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Original Research Article

To Study the Outcomes of Exploratory Laparotomy Done in Children Presenting With Acute Abdomen

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Abstract

Introduction: Acute abdomen in children is a common surgical emergency and may arise from various conditions such as intestinal obstruction, perforation peritonitis, intussusception, Meckel's diverticulum, abdominal tuberculosis, and bowel gangrene. Delayed diagnosis and treatment may lead to severe morbidity and mortality. Exploratory laparotomy plays an important role in the diagnosis and management of such cases. The present study was conducted to evaluate the outcomes of exploratory laparotomy in children presenting with acute abdomen.

Materials and Method: This prospective interventional study was conducted on 50 children aged 0–12 years who underwent exploratory laparotomy for acute abdomen at a tertiary care center. Children with traumatic abdominal injury, birth weight less than 700 grams, age more than 12 years, and those managed conservatively were excluded. Clinical history, examination findings, laboratory investigations, radiological findings, operative details, and postoperative outcomes were recorded in a predesigned proforma. Outcome measures included stoma formation, wound infection, wound dehiscence, return of bowel sounds, and initiation of feeding, hospital stay, and follow-up status after one month.

Result: The majority of patients belonged to the age group of less than 1 year (32.0%), with a mean age of 5.14 ± 4.16 years. Female children constituted 56.0% of cases. Most children had normal nutritional status (78.0%). Multiple air-fluid levels were the most common radiological finding, observed in 34.0% of patients. The mean hospital stay was 9.64 ± 5.93 days. Postoperative wound infection and wound dehiscence were observed in a subset of children, particularly among those with perforation peritonitis, bowel gangrene, severe contamination, and delayed presentation. Stoma formation was required in selected patients with severe disease.

Conclusion: Exploratory laparotomy was associated with favourable outcomes in most children with acute abdomen when timely diagnosis and intervention were performed. Delayed presentation, poor nutritional status, sepsis, and bowel perforation were important determinants of postoperative morbidity and prolonged hospitalization. Early referral, prompt surgical management, and meticulous postoperative care are essential for improving outcomes in paediatric acute abdomen.

Keywords: Acute Abdomen, Exploratory Laparotomy, Children, Intestinal Obstruction, Perforation Peritonitis, Postoperative Complications.

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Introduction

Acute abdomen in children is a common surgical emergency and remains one of the leading causes of emergency hospital admission in the paediatric age group. It refers to the sudden onset of severe abdominal pain associated with symptoms such as vomiting, fever, abdominal distension, constipation, dehydration, or signs of peritonitis, often requiring urgent diagnosis and timely intervention. Acute abdominal pain contributes significantly to the workload of paediatric emergency departments, accounting for nearly 8% of emergency visits in children.[1] Although many cases are due to benign medical causes such as gastroenteritis or constipation, a small but important proportion are caused by life-threatening surgical conditions requiring prompt operative

management.[2]The diagnosis of acute abdomen in children is particularly challenging because children frequently present with vague symptoms, may be unable to localize pain accurately, and often show rapid physiological deterioration compared with adults.[3] Furthermore, the causes of acute abdomen vary according to age. In neonates and infants, intussusception, malrotation with volvulus, necrotizing enterocolitis, incarcerated hernia, and congenital anomalies are common causes, whereas appendicitis, intestinal obstruction, perforation peritonitis, Meckel's diverticulum, abdominal tuberculosis, and abdominal trauma are more commonly encountered in older children.[4,5] Delayed diagnosis in these conditions can lead to bowel ischemia, perforation, septic shock, multi-organ dysfunction, and death.[6]Among the surgical causes of acute abdomen, acute appendicitis is one of the most frequent conditions requiring emergency surgery in children.[7]

