



Research Article

Comparative Study of Result of Peritoneal Wash with Normal Saline Vs Saline and Metronidazole in Patients Undergoing Exploratory Laparotomy for Perforation Peritonitis

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Abstract

Introduction: Perforation peritonitis is a significant surgical emergency with high postoperative infectious morbidity. During exploratory laparotomy, lavage with normal saline is routine, and the addition of metronidazole may be useful for providing additional antimicrobial activity against anaerobic organisms. This study compared postoperative outcomes following saline lavage with or without metronidazole.

Materials and Methods: This randomized clinical trial was carried out in the Department of General Surgery, Sanjay Gandhi Memorial Hospital, Delhi between March 2024 and August 2025. 54 patients, 18-60 years of age, with perforation peritonitis undergoing exploratory laparotomy were randomly divided into two equal groups. Group 1 (n=27) was given 2L of normal saline with 100ml of metronidazole and Group 2 (n=27) was given 2L of normal saline alone. Surgical site infection (SSI), sepsis, intra-abdominal abscess, wound dehiscence, burst abdomen and hospital stay were evaluated. Categorical variables were analyzed using Chi-square test and p value <0.05 was taken as statistically significant.

Results: Age, gender and etiology of perforation were similar at baseline. The metronidazole group had a significantly lower SSI than the saline group (18.52% vs. 48.15%, p=0.0209). Postoperative sepsis was also significantly reduced (25.93% vs. 59.26%; p=0.0132). Intra-abdominal abscess, wound dehiscence and burst abdomen were numerically lower with metronidazole, but were not statistically significant. There was a significant difference in terms of hospital stay, with 77.78% discharged within 10 days compared with 40.74% (p=0.0056).

Conclusion: Postoperative SSI and sepsis rates and hospital stay were significantly reduced after exploratory laparotomy for perforation peritonitis when metronidazole was added to normal saline for peritoneal lavage. These results suggest that lavage with metronidazole is a helpful addition to standard saline lavage.

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KEYWORDS: Perforation peritonitis, Peritoneal lavage, Metronidazole, Surgical site infection, Postoperative sepsis.

1. INTRODUCTION

Peritonitis continues to be a significant and potentially life-threatening surgical emergency, usually caused by a perforation of a hollow viscus and contamination of the peritoneal cavity with gastrointestinal contents and microorganisms [1]. The most common type is secondary peritonitis, which has significant morbidity and mortality, especially if it is not diagnosed and treated definitively in a timely fashion [2]. Perforation peritonitis remains a significant surgical problem in India, and the common sites of perforation are ileal, gastric, duodenal, appendicular and colonic [3]. This inflammatory reaction may lead to surgical site infection (SSI), intra-abdominal abscess, sepsis, multiorgan dysfunction and extended hospital stay [4]. Thus, early resuscitation, appropriate antimicrobial therapy, source control and timely surgical intervention are important elements of management [5,6].

Surgical management, including extensive laparotomy and peritoneal lavage, with closure or resection of the perforated segment is still an important part of the treatment [7]. The purpose of peritoneal lavage is to mechanically remove contaminated fluid, pus, fibrin, necrotic debris and microorganisms from the abdominal cavity and thus reduce the local microbial burden [8]. Normal saline is the most commonly used solution because it is readily available, isotonic, safe and easy to use. Mechanical cleansing, however, may not fully remove pathogenic organisms, especially anaerobic bacteria which are important in intra-abdominal infections after gastrointestinal perforation [9]. Metronidazole is highly active against obligate anaerobic organisms, such as the *Bacteroides* species, and the use of metronidazole in lavage fluid has been suggested as an adjunct to systemic antibiotic treatment [10]. However, the routine use of lavage with antibiotics is controversial because of concerns about the lack of additional clinical benefit, tissue effects, and the contribution to unnecessary antibiotic exposure.

There have been conflicting results from previous comparative studies on the usefulness of peritoneal lavage with metronidazole. A number of studies have shown that metronidazole lavage results in decreased wound infection, postoperative sepsis, intra-abdominal abscess formation and hospital stay; other studies have not shown statistically significant benefit compared to normal saline alone [10-13]. Differences in sample size, etiology and severity of perforation, timing of presentation, perioperative antimicrobial protocols, and surgical techniques may account for the variability in reported outcomes. However, there is still a need for more comparative evidence of the clinical effectiveness of metronidazole lavage in comparison to standard saline lavage, and its use remains in some surgical settings, especially in resource-limited areas where intra-abdominal infection is common.

