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Comparative Study Between Mass Closure and Layered Closure in Midline Abdominal Incisions

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Abstract

Background: The abdomen is the frequent site of operations in general surgery; consequently, incision and suturing of the abdominal wall is a very important aspect of surgery. Conventionally, the midline incision of a laparotomy wound is closed in various layers anatomically. However, a newer method called the mass closure technique is increasingly being utilized for its advantages. **Aim and Objective:** To evaluate the outcomes of midline abdominal surgeries using mass closures and layered closure techniques. **Material and Method:** This prospective study was carried out in the Department of General Surgery, VIMS, Gajraula, UP, India, and they were divided into two groups. Group I patients who were sutured with mass closure technique and Group II patients who had their midline incision closed with conventional layered technique. **Result:** The most common complication in the group I was found to be a superficial infection in n = 2 (8%) of patients. The other complications were seroma, burst abdomen (wound dehiscence), and suture sinus formation in n = 1 (4%) cases each. In group II, layered closure wound infection was found in n = 2 cases; both were superficial infections that were managed adequately. Burst abdomen and seroma were also found in n = 2 (8%); hematoma was seen in n = 1 (4%) cases each. **Conclusion:** In comparison with layered closure, the mass closure technique is less time-consuming, associated with fewer postoperative complications, less costly, and a safe and effective method for the closure of midline laparotomy incisions.

Keywords: midline abdominal incisions, mass closure, layered closure.

Introduction

Suturing and incision of the abdominal layers are the most frequently performed exercises in surgical procedures, as a result of the fact that a significant number of the surgeries conducted by general surgeons are conducted within the abdomen. The importance of abdominal closure according to repair technique, incision, and has created a high interest for surgeons, and the use of newer suture material, The ultimate objective of closure of the wound is reestablishing the functions of the abdomen

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following the surgical procedure. In accordance with the anatomy of the abdominal wall, laparotomy wounds are typically closed in layers. [1]

A midline incision is most widely utilized to access the intra-abdominal pathologies, and it is very useful, especially in emergency laparotomy, as it is simple, quick, and provides excellent exposure. [2-3] Closure of the abdominal wall is even of greater importance. The ultimate goal of wound closure is to restore the functions of the abdomen after the surgical procedure. because it ultimately impacts the outcome of the surgery. However, abdominal closure is performed in various fashions depending on the preference of the surgeon or reliance on traditional and anecdotal experience. [4] The ultimate goal of wound closure is to restore the functions of the abdomen after the surgical procedure. Traditionally, the laparotomy wounds are closed in layers based on the anatomy of the abdominal wall [5]. The peritoneum and tranversalis fascia are closed as layers. However, clinical and experimental studies have shown that closure of the peritoneal layer makes no difference in abdominal wound healing [6]. Hence, it can be omitted without any adverse effect on wound healing. Gilbert et al., in their study of peritoneal closure in lateral paramedian incisions, showed that wound disruption rates did not change in both groups in whom peritoneum was closed with No. 1 chromic catgut as compared to those in whom peritoneum was not closed. They, however, found that layered closure of the abdominal wall provided better aesthetic outcomes. As in the words of Lord Moynihan, “every unnecessary stitch is a bad surgery,” and avoidance of unnecessary steps of peritoneal closure leads to a saving in time and cost [7]. Based on this, a new recently developed closure technique, called mass closure, has been adopted [8]. In this technique, all the layers of the abdominal wall except skin and subcutaneous tissues are sutured in one layer. The skin is later sutured separately with interrupted sutures generally, but in some cases, continuous sutures are also used. Studies have suggested the most effective method of abdominal wall closure in an elective setting is mass closure [9]. Gupta H et al. have shown that chances of burst abdomen are reduced by 50% when an interrupted suture is used in mass closure as compared to continuous suture. [10]There is still a lack of consensus among surgeons regarding the ideal method of abdominal wound closure. Some studies have shown conflicting results, and many surgeons are uncertain about it [4, 11]. The best abdominal closure should be fast, easy, and cost-effective and prevent both early and late complications. With this background, we undertook the present study to compare the two commonly used methods for the closure of midline abdominal incisions in patients undergoing laparotomy.

