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Original Research Article **Surgery**

Effect of Intraperitoneal Gentamicin Lavage on Postoperative Surgical Site Infection (SSI) in Children (Under 5 years) Undergoing Dirty Laparotomy

Dr. Md. Abdullah Al Mahmud[1]*, Prof. Dr. Md. Aminur Rashid[2], Prof. Dr. Swapan Kumar Paul[3], Dr. S. M. Nazmul Islam[4], Dr. Sultana Sharifa Akter[5]

[1]Registrar, Department of Surgery, Kuwait Moitri Govt. Hospital, Uttara, Dhaka, Bangladesh
[2]Head of Dept. of General Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh
[3]Head of Dept. of Pediatric Neurosurgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh
[4]Assistant Professor, Dept. of Neonatal Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh
[5]Resident, Dept. of General Pediatric Surgery, Bangladesh Shishu Hospital & Institute, Dhaka, Bangladesh

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***Corresponding author:** Dr. Md. Abdullah Al Mahmud
Registrar, Department of Surgery, Kuwait Moitri Govt. Hospital, Uttara, Dhaka, Bangladesh

Abstract

Background: Surgical site infection (SSI) remains one of the most common postoperative complications, particularly in cases involving contaminated or dirty abdominal surgeries. Despite improved aseptic techniques and antibiotic prophylaxis, SSI continues to contribute significantly to morbidity, prolonged hospitalization, and increased healthcare costs, especially in developing countries. Intraoperative intraperitoneal antibiotic lavage, particularly using gentamicin, has been proposed as an effective adjunct to reduce microbial contamination and postoperative infection risk. ***Objective:*** The present study aimed to evaluate the effect of intraperitoneal gentamicin lavage on postoperative surgical site infection (SSI) in children undergoing dirty laparotomy. ***Methods:*** This randomized controlled trial was conducted at the Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute, Dhaka, from March 2018 to December 2019. A total of 70 children (≤5 years) undergoing laparotomy for dirty surgery were randomly divided into two groups. Group A (n=35) received intraperitoneal lavage with gentamicin diluted in normal saline (160 mg/500 ml), whereas Group B (n=35) received lavage with normal saline only. Postoperative outcomes, including fever, wound infection, wound dehiscence, secondary closure, and hospital stay duration, were recorded and analyzed using SPSS version 23. ***Results:*** The groups were comparable in age and gender distribution ($p>0.05$). Postoperative fever occurred in 54.3% of Group A and 77.1% of Group B ($p=0.044$), while wound infection rates were significantly lower in the gentamicin group (11.4%) than in the control group (31.4%) ($p=0.041$). Although wound dehiscence and secondary closure did not differ significantly between groups, the mean postoperative hospital stay was notably shorter in Group A (8.17 ± 2.70 days) compared to Group B (10.71 ± 3.89 days) ($p=0.002$). ***Conclusion:*** Intraperitoneal gentamicin lavage significantly reduced postoperative fever, wound infection rates, and hospital stay duration in children undergoing dirty laparotomy. These findings suggest that gentamicin lavage can serve as an effective adjunctive measure to minimize postoperative infectious morbidity and enhance recovery in pediatric contaminated abdominal surgeries.

Keywords: Surgical Site Infection, Gentamicin Lavage, Dirty Laparotomy, Pediatric Surgery, Postoperative Infection, Randomized Controlled Trial.

INTRODUCTION

Surgical site infection (SSI) remains one of the most common and challenging complications following abdominal surgeries, particularly in cases involving contaminated or dirty wounds. Despite advancements in aseptic techniques, antibiotic prophylaxis, and surgical care, SSIs continue to significantly impact patient morbidity, prolong hospital stay, and increase healthcare costs. In developing countries, where resource constraints and higher rates of contamination are prevalent, the burden of postoperative infections is even more pronounced [1-3]. Among various strategies aimed at reducing SSIs, the use of intraoperative antibiotic lavage has gained interest as an adjunctive measure to minimize microbial load directly within the peritoneal cavity.

Gentamicin, an aminoglycoside antibiotic with broad-spectrum bactericidal activity against both Gram-negative and certain Gram-positive organisms, has been widely used in surgical prophylaxis. Its local use as an intraperitoneal lavage agent offers a potential advantage by delivering high antibiotic concentrations at the site of infection risk while minimizing systemic toxicity [4, 5]. Previous studies have reported that intraperitoneal lavage with gentamicin can reduce postoperative infection rates, intra-abdominal abscess formation, and wound complications, particularly in cases of perforated viscus, peritonitis, or other contaminated abdominal conditions [6, 7].

