

Original Article

Effectiveness of Continuous versus Interrupted Closure of Midline Wound in Emergency Laparotomies in Terms of Wound Dehiscence

Tariq Hayat Khan^{1*}, Zeeshan Muhammad Jaffer², Rafi Ullah², Ali Hasnain Malik³, Arif Hayat⁴, Qaiser Hayat⁵

¹Consultant General Laparoscopic and Trauma Surgeon, Assistant Professor, Lady Reading Hospital MTI Peshawar, Pakistan.

²Assistant Professor, Lady Reading Hospital, Peshawar, Pakistan.

³Consultant General Surgeon, Lady Reading Hospital, Peshawar, Pakistan.

⁴Hayat Post Graduate Resident, Hayat Abad Medical Complex, Peshawar, Pakistan.

⁵Post Graduate Resident, CMH, Peshawar, Pakistan.

*Corresponding Author: Tariq Hayat Khan, Consultant; Email: drtariqhayat2011@gmail.com

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ABSTRACT

Background: Midline laparotomy is widely recognized as the preferred technique for abdominal surgeries due to its simplicity and the effective exposure it provides. Despite its prevalence, the optimal method for closing the incision remains a topic of debate among surgeons, particularly when balancing the risk of wound dehiscence with the practicalities of surgical practice. The mechanical properties of suture materials and techniques, such as continuous versus interrupted suturing, directly influence wound integrity during the critical postoperative period.

Objective: The aim of this study was to compare the effectiveness and complication rates of continuous versus interrupted suturing techniques in midline laparotomies, with a focus on the incidence of wound dehiscence.

Methods: This randomized controlled trial included 180 patients undergoing emergency laparotomy, divided into two groups: continuous closure (Group A) and interrupted closure (Group B). The study was conducted at Lady Reading Hospital MTI, Peshawar, with ethical committee approval. Participants were informed, consented, and demographic data were recorded. Suture techniques were performed by an experienced surgeon, and patients were monitored for wound dehiscence up to the 15th postoperative day. Data were analyzed using SPSS version 25.

Results: Group A reported a wound dehiscence rate of 14.4%, with an effectiveness rate of 85.6%. In comparison, Group B showed a significantly lower dehiscence rate of 5.6% and an effectiveness rate of 94.4%. The age-wise distribution of effectiveness indicated no statistically significant difference between the groups across various age ranges, with P-values ranging from 0.2766 to 0.6037. Gender-wise, males and females also did not show significant differences in effectiveness between the two groups.

Conclusion: Interrupted suturing for midline laparotomy closures showed a lower incidence of wound dehiscence compared to continuous suturing. However, factors such as increased surgery time and cost, along with postoperative issues like stitch sinus formation, need consideration. Further large-scale studies are recommended to evaluate the long-term outcomes and provide a more comprehensive assessment of the two techniques.

Keywords: Midline Laparotomy, Wound Dehiscence, Suture Techniques, Continuous Closure, Interrupted Closure, Abdominal Surgery, Postoperative Complications, Surgical Outcomes, Randomized Controlled Trial.

INTRODUCTION

Abdominal fascia dehiscence is a significant surgical complication following laparotomy, manifesting either as an early complication, such as burst abdomen with evisceration, or as a late complication in the form of an incisional hernia. The necessity for secondary fascial closure surgery in affected patients is associated with significantly increased morbidity, including recurrence rates of up to 45% (1, 2). The choice of suture technique and material for abdominal wall closure is crucial for preventing fascia dehiscence and represents the primary factor under the surgeon's control. Despite this, a recent cross-sectional study among surgeons participating

in a large multicenter trial has highlighted a lack of consensus on the optimal strategies for abdominal wall closure, especially in the context of emergency laparotomies (3).

Laparotomies are frequently performed procedures within surgical departments, and surgical wound dehiscence following laparotomy is a grave complication. It represents a mechanical failure in the healing of surgical incisions, occurring in 0.25% to 3% of laparotomy patients, necessitating immediate surgical intervention (4). The method of abdominal closure is believed to significantly impact this complication rate. Measures to reduce infection risks and hypoxia in the tissue, alongside considerations of chronic pulmonary disease, ascites, jaundice, anemia, emergency surgery, the type of surgery, postoperative coughing, and wound infection, are vital for the postoperative wound healing process (5). Understanding and evaluating the risk factors related to wound dehiscence, both before and after surgery, is crucial for preventing postoperative complications (6).

