

COMPARATIVE STUDY OF OUTCOME OF PERITONEAL LAVAGE USING SALINE, METRONIDAZOLE AND BETADINE SOLUTION IN PERITONITIS

Inderpreet Singh¹, Gurjot Singh², Harnam Singh³, Malkiat Singh⁴, Ashwani kumar³, Manjit Kaur¹, Riya Gupta¹

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Corresponding Author:
Dr. Malkiat Singh
Email: drmilky07@gmail.com

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¹Junior Resident, Department of General Surgery, Government Medical College, Patiala, Punjab, India

²Senior Resident, Department of General Surgery, Government Medical College, Patiala, Punjab, India

³Professor, Department of General Surgery, Government Medical College, Patiala, Punjab, India

⁴Assistant Professor, Department of General Surgery, GMC & Rajindra Hospital, Patiala, Punjab, India.

Abstract

Background: Peritonitis is defined as inflammation of the peritoneum and peritoneal cavity. Peritoneal lavage is an intraoperative surgical procedure that reduces the rate of surgical site infection by the removal of debris, dead or damaged tissue, metabolic waste and wound exudates. It aims to create an optimal environment for wound healing and it is used with variable uptake amongst surgical practitioners worldwide and among various lavage materials metronidazole is proven most efficient. **Materials and Methods:** Study includes 90 patients admitted to emergency of General Surgery Department at our institution during year 2021-2022. Patients were randomly divided into group of 30 each and peritoneal lavage after definitive repair was done, in Group A metronidazole with normal saline, in Group B betadine with normal saline used and in Group C normal saline was used. Comparison of the outcomes of the three groups done in terms of return of bowel movement, restoration of enteral feeds, surgical drain patterns, surgical site infection, intra-abdominal abscesses, re-operation/ intervention, duration of hospital stay and mortality, if any. **Result & Conclusion:** Maximum study population was in age group of 21-30 years. Male to female ratio was 7.9:2.1. Leading cause of secondary peritonitis in study was ileal perforation (53.3%). In analysis of other variables metronidazole is concluded most efficient, betadine proved its efficiency in prevention of surgical site infection only and normal saline was proven as least efficient in every variable.

INTRODUCTION

The peritoneal membrane is a serous membrane that lines the abdominal cavity. Embryologically, it is derived from the layers of mesenchyme. Peritoneum consists of glycocalyx and also contains variety of macromolecules such as lipoproteins, phospholipids, and hyaluronan, all of these play important roles in cell to cell contact, tissue integrity and hydration, inflammation regulation, wound healing and the flow of nutrients and growth factors across the peritoneal membrane. Peritoneum mesothelium is the initial line of defense against peritoneal insult.

Peritonitis is defined as inflammation of the peritoneum and peritoneal cavity. Primary peritonitis occurs due to primary acute inflammatory infectious abdominal pathology, secondary peritonitis is the infectious inflammation occurring

consequent to perforation in hollow viscous and tertiary peritonitis is an intra-abdominal infection that persists or recurs 48 hours following successful or adequate surgical source control. Pathophysiology of Defense system of peritonitis by innate immunity and Peritoneal associated lymphoid tissue (PALT).^[1]

Perforation is defined as an abnormal opening in hollow organ or viscus associated with a high morbidity and mortality. Fluid replenishment, nasogastric suction, IV antibiotics, focus debridement, and surgical intervention make up the standard treatment for peritonitis. Hollow viscous perforation peritonitis is the most common surgical emergency in developing countries like India.^[2] and the presentation of patients is often delayed in our setup which leads to septicemia thus reduced

survival rates.^[3] Gastro duodenal perforations is leading cause in hollow viscus peritonitis.^[4] Surgical correction of pathology and peritoneal lavage has been the cornerstone in the management of patients with peritonitis. The theoretical advantage of lavage is to reduce the bacterial load by combination of water pressure and diluting it with or without addition of antimicrobial agents.^[5] The lavage can be altered by changing the following basic variables like volume of the irrigation fluid, mechanism/timing of delivery and composition of the solution.

