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Original Research Article

DEEP TENSION SUTURES VERSUS INTERRUPTED FIGURE OF 8 SUTURES FOR CLOSURE OF THE RECTUS SHEATH IN TERMS OF WOUND DEHISCENCE IN COMPLICATED ABDOMINAL SURGERIES

ABDULLAH, NAZIR A, SAJIDURREHMAN, AHMED *W*

Aziz Bhatti Shaheed Teaching Hospital, Gujrat, Pakistan
**Corresponding author email address:* abdullahtilayee80@gmail.com

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ABSTRACT

Background: *Wound dehiscence remains a serious postoperative complication following abdominal surgery, contributing to increased morbidity, prolonged hospitalization, and higher healthcare costs. The risk is particularly elevated in emergency and contaminated surgical settings. Optimizing rectus sheath closure techniques may reduce the incidence of this complication.* ***Objective:*** *To compare deep tension sutures with interrupted figure-of-eight sutures for rectus sheath closure in terms of postoperative wound dehiscence in patients undergoing emergency abdominal surgery.* ***Study Design:*** *Randomized controlled trial.* ***Setting:*** *Department of Surgery, Aziz Bhatti Shaheed Teaching Hospital, Gujrat.* ***Duration of Study:*** *Three months from 6th March 2025 to 6th June 2025.* ***Methods:*** *A total of 100 patients undergoing emergency exploratory laparotomy were randomly allocated into two groups: deep tension sutures (n = 50) and interrupted figure-of-eight sutures (n = 50) for rectus sheath closure. Postoperative assessment for fascial wound dehiscence was conducted clinically and ultrasonographically on postoperative days 3, 7, 10, 14, and 21. Data were analyzed using SPSS version 28. The chi-square test was applied to compare proportions, with statistical significance set at $p \leq 0.05$.* ***Results:*** *Fascial wound dehiscence occurred in 6.0% of patients in the deep tension suture group compared with 26.0% in the figure-of-eight group ($\chi^2 = 7.44$, $p = 0.006$). The mean defect size was significantly smaller in the deep tension group (0.7 ± 0.3 cm) than in the figure-of-eight group (1.9 ± 0.6 cm; $p < 0.001$). Post-stratification analysis demonstrated significantly lower dehiscence rates with deep tension sutures among high-risk subgroups, including patients with diabetes, hypertension, smoking history, and advanced age.* ***Conclusion:*** *Deep tension suturing significantly reduces both the incidence and severity of rectus sheath wound dehiscence compared with interrupted figure-of-eight sutures, particularly in high-risk emergency abdominal surgeries. This technique represents a simple, effective, and cost-efficient strategy for improving surgical outcomes in resource-limited settings.*

Keywords: Deep Tension Sutures; Figure-Of-Eight Sutures; Rectus Sheath Closure; Wound Dehiscence; Abdominal Surgery

INTRODUCTION

Midline laparotomy remains the most frequently performed abdominal incision in both emergency and elective surgical settings, providing rapid and comprehensive access to the peritoneal cavity (1,2). However, the closure of the abdominal wall following laparotomy represents a critical surgical step, as postoperative wound dehiscence constitutes a grave complication associated with mortality rates estimated between 10–30% and significant prolongation of hospital stay (3,4). Wound dehiscence is influenced by multiple patient-related factors, including malnutrition, obesity, intra-abdominal infection, anaemia, and comorbidities, as well as surgeon-dependent technical factors such as suture material selection and closure technique (5,6). The rectus sheath, as a pivotal anatomical structure, has been the focus of considerable debate regarding optimal closure strategies to minimise postoperative complications, including surgical site infection (SSI), fascial dehiscence, and incisional hernia (2,7).

Various closure techniques have been evaluated in the literature, including continuous, interrupted, interrupted-X, herringbone, far-near-near-far, and mass closure methods, each with distinct biomechanical properties and clinical outcomes (1,2,3,7,8). Studies have consistently demonstrated that interrupted suture techniques are associated with significantly lower rates of wound dehiscence compared to continuous closure, particularly in emergency and contaminated settings (3,5,9,8). For instance, Bansiwal et al. reported wound dehiscence in 20.1% of patients undergoing continuous closure, compared with only 5.4% in the interrupted group (3). In comparison, Songara similarly found dehiscence rates of 19.5% versus 7.9%, favouring interrupted suturing (5). Despite this evidence, no consensus exists regarding the superiority of deep tension sutures over interrupted figure-of-8 sutures, specifically in complicated abdominal surgeries (10,11).