Material and Methods

This prospective study was carried out in the Department of General Surgery, VIMS, Gajraula, UP, India. Institutional Ethical Committee consent was obtained; written consent was obtained from all the participants of the study.

Inclusion Criteria

Patients from age group 20 to 60 years, undergoing laparotomy for an emergency and elective surgery,

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Exclusion Criteria

Patients with comorbid conditions such as hypertension, immunocompromised patients, obesity, diabetes mellitus, COPD, and patients with previous abdominal surgery are on chemotherapy.

Blood sample analysis

After the selection of the patients, they were subjected to a detailed history and thorough clinical examination, along with the examination of CVS, CNS, RS, and routine laboratory investigations (CBP, BT, CT, LFT, KFT, blood sugar, and lipid profile, apart from HBsAg and HIV tests). All the patients were subjected to necessary radiological investigations (USG, CT) for the confirmation of diagnosis.

Preoperative Preparations

In emergency cases, the general condition of the patient was corrected by fluids for dehydration and electrolyte balance and giving antibiotics. Patients with hypertension were brought under suitable control before the surgery. General/spinal anesthesia/epidural anesthesia was administered as the cases. A total of 50 patients were identified during the study period and they were divided into two groups.

In group 2

Group I: patients who were sutured with mass closure technique

Group II: patients who had their midline incision closed with conventional layered technique.

Paramedian incision:

In both groups, a vertical midline incision was used. In Group I, the abdomen was sutured using the mass closure technique, in which all the layers of the abdominal wall except the skin and subcutaneous tissues are sutured as one layer with a No. 1 prolene curved cutting needle with an interrupted suture pattern. In group II, the abdomen was closed in layers using a continuous suture of No. 2-0 vicryl for the peritoneum and posterior rectus sheath and No. 1-0 prolene for the anterior rectus sheath. Drains were placed if required through a separate stab incision.

Postoperative

All the patients have given antibiotics (3rd generation cephalosporin) parenterally for 3 days, followed by orally for 5-7 days. Antibiotics were continued after 10 days if indicated. Analgesics were also given to control postoperative pain. Wound examination was done regularly, and drains, if employed, were removed on the 2nd or 3rd postoperative day. The suture was removed between the 7th and 10th postoperative days. Postoperative examination of patients included vomiting, hiccups, chest infections, and abdominal distension. Signs and symptoms of wound infection or burst abdomen were particularly looked for in the postoperative period.

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Statistical Analysis:

A patient's profile based on clinical indicators, various demographic data, and test results was part of the analysis. Means and standard deviation were used in the descriptive analysis of quantitative parameters, and absolute numbers and percentages were used in the descriptive analysis of ordinal data. To test for relationships, cross tables were created, and the chi square test was applied. The quantitative values were compared using the Student t test. P-values less than 0.05 are regarded as statistically noteworthy. Version SPSS-24.0 software was used for all analyses.

Observation and Result

Table no. 1: showing the age-wise and sex-wise distribution of patients

Age group in years	**Group I (Mass closure)**		**Total (%)**	**Group II (Layered Closure)**		**Total (%)**
	Male	**Female**		**Male**	**Female**	
20-25	0	0	0(0)	1	0	1(4)
26-30	1	1	2(8)	1	1	2(8)
31-35	3	3	6(24)	3	3	6(24)
36-40	1	2	3(12)	2	1	3(12)
41-45	0	1	1(4)	1	0	1(4)
46-50	2	0	2(8)	1	2	3(12)
51-55	3	1	4(16)	2	2	4(16)
56-60	3	2	5(20)	2	1	3(12)
> 60	1	1	2(8)	2	0	2(8)
Total	14	11	25(100)	15	10	25(100)

