

Original Research Article

A comparative study between continuous and x-interrupted sutures in emergency midline laparotomies

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ABSTRACT

Background: Midline laparotomy is the most common technique of abdominal incisions in both emergency and elective settings. Wound dehiscence is related to several factors pertaining to patient besides suture material and method of closure. This study tries to compare continuous sutures with x-interrupted sutures in mass closure of midline laparotomy wound in patients undergoing emergency midline laparotomy for acute peritonitis.

Methods: A total of 60 patients undergoing emergency midline laparotomy for secondary peritonitis were considered for the study, 30 of whom underwent closure of abdominal wall with continuous sutures (Group A) and the other 30 with x-interrupted sutures (Group B) using non-absorbable, monofilament, polypropylene suture. Necessary preoperative data, the time required for rectus closure, length of the suture material required, post-operative complications like surgical site infection, wound dehiscence were analyzed.

Results: The groups were comparable in means of age and sex distribution. Group A was found to have lesser time for closure of rectus, lesser suture length and lesser suture to wound length ratio when compared with Group B. Surgical site infections were similar in both groups. Patients with rectus sheath sutured in x-interrupted sutures (n=2) had significantly less wound dehiscence as compared with continuous sutures (n=8) ($p < 0.05$).

Conclusions: Interrupted -X suture method of suturing reduces post-operative wound dehiscence, although requires more suture and consumes more time than the continuous method of suturing.

Keywords: Continuous suture, X-interrupted suture, Wound dehiscence

INTRODUCTION

Midline laparotomy is the most common technique of abdominal incisions in both emergency and elective settings because it is simple, provides adequate exposure to all four quadrants, affords quick exposure with minimal blood loss.¹

One of the most common and major complication associated with the closure of median laparotomy is wound dehiscence which is a major cause of postoperative morbidity. Wound dehiscence is related to several factors pertaining to patient besides suture

material and method of closure.² Minimization of tissue damage is essential, and this may be done by avoiding inclusion of the abdominal wall musculature in the closure. A 4:1 ratio of suture bites versus suture advancement has been advocated.³ Mass closure of abdominal wall is preferred over layered closure.⁴ Use of non-absorbable sutures for abdominal closure (e.g., polypropylene) has been associated with increased pain and sinus track formation and has not shown any significant difference in the incidence of incisional hernia formation, wound dehiscence, or surgical site infection as compared with slowly absorbing monofilament suture, such as polydioxanone.^{5,6}

The type of closure may not be so important in elective patients who are nutritionally adequate, do not have risk factors for dehiscence and are well prepared for surgery. However, it may prove crucial in emergency patients with peritonitis who often have multiple risk factors for developing dehiscence.⁷

Closure of skin has always been debated in dirty or clean contaminated wounds, but it has been proven beyond doubt that leaving skin open in presence of contamination reduces the chances of wound sepsis as primary closure of skin in such circumstances creates an infected closed space and invariably leads to abscess formation and attendant sequelae.⁷⁻⁹ Therefore, it is logical to exclude this factor when comparing the two method of closure.

This study tries to evaluate prospectively the continuous sutures with interrupted x-type sutures in mass closure of midline laparotomy wound with non-absorbable monofilament suture polypropylene in patients undergoing emergency midline laparotomy for acute peritonitis and its effectiveness in preventing burst abdomen in our hospital.

METHODS

I This prospective randomized trial was conducted in the Department of General Surgery of Bowring and Lady Curzon hospitals and Victoria hospital attached to Bangalore Medical College and Research Institute, Bengaluru, Karnataka January 2017 to December 2017. The study included 60 patients, who were divided randomly into two groups: Group A: 30 patients who underwent continuous closure of abdominal wall using non absorbable (polypropylene) suture. And Group B: 30 patients who underwent X- interrupted suturing of abdominal wall using non absorbable (polypropylene) suture.

Patients undergoing emergency midline laparotomy procedure for perforative peritonitis were included in the study. Patients younger than 18 years, who have undergone previous laparotomies for any condition, or those with incisional hernia or burst abdomen at presentation were excluded from the study.

Preoperative investigations essential for the pre-anesthetic evaluation and fitness for surgery. These included complete blood count, serum electrolytes, blood sugar, blood urea and serum creatinine, total bilirubin, alkaline phosphatase, SGOT/SGPT, total proteins with serum albumin, x-ray erect abdomen, Chest x-ray Electrocardiogram and body mass index.