Lavage variables used in present study are

Normal Saline Normal saline (0.9%) is the most commonly used irrigation solution in surgical theatres across the globe because of its easy availability and low cost, but it is also found that it causes reduction in the opsonin levels and negatively impair the bacterial phagocytosis. It is also concluded non-physiological in terms of Na and Cl concentrations, its high osmolarity and acidic pH.^[6]

Betadine It is a water soluble complex of iodine and polyvinylpyrrolidone. Free iodine kills microorganisms through iodination of lipids, oxidation of cytoplasmic and membranous compounds. It is highly effective in presence of protein load in contaminated areas but its also found that it damages the mesothelial cells and decrease their fibrinolytic activity.^[7] Betadine effectively inhibits the release of exotoxins, endotoxins and tissue destroying enzymes.^[8]

Metronidazole it is most commonly used in anaerobic bacterial infections, protozoal infections and microaerophilic microbial infections. It is also proven beneficial on most of the comparison studies conducted in peritoneal lavage.^[9-11]

Studies concluded that the lavage resulted decrease in complications, hospitalization time and lavage with systemic antibiotics alone or in combination increased the survival rates.^[12]

Aims and Objectives

The primary objective of study to compare the outcomes of the three groups in terms of return of bowel movement, restoration of enteral feeds, surgical drain patterns, surgical site infection, intra-abdominal abscesses, re-operation, duration of hospital stay and mortality, if any

MATERIALS AND METHODS

The present study was done on 90 patients who underwent exploratory laparotomy after admitting to the emergency of Department Of General Surgery at our institution during 2021-2022 with secondary peritonitis.

All patients were randomized into three equivalent groups of 30 individuals in each group

Group A (Metronidazole Group) In this group, after definitive surgery peritoneal lavage with normal saline done and 200 mL (1 mL = 5 mg) of

metronidazole was added in the peritoneal cavity. Thereafter, abdomen was closed in layers after securing drains and drains were clamped for 1 hour after closure of abdomen to prevent the drug to escape.

Group B (Betadine Group) As outlined in Group A, the peritoneal lavage was done utilising normal saline. Thereafter, 20 mL of betadine diluted in 200 mL of normal saline was added in the peritoneal cavity. Then followed by standard abdominal closure technique, tube drainage and drain clamped as in GROUP-A.

Group C (Normal Saline Group) In this group, the peritoneal cavity was lavaged with copious amount of normal saline (0.9%) till it macroscopically appears clean. Then the abdominal cavity was closed after placing and securing wide gauge drains.

Inclusion Criteria

1. All patients presented with secondary peritonitis and underwent exploratory laparotomy.
2. All patients giving informed and written consent for enrolment in the study.

Exclusion Criteria

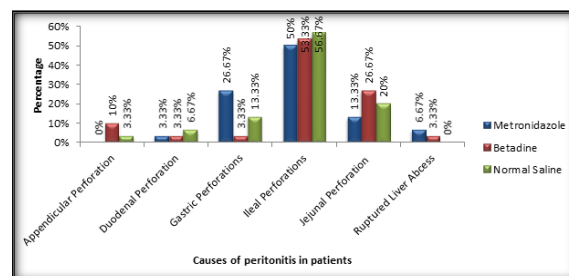
1. Immunocompromised patients having Diabetes Mellitus, HIV or malignancy

Statistical Analysis

- The collected data was analyzed by calculating the mean of each variable and the Pearson Chi-square test used for the qualitative test. p-value less than 0.05 taken as significant. All the statistical calculations were done using IBM SPSS (Statistical Package of the Social Sciences) VERSION 22.