A total of n=25 in group I, out of which n=14 were males and n=11 were females. The most common age group in group I was 31-35 years within 6 (24%) of patients, followed by 56- 60 years n = 5 (20%) of patients. The other age groups in descending order were 51-55 years n = 4 (16%), 36-40 years n = 3 (12%), 45-50 years, and > 60 years n = 2 (8%) each. In group II, out of the total n = 25 patients, n = 15 were males and n = 10 were females. Most the cases were from the age group 31-35 years, n = 6 (20%), followed by the age group 51-55, n = 4 (20%). Least numbers of patients were found in the age group 220-25, n = 1 (4%) of the patients given in table 1.

Table no. 2: Midline incisions performed for various intra-abdominal pathologies

Pathology	**Group I**	**Group II**	**Total**	
	Mass closure	**Layered closure**		%

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Upper GI malignancy	6	5	11	22
Intestinal obstruction	3	4	7	14
Bleeding duodenal ulcer	2	4	6	12
Lower GI malignancy	7	10	17	34
Enteric perforations	3	3	6	12
Splenomegaly	4	3	7	14
others	0	0	0	

The various intra-abdominal pathologies requiring surgery in the study were studied in both groups. The most common reason for surgery was lower gastrointestinal malignancies in n = 17 (34%) of cases of both groups. The upper GI malignancy was the reason in n = 11 (22%). Intestinal obstruction was seen in n = 7 (14%), enteric perforations in n = 6 (12%), and splenomegaly was in n = 7 (14%). The group-wise distribution details are given in table 2.

Table no. 3: Showing the mean time required for the wound closure in groups

Technique	**Meantime for wound closure in minutes**			**P-value**
	Sex (M:F)	**Number of cases (n)**	**Time (minutes) Mean±SD**	
Mass closure technique	15:10	25	21.04±1.54	0.0001
Layered closure technique	14:11	25	27.6±2.27	

The mean duration of wound closure was recorded in both groups (I & II) right from the time of starting the first suture to the completion of sutures. The mean duration of the suture in group I was 21.04± 1.54 min. The mean values of Group II in males were 27.6 ± 2.27 minutes. The mean values of both groups were compared using the student's' test, which showed p values were <0.05, which was found to be significantly shown in Table 3.

Table no. 4: Type of surgery performed in both groups

Type of surgery	**Mass closure**	**percentage**	**Layered closure**	**percentage**
Elective	15	60	20	80
Emergency	10	40	5	20
Total	25	100	25	100

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Most of the surgeries in the study were elective in both groups. The total number of elective cases was n = 20 (80%), and emergency surgeries were n = 10 (40%) of all cases shown in table 4.

Table no. 5: Time in days for suture removal in both groups

Time taken for suture removal (days)	**Group I** **Mass closure**	**percentage**	**Group II** **Layered closure**	**percentage**
7	16	64	15	60
8	5	20	5	20
9	2	8	1	4
10	2	8	4	16
Total	25	100	25	100

In group I of the total n = 25 cases, n = 16 (64%) sutures were removed on the 7th day, and n = 5 (20%) were removed on the 8th postoperative day. In n=2(8%) and n=2(8%) patients, the sutures were removed on 9th and 10th postoperative days. In group II, out of the total n = 25 patients in n = 15 (60%) cases, removal of sutures was done on the 7th day, and in n = 5 (20%) cases, removal of sutures was done on the 7th day, and in n = 5 (20%) cases, removal of sutures was done on the 8th postoperative day, as shown in table 5.

Table no. 6: Complications recorded in both groups

Complication	**Group I** **Mass closure**	**percentage**	**Group II** **Layered closure**	**percentage**
Wound infection	2	8	3	12
Hematoma	0		0	
Burst abdomen	0		2	8
seroma	1	4	2	8
Incisional hernia	1	4	1	4
Suture sinus formation	2	8	1	4
Total	6	24	9	36

The most common complication in the group I was found to be a superficial infection and suture sinus formation in n = 2 (8%) of patients. The other complications were seroma, burst abdomen (wound dehiscence), and suture sinus formation in n = 1 (4%) cases each. In group II, layered closure wound infection was found in n = 3 cases; both were superficial infections that were managed adequately. Burst abdomen and

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seroma were also found in n = 2 (8%), hematoma, and incisional hernia was seen in 1 (4%) cases, each shown in table 6.