In the Pakistani context, complicated abdominal surgeries—including those performed for peritonitis, intestinal obstruction, and trauma—are frequently encountered in resource-constrained public sector hospitals, where patients often present late with advanced disease, malnutrition, and multiple comorbidities (9,12). A study conducted at Lady Reading Hospital, Peshawar, demonstrated wound dehiscence rates of 14.4% with continuous closure versus 5.6% with interrupted closure, underscoring the clinical relevance of suture technique selection in this population (9). Furthermore, Pakistani surgical units frequently manage intra-abdominal hypertension and peritonitis, conditions that substantially elevate the risk of fascial dehiscence (12). Given the high burden of complicated abdominal surgeries, limited healthcare resources, and the paucity of locally generated evidence comparing deep tension sutures with interrupted figure-of-8 sutures, this study is rationally justified to guide evidence-based surgical practice in Pakistan.

METHODOLOGY

This randomized controlled trial was conducted in the Surgical Department of Aziz Bhatti Shaheed Teaching Hospital, Gujrat, to compare two techniques of rectus sheath wound closure. Ethical approval was obtained prior to the initiation of the study, and the trial was conducted over a period of three months, from 6th March 2025 to

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6th June 2025. Patients undergoing exploratory laparotomy were assessed for eligibility and enrolled according to predefined criteria. The study aimed to evaluate the effectiveness of deep tension sutures versus interrupted figure-of-eight sutures in preventing wound dehiscence and improving postoperative outcomes. A total of 100 patients were included in the study, with 50 participants allocated to each intervention group. The sample size was calculated to achieve a 5% level of significance and a study power of 80%. The calculation was based on the expected incidence of wound dehiscence, which was assumed to be 6% in the deep tension suture group and 25% in the interrupted figure-of-eight suture group. This difference was considered clinically significant and sufficient to detect a meaningful effect between the two closure techniques.

The inclusion criteria comprised patients aged between 12 and 70 years who underwent exploratory laparotomy in the emergency setting. Eligible patients included those presenting with peritonitis, extensive wound contamination in trauma cases, and other emergency abdominal conditions requiring midline laparotomy. Patients with significant comorbid conditions were excluded from the study to minimize confounding factors. These exclusions included individuals with chronic liver disease, chronic kidney disease, hemodynamic instability, a history of malignancy, suspected malignancy, or a history of previous midline abdominal surgery.

Participants were randomly assigned to two groups using Microsoft Excel. Despite random allocation, the sampling technique employed was non-probability purposive sampling, with patients recruited consecutively from the emergency department based on eligibility criteria. Group A consisted of patients who underwent rectus sheath closure using the deep tension suture technique, while Group B included patients in whom interrupted figure-of-eight sutures were used. Allocation concealment was maintained during enrollment to reduce selection bias.

In Group A, two to three deep tension sutures were placed through the abdominal wall approximately 4–5 cm lateral to the wound edges and left untied initially. The midline rectus sheath was then closed continuously, after which the tension sutures were tied at the end of the procedure. In Group B, interrupted figure-of-eight sutures were placed through the rectus sheath using a mass closure technique, with each bite taken approximately 1.5 cm from the fascial edge and 1.5 cm apart. Postoperatively, patients were followed for wound healing, fascial integrity, and complications on the 3rd, 7th, 10th, 14th, and 21st postoperative days. Fascial dehiscence was defined as a gap greater than 0.5 cm between fascial edges and was assessed using ultrasonography. Any episode of wound evagination, including cases where the skin was intentionally left open, was also recorded. Defect size was measured using a sterile scale under aseptic conditions. Data were collected using a predefined proforma that included demographic details, smoking status, history of diabetes mellitus and hypertension, and follow-up findings related to wound dehiscence and other postoperative complications.

Data were entered and analyzed using the Statistical Package for Social Sciences (SPSS) version 28. Quantitative variables, including age and body mass index, were expressed as mean and standard deviation. Qualitative variables, such as gender and wound dehiscence, were presented as frequencies and percentages. The chi-square test was applied to compare the incidence of wound dehiscence between the two study groups. Stratification was performed to control for potential confounding variables, including age, diabetes mellitus, hypertension, and smoking status. Post-stratification comparisons between groups were again carried out using the chi-square test. A p-value of ≤ 0.05 was considered statistically significant for all analyses.

