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Research Article

An Observational Study of Abdominal Wound Closure Using Small Tissue Bites versus Large Tissue Bites in Midline Laparotomy Surgeries

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ABSTRACT

Background: Small tissue bite fascial closure may reduce wound complications following midline laparotomy compared with conventional large bites.

Methods: This prospective comparative study included 50 patients undergoing midline laparotomy, equally allocated to small bite and large bite closure groups. Operative parameters, postoperative wound complications, incisional hernia, and hospital stay were compared.

Results: Baseline characteristics were comparable between groups. The small bite group had significantly greater suture length (74.8 ± 9.5 vs 51.6 ± 7.8 cm; $p<0.001$) and SL:WL ratio (4.5 ± 0.5 vs 3.0 ± 0.4; $p<0.001$). SSI (8.0% vs 20.0%), seroma (4.0% vs 12.0%), burst abdomen (0% vs 8.0%), and incisional hernia at 6 months (4.0% vs 16.0%) were lower with small bites, although differences were not statistically significant. Hospital stay was significantly shorter with small bite closure (7.0 ± 1.8 vs 8.2 ± 2.3 days; $p=0.04$).

Conclusion: Small tissue bite closure achieved a higher SL:WL ratio and shorter hospital stay, with a consistent trend toward fewer wound complications and incisional hernias.

Keywords: Midline Laparotomy, Small Bite, Fascial Closure, Surgical Site Infection, Incisional Hernia.

INTRODUCTION

Midline laparotomy is one of the most commonly performed abdominal incisions in general surgical practice because it provides rapid and wide access to the peritoneal cavity, causes minimal blood loss, and can be easily extended according to operative requirements[1]. Despite its technical simplicity, abdominal fascial closure following midline laparotomy remains an important determinant of postoperative outcomes[2]. Complications associated with inadequate wound closure include surgical site infection (SSI), wound dehiscence, seroma, suture sinus, chronic wound pain, and incisional hernia. The incidence of incisional hernia following midline laparotomy has been reported to range from 10% to 20% in elective cases and may exceed 30% among high-risk patients.[1,2] Incisional hernia can cause pain, impaired physical function, bowel obstruction, and reduced quality of life and may require subsequent surgical repair, adding substantially to healthcare burden.[3]Fascial wound healing is influenced by tissue perfusion, collagen synthesis and remodeling, infection, and mechanical forces acting on the abdominal wall. During the early postoperative period, fascial tensile strength remains limited and wound integrity largely depends on suture support. Excessive tension or tissue strangulation may impair local perfusion and collagen deposition, resulting in fascial separation and subsequent incisional hernia formation.[4,5] Therefore, an optimal closure technique should provide adequate mechanical strength while preserving tissue vascularity.

Traditionally, midline laparotomy wounds have been closed using the large tissue bite technique, in which sutures incorporate approximately 1–2 cm of fascia from the wound edge. Jenkins demonstrated the importance of maintaining a suture length-to-wound length (SL:WL) ratio of at least 4:1 to reduce the risk of wound disruption.[6] Subsequent studies emphasized continuous closure, adequate stitch spacing, and uniform distribution of tension across the wound.[7]The small tissue bite technique involves placement of sutures approximately 5–8 mm from the fascial edge and 5–8 mm apart, generally using a continuous slowly absorbable monofilament suture while maintaining an SL:WL ratio of at least 4:1. Smaller, closely spaced bites may provide more uniform distribution of tension, reduce tissue ischemia, preserve microvascular perfusion, and facilitate better fascial healing compared with conventional large bites.[8]The landmark STITCH trial demonstrated a significantly lower incidence of incisional hernia with small-bite closure compared with large-bite closure following elective midline laparotomy, without an increased risk of SSI or wound dehiscence.[9] Subsequent studies and meta-analyses have further supported the benefits of small-bite closure,[10,11] leading to its recommendation in contemporary abdominal wall closure guidelines.[12]However, much of the available evidence originates from elective surgical populations, while emergency laparotomies and patients with contaminated wounds or impaired wound healing remain relatively underrepresented. This is particularly relevant in the Indian setting, where patients undergoing emergency laparotomy may present with sepsis, anemia, malnutrition, and hypoalbuminemia, which can adversely affect wound healing.[13] Therefore, the present observational study was undertaken to compare abdominal wound closure using small tissue bites versus large tissue bites in patients undergoing midline laparotomy and to evaluate postoperative wound-related outcomes associated with these two closure techniques.

