

Original Research Article

A comparative study of single layer closure versus conventional layered closure of laparotomy wounds

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ABSTRACT

Background: The goal of wound closure after laparotomy is to restore the function of the abdominal wall. The techniques for closure of anterior abdominal wall includes either layered closure, modified Smead-Jones technique, mass closure or retention suture or combination of above mentioned techniques. The studies which compared the continuous and interrupted suture techniques have concluded that enmass continuous sutures have an advantage of holding the fascia together. The present study tries to compare the two techniques i.e. single layer closure (mass closure) and layered closure in patients undergoing laparotomy by midline incision in tertiary care hospital.

Methods: 97 patients undergoing either emergency or elective midline laparotomy were included in the study, where in 64 patients laparotomy closure was done in single layer using polypropylene 1-0 and in 33 patients by layered closure where peritoneum was closed with polygalactin 2-0 and linea alba by polypropylene 1-0. Patients were allocated two groups as per convenience of operating surgeon without using any method of randomization.

Results: The single layer closure technique required statistically significant less closure time of 18.2 ± 3.2 minutes as compared to conventional layered closure 26.4 ± 4 minutes time of ($p < 0.001$). Also, the incidence of postoperative complications was found to be comparatively less (17.18%) in single layer closure group as compared to complications (42.42%) in layered closure group.

Conclusions: Single layer closure technique continues to be better than conventional layered closure technique of laparotomy wounds in terms of operative time and post-operative complications.

Keywords: Enmass closure, Laparotomy wounds, Layered closure

INTRODUCTION

Laparotomy is a common surgery performed in an emergency as well as elective setting. The goal of wound closure is not only to restore the function of the abdominal wall but also to provide the patient with a reasonably aesthetic scar and more, so it should minimize the frequency of wound infection, wound gaping, burst abdomen and incisional hernia. The techniques for closure of anterior abdominal wall ranges from layered closure, modified Smead-Jones technique, mass closure and retention suture.^{1,2} In a systematic review it was

found that the most effective method of midline abdominal fascial closure involves mass closure, in a simple running technique, with number 1 or 2 absorbable monofilament suture materials with a suture length to wound length ratio of 4:1.² The studies which compared the continuous and interrupted suture techniques have concluded that the continuous sutures have an advantage of an evenly distributed tension across the suture line, being more expedient, fewer knots and stitch sinuses with an advantage of being a single suture line holding the fascia together.^{3,4} The present study tries to compare the two techniques i.e. single layer closure (mass closure)

and layered closure in patients undergoing laparotomy by midline incision in tertiary care hospital.

METHODS

In this longitudinal study conducted at a tertiary care academic hospital, 97 patients of age between 18 to 75 years undergoing emergency or elective laparotomy by midline incision were included. Patients with co-morbid conditions like diabetes mellitus, immunocompromised patients, patients on cancer chemotherapy, immunotherapy and on long term steroids were excluded from the study. Even patients undergoing relaparotomy or laparotomy by any other incision apart from midline were also excluded from the study.

Out of 97 patients in 64 patients laparotomy closure was done in single layer and in 33 patients by layered closure. Patients were allocated two groups as per convenience of operating surgeon without using any method of randomization.

Single layer closure was performed by suturing the cut edges of the linea alba. Bites were taken about 1 cm from the cut edges and interval of about 1cm with continuous sutures using monofilament suture material (polypropylene No. 1 on loop). Vertical mattress skin sutures were taken by monofilament non-absorbable nylon sutures in intermittent fashion which were removed on 10th post-operative day in absence of surgical site infection (SSI).

In Conventional layered closure the peritoneum was closed with polyglactin 2-0 on round bodied needle by continuous sutures and the linea alba was closed with continuous sutures using monofilament suture material (polypropylene no.1 on loop). Skin sutures were taken as described above in single layer closure technique.

Abdominal drains were kept whenever required in both the groups. Antibiotics were given as per indication of laparotomy and hospital antibiotic protocol for surgical site infection. Primary wound dressing was done on 4th postoperative day in all patients except for those who developed SSI where the dressing was done accordingly.

The outcome factors studied were time for closure of laparotomy wounds and postoperative complications (seroma formation, wound gaping, burst abdomen and incidence of incisional hernia).

Statistical analysis

The two groups were compared for baseline characteristics to observe equality in both groups as randomization of allocation was not done. The continuous variables were analyzed using 'T' test after checking normality of the data. The categorical variables were analyzed by Fischer's exact test or chi square test.

The p value <0.05 was considered as the level of significance.

RESULTS

In single layered closure group, mean haemoglobin was found to be 11.9±2.3gm/dl. In layered closure group, mean haemoglobin was found to be 11.8±1.9gm/dl. Similarly, in single layered closure, the mean serum total protein and albumin was found to be 6.24±0.57 gm/dl and 3.42±0.37 gm/dl respectively.

In layered closure group, mean serum total protein and albumin was found to be 6.25±0.56 and 3.57±0.37 respectively. In the mentioned variables of haemoglobin, serum total proteins and albumin, there was no statistically significant difference in two groups. Despite patients included randomly in two study groups, both the groups were statically comparable (Table 1).

Table 1: Comparison of baseline features between two groups.

Variables	Single layer closure	Layered closure	p value
Haemoglobin	11.939±2.3753	11.803±1.9189	0.777
Serum total proteins	6.248±0.5742	6.257±0.5666	0.946
Serum albumin	3.425±0.3705	3.578±0.3701	0.052

Out of 97 patients, the distribution of patients undergoing elective or emergency with either single layered or conventional layered is shown in Table 2.