Thus, the present study was conducted to evaluate the efficacy of peritoneal lavage with normal saline alone and normal saline with metronidazole in patients who had exploratory laparotomy for perforation peritonitis. The aim of the study was to compare the incidence of superficial surgical site infection in both the groups and to compare secondary postoperative outcomes such as wound dehiscence, burst abdomen, intra-abdominal abscess

formation and length of hospital stay after surgery in patients with perforation peritonitis to determine whether or not metronidazole added to normal saline lavage provided better postoperative outcomes.

2. MATERIALS AND METHODS

The study was a randomized clinical trial carried out in the Department of General Surgery, Sanjay Gandhi Memorial Hospital, Delhi, for 18 months from March 2024 to August 2025 after obtaining institutional ethical approval. Patients 18–60 years old who presented with perforation peritonitis and underwent exploratory laparotomy were included in the study. Patients were included if they met the following inclusion criteria and signed informed consent.

Patients were excluded if they were <18 years or >60 years of age, had poorly controlled diabetes mellitus (HbA1c >7%), TB with cocoon abdomen, chronic kidney disease, coronary artery disease, liver cirrhosis, immunosuppressive disorders, or were on current immunosuppressive therapy, had a previous organ transplant, had perforation peritonitis due to genitourinary causes or were unwilling to participate.

The sample size was calculated based on the difference in postoperative sepsis between the two groups as reported in previous study by Gupta DK et al [14] with minimum sample size of 100 in each group. Based on the proportion of sepsis in the saline lavage group of 0.625 and 0.20 in the metronidazole lavage group, with a 95% confidence level ($\alpha = 0.05$) and 90% statistical power ($\beta = 0.10$), the required sample size was 27 patients in each group. So, 54 patients were recruited. After the eligibility assessment and informed consent, the participants were randomly assigned in equal numbers to two groups. Group A (n = 27) received peritoneal lavage with normal saline (2 L) containing metronidazole (100 mL) and Group B (n = 27) received peritoneal lavage with normal saline (2 L) alone.

All patients had a routine pre-operative assessment, resuscitation and laboratory and radiological investigations prior to exploratory laparotomy. A structured study proforma was used to collect relevant demographic, clinical, laboratory and intraoperative information. Intraoperatively, peritoneal lavage was performed as per the treatment group. All patients had abdominal drains closed for 1 hour after surgery. Surgical site infection, postoperative sepsis, wound dehiscence, burst abdomen, intraabdominal abscess and length of hospital stay were monitored during the postoperative period. Follow up was maintained for 6 weeks post-discharge. Superficial surgical site infection was the primary outcome, and secondary outcomes were wound dehiscence, burst abdomen, intra-abdominal abscess formation, postoperative sepsis, and postoperative hospital stays.

The data were entered in MS-EXCEL and analyzed by IBM SPSS Statistics 20 (IBM Corp., 2011). Categorical variables were presented as frequencies, percentages and analysed using Chi-square test. A p value <0.05 regarded as statistically significant.

3. RESULTS

A total of 54 patients were included in the study, 27 patients in Group 1 (Metronidazole + NS) and 27 patients in Group 2

(NS). The two groups were similar with regard to baseline characteristics. The largest proportion of patients were aged 41–50 years in both Group 1 (40.74%) and Group 2 (37.04%), followed by those aged 21–30 years (29.63% vs. 25.93%). The number of males in Group 1 was 66.67%, and in Group 2 was

74.07%, and females were 33.33% and 25.93% respectively. No significant difference was found between the groups with regard to age distribution ($\chi^2 = 1.0065$, $p = 0.7996$) and gender distribution ($\chi^2 = 0.3552$, $p = 0.5511$). (Table 1)

Table 1. Comparison of Baseline Characteristics Between the Study Groups

Variable	Category	Group 1 (Metronidazole + NS)	Group 2 (NS)	Chi-square	p-value
Age group	21–30 years	8 (29.63)	7 (25.93)	1.0065	0.7996
	31–40 years	5 (18.52)	8 (29.63)		
	41–50 years	11 (40.74)	10 (37.04)		
	51–60 years	3 (11.11)	2 (7.41)		
Gender	Male	18 (66.67)	20 (74.07)	0.3552	0.5511
	Female	9 (33.33)	7 (25.93)		

