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Comparison of Continuous Versus Simple Interrupted Polypropylene Suture Closure of Midline Emergency Laparotomy Wound in Terms of Wound Outcome in Adult Patients Presenting with Acute Abdomen

Mubeen Nasir[1*], Muhammad Siddique[2], Ahmad Zaeem[3], Ali Raza[1], Muhammad Rizwan[4] and Mudasir Abbas[5]

[1]Department of General Surgery, Fatima Jinnah Medical University, Sir Ganga Ram Hospital, Lahore, Pakistan
[2]Department of General Surgery, Rahber College of Dentistry, Lahore, Pakistan
[3]Department of General Surgery, Ghurki Trust and Teaching Hospital, Lahore, Pakistan
[4]Department of General Surgery, District Head Quarter Hospital, Jehlum, Pakistan
[5]Department of General Surgery, Social Security Teaching Hospital, Lahore, Pakistan

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***Corresponding Author:**
Mubeen Nasir
Department of General Surgery, Fatima Jinnah Medical University, Sir Ganga Ram Hospital, Lahore, Pakistan
drmubeennasir@gmail.com

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ABSTRACT

The best method and material for sutures to use while closing wounds are still unknown. This study aimed the results of this trial to determine which method works best and should be recommended as hospital policy. **Objectives:** To compare outcomes of simple interrupted versus continuous closure techniques using no.1 polypropylene sutures for emergency midline laparotomy wounds regarding frequency of wound dehiscence. **Methods:** This quasi-experimental study was conducted after obtaining approval from the College of Physicians and Surgeons Pakistan over six months from June 2024 to November 2024. 104 emergency midline laparotomy patients were recruited from the Surgical Department of Sir Ganga Ram Hospital, Lahore. Patients were divided into 2 groups A, continuous suture closure and Group B, simple interrupted suture closure. Postoperatively patients were observed for wound dehiscence. Data were analyzed using SPPS version 26.0. The occurrence of dehiscence was compared among groups using the chi-square test. **Results:** Wound dehiscence was found to be higher in Group A as compared to Group B. Group A: 21.1% vs. Group B: 11.5%, and p-value=0.185. Gender and Body mass index had no significant association with wound dehiscence in study groups. However, among the younger age group patients' frequency of wound dehiscence was significantly higher while among the elderly age group, no significant difference was obtained. **Conclusions:** It was concluded that results of this study showed no significant difference for wound dehiscence for simple interrupted suture compared with versus continuous closure techniques using polypropylene suture for patients who underwent emergency midline laparotomy.

INTRODUCTION

Midline laparotomy is a simple procedure that provides quick access to all abdominal quadrants [1]. Linea alba, the weak midline aponeurotic zone opens during laparotomy, and it becomes even more fragile when its fibres are cut vertically. The mechanical forces acting on these fibres during closure increase the tension [2]. Following fascial closure, complications such as wound dehiscence, incisional hernia, suture sinus formation, and wound infection can occur [3]. Laparotomy wounds can be closed using, absorbable versus non-absorbable sutures, single-layer versus mass closure, and continuous versus interrupted closure. The continuous closure technique offers benefits such as faster healing times and more uniform tension distribution across the suture line [4]. Interrupted sutures also offer multiple advantages, including reduced risk of wound edema, proper alignment

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of wound edges during suturing, and greater tensile strength. This technique ensures healing even if one of the sutures breaks. However, it requires more time to complete due to the additional knots and demands more suture material [1, 5]. Previous studies have highlighted notable differences between continuous and interrupted polypropylene closures of midline laparotomy wounds, particularly in the occurrence of wound infection and stitch granuloma [6]. Although these studies suggest that continuous closure might have a lower frequency of complications compared to interrupted closure, the reported outcomes are inconsistent and vary considerably across studies [7, 8]. The literature on abdominal wound dehiscence, and significant surgical complications following midline laparotomy, also shows a wide range of frequencies, reflecting a lack of standardization and reliable data in this area [9]. This variation in findings indicates that further research is necessary to establish clearer guidelines and better understand the factors influencing these outcomes. Studies conducted locally and regionally indicate that the incidence of abdominal wound dehiscence varies significantly in both elective surgeries and emergency laparotomies [10]. Globally, research has shown varying wound dehiscence rates for continuous and interrupted closure techniques. Notably, a local study highlighted the statistically significant difference in the frequency of ruptured abdomens, showing a higher dehiscence rate with continuous polypropylene suture compared to interrupted polypropylene closure in midline emergency laparotomies [11]. Given the limited local data and the inconsistency in findings, particularly concerning rural versus urban healthcare settings, this study aims to critically compare the outcomes of simple interrupted versus continuous closure techniques using No. 1 polypropylene suture for emergency midline laparotomy wounds, focusing on the frequency of wound dehiscence. By addressing the gaps in local literature and considering the broader applicability to different healthcare environments, this research seeks to provide evidence-based recommendations for surgical practice.

