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Original Research Article

Comparative Study of Single Layer Closure versus Conventional Layer Closure of Laparotomy Wounds

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Abstract:

Background: Following a laparotomy, the objective of wound closure is to restore the abdominal wall's functionality. Layered closure, the modified Smead-Jones technique, mass closure, retention suture, or a combination of these methods are the methods used to close the anterior abdominal wall. The advantage of mass continuous sutures is that they retain the fascia together, according to research that contrasted interrupted and continuous suture procedures. In this study, patients undergoing laparotomy by midline incision in a tertiary care hospital are compared between two techniques: layered closure and single layer closure (mass closure).

Methods: The study included 97 patients undergoing either emergency or elective midline laparotomy. Of these, 64 patients had laparotomy closure done in a single layer using polypropylene 1-0, and 33 patients had layered closure, with polygalactin 2-0 being used to close the peritoneum and polypropylene 1-0 to close the linea alba. Without employing any sort of randomization, patients were divided into two groups based on the operating surgeon's convenience.

Results: The single layer closure method took 18.2±3.2 minutes, which is statistically significantly less time than the conventional layered closure method of 26.4±4 minutes ($p < 0.001$). Postoperative complications were also observed to be relatively lower in the single layer closure group (17.18%) than in the layered closure group (42.42%).

Conclusion: In terms of operating time and post-operative problems, the single layer closure technique is still superior to a conventional layered closure technique for laparotomy wounds.

Keywords: Enmass closure, Laparotomy wounds, Layered closure.

Introduction

Laparotomy is a common surgical procedure that can be done both electively and in an emergency. Wound closure should reduce the incidence of wound infection, wound gaping, abdominal rupture, and incisional hernia because its objectives include not only restoring the abdominal wall's function but also giving the patient a scar that is reasonably aesthetically pleasing. Layered closure, the modified Smead-Jones technique, mass closure, and retention suture are among the methods used to close the front abdominal wall. [1,2] According to a systematic evaluation, mass closure using a straightforward running approach and number 1 or 2 absorbable monofilament suture materials with a 4:1 suture length to wound length ratio is the most successful way to close the midline abdominal fascia. [2] Continuous sutures have the advantage of having a single suture line holding the fascia together, causing fewer knots and stitch sinuses, and having an evenly distributed tension across the suture line, according to studies comparing the two suture techniques. [3.4] In this study, patients undergoing laparotomy by midline incision in a tertiary care hospital are compared between two techniques: layered closure and single layer closure (mass closure).

Material and Methods

From February 2024 to October 2024, the present study was carried out at the Department of General Surgery, Sri Krishna Medical College and Hospital, Muzaffarpur, Bihar. There were 97 patients in all, ranging in age from 18 to 75, having an elective or emergency laparotomy via midline incision. The

study excluded patients on immunocompromised conditions, co-morbid disorders such as diabetes mellitus, cancer treatment, immunotherapy, and long-term steroids. The study also excluded patients having laparotomy or relaparotomy by any incision other than the midline.

Using monofilament suture material (polypropylene No. 1 on loop), single layer closure was performed by suturing the cut edges of the linea Alba in 64 patients out of 97, while layered closure was performed in 33 patients. The patients were divided into two groups based on the operating surgeon's convenience without the use of any randomization techniques. Monofilament non-absorbable nylon sutures were used to take vertical mattress skin sutures in an intermittent fashion, and these were removed on the tenth post-operative day if there were no surgical site infections (SSI).

In the Conventional layered closure, continuous sutures were used to close the peritoneum using polyglactin 2-0 on a round-bodied needle, and monofilament sutures (polypropylene no.1 on loop) were used to close the linea alba. As previously mentioned, skin sutures were taken using the single layer closure approach. In both groups, abdominal drains were maintained as needed. In accordance with hospital antibiotic protocols for surgical site infections and laparotomy indications, antibiotics were administered. All patients had their primary wound dressing completed on the fourth postoperative day, with the exception of those who experienced SSI, in which case the dressing was completed appropriately. Time needed to close laparotomy wounds and postoperative problems (such as seroma formation, wound gaping, abdominal rupture, and incisional hernia incidence) were the outcome factors that were examined. Since there was no randomization of allocation, the two groups were compared for baseline characteristics to see if they were equal. After confirming that the data was normal, the "T" test was used to assess the continuous variables. The chi square test or Fischer's exact test were used to assess the category variables. The level of significance was defined as a p value <0.05.

Results

Table 1 shows the distribution of 97 patients receiving elective or emergency procedures using either single-layered or conventionally layered procedures.

Table 1: Nature of surgery between two study groups

Nature of surgery	Single layer closure	Layered Closure	Total
Elective	22(34.4%)	14 (42.4%)	36(37.1%)
Emergency	42 (65.6%)	19 (57.6%)	61 (62.9%)
Total	64 (100%)	33 (100%)	97 (100%)

Chi square = 0.604; p = 0.437

Comparing the two groups based on the CDC's classification of wounds revealed no statistically significant variation in the distribution of patients between the two groups (p=0.389), as reported in Table 2. [5] Laparotomy wound closure in this study took an average of 18.2±3.2 minutes using a single layer closure approach and 26.4±4 minutes using a traditional layered closure technique. The mean time difference between the two methods was 8.2 minutes, which is statistically significant (p <0.001).It shows that the time required for the single layer closure method was substantially shorter than that required for the traditional layered closure method.