MATERIALS AND METHODS

This prospective, comparative, randomized, single-blind study was conducted in the Department of General Surgery, SGT Hospital and Medical College (FMHS), Budhera, Gurugram. The study was initiated after obtaining approval from the Institutional Ethics Committee (IEC).The study was conducted over a period of 18 months following IEC approval.

Study Population

Patients undergoing midline laparotomy in the Department of General Surgery during the study period were screened for eligibility and enrolled according to the predefined inclusion and exclusion criteria.

Inclusion Criteria

All patients aged >12 years undergoing midline laparotomy were included in the study.

Exclusion Criteria

Patients with a previous history of midline abdominal surgery and those undergoing midline laparotomy for mesh hernia repair were excluded.

Sample Size Calculation

A total of 50 patients were included, with 25 patients in each group.

Randomization and Blinding

Eligible patients were randomly allocated into two groups using a computer-generated random allocation sequence. Allocation was concealed using sequentially numbered sealed envelopes, which were opened before the procedure. Group A comprised 25 patients who underwent abdominal wall closure using the small tissue bite technique, whereas Group B comprised 25 patients who underwent closure using the large tissue bite technique. The study was single-blinded, with patients remaining unaware of their allocated closure technique.

Preoperative Management

Preoperative assessment, surgical preparation, antibiotic administration, and other aspects of perioperative patient management were performed according to the standard departmental protocol.

Operative Technique

Midline fascial closure was performed using a continuous monofilament polydioxanone violet delayed-absorbable suture in both groups. The groups differed with respect to the distance of the bite from the wound edge and the interval between consecutive stitches.

Group A: Small Tissue Bite Technique

In Group A, abdominal fascial closure was performed using a single continuous suture. Each bite was placed 5–7 mm from the wound edge, with an interval of 5–7 mm between consecutive stitches.

Group B: Large Tissue Bite Technique

In Group B, abdominal fascial closure was performed using a single continuous suture. Each bite was placed at least 10 mm from the wound edge, with an interval of at least 10 mm between consecutive stitches.

Postoperative Follow-up

Patients were assessed during hospitalization until discharge or the 7th postoperative day, whichever occurred earlier. Thereafter, follow-up assessments were performed at the 1st, 2nd, 3rd, and 6th postoperative months. Patients were evaluated for postoperative wound-related complications at each scheduled assessment.

Outcome Measures

The outcomes assessed were seroma, surgical site infection (SSI), wound dehiscence, and incisional hernia.

Seroma

Seroma was defined as a collection of clear serous or lymphatic fluid within the surgical site, predominantly in the subcutaneous plane, without evidence of infection.

Surgical Site Infection

SSI was defined by the presence of purulent discharge from the surgical wound along with a positive wound fluid culture.

Wound Dehiscence

Wound dehiscence was defined as disruption of any or all layers of the operated wound during the postoperative period.

Incisional Hernia

Incisional hernia was defined as a postoperative hernia occurring at the site of the surgical incision. It was diagnosed clinically by the presence of a palpable fascial defect with protruding swelling at the operative site demonstrating an expansile cough impulse during follow-up.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants before enrolment. Confidentiality of patient information was maintained throughout the study, and collected data were used solely for research purposes. Refusal to participate or withdrawal from the study did not interfere with the patient's subsequent medical care.

Statistical Analysis

Data were entered into Microsoft Excel and analyzed using the Statistical Package for the Social Sciences (SPSS) 21. Data were checked for completeness and accuracy before statistical analysis. Continuous variables such as age, body mass index (BMI), incision length, suture length, suture length-to-wound length (SL:WL) ratio, and duration of hospital stay were expressed as mean ± standard deviation (SD). Categorical variables, including sex, type of surgery (elective or emergency), comorbidities, and postoperative complications, were expressed as frequency and percentage [n (%)].Continuous variables were compared between the two groups using the independent-samples Student's t-test. Categorical variables were compared using the Chi-square test or Fisher's exact test, as appropriate. Odds ratios (ORs) were calculated to determine the strength of association between the closure technique and postoperative complications. Binary logistic regression analysis was performed, where applicable, to identify independent predictors of postoperative complications. All statistical tests were two-sided, and a p-value <0.05 was considered statistically significant.