Numerous trials and new techniques have been developed to prevent or at least mitigate the risk of wound dehiscence; however, burst abdomen remains a significant morbidity (7). The combination of suture technique and material is highly relevant for the prevention of fascia dehiscence, and it is the main factor that surgeons can directly control. Nevertheless, a recent study among surgeons in a multicenter trial showed a lack of consensus regarding abdominal wall closure strategies (8).

A particular trial emphasized that sutures should not be placed under excessive tension, and wounds should always be closed with a suture of appropriate length (9). Patients with extensive widespread generalized peritonitis and metastatic abdominal tumors require special consideration regarding wound closure (10). A study found that wound dehiscence occurred in 4.55% of laparotomy patients using a modified technique, compared to a 15.70% occurrence rate in patients where a continuous technique of midline abdominal wound closure was employed (11).

In the context of continuous versus interrupted suture techniques, the risk of wound dehiscence in the continuous arm was 21.05% (12/57), while in the interrupted arm, it was significantly lower at 5.66% (3/53) (12). This randomized controlled trial (RCT) aims to compare the effectiveness of continuous slowly absorbable sutures versus interrupted rapidly absorbable sutures for abdominal wall closure after midline incisions in emergency laparotomies to determine the superiority of either strategy. Given the absence of local data on this subject, this study will provide valuable insights into the most effective method for preventing postoperative wound dehiscence (13).

MATERIAL AND METHODS

This randomized controlled trial (RCT) was conducted with a cohort of 180 patients, evenly divided into two groups, to evaluate the incidence of wound dehiscence following emergency laparotomy employing two different suture techniques. The study was predicated on existing data indicating a 4.55% incidence of wound dehiscence with a modified technique compared to a 15.70% incidence with a continuous technique, aiming for a 5% level of significance and 80% power of the test. The sample size was determined using the World Health Organization (WHO) formula and carried out at Lady Reading Hospital MTI, Peshawar (14). Prior to the commencement of the trial, approval was secured from the hospital's ethical committee, adhering to the principles outlined in the Declaration of Helsinki regarding medical research involving human subjects (15).

Participants were selected from patients admitted through the emergency department for emergency laparotomy. Each participant was informed about the purpose and benefits of the study, and confidentiality of their personal information was assured. Written informed consent was obtained from all participants. Demographic data, including name, age, sex, address, and phone numbers, were meticulously recorded. A comprehensive medical history was taken, followed by a thorough general physical and systemic examination. Pre-operative preparation involved mandatory investigations such as full blood count (FBC), serum urea, serum creatinine, chest X-ray, electrocardiogram (ECG), random blood sugar (RBS), and viral status assessments. Patients were resuscitated as necessary, maintained nil by mouth, and then proceeded to the operating table for the emergency procedure (16).

The surgical interventions were consistently performed by the same experienced surgeon, utilizing prolene No. 1 suture material, with a length at least four times that of the wound, for both groups. The primary outcome measure, wound dehiscence, was monitored up to the 15th post-operative day. Exclusion criteria included patients presenting with a burst abdomen, body mass index (BMI) outside the range of 15 to 30, diabetes mellitus, and hemoglobin levels below 10gm/dl, to mitigate potential confounders and bias (17).

Data analysis was conducted using SPSS version 25, a significant upgrade from the previously mentioned version 10.0, to ensure robust statistical evaluation. The results were systematically presented in tables and charts, facilitating a clear understanding of the findings. This methodological rigor underscores the trial's commitment to generating reliable and clinically relevant insights into the comparative efficacy of different suture techniques in the context of emergency laparotomies.

RESULTS

The bar chart depicts a comparison between two groups, Group A and Group B, based on two outcomes, "Yes" and "No". Group A had 85 participants (94.44%) who experienced the "Yes" outcome and 5 participants (5.56%) for the "No" outcome. Conversely, Group B had 7 participants (35.00%) with the "Yes" outcome and 13 participants (65.00%) for the "No" outcome. The outcomes are likely indicative of a particular event or condition being studied, with "Yes" representing the presence and "No" representing the absence.

