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Original Research Article

Comparison of continuous versus interrupted abdominal fascia closure using polydioxanone suture in laparotomy

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ABSTRACT

Background: Laparotomy is a major surgical procedure in emergency settings. There is paucity of data regarding abdominal fascia closure in emergency laparotomies in Indian population. This study was planned to compare two techniques of fascial closure namely continuous and interrupted using polydioxanone in patients undergoing midline emergency laparotomies in our institute.
Methods: This prospective study was conducted in Surgery Department, MMC&H, Muzaffarnagar, from January 2017 to June 2018. 60 patients undergoing emergency laparotomies were divided into two groups of 30 each. Group I (study group) patients underwent interrupted suture abdominal closure; Group II (control group) patients underwent continuous suture closure.
Results: Commonest diagnoses were duodenal and enteric perforations. Mean closure time in Group 1 was 31.6 minutes and in Group 2 -17.3 minutes. Mean hospital stay in Group I and II were 12.88 and 13.76 days respectively. 4 patients in Group I developed wound discharge versus 6 patients in Group II. Burst abdomen occurred in 3 out of 60 patients. One Group I patient had localised fascial burst. One Group II patient had localized while one had complete fascial burst. One incisional hernia was observed in each group at 3rd month of follow up. Three patients in Group 1 and one in Group 2 developed suture sinus.
Conclusions: Major complication of emergency laparotomy is wound dehiscence leading to increased morbidity, hospital stay and cost. In our study, we used continuous and interrupted PDS sutures and found that interrupted suturing method of abdominal wall closure is better, though it takes more time.

Keywords: Laprotomy, PDS, Interrupted sutures, Continuous sutures, Wound dehiscence

INTRODUCTION

Laparotomy is a major surgical procedure. [1] The choice of surgical incision to open the abdominal cavity is based on patient, surgeon and health care system. Surgeon's main concerns, aside from the optimal exposure of operative field, are time to open and close the abdomen, frequency of burst abdomen, wound infection, incisional hernia and suture sinus. Midline laparotomy is the most common technique of opening the abdomen in both emergency and elective settings because it is simple, provides adequate exposure to all four quadrants and affords quick exposure with minimal blood loss. If needed, we can extend the incision.

A midline laparotomy requires opening of the linea alba, which is a weak, tendinous zone. The weakness of the linea alba is enhanced when its fibres are vertically sectioned to access the peritoneal cavity. Thus, when closing the linea alba using sutures, these fibers are subjected to the tension induced by the mechanical forces that act upon it.[2]

Laparotomy wounds have traditionally been closed in a variety of ways in terms of continuous versus interrupted closure, single layer versus mass closure and absorbable versus non absorbable sutures. The best method of wound closure would be one that provides adequate tensile strength to the incision until the wound heals, approximates the tissue in a way that normal healing mechanism can occur under optimal circumstances, remains secure even in the presence of local or systemic infection, the suture material is well tolerated on a short and long term basis and finally, should be able to be done with expediency. The continuous suture has an advantage of an evenly distributed tension across the suture line and being more expedient. It has the disadvantage of being a single suture holding the whole fascia together. The multiple interrupted suture method has been used successfully for many years, but has the disadvantage of being time consuming to perform and of isolating the tension to each individual stitch.[3,4]

The complications which may arise following fascial closure include wound dehiscence, wound infection, incisional hernia, and suture sinus formation. They may arise partly as a result of poor technique, faulty selection of suture material and patient's factors; however, the most important causes are poor surgical technique, persistent increased intra-abdominal pressure and local necrosis due to infection.[3,4]

One of the most common and major complication associated with the closure of midline laparotomy is wound dehiscence which is a major cause of post-operative morbidity. In addition, there is an increase in cost of treatment and increase in hospital stay. Wound dehiscence means premature bursting, opening or splitting along natural or surgical suture lines. It is often secondary to poor wound healing. Risk factors include diabetes, advanced age, obesity and trauma during the post surgical period.[5] In developing countries like India, patients coming in emergency have poor nutritional status, which is also one of the most important causes of wound dehiscence.

