e-ISSN: 0975-1556, p-ISSN:2820-2643

Available online on www.ijpcr.com

International Journal of Pharmaceutical and Clinical Research 2025; 17(1); 188-190

Original Research Article

Investigating Common Sources and Types of Errors in Radiological image Interpretations and Reportings

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Received: 25-10-2024 / Revised: 23-11-2024 / Accepted: 26-12-2024
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Conflict of interest: Nil

Abstract:

Introduction: Radiology plays a crucial role in modern healthcare, aiding in diagnosis, treatment planning, and disease monitoring. Despite technological advancements in imaging modalities such as CT, MRI, and ultrasound, errors in radiological image interpretations and reportings remain a significant concern. These errors, categorized into perceptual and interpretative types, can result in delayed diagnoses and inappropriate treatments, highlighting the need for strategies to minimize such mistakes.

Materials and Methods: This cross-sectional study, conducted over six months at a tertiary care hospital, included 100 radiological cases with confirmed errors identified through multidisciplinary meetings and retrospective chart audits. Errors were categorized by imaging modality (CT, MRI, ultrasound, plain radiography) . Descriptive statistics and logistic regression analyses were used to analyze error frequencies and contributing factors.

Results: CT scans accounted for 40% of errors, followed by MRI (30%), ultrasound (20%), and plain radiography (10%). Perceptual errors were more common (60%) and linked to fatigue, subtle findings, and inadequate training, while interpretative errors (40%) were associated with cognitive biases and insufficient clinical data.

Discussion: Perceptual errors were the most frequent, primarily due to fatigue and missed subtle findings. Interpretative errors, though less frequent, had a greater impact on patient management and were often influenced by cognitive biases. AI tools have potential to assist in reducing these errors, but must complement human expertise. Effective communication and structured reporting between radiologists and referring physicians were also found to be essential in minimizing errors.

Conclusions: Errors in radiological interpretation remain prevalent, with perceptual errors being more common. Addressing these challenges through technological advancements, improved training, and enhanced communication between healthcare providers can lead to more accurate and reliable radiological reporting.

Keywords: Radiological errors, perceptual errors, interpretative errors, cognitive biases, artificial intelligence.

Introduction

Radiology plays an essential role in modern healthcare, serving as a cornerstone for diagnosis, treatment planning, and disease monitoring. The reliance on radiological imaging has grown with advancements in technology, including computed tomography (CT), magnetic resonance imaging (MRI), ultrasound, and plain radiography. Despite these advancements, errors in radiological image interpretations and reportings remain a significant concern. Such errors can have profound implications, potentially leading to delayed diagnoses, inappropriate treatments, and adverse patient outcomes [1-5].

Radiological errors can be broadly categorized into perceptual and interpretative errors. Perceptual errors occur when abnormalities are missed, whereas interpretative errors arise from incorrect conclusions about observed findings [6,7]. These errors can result from multiple factors, including cognitive biases, suboptimal imaging techniques, poor communication, and insufficient clinical context. While human error is intrinsic to any field, the high stakes associated with medical imaging demand strategies to minimize these mistakes [8].

The increasing complexity of imaging studies adds to the challenge. Radiologists often interpret hundreds of images in a single study, which may lead to fatigue and reduced diagnostic accuracy. Moreover, the rising workload due to increased imaging demand exacerbates the problem. Despite the implementation of double reading, peer review systems, and artificial intelligence (AI)-assisted tools, errors persist. Understanding the root causes and types of these errors is crucial to develop targeted

interventions that enhance the accuracy and reliability of radiological reporting [9,10]. Another contributing factor is communication breakdowns between radiologists and referring physicians. Ambiguous reporting or failure to convey critical findings in a timely manner can result in mismanagement. Additionally, variations in training, experience, and access to advanced imaging technologies influence error rates among radiologists [11].