Table 2: 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

When the two groups were compared according to CDC classification of wounds, there was no statistically significant difference in distribution of patients according to classification of wounds between two groups (p=0.389) as shown in Table 3.⁵

In this study, the mean time taken for closure of laparotomy wounds, by single layer closure technique was 18.2±3.2 min and by conventional layered closure technique was 26.4±4 min. There was a difference of 8.2 minutes in the mean time between the two techniques which is statistically highly significant (p <0.001).

It indicates that the time needed for single layer closure technique was significantly less than that needed for conventional layered closure technique.

Table 3: 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

Out of 97 patients, 25 patients had laparotomy wound related complications. In single layer closure group, 11 (17.18%) patients out of 64; whereas in layered closure group, 14 (42.42%) patients out of 33 had laparotomy wound related complications.

Table 4: Postoperative complications in both groups.

Complication	Single layer closure	Layered closure	Total (%)	p value
Seroma	4 (6.25%)	4 (12.12%)	8 (8.2%)	0.27
Surgical site 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

There is statistically highly significant difference in number of patients with complications in layered closure group as compared to single layered closure group (p=0.007).

This means layered closure technique of midline laparotomy is associated with more complications than single layer closure technique as shown in Table 4.

DISCUSSION

The technique of laparotomy wound closure is one of the important factors in preventing post-operative complications like seroma, SSI/ wound infection, wound gaping, burst abdomen and incisional hernia. Prevention of herniation of abdominal contents through the incisional wound, resulting in burst abdomen or

herniation through a weak scar resulting in incisional hernia are the main aims of a surgeon closing laparotomy wounds. The surgeon's aim is to restore the structural integrity of incised or injured tissues to as near normal as possible.⁶ The importance of the role played by sutures in this cannot be exaggerated; however, the suture technique has been found out to be equally important in surgery. In spite of perfect asepsis, improved surgical skills, antibiotics, etc. wound complications comprise nearly 50% of all postoperative complications.⁷ Since 1973, different workers have carried out comparative studies of these two methods with encouraging results and single layer closure was found to have definite advantages over conventional closure as regards to operating time, cost, feasibility, ease and postoperative morbidity. The present study was taken up to evaluate the advantages of single layer closure over conventional layered closure on the basis of closure time and postoperative laparotomy wound related complications.

In present study, the mean time taken for closure of laparotomy wounds, by single layer closure technique 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 time between the two techniques which is statistically highly significant (p ≤0.001) which is comparable to the studies done by Bannerjee and Chatterjee et al and that of Sreeharsha et al.^{8,9}

Time for closure of laparotomy wound also depends on length of incision and saving few minutes is clinically not that significant. If one can save more time, then it can be clinically significant with reference to harmful effects of anaesthetic drugs, prolonged extubation and more postoperative complications of prolonged surgery.

Literature review shows that since the beginning of abdominal surgery the meticulous layer by layer closure of abdominal wall was being preached and indeed this certainly has strong aesthetic appeal. Smead, a resident to Finney in Baltimore, first used the "far-near" stitch also known as "Smead-Jones technique" in 1900.

In 1941, Jones and associates reported a burst abdomen rate of 11% when incisions were sutured with two layers of catgut, and 7% when sutured with catgut for peritoneum and interrupted steel wire for the anterior rectus sheath.¹⁰

However, only one burst abdomen occurred in 81 operations after steel wire closure with interrupted mass far-near sutures incorporating all layers, apart from skin. In mass closure, a deep bite of tissue provides more cushioning effect and therefore less strangulation of tissue.¹¹

Kirk, had no wound disruption in 186 laparotomies closed with continuous all coat nylon.¹² He also noted that the technique of mass closure with nylon significantly reduced the rate of wound dehiscence.

Weiland DE et al from their meta-analysis study suggested that continuous closure with non-absorbable suture should be used to close most abdominal wounds; but however, if infection or distention is anticipated, interrupted absorbable sutures are preferred.¹⁵ According to them mass closure was superior to layered closure.

In the present study, out of 97 patients, 25 patients had laparotomy wound related complications. In single layer closure group, 11 (17.18%) patients out of 64; whereas in layered closure group, 14 (42.42%) patients out of 33 had laparotomy wound related complications. There is statistically highly significant difference in number of patients with complications in layered closure group as compared to single layered closure group ($p = 0.007$). The higher complication rate in layered closure group is comparable to the other study conducted by Sreeharsha et al.⁹

The SSI/ wound infection rate for study by Togart was 17% and 29%, Shukla et al was 0.5% and 16.9%, Singh et al was 6.6% and 16.6%, Chowdhury and Chowdhury was 22.5% and 47.5%, Sreeharsha was 6% and 8% and Singh and Ahluwalia was 2.5% and 10% in single layer closure and conventional layered closure respectively which was similar to the present study where the SSI rate was 17.18% in single layered group and 42.42% in layered closure group.^{14,6,16,9,17}

Incidence of burst abdomen was 2% and 4% for Sreeharsha, 6.9% and 33% for Chalya et al, 0 and 4% for Singh and Ahluwalia and is comparable to our study i.e. 1.5% and 3.03% in single layer closure and conventional layered closure respectively.^{9,18,17}

In the present study no incisional hernia occurred in either of the groups. This can be because of short follow up period. Overall incidence of incisional hernias in the best centres has been at least 10% according to the literature.¹⁹ Still longer periods of follow up is necessary for the present study to know the incidence of incisional hernias in the comparison groups.

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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