All patients were given pre-operative dose of antibiotics according to hospital antibiotic policy which were continued in the post-operative period also. Exploratory laparotomy was carried out through a midline vertical incision. The length of the incision was measured using a sterilized metallic scale. Necessary procedure was carried

out according to the intra-operative findings. Peritoneal cavity was washed thoroughly with warm normal saline till the effluent was clear. Variable number of peritoneal drains were inserted as required. The required closure was performed accordingly. The time taken for closure was noted. The total length of the suture material used was noted. Suture length: wound length ratio was subsequently computed.

The skin was left unsutured in all the cases. The wound was primarily dressed with sterile surgical gauzes and covered with occlusive adherent bandage. The primary dressing was removed after 48 hours and daily dressing was done. The wounds were inspected for signs of infection and dehiscence before each dressing. Swab cultures from the wound were sent for microbiological culture and antibiotic sensitivity on evidence of any signs of infection. Wounds were closed secondarily if there were no signs of infection or dehiscence and healthy granulation tissue appeared.

Methods of closure

The randomization of the patients was done with computer generated random tables which was informed intraoperatively by a nursing attendant. Written informed consent was taken from all the patients. Patients were subsequently divided into the following two groups for closure:

Group A (continuous non-absorbable)

Non-absorbable No.1 polypropylene was used in a simple running technique starting just proximal to the incision. The bites were taken 1-2cm from the divided edge with a distance of 1cm between the two consecutive bites in a non-interlocking manner.

Group B (X- interrupted non-absorbable)

It was performed using No. 1 polypropylene suture. A large bite was taken on the cut edge of linea alba from outside-in, 2 cm from edge. The needle emerged on the other side from inside-out diagonally 2 cm from the edge and 4 cm above or below the first bite. This strand was crossed or looped around the free end of suture and continued outside-in, diagonally at 90° to the first diagonal.

The two ends were tied just tight enough to approximate the edges of linea alba taking care not to include bowel or greater omentum between the edges. The small free end of the suture was passed deep to the X behind linea alba and again tied to the other end of the suture. This method of tying four throws in front and four throws behind the X created two X-like crosses one on the surface and another deep to linea alba. The central knot allowed fixation of four arms of the X like a pivot. The next X-suture was placed 1 cm away (above or below) from the previous one. Thus, in a 14 cm long wound, 3 X-sutures

were applied. The suture line was then palpated for any gap with the index finger. Any large gap permitting a finger was closed with a simple interrupted suture.

Follow up

Patients were followed up and re-evaluated at 2, 4, 6 and 12 weeks after surgery in outpatient department. The patients were examined for wound infections or dehiscence.

Statistical analysis

Descriptive statistics have been applied. Various case observations are documented on MS office Excel Spreadsheets 2014.

Necessary analysis of data for the purpose of the study has been carried out on SPSS 24.0 software in pursuance of the objectives of the study, to test the difference of significance between the two groups, independent t test has been applied and the level of confidence chosen is 0.05. For categorical data chi-square test has been used.

RESULTS

The study included 60 patients, who were divided into two groups:

- Group A: 30 patients who underwent continuous closure of abdominal wall using non absorbable (polypropylene) suture.
- Group B: 30 patients who underwent X- interrupted suturing of abdominal wall using non absorbable (polypropylene) suture.

Patients between age group 22-70 were included in the study. The mean age of patients was 44.3 ± 11.42 years. Mean age of patient in Group A was 45.1 ± 10.89 years and mean age of patient in Group B was 43.5 ± 12.27 years.

The groups were comparable in means of age. Majority of patients were males 52 (86.67%). The groups were comparable statistically in terms of gender distribution.

Diagnosis

Most common diagnosis for secondary peritonitis was duodenal ulcer perforation, followed by gastric ulcer perforation. Table 1 depicts the various diagnosis for which exploratory laparotomy was performed.

Time taken for closure of rectus sheath

The mean time taken for closure of rectus sheath in Group A was found to be 13.9 ± 2.9 minutes and it was significantly less ($p < 0.05$) when compared with Group B which was about 28.4 ± 3.4 minutes. Although the length of incisions did not vary significantly in two groups (p

> 0.05) patients of group B required significantly more time for rectus closure than Group A.

Table 1: Demographic data and diagnosis in the study population.

	Group A	Group B	Total
Age	45.1 ± 10.89 years	43.5 ± 12.27 years	44.3 ± 11.42 years
Sex			
Male	25 (83.33%)	27 (90%)	
Female	5 (16.67%)	3 (10%)	
Diagnosis			
Duodenal perforation	11	12	23
Gastric perforation	8	7	15
Appendicular perforation	5	5	10
Ileal perforation	5	4	9
Caecal perforation	1	1	2
Bowel gangrene	0	1	1

Suture length

Mean suture length used in Group A was 77.26 ± 14.14 cms which was significantly less ($p < 0.05$) as compared to group B where 116.1 ± 10.12 cms of suture material was required.

