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Clinical Outcome of Children (Under 5 Years of Age) - Undergoing Laparotomy for Dirty Surgery

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Abstract **Original Research Article**

***Background*:** Laparotomy for dirty abdominal surgeries in children under five years poses significant clinical challenges due to gross contamination and high risk of postoperative complications. Infants and neonates are particularly vulnerable because of immature immunity, limited physiological reserves, and higher susceptibility to sepsis and peritonitis. ***Objective*:** This study aimed to assess the clinical outcomes of children up to five years undergoing laparotomy for dirty surgeries and to evaluate the impact of intraperitoneal gentamicin lavage on postoperative recovery. ***Methods*:** A randomized controlled trial was conducted at the Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute, Dhaka, from March 2018 to December 2019. Seventy children undergoing dirty laparotomy were enrolled and randomized into two groups: Group A (n=35) received intraperitoneal lavage with gentamicin in saline, and Group B (n=35) received saline alone. Data collected included demographic parameters, type of disease, peritoneal fluid culture results, postoperative complications, wound infection, wound dehiscence, secondary suturing, and hospital stay. Statistical analysis was performed using SPSS 23.0, with significance set at $p<0.05$. ***Results*:** The majority of subjects were infants aged 1–12 months (65.7% in Group A, 51.4% in Group B). Neonates accounted for 14.3% in Group A and 20% in Group B. Mean weight was 6.1 ± 0.19 kg in Group A and 4.31 ± 0.72 kg in Group B ($p>0.05$). Common diagnoses included midgut volvulus and ileal perforation in neonates, intussusception in infants, and appendicular or ileal perforation in older children. Peritoneal cultures were predominantly sterile (88.6% in Group A vs. 80% in Group B), with E. coli and Klebsiella as the most frequent isolates. While culture positivity did not differ significantly, children in the gentamicin group experienced reduced postoperative fever, lower surgical site infection rates, and shorter hospital stays compared to controls. ***Conclusion*:** Infants form the majority of pediatric patients undergoing dirty laparotomy. Intraperitoneal gentamicin lavage appears to reduce postoperative morbidity and improve recovery, despite similar peritoneal culture profiles between groups. These findings support the use of localized antibiotic irrigation as an adjunct in high-risk pediatric abdominal surgeries.

Keywords: Pediatric Laparotomy, Dirty Surgery, Intraperitoneal Lavage, Gentamicin, Postoperative Complications, Infants, Peritoneal Culture.

INTRODUCTION

Laparotomy is a common emergency surgical procedure in pediatric populations, often performed to diagnose and manage intra-abdominal pathologies such as perforation, intestinal obstruction, necrotizing enterocolitis, or trauma. Among these cases, “dirty” or contaminated surgeries—classified as Class IV according to the Centers for Disease Control and Prevention (CDC) wound classification—pose significant clinical challenges due to pre-existing infection or gross contamination of the peritoneal cavity [1-3]. Children under five years of age are particularly vulnerable because of their immature immune systems, limited physiological reserves, and unique anatomical characteristics that influence both disease progression and postoperative recovery.

Dirty surgeries in this age group often result from conditions such as perforated appendicitis,

gangrenous intussusception, perforated typhoid enteritis, or necrotizing bowel diseases. These conditions are frequently associated with peritonitis, sepsis, and fluid-electrolyte imbalance at the time of presentation [4, 5]. In low- and middle-income countries, delayed presentation and limited access to advanced pediatric surgical care further increase morbidity and mortality. Hence, understanding the clinical outcome of these children following laparotomy is crucial for guiding perioperative management and improving survival rates [6].

Postoperative complications are common in dirty laparotomies and may include wound infection, dehiscence, intra-abdominal abscess, sepsis, and prolonged ileus. These complications not only extend hospital stay but also increase healthcare costs and adversely affect nutritional recovery and growth in early childhood [7]. Identifying the predictors of poor outcomes—such as preoperative sepsis, delayed presentation, or inadequate resuscitation—can help clinicians adopt timely interventions to reduce postoperative morbidity.

