Comparative Study of Povidone Iodine versus Metronidazole in Normal Saline in Peritoneal Lavage in Cases of Peritonitis

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ABSTRACT

BACKGROUND

Peritonitis is a fairly common and challenging emergency encountered in general surgical practice. Intraoperative peritoneal lavage plays an important role in the treatment of peritonitis. Sterile water, warm saline, antibiotics, and povidone-iodine are used for the purpose of peritoneal lavage. The objective of this study is to compare the clinical outcome of patients diagnosed with peritonitis, who underwent peritoneal lavage with povidone-iodine and metronidazole. Early complications like surgical site infection, intraabdominal abscess, paralytic ileus, and late complications like faecal fistula, obstruction were assessed.

METHODS

In this study, we have analyzed 100 patients who were admitted in our department for peritonitis over a period of one year. 100 patients were divided in to two groups with 50 in each group. Group A underwent peritoneal lavage with povidone-iodine in normal saline, group B underwent peritoneal lavage with metronidazole in normal saline. Outcomes were compared between the two groups.

RESULTS

The common age group was 31 - 40 years. Peritonitis was more common in men. Duodenal perforation was the most common perforation. *E. coli* is the most common organism isolated. Postop complications are more in distal perforation. Postop complications like SSI were less in the metronidazole group with a significant p-value. Other clinical outcomes were not statistically significant.

CONCLUSIONS

Peritoneal lavage ensures adequate control of infection, minimizes the risk of postoperative infection. Intraoperative peritoneal lavage with metronidazole in normal saline is more effective compared to povidone-iodine in normal saline.

KEYWORDS

Povidone Iodine, Metronidazole, Peritonitis, Peritoneal Lavage

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BACKGROUND

Peritonitis is defined as inflammation of the peritoneum that lines the inner wall of the abdomen and abdominal organs. Peritonitis usually occurs secondary to contamination of peritoneal cavity by the gastrointestinal contents, either due to hollow viscous perforation or due to bacterial translocation through the wall of ischemic gut.[1] Perforation of any part along the gastrointestinal tract is a life-threatening emergency and is associated with high morbidity and mortality. The most common perforations are gastroduodenal perforations, followed by small intestinal and appendicular perforations. Colonic perforations are uncommon.[2] In developing countries like India, the mortality is still high due to delay in the presentation along with the socio-economic reasons.

Acute generalized peritonitis is considered a surgical emergency, which is very challenging to manage. Early diagnosis, control of sepsis, and management of primary cause are very important.[3] In early medieval times, when a person presented with sudden, severe pain and frequent vomiting, the hardness of the belly, fatal illness, as is seen in peritonitis, was treated with a spoonful of lemon juice morning and night. The early treatment of peritonitis had to be medical since surgery had not progressed to the stage where the abdomen was entered intentionally. The generally accepted treatment for peritonitis was absolute rest, purgatives-especially magnesium sulphate, the abstention of food, cold applied to the abdomen, and opium very sparingly.[4] Later, Mikulicz advocated opening the abdomen at the time of the presentation. He also brought out the so-called toilette of the peritoneum using a 2% thymol solution in sponging the soiled intestines and the use of drainage tubes. Tait advocated filling the abdomen with blood, warm water, and washing all organs repeatedly until the water came off clear. In earlier days, fluids used in peritoneal lavage were ether, amniotic fluid, 25% glucose, water, saline, and antibiotics lavage and aspiration. The most commonly used fluids in peritoneal lavage are warm saline, sterile water, aqueous povidone-iodine, and saline with antibiotics.[5] Peritoneal lavage reduces the bacterial load, thereby reducing the incidence of wound site infection and sepsis. Despite recent advances in surgical treatment, antimicrobial agents, and intensive medical care, the mortality rates around 15%-30% remain high. Saline lavage reduces significantly counts in peritoneal fluid of aerobic and anaerobic bacteria in peritoneal fluid and gives us the idea of the amount of debris present in the peritoneal fluid. Povidone-iodine is a stable chemical complex of polyvinyl pyrrolidone and elemental iodine. It contains 9% to 12% available iodine. It is an effective bactericide and is safe when used as a peritoneal lavage solution. Metronidazole is a nitroimidazole with activity against anaerobic cocci and both anaerobic gram-negative bacilli and anaerobic spore-forming gram-positive cocci. It has been used safely as a single agent and in combination with other antibiotics for peritoneal lavage. The objective of the present study is to compare the efficacy of povidone-iodine in normal saline and metronidazole in normal saline in peritoneal lavage. Peritoneal lavage ensures adequate control of infection and minimizes the risk of post-operative infection, thereby preventing a prolonged hospital stay. Perforation closure with peritoneal lavage has been the critical step in managing peritonitis, and the practice continues even today. In cases of small intestinal perforation, resection and anastomosis can be performed.[6]

