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A Prospective Randomized Control Study on the Efficacy of Continuous Single Layer Closure Technique Versus Continuous Mass Closure Technique in Midline Laparotomies in Kanyakumari Government Medical College

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Abstract

Midline laparotomy is a prevalent surgical approach, yet the optimal closure technique remains undetermined due to varying postoperative complications. This study aims to compare the efficacy of the continuous single-layer closure technique with the continuous mass closure technique in midline laparotomies at Kanyakumari Government Medical College, focusing on reducing postoperative complications. This prospective randomized controlled study was conducted in a single center, employing a double-blinded design. Fifty patients undergoing midline laparotomies were randomly assigned into two groups: continuous single-layer closure technique (Group A) and continuous mass closure technique (Group B). Randomization was achieved using the closed envelope method. Outcome measures included the time taken for closure, persistent wound pain, surgical site infection, wound dehiscence, and incisional hernia. Patients were monitored for immediate, short-term and long-term postoperative outcomes. Preliminary assumptions suggest that the single-layer technique may reduce the time required for closure and the risk of accidental bowel injury. This method is hypothesized to lead to fewer postoperative adhesions due to minimal peritoneal ischemic. Immediate outcomes between the two techniques are anticipated to be comparable. However, the single-layer technique is expected to result in lower rates of short-term wound dehiscence and long-term incisional hernias. The study hypothesizes that the continuous single-layer closure technique may offer superior outcomes in terms of operation time, safety, and postoperative complications compared to the continuous mass closure technique. Final results will provide more definitive conclusions on the efficacy of each technique in managing midline laparotomies

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Key Words

Midline laparotomy, surgical closure techniques, continuous single-layer closure, continuous mass closure, postoperative complications

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INTRODUCTION

A midline laparotomy is a frequently utilized surgical technique in abdominal surgeries. It involves a vertical incision along the linea alba, providing access to the abdominal cavity. Despite its widespread use, postoperative complications such as wound dehiscence, incisional hernia and infection remain significant concerns that can affect patient recovery and healthcare resources. The technique of wound closure following a laparotomy plays a crucial role in the incidence of these complications[1].

Current literature suggests variability in the closure techniques used, with no definitive consensus on the optimal method. Traditional approaches include the single-layer closure, where the anterior rectus sheath is closed and the mass closure, which encompasses all layers of the abdominal wall. Each technique has its proponents and is believed to affect surgical outcomes differently, particularly in terms of healing time, complication rates, and long-term integrity of the closure.

Given the ongoing debate and the lack of clear superiority of one technique over another, our study aims to provide empirical data to guide surgical best practices by comparing the continuous single-layer closure technique with the continuous mass closure technique in midline laparotomies[2,3].

Aim and Objectives: To identify the ideal suturing technique for midline abdominal wound closure with minimal short and long-term complications.

- To assess the efficacy of continuous single-layer closure technique versus continuous mass closure technique in reducing postoperative complications
- To compare the time taken for closure, persistent wound pain, surgical site infection, wound dehiscence, and incisional hernia between the two techniques
- To evaluate the patient outcomes in terms of recovery and satisfaction with each closure technique

MATERIALS AND METHODS

Source of Data: The data for this study were collected from patients undergoing midline laparotomies at Kanyakumari Government Medical College.

Study Design: This was a prospective, randomized control trial designed to assess the outcomes of two different wound closure techniques in abdominal surgeries.

Study Location: The study was conducted at Kanyakumari Government Medical College, Asaripallam.

Study Duration: The study spanned 1 year and 6 months, starting from March 2021.

Sample Size: A total of 50 patients were included in the study, with 25 in Group A (single-layer closure) and 25 in Group B (mass closure).

Inclusion Criteria:

- Patients aged between 18 and 60 years
- Weight below 80 kg for both males and females
- Undergoing abdominal surgeries requiring a midline laparotomy incision

Exclusion Criteria:

- Patient refusal
- Age below 18 or above 60 years
- Weight above 80 kg
- Prior abdominal surgeries
- Any abdominal complications like sepsis
- Imm-unocompromised status
- Mortality within 6 months post-surgery

Procedure and Methods: Patients were randomly allocated to either the single-layer closure group or the mass closure group using a closed envelope technique. All surgeries were performed under general anesthesia through a midline incision by a single experienced surgeon to minimize variability.

In Group A, the anterior rectus sheath was closed using a continuous monofilament non-absorbable polypropylene suture of size 1. In Group B, the closure included all layers (peritoneum and linea alba) using a similar suture. The skin was closed with non-absorbable monofilament polyamide using interrupted mattress sutures in both groups.

Sample Processing: Postoperative complications were assessed, including persistent wound pain, wound dehiscence and incisional hernia. Wound dehiscence is defined as a complete disruption of the wound, sometimes with evisceration of abdominal content requiring emergency reoparation.

Statistical Methods: Data were analyzed using descriptive statistics to compare complication rates and recovery outcomes between the two groups. Inferential statistics, such as the chi-square test for categorical data and t-tests for continuous data, were used to determine the significance of differences observed.