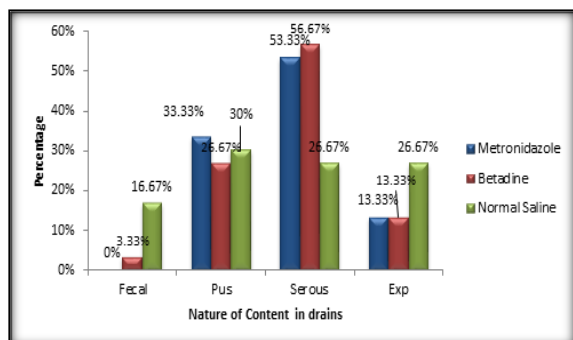
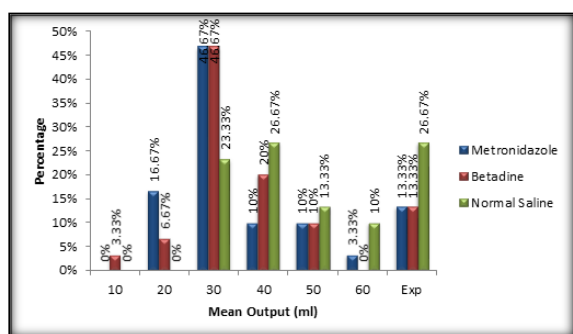
RESULTS

The analysis concluded that the majority of patients were in age group 31-40 years. Male predominance found in study with 71 male patients (78.8%) and the male to female ratio was 7.9:2.1. The leading cause peritonitis was ileal perforation in 48 patients (53.3%) followed by jejunal perforation. Bowel movements were detected on auscultation on 3rd – 4th post-operative day in 52.2% patients, the most delayed presentation of bowel sounds was reported in 6.67% of patients from betadine group.



Betadine was concluded safest in prevention of surgical site infection, only 8 patients suffered from SSI (26.6%) in this group. Normal saline lavage carried maximum risk of surgical site infection.

Comparison between normal saline and betadine is statistically significant with p-value 0.047.



In most of the patients the mean drain output was 30 ml in 38.8% (35 patients), p value is 0.886 shows no statistical significance. Serous content found in

Table 1: Comparison of outcomes of different studies

Parameter	Present study			Gupta et al (2022)		Garg T et al (2018)		Raeeszadeh et al (2017)		Sheeraz Khan et al (2009)	
	NS	B	M	NS	G	NS	G	NS	G	NS	SOS
Surgical site infection	46.6% (14)	26.6 (8)	33.3% (10)	42.5 %	22.5%	40%	26%	35%	17.5%	72.2%	52%
Intra-abdominal abscess	30 % (9)	13.3% (4)	6.67% (2)	12.5 %	7.5 %	12%	10%	17.5%	12.5%	-	-
Death	26.6% (8)	13.3% (4)	13.3% (4)	-	-	8%	10%	10%	12.5%	5%	5%
Hospital stay	6.73+4.75	6.27+3.47	5.47+2.79	-	-	15 Days	13.22 Days	-	-	11.9 Days	14.5 Days
reoperation	16.6% (5)	13.3% (4)	3.33% (1)	-	--	-	-	-	-	-	-

N-Normal Saline, M-Metronidazole, G-Gentamycin, B-Betadine and SOS-Superoxide Solution.

DISCUSSION

Mortality in peritonitis is high despite advances in antibiotics, surgical techniques, radiographic imaging and resuscitation therapy. The advantage of peritoneal lavage is to reduce the bacterial load in the peritoneal cavity by combination of water pressure and dilution with or without addition of antimicrobial agents. Usually, this is undertaken at the end of the operating procedure, before the wound closure and drains insertion.

Maximum numbers of cases were in the age group of 31 to 40 years and minimum number is in the age group of <20 years. This is found similar to the age distribution found by Garg t et al.^[13] Gupta DK et al (2022),^[14] Sheeraz Khan et al (2009),^[15] and Garg et al (2013),^[16] concluded that maximum involved

drains of 41 patients (45.5%), pus content in drains of 27 patients (30%) and faecal content was found in 6 patients (6.6%). Maximum patients with faecal as drain content were from normal saline group and pus content maximally found in metronidazole group. p- value is 0.150 and it is statistically non-significant.