However, the routine use of antibiotic lavage remains controversial due to concerns about antibiotic resistance, tissue toxicity, and the lack of standardized protocols regarding drug concentration, duration, and technique. Some studies have shown significant reductions in postoperative infection rates with antibiotic lavage, while others have found no additional benefit compared to saline irrigation alone. [8] This inconsistency highlights the need for further evidence-based evaluation, particularly in pediatric and high-risk surgical populations where infection control is critical to recovery.

In the context of dirty laparotomies—defined by gross contamination of the peritoneal cavity by pus, fecal matter, or infected material—the risk of SSI is substantially elevated. Here, simple saline irrigation may not be sufficient to eliminate bacterial contamination effectively. Gentamicin lavage, on the other hand, may help achieve a localized bactericidal environment, thereby reducing postoperative morbidity. Assessing its efficacy in such settings is crucial to refining intraoperative infection control measures.

Objective

Therefore, the present study was undertaken to evaluate the effect of intraperitoneal gentamicin lavage on postoperative surgical site infections in patients undergoing dirty laparotomy.

METHODOLOGY

Type of Study

This study was designed as a Randomized Controlled Trial (RCT) to evaluate and compare the clinical outcomes of children undergoing laparotomy for dirty surgery with or without intraperitoneal gentamicin lavage.

Place of Study

The research was carried out at the Faculty of Pediatric Surgery, Bangladesh Shishu Hospital and Institute (BSH&I), Dhaka, a tertiary-level pediatric surgical center that caters to patients from all regions of Bangladesh.

Duration of Study

The study was conducted over a period of 21 months, from March 2018 to December 2019, during which all eligible patients were enrolled, operated upon, and followed according to the study protocol.

Study Population

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

Sampling Method

A total of 70 patients were randomly allocated into two equal groups:

- **Group A (Study Group):** Received intraperitoneal lavage with gentamicin diluted in normal saline (Inj. Gentamicin 160 mg/500 ml).
- **Group B (Control Group):** 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, disseminated intravascular coagulation (DIC), or renal/liver failure.
- Known hypersensitivity to gentamicin.
- Malnourished or immunocompromised patients.
- Patients undergoing re-laparotomy.

Surgical Procedure

All procedures were performed under strict aseptic conditions through a supraumbilical right transverse incision. After completion of the surgical procedure, peritoneal lavage was administered as per group allocation — gentamicin with saline for Group A, and saline alone for Group B. In complicated cases, two drains were placed. The abdominal wall was closed in layers using absorbable vicryl sutures.

Postoperative Management

Patients were kept nil per oral (NPO) until bowel sounds returned. Intravenous fluids, antibiotics, and analgesics were administered (Pethidine 1.5 mg/kg/dose and Paracetamol 20 mg/kg/dose). Wound dressings were inspected on the 5th postoperative day (POD), and any evidence of wound infection was managed appropriately. Secondary suturing was performed on the 14th POD if required.

Data Collection

Data were collected using a structured data collection sheet that recorded demographic characteristics, intraoperative findings, postoperative complications, surgical site infection (SSI) occurrence, wound dehiscence, secondary suturing, and duration of hospital stay.

Data Processing and Analysis

Collected data were entered and analyzed using SPSS version 23.0 (IBM, Chicago, USA). Quantitative variables were expressed as mean ± standard deviation (SD), and categorical variables as frequency and percentage. Statistical comparisons were performed using appropriate tests, and a p-value < 0.05 was considered statistically significant.

RESULTS

A total of 70 children up to five years of age were included in the study, with 35 patients in each group. The majority of the patients in both groups were infants aged 1–12 months, accounting for 65.7% in Group A and 51.4% in Group B. Neonates constituted 14.3% of Group A and 20.0% of Group B, while toddlers and preschool-aged children comprised 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, showing no statistically significant difference between the groups (p = 0.66). Male patients predominated in both groups, representing 62.9% in Group A and 77.1% in Group B; however, this difference was also not statistically significant (p = 0.18).

Table 1: Distribution of the Study Subjects by Age and Gender (N=70)

Variables	Category	Group A (n=35)		Group B (n=35)		p-value
		n	%	n	%	
Age (months)	Neonate (<1 month)	5	14.3	7	20.0	
	Infant (1–12 months)	23	65.7	18	51.4	
	Toddler (13–36 months)	2	5.7	3	8.6	
	Pre-school (>36 months)	5	14.3	7	20.0	
Mean ± SD		10.5 ± 9.7		12.1 ± 11.4		0.66^{ns}
Range (min–max)		1.0–42		1.0–43		
Gender	Male	22	62.9	27	77.1	0.18^{ns}
	Female	13	37.1	8	22.9	

Table showed that 19(54.3%) patients was found post-operative fever in group A and 27(77.1%) in group B. The difference was statistically significant (p<0.05) between two groups.