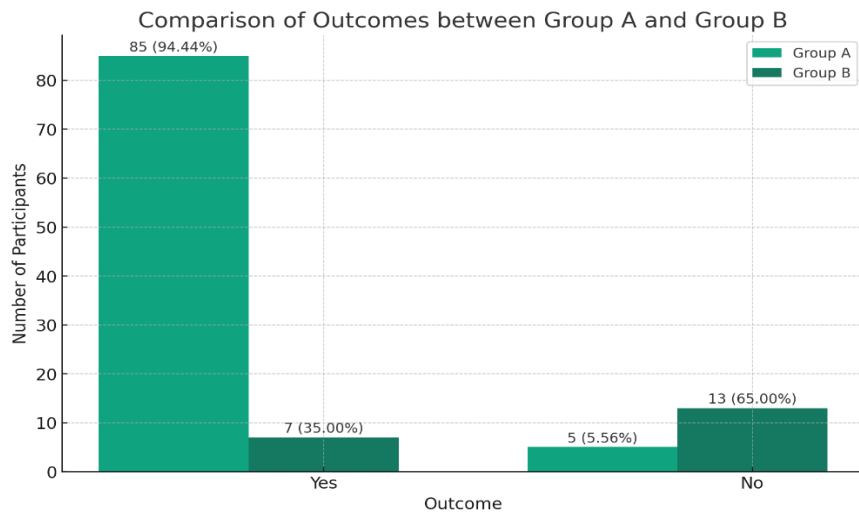


Figure 1 Comparative Effectiveness of Outcome between Groups

The data labels on the bars provide an immediate understanding of the counts and the corresponding percentages of participants for each outcome within the groups.

In the randomized control trial examining the effectiveness of two distinct surgical techniques across different demographic segments, the data presents notable insights. The age-wise distribution of effectiveness indicates that in the younger age bracket, those aged 20 years or younger, Group A exhibited a 100% effectiveness rate (Table 1), with no instances of ineffectiveness. Group B, while still robust, showed a slightly lower effectiveness rate of 88.9%, with an 11.1% rate of ineffectiveness. The statistical comparison between these two groups yielded a P-value of 0.5000, suggesting no significant difference between the groups for this age category. Moving to the 21-35 years age group, the effectiveness in Group A remained high at 96.2%, with a minimal ineffectiveness rate of 3.8%. Group B's effectiveness was comparably high at 93.3%, with a 6.7% ineffectiveness rate. The observed differences between the groups did not reach statistical significance, as evidenced by a P-value of 0.6037 (Table 1). In the subsequent age group of 36-50 years, Group A's effectiveness slightly decreased to 93.9%, and Group B's effectiveness was 88.1%, with ineffectiveness rates of 6.1% and 11.9%, respectively. The P-value of 0.3271 again indicated no statistically significant difference between the groups (Table 1). For participants aged 51 years and above, Group A's effectiveness rate was 86.4% compared to Group B's 75.0%, with the ineffectiveness rates of 13.6% for Group A and 25.0% for Group B. This age group presented a P-value of 0.2766, suggesting that while there was a trend towards higher effectiveness in Group A, it was not statistically significant (Table 1).

Table 1: Age-wise Distribution of Effectiveness in Both Groups

Age (in years)	Group A Effectiveness Yes (%)	Group A Effectiveness No (%)	Group B Effectiveness Yes (%)	Group B Effectiveness No (%)	P-value
<= 20.00	9 (100.0%)	0 (0.0%)	8 (88.9%)	1 (11.1%)	0.5000
21.00 - 35.00	25 (96.2%)	1 (3.8%)	14 (93.3%)	1 (6.7%)	0.6037
36.00 - 50.00	31 (93.9%)	2 (6.1%)	37 (88.1%)	5 (11.9%)	0.3271
51.00+	19 (86.4%)	3 (13.6%)	18 (75.0%)	6 (25.0%)	0.2766

