

A Comparative Study between Continuous and X-Interrupted Suturing For Mass Closure Using Non-Absorbable Sutures in Emergency Exploratory Laparotomy

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Abstract

Background: Emergency exploratory laparotomy is a life-saving procedure performed under urgent conditions. The choice of abdominal wall closure technique significantly affects postoperative outcomes, including wound healing, infection, and dehiscence. While continuous suturing is faster and commonly used, interrupted (X-pattern) suturing may provide better strength and resistance to complications. Evidence comparing these techniques, particularly with non-absorbable sutures in emergency settings, remains limited.

Aims: This study compares the efficacy and outcomes of continuous versus X-interrupted mass closure using non-absorbable sutures in patients undergoing emergency exploratory laparotomy.

Methodology: A total of 100 patients undergoing emergency midline laparotomy were randomly divided into two groups: Group A (Interrupted X-mass closure) and Group B (Continuous mass closure), with 50 patients each. Parameters assessed included operative times, wound healing duration, postoperative pain scores, infection rates, and complications.

Results: Both groups were comparable in age, gender, and surgical indications. Closure time was significantly shorter in Group B, whereas Group A showed significantly faster wound healing ($p < 0.001$). Postoperative wound infection, pain scores, and complications (suture sinus, gaping, dehiscence) were significantly higher in the continuous closure group ($p < 0.05$).

Conclusion: While continuous suturing reduces closure time, X-interrupted suturing results in superior wound healing and fewer postoperative complications, making it a safer and more effective technique for abdominal wall closure in emergency laparotomies.

Keywords: Emergency laparotomy, abdominal closure, continuous sutures, interrupted sutures, wound dehiscence, surgical site infection.

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Introduction

Emergency exploratory laparotomy is a crucial procedure for various intra-abdominal pathologies such as trauma, bowel obstruction, perforation, and peritonitis [1, 2]. The most popular method for opening the abdomen is the midline laparotomy because it is simple to execute, allows for quick exposure with minimal blood loss, and adequately exposes all four quadrants [2].

The quality of the abdominal wall closure following laparotomy has a substantial impact on patient outcomes [3, 4]. Significant postoperative problems include wound dehiscence, incisional

hernias (IH), and surgical site infections (SSI) [3, 4]. The incidence of IHs after major abdominal surgery varies between 2 and 40% [5], while abdominal surgical wound dehiscence can occur up to 3% of the time and is linked to a 25% fatality rate [6].

Surgeons have a number of options for sealing the abdominal fascia, primarily categorized into layered closure and mass closure [11, 27]. Continuous fascial closure (mass closure) with a single stitch distributes tension evenly and is expedited, making it appropriate for emergency

situations [11]. Conversely, interrupted sutures—specifically the X-interrupted technique—arrange sutures in an X pattern, each tied independently [12]. This provides better localized tension distribution and protection against complete wound dehiscence in the event that one suture breaks [12].

The selection of the best abdominal closure method is critical in resource-limited healthcare systems where patients frequently arrive late with severe illness, malnutrition, or contaminated tissues. This study aims to compare the intra-operative and post-operative outcomes of continuous versus X-interrupted mass closure utilizing non-absorbable sutures in exploratory laparotomies.

Materials and Methodology

Study Design and Setting: A randomized control study was conducted from May 2023 to October 2024 at the Department of General Surgery, Basaveshwara Medical College and Hospital, Chitradurga.

Participants:

A total of 100 patients aged 15–75 years undergoing emergency exploratory laparotomy via midline incisions were selected.

Patients were randomized using computer-aided random numbers into two equal groups of 50.

- Group A underwent X-Interrupted Mass Peritoneal Closure.
- Group B underwent Continuous Mass Peritoneal Closure.

Exclusion criteria included immunocompromised patients, those on chemotherapy/long-term steroids, previous incisional hernias, and re-laparotomies.

Surgical Technique: In all cases, the incision did not extend below the level of the arcuate line. Both groups received single-layer closure utilizing No. 1 Prolene curved cutting needle.

Data Collection & Follow-up: Variables recorded included operative time, closure time, and length of incision. Postoperative parameters included wound infection, wound dehiscence, pain (VAS score), and other complications followed up at 1st and 3rd months.

Statistical Analysis: Data was analyzed utilizing GraphPad InStat v3.0. Independent Sample t-tests or Mann Whitney U tests were used for continuous measurements, and Chi-square or Fisher's exact tests for categorical observations, with a p-value <0.05 considered significant.

