

Comparative study between continuous and interrupted suturing for rectus sheath closure in exploratory laparotomy



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ABSTRACT

Background: Exploratory laparotomy is a major surgical procedure. Midline laparotomy is the most common technique of opening the abdomen as it is simple, provides adequate exposure to all four quadrants, and affords quick exposure with minimal blood loss. Laparotomy wounds have been closed in various ways in terms of continuous versus interrupted closure, single layer versus mass closure, and absorbable versus non-absorbable sutures. **Aims and Objectives:** The aim of the study was to find out the technique of rectus sheath closure in patients undergoing exploratory laparotomy that can reduce the burden of complications in post-operative period. **Materials and Methods:** It is a hospital-based prospective randomized observational study which was conducted in a rural-based tertiary care hospital and medical college with a time frame of about 1½ years. A total number of 74 patients of adult age group (21–70 yrs) admitted in general surgery ward of Bankura Sammilani Medical College and Hospital, undergoing exploratory laparotomy. **Results:** Thirty-seven (50%) patients of midline laparotomy were closed in continuous technique. Rest 37 (50%) patients were closed in interrupted technique. The hospital stay was similar in both groups. There was no significant difference in incidence of wound infection ($P=0.4687$). Wound dehiscence and requirement of burst abdomen repair was significantly higher in continuous suture group as compared to interrupted suture group, but mean closure time ($P<0.0001$) and mean suture length ($P=0.0436$) were significantly higher in interrupted suture group. **Conclusion:** The major complication of emergency laparotomy is wound dehiscence which leads to increased morbidity and subsequent requirement of re-operation of burst abdomen and hospital cost. In our study, we found that interrupted suturing method of abdominal closure is better in respect to major post-operative complications though it requires more suture length and time.

Key words: Interrupted suturing; Continuous suturing; Rectus sheath closure; Exploratory laparotomy; Wound dehiscence; Burst abdomen

INTRODUCTION

Exploratory laparotomy is a major surgical procedure. Midline laparotomy is the most common technique of opening the abdomen as it is simple, provides adequate exposure to all four quadrants, and affords quick exposure with minimal blood loss.¹

A midline laparotomy requires opening of linea alba which is a weak and tendinous zone. The weakness of the linea

alba is enhanced when its fibers are vertically sectioned to access the peritoneal cavity. Thus, when closing the linea alba using sutures, these fibers are subjected to the tension induced by the mechanical forces that act on it.²

Laparotomy wounds have been closed in various ways in terms of continuous versus interrupted closure, single layer versus mass closure, and absorbable versus non-absorbable sutures. The continuous sutures have the advantage of evenly distributed tension across the suture line and being

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more expedient. It has the disadvantage of being a single suture holding the fascia together. The multiple interrupted suture method has been used successfully for many years, but it has the disadvantage of being time consuming to perform and of isolating the tension of each individual stitch.^{3,4}

The complications which may arise following fascial closure include wound dehiscence, wound infection, incisional hernia, and suture sinus formation. They may arise partly as a result of poor technique, faulty selection of suture material, and patient's factors; however, the most important causes are poor surgical technique, persistent intra-abdominal pressure, and local necrosis due to infection.^{3,4}

Elective patients with adequate nutritional status and otherwise free from risk factors related to dehiscence, type of closure may not be so important, but in emergency patients with multiple risk factors for developing dehiscence or burst abdomen, it may prove decisive. There is no best wound closure method that would be suitable for all situations. Therefore, the correct choice of suturing technique is vital. A marked reduction in the incidence of burst abdomen can be achieved by utilizing employing a correct technique of abdominal closure.⁵

A major surgical complication after emergency midline laparotomy is abdominal fascial dehiscence. It may appear either as an early (burst abdomen with evisceration and partial dehiscence) or a late (incisional hernia) complication. Post-operative complete wound dehiscence is an unfortunate condition and serious complication is associated with a high morbidity and mortality rate. These patients usually undergo multiple dressings, fecal fistula formation, and surgery for secondary fascial closure, which is associated with markedly increased morbidity, with high incidence of incisional hernia (up to 45%).⁶

The choice of method of closure may not be very crucial in patients undergoing elective laparotomy with adequate nutritional status and no other risk factor for burst, but in developing countries such as India, most patients present with one or more risk factors such as prolonged intra-peritoneal sepsis and malnutrition.⁷

Aims and objectives

General

The aim of the study was to compare the intra-operative and post-operative outcome of continuous and interrupted suturing for rectus sheath closure in exploratory laparotomy.