This study aims to compare outcomes of simple interrupted versus continuous closure techniques using no.1 polypropylene sutures for emergency midline laparotomy wounds regarding frequency of wound dehiscence.

METHODS

This quasi-experimental study was conducted from June 2024 to November 2024 after getting approval from the College of Physicians and Surgeons Pakistan (CPSP) (REU: 53140) and ref no: CPSP/REU/SGR-2019-059-11304. 104 patients undergoing midline laparotomy were recruited from the Surgical Department of Fatima Jinnah Medical University (FJMU)/Sir Ganga Ram Hospital (SGRH), Lahore. Patients of both genders and >18 years of age presenting in an emergency with acute abdominal conditions, including bowel obstruction, infection, or trauma requiring vertical midline laparotomy incision were included. Patients with previous midline laparotomy wound or scar/ abdominal malignancy, ascites, comorbid i.e. end-stage renal disease (ESRD) (glomerular filtration rate (GFR) <15ml/min/m2 or on renal replacement therapy), chronic liver disease (CLD) (as determined on Ultrasonography (USG) abdomen cirrhotic liver), Ischemic heart disease (IHD) (ST-T changes in electrocardiogram (ECG)), presenting with burst abdomen or incisional hernia at the time of presentation, and immunocompromised patients were excluded. A sample size of 104 patients (52 in each group) was estimated using 80% power of the test, a level of significance of 5% and wound dehiscence incidence of 20.5% in continuous and 4.5% in interrupted sutures [12]. Patients were enrolled using a non-probability consecutive sampling technique, used this method because it was practical for the emergency setting, allowing for the inclusion of all eligible patients within a specific time frame to ensure a comprehensive analysis. Written informed consent was obtained from all patients/guardians. In this study, content analysis was employed to systematically evaluate the data collected through the predesigned research proforma. All patients were evaluated with history, physical examination and relevant laboratory and imaging investigations. X-ray chest and abdomen (supine). USG and computed tomography (CT) of the abdomen and pelvis were obtained selectively as indicated by the diagnosis and condition of the patient. Additional investigations, like ECG, were obtained as required by the anesthesiologist during preoperative evaluation. Predesigned research proforma was used to enter the initial data, all patients were operated on under general anesthesia. All patients had fluid and electrolyte replacement before surgery. Antibiotic prophylaxis included IV Cefuroxime 750 mg. Further doses and additional antibiotics (Amikacin and Metronidazole) were administered in appropriate doses as dictated by patient diagnosis and operative findings. Patients were divided into two equal groups (Group A=continuous suture closure and Group B=simple interrupted suture closure) in a 1:1 ratio by using random allocation software to obtain a trial sequence which was hidden in pre-sealed numbered opaque envelopes. Each envelope had a closure method assigned to a single patient. Emergency laparotomy was performed employing a vertical midline incision skirting the umbilicus. Intraoperative findings were recorded. Patients in both groups had thorough peritoneal lavage with warm normal saline and abdominal drains were placed