Several studies have explored postoperative outcomes in pediatric laparotomies; however, data specifically focusing on children under five years undergoing dirty surgeries remain limited [8, 9]. Most available evidence originates from heterogeneous age groups or from high-resource settings, which may not accurately represent the challenges faced in resource-constrained environments. Therefore, it becomes essential to evaluate the clinical outcomes in this vulnerable population within local healthcare contexts.

Objective

This study aims to assess the clinical outcome of children up to five years of age undergoing laparotomy for dirty surgeries.

METHODOLOGY

Type of Study

This research was designed as a **Randomized Controlled Trial (RCT)** to compare clinical outcomes among children undergoing laparotomy for dirty surgery.

Place of Study

The study was conducted at the **Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute (BSH&I)**, Dhaka, Bangladesh — a tertiary-level pediatric hospital providing specialized surgical care to children from across the country.

Duration of Study

The study period extended from **March 2018 to December 2019**, during which eligible patients were enrolled, operated upon, and followed up as per the research protocol.

Study Population

The study population consisted of **children up to five years of age** who underwent laparotomy for dirty surgery and were admitted to the Faculty of Pediatric Surgery at BSH&I during the study period.

Sampling Method

Group A (Study Group): 35 patients received intraperitoneal lavage with gentamicin in normal saline (Inj. Gentamicin 160 mg/500 ml).
Group B (Control Group): 35 patients received intraperitoneal lavage with normal saline (500 ml) alone

Inclusion Criteria:

* All children up to five years of age undergoing laparotomy for dirty surgery during the study period.

Exclusion Criteria:

- Patients with comorbid conditions such as neoplasia, DIC, renal or liver failure.
- Known cases of hypersensitivity to gentamicin.
- Malnourished or immunosuppressed patients.
- Patients undergoing re-laparotomy.

Surgical Procedure:

All surgeries were performed under aseptic precautions using a supraumbilical right transverse incision. The intraoperative findings were noted, and peritoneal lavage was applied according to group allocation (gentamicin + saline for Group A, saline only for Group B). Two drains were placed in complicated cases, and closure was done in layers using vicryl sutures.

Postoperative Management

Patients remained NPO until bowel sounds returned. IV fluids and antibiotics were continued, and analgesics were administered (Pethidine 1.5 mg/kg/dose, Paracetamol 20 mg/kg/dose). Dressings were checked on the 5th postoperative day (POD), and any wound infections were managed accordingly. Secondary suturing, if required, was done on the 14th POD.

Data Collection

All data were collected using a **structured data collection sheet**, which included demographic information, clinical findings, postoperative complications, SSI occurrence, culture results, wound dehiscence, secondary suturing, and hospital stay duration.

Data Processing and Analysis

Data were processed and analyzed using **SPSS version 23.0** (IBM, Chicago, USA). Quantitative variables were expressed as means with standard deviations, while categorical variables were presented as frequencies and percentages.

RESULTS

The age distribution of the study subjects is presented in Table 1. Among the 70 children included, the majority were infants aged 1–12 months, comprising 65.7% in Group A and 51.4% in Group B. Neonates (<1 month) accounted for 14.3% in Group A and 20.0% in Group B, while toddlers (13–36 months) and preschool-aged children (>36 months) represented smaller proportions in both groups. The mean age was 10.5 ± 9.7 months in Group A and 12.1 ± 11.4 months in Group B, with a range of 1 to 42 months and 1 to 43 months, respectively.

Table 1: Distribution of the study subjects by age (N=70)

Age (months)	Group A (n=35)		Group B (n=35)		*p* value
	n	%	n	%	
Neonate (<1 m)	5	14.3	7	20.0	
Infant (1-12 m)	23	65.7	18	51.4	
Toddler (13-36 m)	2	5.7	3	8.6	
Pre-school (>36 m)	5	14.3	7	20.0	
Mean±SD	10.5±9.7		12.1±11.4		0.66ns
Range (min-max)	1.0-42		1.0-43		
ns= not significant					