Wound infection has been frequently implicated as a contributing factor to wound dehiscence. In cases of wound dehiscence, between the 6^{th} and 8^{th}day after operation, the abdominal wound bursts open and the viscera are extruded. The disruption of the wound tends to occur a few days before and when the sutures apposing the deep layers (peritoneum, posterior rectus sheath) tear through or even become untied.

Several studies have been carried out and published investigating the ideal method for closure of midline laparotomy wound especially in elective settings. The consensus that has been built upon by these studies is using delayed absorbable suture in continuous manner. But there is paucity of data regarding abdominal fascia closure in emergency laparotomies in Indian population. So, this study was planned to compare two techniques of fascial closure namely continuous and interrupted using a delayed absorbable suture material (polydioxanone) in patients undergoing midline emergency laparotomies in our institute.

METHODS

The present prospective study was conducted in Department of General Surgery, Muzaffarnagar Medical College and Hospital, Muzaffarnagar, from January 2017 to June 2018. A total of 60 patients were enrolled who underwent emergency laparotomies. These patients were divided into two groups of 30 each. Alternate patient was allocated to Group I and Group II. Group I (study group) patients underwent closure of abdominal wall using interrupted polydioxanone No 1 suture. Group II (control group) underwent closure of abdominal wall using continuous polydioxanone No 1 suture. An informed consent was taken from all patients.

Selection of the patients

Inclusion criteria

Inclusion criteria were patients having perforation peritonitis; age 18 – 75 years; laparotomy through midline incision.

Exclusion criteria

Exclusion criteria were cases of primary peritonitis, ileostomy and colostomy; pre-existing severe co-morbid conditions: severe renal and liver disease, anaemia (Hb<10 mg/dl), uncontrolled diabetes, malignancy and patients on anticancer chemotherapy or steroids; age <18 years and >75 years; previous laparotomies through midline incision.

Pre-operative evaluation

All the patients enrolled in the study underwent pre-operative investigations including complete haemogram, bleeding time, clotting time, urine complete examination, serum electrolytes, blood sugar, blood urea, X-ray abdomen (erect and supine), chest x-ray PA view, ECG and USG abdomen.

Procedure

Patients were first seen in emergency department where detailed history was taken from the patient if possible or the relative accompanying the patient. They were thoroughly examined and optimally stabilized before laparotomy was performed

Method of closure

Group I (interrupted polydioxanone): PDS no. 1 was used taking interrupted sutures at a distance of 1 cm from the divided edge with a distance of 1 cm between the two

consecutive suture taking 5-6 squared knots in a single suture tie.

Group II (continuous polydioxanone): PDS no. 1 was used in a simple running technique starting just proximal to the incision. The bites were taken 1 cm from the divided edge with a distance of 1 cm between the two consecutive bites in a non-interlocking manner and was closed using Aberdeen knot at the other end of the incision.

Postoperatively wound was examined on 3rd day for any infection. If there was any discharge, dressing was done as required. Condition of wound was monitored regularly and any complication was noted in a chronological manner. Stitches were removed at appropriate time. The number of days patient stayed in the hospital was recorded. The patients were followed up at 3 weeks, 2 months and 3 months interval after surgery in outpatient department for any suture sinus formation or incisional hernia.

Statistical analysis

The software used for the statistical analysis was SPSS (statistical package for social sciences) version 22.0. Descriptive statistics was performed by calculating mean and standard deviation for the continuous variables. Categorical variables are presented as absolute numbers and percentage. Nominal categorical data between the groups were compared using chi-square goodness-to-fit test. Unpaired or Independent t-test was used for comparison of mean value between the two groups.

RESULTS

In our study, the mean age in Group I was 36.72 years and 43.40 years in Group II. Majority of the patients were male i.e. 39 out of 60 (65%). Out of which, Group I had 19 (63%) male while Group II had 20 (66%) male.

Table 1: Diagnosis in the patients.