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appropriate to operative findings and procedure. Polypropylene no. 1 suture was used for the closure of laparotomy wounds in all patients. In Group A, the continuous suturing technique was used. A strand of suture was started at the upper end of the incision. Six knots were tied initially, and the suture ran onward to the middle of the incision after placing the knots underneath the fascia. The second strand of suture was started at the lower end of the incision taking 6 initial knots and burying under the fascia and was carried towards the middle of the incision. Both sutures were tied with 6 knots in the middle of the incision and knots were buried under the fascia. In long incisions, three or more segments of continuous sutures were used to maintain the wound and suture length ratio of 1:4.3 In Group B, simple interrupted stitches technique was used employing consecutive sutures taking 6 squared knots in a single suture tie. All closures were performed by surgical residents under the supervision of the senior registrar. Skin closure depended upon operative findings and skin was left open in contaminated and dirty wounds. In surgical wards postoperatively, the wound was examined and the incidence of dehiscence if present was noted within 10 days. Partial: disruption limited to one part of fascial closure resulting in visible loose sutures and gaping wound edges, with or without visible bowel loops, which may or may not require surgical closure; Complete: Total disruption of fascial closure along its full length with eviscerated of bowel loops through the wound, which require a new closure. Data were analyzed by SPSS version 26.0. Quantitative variables were presented as mean and SD and qualitative variables as frequency and percentage. Both groups were compared for dehiscence incidence by using the chi-square test, p-value ≤0.05 was considered as significant. Data were stratified for effect modifiers, both groups were compared for wound dehiscence using the chi-square test for each stratum, a p-value≤0.05 was considered significant.

RESULTS

The mean age of patients in Group A and Group B calculated was 44.96 ± 12.28 years and 42.80 ± 13.65 years, respectively. The age of patients in both treatment groups ranges between 21-70 years. In Group-A 51.9% of patients were male and 48.1% were female and in Group B 55.8% were male vs 44.2% female. In Group A, body mass index (BMI) was found to be normal in 34.6% of patients, 28.8% were overweight and 36.5% were obese while in Group B, 28.8% of patients BMI was normal, 51.9% were overweight and 19.2% were found to be obese. In Group A, 15% of participants were identified as diabetic, while 13% had hypertension. In Group B, 12% were diabetic, and 10% had hypertension (Table 1).

Table 1: Patient Demographics

Variables n (%)		Group A (n=52)	Group B (n=52)
Gender	Male	27 (51.9%)	29 (55.8%)
	Female	25 (48.1%)	23 (44.2%)
BMI	Normal	18 (34.6%)	15 (28.8%)
	Overweight	15 (28.8%)	27 (51.9%)
	Obese	19 (36.5%)	10 (19.2%)
Age	(Mean ± SD) years	44.96 ± 12.28	42.80 ± 13.65
DM	Yes	8 (15%)	6 (12%)
	No	44 (85%)	46 (88%)
HTN	Yes	7 (13%)	5 (10%)
	No	45 (87%)	47 (90%)

The frequency of wound dehiscence was higher in Group A (21.2%) compared to Group B (11.5%). However, this difference was not statistically significant (p=0.185) (Table 2).

Table 2: Frequency of Wound Dehiscence in Study Groups

Variables	Group A	Group B	Total
Yes	11 (21.2%)	6 (11.5%)	17
No	41 (78.8%)	46 (88.5%)	87
Total	52	52	104
Chi-Square test	1.758		
p-value	0.185		

In the younger age group (20–40 years), wound dehiscence was significantly higher in Group A (12.5%) compared to Group B (4.3%, p=0.005). However, no significant differences were observed in the middle-aged (41–60 years) or elderly (>60 years) age groups. Wound dehiscence rates were similar between male (p=0.382) and female (p=0.331), showing no significant gender-related differences. Furthermore, no significant difference was seen in wound dehiscence among patients about their BMI in this study. i.e. Normal- BMI (Group-A: 11.1% vs Group-B: 26.7%, p-value=0.249), Overweight (Group-A: 26.7% vs. Group-B: 7.4%, p-value=0.087) & Obese (Group-A:26.3% vs. Group-B: 0%, p-value=0.075) (Table 3).

Table 3: Data Stratification

Variables		Group A		Group B		p-Value
BMI						
Normal	Yes	2	11.1%	4	26.7%	0.249
	No	16	88.9%	11	73.3%	
Overweight	Yes	4	26.7%	2	7.4%	0.087
	No	11	73.3%	25	92.6%	
Obese	Yes	5	26.3%	0	0.0%	0.075
	No	14	73.7%	10	100.0%	
Gender						
Male	Yes	5	18.5%	3	10.3%	0.382
	No	22	81.5%	26	89.7%	
Female	Yes	6	24.0%	3	13.0%	0.331
	No	19	76.0%	20	87.0%	