Drains were kept for most prolong period in normal saline group, in most of the patients drains were removed on post-operative day 6th to 10th. Maximum incidences Intra-Abdominal Abscess was found in normal saline group 9 patients (30%). Metronidazole concluded as most safe with only 2 cases of IAA (6.67%). p-value of analysis is non-significant (0.673). Hospital Stay was most prolonged in individuals lavaged with normal saline (30%) with >15 days of stay. Most of the patients discharged between 6 to 10 days, 36 patients (40%), p-value is non-significant (0.727) in this analysis.

Reoperation needed in 5 patients of normal saline group (16.6%), 4 patients of betadine group (13.3%) and in 1 patient of metronidazole group (3.33%). Metronidazole is concluded to be the most safe in all. p-value for analysis is non-significant (0.619). Mortality in metronidazole and betadine group was 4 patients in each (13.3%) and normal saline group had highest mortality of 8 patients (26.6%).

patients was of adults of age group of 20-40 years which is similar to present study.

Ileal perforation was the leading cause of peritonitis in the present study, followed by jejunal perforation. Similarly, ileal perforation was leading cause of peritonitis in studies done by Gupta DK et al 2022 and Garg et al 2013. In studies done by Singal et al,^[17] and Garg et al leading cause were gastric and duodenal perforations respectively.

In the present study, maximum individuals suffered from surgical site infection was in normal saline group i.e 14 patients (46.6%) and betadine was found to most effective in prevention of surgical site infection, 60% of individuals in betadine group were free from SSI. Similar study done by Gupta D K et al, they compiled that there was 20% reduction in incidence of SSI in metronidazole group. Sheeraz

Khan et al reported 20% reduction in SSI, when superoxide solution was used, Raeeszadeh et al (2017) reported reduction in SSI with Gentamycin. IAA was found in 30%(9 patients) in normal saline group and only 2 patients in metronidazole, however this is not statistically significant. In study done by Gupta D K (2022) there is reduction of 20% in IAA in patients of metronidazole group. Raeeszadeh et al (2017) reported 5% reduction in the incidence of intra-abdominal abscess with Gentamycin.

Mean postoperative stay was 6.3 $\pm$ 4.75 days in saline lavage group, 5.47 $\pm$ 2.79 days in metronidazole lavage group and 6.27 $\pm$ 3.47 in betadine group. Gupta et al (2022) concluded that patients in the metronidazole group had a significantly shorter hospital stay than those in the normal saline group. Sheeraz Khan et al. (2009) reported a 1.5 days reduction in hospital stay when antibiotics used in peritoneal lavage.

16.6% (5 patients) required re-exploration in normal saline group and this is least in metronidazole group 3.33%. Raeeszadeh et al (2017),^[9] concluded peritoneal lavage with gentamycine reduced reoperation rates.

Mortality was highest in the normal saline IOPL group 26.67% (8 patients) in present study. Gupta D K et al (2022) concluded that mortality was also higher in normal saline group. Garg et al (2018) concludes that mortality was 2% higher in the metronidazole lavage group. Raeeszadeh et al (2017) found 2.5% higher mortality with gentamycin.

CONCLUSION

Peritonitis is most common in the age group of 31 to 40 years. There is a male preponderance in study. Ileal perforation is the leading cause of peritonitis, followed by the jejunal and gastric perforation. In most of the patients bowel movements reappeared on post-operative day third to fourth. Enteral feed was restored in maximum patients on post-operative day 5th to 6th. 60% of the patients of the betadine group were free from surgical site infection. Serous content was found in mostly in patients of betadine group, pus as drain content was found in 10 patients of the metronidazole group and fecal content in the drain was found in 16.67% individuals of the normal saline group. Patients lavaged with normal saline stayed in the hospital for maximum time as compared to other two groups. Reoperation or intervention required in maximum patients from normal saline group and patients in metronidazole group needs least re-interventions. Mortality rate was highest in normal saline group.

Addition of the Metronidazole drug to normal saline in intraoperative peritoneal lavage has beneficial effects in terms of intra-abdominal abscess, systemic sepsis and post-operative hospital stay. However these are statistically not significant. Betadine is

concluded as most safe in prevention of surgical site infection. This comparative study concluded that adjuvants lead to better outcomes in every analyzed terms in peritoneal lavage.

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