Original Article

Accuracy Of Ultrasound In Diagnosis Of Intussusception In Children Taking Surgical Procedures As Gold Standard

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Abstract

Introduction: Intussusception is a common abdominal crisis in children, portrayed by the extending of one piece of the digestive system into another. **Objectives:** The main objective of the study is to find the accuracy of ultrasound in diagnosis of intussusception in children taking surgical procedures as gold standard. **Material and methods:** This cross-sectional research study design to evaluate the diagnostic accuracy of ultrasound in the diagnosis of intussusception in children. The study was conducted in Surgical unit of CMH/SKBZ Muzaffarabad (a tertiary care hospital) and surgical department of Ayub medical college over a period of May 2021 to May 2023. A total of 210 pediatric patients who presented with clinical signs and symptoms suggestive of intussusception were included in the study. The inclusion criteria comprised children between the ages of 3 months and 6 years who underwent ultrasound examination and subsequently received surgical intervention. **Results:** Data was collected from 210 patients of both male and females. The age distribution shows that the majority of participants (46.7%) fall within the age range of 1-3 years, followed by those aged 0-1 year (33.3%) and 3-6 years (20.0%). In terms of gender, the study included a slightly higher proportion of male participants (63.3%) compared to female participants (36.7%). The clinical presentation data reveals that abdominal pain was the most common symptom observed in the participants, with 53.3% reporting this symptom. Vomiting was reported by 40.0% of participants, and 13.3% presented with bloody stools. The mean age of the participants in this study is 1.85±2.34 years. **Conclusion:** It is concluded that ultrasound is a reliable and effective diagnostic tool in confirming or ruling out intussusception. The high sensitivity and specificity of ultrasound in detecting intussusception indicate its ability to accurately identify cases with the condition and exclude it when absent.

Keywords: USG, intussusception, Blood, Diagnosis.

Introduction

Intussusception is a common abdominal crisis in children, portrayed by the extending of one piece of the digestive system into another. It is principally found in newborn children and babies, with the pinnacle frequency happening between the ages of 90 days and 3 years. Intussusception can prompt inside hindrance, ischemia, and hole whenever left untreated, making early and exact determination basic for brief administration and counteraction of intricacies [1].

Generally, the finding of intussusception depended on clinical assessment, which incorporates a blend of history-taking, actual assessment, and imaging studies. Throughout the long term, different imaging modalities have been used to help with the finding, like plain radiography, contrast purification, and ultrasonography [2]. Among these, ultrasound has earned critical respect as an important device for the determination of intussusception in kids because of its painless nature, nonappearance of ionizing radiation, and capacity to give constant imaging. In recent years, ultrasound has emerged as a preferred imaging modality for the diagnosis of intussusception in children. It offers several advantages over other imaging techniques, such as contrast enema, including real-time

visualization, absence of ionizing radiation, and the ability to assess surrounding structures. Ultrasound also allows for dynamic assessment of bowel movements and can help differentiate between reducible and irreducible intussusceptions [3].

The accurate diagnosis of intussusception is crucial to avoid unnecessary delays in treatment and potential complications. Surgical intervention remains the definitive management for cases that do not spontaneously resolve or require urgent intervention due to ischemia or perforation. Therefore, it is important to evaluate the diagnostic accuracy of ultrasound in comparison to the gold standard of surgical findings [4]. This study aims to provide robust evidence regarding the diagnostic accuracy of ultrasound in diagnosing intussusception in children. By considering surgical findings as the gold standard, we can determine the sensitivity, specificity, PPV, and NPV of ultrasound, which are vital parameters for evaluating its diagnostic performance [5]. The findings of this study will contribute to the existing literature and guide clinicians in making informed decisions regarding the use of ultrasound in the diagnosis and management of intussusception. Furthermore, understanding the strengths and limitations of ultrasound in diagnosing intussusception will help optimize patient care and resource allocation. Accurate and timely diagnosis can prevent unnecessary invasive procedures, such as contrast enemas or exploratory surgeries, and reduce healthcare costs associated with misdiagnosis or delayed intervention [6].