Specific objectives

The objective of this study was to find out the superior technique of midline closure in patients undergoing

exploratory laparotomy that can reduce the burden of post-operative complications.

MATERIALS AND METHODS

The present study was a hospital-based prospective randomized observational study which was conducted in a rural-based tertiary care hospital and medical college with a time frame of about 1½ years from ethical approval. A total number of 74 patients of age group 21–70 years admitted in general surgery ward of Bankura Sammilani Medical College and Hospital, undergoing exploratory laparotomy.

Inclusion criteria

All patients presenting in emergency surgical ward who undergone exploratory laparotomy through midline incision were included in the study.

Exclusion criteria

The following criteria were excluded from the study:

- 1) Patients under the age of 18 years
- 2) Patients with previous abdominal surgery with midline incision scar.
- 3) Patients with comorbid conditions such as renal failure, malignancy, undergoing radio or chemotherapy, and collagen vascular disease.
- 4) Patients with increased intra-abdominal pressure intraoperatively.

RESULTS

We found that in continuous suturing, the mean closure time (Mean±S.D) of patients was 30.9459±4.3966. In interrupted suturing, the mean closure time (Mean±S.D) of patients was 40.9459±8.0517. Difference of mean closure time with both technique of suturing was statistically significant (P<0.0001), as shown in Table 1.

In continuous suturing, the mean suture length (Mean±S.D) of patients was 87.7297±10.2107. In interrupted suturing, the mean suture length (Mean±S.D) of patients was 94.8649±18.5025. Difference of mean suture length with both technique of suturing was statistically significant (P=0.0436), as shown in Table 2.

In continuous suturing, the mean hospital stay (Mean±S.D) of patients was 9.4324±4.8964. In interrupted suturing, the mean hospital stay (Mean±S.D) of patients was 8.0270±2.0479. Difference of mean hospital stay with both technique of suturing was not statistically significant (P=0.1116), as shown in Table 3.

In continuous suturing, 15 (40.5%) patients had wound infection. In interrupted suturing, 12 (32.4%) patients had

wound infection. Association of wound infection versus technique of suturing was not statistically significant ($p=0.4687$), as shown in Table 4.

In continuous suturing, 8 (21.6%) patients had wound dehiscence. There was no wound dehiscence in interrupted suturing. Association of wound dehiscence versus technique of suturing was statistically significant ($P=0.0027$), as shown in Table 5.

In continuous suturing, 15 (40.5%) patients had requirement of reoperation in interrupted suturing, 12 (32.4%) patients had requirement of reoperation. Association of requirement of reoperation versus technique of suturing was not statistically significant ($P=0.4687$), as shown in Table 6.

In continuous suturing, 8 (21.6%) patients had enmass closure of burst abdomen and 7 (18.9%) patients had secondary suturing. In interrupted suturing, no patient had to undergo enmass closure of burst abdomen, 12 (32.4%) had secondary suturing. Association of type of reoperation versus technique of suturing was statistically significant ($P=0.0086$), as shown in Table 7.

DISCUSSION

The best method of abdominal closure is one that maintains tensile strength throughout the healing process with good tissue approximation, does not promote wound infection or inflammation, is well tolerated by patients, and is technically simple and expedient. The specific technique used in closure of abdominal fascia for the individual is frequently based on non-scientific factors. Because of difficulties arising from differently tailored study designs, the surgical literature has not clearly demonstrated an optimal technique to close abdominal fascia, especially in emergency settings.