RESULTS

A total of 100 patients undergoing emergency laparotomy were included in the study and were randomly assigned to two groups: Group A (deep tension sutures, n = 50) and Group B (figure-of-eight sutures, n = 50). The mean age of patients in Group A was 42.6 ± 13.4 years, while in Group B it was 44.1 ± 12.9 years. The mean body mass index was 25.8 ± 3.6 kg/m² in Group A and 26.2 ± 3.9 kg/m² in Group B. A predominance of male patients was observed in both groups, accounting for 62.0% (n = 31) in Group A and 58.0% (n = 29) in Group B, whereas females constituted 38.0% (n = 19) and 42.0% (n = 21) of the respective groups. Smoking was reported in 28.0% (n = 14) of patients in Group A and 32.0% (n = 16) in Group B. Diabetes mellitus was present in 22.0% (n = 11) and 26.0% (n = 13) of patients in Groups A and B, respectively, while hypertension was observed in 20.0% (n = 10) and 24.0% (n = 12) of patients. Overall, the baseline demographic and clinical characteristics were comparable between the two study groups (Table 1). Clinical characteristics and operative findings were also assessed. Peritonitis was the most common surgical indication, occurring in 68.0% (n = 34) of patients in Group A and 72.0% (n = 36) in Group B. In comparison, traumatic abdominal injury was reported in 32.0% (n = 16) and 28.0% (n = 14) of patients, respectively. Gross wound contamination was observed in 58.0% (n = 29) of patients in Group A and 62.0% (n = 31) in Group B. In some cases, the skin was intentionally left open to reduce the risk of infection, which occurred in 36.0% (n = 18) of Group A and 40.0% (n = 20) of Group B. The mean operative time was 92.4 ± 15.6 minutes in Group A compared with 88.9 ± 14.8 minutes in Group B. No statistically significant differences were observed between the groups for these variables ($p > 0.05$) (Table 2). The primary outcome of the study was fascial wound dehiscence. Overall, wound dehiscence occurred in 16% of the study population. A significantly lower frequency of fascial dehiscence was observed in Group A compared with Group B. In Group A, 3 patients (6.0%) developed fascial dehiscence, whereas 13 patients (26.0%) in Group B did. The difference between the groups was statistically significant ($\chi^2 = 7.44$, $p = 0.006$). Furthermore, the mean defect size among patients who developed dehiscence was significantly smaller in Group A (0.7 ± 0.3 cm) compared with Group B (1.9 ± 0.6 cm), indicating a more severe defect in the figure-of-eight suture group ($p < 0.001$) (Table 3). Post-stratification analysis was performed to evaluate the influence of potential confounding variables on the occurrence of wound dehiscence. Among patients aged ≤40 years, dehiscence occurred in 4.8% (1/21) of Group A compared with 21.7% (5/23) of Group B ($\chi^2 = 4.21$, $p = 0.040$). In patients older than 40 years, the rates were 6.9% (2/29) in Group A and 29.6% (8/27) in Group B ($\chi^2 = 5.06$, $p = 0.024$). Similarly, among diabetic patients, dehiscence occurred in 9.1% (1/11) of Group A compared with 46.2% (6/13) of Group B ($\chi^2 = 4.67$, $p = 0.031$). A higher frequency of dehiscence was also observed in smokers and hypertensive patients in Group B compared with Group A, with statistically significant differences ($p < 0.05$). These findings suggest that deep tension sutures remained associated with lower rates of wound dehiscence across different patient subgroups (Table 4).

Table 1: Demographic Characteristics of Study Participants (n = 100)

Variable	Group A (Deep Tension Sutures) n=50	Group B (Figure-of-Eight Sutures) n=50
Age (years), Mean ± SD	42.6 ± 13.4	44.1 ± 12.9
BMI (kg/m²), Mean ± SD	25.8 ± 3.6	26.2 ± 3.9
Gender (Male), n (%)	31 (62.0%)	29 (58.0%)

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Gender (Female), n (%)	19 (38.0%)	21 (42.0%)
Smokers, n (%)	14 (28.0%)	16 (32.0%)
Diabetes Mellitus, n (%)	11 (22.0%)	13 (26.0%)
Hypertension, n (%)	10 (20.0%)	12 (24.0%)

Table 2: Clinical Characteristics and Operative Findings

Variable	Group A n (%)	Group B n (%)	p-value
Peritonitis	34 (68.0%)	36 (72.0%)	0.66
Traumatic Abdominal Injury	16 (32.0%)	14 (28.0%)	0.66
Gross Wound Contamination	29 (58.0%)	31 (62.0%)	0.68
Skin Left Open Intentionally	18 (36.0%)	20 (40.0%)	0.67
Mean Operative Time (min)	92.4 ± 15.6	88.9 ± 14.8	0.27