Observations and Results

Demographics and Baseline Characteristics: The mean age was 40.46 ± 12.24 years in Group A and 36.98 ± 11.49 years in Group B ($p=0.683$). Group A comprised 28% females and 72% males, whereas Group B comprised 24% females and 76% males. ASA status, co-morbidities, and type of anesthesia administered were comparable between the two groups.

Operative Outcomes: There was no significant difference in total surgical time or the length of the incision between the two groups. However, the time taken for fascial closure was significantly lower in the Continuous closure group.

Table 1: Variable of Group A and Group B

Variable	Group A (Interrupted)	Group B (Continuous)	p-value
Time taken for surgery (min)	89.00 ± 26.26	85.50 ± 26.83	0.885
Length of incision (cm)	15.58 ± 2.28	15.58 ± 2.36	0.9904
Time taken for closure (min)	15.20 ± 2.67	13.70 ± 3.16	0.019*
Duration of wound healing (days)	14.12 ± 0.33	15.10 ± 2.33	<0.001*

*Statistically significant

Post-operative Pain (VAS Scores): Patients in Group B (Continuous) experienced significantly higher pain scores at 12, 48, and 72 hours post-surgery compared to Group A (Interrupted).

Table 2: Time Post-Op of Group A and Group B

Time Post-Op	Group A (Mean $\pm$ SD)	Group B (Mean $\pm$ SD)	p-value
12 Hours	9.70 ± 4.26	10.76 ± 4.24	<0.001*
48 Hours	8.70 ± 4.26	9.76 ± 4.24	<0.001*
72 Hours	7.70 ± 4.26	8.76 ± 4.24	<0.001*

*Statistically significant

Post-operative Complications: Group A exhibited 0% infection rates on days 3, 5, and 7, whereas Group B demonstrated infection rates of 18%, 16%, and 16% respectively, which was highly significant ($p<0.05$).

Table 3: Complication of Group A and Group B

Complication	Group A (%)	Group B (%)	p-value
Suture Sinus	0%	18%	0.002*
Wound gaping and dehiscence	0%	18%	0.002*
Pain around suture line	0%	12%	0.02*
Abdominal distention	0%	6%	0.20

*Statistically significant

Discussion

An ideal abdominal wall closure should provide strong, tension-free approximation to prevent wound dehiscence and incisional hernia while maintaining tissue vascularity to promote healing [8, 10]. Our study highlights crucial differences between continuous and X-interrupted closure methods in emergency settings.

Consistent with demographic trends in similar studies, we noted a higher proportion of male patients undergoing emergency laparotomy (74% overall), which is often attributed to greater occupational exposure to trauma and higher rates of lifestyle-related gastrointestinal conditions [19]. The leading indications for surgery—colonic mass obstruction, duodenal perforations, and adhesions—reflect the acute, life-threatening pathologies typical in our region [20, 21].

Our data confirms that continuous suturing is faster (13.70 vs 15.20 minutes, $p=0.019$), utilizing a single uninterrupted thread that expedites closure [13]. However, this speed comes at the cost of higher complication rates [15, 18]. A major limitation of continuous closure is that failure at a single point can compromise the entire suture line [13]. In our study, continuous closure was associated with an 18% rate of wound gaping/dehiscence, 18% suture sinus formation, and significantly higher SSI rates compared to zero such instances in the interrupted group [17, 18].

These findings align with prior literature; for instance, Shashikala V et al. reported a dehiscence rate of 26.7% in continuous versus 6.7% in interrupted closures [18]. Furthermore, wound healing duration was significantly prolonged in the continuous group (15.10 vs 14.12 days, $p<0.001$), accompanied by greater postoperative pain at 12, 48, and 72 hours. X-interrupted suturing, by allowing independent, segmental tension control, minimizes the risk of total wound dehiscence if one stitch fails, proving to be far more resilient in contaminated or high-tension wounds [16, 17, 18].

Conclusion

This comparative study demonstrates that while continuous mass closure using non-absorbable sutures offers a faster fascial closure time in emergency exploratory laparotomies, it is associated with a significantly higher burden of postoperative complications [15, 18]. The

continuous technique resulted in prolonged wound healing, elevated pain scores, and increased incidences of wound dehiscence, infection, and suture sinus [15, 17, 18].

Conversely, the X-interrupted suturing technique, despite requiring marginally more time to execute, provided superior clinical outcomes [16, 18]. It fostered faster wound healing, substantially lower infection rates, and minimized severe postoperative wound failures [16, 18]. Therefore, X-interrupted closure is the safer, more effective, and preferred technique for abdominal wall closure in the challenging conditions of emergency laparotomy [16, 17, 18].

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