

Layered Closure and Retention Closure Technique for the Abdominal Wall in Midline Laparotomy at a Tertiary CentreAmit Ranjan¹, Noor Hasan Hussain², Khursheed Alam³^{1,2}Senior Resident, Department of surgery, Government Medical College and Hospital, Bettiah, West Champaran, Bihar, India.³Assistant Professor, Head of Department, Department of surgery, Government Medical College and Hospital, Bettiah, West Champaran, Bihar, India.

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Conflict of interest: Nil

Abstract:**Background:** The choice between layered closure and retention closure should be individualized based on patient factors. The present study was conducted to compare layered closure and retention closure technique for the abdominal wall in midline laparotomy**Materials & Methods:** 114 patients undergoing elective or emergency midline laparotomy of both genders were divided in to two groups of 60 and 54 in each depending on the closure type, layered closure (Group I) and retention closure (Group II) depending on the operating surgeon: retention closure was done in a single surgical unit and layered closure was done in rest of the respective units. Patients were followed-up meticulously and immediate postoperative complications were recorded up to four weeks.**Results:** Group I had 32 males and 28 females and group II had 24 males and 30 females. Pain score at day 1 was 3.4 and 3.8, at day 2 was 3.2 and 3.5, at day 3 was 2.5 and 2.8 and at day 7 was 2.1 and 2.5 respectively. Closure status had no dehiscence seen in 50 and 53, partial dehiscence in 7 and 1 and complete dehiscence in 3 and 0. Wound healing with primary intention seen in 58 and 50 patients in group I and II and secondary intention seen in 2 and 4 patients respectively. The difference was significant ($P < 0.05$).**Conclusion:** Retention closure found to be advantageous over layered closure.**Keywords:** Midline laparotomy, dehiscence, wound healing.

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Introduction

Although co-opting the different layers of a midline laparotomy incision is the traditional way of closure, other techniques have gained popularity recently [1]. One such method is the single layer mass closure approach, in which the skin and subcutaneous tissues are closed in separate layers, but all other layers of the abdominal wall are closed in a single layer. An additional technique that has gained popularity is the retention closure technique, which closes the wound in a single layer by encompassing all layers, including the skin and subcutaneous tissue [2]. These techniques are still used today to reduce wound complications after laparotomies, particularly in emergency situations [3]. They are typically used in elective procedures, while other reports claim that because of the patient's strong nutritional health, sufficient surgical preparation, and lack of related risk factors, the method of closure usually has little effect on the outcome of surgery in elective scenarios. Compared to the multilayer closure approach, the retained closure technique had lower postoperative rates of both early and late wound

complications [4]. The choice between layered closure and retention closure should be individualized based on patient factors [5]. Risk of dehiscence is higher in patients with factors like obesity, diabetes, chronic steroid use, malnutrition, and prior abdominal surgeries. The surgeon's assessment of tissue quality and tension on the closure. Anticipated recovery time, pain management, and potential for follow-up complications [6].

Aim and Objectives

The present study was conducted to compare layered closure and retention closure technique for the abdominal wall in midline laparotomy.

Materials & Methods

The present cross-sectional observational study included 114 patients between undergoing elective or emergency midline laparotomy of both genders and met the specified criteria for inclusion and exclusion was conducted at the Department of Surgery, Government Medical College, Bettiah,

West Champaran, Bihar, India, for a period of one year (January 2023– December 2023). All were informed regarding the study and their written consent was obtained. The Institutional Ethics Committee gave the study its approval. Data such as name, age, etc. was recorded. The participants were monitored and follow up for a period of 1 year.

Inclusion Criteria

- Patients to give written informed consent
- Patient's age between 18-60 years
- Available for follow up.

Exclusion Criteria:

- Patients not give written informed consent
- Patients with immune-compromised status and patients on chemotherapy or steroid treatment, re-operation of the abdominal surgery and
- Those unable to attend follow-up.