Aim

- To compare the clinical outcome of povidone-iodine versus metronidazole in normal saline in peritoneal lavage.

Objectives

- To study the clinical outcome of patients diagnosed with peritonitis who have received peritoneal lavage with povidone-iodine in normal saline.
- To study the clinical outcome of patients diagnosed with peritonitis who have received peritoneal lavage with metronidazole in normal saline.
- To compare the clinical outcome between two sets of patients.

METHODS

This is a comparative study conducted on 100 consecutive patients who presented to the surgical department, SVRRGGH, Tirupati, with peritonitis. The study period from September - 2018 to September - 2019.

Choosing Subjects

100 patients who are undergoing surgeries for peritonitis admitted under different surgical units. Divided as 50 in each group comprising of odd and even serial numbers.

Group A: Patients with all odd serial numbers were included in this group, and peritoneal lavage with povidone-iodine in normal saline is used.

Group B: Patients with all even serial numbers were included in this group peritoneal lavage with metronidazole in normal saline is used.

The preoperative preparation of each case consists of correction of shock, electrolyte imbalance, dehydration, gastric aspiration, parenteral broad-spectrum antibiotic coverage. Operative details such as date of surgery, hospital number, site of perforation, and degree contamination is noted. At operations, a definitive procedure for underlying pathology followed by peritoneal lavage with povidone-iodine in normal saline and metronidazole in normal saline is done.

- 2 litres of warm saline 20 ml of betadine, 2 litres of warm saline with metronidazole (10% wt./volume) abdomen closed in layers, and drain is kept.
- Post-operative progress was assessed by comparing the development of surgical site infection, intra-abdominal abscess, paralytic ileus, and duration of hospital stay.
- Late complications like faecal fistula, enterocutaneous fistula were assessed.

Inclusion Criteria

- All patients with an age group of 18-80 years with peritonitis.

Exclusion Criteria

- Peritonitis secondary to trauma.
- Peritonitis secondary to gynaecological intervention.
- Peritonitis secondary to malignancy and
- Peritonitis secondary to immuno-compromised state.

Statistical Analysis

Data were entered into Microsoft Excel datasheet and was analysed using SPSS 22 version software. Categorical data was represented in the form of frequencies and proportions. Chi-square test was used as a test of significance for qualitative data. Continuous data were represented as mean and standard deviation. Independent t-test was used as a test of significance to identify the mean difference between two quantitative variables.

Graphical Representation of Data

MS Excel and MS word were used to obtain various types of graphs such as bar diagram s and pie diagrams. P-value (probability that the result is true) of <0.05 was considered as statistically significant after assuming all the rules of statistical tests.

Statistical Software

MS Excel**,** SPSS version 22 **(**IBM SPSS Statistics, Somers NY, USA) was used to analyze data.

RESULTS

Age

The most vulnerable age group in this study was between 31 to 40 years. Most of the patients, 41/100 cases (41%), were in this age group, followed by 41-50 years of age, which accounted for 24 /100 cases (24%). Patients between age group 31-50 years accounted for 65/100 (65%). The youngest patient was a 23 years old male with duodenal perforation and the oldest being 78-year-old male with colonic perforation. The mean age at the time of presentation was 44.6 years.