Suture length: wound length ratio

SL: WL was calculated by dividing the length of the suture used in closing the rectus sheath and then dividing it by total incision length individual patient and then calculating the mean. The mean SL: WL for Group A was 4.08 and for group B was 6.49.

Table 2: Intra-operative data regarding rectus closure.

	Group A	Group B	P value
Avg. closure time	13.9 min	28.4 min	< 0.05
Mean suture length	77.26 ± 14.14 cm	116.1 ± 10.12 cm	< 0.05
Suture: wound length ratio	4.08	6.49	< 0.05

Wound infection

Surgical site infection was noted and recorded in 9 out of 30 patients (30%) of group A and 7 out of 30 patients (23.33%) of group B. There was not statistically significance in terms of surgical site infection ($p > 0.05$)

in both the groups. Maximum wound infection rate was present at the end of two weeks. No wound infection persisted till 12 weeks.

Wound dehiscence

Wound dehiscence was noted and recorded in both the groups in the immediate post-operative period till the time of discharge. Wound dehiscence occurred in 16.67 % patients. In group A 8 out of 30 (26.67%) patients developed wound dehiscence and in group B 2 out of 30 patients (6.67 %) developed wound dehiscence. Patients with rectus sheath sutured in x-interrupted sutures had significantly less wound dehiscence as compared with continuous sutures.

Table 3: Post-operative wound complications.

	Group A	Group B	P value
Wound infection	9 (30%)	7 (23.33%)	>0.05
Wound dehiscence	8 (26.67%)	2 (6.67%)	<0.05

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 nonscientific 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.

Mean time taken for closure of rectus sheath in group A was 13.9±2.9, and that for group B was 28.9±3.4. Mean time taken for closure in continuous technique was less as compared to x - interrupted group, the difference being statistically highly significant ($p<0.05$). The difference in time can be attributed to running closure in continuous suturing without having to tie multiple knots.

Mean suture length used in closing rectus sheath in group A was 77.26±14.14 cms, and that in group B was 116.1±10.12 cms. Mean suture length used in continuous suturing was less compared to x - interrupted suturing, the difference being statistically significant ($p<0.05$). Since difference in suture length can be present depending upon the length of the incision, it was standardized in each group and each group was comparable with regards to incision length. SL:WL was, therefore, considered a more standard parameter to evaluate and compare the amount of suture material used in either technique. Mean SL:WL for continuous and x-interrupted groups as computed was 4.08 and 6.49, the difference being statistically significant ($p<0.05$).

Jenkins was the first one to define an ideal ratio of 4:1 for closure of laparotomy wounds based on clinical trials and mathematical model.⁹ This fact has been since then validated by many studies and meta-analysis. Although there has been no randomized trial looking at SL: WL ratio, Kendall et al had a SL: WL ratio of 3.7:1 in layered closure and 5:1 in the mass closure group ($p<0.001$).¹⁰ Despite this there was no difference in incisional hernia rates at one-year follow-up and suggests that SL: WL may not be critical as suggested by Israelsson and Jonsson and other similar studies.¹¹⁻¹³

Wound infection rate in the group A was 30 % and that in group B was 23.3%. The total wound infection rate was 26.67%. Wound infection rate in continuous group was more as compared to x- interrupted group but was not statistically significant. No statistically significant difference was observed in the wound infection rate between the continuous and interrupted closure in similar studies published elsewhere.^{14,15}

Wound dehiscence was noted in 16.67% of the patients. It was present in 26.67 % in group A and 16.67% in group B. This difference was statistically significant. Indian authors have reported burst abdomen to occur in 10-30% of emergency cases. 93 High percentage of wound dehiscence could be attributed to higher wound infection rate and malnourishment. Kumar et al in a prospective study of 100 patients concluded that the interrupted x suture technique is better than continuous suture technique in prevention of burst abdomen in both emergency as well as elective mid line laparotomy, with the burst abdomen rate of 2% in interrupted X suture as compared to 12% burst abdomen in continuous suture technique.¹⁶

CONCLUSION

X-interrupted method of suturing also requires significantly more suture material than the conventional continuous method. Interrupted -X suture method of suturing is better than the conventional continuous method in the management of closure of emergency vertical midline laparotomy incision as the post-operative complications like wound dehiscence is found to be significantly lesser with the use of interrupted method of closure.

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