Sampling Size Determination and Sampling Technique

The following simple formula would be used for calculating the adequate sample size in prevalence study

$$N = Z^2 P (1-P)/d^2$$

N= sample size, Z= level of confidence, P= prevalence, d= Absolute error or precision

Z = Is standard normal variate (at 5% type 1 error (P< 0.05) it is 1.96 and at 1% type 1 error (P<0.01) it is 2.58). As in majority of studies P values are considered significant below 0.05 hence 1.96 is used in formula. p = Expected proportion in population based on previous studies or pilot studies.

The sample size was calculated using a single population proportion formula, by considering, 95% confidence level, a 5% margin of error, and a 6% estimated proportion of overall prevalence

$$\begin{aligned} \text{Sample size} &= 1.962 \times 0.06 (1-0.06)/0.052 \\ &= 86.67 \end{aligned}$$

Considering 10% non-response rate, the total minimum sample size for study was 96 patients. We included 114 (more than the minimum required number of cases) cases in the present study. They were divided into two groups of 60 in Group I and 54 in Group II depending on the closure type, layered closure (Group I) and retention closure (Group II) depending on the operating surgeon: retention closure was done in a single surgical unit and layered closure was done in rest of the respective units. All patients underwent treatment as per department standard protocol. Initial assessment included complete history, general physical and systemic examination. All routine blood investigations such as complete blood count, blood urea, serum creatinine, serum electrolytes, blood sugar, liver function test, X-ray Chest and abdomen, ultrasonography/ Contrast Enhanced Computed Tomography (CECT) abdomen were done, if required. Patients were followed-up meticulously and immediate postoperative complications were recorded up to four weeks.

Statistical Analysis

Data thus obtained were subjected to statistical analysis by using SPSS version 22.0 (IBM Corp., 2016) and Microsoft 16. P value < 0.05 was considered significant.

Results

Table 1: Demographic distribution of patients

Parameters	Group I (n=60)	Group II (n=54)	p Value
Method	Layered closure	Retention closure	0.34
M:F	32:28	24:30	
Age (in years)	39.23±12.65	43.83±11.81	0.079

Table 1 and figure I, shows that group I had 32 males and 28 females and group II had 24 males and 30 females with p value is 0.34 and mean age of patients in group I was 39.23±12.65 years and in group II was 43.83±11.81 years respectively with p value is 0.079.

