

Comparison of Frequency of Surgical Site Infection in Patients of Peritonitis Undergoing Laparotomy with Closed Wound and Drain Placed vs Open Wound Without Drain

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ABSTRACT

Objective: To compare of frequency of “surgical site infection (SSI)” in patients of peritonitis undergoing laparotomy with abdominal closure with subcutaneous drain placement versus open skin technique without drain.

Study Design: Comparative observational study.

Place and Duration of Study: Combined Military Hospital, Rawalpindi Pakistan, from Mar 2023-2024.

Methodology: A total of 240 patients who underwent laparotomy for peritonitis were included in the study and were divided into “abdominal closure with subcutaneous drain Group (A)” and “open skin technique without drain Group (B)”. At 30-days post-operative period, patients were assessed for presence of surgical site/wound infection. Data was analyzed by SPSS 20.

Results: Mean age was 40.98 ± 8.81 years. There were 134(55.83%) males and 106(44.17%) were females. Most common reason for peritonitis was “intestinal perforation” 87(36.25%) followed by “perforated appendix” 78(32.50%) and “gastric ulcer perforation” 75(31.25%). In “closed wound with drain Group”/Group A, frequency of SSI was 12(10.00%) while in “open skin technique without drain Group”/Group B, it was 25(20.83%), respectively ($p=0.020$).

Conclusion: Frequency of SSI was significantly lower when wound was closed and a subcutaneous drain was placed as compared to open skin technique without drain.

Keywords: Laparotomy, Peritonitis, Surgical wound infection.

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INTRODUCTION

Laparotomy is a time-sensitive surgical procedure performed on different patient populations with a significant likelihood of complications associated to the surgery.¹ Although it is a frequently performed operation, the overall mortality rate for the procedure is quite substantial, ranging from 10.2% to 50.5% as reported in various studies, which is significantly greater than the mortality rate recorded in other surgeries.² Indications for laparotomy include both traumatic and non-traumatic conditions as reported in literature.³

Another important indication for a patient to undergo laparotomy is “peritonitis” which is characterized by inflammation of the peritoneum and is a surgical emergency.⁴ Purpose of laparotomy in such cases is to remove the infectious source so that inflamed peritoneum can heal, however, in most cases once the surgery is completely, preferred option adopted by surgeons is to keep the skin wound open so that the potential bowel wall edema can be

accommodated through an open abdomen and avoid “abdominal compartment syndrome.”⁵ An important aspect of laparotomy, like any other surgery is the development of “surgical site infection (SSI)” which adds to the surgical morbidity.⁶ To reduce the incidence of SSI after laparotomy, role of subcutaneous drain placement is controversial at best. In this instance, a study reported that subcutaneous drain placement can significantly reduce frequency of SSI after laparotomy ($p=0.002$).⁷ On the other hand, a large meta-analysis that analyzed multiple studies reported no significant difference in terms of frequency of SSI with or without subcutaneous drain.⁸

Owing to such gap in literature, choice of wound care after laparotomy performed for managing cases of peritonitis is still controversial and needs further exploration to determine that which of the technique provides best possible outcome in terms of frequency of post-operative surgical site/wound infection. To address this literature gap, this study was conducted with the aim to compare of frequency of “surgical site infection (SSI)” in patients of peritonitis undergoing laparotomy with “abdominal closure with subcutaneous drain” versus “open skin technique without drain”.

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METHODOLOGY

This comparative observational study was conducted at surgical department of "CMH, Rawalpindi from March 2023 to 2024" (ERB #: 563). Appropriate sample size was calculated using "WHO sample size calculator for two population proportions" using following formula:

For calculations, following assumptions were used; "level of significance of 5%", "power of 95%" and anticipated frequency of SSI in drain and no drain Group at 24% and 46%.⁹ This gave a sample size of 240

$$n = \frac{\left\{ z_{1-\alpha/2} \sqrt{2\bar{P}(1-\bar{P})} + z_{1-\beta} \sqrt{P_1(1-P_1) + P_2(1-P_2)} \right\}^2}{(P_1 - P_2)^2}$$

(120 in each Group).

Inclusion Criteria: Patients over the age of 18 years, both males and females, who underwent laparotomy to manage peritonitis were included in the study.