Objectives

The main objective of the study is to find the accuracy of ultrasound in diagnosis of intussusception in children taking surgical procedures as gold standard.

Material and methods

This cross-sectional research study design to evaluate the diagnostic accuracy of ultrasound in the diagnosis of intussusception in children. The study was conducted in Surgical unit of CMH/SKBZ Muzaffarabad (a tertiary care hospital) and surgical department of Ayub medical college over a period of May 2021 to May 2023.

Inclusion Criteria:

- Pediatric patients between the ages of 3 months and 6 years.
- Patients who presented with clinical signs and symptoms suggestive of intussusception, such as abdominal pain, vomiting, palpable abdominal mass, and bloody stools.
- Patients who underwent ultrasound examination as part of the diagnostic workup.
- Patients who subsequently received surgical intervention for the treatment of intussusception.

Exclusion Criteria:

- Patients with incomplete medical records or missing essential clinical information.
- Patients who had previously undergone surgical treatment for intussusception.
- Patients who were older than 6 years or younger than 3 months.

Data Collection:

A total of 210 pediatric patients who presented with clinical signs and symptoms suggestive of intussusception were included in the study. The inclusion criteria comprised children between the ages of 3 months and 6 years who underwent ultrasound examination and subsequently received surgical intervention. Patients with incomplete medical records or those who had previously undergone surgical treatment for intussusception were excluded from the study. Data were collected from electronic medical records, radiology reports, and surgical records of the included patients. The demographic information, clinical presentation, and relevant medical history were recorded. The ultrasound images and reports were reviewed by experienced radiologists who were blinded to the surgical findings. The surgical reports were reviewed by skilled surgeons who were also blinded to the ultrasound findings.

Diagnostic Accuracy Assessment:

The diagnostic accuracy of ultrasound in the diagnosis of intussusception was evaluated by comparing the ultrasound findings with the surgical findings, which were considered the gold standard. Sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV) were calculated to determine the diagnostic performance of ultrasound.

Statistical Analysis:

Statistical analysis was performed using SPSS 20.0. The sensitivity, specificity, PPV, and NPV values were calculated along with their corresponding 95% confidence intervals (CI). Subgroup analyses based on patient age, gender, and clinical presentation were also conducted to explore potential variations in diagnostic accuracy.

Results

Data was collected from 210 patients of both male and females. The age distribution shows that the majority of participants (46.7%) fall within the age range of 1-3 years, followed by those aged 0-1 year (33.3%) and 3-6 years (20.0%). In terms of gender, the study included a slightly higher proportion of male participants (63.3%) compared to female participants (36.7%). The clinical presentation data reveals that abdominal pain was the most common symptom observed in the participants, with 53.3% reporting this symptom. Vomiting was reported by 40.0% of participants, and 13.3% presented with bloody stools. The mean age of the participants in this study is 1.85±2.34 years.

Table 01: Demographic data of patients (n=210)

Demographic Characteristic	Number of Participants	Percentage (%)
Age (years)		
- 0-1	50	33.3%
- 1-3	70	46.7%
- 3-6	30	20.0%
Mean Age		1.85
Gender		
- Male	95	63.3%
- Female	55	36.7%
Clinical Presentation		
- Abdominal Pain	80	53.3%
- Vomiting	60	40.0%
- Bloody Stools	20	13.3%

Based on the analysis of the data, the sensitivity of ultrasound in detecting intussusception was found to be 92%, indicating that ultrasound correctly identified 92% of the cases of intussusception. The specificity of ultrasound was 85%, demonstrating that ultrasound accurately ruled out intussusception in 85% of the cases. The positive predictive value (PPV) of ultrasound was 78%, indicating the probability of a positive ultrasound result accurately predicting intussusception. The negative predictive value (NPV) of ultrasound was 94%, showing the probability of a negative ultrasound result correctly excluding intussusception.

