

A Comparison of the Efficacy Between Mass Closure and Layer by Layer Closure of Midline Laparotomy and Its Influence on Wound Healing: A Prospective Study

Kidwai R, Sharma A

ABSTRACT

Introduction: The midline laparotomy is the most common approach in surgery which gives access to viscera of the abdomen. Following surgery, the laparotomy wound is sutured by two techniques: mass closure and layer by layer closure. The primary objective of wound closure is to restore the function of the abdominal wall. However the method adopted for incision closure has an influence on the outcomes of wound healing. Our study wants to compare the two suture techniques in terms of efficacy and wound healing. **Aims:** To compare conventional layer by layer suture technique versus mass closure in terms of efficacy and wound healing in patients with midline laparotomy approach. **Methods:** A Prospective study with a population size of 94 was performed at the surgery department of Nepalgunj medical college teaching hospital, Nepalgunj, starting from September 2023 to May 2024. A pre-tested questionnaire containing structural, semi-structural, and open-ended questions in printed form was made as a data collection tool. All the people in this study were interviewed after receiving their consent. Patients were followed up for 3 months to rule out any post operative complications. **Results:** Total 94 patients were studied among which majority of patients were in 30-39 age group. Male outnumbered the females. Incidence of early complications like seroma, wound infection and wound dehiscence was more in layered closure group as compared to mass closure. Average time taken in layered vs. mass closure group is 15 vs 25 mins respectively. Overall wound healing was found more efficacious in mass closure group which is also cost effective than layered closure group. **Conclusion:** Mass closure technique is less time consuming, along fewer instances of surgical site infection and dehiscence with better overall compliance.

Keywords: Efficacy, Laparotomy, Layered vs Mass closure, Wound healing

Author:

1. Dr. Roman Kidwai
2. Prof. Dr. Anup Sharma

Department of General Surgery, Nepalgunj Medical College and Teaching Hospital, Banke, Nepal

Address for Correspondence:

Dr. Roman Kidwai
Associate professor
Department of General Surgery
Nepalgunj Medical College and Teaching Hospital
Nepalgunj, Banke, Nepal
Email: roman.kidwai@ngmc.edu.np

INTRODUCTION

Wound dehiscence involves the partial or complete separation of wound edges, often leading to acute wound failure.¹ The risk of a burst abdomen is highest between the 6th to 9th postoperative day.² The strength of the abdominal wound closure is influenced by both the tissues' suture holding capacity and vice versa.¹ The choice of incision and closure technique in abdominal surgery significantly impacts surgical success, considering factors like ease, time, costs, and wound complication rates.^{3,4,5} While layer-by-layer closure was traditionally accepted, recent studies suggest that the mass closure technique offer superior outcomes.^{6,7} Mass closure involves all the layers closed en masse, except for the skin which is sutured separately. The primary advantage is less operating time and good approximation, minimizing tension across the wound edges. However may lead to inadequate vascularization of the deeper tissues, impairing wound healing and increasing risk of SSI due to limited wound inspection.

In this study, evaluated and compared the efficacy of the layer-by-layer and mass closure technique, based on postoperative wound complications, time required and the strength of the wound.

METHODS

This study is a hospital based prospective study conducted at Surgery department of Nepalgunj Medical College Teaching Hospital, Nepalgunj from September 2023 to May 2024. In this study, a total of 94 patients who underwent both elective and emergency laparotomies through vertical midline incisions were taken as study population. Equal number of cases (47 each) were studied for comparison in closure with the two techniques, mass closure and layered closure. All patients between age group 20-60 years undergoing ventral midline approach with at least 10 cm of incision either in elective or emergency case were taken in the study. However age <20

years or >70 years, other approach of incision like paramedian, transverse or other non-vertical, patients with any previous abdominal surgeries and co-morbidities like Hypertension, Diabetes Mellitus (DM), Chronic obstructive pulmonary disease (COPD), Tuberculosis (TB) and other chronic conditions were excluded from our study. This study was done mainly to compare the two methods of midline laparotomy closure i.e. mass and layered closure taking into regard wound complications (wound infection, dehiscence, incisional hernia, time taken for closure and wound strength. We started our study after taking the Ethical clearance from the institutional review committee (IRC). During the study period, patients meeting the inclusion criteria were enrolled in our study and grouped accordingly. First group contained patients with mass closure with polypropylene 1-0 in continuous fashion except the skin which was close with subcutaneous tissue with 1-0 polygalactin in simple interrupted manner while skin with staples. A detailed proforma was developed and written consent was taken from the patients. Statistical Analysis - Data was analyzed in statistical package program SPSS version 25. All numerical variables were tabulated and calculated by using descriptive statistics, Chi-square test, and odds ratio. P value less than 0.05 was considered as of statistical significance. To pass the inclusion criteria; head to toe clinical examination of the patient were made and recorded to rule out anemia, jaundice, obesity and nutritional status. Patients landing up in emergency had specific investigations like plain X-ray abdomen erect and supine, USG abdomen and pelvis, CT abdomen to compliment the diagnosis.