Agrawal et al.,⁸ found that the study included 139 male and 35 female patients between the ages of 10 and 75 years. The incidence of wound infection ($P=0.656$), dehiscence ($P=0.997$), and incisional hernia ($P=0.930$) at 3 months and 4 years ($P=0.910$) was not statistically significant. There was no sinus formation in Groups A and B, however, two patients of Group C and six patients of Group D did develop suture sinus ($P=0.003$). Suture material and technique of closure do not influence wound outcome in patients of peritonitis except for a significantly lower incidence of sinus formation when non-absorbable sutures are used.

Kumar and Hastir⁹ (2017) found that in post-operative period patients closed by mass closure technique, 8 patients (16%) had post-operative complications in the form of seroma in 2 patients (4%), infection in 3 patients (6%), wound gaping in 2 patients (4%), and incisional hernia in 1 patient (2%) and no patient had burst abdomen whereas in layered closure, total 16 (32%) patients had complications as seroma in 5 patients (10%), wound infection in 4 patients (8%), gaping in 4 patients (8%) burst abdomen in 1 patient (2%), and incisional hernia in 2 patients (4%). Single-layered closure technique is better than layered closure in term of operation time and post-operative complications such as a seroma, infection, wound gaping, burst an abdomen, and incisional hernia.

Abd El Shahid et al.,¹⁰ found that wound infection was noticed in 12/168 (7.2%) cases and 2/168 (1.2%) patients developed wound dehiscence. The present study demonstrates that new technique (Moharam Repair) of abdominal wall closure after midline laparotomies is efficient in reducing post-operative wound dehiscence (burst abdomen). Hence, this technique is applicable, safe, and can minimize morbidities and mortalities related to wound dehiscence

Table 1: Distribution of mean closure time: Technique of suturing

Closure time	Number	Mean	SD	Minimum	Maximum	Median	P-value
Continuous suturing	37	30.9459	4.3966	25.0000	40.0000	30.0000	<0.0001
Interrupted suturing	37	40.9459	8.0517	30.0000	50.0000	40.0000	

Table 2: Distribution of mean suture length: Technique of suturing

Suture length	Number	Mean	SD	Minimum	Maximum	Median	P-value
Continuous suturing	37	87.7297	10.2107	70.0000	100.0000	90.0000	0.0436
Interrupted suturing	37	94.864	18.502	70.0000	120.0000	100.00	

Table 3: Distribution of mean hospital stay: Technique of suturing

Hospital stay	Number	Mean	SD	Minimum	Maximum	Median	P-value
Continuous suturing	37	9.4324	4.8964	5.0000	20.0000	7.0000	0.1116
Interrupted suturing	37	8.0270	2.0479	5.0000	12.0000	7.0000	

Table 4: Association between wound infection: Technique of suturing

Wound infection	Continuous suturing	Interrupted suturing	Total
Wound infection present	15 (40.5%)	12 (32.4%)	27 (100%)
Wound infection absent	22 (46.8%)	25 (53.2%)	47 (100%)
Total	37	37	74

Chi-square: 0.5248; P: 0.4687, Odds Ratio: 0.7040 (0.2720, 1.8223)

Table 5: Association between wound dehiscence: Technique of suturing

Wound dehiscence	continuous suturing	interrupted suturing	Total
Wound dehiscence occurred	8 (21.6%)	0 (0%)	8 (100%)
Wound dehiscence did not occur	29 (43.9%)	37 (56.1%)	66 (100%)
Total	37	37	74

Chi-square: 8.9697; P: 0.0027

Table 6: Association between requirement of reoperation: Technique of suturing

Requirement of reoperation	Continuous suturing	Interrupted suturing	Total
Reoperation required	15 (55.6%)	12 (44.4%)	27 (100%)
Reoperation did not require	22 (46.8%)	25 (53.2%)	47 (100%)
Total	37	37	74

Chi-square: 0.5248; P: 0.4687, Odds Ratio: 0.7040 (0.2720, 1.8223)

Table 7: Association between type of reoperation: Technique of suturing

Type of reoperation	Continuous suturing	Interrupted suturing	Total
Enmass closure of burst abdomen	8 (100%)	0 (0%)	8 (100%)
Secondary suturing	7 (36.8%)	12 (63.2%)	19 (100%)
Reoperation not required	22 (46.8%)	25 (53.2%)	47 (100%)
Total	37	37	74

Chi-square: 9.5073; P: 0.0086

(as a short-term complication) after midline exploratory laparotomies.

