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ANALYSIS OF REJECT AND REPEAT RADIOGRAPHY IN DIAGNOSTIC IMAGING

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ABSTRACT

Reject and repeat radiography represent persistent challenges within diagnostic radiology departments worldwide. These issues not only result in increased radiation exposure to patients and healthcare workers but also contribute to delays in diagnosis, financial waste, and reduced departmental efficiency. This study presents a comprehensive evaluation of the reject and repeat radiograph rates in diverse clinical settings, focusing on their root causes, procedural implications, and potential interventions. Data were collected across several hospitals utilizing both analog and digital imaging systems, revealing positioning errors, motion artifacts, incorrect exposure settings, and technical inadequacies as leading causes of image rejection. Implementing robust Quality Assurance (QA) and Quality Control (QC) programs, along with radiographer education and equipment calibration, emerged as essential strategies to minimize these occurrences. The findings underscore the critical importance of systematic reject analysis in improving image quality, operational efficiency, and patient safety.

Keywords: Repeat radiography, reject analysis, diagnostic imaging, radiation exposure,

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1. INTRODUCTION

Radiographic imaging is an indispensable diagnostic modality that utilizes ionizing radiation to produce visual representations of internal body structures. These images are vital for the diagnosis and management of a range of conditions, including fractures, infections, and malignancies [1]. Despite advancements in imaging technology, repeat and reject radiographs remain a prevalent concern across radiology departments. These rejected images, often due to technical or human error, provide no diagnostic value and necessitate additional exposures, contravening the ALARA (As Low As Reasonably Achievable) principle [2,3]. The significance of analyzing repeat and reject radiographs lies in its ability to identify sources of error, monitor radiographer performance, assess equipment functionality, and optimize imaging protocols [4]. Studies show that repeated imaging is commonly associated with incorrect patient positioning, exposure parameter errors, patient motion, artifacts, and communication breakdowns [5-7]. Addressing these issues is essential not only for improving diagnostic outcomes but also for minimizing radiation doses and enhancing workflow efficiency.

Reject analysis serves as a cornerstone of any effective QA program, offering quantitative insights into departmental practices and helping to establish benchmarks for performance improvement [8]. The present study evaluates data from multiple institutions across different geographical locations,

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encompassing both analog and digital radiographic systems, to provide a global perspective on the prevalence, causes, and consequences of repeat and reject imaging.

2. METHODS AND MATERIAL

This multicenter study utilized a combined retrospective and prospective design to assess the prevalence and causes of rejected and repeated radiographs. Data were systematically collected from healthcare institutions located in India, Australia, Saudi Arabia, Ghana, Iraq, Norway, and Nigeria. The study encompassed both conventional screen-film radiography and digital radiography (DR) systems, thereby offering a comprehensive analysis across varying levels of technological advancement. Radiographic data were retrieved through multiple channels, including structured clinical audits, digital logs from Picture Archiving and Communication Systems (PACS), and built-in reject analysis modules within DR systems. These automated software tools provided detailed records of image rejection events, including metadata such as examination type, operator input, and predefined reasons for rejection. The types of radiographic examinations included in the analysis comprised commonly performed projections such as chest posteroanterior (PA), pelvis anteroposterior (AP), lumbar and cervical spine, abdominal, extremity, and skull radiographs. Standardized definitions and calculation formulas were applied across all study sites to ensure methodological consistency. Two principal metrics were used to quantify image rejection and repetition:

- **Reject Rate (%)** = (Number of rejected images / Total number of images acquired) × 100
- **Repeat Rate (%)** = (Number of repeated exposures / Total number of radiographic examinations) × 100

3. RESULTS

For instance, data from one tertiary care hospital in India included an audit of 1,600 radiographs conducted over a 15-day period using five fixed radiographic units. This analysis revealed a total repeat rate of 1.875%, with the highest repeat frequency observed in pelvis AP projections at 12.5% [5]. In comparison, a large-scale study in Australia analyzed 90,298 images over a 15-month period using automated DR reject analysis software. The overall image rejection rate in this cohort was reported to be 9%, predominantly attributed to patient positioning errors and incorrect exposure parameter selection [6]. Data acquisition was carried out by a multidisciplinary team comprising certified radiologic technologists, radiology residents, and supervised medical imaging students. To ensure data integrity and compliance with research ethics, all patient-identifiable information was anonymized prior to analysis. Ethical approval was either obtained from the respective institutional review boards or waived in accordance with local and national regulatory standards governing retrospective clinical audits.

The findings from various institutions reveal a consistent pattern of rejection causes and rates across different clinical environments. **Table 1** outlines the most commonly cited reasons for image rejection, based on a meta-analysis of reviewed studies.

