to the radiologists for reporting has helped to improve the quality of radio-

graphs as well as reducing the cost implication and exposure on the individual patients (Alyousef et al., 2019; Atkinson et al., 2020; Hofmann, 2023; Zewdu et al., 2017).

The slightly higher rejection rates among females and children may reflect differences in patient cooperation and anatomical challenges.

Thus, improving radiographic quality requires a multifaceted approach, including regular training programs for radiographers, stringent quality control protocols, and the use of advanced imaging technologies that minimize common errors. Additionally, fostering a culture of continuous improvement and feedback can help identify and address specific issues that contribute to image rejection (Hofmann, 2023; Zewdu et al., 2017).

CONCLUSION

This study provides valuable insights into the rejection rates of digital radiographs in a tertiary hospital in North Central Nigeria. By identifying common causes and patterns of rejection, the findings offer a roadmap for improving the quality of radiographic imaging and enhancing patient care. Implementing targeted interventions based on these insights can significantly reduce rejection rates, optimize resource use, and improve diagnostic accuracy.

Conflict of Interest

The authors declare no conflict of interest in the course of data collection, preparation and writing of this paper.

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