

Original Research Article

A comparative study between povidone iodine and metronidazole for peritoneal lavage in cases of peritonitis

Asadulla Baig*, Mohan Kumar K.

Department of General Surgery, Sri Devraj Urs Medical College, Kolar, Karnataka, India

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***Correspondence:**

Dr. Asadulla Baig,

E-mail: asadullabaig9@gmail.com

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ABSTRACT

Background: Peritonitis secondary to hollow viscous perforation is one of the commonest emergencies encountered in general surgical practice. This randomized study aimed to compare the efficiency of Povidone iodine and Metronidazole in these cases by quantitative analysis of bacterial colony count in patients who have received peritoneal lavage with either of them.

Methods: A total of 100 consecutive patients who presented with peritonitis secondary to hollow viscous perforation were enrolled in this study (February 2010 to February 2011) and systematically divided into 2 groups: peritoneal lavage with povidone iodine group and lavage with metronidazole group. The post-operative progress was assessed by comparing the pre-wash and post wash colony counts in both the groups, development of surgical site infection and duration of hospital stay.

Results: The median age of the patients was 33 years (range: 12-75 years), with a male: female ratio of 3.8:1. Perforation of duodenal ulcer (67%) was the commonest cause of peritonitis with *E. coli* (65%) being the commonest organism isolated from the peritoneal fluid. Reduction in bacterial colony count was seen in both the groups of patients, however, there was significantly greater reduction in the patients who received lavage with Metronidazole ($p=0.06$). Incidence of surgical site infection was less in the Povidone iodine group though it did not reach statistical significance.

Conclusions: The use of povidone iodine in peritoneal lavage significantly reduce the bacterial colony and may also result in fewer surgical site infections.

Keywords: Metronidazole, Peritonitis, Peritoneal lavage, Povidone Iodine

INTRODUCTION

Peritonitis secondary to hollow viscus perforation is one of the commonest emergencies encountered in general surgical practice. The rate of secondary infection is higher as majority of patients being from rural areas, present late to the hospital due to low awareness, local belief and faith in native medicine.¹

Hoffmann in 1988 suggested peritoneal lavage as an aid in the diagnosis of peritonitis of non-traumatic origin.²

The pathogenesis of peritonitis due to hollow viscus perforation is currently accepted as being mainly based on the local as well as systemic release of pro and anti-inflammatory mediators triggered by the presence of bacteria and bacterial products in the abdominal cavity.² Therefore, treatment consists of focal restoration, intraoperative debridement and lavage. In order to evaluate the pathophysiological relevance of the bacterial load of the peritoneal exudate, the peritoneal fluid from patients presenting with peritonitis secondary to hollow viscus perforation will be obtained for bacterial colony

prior to as well as after peritoneal lavage.³ This study were aimed to compare the efficacy of povidone iodine and metronidazole in peritoneal lavage and to ensure adequate control of infection and to decrease the chances of post-operative wound infection thereby preventing prolonged hospital stay.

METHODS

The study was performed between February 2010 to February 2011, 100 consecutive patients who presented to the Department of General Surgery, RL Jalappa hospital and research centre, with features of peritonitis secondary to hollow viscous perforation were in the study. They were divided into 2 groups:

Group 1: patients with odd serial numbers were included in this group and were given peritoneal lavage with povidine iodine (1% weight/volume of povidine iodine in 2 liters of normal saline).

Group 2: patients with all even serial numbers were included in this group and given peritoneal lavage using Metronidazole (200 ml of metronidazole in 2 litres of normal saline).

Inclusion criteria

All patients who presented with peritonitis secondary to hollow viscous perforation were included in this study.

Exclusion criteria

Patients developing peritonitis following blunt or penetrating injury to the abdomen were excluded from the study. Patients developing peritonitis following blunt or penetrating injury to the abdomen were excluded from the study.

All patients were prepared preoperatively by correction of shock and electrolyte imbalance and were administered a parenteral broad-spectrum antibiotic.

Operative details

On laparotomy 2 ml of the contaminated peritoneal fluid was collected (sample 1). Appropriate surgery was done to control the source of contamination followed by a thorough peritoneal lavage with either povidone iodine or metronidazole. Another sample of the peritoneal fluid was collected after lavage (sample 2) and both the samples were sent immediately for isolation of the organism and bacterial count. Primary skin closure was done in all patients. Semi quantitative bacterial count of the peritoneal fluid collected before and after lavage was performed by plating on blood agar and Mac Conkey agar. Sometimes to facilitate the counting specially in cases which were heavily contaminated, serial dilution of the peritoneal fluid was done and then plated and the

resulting colonies were counted. The colonies thus grown were identified by using routine bacteriological methods.

