

Small Bite Closure in Midline Laparotomy; A Practice to Reduce the Surgical Site Infection, Wound Dehiscence, and Incisional Hernia

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Abstracts

Background: Postoperative wound site complications are a significant source of morbidity after midline laparotomy. The study's objectives were to compare the two suture patterns for fascial closure in midline abdominal wounds and their effect on postoperative wound site complications. **Materials and Methods:** Over 4 years, the prospective comparative study was conducted at the Government Medical College Hospital, Srinagar. All the patients ≥ 18 years and ≤ 70 years of age underwent midline laparotomy for various indications were included. Patients were randomized to two groups using computer-generated numbers based on closure techniques. Group A; Large Tissue Bite closure (10 mm from the wound edge and 10 mm apart and Group B; Small Tissue Bite closure (5–7 mm from the wound edge and 5–7 mm apart). Effect of age, sex, body mass index (BMI), albumin, and suture bite on postoperative complications were analyzed. **Results:** Among 324 patients who met the inclusion criteria, the mean age was 39.17 years, 84.56% were male with a Male: Female ratio of 5.48. Two hundred and two (62.35%) patients had large tissue bite closure, and 122 (37.75%) had small bite closure. There was no statistically significant difference between the two groups concerning age, sex, albumin levels, BMI, and type of surgery. About 35.64% of patients in the large tissue bite closure group and 19.67% patients in small bite closure developed surgical site infection (SSI) ($P = 0.002$). The difference in wound dehiscence between the two groups (15.84% vs. 7.38%) was statistically insignificant ($P = 0.29$). In midline laparotomy closure, the small bites technique results in significantly less incisional hernias than the large bites technique ($P = 0.00001$). None of our patients expired during the study period. **Conclusion:** The small bite technique substantially reduces SSIs, wound dehiscence, and incisional hernia. The accident-emergency and general surgery residents, in particular, should be made familiar with this technique to avoid postoperative wound site complications and improve the quality of postoperative life.

Keywords: Complications, laparotomy, midline incision, small bite closure, suture technique

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Submitted: 21-Aug-2021 **Revised:** 20-Sep-2021
Accepted: 21-Sep-2021 **Published:** 16-Dec-2021

Access this article online

Quick Response Code:



Website:
www.ijmbs.org

DOI:
10.4103/ijmbs.ijmbs_65_21

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How to cite this article: Hassan Y, Arajmand ST, Wani A, Gilkar IA, Ahmad Shah SM. Small bite closure in midline laparotomy; A practice to reduce the surgical site infection, wound dehiscence, and incisional hernia. *Ibnosina J Med Biomed Sci* 2021;13:204-8.

INTRODUCTION

Midline incisions are the most commonly used laparotomy incision^[1] due to ease and speed of access, less bleeding, no intervening muscles, and subsequent mass closure. The postoperative wound site complications after laparotomy are of much concern and worry for a general surgeon. These complications include surgical site infection (SSI), wound dehiscence, chronic discharge, and delayed complication of incisional hernia. SSIs are a significant complication of emergency surgery and the second most common nosocomial infection, accounting for 17% of all healthcare-associated infections among hospitalized patients. The Centers for Disease Control and Prevention classifies SSIs as superficial incisional, deep incisional, and organ-space, depending on the depth of the infection at the surgical site.^[2] Clean and clean-contaminated wounds have a low risk of SSI, and contaminated and dirty wounds are highly likely to develop SSIs. Besides the nature of the wound, the chances of developing an SSI after surgery depends upon host factors (malnutrition, metabolic disease, immunosuppression). Furthermore, this is influenced by the virulence of the infective agent, vascularity and health of the invaded tissue, presence of dead or foreign tissue, and use of antibiotics during the decisive period.^[3]

SSI after midline laparotomy is the most crucial risk factor for wound dehiscence and the development of an incisional hernia. Wound dehiscence is a complication of elective and emergency laparotomy with incidence rates of 1%–3% in elective surgery and 5%–50% in emergency operations. After primary midline laparotomy, the reported incidence of incisional hernia is 5%–20% in the literature.^[4] Efforts have been made to overcome and reduce postoperative complications, decrease morbidity, and increase the quality of life. The proper operating theatre sterilization and disinfection methods, preoperative antibiotic prophylaxis, clipping of hair, and proper surgical skin preparation and delayed wound closure have drastically reduced the incidence of wound site complications.

Further, the different innovations in techniques of laparotomy closure and quality of suture material

used have a profound effect on postoperative wound site complications. The long continuous stitches are associated with higher rates of SSI and incisional hernia.^[5,6] We aimed to compare the two suture patterns (small bites vs. large bites) for fascial closure in midline abdominal wounds and their effect on postoperative wound site complications.