Sex

The number of males in the study was 73 which accounted for 73% of the Cases of which 33 (45%) were in the povidone-iodine group and 40 (55%) were in metronidazole group, and the number of females was 27 of which 17 (63%) were in povidone-iodine group, and 10 (37%) were in metronidazole group who formed 27% of the cases.

Type of Perforation

The commonest cause for peritonitis in the study was a perforation. Among the various sites of gastrointestinal perforation, duodenal perforation was the commonest, accounting for 33/100 (33%). This was followed by prepyloric perforation patients 28/100 (28%), appendicular perforation 19/100 (19%), ileal perforation 11/100 (11%) and jejunal perforation 8/100 (8%). There was only one case of colonic perforation in the present study.

Type of Perforation	Group		Total
	Povidone Iodine	Metronidazole	
Prepyloric Perforation	15 (30%)	13 (26%)	28 (28%)
Duodenal Perforation	17 (34%)	16 (32%)	33 (33%)
Appendicular Perforation	9 (18%)	10 (20%)	19 (19%)
Ileal Perforation	5 (10%)	6 (12%)	11 (11%)
Jejunal Perforation	3 (6%)	5 (10%)	8 (8%)
Colonic Perforation	1 (2%)	0 (0%)	1 (1%)

Table 1. Comparison of Type of Perforation Between the Two Groups

χ^2=1.817, df=5, p=0.8739

Hospital Stay

The duration of hospital stay in the povidone-iodine group was 9.44 ± 1.48 days, whereas in the metronidazole group was 9.36 ± 1.17 days. The earliest to get discharged was a 47-year-old male with appendicular perforation, i.e., 6 days who received lavage with metronidazole, whereas the patient who stayed for the longer duration was a 48-year-old male with ileal perforation. i.e., 13 days.

		Hospital Stay (Days)		p value
		Mean	SD	
Group	Povidone Iodine	9.44	1.48	0.7658
	Metronidazole	9.36	1.17	

Table 2. Comparison of Number of Days of Hospital Stay between the Two Groups

Organism

32 patients showed culture positive with *E. coli* being the most common, i.e., 19, 10 in the povidone-iodine group, 9 in the metronidazole group followed by Enterococcus in 13 patients with 7 in povidone-iodine and 6 in metronidazole group.

Surgical Site Infection

26 patients showed surgical site infection, of which 18 were in the povidone-iodine group, and 8 were the povidone-iodine group. There is a statistically significant association between the usage of metronidazole in peritoneal lavage

and the decrease in the incidence of surgical site infections as compared to povidone-iodine.

Surgical Site Infection	Group	
	Povidone Iodine	Metronidazole
Present	18	8
Absent	32	42
Table 3. Comparison of Surgical Site Infection between the Two Groups		
χ^2=5.1975, df=1, p=0.022619		

Outcome

Out of 100 patients, 4 patients succumbed to death with 3 in the povidone-iodine group and 1 in the metronidazole group, whereas the remaining 96 patients recovered well.

Early Complications

Surgical site infection was observed in 26 patients with 18 in the povidone-iodine group, 8 in the metronidazole group. The intraabdominal abscess was observed in 2 patients with 1 in each group. Paralytic ileus was observed in 3 patients with 2 in the povidone-iodine group, 1 in the metronidazole group.

Early Complications	Group	
	Povidone Iodine	Metronidazole
Surgical Site Infection	18	8
Intraabdominal Abscess	1	1
Paralytic Ileus	2	1
Table 4. Comparison of Early Complications between the Two Groups		
χ^2=0.3161, df=2, p=0.853826		

Late Complications

The faecal fistula was observed in 2 patients with 1 in each group.

Late Complications	Group	
	Povidone Iodine	Metronidazole
Faecal Fistula	1	1
Incisional Hernia	0	0
Table 5. Comparison of Late Complications between the Two Groups		

DISCUSSION

A total of 100 patients who presented with features of peritonitis secondary to hollow viscus perforation to SVRRGGH, Tirupati, from September 2018 to September 2019 were randomized into two groups and studied.

