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Midline Abdominal Incisions: Mass Closure and Layered Closure

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KEYWORDS
layered closure, burst abdomen, mass closure

ABSTRACT:
The method and proper technique of closure of abdominal incisions during Laparotomy surgeries result in to good outcome in terms of pain, infection and healing which avoids complications like burst abdomen. This comparative study between mass closure and layered closure was done within 18 months at the Department of General Surgery, Dr. D. Y. Patil Medical College, Hospital & Research Centre, Pimpri, Pune. In mass closure-the abdomen is closed using the single layer closure technique with all layers of the abdominal wall sutured in a single layer. In layered closure the peritoneum, linea alba and Skin closed separately with non absorbable sutures after keeping abdominal drains wherever found necessary. The study showed differences between the two procedures in terms of risks like infection, burst abdomen and later on incisional hernia.

INTRODUCTION

Properly closing the abdominal wall is crucial for postgraduate surgical training. The European Hernia Society (EHS) introduced guidelines in 2015 to minimize the risk of incisional hernia formation. Abdominal incisions follow a healing process; inflammation for around 4 days, proliferation for up to 3 weeks, and maturation over a year. After the proliferative phase, the abdominal fascia is only 20% as strong as before. At 6 and 20 weeks post-surgery, it regains 50% and 80% of its strength respectively. However, it never fully recovers[2]. In 1970, Dudley's study using stainless steel wire showed that mass closure outperformed layered closure. A subsequent 1982 study with 1129 abdominal operations demonstrated that mass closure (3.81% vs. 0.76%) had a significantly lower dehiscence rate compared to layered closure[3,4]. Peritoneal closure can lead to increased adhesions, delayed subsequent layer closure, and prolonged surgery time[5]. Mass closure significantly reduces the risk of postoperative dehiscence and hernia formation, according to recent meta-analyses[6].

MATERIAL AND METHODS

It was a randomized non-blinded prospective study done from September 2021 till February 2023.

INCLUSION CRITERIA

Patients from age group 15 to 75 years, undergoing laparotomy for an emergency and elective surgery,

EXCLUSION CRITERIA

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

OPERATIVE DETAILS: All patients underwent exploratory laparotomy with a vertical midline incision extending below the arcuate line. In the mass closure group, a single-layer closure technique was employed. All layers of the abdominal wall were sutured together using

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reverse cutting Polypropylene (1-0) suture with continuous suturing and burying of the knots, performed in a mass fashion. For the layered closure group, the abdomen was closed in multiple layers with peritoneum and posterior rectus sheath sutured continuously with Polyglactin (2-0), while the anterior rectus sheath was sutured with Polypropylene (1-0) loop.

The patients were kept on a 6-month follow up. those who were lost to follow up, were requested to notify by phone or mail of any complications, such as surgical site infection, burst abdomen, or incisional hernia. Patients received intravenous antibiotics, including Ampicillin (500 mg, 4x a day for 5 days), gentamicin (80 mg, 2x day for 5 days), and Metronidazole (500 mg, 3x day for 2 days), only for clean-contaminated and contaminated surgeries. Skin closure was done with interrupted mattress sutures. Additionally, abdominal drains were inserted when deemed necessary.

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 number and percentage 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 24.0 of the SPSS program was used for all analyses.

ETHICAL STATEMENT: The Helsinki Declaration is complied with by the research protocol. The Institutional Ethics Committee gave its approval to the study before it started. All patients gave written informed consent. Intended harm to the subjects is absent. Before they gave their agreement, participants were informed of the study's methodology. The study did not impose any additional costs on the participants.