RESULTS

A total of 50 patients were included in the study, with 25 patients each in the small bite and large bite groups.The mean age was 43.6 ± 11.8 years in the small bite group and 45.2 ± 12.4 years in the large bite group (p=0.68). Males constituted 64.0% (16/25) and 60.0% (15/25) of the respective groups (p=0.78). The mean BMI was comparable between the small bite and large bite groups (24.4 ± 3.1 vs 25.0 ± 3.3 kg/m²; p=0.52). Emergency surgery was performed in 60.0% and 64.0% of patients, respectively (p=0.77). Diabetes (16.0% vs 20.0%; p=0.71), smoking (20.0% vs 24.0%; p=0.73), and anemia (28.0% vs 32.0%; p=0.76) were also comparable between the two groups. None of the baseline demographic or clinical characteristics differed significantly between the groups (Table 1).The mean incision length was comparable between the small bite and large bite groups (16.5 ± 3.0 vs 17.1 ± 3.2 cm; p=0.55). However, the mean suture length was significantly greater in the small bite group (74.8 ± 9.5 vs 51.6 ± 7.8 cm; p<0.001). Similarly, the mean suture length-to-wound length (SL:WL) ratio was significantly higher in the small bite group (4.5 ± 0.5 vs 3.0 ± 0.4; p<0.001) (Table 2).

Surgical site infection occurred in 2 (8.0%) patients in the small bite group compared with 5 (20.0%) patients in the large bite group (p=0.22). Seroma was observed in 1 (4.0%) and 3 (12.0%) patients, respectively (p=0.29). No patient in the small bite group developed burst abdomen, whereas it occurred in 2 (8.0%) patients in the large bite group (p=0.14). Although early postoperative wound complications were numerically less frequent in the small bite group, none of these differences reached statistical significance (Table 3, Figure 1).

At 3 months, incisional hernia was observed in 1 (4.0%) patient in the small bite group compared with 3 (12.0%) patients in the large bite group (p=0.29). At 6 months, incisional hernia was present in 1 (4.0%) patient in the small bite group and 4 (16.0%) patients in the large bite group (p=0.16). Thus, the incidence of incisional hernia remained numerically lower with the small bite technique at both follow-up assessments, although the differences were not statistically significant (Table 4, Figure 2).The mean duration of hospital stay was significantly shorter in the small bite group compared with the large bite group (7.0 ± 1.8 vs 8.2 ± 2.3 days; p=0.04). This represented an approximately 1.2-day reduction in mean hospital stay with the small bite technique (Table 5).On binary logistic regression analysis, the large bite technique was associated with higher odds of postoperative complications (OR 2.8; p=0.08). Emergency surgery (OR 2.3; p=0.09) and diabetes (OR 2.0; p=0.11) were also associated with increased odds of postoperative complications. However, none of these risk factors demonstrated a statistically significant association at the conventional p<0.05 level (Table 6, Figure 3).

Table 1. Baseline Demographic and Clinical Characteristics of the Study Participants

Variable	Small bite (n=25)	Large bite (n=25)	p-value	Statistical test
Age (years), mean ± SD	43.6 ± 11.8	45.2 ± 12.4	0.68	Independent-samples t-test
Male, n (%)	16 (64.0)	15 (60.0)	0.78	Chi-square test
Female, n (%)	9 (36.0)	10 (40.0)	—	—
BMI (kg/m²), mean ± SD	24.4 ± 3.1	25.0 ± 3.3	0.52	Independent-samples t-test
Emergency surgery, n (%)	15 (60.0)	16 (64.0)	0.77	Chi-square test
Diabetes, n (%)	4 (16.0)	5 (20.0)	0.71	Fisher's exact test
Smoking, n (%)	5 (20.0)	6 (24.0)	0.73	Fisher's exact test
Anemia, n (%)	7 (28.0)	8 (32.0)	0.76	Chi-square test