In Group A, patients with all odd serial numbers were included and received peritoneal lavage with povidone-iodine in normal saline, and Group B patients with all even serial numbers were taken and received peritoneal lavage with metronidazole in normal saline. This clinical study was intended to determine the postoperative progress by comparing the development of surgical site infection, duration of hospital stay in both groups.

Age Distribution

Most of the patients were in the age group 31 to 40 years, 41 (41%). The next common age group was between 41-50 years, accounting for 24 (24%) patients. The youngest patient was a 23-year-old male with duodenal perforation, and the oldest patient was a 78-year-old male with colonic perforation. The mean age group in our study was of 44.6 years. Among the age groups encountered in our study, perforations at the duodenal region were very commonly seen, followed by prepyloric, appendicular, ileal, and jejunal in order of decreased frequency. This predilection of peritonitis to commonly affect elderly age groups is due to the chronic ill habits like smoking, alcohol consumption, chronic infection with H Pylori, and faulty dietary habits. A study by Ramachandra ML[6] et al. also showed the vulnerable age group to be 31 - 40 years, and these findings are consistent with ours.

Study	Predominant Age Group
Ramachandra ML[6]	31 - 40 Years
Samir Delibegovic et al[7]	21 - 40 Years
Ashish Ahuja et al[1]	21 - 40 Years
Ohmann et al[8]	50 - 69 Years
Our study	31 - 40 Years
Table 6. Comparison of Predominant Age Group in Peritonitis in Various Studies	

Gender Distribution

The number of males in our study was 73, constituting 73% of the cases. The number of females was 27, which formed 27% of the cases. The male to female ratio was 2.7:1, showing a male preponderance. This could be due to various personal and social factors like habits, diet, socio-economic status, cumulatively making the male gender more prone to peritonitis. Male preponderance was also found in Samir Delibegovic et al. with a male to female ratio of 3:1, Ajaz Ahamed Malik et al. with 2:1 and in Sharma R, Huttunen et al.

The conditions encountered in this study was perforations at the appendix, prepylorus, duodenum, ileum, which was commonly seen in males.

Studies	M:F ratio
Samir Delibegovic et al[7]	3: 1
Ajazahamed Malik et al[9]	2: 1
Sharma R, Huttunen et al[10]	2: 1
Our study	2.7: 1
Table 7. Comparison of Sex Distribution in Various Studies	

Type of Perforation

The most frequent cause of peritonitis in the study was a perforation. Among the various sites of gastrointestinal perforation, duodenal perforation was the commonest, accounting for 33%, followed by prepyloric 28%, appendicular perforation 19%, ileal perforation 11% and jejunal perforation 8%. There was only one case of colonic perforation in the present study. Studies by Baig A et al,[11] Saha et al,[12] Sulli et al[13] stated that duodenum is the most common site of perforation, which was following the present study.

Study	Site of Perforation		
	Gastroduodenal	Small Intestine	Large Intestine
Ajaz Ahamed Malik et al	30.6%	5.9%	9.9%
Notash et al[14]	60%	42.5%	
RS Jhobta[15]	65.67%	8.27%	3.7%
Nithin Agarwal et al[16]	23%	43%	6%
Our study	61%	38%	1%

Table 8. Site of Perforation in Various Studies

Duration of Hospital Stay

The duration for which patients stayed in hospital varied from 6 to 13 days. The earliest to get discharged was a case of appendicular perforation, and the patient with ileal perforation stayed for longer duration due to faecal fistula that had developed as a result of post-operative complications. Abdominal contamination was less in duodenal and prepyloric perforations compared to ileal, jejunal, and colonic perforations. The time duration between patients developing symptoms and seeking intervention also has an influence. Mean postoperative hospital stay was 9.44 ± 1.48 days in the povidone-iodine group and 9.36 ± 1.17 days in the metronidazole group. Vallance et al. (1985)[17] found no improvement in the duration of hospital stay of patients treated with intraperitoneal lavage with chlorhexidine gluconate or povidone-iodine when compared with those who received only saline lavage. Sheeraz Khan et al. (2009)[18] reported a reduction in hospital stay by 1.5 days.