Complicated appendicitis, particularly with perforation or generalized peritonitis, contributes significantly to morbidity, prolonged hospitalization, and postoperative complications.[8] Similarly, intestinal obstruction due to intussusception, congenital bands, adhesions, volvulus, or Meckel's diverticulum often requires urgent laparotomy when conservative measures fail or bowel viability is compromised.[9] In low- and middle-income countries, delayed presentation is common, and children often reach tertiary care centres only after the disease has progressed to bowel gangrene, perforation, or severe sepsis.[10]Exploratory laparotomy remains a vital surgical procedure in paediatric acute abdomen. It is indicated in children presenting with generalized peritonitis, bowel perforation, intestinal obstruction with strangulation, failed conservative treatment, worsening sepsis, or uncertain diagnosis despite adequate clinical and radiological evaluation.[11] In such situations, laparotomy is both diagnostic and therapeutic, allowing procedures such as appendectomy, bowel resection and anastomosis, adhesiolysis, stoma creation, repair of perforation, and reduction of intussusception.[12]

The outcome of exploratory laparotomy in children depends on several factors including the age of the patient, nutritional status, duration of symptoms, degree of contamination, bowel viability, presence of sepsis, intra-operative findings, and postoperative care.[13] Children presenting late usually have a higher risk of postoperative complications such as surgical site infection, wound dehiscence, intra-abdominal abscess, burst abdomen, postoperative ileus, respiratory complications, electrolyte imbalance, and mortality.[14] Surgical site infection is one of the most common postoperative complications following emergency laparotomy because most procedures are performed in contaminated or dirty abdominal conditions.[15]Global studies have demonstrated major differences in outcomes between high-income and low-resource countries. Mortality following emergency abdominal surgery in children is significantly higher in low- and middle-income countries because of delayed presentation, poor referral systems, inadequate perioperative care, and limited access to paediatric intensive care facilities.[16] Therefore, evaluating local patterns of presentation, operative indications, postoperative complications, duration of hospital stay, and mortality is essential to improve the quality of care and reduce preventable morbidity in children undergoing emergency exploratory laparotomy.[17]In this context, the present study was undertaken to evaluate the outcomes of exploratory laparotomy in children presenting with acute abdomen, with special emphasis on diagnostic aspects, operative findings, postoperative recovery, complications, duration of hospitalization, and final outcome.

Materials and Methods

This prospective interventional study was conducted in the Department of Surgery in collaboration with the Department of Paediatrics at Sri Guru Ram Das Institute of Medical Sciences and Research. The study was carried out over a period of 18 months from July 2024 to December 2025.The study population included infants and children admitted through the inpatient department and emergency services with symptoms suggestive of acute abdomen requiring surgical intervention. Children aged 0–12 years who underwent exploratory laparotomy for acute abdominal conditions were included in the study. Patients aged more than 12 years, those managed conservatively without laparotomy, children with birth weight less than 700 grams, and those undergoing exploratory laparotomy for traumatic abdominal injury were excluded from the study. Approval for the study was obtained from the Institutional Research and Ethics Committee of Sri Guru Ram Das University of Health Sciences before commencement of the study. Written informed consent was obtained from the Legal Authorized Representative of all enrolled children, and assent was taken wherever applicable.

All enrolled children underwent detailed clinical evaluation at admission. A thorough history was obtained regarding presenting complaints, duration of symptoms, vomiting, abdominal distension, constipation, fever, previous illness, and associated comorbidities. General physical examination and detailed abdominal examination were performed in all patients.

Relevant laboratory investigations were carried out, including complete blood count, serum electrolytes,

serum amylase, serum lipase, renal function tests, and other investigations as indicated clinically. Radiological evaluation included plain X-ray abdomen erect view and ultrasonography of the abdomen and pelvis. Additional imaging was performed wherever required. The diagnosis of acute abdomen was established based on clinical findings, laboratory investigations, and imaging studies. Depending on the severity of illness and intra-operative findings, all patients underwent emergency exploratory laparotomy under general anaesthesia.

Data were collected using a pre-designed proforma. Variables recorded included demographic profile, nutritional status, presenting symptoms, duration of illness, biochemical parameters, radiological findings, operative diagnosis, surgical procedure performed, intra-operative findings, postoperative recovery, and complications.

The primary outcome measures included postoperative recovery and complications. Recovery parameters assessed were return of bowel sounds, passage of flatus, passage of first stool, initiation of oral or Ryle's tube feeding, drain removal, duration of hospital stay, and discharge status. Postoperative complications such as wound infection, wound dehiscence, stoma formation, prolonged Ryle's tube output, re-exploration, and mortality were also recorded. Follow-up was performed up to one month after discharge.