After the operation the patients were closely observed in the post-op unit till the day of discharge from the hospital. Common postoperative complications like vomiting, abdominal distension, wound infection and burst abdomen were noted during the 3rd, 5th and 7th post op days. The patients were instructed to care their surgical site properly and counseled for hospital visit on the day of suture removal. Further instructions were given for follow up in every subsequent month till 3 months. At the time of suture removal and during follow up period, the surgical site was thoroughly inspected for any infection or dehiscence, pain, incisional hernia, sinus or scar formation. If wound discharge was present, pus was sent for culture and sensitivity. The records of all the patients were maintained in our developed proforma.

RESULTS

A total of 94 patients aged between age group 20-60 years meeting inclusion criteria were included in our study. Males constituted 59.57% of study population and remaining were females with a sex ratio of 1.47:1 (fig.1). Maximum numbers of patients belonged to age group 30-39 years (40.43%) whereas least number of patients belonged to 50-59 years (9.57%) as shown in fig.2. Out of 94 patients who underwent midline laparotomy, 50% of patients underwent mass closure among which maximum 52.63% were from the age group 30-39 years. Among the 50% of patients who had layered suture closure, 47.39% were from 30-39 age group which constituted the maximum number as presented in table I. In our study, 31 (32.98%) elective and 63 (67.02%) of the emergency cases were taken

and categorized into mass closure and layer closure groups. In the mass closure group 41.94% patients had undergone elective whereas 53.97% patients underwent emergency surgery. In the layered closure group 58.06% patients underwent elective surgery whereas 46.03% patients underwent emergency surgery respectively as shown in table II. Association of wound infection among the elective or emergency cases and closing techniques and its impact on wound healing is depicted in table III. The rate of infection in our overall study was 22.34%. The surgical site infection (SSI) rate in the mass closure group was 12.76% while it was 31.91% in the layered closure group. Statistically this was found to be significant with the p value 0.046. It implies that the rate of wound infection was significantly lower in the mass closure group as compared to the layered closure group as shown in contingency table IV. Association of wound infection among the cases and its association with wound dehiscence is presented in table V. The rate of wound dehiscence in our overall study was 8.51%. Among the layered closure technique only one patient (5.55%) from elective and 5 patients (17.24%) from the emergency group developed wound dehiscence while from the mass closure group only two patients (5.88%) from the emergency surgery group developed wound dehiscence. The association of surgical closing techniques on wound dehiscence is found to be statistically non-significant with a p value of 0.267 as shown in contingency table VI.

The average time taken for closure of abdominal wound using mass closure technique was 15 minutes (range 14 to 17 minutes) as compared to 25 minutes (23 to 28 minutes) in layered closure as shown in table VII. It was statistically found to be significant.

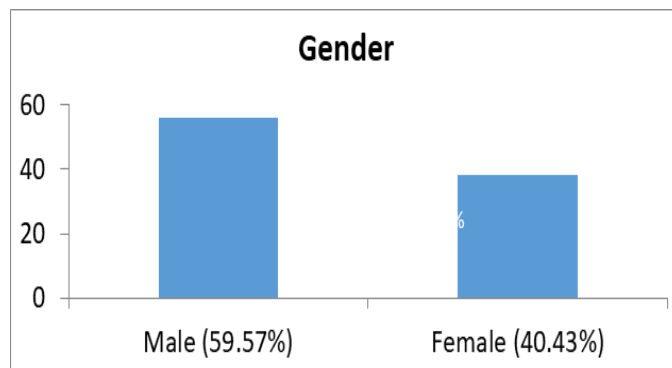


Figure 1: Sex distribution of Patients

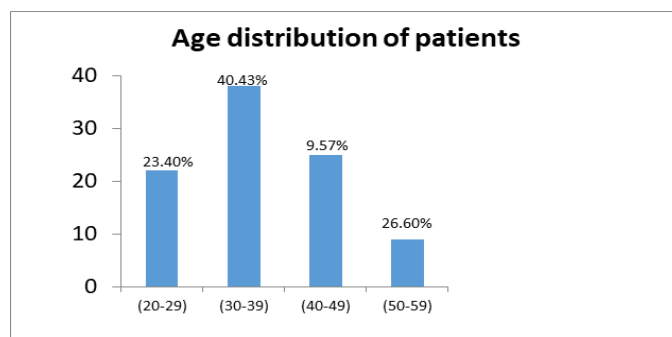


Figure 2: Distribution of age of patients

Age Group (In Years)	Closure Techniques		Total	Percentage (%)
	Mass	Layered		
20-29	9	13	22	23.40
30-39	20	18	38	40.43
40-49	13	12	25	26.60
50-59	5	4	9	9.57
Total	47	47	94	100

