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Original Research Article

Mass closure versus layered closure of midline laparotomy incisions

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ABSTRACT

Background: When surgeons started performing surgeries since 19th century, they have to impose wound on their patients and it is their duty to strive constantly to get these wounds to heal as quickly, reliably and severely as possible, and now the behaviour of surgical wound is largely predictable. This study aims to evaluate the benefits or otherwise between single layer closure and layered closurein a peripheral medical college.
Methods: All patients who have undergone emergency exploratory laparotomy in Department of General Surgery, College of Medicine and JNM Hospital, Kalyani
Results: In our study, out of 50 patients, most of the patients were >30 years old [19 (38.0%)]. Seven (28.0%) patients were >30 and <61 years of age in group A (mass closure) and 12 (48.0%) patients were >30 years of age in group B (layered closure). Age was not significantly associated with group in group A (mass closure) and group B (layered closure) (p=0.0540). We observed that, mean age was lower in group B (layered closure) (37.7600±14.8304) compared to group A (mass closure) (47.3600±15.0993) though it was statistically significant (p=0.0279).
Conclusions: In our study, out of 50 patients, most of the patients were >30 years old and age was not significantly associated with group in group A (mass closure) and group B (layered closure). We found that, male population and female population were equal in both two groups. Sex was significantly related with two groups. We observed that, Band adhesion and Perforated appendix were equal in both groups. Which was not statistically significant.

Keywords: Mass closure, Layered closure, Laparotomy incisions

INTRODUCTION

In the 19th century, when surgeons began performing surgeries, they needed to create incisions in their patients and were responsible for ensuring these wounds healed as quickly, reliably, and effectively as possible. Nowadays, the healing behaviour of surgical wounds is largely predictable. Many factors influencing the healing process can be managed through surgical science, making a healed, uncomplicated wound the expected outcome.[1] However, surgeons still face the challenge of wound dehiscence, whether incomplete or complete. Peritoneal adhesions and chronic discharging sinuses can develop in some surgical wounds, leading to high morbidity and mortality, often due to factors beyond the surgeon's control.[1]

Despite advances in pre- and postoperative care, anaesthesia methods, and antibiotic use, wound complications remain common.[2] The reported incidence of wound dehiscence after abdominal surgery ranges from 0.2% to 5.8%, with higher rates observed after emergency surgeries. Incidence is also age-related, being higher at 5.4% in patients over 45 years. The mortality rate associated with wound disruption is between 22%

and 50%.[3] Wound dehiscence is more frequent with longitudinal incisions compared to transverse ones, as the latter are not aligned with the shearing forces on the abdominal wall. However, transverse incisions are less suitable for complex surgical procedures.[4]

Wound dehiscence often results from increased intra-abdominal pressure in the early postoperative period and poor wound healing. Factors contributing to increased intra-abdominal pressure include prolonged postoperative ileus or adhesive obstruction, ascites, repeated retching and the vomiting, persistent hiccups, and the coughing fits.[5]

Proper abdominal closure is crucial, and the choice of incision technique, repair method, and suture material significantly impact outcomes. The integrity of a sutured abdominal wound relies on balancing the tissue's suture-holding capacity and the suture's tissue-holding capacity. Clinical trials comparing layered versus mass abdominal closure techniques have shown mixed results. Some studies report higher rates of burst abdomen and incisional hernia with layered closure, while others find no significant difference. No study has conclusively demonstrated the superiority of layered closure over mass closure.

Most general surgeries involve the abdomen, making the incision and suturing of abdominal layers common practices. An ideal abdominal closure should be efficient, strong, and act as a barrier to infection. It should minimize the rates of wound dehiscence, infection, and incisional hernia formation while ensuring patient comfort and aesthetic appeal.

Objectives

This study aims to evaluate the benefits or otherwise between single layer closure and layered closure in a peripheral medical college.

METHODS

Study design

It was an interventional and longitudinal study.

Study population

All patients who have undergone emergency exploratory laparotomy in department of general surgery, college of medicine and JNM hospital, Kalyani.

Target population

Patients attending surgery indoor through Emergency Department/ Outpatient Department, College of Medicine and JNM Hospital, Kalyani were selected for the study.

Inclusion criteria

Male and female both sexes and patients having age above 18 years and patients with indications of laparotomy were included in study.

Exclusion criteria

Age <18 years and patients who are having incisional hernia due to previous midline laparotomy were excluded.

Study area

Study conducted at indoor patients of College of Medicine and JNM Hospital, Kalyani.

Study period

Study conducted from January 2023 to July 2023.

Sample size

Total 50 patients (prevalence 2.8%, estimated error 5%) were involved in study.