Children with intestinal perforation peritonitis underwent procedures such as primary repair, wedge resection with closure, bowel resection and anastomosis, or stoma creation depending on bowel condition and degree of contamination. Patients with intussusception underwent hydrostatic reduction, manual reduction, bowel resection, hemicolectomy, or stoma formation depending on bowel viability. Meckel's diverticulum was managed by diverticulectomy or bowel resection with anastomosis. Children with appendicitis underwent appendectomy, while those with abdominal tuberculosis or ascariasis underwent appropriate surgical management based on intra-operative findings.

Statistical analysis was performed using appropriate statistical software. Qualitative variables were expressed as frequency and percentage, whereas quantitative variables were expressed as mean ± standard deviation. Appropriate inferential statistical tests were applied wherever required, and a p-value of less than 0.05 was considered statistically significant.

Results

A total of 50 children undergoing exploratory laparotomy for acute abdomen were included in the study. The age distribution showed that the highest proportion of patients belonged to the age group of less than 1 year, accounting for 16 cases (32.0%), followed by the 5–8 years age group with 14 cases (28.0%). Children aged 9–12 years constituted 13 cases (26.0%), while the 1–4 years age group accounted for 7 cases (14.0%). The mean age of the study population was 5.14 ± 4.16 years. Female predominance was observed in the study, with 28 females (56.0%) and 22 males (44.0%) (Table 1).

Table 1: Demographic Characteristics of Study Population (N = 50)

Variable	Number (n)	Percentage (%)
Age Group		
<1 year	16	32.0
1–4 years	7	14.0
5–8 years	14	28.0
9–12 years	13	26.0
Sex		
Male	22	44.0
Female	28	56.0
Nutritional Status		
Normal	39	78.0
Under-nourished	11	22.0

Most of the children had normal nutritional status at admission, accounting for 39 cases (78.0%), whereas 11 children (22.0%) were under-nourished. The mean weight of the study population was 17.96 ± 10.01 kg. The mean hemoglobin level was 10.99 ± 1.58 g/dL, indicating mild anemia among some children, while the mean total leukocyte count was 13,608.74 ± 4,524.57/mm³, reflecting the inflammatory nature of the disease process (Table 2).

Table 2: Baseline Clinical and Biochemical Parameters of Study Population

Parameter	Mean ± SD
Age (years)	5.14 ± 4.16
Weight (kg)	17.96 ± 10.01
Hemoglobin (g/dL)	10.99 ± 1.58
Total Leukocyte Count (/mm³)	13608.74 ± 4524.57
Serum Sodium (mmol/L)	133.42 ± 4.14
Serum Potassium (mmol/L)	4.06 ± 0.51
Serum Chloride (mmol/L)	100.32 ± 3.91
Serum Calcium (mg/dL)	9.35 ± 0.63
Urea (mg/dL)	25.28 ± 9.92
Creatinine (mg/dL)	0.52 ± 0.17
Length of Stay (days)	9.64 ± 5.93