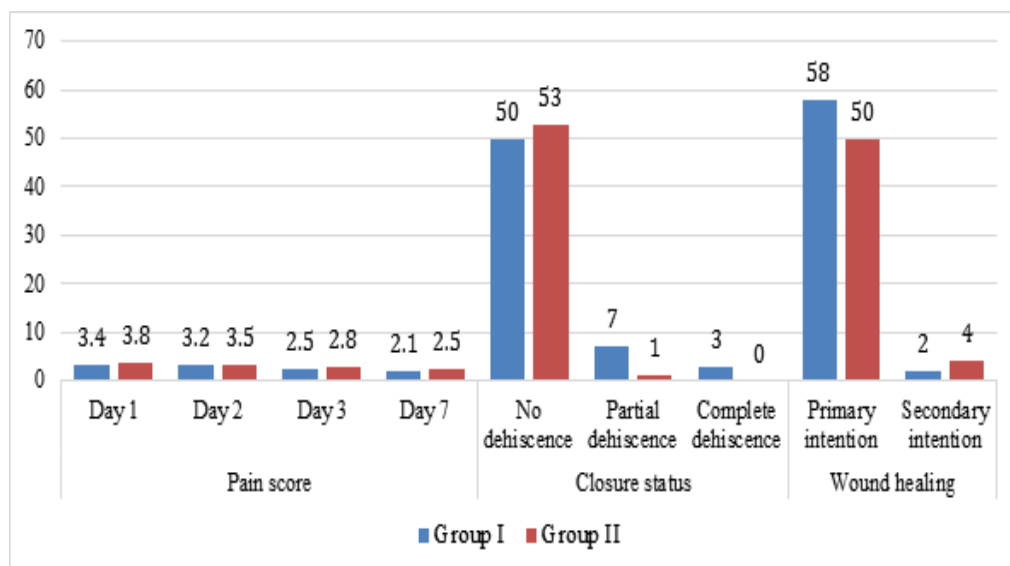


Figure 1: Assessment of different parameters among two groups

Table 2: Assessment of parameters

Parameters	Variables	Group I (n=60)	Group II (n=54)	P value
Pain score	Day1	3.4	3.8	0.05
	Day 2	3.2	3.5	
	Day 3	2.5	2.8	
	Day 7	2.1	2.5	
Closure status	No dehiscence	50	53	0.016
	Partial dehiscence	7	1	
	Complete dehiscence	3	0	
Wound healing	Primary intention	58	50	0.33
	Secondary intention	2	4	

Table 2 and figure I shows that pain score at day 1 was 3.4 and 3.8, at day 2 was 3.2 and 3.5, at day 3 was 2.5 and 2.8 and at day 7 was 2.1 and 2.5 respectively. Closure status had no dehiscence seen in 50 and 53, partial dehiscence in 7 and 1 and

complete dehiscence in 3 and 0. The difference was significant ($P < 0.05$). Wound healing with primary intention seen in 58 and 50 patients in group I and II and secondary intention seen in 2 and 4 patients respectively.

Table 3: Comparison of complication rate among two groups

Complications	Group I(n=60)	Group II(n=54)	p Value
	Frequency (Percentage)	Frequency (Percentage)	
Hematoma	6 (10)	2 (3.7)	0.193
Suture Sinus formation	4 (6.66)	0	0.032
Infections at the surgical site	10 (16)	2 (3.7)	0.022
Wound gaping	7 (11.66)	3 (5.55)	0.25

Table III and figure I, shows that Hematoma in 6 and 2 patient, Suture sinus formation in 4 and 0 patients, infection at the surgical site in 10 and 2 patients and wound gaping in 7 and 3 patients in Group I and II respectively. The difference was significant ($P < 0.05$).

Discussion

Midline laparotomy, a common surgical approach for accessing the abdominal cavity, requires careful closure techniques to prevent complications such as wound dehiscence, incisional hernia, and infection. Two primary techniques for closing the abdominal wall in midline laparotomy are layered closure and retention closure.⁷ Understanding the differences between these techniques and their respective

outcomes is crucial for surgical decision-making. Because it is less time-consuming and easy to access, the midline incision has always been the most popular technique for laparotomies. Notwithstanding improvements in surgical technique, antibiotic coverage, and suture material, postoperative wound failure is nevertheless frequently a serious side effect after laparotomies [8].

Numerous risk factors, including as patients' comorbid diseases such as diabetes mellitus, malnourishment, anaemia, uraemia, and a sudden increase in intra-abdominal pressure following surgery brought on by vomiting, coughing, or sneezing, among others, are commonly responsible for wound failure. Because of these factors, several

closure techniques have been favoured by surgeons based on their training and intraabdominal contamination during the surgical procedure [9]. The present study was conducted to compare layered closure and retention closure technique for the abdominal wall in midline laparotomy.