Rahman et al.,¹¹ found that total 14% wound infection was detected in interrupted suture group whereas wound infection was 18% in continuous suture group of wound closure. Although the wound infection is higher in Group-II but the difference of wound infection is not statistically significant between two groups. The wound pain assessed

in 7 post-operative days was higher in continuous closure group than interrupted group but the difference was not significant. There is no significant difference of wound infection and wound pain between interrupted and continuous suture group in clean-contaminated laparotomy.

Balaji et al.,¹² found group a was found to have less wound dehiscence (P=0.001 for partial and P=0.008 for complete) and less period of hospital stay (P=0.054), which were statistically significant. Surgical site infections were similar in both groups. Group B was found to have less time taken for closure (P=0.003) and less length of suture material used (P=0.003), which were statistically significant. Interrupted-x technique of rectus sheath closure reduces the rate of wound dehiscence and period of hospital stay, although it consumes more length of suture material and more time for suturing as compared to conventional continuous closure.

We showed that in continuous, 15 (40.5%) patients had wound infection. In interrupted, 12 (32.4%) patients had wound infection. Association of wound infection versus technique of suturing was not statistically significant (P=0.4687). In continuous, 8 (21.6%) patients had wound dehiscence. Association of wound dehiscence versus technique of suturing was statistically significant (P=0.0027). In continuous, 15 (40.5%) patients had requirement of reoperation. In interrupted, 12 (32.4%) patients had requirement of reoperation. Association of requirement of reoperation versus technique of suturing was not statistically significant (P=0.4687). In continuous, 8 (21.6%) patients had enmass closure of burst abdomen and 7 (18.9%) patients had secondary suturing. In interrupted, no patient had to undergo enmass closure of burst abdomen and 12 (32.4%) patients had secondary suturing. Association of type of reoperation versus technique of suturing was statistically significant (P=0.0086).

Singal et al.,¹³ found that the incidence rates of wound infection, dehiscence, suture sinus formation, and incisional hernia were recorded. The patients were followed up for a period of 1 year. Out of the 60 patients, the rates of wound pain, discharge, and dehiscence in Group A were 30%, 23.3%, and 26.7% and in Group B were 6.7%, 16.6%, and 23.3%. There was zero burst abdomen in Group A compared to one burst abdomen in Group B. Suture sinus formation, chronic wound infection, and stitch granuloma were one each in Group A and were zero in Group B. Incisional hernia was not found in any of the group.

Hansda and Hansda¹⁴ (2018) found that mean post-operative hospital stay was 9.1 ± 3.6 days (Range 3–30 days) and was affected by the post-operative course. Post-operative complications seen in 40.8% and it was affected by indication for surgery, $P=0.01$. The complications encountered were wound infection, sepsis, chest infection, DVT, wound dehiscence, and incisional hernia in 29.6%, 6.8%, 3.4%, 1%, 0.5%, and 0.5%, respectively.

We found that in continuous, the mean hospital stay (Mean \pm S.D) of patients was 9.4324 ± 4.8964 . In interrupted, the mean hospital stay (Mean \pm S.D) of patients was 8.0270 ± 2.0479 . Difference of mean hospital stay with both technique of suturing was not statistically significant ($P=0.1116$).

Limitations of the study

In spite of every sincere effort my study has lacunae.

The notable short comings of this study are:

1. The study has been done in a single centre.
2. The study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

CONCLUSION

The study found that use of continuous suturing technique is less time consuming. The mean closure time was higher in interrupted suturing technique compared to continuous suturing technique that was statistically significant. The mean suture length was higher in interrupted suturing technique compared to continuous suturing technique that was statistically significant. We found that hospital stay was not significant difference in two groups. It was found that association of wound infection with technique of suturing was not statistically significant. Wound dehiscence was more in continuous suturing technique compared to interrupted suturing technique, which was statistically significant. In our study, requirement of reoperation was not significant difference in two groups. Secondary suturing was more in interrupted suturing technique compared to continuous suturing technique, which was statistically significant. Requirement of enmass closure of burst abdomen is more in continuous suturing technique, which is statistically significant, so the major complication of emergency laparotomy is wound dehiscence which leads to increased morbidity and subsequent requirement of re-operation of burst abdomen and hospital cost. In our study, we found that interrupted suturing method of abdominal closure is better in respect to major post-operative complications though it requires more suture length and time.