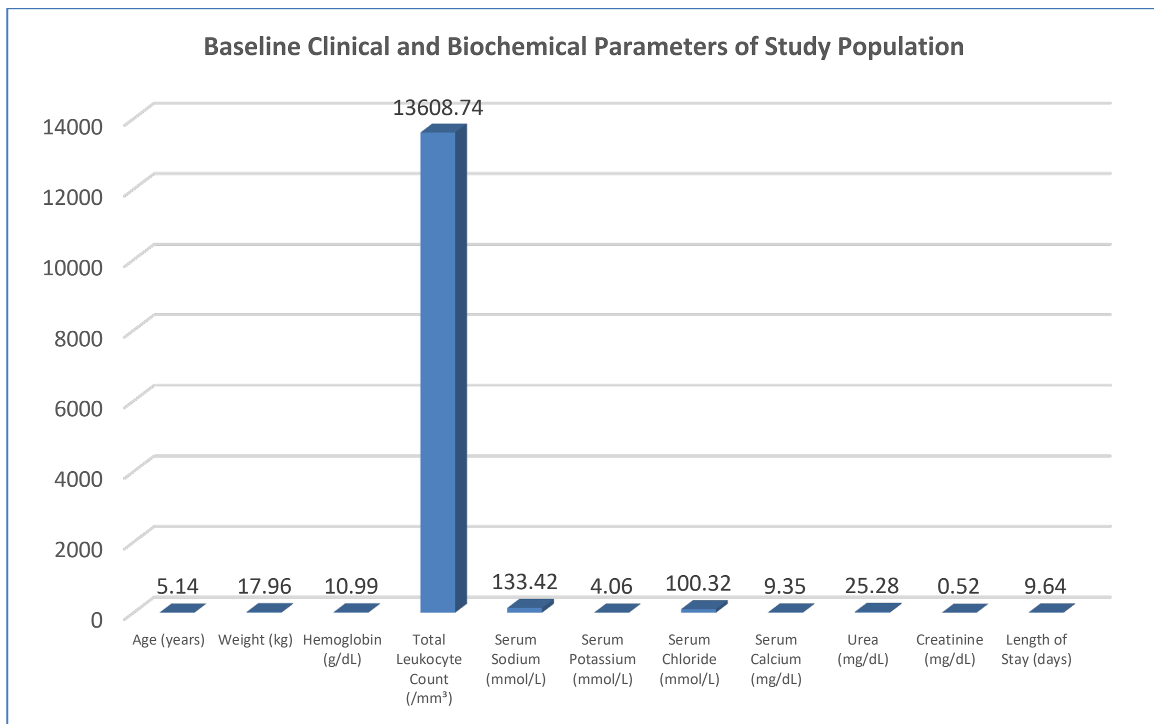

Figure 1: Baseline Clinical and Biochemical Parameters of Study Population

Radiological evaluation by erect abdominal X-ray showed that multiple air-fluid levels were the most common finding, seen in 17 cases (34.0%). Gasless abdomen with free air was observed in 7 cases (14.0%), while soft tissue mass with few air-fluid levels was noted in 6 cases (12.0%). Paucity of gas in the right abdomen and multiple air-fluid levels with free air were each seen in 5 cases (10.0%). Dilated small bowel with central air-fluid levels was observed in 4 cases (8.0%) (Table 3).

Table 3: X-ray Erect Abdomen Findings among the Study Population (N = 50)

X-ray Finding	Number (n)	Percentage (%)
Multiple air-fluid levels	17	34.0
Gasless abdomen with free air	7	14.0
Soft tissue mass with few air-fluid levels	6	12.0
Paucity of gas in right abdomen	5	10.0
Multiple air-fluid levels with free air	5	10.0
Dilated small bowel with central air-fluid levels	4	8.0
Free air under diaphragm	2	4.0
Non-specific findings	2	4.0
Few air-fluid levels	1	2.0
Dilated stomach/duodenum with distal gas paucity	1	2.0