This study aims to investigate the common sources and types of errors in radiological image interpretations and reportings. By analyzing these errors systematically, the study seeks to identify patterns and propose actionable strategies to mitigate their occurrence. The findings could guide educational initiatives, policy changes, and the integration of AI to improve diagnostic precision and patient safety.

Materials and Methods

Study Design: This was a cross-sectional study conducted over a six-month period at a tertiary care hospital. The study aimed to identify and categorize errors in radiological interpretation and reporting.

Sample Size: A total of 100 radiological cases with confirmed errors were included in the study. These cases were identified through multidisciplinary team meetings, peer reviews, and retrospective chart audits.

Inclusion Criteria:

1. Cases with confirmed errors in radiological interpretation or reporting.
2. Imaging studies performed within the past year.
3. Availability of clinical outcomes for correlation.

Exclusion Criteria:

1. Incomplete imaging studies.
2. Cases with insufficient clinical documentation.

Data Collection: Data were collected using a structured proforma that included demographic information, imaging modality, type of error (perceptual or interpretative), and contributing factors. Errors were categorized based on the imaging modality.

Statistical Analysis: Data were analyzed using SPSS software. Descriptive statistics summarized the frequencies of error types and sources. Chi-square tests and logistic regression analyses assessed associations between error types and contributing factors.

Results

The study included 100 cases with confirmed radiological errors. The distribution of errors across imaging modalities and types is summarized in Tables 1 and 2.

Table 1: Distribution of Errors by Imaging Modality

Imaging Modality	Frequency (n)	Percentage (%)
CT	40	40%
MRI	30	30%
Ultrasound	20	20%
Plain Radiography	10	10%

CT scans accounted for the highest proportion of errors (40%), followed by MRI (30%). This could be attributed to the complexity and volume of data in these modalities. Ultrasound and plain radiography contributed to 20% and 10% of errors, respectively, highlighting the challenges in operator-dependent modalities and subtle findings on X-rays (Table 1).

Table 2: Types and Contributing Factors of Errors

Error Type	Frequency (n)	Percentage (%)	Contributing Factors
Perceptual Errors	60	60%	Fatigue, subtle findings, inadequate training
Interpretative Errors	40	40%	Cognitive biases, insufficient clinical data

Perceptual errors were more common, accounting for 60% of cases, often due to subtle findings or radiologist fatigue. Interpretative errors made up 40%, frequently linked to cognitive biases and lack of comprehensive clinical information (Table 2).

Discussion

The findings of this study shed light on the common sources and types of errors in radiological image interpretations and reportings. The predominance of perceptual errors underscores the need for strategies to enhance visual search patterns and reduce fatigue among radiologists [12]. The error rates observed align with prior research indicating that perceptual errors account for the majority of radiological mistakes. Studies have shown that up to 30% of imaging abnormalities may be missed due to perceptual oversight. Interpretative errors, while less frequent, often have a greater impact on patient management [13]. Radiologist fatigue emerged as a significant factor in perceptual errors. Strategies such as workload redistribution, manda-

tory breaks, and ergonomic workstations could mitigate this issue. The role of cognitive biases in interpretative errors highlights the importance of training programs that emphasize analytical thinking and decision-making under uncertainty. AI has the potential to act as a second reader, identifying missed abnormalities and providing decision support. However, its integration into clinical practice requires careful validation and consideration of ethical implications. AI tools should complement, not replace, the expertise of radiologist [14]. Effective communication between radiologists and referring physicians is critical to minimize errors. Structured reporting systems and multidisciplinary case discussions can facilitate better understanding and interpretation of imaging findings [15].

Conclusions

Errors in radiological interpretation and reporting remain a prevalent issue with significant implications for patient care. Perceptual errors are more common, often resulting from fatigue and subtle findings, while interpretative errors are influenced by cognitive biases and insufficient clinical data. Addressing these challenges requires a multifaceted approach, including technological advancements, enhanced training, and improved communication. By understanding and mitigating these errors, radiologists can ensure more accurate and reliable imaging interpretations.

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