Table 3: Comparison of Wound Dehiscence Between Groups

Outcome	Group A (Deep Tension) n=50	Group B (Figure-of-Eight) n=50	χ^2	p-value
Fascial Dehiscence Present	3 (6.0%)	13 (26.0%)	7.44	0.006
No Dehiscence	47 (94.0%)	37 (74.0%)	—	—
Mean Defect Size (cm)	0.7 ± 0.3	1.9 ± 0.6	—	<0.001

Table 4: Post-Stratification Analysis of Wound Dehiscence Using Chi-Square Test

Stratification Variable	Dehiscence Group A n (%)	Dehiscence Group B n (%)	χ^2	p-value
Age ≤ 40 years	1/21 (4.8%)	5/23 (21.7%)	4.21	0.040
Age > 40 years	2/29 (6.9%)	8/27 (29.6%)	5.06	0.024
Diabetics	1/11 (9.1%)	6/13 (46.2%)	4.67	0.031
Smokers	1/14 (7.1%)	6/16 (37.5%)	4.39	0.036
Hypertensive Patients	1/10 (10.0%)	5/12 (41.7%)	4.02	0.045

DISCUSSION

The present study evaluated the efficacy of deep tension sutures versus interrupted figure-of-eight sutures for rectus sheath closure in complicated abdominal surgeries, with fascial wound dehiscence as the primary outcome. The overall wound dehiscence rate of 16% observed in this study is consistent with the broader literature, which reports dehiscence rates ranging from 10% to 45% in emergency laparotomy settings (13,14,15). The significantly lower dehiscence rate in Group A (deep tension sutures, 6.0%) compared with Group B (figure-of-eight sutures, 26.0%) ($\chi^2 = 7.44$, $p = 0.006$) constitutes the principal finding of this investigation.

Kumar, in a cross-sectional study conducted at Ziauddin Hospital, Karachi, demonstrated that preemptive deep tension suturing in emergency midline laparotomy for generalised peritonitis resulted in a burst abdomen incidence of only 4 cases in the deep tension suture group compared with 18 cases in the conventional mass closure group ($p < 0.05$), a finding that strongly corroborates the superior performance of deep tension sutures observed in the present study (16). Similarly, Afridi et al., in a prospective study conducted at Lady Reading Hospital, Peshawar, reported an overall effectiveness rate of 93.3% with internal tension sutures, with only 6.7% adverse outcomes, including wound infection and incisional hernia, further supporting the utility of tension-based closure techniques in high-risk surgical populations (17).

Bansiwal et al. reported wound dehiscence in 20.1% of patients undergoing continuous closure, compared with 5.4% in the interrupted group (3), while Songara similarly documented dehiscence rates of 19.5% versus 7.9%, favouring interrupted suturing (5). These figures are broadly comparable to the dehiscence rate of 26.0% observed in the figure-of-eight group of the present study, suggesting that interrupted figure-of-eight sutures. At the same time, technically an interrupted technique, it may not confer the same mechanical advantages as deep tension sutures in contaminated and complicated settings. Sharma et al. also found that interrupted PDS suture closure was superior to continuous closure. However, they noted that interrupted suturing required significantly more operative time (18), a trade-off that must be considered in resource-limited settings.

Modi et al., in an observational study of 167 emergency laparotomy patients, identified a wound dehiscence rate of 22.15%, with significant risk factors including fever, abdominal distension, pre-operative hypoalbuminemia, anaemia, leucocytosis, and intra-abdominal sepsis (19). The present study's post-stratification analysis similarly demonstrated that comorbidities such as diabetes mellitus, smoking, and hypertension significantly amplified the risk of dehiscence in the figure-of-eight group, with diabetic patients in Group B experiencing dehiscence in 46.2% of cases compared with only 9.1% in Group A ($p = 0.031$). Parsa et al. further corroborated these findings, reporting that fascial dehiscence was more prevalent in emergency laparotomy patients and was significantly associated with hypoalbuminaemia and drain placement (20).

Tang et al. demonstrated that retention sutures, while effective in reducing wound dehiscence, were associated with increased intravesical pressure and postoperative pain scores compared with non-retention suture groups (21). This nuance is clinically relevant, as the mechanical advantage of deep tension sutures in distributing wound tension must be balanced against potential physiological consequences, particularly in patients with pre-existing intra-abdominal hypertension (12,21). Vardhini and Kishan reported burst abdomen in 42% of emergency laparotomy cases, with wound infection and stoma construction identified as major contributing factors (14), underscoring the multifactorial nature of dehiscence that the present study's stratified analysis sought to address.