Table I: Type of closing technique according to age

Nature of surgery	Closure Techniques		Total	Percentage (%)
	Mass	Layered		
Elective	13	18	31	32.98
Emergency	34	29	63	67.02
Total	47	47	94	100%

Table II : Distribution of cases based upon nature of surgery and the closing techniques

Type of Closure	Elective		Emergency		Total Wound infection	Percentage (%)
	Number of cases	Wound infection %	Number of cases	Wound infection %		
	Mass	13	7.69	34		
Layered	18	26.67	29	37.93	15	31.91

Table III: Distribution of cases based upon the incidence of wound infection in relation to the closing techniques

Type of closure	Wound infected	Wound healthy	Total
Mass	6	41	47
Layered	15	32	47
Total	21	73	94

Table IV : 2 X 2 contingency table for calculation of p value (The two tailed p value using Fisher's exact test is 0.0460 i.e. statistically significant)

Type of Closure	Elective		Emergency		Total Wound infection	Percentage (%)
	Number of cases	Wound dehiscence %	Number of cases	Wound dehiscence %		
	Mass	13	0	34		
Layered	18	5.55	29	17.24	6	12.76

Table V: Distribution of cases based upon the incidence of wound dehiscence in relation to the closing techniques

Type of closure	Wound dehiscence	Wound healthy	Total
Mass	2	45	47
Layered	6	41	47
Total	8	86	94

Table VI: 2 X 2 contingency table for calculation of p value (The two tailed p value using Fisher's exact test is 0.2673 i.e. not statistically significant)

Type of closure	No. of cases	Average time taken (Minutes)
Mass	47	15
Layered	47	25
Total	8	86

Table VII: Showing average time taken for different closing techniques

DISCUSSION

Wound closure is a critical step in laparotomy surgeries, as it significantly impacts postoperative complications, incisional hernias, patient discomfort, and overall recovery. Dambrin reported the decreased incidence of wound evisceration with a mass layer technique.⁸ Hoerr et al in their study at Cleveland clinic suggested better wound closure with mass technique which is also supported by Spencer et al.^{9,10} In our study among 94 patients, we observed that mass closure technique resulted in better healing of wound than layered technique. Higgins et al in their experimental study showed abdominal incisions closed by mass suture technique had greater strength than those closed with conventional layer method.¹¹

The rate of infection in our overall study was 22.34%. The infection rate in the mass closure group was 12.76% while it was 31.91% in the layered closure group. A research conducted by Kumar S in Coimbatore Medical college showed 30% of overall infection rate among the study population.¹²

Our data show 12.76% wound infection in mass closure group and 31.91% in layered closure group. Our results shows similarity with various researches with 12% vs 48% Kumar S, 6% vs 8% Sreeharsha et al, 6% vs 8% Kumar et al, 20% vs 37.5% Chhabra et al 6.6% vs 10% Walia D S, 22.5% vs 47.5% Choudhury.^{12,5,4,13,14,15} However contrarily layered technique was associated in less wound infection than mass closure by 0% vs 29% Pollock, 0% vs 8.5% Shepherd, 18% vs 22% Ausobsky, 0% vs 7.9% Israelsson, 0% vs 3.5% Carlson, 6.6% vs 10% Deshmukh et al.^{16,17,18,19,20,21}

The rate of wound dehiscence in our overall study was 8.51% which represents 5.55% from layered group and 17.24% from the mass closure group. Study by Kumar S represented 4% overall wound dehiscence as 8% vs 0%.¹² Various researchers reflected their results in favor of our study like 4% vs 2% Sreeharsha et al 2% vs 0% Kumar et al, 10% vs 5% Chhabra et al, 10% vs 3.3% Walia D S, 3.75% vs 0% Choudhury, 1.48% vs 0.6%

Ausobsky, 3.88% vs 0.31% Kirk, 10.28% vs 0.92% Goligher, 1.05% vs 1.04% Irvin.^{13,5,4,14,15,18,22,23,24} However contrarily layered technique was associated in less wound infection than mass closure by 0% vs 0.7% Israelsson, 0% vs 1.3% Carlson.^{19,20}

Our study concludes the average time abdominal wound closure using mass vs layered technique to be 15 minutes and 25 minutes which is almost similar to time taken in a Study by Kumar S at Coimbatore Medical College.¹²

LIMITATIONS

The limitation of our study was that it was a single center study conducted in a small sample size, with convenient sampling so for generalization of results in multicentric study on a larger sample size should be done. The length of the incision site and total duration of hospital stay of the patients might have influenced by social and financial factors which is not avoided in this study.

CONCLUSION

Our study comparing mass versus layered closure of midline laparotomy found that mass closure is more effective in providing strength to the wound. Further we conclude that mass closure results in fewer instances of wound infection and dehiscence, with relatively less operative time and better overall compliance.

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