Fluid and electrolyte balance were maintained in the post-operative period and in most cases broad spectrum antibiotics which were started in the preoperative period were continued post operatively till the culture reports were obtained. Post operatively the patients in both groups were compared for duration of hospital stay and were followed up for a period of 30 days for development of surgical site infection. SSI was assessed by clinical examination. Since, none of the wounds met the criteria for treatment with antibiotic, culture from wound was not done.

Statistical analysis

The following methods of statistical analysis were used in this study. Independent student 't' test, Paired sample 't' test, chi-square test. Proportions were compared using chi square test of significance. A "p" value of less than 0.05 was accepted as statistically significant. Data analysis was carried out using SPSS package.

RESULTS

Males showed a higher incidence of peritonitis at 79% with female accounting for 21% (Table 1).

Table 1: Incidence of perforation in males and females.

Sex	No. of patients	(%)	Mortality
Male	79	79	3
Female	21	21	1
Total	100	100	4

There were 4 deaths during the study of which 3 were male patients and 3 patients developed enterocutaneous fistulae. Thirty-three years was the median age of the patients with the youngest being 12 years old and the oldest 75 years old both of whom had a duodenal perforation. Most of the patients were aged between 21-30 years.

Table 2: Incidence of type of perforation.

SSI	No. of patients	Percentage
Present	37	37
Absent	63	63
Total	100	100

The first part of duodenum was the most common site of perforation (67%) followed by appendix (21%), ileum (11%) and stomach (1%) (Table 2). A total of 37 patients developed surgical site infection which is within the limits expected for dirty wounds. Surgical site infection was less in group 1 compared to group 2 (30% vs 42%) (Table 3).

Table 3: Incidence of surgical site infection.

SSI	No. of patients	Percentage
Present	37	37
Absent	63	63
Total	100	100

The mean stay in the hospital was 16 days for patients who received lavage with Povidine iodine and 17 days in patients who underwent lavage with metronidazole.

Table 4: Incidence of organism isolated in peritoneal lavage.

Organism isolated	Pre-lavage	Post-lavage
<i>E. coli</i>	65	33
<i>Enterococci</i>	14	6
<i>Klebsiella</i>	10	7
<i>Candida Albicans</i>	9	0
Acinetobacter	4	0
No organism	5	5

E. coli was the major organism grown accounting for 65% of the patients (Table 4).

Table 5: Incidence of surgical site infection in each group.

Group	Present (%)	Absent (%)	Total
Povidone Iodine	15 (30%)	35 (70%)	50
Metronidazole	21 (42%)	29 (58%)	50
Total	100		

In group 1, (Povidine iodine) there were 31 patients with *E. coli* in the pre-lavage sample, the colony count varied from 8-21000 organisms/ml with an average of 3645 organisms/ml. After lavage no organism could be isolated from 15 (50%) of the patients.

The colony counts after lavage had dropped drastically to a range of 0-7200 organisms/ml and an average count of 554 organisms/ml. In group 2, (Metronidazole) there were 34 (68%) patients who had *E. coli* as the infecting organism with the colony count ranging from 3-60,000 with an average of 7,725 organisms/ml. After lavage sample of 17 patients yielded no growth, in the rest the colony count varied from 2-25600 organisms/ml with an average of 3006 organisms/ml (Table 5).

The proportion of patients who did not grown any organisms after lavage was almost the same in both groups. The use of povidine iodine in the lavage caused a drastic reduction in the colony counts when compared to metronidazole.

Statistical analysis of these data showed a significant reduction in the bacterial load in group 1 ($p=0.0007$) when compared to group 2 ($p=0.06$) (Table 6). Group 2 patients showed a greater reduction in the counts of

klebsiella, but this could be related to a low initial count in sample 1 of these patients. *Candida* was easily cleared by either type of lavage. The *Acinetobacter* could have been a contaminant carried from the environment through the instruments used for laparoscopic closure of perforation.

Table 6: P-value comparing the two washes.