Study method

After taking detailed history and thorough clinical examinations, all patients were investigated and required lab investigations was done. Patients fulfilling the indications of an emergency exploratory laparotomy (perforation peritonitis, blunt abdominal trauma, acute intestinal obstruction, etc.) and elective will then be informed regarding this trial in their own language both written as well as the verbal with all the risk factors involved.

Statistical tool

For statistical analysis data were entered into a Microsoft excel spreadsheet and then analysed by SPSS (version 27.0; SPSS Inc., Chicago, IL, USA) and Graph Pad Prism version 5.

RESULTS

In group A (mass closure), 7 (28.0%) patients were >30 years of age, 3 (12.0%) patients were 31-40 years of age, 2 (8.0%) patients were 41-50 years of age, 6 (24.0%) patients were 51-60 years of age and 7 (28.0%) patients were <61 years of age. In group B (layered closure), 12 (48.0%) patients were >30 years of age, 5 (20.0%) patients were 31-40 years of age, 4 (16.0%) patients were 41-50 years of age and 4 (16.0%) patients were <61 years of age. Association of age in group with group was not statistically significant (p=0.0540) (Table 1).

Table 1: Association between age groups.

Age in group (in years)	Group A (mass closure)	Group-B (layered closure)	Total
>30	7	12	19
Row%	36.8	63.2	100.0
Col%	28.0	48.0	38.0
31-40	3	5	8
Row%	37.5	62.5	100.0
Col%	12.0	20.0	16.0
41-50	2	4	6
Row%	33.3	66.7	100.0
Col%	8.0	16.0	12.0
51-60	6	0	6
Row%	100.0	0.0	100.0
Col%	24.0	0.0	12.0
<61	7	4	11
Row%	63.6	36.4	100.0
Col%	28.0	16.0	22.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=9.3006; p=0.0540

In group A (mass closure), 17 (68.0%) patients were female and 8 (32.0%) patients were male. In group B (layered closure), 8 (32.0%) patients were female and 17 (68.0%) patients were male. Association of sex with group was not statistically significant (p=0.0109) (Table 2).

Table 2: Association between sex groups.

Sex	Group A (mass closure)	Group B (layered closure)	Total
Female	17	8	25
Row%	68.0	32.0	100.0
Col%	68.0	32.0	50.0
Male	8	17	25
Row%	32.0	68.0	100.0
Col%	32.0	68.0	50.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=6.4800; p=0.0109, odds ratio=4.5156 (1.3759, 14.8199).

In group A (mass closure), 5 (20.0%) patients had band adhesion 4 (16.0%) patients had gut obstruction with gangrene, 4 (16.0%) patients had peptic perforation, 4 (16.0%) patients had perforated appendix, 4 (16.0%) patients had ruptured liver abscess and 4 (16.0%) patients had tubercular peritonitis. Group B (layered closure), 4 (16.0%) patients had band adhesion, 4 (16.0%) patients had blunt trauma abdomen with ileal perforation,4 (16.0%) patients had peptic perforation, 5 (20.0%) patients had perforated appendix, 4 (16.0%) patients had ruptured liver abscess and 4 (16.0%) patients had Tubercular peritonitis. Association of operative findings with group was not statistically significant (p=0.2223) (Table 3).

Table 3: Association between operative findings.

Operative findings	Group A (mass closure)	Group B (layered closure)	Total
Band adhesion	5	4	9
Row%	55.6	44.4	100.0
Col%	20.0	16.0	18.0
Blunt trauma abdomen with ilealperforation	0	4	4
Row%	0.0	100.0	100.0
Col%	0.0	16.0	8.0
Gut obstruction with gangrene	4	0	4
Row%	100.0	0.0	100.0
Col%	16.0	0.0	8.0
Peptic perforation	4	4	8
Row%	50.0	50.0	100.0
Col%	16.0	16.0	16.0
Perforated appendix	4	5	9
Row%	44.4	55.6	100.0
Col%	16.0	20.0	18.0
Ruptured liver abscess	4	4	8
Row%	50.0	50.0	100.0
Col%	16.0	16.0	16.0
Tubercular peritonitis	4	4	8
Row%	50.0	50.0	100.0
Col%	16.0	16.0	16.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=8.2222; p=0.2223.

In group A (mass closure), 20 (80.0%) patients had intestinal contamination. In group B (layered closure), 21 (84.0%) patients had intestinal contamination. Association of intestinal contamination with group was not statistically significant (p=0.7127) (Table 4).

In group A (mass closure), 9 (36.0%) patients had previous history of OT. In group B (layered closure), 8 (32.0%) patients had previous history of OT. Association of previous history of OT with group was not statistically significant (p=0.7127) (Table 5).

In group A (mass closure), 4 (16.0%) patients had hematoma. Association of previous hematoma with group was statistically significant (p=0.0370) (Table 6).