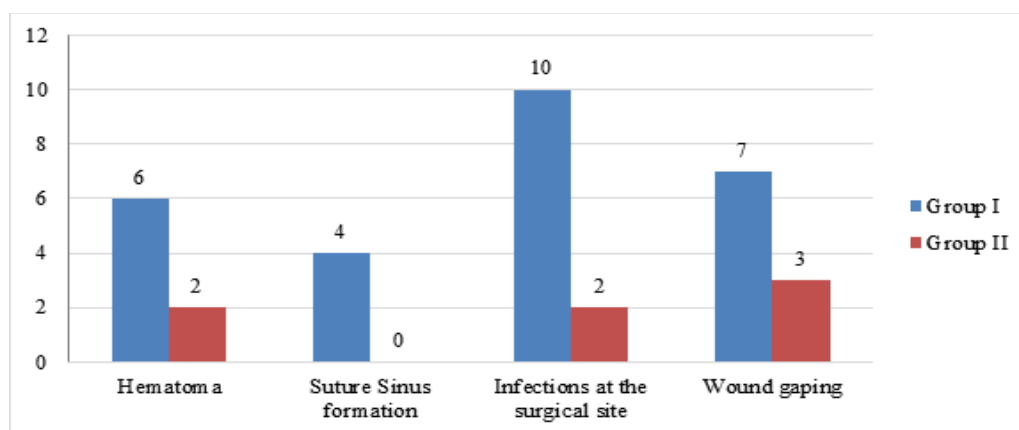


Figure 2: Comparison of complication rate among two groups

We found that group I had 32 males and 28 females and group II had 24 males and 30 females. Pain score at day 1 was 3.4 and 3.8, at day 2 was 3.2 and 3.5, at day 3 was 2.5 and 2.8 and at day 7 was 2.1 and 2.5 respectively. Murugan et al [10] compared the postoperative wound complications in layered closure with retention closure technique on 57 consecutive patients who underwent midline laparotomy. They were divided in to two groups depending on the closure type, layered closure (Group A) and retention closure (Group B) depending on the operating surgeon: retention closure was done in a single surgical unit and layered closure was done in rest of the respective units. Patients were followed-up meticulously and immediate postoperative complications were recorded up to four weeks. In Group A there were 30 patients while in group B there were 27 patients. In layered closure technique out of 30 patients 12 (40%) patients developed wound infection, 1 (3.3%) patient developed partial dehiscence, and 2 (6.6%) patients developed complete dehiscence. In retention closure technique out of 27 patients only 5 (18.5%) patients developed wound infection, 3 (11%) patients developed partial dehiscence and none of them had complete dehiscence in this group. There was significant association between wound complications and patients with uraemia and hypoalbuminemia. Out of 12 uremic patients 8 (66%) developed wound infection, 2 (16.7%) patients developed partial dehiscence and 2 (16.7%) patients developed complete dehiscence. In patients who had hypoalbuminemia, out of seven patients, 5 (71.4%) patients had wound infection and 2 (28.6%) patients did not have wound infection. Four (57.1%) patients had partial

dehiscence and 2 (28.6%) had complete dehiscence only 1 (14.3%) patient did not have any dehiscence.

We observed that closure status had no dehiscence seen in 50 and 53, partial dehiscence in 7 and 1 and complete dehiscence in 3 and 0. Wound healing with primary intention seen in 58 and 50 patients in group I and II and secondary intention seen in 2 and 4 patients respectively. Bande A et al.[11] studied comparing single layer closure and layered closure in 97 patients. The wound infection rate was 17.18% and 42.42% and burst abdomen rate was 1.5% and 3.03%, respectively between the two procedures. They concluded that single layer closure was less time consuming with fewer postoperative complications and superior to layered closure technique. Mohanad A:[12] had reported comparing mass closure and retention closure in 150 patients. The wound infection rate was 15.8% and 13.8% and the wound dehiscence rate was 13.5% and 4.1% respectively between the two procedures. They concluded that prophylactic retention sutures can decrease the incidence of abdominal wound dehiscence. However, although there was a decrease incidence of postoperative evisceration, wound infection and postoperative pain, this did not reach statistical significance. In our study, there were no statistically significant differences observed between the two groups in terms of age (39.23 ± 12.65 years in the layered suturing group vs. 43.83 ± 11.81 years in the retention closure group, $p=0.079$). The studies by Koi rala et al., and Chiu et al., also reported the mean age of the patients undergoing laparotomy to be 42 years and 30 years, respectively [13,14].

