Original Research Article

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A prospective study in peritonitis patients to compare the impact of subcutaneous negative suction closure, conventional primary closure of skin and subcutaneous tissue and open skin technique following laparotomy

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ABSTRACT

Background: Abdominal wall closure in the presence of sepsis presents a challenge to the surgeon. The objective of this study is to determine the advantages and disadvantages of each method to individualise the techniques based on patient profile about surgical site infection, duration of hospitalisation and morbidity.

Methods: A prospective comparative study was conducted among 102 operated patients of peritonitis in the Department of General Surgery at St John's Medical College and Hospital. The patients were divided into three groups, group A, group B and group C. In group A, skin and subcutaneous tissue was closed after draining the subcutaneous space by a negative-suction drain. In group B, the patient's skin and subcutaneous tissues were closed primarily with continuous sutures without negative suction drain. In group C, the laparotomy wound was closed and the skin was left open. And the outcome compared in the form of wound infection, hospital stay and morbidity. Patients on immunosuppressive therapy and paediatric patients were excluded. Demographic and clinical variables were recorded at the time of admission. SPSS version 18 was used for analysis.

Results: The study showed male preponderance and the mean age was 43.2 years. Duodenal perforation was the commonest cause of peritonitis in this study (38.2%). Incidence of surgical site infection was less in Group A (20.6%) compared to group B (52.9%) and group C (29.4%). Duration of hospital stay was also less in Group A patients (9.3±3.6 days) compared to other two groups. 37 patients who were included in the study were diabetic, out of which 25 patients (67.6%) developed surgical site infection.

Conclusions: It can be concluded from this study that abdominal wall closure using a sub cutaneous negative suction drain in peritonitis cases reduces the incidence of surgical site infection, duration of hospital stays, subsequent surgeries related to wound dehiscence and its associated morbidity.

Keywords: Peritonitis, Laparotomy, Subcutaneous negative suction closure, Surgical site infection

INTRODUCTION

Abdominal wall closure in the presence of sepsis presents a challenge to the surgeon. Quite often these patients present late after many hours or days after perforation. In the presence of peritonitis, the gut is edematous and presence of sepsis in the peritoneal cavity causes outpouring of fluid, sometimes till the infection is controlled. After dealing with pathology and peritoneal cavity washing, if tight closure of abdominal wall is done, it may lead to compartment syndrome or wound dehiscence or burst abdomen in a significant number of

patients. This wound dehiscence is often difficult to manage as reclosure frequently leads to compromise of chest condition and hypoxia, while, if the wound is left open, this adds the risk of nosocomial infection in the wound.¹ Patients requiring surgical intervention for peritonitis demonstrate a significantly increased risk for surgical-site infection and delayed wound failure. Negative suction in the subcutaneous space with or without irrigation with antibiotic solution has been shown to reduce the incidence of infection by evacuation of infected contents. However various other studies proved that leaving the skin open facilitates drainage and uncompromising debridement of the abdominal wall, and is compatible with good recovery.² Based on many studies there is controversy regarding the best way of managing laparotomy wound in cases of peritonitis.³ So, the rationale behind this study is to compare the subcutaneous negative suction closure, open skin technique, conventional closure of skin and sub cutaneous planes after laparotomy in cases of peritonitis. This study has evaluated the advantages and disadvantages of each of these three techniques with regard to surgical site infection (SSI), duration of hospital stay and morbidity. The effect of hypoalbuminemia and diabetes mellitus on SSI has also been evaluated in this study.

METHODS

This prospective comparative study was conducted in the Department of General Surgery at St John's Medical College and Hospital between the period from October 2013 to June 2015. A total of 102 operated cases of peritonitis (18-80 yrs) in the Department of General Surgery at St John's Medical College Hospital were included in the study and was analysed using purposive sampling technique.

Inclusion criteria

All the adult patients who had undergone laparotomy for peritonitis in the Department of General Surgery of St John's Medical College Hospital, in the study period of October 2013 to January 2015 were included.

Exclusion criteria

Patients on immunosuppressive therapy, paediatric patients, patients who need laparostomy, who had stomas after laparotomy and patients who require stomas for surgical reasons were excluded from the study.

Methodology

After taking detailed history, all the patients were investigated, and routine laboratory investigations were done. Plain X-ray of abdomen and chest to look for free air under the domes of the diaphragm, nasogastric suction, correction of fluid and electrolytes were done, and appropriate antibiotics were started. Demographic and clinical variables were recorded at the time of admission. Variables for each patient included: age, gender, diagnosis, history of diabetes mellitus, preoperative albumin levels, preoperative steroid use, and use of prophylactic antibiotics. O/E: tachycardia, guarding, rigidity of abdomen, free fluid in the abdomen, absent or decreased bowel sounds. On investigation: raised leucocyte count/ free air under diaphragm / free fluid in peritoneal cavity. The patients were divided into three groups, group A, group B and group C. In group A patients with peritonitis, the abdominal wall closure was done by suturing of the linea alba with continuous suture without tension at the suture line with or without interrupted suture at 2 or 3 places, depending on the length of incision, and the subcutaneous space was drained by a negative-suction drain (Romovac drain no-14) and the skin was closed. In group B, after closure of linea alba the patient's skin and subcutaneous tissues were closed primarily without negative suction drain. In group C, after closure of linea alba', and the skin was left open. In all the groups, No. 1 loop PDS suture was used for closure of the linea alba. All the patients had given written informed consent.

Statistical analysis

The recorded observations were stored in Microsoft Excel sheet and Continuous variables were reported using mean $\pm SD$ (standard deviation). Categorical variable was reported using number and percentages. Chi-square test used to find the association between categorical variable. All the analysis was done using SPSS version 18.0 (trail version). p value <0.05 is considered statistically significant.