Discussion

Midline incisions are most commonly used to access the abdominal cavity both in elective and emergency surgeries. The surgeon aims to restore the structural integrity of incised or injured tissue to as normal as possible [12]. The role played by sutures cannot be overstated, and the technique of sutures is also an equally important part of the surgery. A poorly placed incision and unsatisfactory method of closure or inappropriate selection of suture can lead to complications like hematoma, suture infection, wound dehiscence or incisional hernia, and scar formation. The two The main methods of suture placement for midline laparotomy incisions are being used widely. The old conventional method is also called a layered suture technique. The more recent one is called the mass closure technique.

This is a prospective randomized comparative study involving 50 patients aged 20 to 70, undergoinglaparotomy on either an emergency or elective basis. There were 25 patients in both the mass closure and layered closure groups. In the layered closure group, the mean age was 37.36 ± 7.85 years, while in the mass closure group, it was 35.16 ± 8.64 years. Among the patients, 58% were male (n = 29), and the remaining 42% were female (n = 21). We found that 20% of the patients in either of the study groups got an infection in their wounds. The overall infection rate in the study by Bhavikatti GS & Gupta GHVR is 25%. In the mass closure group, the infection rate was 8%, but in the multilayer closure group, it was 12%. With a p value of 0.05, this was determined to be statistically extremely significant, i.e., the rate of wound infection was reduced in the mass closure group when compared to the multilayer closure group. [13]

A similar study by Israelsson et al. has also shown the rate of infection to be 7% in their study. [14] In comparison to mass closure, the wound infection in the present study was lesser in the layered closure in contract. Deshmukh SN et al. have found higher infection rates in layered closure when compared to mass closure. The difference could be because of the patient factors in wound healing. [15]

The incidence of burst abdomen was 8% of all the cases. The incidence of burst abdomen in layered closure was slightly higher compared to mass closure. A study by Bhavikatt GS et al. found the incidence of burst abdomen in mass closure to be 0%, which is similar to our results; however, they found the incidence of burst abdomen in mass closure to be 23.33%, which is quite high as compared to the present study. [13] The incidence of suture sinus formation was found in 4% of mass closures. Deshmukh SN et al. found an incidence of suture sinus formation in 0% of mass closure and 3.33% of the layered closure. [15]

The mean duration of wound closure in mass closure was 21.04 minutes and layered closure was 27.6. minutes. The mass closure took 6.56 minutes less time than the conventional layered closure. A study by Banerjee et al. found that mass closure took about 10 minutes less than the conventional layered closure. [16] In this study, the

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difference was lesser; however, a reduction in operative time is always desired as it reduces the cost of anesthetic agents and saves time for the surgeon. In the present study, seroma was found in 4% of the mass closure and 8% of the layered closure. Early detection of seroma and its management is very important in the postoperative period since it may lead to the formation of wound infection or tearing through the weak infected tissue with an intact suture and may cause wound dehiscence. In the present study, mass closure technique is found to be more effective as compared to layered closure technique. Similar findings were noted in the studies carried out by Ausobsky JR et al. and Pollock AV et al. [17–18].

Conclusion

Getting the best outcomes from the midline incision closure is a persistent challenge for the surgeons. The success of surgery depends to a large extent on wound healing with minimal complications and better cosmetic appearance. Within the limitations of the present study, it can be concluded that the mass closure technique appears to be the better choice for midline laparotomy wound closure as compared to the conventional layered technique since it requires a shorter time with minimal complications and is cost-effective.

Conflict of interest: None

Source of support: Nil

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