Table 2: Distribution of the study subjects according to post-operative fever (N=70)

Post- Post-operative fever operative fever	Group A		Group B		p value
	(n=35) n	(n=35) %	(n=35) n	(n=35) %	
Yes	19	54.3	27	77.1	**0.044***
No	16	45.7	8	22.9	

s= significant

P value reached from chi square test

Table showed that most of the patients 13(37.2%) were found post-operative fever on 3rd and 4th POD in group A and 20(57.1%) in group B.

Table 3: Post-operative fever follow up (according to POD) (N=70)

Post-operative fever	1st POD	2nd POD	3rd POD	4th POD	5th POD	6th POD
Group-A	1(2.9%)	6(17.1%)	13(37.2%)	13(37.2%)	6(17.1%)	3(8.6%)
Group-B	11(31.4%)	13(37.2%)	20(57.1%)	20(57.1%)	6(17.1%)	13(37.2%)

Figure-1 shows post-operative mean temperature in Group-A is 99.1◦F, 99.5◦F, 99.9◦F, 100.2◦F, 99.9◦F, 99.3◦F and 98.7◦F on1st ,2nd, 3rd,4th ,5th,6th and 7th POD & post-operative mean temperature in Group-B is 98.3◦F, 98.6◦F, 99.1◦F,99.3◦F, 99.0◦F, 98.4◦F& 98.1 ◦F on1st ,2nd, 3rd,4th ,5th, ,6th and 7th POD.

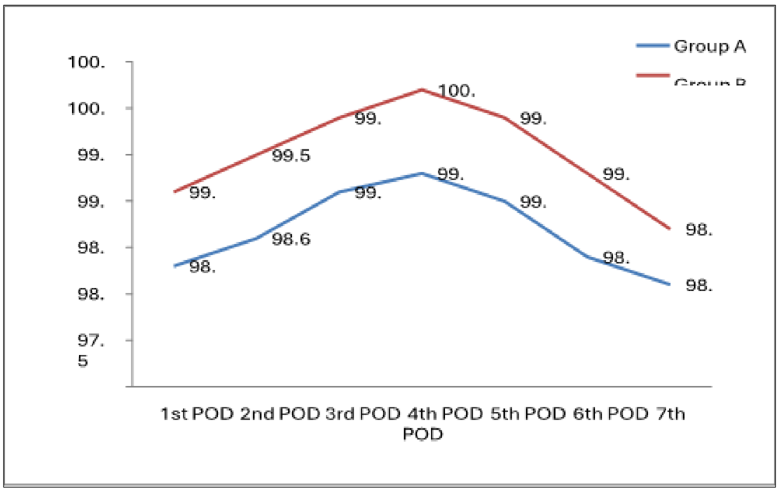

Figure 1: Line diagram showing post-operative mean temperature of the study subjects (N=70)

Table-4 showed that 4(11.4%) patients was found wound infection in group A and 11(31.4%) in group B. The difference was statistically significant (p<0.05) between two groups.

Table 4: Comparison of occurrence of wound infection between two groups (N=70)

Wound infection	3rd POD	5th POD	7st POD	14th POD	1 month	Total	*p*-value
Group-A	0(0.0%)	2 (5.7%)	2 (5.7%)	0(0.0%)	0(0.0%)	**4(11.4%)**	
Group-B	2(5.7%)	6(17.1%)	3 (8.6%)	0(0.0%)	0(0.0%)	**11(31.4%)**	**0.041^{s}**

s= significant

p value reached from chi square test

Table showed that 2(5.7%) patients had wound dehiscence (superficial) in group A and 4(11.4%) in group B. The difference was not statistically significant (p>0.05) between two groups.

Table 5: Comparison of occurrence of wound dehiscence (superficial) between two groups (N=70)

Wound dehiscence (superficial)	3rd POD	5th POD	7th POD	14th POD	1 month	Total	*p*-value
Group-A	1(2.86%)	0(0.0%)	1(2.86%)	0(0.0%)	0(0.0%)	**2(5.7%)**	
Group-B	0(0.0%)	3(8.6%)	1 (2.86%)	0(0.0%)	0(0.0%)	**4(11.4%)**	**0.337ns**

ns = not significant

P value reached from chi square test

Table-6 showed that 1(2.86%) patients had secondary closure in group A and 3(8.6%) in group B. The difference was not statistically significant (p>0.05) between two groups.