RESULTS

Table 1 show the mean age in group A was 43.2 years, 38 years in group B and 42.2 in Group C. As per sex distribution the study showed male preponderance which concludes that peritonitis is common in males.

Table 1: Distribution of patients according to age and sex.

Group	Age (years)		Sex	
	Mean	Std. deviation	Male	Female
Group A	43.2	14.2	23	11
Group B	38	13.6	28	6
Group C	42.2	13.3	23	11

Table 2: Incidence of SSI.

Group	SSI (%)	No SSI (%)	Total	p value
Group A	7 (20.6)	27 (79.4)	34	
Group B	18 (52.9)	16 (47.1)	34	0.01
Group C	10 (29.4)	24 (70.6)	34	

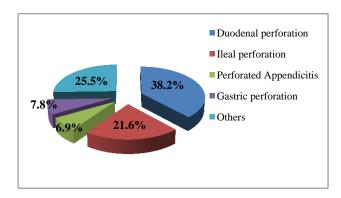


Figure 1: Causes of peritonitis.

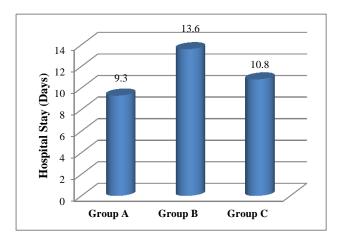


Figure 2: Duration of hospital stay in all the groups.

Duodenal perforation was the commonest cause of peritonitis in this study (38.2%). Ileal perforation was the second most common cause (21.6%) and causes included post-enteric fever and blunt/penetrating trauma.

Perforated appendix and gastric perforation were the cause in 6.9% and 7.8% of patients respectively. Other causes included colonic perforation, jejunal perforation, ruptured liver abscess & biliary peritonitis (Figure 1).

As per Table 2 total number of patients enrolled in this study were 102. Number of patients in each group were 34. Highest incidence of SSI was found in group B (52.9%), where the patient's skin and subcutaneous tissues were closed primarily. Least incidence of SSI in group A (20.6%), where the patient's skin and subcutaneous tissues were closed with a negative suction drain. Incidence of SSI in group C was 29.4% where the laparotomy wound was closed, and the skin was left open. This was statistically significant (p=0.01).

As per Figure 2 duration of hospital stay in group A patients was 9.3 ± 3.6 days. Duration of hospital stay in group B patients was 13.6 ± 6 days. Duration of hospital stay in group C patients was 10.8 ± 3.9 days. This was statistically significant (p=0.001).

As per Table 3, 37 patients who were included in the study were diabetic, out of which 25 patients (67.6%) developed SSI compared to 10 patients (15.45%) who developed SSI in the non-diabetic category. This was statistically significant (p<0.001).

As per Table 4, 41 patients had low albumin levels, out of which 22 patients (53.7%) developed surgical site infection. 13 patients (21.3%) with normal albumin levels developed SSI. This was statistically significant (p<0.001).

Table 3: Incidence of SSI in diabetic and non-diabetic patients.

	SSI (%)	No SSI (%)	Total	p value
Diabetic	25 (67.6)	12 (32.4)	37	<0.001
Non-diabetic	10 (15.4)	55 (84.6)	65	<0.001

Table 4: Hypoalbuminemia in SSI.

Albumin level	SSI	No SSI	Total	p value
Low (<3.5)	22 (53.7)	19 (46.3)	41	<0.001
Normal (≥3.5)	13 (21.3)	48 (78.7)	61	

DISCUSSION

Patients requiring surgical intervention for peritonitis demonstrate a significantly increased risk for surgical-site infection and wound-healing failure. They require close monitoring for these potential complications. Surgeons have used various suture materials for closure of the abdomen varying from delayed absorbable to non-

absorbable sutures. The incidence of surgical-site infection increases with the degree of contamination; therefore, surgical-site infection occurs at much higher rates after operations for peritonitis and peritoneal abscess (i.e., 20-40%, compared with <5% for elective abdominal operations for non-infectious etiologies).^{3,4} In the literature it is also reported that closure of abdominal incisions with subcutaneous, closed suction catheters intermittently irrigated with antibiotics resulted in decreased wound infection rates.⁵ Presence of infected fluid and microorganisms in the subcutaneous space leads invasion of tissues by bacteria and these microorganisms consume the nutrients and oxygen that would otherwise be directed towards the tissue repair. Numerous studies have been conducted to determine the effects of negative pressure on wound healing.⁶⁻⁸ Surgeons usually use subcutaneous drains to prevent the formation of seroma and hematoma and specially to eliminate the dead-space occurring in obese patients having thick subcutaneous fat tissue. On the other hand, according to some surgeons, placement of drains predisposes the area to infection and prolongs hospital stay. Poor perioperative glycemic control increases the risk of infection and worsens outcomes from sepsis for diabetic and nondiabetic patients. Moderate hyperglycemia (>200 mg/dl) at any time on the first postoperative day increases the risk of SSI fourfold after cardiac and noncardiac surgery. ^{10,11} Insulin infusion to keep the blood glucose level less than 110 mg/dl was associated with a 40% decrease in mortality among critically ill postoperative patients (≈70% of whom had undergone cardiac surgery), and also fewer nosocomial infections and less organ dysfunction.¹²

CONCLUSION

It can be concluded from this study that abdominal wall closure using a sub cutaneous negative suction drain in peritonitis cases reduces the incidence of surgical site infection, duration of hospital stay, subsequent surgeries related to wound dehiscence and its associated morbidity. It was also found that hypoalbuminemia and hyperglycemia are risk factors for developing surgical site infection.

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Institutional Ethics Committee

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