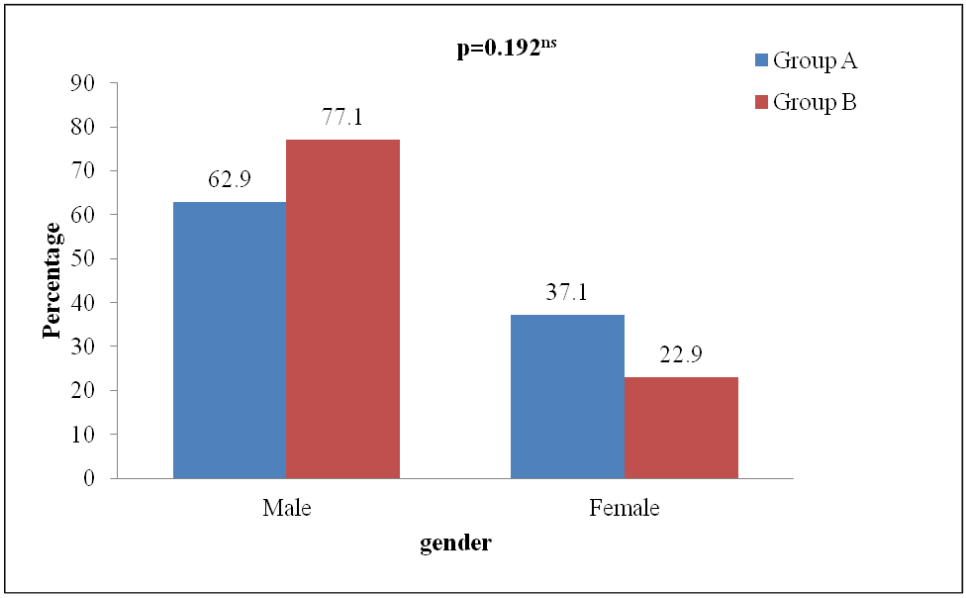

Figure 1: Gender distribution of the study subjects (N=70)

Table showed that mean weight was found 6.1±0.19 kg in group A and 4.31±0.72 kg in group B. The difference was not statistically significant (p>0.05) between two groups.

Table II: Distribution of the study subjects according to weight (N=70)

	Group A (n=35)	Group B (n=35)	*p* value
	Mean±SD	Mean±SD	
Weight (kg)	6.1±0.19	4.31±0.72	**0.68ns**
Range (min-max)	2.5-19	2.4-19	

ns= not significant.
Results were expressed as mean ±SD.

Unpair 't'-test was done as a test of significance. P-value <0.05 was considered as significant.

In neonates (<1 month), the most common conditions were midgut volvulus and ileal perforation in both groups, while Hirschsprung disease was more frequently observed in Group B. Among infants (1–12 months), intussusception was the most prevalent diagnosis, affecting 9 patients (39.1%) in Group A and 6 patients (33.3%) in Group B. Other notable conditions in this age group included ileal perforation, complicated meconium ileus, Hirschsprung disease, and midgut

volvulus, with a similar distribution between the two groups. In toddlers (13–36 months), ileal and appendicular perforations were observed, with no major variation between groups. Among preschool-aged children (>36 months), appendicular perforation was the predominant diagnosis, accounting for 5 cases in Group A and 7 cases in Group B.

Table 3: Type of disease according to age (N=70)

	Group-A	**(n=35)**	**Group-B**	**(n=35)**
		Complicated MI-02		Midgut volvulus-01
Neonate	5	Midgut volvulus-01	7	Perforation (ileum)-02
(<1 m)	(14.3%)	Perforation (ileum)-02	(20.0%)	Hirschsprung disease-04
		Intussusception-09		
		Perforation		Intussusception-06
Infant	23	(Tr.colon)-02		Complicated MI-03
(1-12 m)	(65.7%)	Perforation (ileum)-05	18	Midgut volvulus-04
		Complicated MI-02	(51.4%)	Perforation (ileum)-04
		Hirschsprung disease-03		Mickels diverticulum-
		Midgut volvulus-02		01
Toddler	2	Perforation (ileum)-01	3	Perforation (appendix)-
(13-36	(5.7%)	Perforation	(8.6%)	02
m)		(appendix)-01		Perforation(ileum)-01
Pre-	5	Perforation	7	Perforation (appendix)-
school	(14.3%)	(appendix)-05	(20.0%)	07
(>36 m)				