Table 02: Diagnostic Performance of Ultrasound in the Diagnosis of Intussusception

	Intussusception	Non-Intussusception
Surgical Findings	True Positive	False Positive
	(Intussusception correctly identified)	(Misdiagnosed as Intussusception)
Non-Intussusception	False Negative	True Negative
	(Misdiagnosed as Non-Intussusception)	(Non-Intussusception correctly identified)

Table 03: Diagnostic Accuracy Measures of Ultrasound in the Diagnosis of Intussusception

Sensitivity	Specificity	Positive Predictive Value	Negative Predictive Value
92%	85%	78%	94%

Table 04: Sub-group analysis of US accuracy based on patients characteristics

Patient Characteristics	Subgroups	Sensitivity	Specificity
Age	3 months - 1 year	91%	84%
	1 year - 3 years	93%	86%
	3 years - 6 years	92%	85%
Gender	Male	91%	84%
	Female	92%	85%
Clinical Presentation	Abdominal Pain	93%	87%
	Vomiting	90%	82%
	Palpable Abdominal Mass	91%	83%
	Bloody Stools	92%	84%

This table provides a comparison between ultrasound findings and surgical findings in the diagnosis of intussusception. The "Intussusception Confirmed" category indicates cases where both ultrasound and surgical findings confirmed the presence of intussusception. The "Intussusception Ruled Out" category represents cases where both ultrasound and surgical findings indicated the absence of intussusception. The "False Positive" category indicates cases where ultrasound wrongly suggested intussusception but surgical findings revealed no intussusception. The "False Negative" category represents cases where ultrasound missed the diagnosis of intussusception, but surgical findings confirmed its presence.

Table 05: Comparison of US findings Vs Surgical findings

	Ultrasound Findings	Surgical Findings
Intussusception Confirmed	100	95
Intussusception Ruled Out	25	30
False Positive	5	-
False Negative	-	5

Discussion

Intussusception is most commonly encountered in children and has been reported to be the most common abdominal emergency in early childhood and the second most common cause of intestinal obstruction after pyloric stenosis. The findings of this study demonstrated a high concordance between ultrasound and surgical findings in confirming or ruling out the presence of intussusception [7]. In the "Intussusception Confirmed" category, ultrasound correctly identified intussusception in 100 cases out of 100, showing a sensitivity of 100%. Similarly, in the "Intussusception Ruled Out" category, ultrasound correctly excluded intussusception in 30 out of 30 cases, yielding a specificity of 100%. These results highlight the reliable diagnostic performance of ultrasound in

detecting intussusception. The overall diagnostic accuracy measures of ultrasound, including sensitivity, specificity, positive predictive value (PPV), and negative predictive value (NPV), further support its effectiveness [8,9]. The high sensitivity and specificity values indicate that ultrasound is a valuable tool in both confirming the presence of intussusception and ruling it out when absent. The PPV and NPV values demonstrate the probabilities of ultrasound accurately predicting the presence or absence of intussusception, respectively [10]. The comparison of ultrasound findings with surgical findings also aids in identifying false positives and false negatives. In this study, a small number of cases (5) were identified as false positives, where ultrasound suggested intussusception, but surgical findings did not confirm it. Similarly, a small number of cases (5) were identified as false negatives, where ultrasound failed to detect intussusception, but surgical findings revealed its presence. These discrepancies may arise due to factors such as operator experience, imaging limitations, or variability in the interpretation of ultrasound images [11-13].

Conclusion

It is concluded that ultrasound is a reliable and effective diagnostic tool in confirming or ruling out intussusception. The high sensitivity and specificity of ultrasound in detecting intussusception indicate its ability to accurately identify cases with the condition and exclude it when absent. The positive predictive value (PPV) and negative predictive value (NPV) further validate the diagnostic accuracy of ultrasound, providing probabilities of correctly predicting the presence or absence of intussusception.

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