Table 2. Comparison of Operative Parameters between the Study Groups

Operative parameter	Small bite (n=25)	Large bite (n=25)	p-value	Statistical test
Incision length (cm), mean ± SD	16.5 ± 3.0	17.1 ± 3.2	0.55	Independent-samples t-test
Suture length (cm), mean ± SD	74.8 ± 9.5	51.6 ± 7.8	<0.001	Independent-samples t-test
SL:WL ratio, mean ± SD	4.5 ± 0.5	3.0 ± 0.4	<0.001	Independent-samples t-test

Table 3. Comparison of Early Postoperative Wound Complications between the Study Groups

Complication	Small bite (n=25), n (%)	Large bite (n=25), n (%)	p-value	Statistical test
Surgical site infection	2 (8.0)	5 (20.0)	0.22	Fisher's exact test
Seroma	1 (4.0)	3 (12.0)	0.29	
Burst abdomen	0 (0.0)	2 (8.0)	0.14	

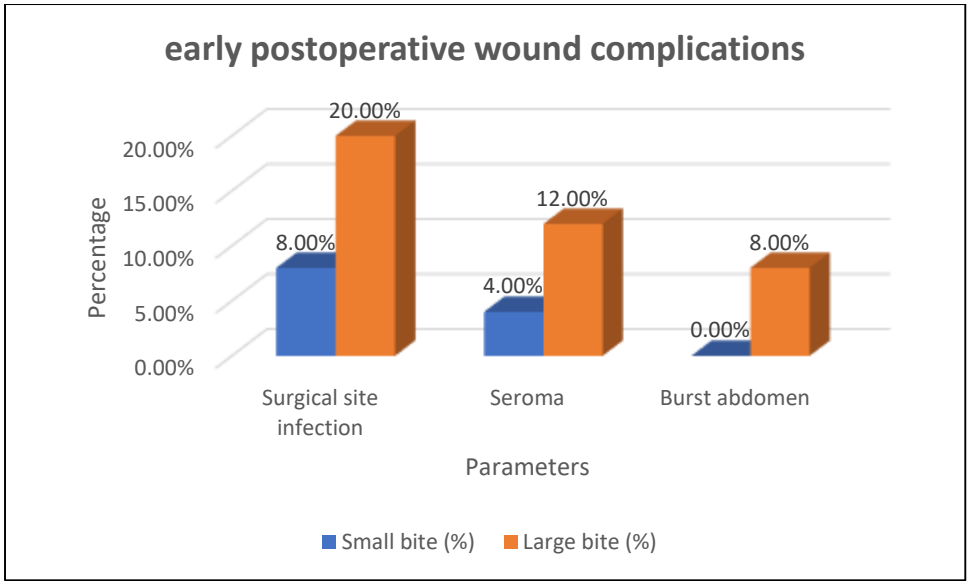

Figure 1. Comparison of Early Postoperative Wound Complications between the Study Groups

Table 4. Comparison of Incisional Hernia during Follow-up

Follow-up period	Small bite (n=25), n (%)	Large bite (n=25), n (%)	p-value	Statistical test
3 months	1 (4.0)	3 (12.0)	0.29	Fisher's exact test
6 months	1 (4.0)	4 (16.0)	0.16	