RESULTS

Table 1. Age group

Age Group(years)		Mass	Layered	Total
20 to 40	N	11	10	21
41 to 60	N	6	6	12
More than 60	N	0	1	1
Total	N	17	17	34

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Table 2. Gender

Type of Closure				**Total**
Sex		**Layered**	**Mass**	
Female	N	4	7	11
Male	N	13	10	23
Total	N	17	17	34

Table 3. Comparison of postoperative pain VAS score

Closure type	**Post- operative mean painVAS**	**Std. Deviation**	**p value**
Layered	1.77	1.39	
Mass	0.47	0.72	< 0.01

**analyzed using student's t test*

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Table 4. Distribution of patients according to surgical site infection rate

Type of Closure				**Total**
Wound Infection		**Layered**	**Mass**	
No	N	12	12	24
	%	70.60%	70.60%	70.60%
Yes	N	5	5	10
	%	29.40%	29.40%	29.40%
Total	N	17	17	34
	%	100.00%	100.00%	100.00%

Table 5. Distribution of patients according to their burst abdomen rate

Type of Closure				**Total**
Burst Abdomen		**Layered**	**Mass**	
No	N	9	16	25
	%	52.90%	94.10%	73.50%
Yes	N	8	1	9
	%	47.10%	5.90%	26.50%
Total	N	17	17	34
	%	100.00%	100.00%	100.00%
		p value* < 0.01		

**analyzed using chi-square test*

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DISCUSSION

This is a prospective randomized comparative study involving 34 patients aged 15 to 75, undergoing laparotomy on either an emergency or elective basis. There were 17 patients in both the mass closure and layered closure groups.

In the layered closure group, the mean age was 39.2 ± 11.6 years, while in the mass closure group, it was 38.5 ± 10.8 years. Among the patients, 67.6% were male (n=23), and the remaining 32.4% were female (n=11).

The postoperative mean pain VAS score was 0.47 ± 0.72 in the mass closure group, significantly lower than the score of 1.77 ± 1.39 in the layered closure group (p value < 0.01). Notably, prior similar studies did not compare postoperative pain between mass closure and layered closure groups.

We found that 29.4% 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 [7] is 25%. In the mass closure group, the infection rate was 13.33%, but in the multilayer closure group, it was 36.66%. 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.

A different study found that the rate of surgical site infections was 3.3% for the mass closure group and 10% for the multilayer closure group[8]. Euvalingam D, Nathan S, Deshmukh SN & Maske AN observed wound infection rate of 10% in the mass closure group and 6.6% in the layered closure group[9].

The incidence of burst abdomen was 5.1% in mass closure, significantly lower than the 47.1% observed in the layered closure (p value < 0.01)[10]. In a study by Walia DS, Mittal S, Singh K, and Kaur D, the burst abdomen incidence was 10% in the layered closure and 3.3% in the mass closure(p value = 0.61). Maruthi CH and Katari A reported a burst abdomen rate of 6.6% in the layered closure and 4% in the mass closure[9,11]. Euvalingam D and Nathan S found a burst abdomen rate of 3.3% in the layered closure group and 0% in the mass closure group[8].

Regarding incisional hernias, both the layered and mass closure groups had a 3.3% incidence. In a study by Akela A and Kumari R, wound dehiscence occurred in 7.1% of the layered closure group compared to 1.8% in the single layer closure group. Incisional hernias were observed in 4.1% of the single layer group and 7.1% of the layered closure group[12].

Mean days to return to activity

We concluded that the mass closure group took 23.35 days and the layered closure groups took 28.06 days on average to resume their regular activities. Regarding the mean days it took for each group to resume regular activities, there was no discernible variation.

CONCLUSION

Based on the findings of this study, we reach the following conclusion: Mean incision closure time was significantly shorter in the mass closure group (15.5 ± 2.8 minutes) than in the layered closure technique (23.4 ± 2.7 minutes) (p value < 0.001).

Compared to the layered closure group, the mass closure group experienced less mean pain and an incidence of burst abdomen after surgery. The two research groups' rates of wound infection were comparable.

Less closure time and improved clinical results were linked to the mass closure technique. It is advised that: For open midline abdominal incisions, the mass closure technique be used.