Table 4: Association between intestinal contamination.

Intestinal contamination	Group-A (mass closure)	Group-B (layered closure)	Total
No	5	4	9
Row%	55.6	44.4	100.0
Col%	20.0	16.0	18.0
Yes	20	21	41
Row%	48.8	51.2	100.0
Col%	80.0	84.0	82.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=0.1355; p=0.7127, odds ratio=1.3125 (0.3077, 5.5977).

Table 5: Association between previous history of OT.

Previous history of OT	Group-A (mass closure)	Group-B (layered closure)	Total
No	16	17	33
Row%	48.5	51.5	100.0
Col%	64.0	68.0	66.0
Yes	9	8	17
Row%	52.9	47.1	100.0
Col%	36.0	32.0	34.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=0.0891; p=0.7652, odds ratio=0.8366 (0.2592, 2.7004).

Table 6: Association between hematoma.

Hematoma	Group-A (mass closure)	Group-B (layered closure)	Total
No	21	25	46
Row%	45.7	54.3	100.0
Col%	84.0	100.0	92.0
Yes	4	0	4
Row%	100.0	0.0	100.0
Col%	16.0	0.0	8.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=4.3478; p=0.0370.

In group B (layered closure), 4 (16.0%) patients had seroma. Association of seroma with group was statistically significant (p=0.0370) (Table 7).

In group A (mass closure), 8 (32.0%) patients wound infection. In group B (layered closure), 17 (68.0%) patients had wound infection. Association of wound infection with group was statistically significant (p=0.0109) (Table 8).

Table 7: Association between seroma.

Seroma	Group-A (mass closure)	Group-B (layered closure)	Total
No	25	21	46
Row%	54.3	45.7	100.0
Col%	100.0	84.0	92.0
Yes	0	4	4
Row%	0.0	100.0	100.0
Col%	0.0	16.0	8.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=4.3478; p=0.0370.

Table 8: Association between wound infection.

Wound infection	Group-A (mass closure)	Group-B (layered closure)	Total
No	17	8	25
Row%	68.0	32.0	100.0
Col%	68.0	32.0	50.0
Yes	8	17	25
Row%	32.0	68.0	100.0
Col%	32.0	68.0	50.0
Total	25	25	50
Row%	50.0	50.0	100.0
Col%	100.0	100.0	100.0

Chi-square value=6.4800; p=0.0109, odds ratio=4.5156 (1.3759, 14.8199).

DISCUSSION

This interventional and longitudinal study was conducted on patients who underwent emergency exploratory laparotomy in the department of general surgery at the college of medicine and JNM hospital, Kalyani. The study spanned one year from the approval of the institutional ethical committee. Both male and female patients over 18 years old who had indications for laparotomy were included in the study.

In our study, out of 50 patients, most were over 30 years old 19 (38.0%). In group A (mass closure), 7 (28.0%) patients were between 30 and 61 years old, while in group B (layered closure), 12 (48.0%) patients were over 30 years old. Age was not significantly associated with the closure method (p=0.0540). The mean age was lower in group B (layered closure) (37.76±14.83) compared to group A (mass closure) (47.36±15.10), which was statistically significant (p=0.0279).

Khan et al compared the effectiveness of continuous versus interrupted X-suturing for abdominal wall closure in patients undergoing emergency midline laparotomy. In our study, the male-to-female distribution was similar in both groups: 41 (82%) males and 9 (18%) females in

group A, and 42 (84%) males and 8 (16%) females in group B. Sex was significantly related to the groups (p=0.0109).[7]

We observed that band adhesion in group A (mass closure) and perforated appendix in group B (layered closure) were equally prevalent, though not statistically significant (p=0.2223). Slightly more patients had intestinal contamination in group B (layered closure) [21 (84.0%)] compared to group A (mass closure) [20 (80.0%)], but this was not statistically significant (p=0.7127). Fewer patients in group B (layered closure) [8 (32.0%)] had a previous history of surgery compared to group A (mass closure) [9 (36.0%)], which was also not statistically significant (p=0.7127).