MATERIALS AND METHODS

This study is a prospective comparative observational study in which midline abdominal wound closure was performed on 324 patients in the Department of Surgery, Government Medical College Srinagar between 2015 and 2019. All the patients between 18 and 70 years of age of either sex and underwent any abdominal surgery through midline incision for various indications in either elective or emergency settings were included in the study. Patients with a history of abdominal surgery and patients with medical comorbidities (T2DM, Chronic Liver or kidney disease, connective tissue disorders) were excluded. After a thorough history and clinical examination, all the patients were subjected to baseline and other relevant investigations to reach a definitive diagnosis. A single preoperative dose of the 3rd generation cephalosporin was used in all the subjects before the induction of anesthesia and continued postoperatively as per the patient's clinical status. On-table shaving of hair with a sterilized blade was done in all our cases. We used 10% povidone-iodine as an anti-septic solution to prepare the area, which included nipples to the mid-thighs. Proper sterilized green drapes were used for covering the operative area.

Patients were divided into two groups using computer-generated random numbers based on the closure techniques; Group A included patients who underwent midline wound closure with large tissue bites (10 mm from the wound edge and 10 mm apart) and Group B with small tissue bites (5–7 mm from the wound edge and 5–7 mm apart) and included only the aponeurosis in the stitches without peritoneum. A continuous, single-layer monofilament suture (No. 1 polypropylene) on a round body needle was used in both groups to close the abdomen. The skin was closed as a separate layer with interrupted

vertical mattress silk sutures. Postoperatively, all the patients were strictly monitored in our surgical ward and examined for the presence or absence of any wound site complications. Patients were invited for follow-up at out-patient-department fortnightly for the first 2 months and, after that, 6-monthly after surgery. All the patients had a clinical examination and ultrasonography abdomen (case-to-case basis) on follow-up visits.

Statistical analysis

The statistical analysis was performed using SPSS software (SPSS version 22, IBM, Armonk, NY, USA). The mean and frequency were calculated using exile table 10, and the *P* values were considered statistically significant if ≤ 0.05 .

RESULTS

A total of 324 patients were included in the study. Two hundred and two (62.35%) patients underwent midline wound closure with large bites, and 122 (37.75%) had small bite closure. Males (84.56%) outnumbered the females (15.43%) with M: F ratio of 5.48. The preponderance of males could be due to heavy smoking, irregular meals, spicy meals and outdoor life, and higher trauma and blast injuries rates in this conflict zone. A maximum number of patients were between 40 and 49 years of age ((34.57%), followed by 30–39 years (32.72%), 19–29 years (14.51%), 50–59 years (5.86%), and 60–70 years (5.86%). The mean age in large tissue bite closure was 38.25 years, while 40.69 years in small bite closure. Overall mean age in the study population was 39.17 years. Two hundred and thirty-three patients (71.91%), including 138 (68.32%) patients in the large bite group and 95 (77.86%) in the small bite group, were operated on in an emergency setting. There was no statistically significant difference between the two groups concerning age, sex, albumin levels, body mass index (BMI), and type of surgery [Table 1].

About 29.6% of patients developed SSIs, and 12.7% had wound dehiscence. 19.14% of patients had minor SSI and 11.1% of subjects had major SSI. Seventy-two (35.6%) patients out of 202 patients in the large tissue bite group, and 24 (19.7%) patients out of 122 in small bite closure developed

SSI. The difference was found to be statistically significant with a *P* value of 0.002. The patients were managed by culture-specific antibiotics, wound care, and twice-daily anti-septic dressings. Infected sutures were removed to allow the pus to be evacuated completely. Thorough debridement and irrigation with normal saline, betadine, and antibiotics were made. Some patients with major SSI were subjected to secondary drainage procedures. Thirty-two (15.84%) patients in the large tissue bite group and 9 (7.38%) patients in small tissue bite developed wound dehiscence. The difference was statistically insignificant, with a *P* value of 0.29. All wound dehiscence patients underwent closure with tension sutures under general anesthesia. None of them developed any further complications in immediate follow-up. We found significantly less incisional hernia in small bites techniques than large bites techniques ($P = 0.00001$). Fifty-four (26.73%) out of 202 patients in the large tissue bite group, while only 6 (4.92%) patients in small tissue bites developed an incisional hernia [Table 2].

DISCUSSION

General surgeons commonly use the midline incision for wide and rapid access to the general peritoneal cavity. Postoperative wound site complications are a significant source of morbidity after midline laparotomy. After laparotomy, the incidence of wound dehiscence and incisional herniae are 4%

Table 1: Study population characteristics

Characteristics	Large tissue bite	Small tissue bite	<i>P</i>
Age (years)	38.25	40.69	0.39
Sex (male: female ratio)	5.73	5.1	
BMI (mean kg/m ²)	24.94	24.91	0.11
Albumin (g/dl)	3	3	3
Type of surgery (percentage of elective vs. emergency)	31.68/68.32	22.13/77.87	0.72