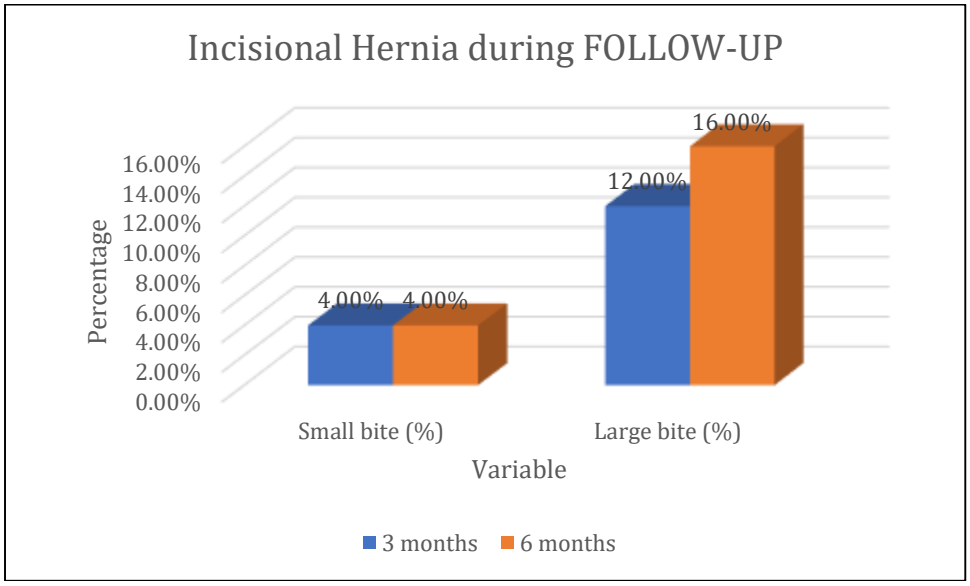

Figure 2. Comparison of Incisional Hernia during Follow-Up

Table 5. Comparison of Duration of Hospital Stay between the Study Groups

Parameter	Small bite (n=25)	Large bite (n=25)	p-value	Statistical test
Hospital stay (days), mean ± SD	7.0 ± 1.8	8.2 ± 2.3	0.04	Independent-samples t-test

Table 6. Risk Factor Analysis for Postoperative Complications

Risk factor	Odds ratio (OR)	p-value	Statistical test
Large bite technique	2.8	0.08	Binary logistic regression
Emergency surgery	2.3	0.09	
Diabetes	2.0	0.11	