Deshmukh et al noted that abdominal fascial closure remains a procedure often reflecting a surgeon's personal preference, with reliance on traditional and anecdotal experience. Correct incision and closure techniques are crucial to avoid serious complications. Our study found that 16% of patients in group A (mass closure) developed hematoma, while 16% of patients in group B (layered closure) developed seroma, which was statistically significant (p=0.0370).[8]

Bhavikatti et al reported a higher incidence of wound infection in the layered closure group compared to the mass closure group (36.66% vs. 13.33%). Our study showed a higher number of wound infections in group B (layered closure) [17 (68.0%)] compared to group A (mass closure) [8 (32.0%)], which was statistically significant (p=0.0109).[9]

Sreeharsha et al compared single-layer and conventional layered closure techniques. They found wound gaping in 4% of patients with single-layer closure and 6% with conventional layered closure. In our study, 32.0% of patients in group B (layered closure) had wound gaping, which was statistically significant (p=0.0020). Sreeharsha et al also reported burst abdomen in 2% of single-layer closure patients and 4% of conventional layered closure patients.[10] In our study, 36.0% of patients in group B (layered closure) experienced burst abdomen, which was statistically significant (p=0.0009).[10]

Joshi et al highlighted the importance of proper laparotomy wound closure to minimize postoperative complications.[11]

Chalya et al found that mass closure was associated with a lower incidence of wound dehiscence and incisional hernia (p<0.001). In our study, none of the patients in either group developed an incisional hernia or sinus tract formation. This interventional and longitudinal study was conducted in all patients who have undergone emergency exploratory laparotomy in department of general surgery, college of medicine and JNM hospital, Kalyani. The study period was 1 year from the approval of institutional ethical committee. Male and female both sexes, above 18 years and patients with indications of laparotomy were includedin this study.[12]

In our study, out of 50 patients, most of the patients were >30 years old [19 (38.0%)]. Seven (28.0%) patients were >30 and <61 years of age in group A (mass closure) and 12 (48.0%) patients were >30 years of age in group B (layered closure). Age was not significantly associated with group in group A (mass closure) and group-B (layered closure) (p=0.0540). We observed that, mean age was lower in group B (layered closure) (37.7600±14.8304) compared to group A (mass closure) (47.3600±15.0993) though it was statistically significant (p=0.0279).

Limitations

In spite of every sincere effort my study has lacunae. The notable short comings of this study are: The sample size was small, only 50 cases are not sufficient for this kind of study and the study has been done in a single centre and the study was carried out in a tertiary care hospital, so hospital bias cannot be ruled out.

CONCLUSION

We found that the male and female populations were equal in both groups, with sex being significantly related to the two groups. Band adhesions and perforated appendices were equally present in both groups, which was not statistically significant. We observed that the majority of patients had wound infections in group B (layered closure) compared to group A (mass closure), and this difference was statistically significant. In group B (layered closure), 32.0% of patients experienced wound gaping and 36.0% had burst abdomen, both of which were statistically significant. None of the patients in either group developed incisional hernia or sinus tract formation.

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REFERENCES

1. Walter JB, Talbot IC, Gardner HA, Halloran PF, Zuckerman M, Bird AG, et al. Wound healing. In: General pathology. 7th ed. New York: Churchill Livingstone. 1996;165-80.
2. Cuschieri A, Steel RJC, Moore AR. Surgical biology and pathological examination. 4th ed. London. Reed Educational and Professional Publishing. 2000.
3. Bewes P. Abdominal closure. Trop Doct. 2000;30(1):39.
4. Weioland DE, Bay RC, Delsordi S. Choosing the best abdominal closure by meta-analysis. Am J Surg. 1998;176(6):666-70.

5. Ikram MS. Incisional hernia. A study of etiological factors. Pak J Surg. 1995;11(3):146-8.
6. Challa V, Dhar A, Anand S, Srivastava A. Abdominal wound dehiscence: the science and art of its occurrence and prevention. In: Gupta RL, editor. Recent advances in surgery-11, 1st ed. New Delhi: Jaypee Brothers. 2009;225-50.
7. Khan AA, Khan N, Qayyum A, Abbasi HJ. Comparison of continuous versus interrupted x-suturing technique for abdominal wall closure in emergency midline laparotomy wound. J Postgraduate Med Institute. 2018;32(4):390-4.
8. Deshmukh SN, Maske AN. Mass closure versus layered closure of midline laparotomy incisions: a prospective comparative study. Int Surg J. 2018;5(2):584-7.
9. Bhavikatti GS, GHV RG. Comparitive Study of Mass Closure and Layered Closure Techniques in Midline and Paramedian Laparotomies. Acad J Surg. 2019;2(1):42-6.
10. Sreeharsha MV. A comparative study of single layer closure and conventional layered closure of laparotomy wounds. J Evolution Med Dental Sci. 2013;2(40):7695-710.
11. Joshi D, Varandani N, Vaidya M. Study of Different Methods of Midline Laparotomy Incision Closure and their Outcomes. MVP J Med Sci. 2022;8(2):249-52.
12. Chalya PL, Massinde AN, Kihunrwa A, Mabula JB. Abdominal fascia closure following elective midline laparotomy: a surgical experience at a tertiary care hospital in Tanzania. BMC Res Notes. 2015;8(1):1-9.

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