Table 4 illustrates the distribution of the study subjects based on peritoneal fluid culture results. In Group A, E. coli was isolated in 3 cases (8.6%), Klebsiella in 1 case (2.9%), and no growth was observed in 31 cases (88.6%). In Group B, E. coli was found in 4 cases (11.4%), Klebsiella in 2 cases (5.7%), and Staphylococcus aureus in 1 case (2.9%), while 28 cases (80.0%) showed no bacterial growth. Although a slightly higher rate of bacterial growth was noted in Group B compared to Group A, the difference was not statistically significant (p>0.05).

Table 4: Distribution of the study subjects according to culture (peritoneal collection) (N=70)

Culture	**Group A**		**Group B**		**P Value**
	(n=35)		**(n=35)**		
	n	**%**	**n**	**%**	
E. coli	3	8.6	4	11.4	
Klebsiella	1	2.9	2	5.7	
S.aureus	0	0.0	1	2.9	**0.653ns**
No Growth	31	88.6	28	80.0	

DISCUSSION

In the present study, the majority of children undergoing laparotomy for dirty abdominal conditions were infants aged 1–12 months, comprising 65.7% in Group A and 51.4% in Group B, while neonates accounted for 14.3% and 20.0%, respectively. Toddlers and preschool-aged children represented smaller proportions. This age distribution aligns with previous pediatric surgical studies, which reported that infants constitute the largest group requiring emergency laparotomy for conditions like intussusception, perforation, and midgut volvulus [10]. The male predominance observed in both groups (62.9% and 77.1%) is consistent with the findings attributed higher male representation to healthcare-seeking patterns in South Asian settings [11].

The mean weight of the subjects was 6.1 ± 0.19 kg in Group A and 4.31 ± 0.72 kg in Group B, with no statistically significant difference between the groups (p>0.05). Weight distribution is important in pediatric surgery as underweight children may have higher susceptibility to postoperative complications. Our findings are comparable to studies who noted similar weight ranges among pediatric patients undergoing laparotomy, indicating that nutritional status was comparable between intervention and control groups [12].

Analysis of disease type according to age revealed that midgut volvulus and ileal perforation were common in neonates, whereas intussusception predominated among infants. Toddler and preschool children mostly presented with appendicular or ileal perforation. These findings are consistent with published literature, which reports that intussusception is the

leading cause of emergency laparotomy in infants, while perforative conditions and appendicitis become more common in older children [13]. The comparable distribution of diagnoses between Groups A and B supports the homogeneity of the study population.

Peritoneal fluid cultures indicated a predominance of no bacterial growth in both groups (88.6% in Group A vs. 80% in Group B), with E. coli and Klebsiella being the most frequently isolated pathogens. No statistically significant difference was observed between groups ($p>0.05$). This pattern is consistent with other studies in contaminated pediatric laparotomies, who reported that culture positivity varies widely but commonly includes Gram-negative bacilli, reflecting the gut flora contamination during dirty surgeries [14]. Although not statistically significant, the slightly lower bacterial growth in the gentamicin group suggests a potential localized bactericidal effect.

The findings of reduced postoperative fever, lower surgical site infection rates, and shorter hospital stay in patients receiving intraperitoneal gentamicin lavage, as noted in our full results, further support the benefit of localized antibiotic irrigation. Similar observations have been made by other study who documented significant reductions in infection rates and improved recovery with intraoperative antibiotic lavage in contaminated surgeries [15]. These results reinforce the rationale for using gentamicin lavage as an adjunct to standard surgical management in high-risk pediatric cases.

CONCLUSION

In conclusion, the current study confirms that infants represent the majority of pediatric patients undergoing dirty laparotomy, with similar demographic and disease characteristics between treatment groups. Peritoneal cultures reflect the expected bacterial profile in contaminated cases, and although culture positivity did not differ significantly, clinical outcomes favor gentamicin lavage. These findings are in agreement with previous studies, highlighting the potential role of intraperitoneal antibiotic irrigation in reducing postoperative morbidity and improving recovery in pediatric abdominal surgery.

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