Exclusion criteria: Patients who had evidence of abdominal trauma, history of any co-morbidity (uncontrolled hypertension, chronic renal failure, diabetes, chronic liver disease, collagen disease, smoking, immunosuppression or connective tissue disease), hypoalbuminemia and those younger than eighteen years were excluded from the study.

Co-morbidities and hypoalbuminemia were made part of exclusion criteria as they have direct impact on frequency of post-op SSI. Patients were selected by using "non-probability consecutive sampling technique". Baseline characteristics of the patients including age, gender and reason for peritonitis identified upon opening of the abdomen were documented. All patients received preoperative evaluations according to the established protocol at CMH, Rawalpindi. All patients had laparotomy under general anesthesia. The procedures were all conducted by the same surgical team consisting of three post-graduate trainees, two registrars and one consultant to reduce operator bias. Once surgery was completed, based on medical registration (MR) number patients were divided into two Groups. In patients with MR number ending at an even number, wound and skin was closed with placement of subcutaneous drain (Group A) while in patients with MR number ending at an odd number, skin was kept open without placement of subcutaneous drain (Group B).

In Group A (n=120), once surgery was completed, the operating surgeon closed the abdomen by using "polypropylene 1 sutures" applied

continuously on the "linea alba" avoiding tension at the suture line. A subcutaneous drain was placed, skin was closed using a "2-0 polypropylene on a curved cutting needle. Drain was left in place for 10-days. After 10 days, drain was removed and skin gap was sutured.

In Group B (n=120), after completion of surgery, linea alba was closed while the skin was left open which was irrigated by normal saline followed by covering of wound with normal saline soaked gauze pieces. In this Group, dressing was changed twice daily till day 4 after surgery and on 5th day, skin wound was closed by interrupted skin sutures.

Sham feeding with gum was started on 2nd day of surgery with chewing gum in all the patients. All the patients were provided standard post-op care package as per hospital protocol which included injection co-amoxiclav 1.2g (Augmentin®) eight hourly for seven days, injection metronidazole 500mg (Flagyl®) eight hourly for seven days and intravenous fluids for three days while their stay at hospital for 14 days. On 15th day after surgery, patients were discharged from the hospital and were called for follow up on day 30 of the surgery. Patients were followed up till day 30 after the surgery for presence of "surgical site infection (SSI)". SSI was defined as "presence of erythema, discharge and swelling of the surgical wound and surrounding skin along with raised white cell count (> 11,000/mm³) on complete blood count). In case of SSI, appropriate management was provided as per patient's condition through antibiotics with or without surgical intervention.

"Data analysis was performed using SPSS version 20. Normality of data was checked by Shapiro-Wilk test. Quantitative data was represented using Mean±SD. Qualitative data was represented by using percentage and frequency. To compare frequency of SSI between Groups, Chi-square test was used. A *p*-value of ≤0.05 was taken as significant.

RESULTS

In this study, 240 patients (120 in each Group) were included. Mean age was 40.98±8.81 years. There were 134(55.83%) males and 106(44.17%) were females. Most common reason for peritonitis identified upon opening of the abdomen was "intestinal perforation" [n=87 (36.25%)] followed by "perforated appendix" [n=78(32.50%)] and "gastric ulcer perforation" [n=75 (31.25%)]. Comparison of these baseline demographic

characteristics between study Groups is summarized in tabulated form below in Table-I.

Composite frequency of SSI in present study was 37(15.42%). In “closed wound with drain Group”/Group A, frequency of SSI was 12(10.00%) while in “open skin technique without drain Group”/Group B, it was 25(20.83%), respectively ($p=0.020$), depicted below in Figure-1.

Table-I: Comparison of Baseline Characteristics Between Groups (n = 240)

Characteristic	Group A (n=120)	Group B (n=120)	p-value
Mean age	41.35±8.86 years	40.60±8.78 years	0.511
Gender			
Male	68(56.67%)	66(55.00%)	0.795
Female	52(43.33%)	54(45.00%)	
Reason for Peritonitis			
Perforation of appendix	32(26.66%)	46(38.34%)	0.092
Intestinal perforation	44(36.67%)	43(35.83%)	
Gastric ulcer perforation	44(36.67%)	31(25.83%)	