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REFERENCES

1. Murtaza B, Saeed S and Sharif MA. Postoperative complications in emergency surgery versus elective laparotomy at a peripheral hospital. *J Ayub Med Coll Abbottabad*. 2010;22(3):42-47.
2. Bellon JM, Lopez PP, Allue RS, Sotomayor S, Kohler BP, Pena E, et al. New suture materials for midline laparotomy closure: An experimental study. *BMC Surg*. 2014;14:70. <https://doi.org/10.1186/1471-2482-14-70>
3. Riou JP, Cohen JR and Johnson H. Factors influencing wound dehiscence. *Am J Surg*. 1992;163(3):324-330. [https://doi.org/10.1016/0002-9610\(92\)90014-i](https://doi.org/10.1016/0002-9610(92)90014-i)
4. Ceydeli A, Rucinski J and Wise L. Finding the best abdominal closure: An evidence-based review of literature. *Curr Surg*. 2005;62(2):220-225. <https://doi.org/10.1016/j.cursur.2004.08.014>
5. Jenkins TP. The burst abdominal wound: A mechanical approach. *Br J Surg*. 1976;63(11):873-876. <https://doi.org/10.1002/bjs.1800631110>
6. Sharma S, Sunkaria BL and Singh G. A comparative study of laparotomy wounds closed with interrupted-X technique and conventional continuous closures with Vicryl. *J Evol Med Dent Sci*. 2017;13(6):1710-1713.
7. Agrawal CS, Tiwari P, Mishra S, Rao A and Hadke NS. Interrupted abdominal closure prevents burst: randomized controlled trial comparing interrupted-X and conventional continuous closures in surgical and gynecological patients. *Ind J Surg*. 2014;76(4):270-276. <https://doi.org/10.1007/s12262-012-0611-8>
8. Agrawal V, Sharma N, Joshi MK and Minocha VR. Role of suture material and technique of closure in wound outcome following laparotomy for peritonitis. *Trop Gastroenterol*. 2010;30(4):237-240.
9. Kumar R and Hastir A. Prospective clinical study: Mass closure versus layer closure of the abdominal wall. *Indian J Sleep Med*. 2017;3(4):228-233.
10. Abd El Shahid MA, Mahmoud FA and Elmallah AS. Evaluation of a new technique for abdominal wall closure in midline laparotomies. *Int Surg J*. 2018;5(8):2701-2707. <http://dx.doi.org/10.18203/2349-2902.isj20183188>
11. Rahman MM, Azad AS, Mawla MG, Alam MM and Rahman MM. Outcome of abdominal wound closure following continuous and interrupted suture in elective laparotomy. *Faridpur Med Coll J*. 2013;8(2):73-76.
12. Balaji C, Neogi S, Ramasamy S and Vats M. Comparison of

- interrupted-X technique closure versus conventional continuous closure of rectus sheath: A randomized control study. *Int Surg J.* 2019;6(9):3233-3237.
13. Singal R, Kumar M, Kaushik N, Dhar S and Singh B. A comparative study of polydioxanone and nylon for abdominal wall closure with interrupted figure of eight in peritonitis cases. *J Curr Surg.* 2016;6(3-4):65-72.
14. Hansda D and Hansda L. Evaluation of abdominal closure technique in emergency laparotomies at a tertiary care hospital in Jharkhand. *IOSR J Dent Med Sci.* 2018;17(7):55-58. <https://doi.org/10.9790/0853-1707145558>

Authors Contribution:

SR- Manuscript preparation, data collection, and literature search; **KK-** Conceptualized the study, literature search, data analysis and interpretation, and revision of manuscript; **SD-** Literature search and prepared first draft; and **SSK-** Concept and design of the study, reviewed the literature and revision of manuscript, and literature search.

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This work is attributed to all my patients, my teachers, my parents and Almighty god.

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