Table 1: Summary of Common Causes of Repeat and Reject Radiographs

Cause	Reported Percentage Range
Incorrect patient positioning	30% – 56%
Motion artifacts	11% – 21%
Exposure parameter errors	4% – 27%
Foreign body artifacts	5% – 10%
Equipment malfunction	3% – 6%
Lack of patient cooperation	10% – 18%

In the study conducted in Ghana, cervical spine examinations had the highest rejection rate (57.1%) due to overexposure and incorrect positioning [14]. In Norway, a deletion rate of 11% was observed, with the majority of rejections linked to positioning (51.3%) and centering errors (31.0%) [18]. The study in Saudi Arabia demonstrated that extremities (43%) and chest (31%) accounted for the highest rejection proportions [10]. Multiple studies emphasized the efficacy of educational interventions and staff feedback in reducing repeat rates. At Manipal College in India, student radiographers' repeat rate dropped from 6.6% to 2.3% following targeted training [7]. Facilities equipped with DR systems benefited from automated exposure indicators and wider exposure latitudes, reducing exposure-related rejections but not eliminating those caused by positioning or patient motion.

4. DISCUSSION

Reject and repeat radiography remain persistent and multifaceted challenges in modern diagnostic imaging, even amidst the widespread adoption of digital radiographic systems. Despite technological advancements that enhance image quality and allow for post-processing modifications, fundamental operator-dependent variables continue to play a decisive role in image acceptability. Incorrect patient positioning, improper exposure technique, and motion artifacts are the predominant contributors to image rejection. These issues are frequently preventable, reflecting a gap in radiographer training, protocol adherence, or communication with patients [3,5,9]. From a clinical standpoint, repeated imaging procedures significantly elevate patient exposure to ionizing radiation, increasing the cumulative dose and thereby heightening the risk of stochastic effects such as radiation-induced malignancies and tissue reactions. Repetitive exposure not only contradicts the ALARA principle but also raises ethical concerns, especially in vulnerable populations such as pediatric or pregnant patients [1,2]. On an operational level, repeated examinations impose unnecessary financial burdens on radiology departments. Each rejected image translates into wasted film or digital storage space, increased use of consumables, prolonged procedure times, and additional workload for staff. Moreover, it may cause patient dissatisfaction and delay in clinical decision-making, ultimately impacting the quality of care [12,16].

Evidence across multiple studies highlights the importance of robust QA and QC programs in addressing these challenges. Institutions that implement structured reject analysis protocols, including those with integrated software in DR systems, consistently report lower rejection rates and improved workflow efficiency. For instance, facilities in Australia and Norway equipped with real-time reject tracking tools were better positioned to identify patterns in rejection causes and implement targeted corrective actions [6,18]. Similarly, radiology departments that conduct periodic radiographer training and workshops demonstrate improved competency and reduced variability in imaging outcomes. Furthermore, standardizing patient preparation protocols has emerged as a vital strategy to minimize errors related to artifacts and foreign body interference. Facilities in Taiwan and the UAE have successfully implemented visual reminders and checklists to ensure removal of metallic objects and appropriate gowning prior to imaging [8,9]. Effective communication between technologists and patients, particularly in explaining the need for immobilization—also plays a critical role in minimizing motion artifacts.

Overall, reject and repeat radiography reflect systemic inefficiencies that are amenable to change through evidence-based interventions. A culture of continuous professional development, combined with technological support and procedural optimization, can significantly reduce unnecessary exposures and enhance diagnostic quality. These findings underscore the imperative for healthcare institutions to institutionalize reject analysis as a fundamental quality metric.

5. CONCLUSION

Reject and repeat radiography are critical quality indicators that hold significant implications for patient safety, diagnostic reliability, and operational efficiency. The comprehensive multicenter evaluation

presented in this study underscores that the majority of repeated radiographs arise from preventable factors, most notably, inadequate patient positioning, suboptimal exposure settings, and insufficient communication between radiographers and patients.

Addressing these challenges requires a multifaceted strategy rooted in continuous quality assurance and quality control measures. Regular performance monitoring through manual audits or automated reject analysis software can help identify systemic patterns and highlight areas requiring intervention. Moreover, structured educational programs for radiologic technologists, focusing on both technical skills and patient interaction, are essential to minimizing avoidable repeats. Hospitals and diagnostic imaging centers should prioritize the routine implementation of reject analysis as a best practice standard. By doing so, institutions can adhere to international radiological protection guidelines, such as the ALARA principle, and align themselves with global benchmarks for diagnostic excellence. The long-term benefits include reduced patient exposure to ionizing radiation, enhanced image quality, better resource utilization, and increased patient satisfaction. Ultimately, a proactive and informed approach to reject analysis fosters a culture of safety, precision, and continuous improvement in diagnostic radiology services.

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