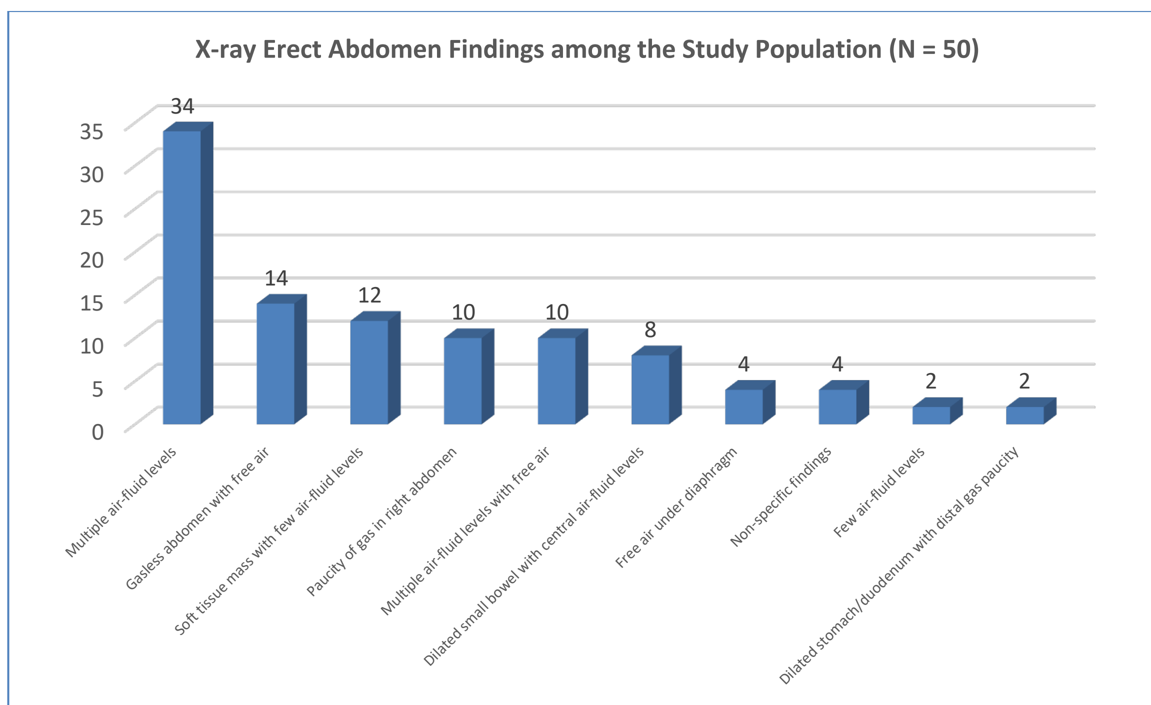

Figure 2: X-ray Erect Abdomen Findings among the Study Population (N = 50)

The mean duration of hospital stay among the study participants was 9.64 ± 5.93 days. The majority of children recovered after surgery with gradual return of bowel sounds, passage of flatus, initiation of oral feeds, and wound healing. However, a subset of children developed postoperative complications such as wound infection, wound dehiscence, prolonged ileus, and need for stoma formation. These complications were more common among children presenting late with perforation peritonitis, bowel gangrene, and severe sepsis. The overall findings of the present study suggested that exploratory laparotomy in children presenting with acute abdomen was associated with favourable outcomes in most patients when timely diagnosis and surgical intervention were performed. However, delayed presentation, severe contamination, and poor nutritional status contributed to prolonged hospitalization and postoperative morbidity.

Discussion

In the present study, the majority of children undergoing exploratory laparotomy belonged to the age group of less than 1 year (32.0%), followed by 5–8 years (28.0%) and 9–12 years (26.0%). The mean age of the study population was 5.14 ± 4.16 years. Female children constituted 56.0% of cases, while males accounted for 44.0%. Similar findings were reported by Mboutol-Mandavo C et al. (2020) [18], who observed that most paediatric surgical emergencies occurred in children below 5 years of age. Likewise, Abantanga FA et al. (2009)[19] reported that younger children constituted the largest proportion of abdominal surgical emergencies, particularly due to congenital and obstructive pathologies. The predominance of younger children in the present study may be explained by the high frequency of conditions such as intussusception, perforation peritonitis, intestinal obstruction, and congenital gastrointestinal anomalies in infancy and early childhood. Nutritional status assessment in the present study revealed that 22.0% of children were undernourished, whereas 78.0% had normal nutritional status. Poor nutritional status is an important predictor of adverse postoperative outcomes, delayed wound healing, increased risk of infection, and prolonged recovery. Similar observations were made by Firomsa T et al. (2018)[20], who reported that malnourished children had higher rates of postoperative complications and longer duration of hospitalization. Additionally, Nelson O et al. (2024)[21] found that children with low nutritional reserves and sepsis were more likely to require prolonged postoperative support and intensive care. These findings suggest that nutritional optimization before and after surgery may improve outcomes in paediatric laparotomy patients. The present study demonstrated that the mean hemoglobin level was 10.99 ± 1.58 g/dL and the mean total leukocyte count was 13,608.74 ± 4,524.57/mm³. The elevated leukocyte count observed in the study reflected the inflammatory and infective nature of the underlying abdominal pathologies. Similar findings were reported by Abed BA et al. (2022) [22], who observed that children with acute abdominal emergencies commonly presented with leukocytosis and mild anemia. Raised leukocyte