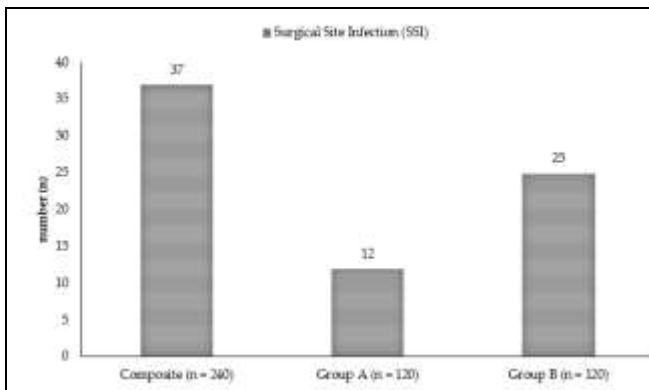


Figure-1: Comparison of Frequency of SSI Between Groups (n=240)

DISCUSSION

Peritonitis is an urgent case presenting at the casualty departments of the hospital requiring immediate intervention to clear out intra-abdominal inflammatory and infectious process as it is associated with a high risk of disease related death with approximated mortality rate exceeding 20%.^{10,11} Cornerstone of managing patients who present with “peritonitis” is to perform exploratory laparotomy as early as possible, with literature stating less than twelve hours to be ideal time to achieve maximal benefit and optimal outcomes.¹² Existence of peritonitis prior to laparotomy significantly increases the risk of developing post-operative SSI and thus surgeons practice a variety of operative maneuvers to

reduce the rate of this surgical morbidity.^{13,14} Present study focused on impact of one such aspect of peritonitis related laparotomy by comparing the frequency of “surgical site infection (SSI)” in patients of peritonitis undergoing laparotomy with “abdominal closure with subcutaneous drain” versus “open skin technique without drain”.

In this study, male-to-female ratio of patients who underwent laparotomy was approximately 1.22:1 which was almost similar to the ratio reported in a study conducted by Hendriksen *et al.*¹⁵ In this study, reasons that precipitated peritonitis included perforation of the gut, appendix and gastric ulcer. These conditions involving loss of integrity of the abdominal hollow viscera have been reported in multiple previous studies to be the common causes of causing “intra-abdominal infection (IAI)” and “peritonitis”.^{16,17} In present study, two different wound care approaches were compared in terms of their impact on the frequency of “post-laparotomy SSI”. One was primary closure of the wound with placement of subcutaneous drain while the other was leaving the skin wound open without placing any subcutaneous drain.

In present study, it was observed that when the wound was closed and a subcutaneous drain was placed it resulted in a significant reduction in frequency of “post-laparotomy SSI”. This reduction in SSI frequency with wound closure and subcutaneous drain placement was coherent with the findings of the studies conducted by Khan *et al.*¹⁸ Mathews *et al.*¹⁹ and Manoharan *et al.*²⁰ all of which reported reduced “post-laparotomy SSI” frequency with this method of wound care. However, in most studies, instead of conventional drain, negative suction drain has been studied while present study focused on the outcome of conventional drain. Contrary to findings of present study, Mukherjee *et al.*, found that leaving the wound open without placing any drain rather than closing the wound resulted in significantly lower frequency of “post-laparotomy SSI” making “open skin technique without drain” a better preventive method.²¹

Present study, in addition to various previous studies 18-20, clearly show the beneficial role of wound closure and subcutaneous drain placement after laparotomy, performed to manage cases of peritonitis, in terms of reducing the frequency of “post-laparotomy SSI”. Therefore, it is recommended that rather than the conventional practice of leaving the skin wound open, wound closure with

subcutaneous drain placement should be preferred. There were a few limitations of present study including limited follow up period, non-inclusion of patients with co-morbidities and use of conventional subcutaneous drain instead of negative suction subcutaneous drain. For this, it is recommended that additional studies including this subset of population and suction type should be conducted so that ideal post-laparotomy wound care technique can be established.

CONCLUSION

Wound closure with subcutaneous drain placement is a much better option compared to open skin technique without subcutaneous drain as it significantly reduces frequency of "post-laparotomy SSI.

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Authors' Contribution

Following authors have made substantial contributions to the manuscript as under:

UN & IA: Study design, drafting the manuscript, data interpretation, critical review, approval of the final version to be published.

AA & MT: Data acquisition, data analysis, approval of the final version to be published.

MN & HJ: Critical review, concept, drafting the manuscript, approval of the final version to be published.

Authors agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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