		Group 1	Group 2
		N (%)	N (%)
Diagnosis	Enteric perforation	11 (36.6)	11 (36.6)
	Tubercular ileal perforation	4 (13.33)	4 (13.33)
	Gastric perforation	1 (3.33)	2 (6.66)
	Duodenal perforation	14 (46.6)	13 (43.33)
Procedure performed	Modified Grahm's Patch	14 (46.66)	13 (43.33)
	Primary repair	12 (40.0)	13 (43.33)
	Resection and Anastomosis	4 (13.33)	4 (13.33)

Most common diagnosis was duodenal perforation in 27 patients followed by enteric perforation in 22 patients. Least number of cases (i.e. 3) were of gastric perforation. Only cases of secondary peritonitis were included in the study. Most common procedure performed was Modified Grahm's patch in 27 followed by primary repair in 25 patients and resection anastomosis in 8 patients (Table 1).

Table 2: Time taken for closure of rectus sheath.

Author	Interrupted	Continous
Shashikala	28.4	13.9
McNeill	43	24
Richards	40-45	20-25
Our study	31.60	17.30

Mean time taken for closure in Group 1 was 31.6 minutes and in Group 2 was 17.3 minutes (Table 2).

In our study, mean duration of hospital stay in Group I was 12.88 days and 13.76 days in Group II with no significant difference between 2 groups. The longer duration of hospital stay in both groups was attributed to the complications occurring in post-op period, commonly wound infection and burst abdomen.

Four patients (13.33%) in Group I developed wound discharge as compared to 6 patients (20%) in Group II. In total, 10 patients (16.66%) out of 60 developed wound infection. The difference was found to be statistically not significant.

Table 3: Study of wound dehiscence in the two groups.

Author	Continuous (%)	Interrupted (%)
Richards	2	0.9
McNeill	12.96	15.65
Trimbos	0.6	0
Srivastava	14.8	2.17
Bansiwal	20.1	5.4
Our study	6.66	3.33

Burst abdomen occurred in 3 patients (5%) out of 60 patients. One patient (3.33%) belonged to Group I (who had localised fascial burst) and 2 patients (6.66%) were from Group II, out of which 1 had localized while the other had complete fascial burst with no statistical difference between the 2 groups. The patient who had complete fascial burst was managed by application of Bagota bag under general anaesthesia and was followed by secondary wound healing. On the other hand, both the patients who had localised fascial wound burst were managed by daily aseptic dressing followed by secondary suturing (Table 3).

One patient (1.66 %) developed incisional hernia in each group during third month of follow up. In total, 2 patients (3.33%) out of 60 had incisional hernia as complication of surgery. There was no difference in incidence of

incisional hernia in both the groups. Three (10%) patients in interrupted group (Group 1) and one (3.33%) in continuous group (Group 2) developed suture sinus. In all, 4 patients out of 60 i.e. 6.66% had suture sinus as the complication of laparotomy. The difference was found to be statistically not significant (p=0.602) using chi square.

DISCUSSION

The best method of abdominal closure is one that maintains tensile strength throughout the healing process with good tissue approximation, does not promote wound infection or inflammation, is well tolerated by patients and is technically simple and expedient. The specific technique used in closure of the abdominal fascia for the individual is frequently based on non-scientific factors. Because of difficulties arising from differently tailored study designs, the surgical literature has not clearly demonstrated an optimal technique to close abdominal fascia, especially in emergency settings.

The mean time taken for closure of rectus sheath in Group I (31.60 minutes) was significantly more than Group II (17.30 minutes).This can be attributed to the fact that interrupted suturing technique requires multiple knots whereas in continuous suturing we place a single Aberdeen knot at the end of the fascial wound.