count has consistently been considered a marker of bowel ischemia, perforation, peritonitis, and sepsis in children presenting with acute abdomen. Radiological evaluation in the present study showed that multiple air-fluid levels were the most common X-ray finding, observed in 34.0% of cases. Gasless abdomen with free air was present in 14.0% of patients, while soft tissue mass with few air-fluid levels was seen in 12.0% of cases. These findings were suggestive of intestinal obstruction, perforation peritonitis, and intussusception. Similar observations were reported by Thomas S et al. (2017)[23], who found that dilated bowel loops, multiple air-fluid levels, and free intraperitoneal air were common radiological findings in children requiring urgent laparotomy. Furthermore, the present study demonstrated selective use of contrast-enhanced computed tomography in severe cases, which was comparable to the observations of Nelson O et al. (2024)[21] , who reported higher use of advanced imaging in children with complex abdominal pathology and physiological instability. The mean duration of hospital stay in the present study was 9.64 ± 5.93 days. Prolonged hospital stay was more common among children with perforation peritonitis, bowel gangrene, severe sepsis, wound infection, and delayed presentation. Similar findings were reported by Mboutol-Mandavo C et al. (2020)[18], who found that children with perforation and generalized peritonitis required prolonged hospitalization and postoperative intensive care.

Likewise, Abantanga FA et al. (2009)[19] observed that bowel perforation and delayed referral significantly increased hospital stay and morbidity. The present study also showed that children who developed wound infection had a much longer duration of hospitalization than those without infection. Similar findings were reported by Prajapati AJ et al. (2024)[24], who identified wound infection as one of the strongest predictors of prolonged hospital stay following exploratory laparotomy. Postoperative wound infection was one of the important complications observed in the present study. Wound infection was more common in children with perforation peritonitis, fecal contamination, bowel gangrene, and delayed presentation. Similar observations were reported by Prajapati AJ et al. (2024)[24], who found that perforation peritonitis was the most important predictor of postoperative wound infection and morbidity.

Likewise, Mboutol-Mandavo C et al. (2020)[18] and Abantanga FA et al. (2009)[19] reported that generalized peritonitis and gross contamination of the abdominal cavity were major contributors to postoperative wound complications and prolonged recovery. Wound dehiscence was observed in a few patients in the present study and was seen predominantly in those who already had wound infection. Similar findings were reported by Thomas S et al. (2017)[23], who observed that severe abdominal sepsis, poor wound healing, and surgical site infection predisposed children to wound dehiscence and burst abdomen. Similarly, Prajapati AJ et al. (2024)[24] reported higher rates of wound failure in patients with prior wound infection. Stoma formation was performed in selected patients with bowel gangrene, perforation, or severe contamination. In the present study, stoma formation was not associated with increased wound dehiscence. Similar findings were reported by Ghritlaharey RK et al. (2011)[9], who emphasized that diversion stoma can protect the primary bowel repair and reduce pressure on the abdominal wound, thereby reducing the risk of dehiscence and leakage. Overall findings of the present study suggested that exploratory laparotomy in children with acute abdomen was associated with good outcomes in the majority of cases when diagnosis and intervention were timely. However, delayed presentation, bowel perforation, sepsis, poor nutritional status, and wound infection remained important determinants of postoperative morbidity, prolonged hospital stay, and adverse recovery.

Conclusion

The present study concluded that exploratory laparotomy remained an important lifesaving procedure in children presenting with acute abdomen, particularly in cases of intestinal obstruction, perforation peritonitis, bowel gangrene, and other surgical emergencies. Early diagnosis and timely surgical intervention were associated with favourable postoperative outcomes in the majority of patients. Delayed presentation, severe intra-abdominal contamination, poor nutritional status, and sepsis were major factors contributing to wound infection, prolonged hospital stay, and postoperative morbidity. Proper perioperative care, early referral, adequate resuscitation, and meticulous postoperative monitoring are essential to improve surgical outcomes and reduce complications in paediatric patients undergoing exploratory laparotomy.

Limitation of the Study

The present study had a relatively small sample size and was conducted at a single tertiary care center, which may limit the generalizability of the findings to other settings. The follow-up period was short and mainly limited to the immediate postoperative period and one-month follow-up, therefore long-term complications and outcomes could not be assessed. In addition, the heterogeneity of underlying diagnoses and surgical procedures may have influenced the postoperative outcomes.

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