The most common cause of peritonitis in both groups was perforation of the ileum (44.44% in Group 1 and 37.04% in Group 2). Gastric perforation was seen in 22.22 % and 25.93 % and appendicular perforation in 22.22 % and 18.52 % respectively. Caecal perforation was seen in 3.70% of patients

in both the Group 1 and Group 2, while colonic perforation was seen in 3.70% and 7.41% respectively. Jejunal perforation was seen in 3.70% of patients in both the groups. The distribution of etiologies was similar and no significant difference was found among the groups ($\chi^2 = 1.0163$, $p = 0.9612$). (Table 2)

Table 2: Comparison of Etiology of Peritonitis Between the Study Groups

Cause of peritonitis	Group 1 (Metronidazole + NS)	Group 2 (NS)	Chi-square	p-value
Gastric perforation	6 (22.22)	7 (25.93)	1.0163	0.9612
Ileal perforation	12 (44.44)	10 (37.04)		
Appendicular perforation	6 (22.22)	5 (18.52)		
Caecal perforation	1 (3.70)	2 (7.41)		
Colonic perforation	1 (3.70)	2 (7.41)		
Jejunal perforation	1 (3.70)	1 (3.70)		

The incidence of most of the postoperative complications was generally lower in the Metronidazole + NS group. There was a statistically significant difference between the two groups, with surgical site infection rates of 18.52% in Group 1 and 48.15% in Group 2 ($\chi^2 = 5.3333$, $p = 0.0209$). Postoperative sepsis was also significantly lower in Group 1 (25.93%) than in Group 2

(59.26%) ($\chi^2 = 6.1346$, $p = 0.0132$). Intra-abdominal abscess was observed in 3.70% and 11.11%, wound dehiscence in 7.41% and 14.81%, and burst abdomen in 3.70% and 7.41% of the patients in Groups 1 and 2, respectively, but these differences were not statistically significant ($p > 0.05$). (Table 3)

Table 3: Comparison of Postoperative Complications Between the Study Groups

Postoperative complication	Group 1 (Metronidazole + NS)	Group 2 (NS)	Chi-square	p-value
Surgical site infection	5 (18.52)	13 (48.15)	5.3333	0.0209
Intra-abdominal abscess	1 (3.70)	3 (11.11)	1.0800	0.2986
Postoperative sepsis	7 (25.93)	16 (59.26)	6.1346	0.0132
Wound dehiscence	2 (7.41)	4 (14.81)	0.7499	0.3864
Burst abdomen	1 (3.70)	2 (7.41)	0.3529	0.5524

The postoperative hospital stay was significantly reduced in the Metronidazole + NS group. Of the patients in Group 1, 77.78% had a hospital stay of <10 days compared with 40.74% in Group 2, while 22.22% patients in Group 1 had a hospital stay

of >10 days compared with 59.26% patients in Group 2. The length of hospital stay after surgery was statistically significant between the two groups ($\chi^2 = 7.6704$, $p = 0.0056$). (Table 4)

Table 4: Comparison of Postoperative Hospital Stay Between the Study Groups

Postoperative hospital stays	Group 1 (Metronidazole + NS)	Group 2 (NS)	Chi-square	p-value
<10 days	21 (77.78)	11 (40.74)	7.6704	0.0056
>10 days	6 (22.22)	16 (59.26)		

4. DISCUSSION

This current research showed that adding metronidazole to normal saline for peritoneal lavage was linked to improved postoperative outcomes than normal saline alone in patients

who had exploratory laparotomy for perforation peritonitis. Both groups were similar in age, gender and etiology of perforation, the most common being ileal perforation in the present study. Gupta DK et al. and Chaudhary et al. have

reported the same predominance of ileal perforation, and found that ileal perforation was the most common cause of perforation [14,15]. These two groups of patients in this study had similar baseline characteristics and etiological distribution, which supports the validity of the subsequent comparison of postoperative outcomes.