Organism

It was found that irrespective of the kind of lavage patients received, all peritoneal fluids were subjected to culture and sensitivity of the organisms were noted. Out of 100 patients studied thirty-two patients showed positive culture. The most common organism to be isolated was *E. coli*, followed by Enterococci. The duration between the onset of symptoms and presenting to the hospital plays a vital role in the prognosis of the patient. The contamination levels also go hand in hand with the duration of perforation.

Complications

Many complications after exploratory laparotomy have been studied worldwide. The study focussed more on the development of intra-abdominal abscess (pelvic abscess, sub-diaphragmatic abscess and subhepatic abscess) stitch abscess, burst abdomen, paralytic ileus, faecal fistula, intestinal obstruction due to adhesions and incisional hernia. 26 patients showed signs of SSI, 2 patients developed an intraabdominal abscess, 3 patients had paralytic ileus, and 2 developed faecal fistulae. All complications were treated conservatively, and the patients recovered well.

Surgical Site Infection

In 100 patients, surgical site infection was developed in 26 patients. Surgical site infection depends on the site of perforation, time of presentation to the hospital, degree of peritoneal contamination.

Patients with pre-pyloric and duodenal perforation have fewer chances of contamination. An increase in the time of presentation leads to an increase in the chance of infection. Five patients of pre-pyloric perforation had surgical site infection; among them, four patients were in the povidone-iodine group, and one patient is of the metronidazole group. In duodenal perforation, eight patients developed surgical site infection. Among the six patients were in the povidone-iodine group, and two patients were of the metronidazole group.

Five patients of appendicular perforation of which three were in the povidone-iodine group and two were in metronidazole group, five patients of ileal perforation of which three in the povidone-iodine group and two in metronidazole group and two patients of jejunal perforation of which one in the povidone-iodine group and one in metronidazole group developed surgical site infection. One patient with colonic perforation in the povidone-iodine group developed surgical site infection. More distal the site of perforation in the gastrointestinal tract (GIT), more is the peritoneal contamination. More proximal is the site of perforation, and less is the degree of peritoneal contamination.

36% of patients in the povidone-iodine group had wound infection, and 16% of patients had wound infection in the metronidazole group. Incidence of infection was more in colonic perforations, followed by ileal, appendicular, jejunal, duodenal, and prepyloric perforations. Sheeraz Khan et al[18] reported a 20% reduction in the incidence of wound infection when a superoxide solution was used for intraoperative peritoneal lavage. On the contrary, Schein et al[19] did not find any difference in the incidence of wound infection when Chloramphenicol was used for intraoperative peritoneal lavage.

Faecal Fistula

In our study, 2 patients developed a faecal fistula, 1 in the povidone-iodine group, and 1 in the metronidazole group. There was no significant difference in the development of faecal fistulas in both groups. Sheeraz Khan et al[18] (2009) reported a 2.5% reduction in the incidence of faecal fistula in the study group when a superoxide solution was used for intraoperative peritoneal lavage. This was not significant statistically.

Other complications like paralytic ileus, intraabdominal abscess, etc. were not significantly different in both groups.

Mortality

With modern treatment, diffuse peritonitis carries a mortality rate of about 10 percent, reflecting the degree and duration of peritoneal contamination, age, and fitness of the patient and the nature of the underlying cause. Patients with delayed presentations have a high rate of mortality. In our study, 4 patients operated were succumbed to death. They were elderly with a severe degree of sepsis at presentation.

CONCLUSIONS

The commonest cause for peritonitis is a perforation. Peritonitis is more common in men compared to women. The common age group to be affected is 31 - 40 yrs. Duodenal perforation is the commonest site of perforation. *E. coli* is the most common organism isolated from peritoneal contamination. Early presentation had lower degree of contamination. Postoperative complications like surgical site infections, the intra-abdominal abscess is more in the patients with distally situated perforation and who had delayed presentation. Surgical site infections were less in the metronidazole group compared to the povidone-iodine group. There is a statistically significant association in the incidence of surgical site infections between the two groups. As far as other clinical outcomes are concerned, there is no significant difference in both groups.

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