A recent study done by Murtaza et al., [15] using modified abdominal wound closure, reported a

wound infection rate of 33.33%¹⁵. In the present study, the incidence of Hematoma are 6 (10%) and 2 (3.7%), Suture sinus formation are 4 (6.66%) and 0, Infections at the surgical site are 10 (16%) and 2 (3.7%) and wound gaping are 7 (11.66%) and 3 (5.55%) were in the layered suturing group compared to the retention closure group respectively.

Limitation of the study: The shortcoming of the study is small sample size and short duration of the study.

Conclusion

Authors found that retention closure found to be advantageous over layered closure.

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References

- Murtaza B, Ali Khan N, Sharif MA, Malik IB, Mahmood A. Modified midline abdominal wound closure technique in complicated/high risk laparotomies. *J Coll Physicians Surg Pak*. 2010;20(1):37-41.
- Sivam NS, Suresh S, Hadke MS, Kate V, Ananthkrishnan N. Results of the Smead-Jones technique of closure of vertical midline incisions for emergency laparotomies-a prospective study of 403 patients. *Trop Gastroenterol*. 1995;16(4):62-67.
- Haefeli M, Elfering A. Pain assessment. *Eur Spine J*. 2006;15(Suppl 1):S17-24.
- Anderson DJ, Podgorny K, Berríos-Torres SI, Bratzler DW, Dellinger EP, Greene L, et al. Strategies to prevent surgical site infections in acute care hospitals: 2014 update. *Infect Control Hosp Epidemiol*. 2014;35(6):605-27.
- EL-Awany AS, Fouad AM. Partial wound dehiscence after midline laparotomy: A complication after tubo-ovarian abscess evacuation with pregnancy. *Archives of Perinatal Medicine*. 2014;20(4):229-31.
- Pollock AV. Laparotomy. *J R Soc Med*. 1981; 74(7):480-84.
- Burt BM, Tavakkolizadeb A, Ferzoco SJ. Incisions, closure and management of the abdominal wound: Michael J. Zinner, Stanley W. Ashley. *Maingot's abdominal operations*. 11th edition. United States: McGraw-Hill; 2007. chapter 4, Pp. 71-101.
- Nitin KB, Vasudevaiah DT, Nayak DRM, Naik DD, Dk DD. Comparative study of efficacy of modified Smead-Jones technique versus conventional closure of midline laparotomy wound. *Int J Surg Sci*. 2020;4(1):134-37.
- Ramneesh G, Sheerin S, Surinder S, Bir S. A prospective study of predictors for post laparotomy abdominal wound dehiscence. *J Clin Diagn Res*. 2014;8(1):80-83.
- Murugan A, Karthik M, Nilakantan A. Layered Closure Versus Retention Closure Technique for the Abdominal Wall in Midline Laparotomy: A Longitudinal Cohort Study. *Journal of Clinical & Diagnostic Research*. 2021 Oct 1;15(10).
- Bande A, Saxena D, Nichkaode PB, Akhtar M. A comparative study of single layer closure versus conventional layered closure of laparotomy wounds. *Int Surg J*. 2018;5(4):1459-63.
- Mohanad A. Effect of retention sutures for prevention of abdominal wound dehiscence after laparotomy in high- risk patients (a prospective study). *IOSR J Pharm*. 2014;4(2):38-43.
- Koirala R, Mehta N, Varma V, Kapoor S, Kumaran V, Nundy S. Urgent Redo Laparotomies: Patterns and Outcome A Single Centre Experience. *Indian J Surg*. 2015;77(3):195 19 9.
- Chiu WC, Shanmuganatha n K, Mirvis SE, Scalea TM. Determining the need for laparotomy in penetrating torso trauma: a prospective study using triple contrast enhanced abdominopelvic computed tomography. *J Trauma*. 2001;51(5):860 86 8.
- Murtaza B, Ali Khan N, Sharif MA, Malik IB, Mahmood A. Modified midline abdominal wound closure technique in complicated/high risk laparotomies. *J Coll Physicians Surg Pak*. 2010;20(1):37 41.