Surgical site infection was significantly reduced with metronidazole containing lavage as compared to saline lavage (18.52% vs. 48.15%, $p=0.0209$). This is in line with the findings of Gupta DK et al. who reported SSI rates of 22.5% with metronidazole lavage and 42.5% with saline lavage and Yashaswi YK et al. who reported rates of 22% and 44% respectively [10,14]. Kumari P et al. also showed a significant decrease in SSI when using metronidazole lavage (20% vs. 32%, $p=0.037$) [16]. Gangwal M et al. also found that the saline plus metronidazole lavage had a lower postoperative wound infection rate [17]. This uniformity among different studies could be due to the activity of metronidazole against anaerobic organisms, which play a major role in contamination in perforation peritonitis. In the present study, the number of intra-abdominal abscess was also numerically less with metronidazole lavage as compared to saline alone (3.70% vs. 11.11%) but the difference was not statistically significant ($p=0.2986$), similar to the nonsignificant trends observed by Gupta DK et al., Yashaswi YK et al. and Kumari P et al. [10,14,16].

The incidence of postoperative sepsis was significantly lower in the metronidazole group (25.93%) as compared to the saline group (59.26%) ($p=0.0132$). This finding is very similar to that of Gupta DK et al., who found 20% of patients who received metronidazole lavage had sepsis, while 62.5% of patients who received saline alone did have sepsis, and Yashaswi YK et al., who found 20% to 60% ($p=0.002$) [10,14]. Chaudhary et al. and Kumari P et al. also reported lesser incidence of sepsis after surgery in Metronidazole lavage group [15,16]. The incidence of wound dehiscence was also less in the present study with metronidazole lavage (7.41% vs. 14.81%), but not statistically significant ($p=0.3864$). Gupta DK et al., Yashaswi YK et al., Chaudhary et al. and Kumari P et al. [10,14-16] reported similar nonsignificant reduction. The incidence of burst abdomen was also low and similar in both groups (3.70% vs. 7.41%, $p=0.5524$), indicating that there are a number of factors contributing to mechanical wound integrity other than the type of lavage solution used.

A significant difference in the duration of postoperative hospital stay was observed in the patients treated with metronidazole lavage in the present study. Almost 80% of those in the metronidazole group were discharged within 10 days as compared to 40.74% in the saline group, and prolonged hospitalization (more than 10 days) was significantly higher in the saline group than in the metronidazole group (59.26% vs. 22.22%, $p=0.0056$). This observation is in line with Gupta DK et al., who reported shorter hospitalization with metronidazole lavage, and Yashaswi YK et al., who found a mean stay of 10.54 ± 1.32 days compared to 12.01 ± 1.55 days [10,14]. Kumari P et al. also showed a statistically significant decrease in the length of stay in hospital when using metronidazole lavage, while Srinivas showed a similar reduction but not a

statistically significant one [16,18]. The results of the present study and the available comparative information suggest a consistent pattern of a decrease in the infectious morbidity and an earlier postoperative recovery with the use of metronidazole-containing peritoneal lavage in perforation peritonitis.

The randomized clinical design, equal allocation of patients to both treatment groups, uniform peritoneal lavage procedures, and the evaluation of clinically relevant postoperative complications such as surgical site infection, postoperative sepsis, intra-abdominal abscess, wound dehiscence, burst abdomen, and length of hospital stay are the major strengths of the present study. There are several limitations to the study, such as the relatively small sample size (54 patients), single-center design, and short follow-up period (6 weeks post-discharge), which could limit the generalizability of these findings. Further, the severity and location of the perforation, extent of peritoneal contamination, and other peri-operative factors may have affected the outcome of the postoperative period, despite the randomisation. Thus, larger multicentric randomized studies with longer follow-up are needed to confirm these results.

5. CONCLUSION

The present study showed that combination of metronidazole with normal saline for intraperitoneal lavage was superior to normal saline alone in decreasing the postoperative infectious complications after exploratory laparotomy for perforation peritonitis. The surgical site infection and postoperative sepsis incidence were significantly lower and the hospital stay was shorter in the metronidazole lavage group, suggesting improved recovery and decreased morbidity. While the differences in intra-abdominal abscess formation, wound dehiscence and burst abdomen were not statistically significant, all these outcomes were numerically in favor of the metronidazole group. These results indicate that saline lavage with metronidazole may be beneficial in the surgical treatment of peritonitis, both in terms of antimicrobial activity and postoperative outcomes.

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