Table 2: Central Disease Control (CDC) classification of wounds

CDC classification	Single layer closure	Layered closure	Total
Clean	2 (3.12%)	2 (6.06%)	4 (4.1%)
Clean contaminated	9 (14.06%)	3 (9.09%)	12 (12.4%
Contaminated	16 (25%)	13(39.39%)	29 (29.9%)
Dirty	37 (57.81%)	15 (45.45%)	52 (53.6%)
Total	64 (100%)	33 (100%)	97 (100%)

Chi square test = 3.019; p = 0.389

Twenty-five of the 97 patients experienced problems due to their laparotomy wounds.

Eleven (17.18%) of the 64 patients in the single layer closure group experienced issues linked to their laparotomy wounds, while 14 (42.42%) of the 33 patients in the layered closure group did the same.When comparing the number of patients with problems in the layered closure group to the single layered closure group, there is a statistically significant difference (p=0.007).

According to Table 3, this indicates that the layered closure technique for midline laparotomy is linked to more complications than the single layer closure technique.

Table 3: Postoperative complications in both groups

Complications	Single layer closure	Layered closure	Total (%)	p value
Seroma	4 (6.25%)	4 (12.12%)	8 (8.2%)	0.27
Surgicalsite infection	3 (4.6%)	4 (12.12%)	7 (7.2%)	0.18
Wound gaping	3 (4.6%)	5 (15.15%)	8 (8.2%)	0.04
Burst abdomen (dehiscence)	1 (1.5%)	1 (3.03%)	2 (2.1%)	0.47
Total	11 (17.18%)	14 (42.42%)	25 (25.78%)	0.007

Discussion

Closing the laparotomy wound is a crucial step in avoiding post-operative problems such as seroma, SSI/wound infection, wound gaping, abdominal rupture, and incisional hernia. During laparotomy wound closure, the surgeon's primary goal is to prevent the abdominal contents from herniating through the incisional wound, which could cause the abdomen to burst, or from herniating through a weak scar, which could result in an incisional hernia. The goal of the surgeon is to return damaged or incised tissues to as close to their original structural state as feasible.[6] It is impossible to overstate the significance of the function sutures play in this, yet suture technique has been discovered to be just as critical in surgery. Wound problems account for over half of all postoperative complications, even in the presence of flawless asepsis, better surgical techniques, medicines, etc.[7] Comparative investigations of these two techniques have been conducted since 1973 by many researchers with promising findings, and single layer closure was determined to have clear advantages over conventional closure in terms of operating time, cost, feasibility, ease, and postoperative morbidity. The goal of the current study was to compare the benefits of single layer closure to traditional layered closure based on closure time and problems linked to the wounds after postoperative laparotomy. In the current investigation, the mean time taken for closure of laparotomy wounds, by single layer closure approach was 18.2±2.7 min and by conventional layered closure technique was 26.4±3.2 min. There was a difference of 8.2 minutes in the mean duration between the two procedures which is statistically highly significant ($p \leq 0.001$) which is equivalent to the research done by Bannerjee and Chatterjee et al and those of Sreeharsha et al.[8,9]

The length of the incision also affects how long it takes to close the laparotomy wound, thus saving a few minutes is not clinically important. In light of the negative effects of anesthetic medications, extended extubation, and increased postoperative problems from prolonged surgery, time savings can have a clinically significant impact. Jones and colleagues reported a burst abdomen rate of 11% in 1941 when incisions were sutured with two layers of catgut and 7% when incisions were sutured with interrupted steel wire for the anterior rectus sheath and catgut for the peritoneum.[10] However, only one burst abdomen occurred in 81 operations following steel wire closure with interrupted mass farnear sutures incorporating all layers, except skin.[11] Kirk experienced no wound disruption in 186 laparotomies closed with continuous all coat nylon.[12] He also observed that the mass closure technique with nylon significantly decreased the rate of wound dehiscence.

According to Weiland DE et al. a meta-analysis study, most abdominal wounds should be closed continuously with non-absorbable sutures; however, interrupted absorbable sutures are recommended if infection or distention is expected. [13] They claimed that bulk closure was better than stratified closure. Twenty-five of the 97 participants in this study experienced problems linked to their laparotomy wounds. Eleven (17.18%) of the 64 patients in the single layer closure group experienced issues linked to their laparotomy wounds, while 14 (42.42%) of the 33 patients in the layered closure group did the same. When comparing the number of patients with problems in the layered closure group to the single layered closure group, there is a statistically significant difference ($p = 0.007$). Comparable to the other trial by Sreeharsha et al., the multilayer closure group experienced a greater rate of complications [9]. Similar to the current study, which found that the SSI rate was 17.18% in the single layered group and 42.42% in the layered closure group, the Togart study's SSI/wound infection rate was 17% and 29%, Shukla et al.'s was 0.5% and 16.9%, Singh et al.'s was 6.6% and 16.6%, Chowdhury and Chowdhury's was 22.5% and 47.5%, Sreeharsha was 6% and 8%, and Singh and Ahluwaliya had rates of 2.5% and 10% in single layer closure and conventional layered closure, respectively. [14, 6, 16, 9, 17]

According to our study, the incidence of burst abdomen was 1.5% and 3.03% in single layer closure and conventional layered closure, respectively, and was 2% and 4% for Sreeharsha, 6.9% and 33% for Chalya et al., and 0 and 4% for Singh and Ahluwalia. [9,18,17] In the present study, neither group reported an incisional hernia. This can be the result of a brief follow-up. The literature indicates that at least 10% of incisional hernias occur overall in the finest centers. [19]. In order to determine the incidence of incisional hernias in the comparison groups, the current study will require even longer follow-up periods.

Conclusion

Single layer closure of laparotomy wounds requires less operative time with fewer postoperative complications as compared to layered closure. Hence, single layer closure technique continues to be better closure technique for laparotomy wounds.

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