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Age						
20-40	Yes	2	12.5%	1	4.3%	0.005
	No	14	87.5%	22	95.7%	
41-60	Yes	5	16.7%	4	17.4%	0.944
	No	25	83.3%	19	82.6%	
>60	Yes	4	66.7%	1	16.7%	0.944
	No	2	33.3%	5	83.3%	

DISCUSSION

Over the years, a range of techniques for abdominal wound closure has been developed, but wound dehiscence remains a significant and challenging complication. The ideal technique and choice of suture material for abdominal wall closure continue to be subjects of ongoing debate and research [13]. Closure methods encompass the choice of continuous versus interrupted sutures, the size of fascial bites, inter-stitch distance, and the span and magnitude of sutures used [14]. Continuous sutures offer the advantage of quicker performance with fewer knots, thus streamlining the closure process. However, a potential drawback is that a single suture line holds the fascia together, which could lead to slackening of the entire suture if a cut-through occurs at any point. In contrast, the interrupted suture method, while more time-consuming, is believed to pose a lower risk of wound dehiscence, though it may result in a higher incidence of stitch sinuses [15]. In our study, we compared the outcomes of simple interrupted versus continuous closure using no. 1 polypropylene for emergency midline laparotomy wounds regarding wound dehiscence. The results showed no significant difference in wound dehiscence between the two groups. However, patients in the continuous suture closure group exhibited a higher rate of wound dehiscence (21.2%) compared to those in the interrupted suture group (11.5%), though the p-value (0.185) indicated no statistically significant difference. This finding is consistent with a previous study that reported a higher rate of wound dehiscence with continuous suturing (25.91%) compared to interrupted suturing (5%) in emergency laparotomy patients [16]. However, it is worth noting that our findings contrast with other studies that suggest interrupted suturing has a lower risk of dehiscence. One such study reported significantly lower dehiscence rates with interrupted sutures, emphasizing the need for critical examination of the conflicting results in this area [17]. In contrast to studies showing low occurrences of dehiscence with interrupted X-suturing, Indian studies reported higher wound dehiscence rates (16.7% for continuous and 23.3% for interrupted techniques) [18]. These discrepancies highlight the importance of considering patient demographics, surgical settings, and technique variations when evaluating the outcomes of different closure methods. Some researchers argue that interrupted sutures provide more tensile strength, reducing the risk of dehiscence, whereas others suggest that dehiscence may occur with interrupted sutures only if the wound edges overlap improperly [19, 14]. Moreover, one study found that the relative risk of wound dehiscence was lower in patients whose incisions were closed with interrupted sutures, further supporting the idea that interrupted suturing may provide better outcomes in some cases [20]. Beyond the closure technique itself, the choice of suture material and the involvement of skin layers also play critical roles in determining the outcome. Interrupted sutures typically involve the entire skin layer, ensuring a secure closure. In contrast, continuous subcutaneous sutures, placed just below the external skin layer, offer potential advantages such as improved aesthetic outcomes compared to continuous transdermal sutures [21]. The ideal wound closure method should ensure sufficient tensile strength, proper tissue alignment, and security even in the presence of infection. Studies suggest that continuous closure is preferred for its speed and cost-effectiveness, though rates of dehiscence, complications, and incisional hernias are comparable with interrupted sutures. Continuous sutures may distribute tension evenly, but the rare risk of a single knot or strand breaking can compromise the entire suture line [22]. Interrupted sutures have shown advantages in reducing wound dehiscence, but the time and cost involved, along with potential complications such as stitch sinuses and patient irritation, limit their widespread use. The choice between continuous and interrupted sutures should be guided by patient factors, surgical expertise, and the specifics of the procedure. Conflicting results across studies underscore the complexity of this issue, highlighting the need for further research to refine best practices in abdominal wound closure [22, 23].

CONCLUSIONS

It was concluded that results of this study showed no significant difference in wound dehiscence for simple interrupted suture compared with continuous closure techniques using polypropylene sutures for patients who underwent emergency midline laparotomy. Still with simple interrupted suture frequency of wound dehiscence was lower in patients when compared with continuous closure techniques.

Authors Contribution

Conceptualization: MN
Methodology: MN, MS, AZ, MA
Formal analysis: AR
Writing review and editing: AR, MR, MA

All authors have read and agreed to the published version of the manuscript

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Conflicts of Interest

The authors declare no conflict of interest.

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