Table 6: Comparison of need of secondary closure between two groups (N=70)

Secondary closure	3rd POD	5th POD	7th POD	14th POD	1 month	Total	*p*-value
Group-A	0(0.0%)	0(0.0%)	0(0.0%)	1(2.86%)	0(0.0%)	**1(2.86%)**	
Group-B	0(0.0%)	0(0.0%)	0(0.0%)	3(8.6%)	0(0.0%)	**3(8.6%)**	**0.61ns**

ns= not significant

P value reached from chi square test

Table-7 showed that mean duration of hospital stay was found 8.17±2.70 days in group A and 10.71±3.89 days in group B. The difference was statistically significant (p<0.05) between two groups.

Table 7: Distribution of the study subjects according to duration of post-operative hospital stay (N=70)

	Group A	**Group B**	***p* value**
	(n=35)	**(n=35)**	
	Mean±SD	**Mean±SD**	
Duration of hospital stay (days)	8.17±2.70	10.71±3.89	**0.002s**
Range (min-max)	7.0-20.0	7.0-20.0	

s= significant

P value reached from unpaired t-test

DISCUSSION

In the present study, the majority of children undergoing laparotomy for dirty surgery were below one year of age in both groups—65.7% in Group A and 51.4% in Group B. This finding aligns with the observations of one study who also reported that infants constitute the largest proportion of pediatric patients requiring emergency laparotomy for perforated or infected intra-abdominal conditions [9]. The predominance of male patients in both groups (62.9% and 77.1%) is also consistent with another report, who found a similar male predominance in pediatric surgical infections, possibly due to greater healthcare-seeking behavior for male children in South Asian settings [10].

The incidence of postoperative fever was significantly lower in Group A (gentamicin lavage) than in Group B (normal saline lavage), 54.3% versus 77.1%, respectively ($p<0.05$). This indicates that the use of intraperitoneal gentamicin irrigation effectively reduces postoperative inflammatory response. Comparable findings were reported by one study who demonstrated that antibiotic lavage decreases postoperative fever and peritoneal contamination [10]. Similarly, other study reported that antibiotic irrigation significantly reduces early postoperative pyrexia and intra-abdominal infection rates following contaminated abdominal surgeries in pediatric patients [11].

Postoperative wound infection was another critical outcome in this study. The overall rate of wound infection was significantly lower in Group a (11.4%) compared to Group B (31.4%) ($p<0.05$). These results corroborate the findings of one study who documented a reduction in surgical site infection (SSI) from 58% in the control group to 16% in the gentamicin lavage group [12]. The reduction may be attributed to the local antibacterial effect of gentamicin, which minimizes residual bacterial load and prevents early colonization at the incision site. One study also highlighted that antibiotic lavage in contaminated and dirty surgeries significantly decreases wound infection rates, especially in resource-limited settings where infection control measures are often suboptimal [13].

Wound dehiscence and secondary closure were not statistically different between the two groups, although the frequency was numerically lower in Group A. This suggests that while gentamicin lavage may effectively reduce infection, mechanical wound healing depends on multiple other factors such as nutritional status, tension at the suture line, and patient comorbidities. These findings are in agreement with one study who noted that while antibiotic lavage decreases superficial wound complications, it has limited influence on deeper wound healing and fascial integrity [14].

The mean postoperative hospital stay was significantly shorter in Group A (8.17 ± 2.70 days) compared to Group B (10.71 ± 3.89 days) ($p=0.002$). This finding is similar to that reported by one study where patients receiving intraperitoneal antibiotic lavage had faster recovery, reduced infection rates, and shorter hospital stays [15]. Shorter hospitalization not only reduces healthcare costs but also minimizes the risk of nosocomial infections, which are particularly concerning in pediatric populations.

CONCLUSION

In conclusion, this study demonstrated that the use of intraperitoneal lavage with gentamicin in dirty laparotomy among children under five years of age significantly reduced post-operative complications compared to normal saline lavage. Patients in the gentamicin group experienced a lower incidence of post-operative fever and wound infection, as well as a shorter duration of hospital stay, highlighting the effectiveness of antibiotic lavage in minimizing infectious morbidity and promoting faster recovery. Although differences in wound dehiscence and secondary closure rates were not statistically significant, the overall clinical outcomes were better in the gentamicin group, suggesting that intraperitoneal antibiotic lavage can be a valuable adjunct in managing contaminated pediatric laparotomies to improve surgical outcomes and patient recovery.

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