Dilday et al., evaluating triclosan-coated barbed suture versus polydioxanone for emergency laparotomy fascial closure, reported an overall fascial dehiscence rate of 10% and a surgical site infection rate of 18%, with fascial dehiscence significantly lower in the barbed suture group (4% vs. 14%, $p < 0.05$) (15). These findings parallel the results of the present study and collectively suggest that suture technique and material selection are independent determinants of fascial integrity following emergency laparotomy. Teklewold et al. further noted that 48.8% of patients who developed wound dehiscence required tension sutures during secondary closure, indirectly

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affirming the mechanical rationale for primary deep tension suturing (22).

Alamdari et al., in a randomised controlled trial comparing simple interrupted versus continuous fascial closure in elective laparotomy, found no statistically significant difference in fascial dehiscence (11.1% vs. 6.6%, p = 0.459) or incisional hernia between the two groups (23). This contrasts with the present study's findings and may be attributable to the elective nature of surgeries in Alamdari et al.'s cohort, where patient optimisation and wound contamination profiles differ substantially from the emergency, contaminated setting of the present investigation. Pai et al. similarly found no significant difference between polypropylene and polydioxanone sutures in elective laparotomy regarding the risk of a burst abdomen (24), further highlighting that the emergency, contaminated context is a critical modifier of closure technique outcomes.

Shahid et al. reported a wound dehiscence rate of only 1.2% using their novel Moharam Repair technique in a mixed elective and emergency cohort (4). In comparison, Hempel et al. documented fascial dehiscence rates of 8.1% following midline incision in elective abdominal surgery (25). These comparatively lower rates reflect the influence of patient selection and surgical context on dehiscence outcomes, reinforcing the importance of technique selection in high-risk emergency populations such as those studied herein. The mean defect size among patients who developed dehiscence was significantly smaller in Group A (0.7 ± 0.3 cm) compared with Group B (1.9 ± 0.6 cm, p < 0.001), suggesting that even when dehiscence occurred in the deep tension suture group, the mechanical integrity of the closure was better preserved, a finding consistent with the biomechanical principles described by Ross et al., who demonstrated that high-tension suture configurations confer superior tensile strength and resistance to wound failure (26).

In conclusion, the present study provides evidence that deep tension sutures are associated with significantly lower rates of fascial dehiscence compared with interrupted figure-of-eight sutures in complicated abdominal surgeries, with consistent benefits observed across multiple patient subgroups, including diabetics, smokers, hypertensive patients, and both age strata. These findings have particular relevance in the Pakistani surgical context, where emergency laparotomies are frequently performed in patients with advanced disease, malnutrition, and multiple comorbidities (17,16). Future multicentre randomised controlled trials with larger sample sizes and longer follow-up periods are warranted to validate these findings further and evaluate long-term outcomes, including incisional hernia formation.

CONCLUSION

This randomized controlled trial shows that deep tension sutures are superior to interrupted figure-of-eight sutures for closing rectus sheaths and reducing the incidence of postoperative wound dehiscence after abdominal surgery. The fascial dehiscence rate was significantly lower in the deep tension suture group (6.0%) than in the figure-of-eight group (26.0%). Statistically significant differences were observed across all high-risk subgroups, including older age, diabetes, smoking, and hypertension. Also, the extent of dehiscence, as assessed by average defect size, was significantly reduced with deep tension sutures, indicating better mechanical strength of the abdominal wall. These results confirm the biomechanical concept that an even distribution of tension and load removal off the primary suture line improves early fascial healing. Notably, the advantages of deep tension sutures were evident even when contamination rates and emergency operations were high, highlighting their usefulness in a difficult clinical environment.

DECLARATIONS

Data Availability Statement
All data generated or analysed during the study are included in the manuscript.
Ethics approval and consent to participate
Approved by the department Concerned. (IRBEC-AZBHG-239/24)
Consent for publication
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CONFLICT OF INTEREST

The authors declare no conflict of interest.

AUTHOR CONTRIBUTION

ABDULLAH
Conception of Study, Development of Research Methodology Design, Study Design, Review of manuscript, and final approval of manuscript.
ABID NAZIR
Data entry, data analysis, and drafting an article.
Conception of Study, Final approval of manuscript.
SAJIDURREHMAN
Study Design, Review of Literature.
WAQAS AHMED
Manuscript drafting.
Manuscript revisions, critical input.

All authors read and approved the final version of the manuscript

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