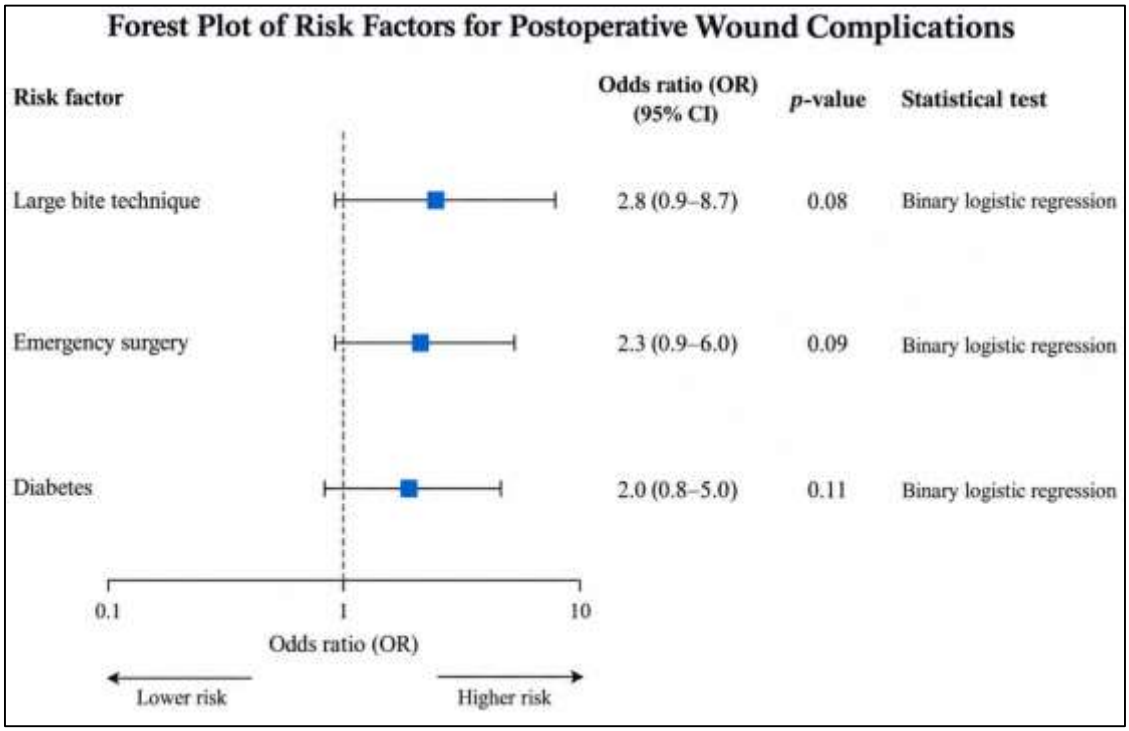

Figure 3. Risk Factor Analysis for Postoperative Complications

DISCUSSION

The two groups were comparable for age, sex, BMI, emergency surgery, diabetes, smoking, and anemia, with no statistically significant differences. This comparability is important because Sørensen (2012) [14] and Bickenbach et al. (2013) [15] reported that patient-related factors such as obesity, diabetes, smoking, anemia, and nutritional status may adversely affect wound healing. The high proportion of emergency procedures in both groups reflects routine surgical practice, where contamination and associated systemic factors may increase postoperative wound complications, as also reported by Srivastava et al. (2017) [16].Although incision length was comparable, suture length was significantly greater with small bite closure (74.8 ± 9.5 vs 51.6 ± 7.8 cm; p<0.001), resulting in a higher SL:WL ratio (4.5 ± 0.5 vs 3.0 ± 0.4; p<0.001). Jenkins (1976) [17] emphasized adequate suture length for preventing abdominal wound disruption, while Israelsson and Jonsson (1994) [7] highlighted the importance of an adequate SL:WL ratio. Similar findings were reported by Singh et al. (2018) [18]in an Indian population. Furthermore, the STITCH trial by Deerenberg et al. (2015) [9] demonstrated the clinical benefit of small bites for midline fascial closure.SSI (8.0% vs 20.0%), seroma (4.0% vs 12.0%), and burst abdomen (0% vs 8.0%) were less frequent in the small bite group, although the differences were not statistically significant. Sørensen (2012) [14] and Bickenbach et al. (2013) [15] highlighted the importance of tissue perfusion and wound-related factors in surgical healing. These findings are also consistent with the mechanical principles described by Jenkins (1976) [17] Diener et al. (2010) [19] demonstrated the importance of fascial closure technique in reducing postoperative complications, while Seiler et al. (2009) [20] reported that the method of abdominal fascial closure influences postoperative wound outcomes.Incisional hernia was less frequent with small bite closure at 3 months (4.0% vs 12.0%; p=0.29) and 6 months (4.0% vs 16.0%; p=0.16). Although not statistically significant, the direction of effect was consistent with the STITCH trial by Deerenberg et al. (2015) [9], which demonstrated fewer incisional hernias following small bite closure. Diener et al. (2010) [19] similarly supported optimization of fascial closure to reduce incisional hernia, while Muysoms et al. (2015) [21] emphasized evidence-based abdominal wall closure techniques in the European Hernia Society guidelines.

Hospital stay was significantly shorter in the small bite group (7.0 ± 1.8 vs 8.2 ± 2.3 days; p=0.04). This may be related to the lower frequency of postoperative wound complications and suggests a potential benefit

in postoperative recovery and healthcare resource utilization, consistent with general surgical principles described by Brunicardi et al. (2015) [22] and Townsend et al. (2021) [23].Large bite closure (OR=2.8; p=0.08), emergency surgery (OR=2.3; p=0.09), and diabetes (OR=2.0; p=0.11) showed increased odds of postoperative complications, although none reached statistical significance. Sørensen (2012) [14] and Bickenbach et al. (2013) [15] described diabetes and other patient-related factors as important determinants of wound healing, while Srivastava et al. (2017) [16] highlighted the clinical challenges associated with abdominal wall closure in emergency laparotomy. The higher odds with large bite closure suggest that closure technique may represent an important modifiable surgical factor.

CONCLUSION

Small tissue bite closure following midline laparotomy was associated with a higher SL ratio, fewer postoperative wound complications and incisional hernias, and a significantly shorter hospital stay compared with large bite closure. Although differences in individual wound complications were not statistically significant, the overall trend consistently favored the small bite technique. Small bite fascial closure may therefore represent a simple and effective technique for improving postoperative outcomes after midline laparotomy.

Limitations

The study was limited by its small sample size and single-centre design, which may have reduced the statistical power to detect differences in infrequent postoperative complications. The follow-up period of six months was relatively short for assessing the long-term incidence of incisional hernia.

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