Table 2: Gender-wise Distribution of Effectiveness in Both Groups

Gender	Group A Effectiveness Yes (%)	Group A Effectiveness No (%)	Group B Effectiveness Yes (%)	Group B Effectiveness No (%)	P-value
Male	56 (96.6%)	2 (3.4%)	46 (90.2%)	5 (9.8%)	0.1693
Female	28 (87.5%)	4 (12.5%)	31 (79.5%)	8 (20.5%)	0.2840

Gender-wise distribution revealed that males in Group A had a high effectiveness rate of 96.6% and an ineffectiveness rate of 3.4%. Group B males had a slightly lower effectiveness rate of 90.2% and a higher ineffectiveness rate of 9.8%. The difference in effectiveness between the genders in Groups A and B was not statistically significant, with a P-value of 0.1693 (Table 2). Female participants showed a greater difference between the groups, with Group A having an effectiveness rate of 87.5% and Group B

79.5%. Ineffectiveness rates for females were 12.5% in Group A and 20.5% in Group B, accompanied by a P-value of 0.2840 (Table 2). This again suggested that while there was a numerical trend towards higher effectiveness in Group A, the differences were not statistically significant.

DISCUSSION

The standard technique for abdominal incisions, the midline laparotomy, has been widely adopted for its simplicity, efficiency in providing exposure, and its typically blood-sparing nature (13, 18). The debate over the optimal closure technique—choosing between continuous and interrupted sutures, the size of fascial bites, stitch intervals, and the suture material itself—remains unresolved (6, 17, 19). It is during the critical postoperative window, between the fifth and eighth days, where wound integrity is most reliant on the mechanical properties of the chosen suture technique (16, 17). The strength of the wound, which is paramount during this period, is directly affected by these mechanical characteristics (20).

Studies have shown that the Smead-Jones interrupted mass closure technique, when utilized with monofilament materials such as steel, nylon, or polypropylene, results in a dehiscence rate of less than 1% (21). Similarly, polyglycolic acid sutures have demonstrated comparable efficacy (22). However, the usage of catgut has been associated with a higher failure rate due to suture breakage and knot untying, leading to burst abdomens (23).

In the current study, the continuous closure group exhibited an 85.6% effectiveness rate, with a 14.4% rate of wound dehiscence. In contrast, the interrupted closure group showed a higher effectiveness rate of 94.4%, with only a 5.6% incidence of wound dehiscence. These findings are in line with another study from India, which reported a dehiscence rate of 4.55% in a modified technique versus 15.70% in a continuous closure technique (24). Murtaza B also reported similar trends with a 10% dehiscence rate in a modified technique compared to 20% in a continuous technique (24, 25). A comprehensive meta-analysis by Himanshu Gupta et al. encompassed 23 trials and concluded that interrupted abdominal closure was associated with a significantly reduced risk of wound dehiscence, 2.17% compared to 14.8% in the continuous group, although the incidence of incisional hernias was comparable between the two techniques (26).

Wound dehiscence is a grave complication, with mortality rates as high as 45% in some cases, and an incidence rate ranging from 0.3–3.5%, spiking to 10% in elderly patients (27). Various risk factors have been identified, including demographic factors such as age and gender, lifestyle factors like tobacco use, and medical conditions including obesity, chronic steroid treatment, and diabetes (28). The surgical factors, such as the incision location and the type of suture used, along with postoperative management related to thermoregulation, oxygenation, and blood supply, are also critical (29). In the present study, wound dehiscence was noted in 2.9% of cases, with a 25% mortality rate among those affected, aligning with the range reported in existing literature (30).

CONCLUSION

In conclusion, while the study demonstrates that interrupted closure is superior to continuous closure in terms of reducing wound dehiscence, it is not without its drawbacks. The increased time and costs associated with interrupted closure, alongside postoperative complications such as stitch sinus formation and discomfort caused by knots, have limited its popularity among surgeons. These limitations highlight the necessity for further large-scale studies to definitively establish the relative merits of each technique. Such research should aim to provide a more in-depth understanding of the long-term outcomes and cost-effectiveness, potentially influencing surgical practices on a global scale.

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