BMI: Body mass index

Table 2: Wound-site complications

	Large bite closure, <i>n</i> (%)	Small bite closure, <i>n</i> (%)	<i>P</i>
Surgical site infection	72 (35.64)	24 (19.67)	0.002
Wound dehiscence	22 (10.89)	9 (7.38)	0.29
Incisional hernia	54 (26.73)	6 (4.92)	0.00001

and 5%–30%, respectively, resulting in increased pain, prolonged hospitalization, reduced quality of life, increased healthcare burden and cost, and enhance morbidity rates.^[7-10] Different innovations in techniques of closure of midline laparotomy incisions have a profound effect on preventing postoperative complications. The ideal technique is the one with reduced incidence of SSI, wound dehiscence, incision hernia, and, therefore, a better quality of life. A small bites technique with a suture length to wound length ratio of at least 4:1 is the current recommended method of fascial closure.^[11] Millbourn *et al.*^[12] demonstrated that small bite closure of midline incision resulted in significant less incisional hernias (5.6% vs. 18.0%; $P = 0.001$) and less SSIs (5.2% vs. 10.2%; $P = 0.02$). The objective of this study was to compare the suture techniques (small bite closure vs. large bite closure) and their effect on the incidence of postoperative wound site complications after midline laparotomy in our medical college hospital.

In our study, a total of 324 patients, 202 (62.35%) patients underwent midline wound closure with large bites, and 122 (37.75%) had small bite closure. Males (84.56%) outnumbered the females (15.43%) with M: F ratio of 5.48. The more preponderance of males could be due to heavy smoking, spicy meals, outdoor life, and higher trauma, and blast injuries rates in this conflict zone. A maximum number of patients were between 40 and 49 years of age ((34.57%) and the mean age in the study population was 39.17 years. There was no statistical difference between the two groups concerning age, sex, albumin levels, and BMI and these characteristics were similar in both the groups. Our findings are concordant with those of Millbourn *et al.*^[12]

Wound infection occurs when the suture site gets contaminated with microorganisms. Signs that a surgical wound has been infected include pain, warmth, redness around the wound site, and unexplained fever. In our study, 72 (35.64%) patients in the large tissue bite group and 24 (19.67%) patients in small tissue bite developed SSI. The difference was found to be statistically significant with a P value of 0.002. The patients with minor SSI were treated with culture-specific antibiotics,

wound care, and twice-daily anti-septic dressings. Infected sutures were removed to allow the pus to be evacuated completely. Thorough debridement and irrigation with normal saline, betadine, and antibiotics were made. Some patients with major SSI were subjected to secondary drainage procedures. These findings were compared with the study of de Vries *et al.*^[13]

Incisional hernia and wound dehiscence are notorious complications of midline laparotomy and a substantial cause of morbidity. Wound dehiscence refers to the premature splitting or bursting along the suture lines secondary to poor wound healing. Incisional hernia is the one that develops at previous surgical scar as a result of improper healing of fascial tissues. Clinically, it may present as a simple bulge over the operative scar on straining or sometimes as intestinal obstruction or strangulation. Acute wound failure (abdominal dehiscence) primarily develops 7–10 days postoperatively and may occur in approximately 1% to 3% of subjects who undergo the abdominal operation.^[14] Many factors, including patient-related factors, technical error in fascial closure, local wound factors, and type of surgery, may contribute to wound dehiscence. The incisional hernias are twice as common in women as in men and account for 15% to 20% of all abdominal wall hernias.^[14] The incidence of incisional hernia ranges from 3% to 20% after midline laparotomy. This rate doubles if the operation is associated with SSI.^[14] In our study, wound dehiscence and incisional herniae were 9.6% and 18.5%, respectively. About 15.8% of patients in large bites technique and 7.4% of patients in small bites technique developed wound dehiscence. 26.7% of patients in the large bite closure group, while only 4.9% of patients in the small bite closure group developed an incisional hernia. The difference was statistically significant ($P = 0.00001$). In the present study, SSI wound dehiscence and the incisional hernia were high. This can be attributed to several factors. Many patients were operated on in emergency settings. Furthermore, the poor setup of hospitals in low-income countries (lacking standard setup to maintain strict asepsis guidelines), poor hygiene of patients in developing countries, and delayed

presentation of our patients due to late referral from peripheral centers. In a systemic review by Rene H. Fortelny in 2018, the small bites technique results in significantly less incisional hernias than a large bites technique in an elective midline wound closure.^[15] The incidence of incisional hernia is significantly lower in small-bite closure than large-bite closure in other studies found in the literature.^[13,16]

CONCLUSION

A midline incision closed with small tissue bites is associated with lower postoperative wound site complications. This technique substantially reduces SSIs and wound dehiscence and results in a low incidence of incisional hernia. The conventional practice of large tissue bites should be changed to small-bite closure to avoid patient suffering and health-care burden in a low-resource setup like ours. The accident-emergency and general surgery residents, in particular, should be made familiar with this technique to avoid postoperative wound site complications and improve the quality of postoperative life.

Authors contributions

All the named authors fulfilled the ICMJE authorship criteria by substantial contribution to the conception and designing, data collection, and data interpretation. They all contributed to the drafting and revising of the manuscript for intellectual content and approval of its final version.

Financial support and sponsorship

Nil.

Conflicts of interest

There are no conflicts of interest.

Compliance with ethical principles

The study was approved by Institutional Ethical Committee (IEC) of the Government Medical

College, Jammu and Kashmir. Written informed consent was taken from all the patients before the procedure.

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