Agent used	P-value
Povidone Iodine	0.007
Metronidazole	0.06

DISCUSSION

Peritonitis, secondary to hollow viscous perforation, has for long been treated with control of the source of contaminated followed by copious irrigation with normal saline (0.9% NS) till the returning fluid is clear. Any inflammatory exudate formed following peritoneal injury leads to deposition of fibrin in the peritoneal cavity.⁴ The final resolution of the infecting focus would seem to depend on the critical interaction between the phagocyte and the bacterium within a fibrin laden microenvironment.⁵ Transudation of fluid with low protein content from the extracellular interstitial compartment into the abdominal cavity is accompanied by diapedesis of large number of polymorphonuclear (PMN) leukocytes. During the early vascular and transudative phase, the peritoneum acts as a "two-way street" so that toxins and other materials that may be present in the peritoneal fluids are readily absorbed, enter the lymphatics and blood stream and can lead to systemic symptoms.

Experimental studies of energy metabolism of the peritoneum in peritonitis have shown increased oxygen and glucose consumption and increased lactate production. There is increased anaerobic metabolism mainly due to glycolysis. Coupled with a decreased partial pressure and increase consumption of oxygen, these changes lead to hypoxic environment in the peritoneal cavity that favors growth of anaerobic bacteria.⁶

Most cases of secondary peritonitis represent mixed flora of intestinal tract and its adnexa. Bacteriological examination of pus shows *E. Coli*, *Enterococcus faecalis*, *Pseudomonas aeruginosa*, *Staphylococcus*, *Klebsiella* and *Proteus*.

Anaerobic culture shows strains of bacteroid especially *B. Fragilis* and other anaerobes like *Clostridia* and anaerobic *streptococci*.⁷ The Gram-negative aerobic bacteria exert their action through endotoxins. The main virulence factors of anaerobic bacteria are exoenzymes and capsular polysaccharides.⁸ The characteristic foul smell associated with pus of peritonitis of GI origin is due to production of free fatty acids and their esters as the result of anaerobic bacterial action, mainly *B. fragilis*.⁹

Peritoneal lavage was found to be therapeutically effective in a study conducted by Nathens and colleagues.¹⁰ The study done by Hau T et al, and colleagues on irrigation of the peritoneal cavity and local antibiotics had similar results. A meta-analysis of all experimental studies of the effect of lavage on peritonitis has shown a significant reduction of mortality after the use of antibiotic for irrigation.¹¹ There was a reduction in bacterial colony count following lavage in present study.

Some studies have failed to show any advantage of peritoneal lavage over simple systemic antibiotics.^{12,13} Recently a study on mice using lavage with activate protein C has shown promise.¹³ Peritoneal dialysis fluid has been suggested as an ideal agent for lavage as it causes less damage to the mesothelial cells compared to 0.9% normal saline.¹⁴ Metronidazole, gentamicin, cephalosporin, lincomycin, ampicillin, kanamycin and doxycycline and the antiseptics povidine iodine and chlorhexidine have all been studied with conflicting results. In a review of 15 studies by Josie Chundamala J et al, and James G et al. Wright showed a definite reduction of SSI with povidine iodine when compared to saline or no irrigation.¹⁵

Metronidazole is a nitroimidazole with activity against anaerobic cocci and both anaerobic gram-negative bacilli and anaerobic spore forming gram positive cocci.¹² It has been used safely as a single agent and in combination with other antibiotics for peritoneal lavage with good results.¹⁵

Betadine is a broad spectrum microbicidal with good tolerability and very few adverse effects and toxicity.¹⁶⁻¹⁸ It is efficacious even in the presence of protein load and after short exposure times, in heavily contaminated areas it, in addition to its bactericidal activity, it also inhibits the release of exotoxins, endotoxins and tissue destroying enzymes.⁴ A study by Keating JP et al, has shown that use of povidine iodine in concentrations greater than 1 % can lead to sclerosing encapsulating peritonitis.¹⁹ In present study, author have used 1% wt/vol betadine diluted in 2 liters of saline, which has shown good bactericidal activity with no adverse effects. Two studies have previously measured the serum iodine levels after irrigation and have shown a transient rise in serum iodine levels but no adverse effect.^{20,21} Peritoneal lavage assumes greater significance in laparoscopic surgery for peritonitis where simple swabbing out of contaminated material is difficult. Studies relating to treatment options for Hinchey III sigmoid diverticulitis have shown that simple laparoscopic lavage suffices in most cases and thus avoiding a Hartmann's procedure.^{22,23}

CONCLUSION

The use of povidine iodine in peritoneal lavage significantly reduces the bacterial colony count may also result in fewer surgical site infections.

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