This was similar to the study by Shashikala et al, mean time taken for closure of rectus sheath in group A (continuous) was 13.9±2.9, and that for group B (interrupted) was 28.9±3.4.[6] Mean time taken for closure in continuous technique was less as compared to x-interrupted group, the difference being statistically highly significant ($p<0.05$) McNeill et al in their prospective study found mean closure time to be 43 mins in interrupted group and 21 mins in continuous group.[7] Similarly, Richards et al found it to be 40–45 minutes and 20-25 minutes respectively.[8]

In our study, mean duration of hospital stay in Group I was 12.88 days and 13.76 days in Group II. It compares well with findings of Richards who noted hospital stay of 12.9 in interrupted group and 19.5 in continuous group.[8]

In our study, the patients who underwent midline incisions, the dehiscence rate was 6.66% for the continuous group versus 3.33% for the interrupted group. This difference was not statistically significant.[8] McNeil et al, compared continuous absorbable No.2 coated polyglycolic acid suture (Dexon Plus) versus interrupted non absorbable No.28 monofilament stainless steel wire suture. They enrolled 105 patients for midline fascial closure following gastric surgery and did not found any significant difference in the wound infection rate between two closure methods (7/54 (12.96%) for interrupted wire and 8/51(15.68%) for continous polyglycolic acid).[7] Trimbos et al, conducted a randomized study, comparing interrupted versus continuous suture technique. All patients underwent midline laparotomies in the study. Early evaluation of study resulted in no difference between the continuous and interrupted suture groups with respect to wound infection (3% versus 1%), superficial wound dehiscence (2% versus 4%) and deep wound dehiscence (0.6% versus 0%).[9]

Gislason et al also did a study and found infection rates to be 14% in all laparotomy wounds taken together.[10] Cruse and Foord found in a retrospective survey a wound infection rate of 40% among 2093 dirty wounds but they did not specify how skin closure was performed.[11]

Abdominal wound dehiscence is defined as postoperative wound separation that involves all the layers of the abdomen wall. The abdominal wound dehiscence is associated with morbidity of up to 40% and up to 18% mortality in malnourished and elderly patients. Burst abdomen represents as an additional final insult to their already stressed physiology in emergency cases.

Wound dehiscence/burst abdomen was noted and recorded in all patients from both the groups in the immediate post-operative period till the time of discharge. Burst abdomen occurred in 3 patients (5%) out of 60 patients. One patient (3.33%) belonged to Group I and 2 patients (6.66%) were from Group II. In total, 3 patients (5%) out of 60 had burst abdomen as a complication to the surgery.

In the study by Bansiwal et al 20.1% of patients in continuous group developed wound dehiscence, while 5.4% patients in the interrupted group developed wound dehiscence.[12] Peter et al compared continuous versus interrupted technique for closing abdominal incisions. The patients who underwent midline incisions, the dehiscence rate was 2% for the continuous group versus 0.9% for interrupted group with no statistically significant difference between them.

Sahlin et al noted that both elective and urgent operations showed no significant difference in rates of wound dehiscence between interrupted (1%) and continuous (1%) closure.[13] Richard et al also demonstrated no significant difference in wound dehiscence in postoperative period between the interrupted(0.9%) and continuous (2%) closure.[8] Wissing et al in their study also showed no difference in rates of wound dehiscence between interrupted and continuous closure.[14] Srivastava et al found burst abdomen in 2.17% cases in interrupted group and 14.8% in continuous group.[15]

In the study by Karwasara et al there was no difference in incidence of incisional hernia in both the groups (4%).[16] Similarly, no statistical difference was found in earlier studies too.[8,13,17] Another late complication is suture sinus; three (12%) patients in interrupted group and one (4%) in continuous group developed suture sinus.

In our study, no suture sinus was present till 2 months. First evidence of suture sinus was detected in 3rd month

in both the groups. Three (10%) patients in interrupted group and one (3.33%) in continuous group developed suture sinus. In the study by Iwase et al, suture sinus was found in 7.1% patients in interrupted group and 1.3% in continuous group (PDS versus Silk). [17]

Thus we arrived at the conclusion that midline laparotomy is the most common technique of opening up the abdomen in emergency settings. Our hospital is a tertiary health centre in western Uttar Pradesh where patients mostly come from low socio–economic status and are nutritionally poor; often coming late in emergency. So, major complication of emergency laparotomy is in wound dehiscence which leads to increased morbidity, increased hospital stay and increased cost. In our study, we used continuous and interrupted PDS sutures and found that interrupted suturing method of abdominal wall closure is better, though it takes more time.

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