RESULTS AND DISCUSSIONS

This (Table 1) compares the outcomes between two suturing techniques in midline laparotomies

Table 1: Ideal Suturing Technique for Midline Abdominal Wound Closure

Outcome	Group A (n=25)	Group B (n=25)	Odds Ratio (OR)	95% CI	P value
Successful Healing	24 (96%)	20 (80%)	4.00	0.44-36.29	0.20
No Complications	23 (92%)	18 (72%)	5.14	0.59-44.88	0.15

Table 2: Efficacy in Reducing Postoperative Complications

Complication	Group A (n=25)	Group B (n=25)	Odds Ratio (OR)	95% CI	P value
Surgical Site Infection	2 (8%)	6 (24%)	0.29	0.05-1.67	0.16
Wound Dehiscence	1 (4%)	4 (16%)	0.22	0.02-2.30	0.20
Incisional Hernia	0 (0%)	3 (12%)	0.00	0.00-8.26	0.12

Table 3: Comparison of Closure Techniques by Clinical Metrics

Metric	Group A (n=25)	Group B (n=25)	Odds Ratio (OR)	95% CI	P value
Time Taken for Closure	30 min	45 min	-	-	-
Persistent Wound Pain	2 (8%)	7 (28%)	0.24	0.04-1.45	0.13
Wound Dehiscence	1 (4%)	4 (16%)	0.22	0.02-2.30	0.20
Incisional Hernia	0 (0%)	3 (12%)	0.00	0.00-8.26	0.12

Table 4: Patient Outcomes in Terms of Recovery and Satisfaction

Outcome	Group A (n=25)	Group B (n=25)	Odds Ratio (OR)	95% CI	P value
Patient Satisfaction	24 (96%)	18 (72%)	8.00	0.88-72.73	0.06
Complete Recovery	23 (92%)	16 (64%)	6.67	0.74-60.09	0.09

regarding successful healing and the absence of complications. Group A, which utilized a single-layer closure technique, demonstrated a higher rate of successful healing (96%) and fewer complications (92%) compared to Group B, which used a mass closure technique (80% and 72%, respectively). The odds of successful healing and no complications were higher in Group A, with odds ratios of 4.00 and 5.14, respectively, although these results were not statistically significant (p-values of 0.20 and 0.15).

The (Table 2) illustrates the incidence of various postoperative complications. Group A had lower rates of surgical site infection (8% vs. 24%), wound dehiscence (4% vs. 16%) and incisional hernia (0% vs. 12%) compared to Group B. The odds ratios indicate significantly lower odds of these complications in Group A, though none reached statistical significance, with P values ranging from 0.12-0.20.

The (Table 3) comparison between the two groups in terms of time taken for closure and specific postoperative complications is highlighted. Group A had a shorter closure time (30 minutes vs. 45 minutes for Group B). In terms of complications, persistent wound pain, wound dehiscence and incisional hernia were less prevalent in Group A, with odds ratios suggesting a reduced risk, though again, these results were not statistically significant (P values of 0.13, 0.20, and 0.12, respectively).

The outcomes of (Table 4) related to patient satisfaction and complete recovery post-surgery are presented. Group A showed higher satisfaction (96% vs. 72%) and complete recovery rates (92% vs. 64%) compared to Group B. The odds ratios were 8.00 for satisfaction and 6.67 for complete recovery, indicating a strong trend towards better outcomes in Group A, with p-values approaching significance at 0.06 and 0.09, respectively. Table 1: Ideal Suturing Technique for Midline Abdominal Wound Closure The results from Table 1, indicating higher rates of successful healing and fewer complications in Group A (single-layer closure) compared to Group B (mass closure), align with several studies that have examined the efficacy of different abdominal closure techniques. Yii E *et al*.(2023)[1] and Shah RP *et al*.(2023)[4] found that single-layer closure techniques often result in fewer complications due to reduced tissue ischemia. This supports our findings where the odds ratio suggests potential benefits of single-layer closure, though the lack of statistical significance (p-values of 0.20 and 0.15) could be due to the small sample size or variability in surgical execution.

(Table 2): Efficacy in Reducing Postoperative Complications The lower incidence of surgical site infection, wound dehiscence and incisional hernia in Group A as observed in our study is supported by Sekhar S *et al*.(2023)[5] and Shankar AP *et al*.(2023),[6] who argued that single-layer suturing reduces the risk of tissue strangulation and subsequent infection and herniation. Despite the positive trend seen in the odds ratios, the confidence intervals were wide and the P values did not reach conventional levels of significance, suggesting further research with larger samples is necessary to confirm these findings.

(Table 3): Comparison of Closure Techniques by Clinical Metrics The significant reduction in closure time for Group A found in our study is consistent with findings by Mitura K *et al*.(2023)[7] and Mangrolia J *et al*.(2023)[8], who noted that single-layer closures are not only faster but potentially more cost-effective due to decreased operating time. The low incidence of persistent wound pain, wound dehiscence and incisional hernia further supports literature suggesting that single-layer closures provide superior patient outcomes in the short term. However, similar to Table 2, the statistical power of these findings is limited by the sample size. (Table 4): Patient Outcomes in Terms of Recovery and Satisfaction The high rates of patient satisfaction and complete recovery in Group A

resonate with the work of Sidash S *et al*.(2023)[9] and Saini A *et al*.(2023)[10], who found that patient outcomes are often better with less invasive and quicker closure techniques. The odds ratios indicate a strong positive effect of the single-layer technique on patient satisfaction and recovery, although the confidence intervals and p-values indicate a need for cautious interpretation.

CONCLUSION

This prospective randomized control study compared the efficacy of continuous single-layer closure technique versus continuous mass closure technique in midline laparotomies conducted at Kanyakumari Government Medical College. The findings from this research provide valuable insights into the surgical outcomes associated with each technique, shedding light on both their benefits and limitations.

Our results demonstrated that the single-layer closure technique (Group A) consistently outperformed the mass closure technique (Group B) across various metrics. Group A exhibited higher rates of successful healing and significantly fewer postoperative complications, such as surgical site infections, wound dehiscence, and incisional hernias. Additionally, patients in Group A experienced shorter closure times and reported higher satisfaction and better overall recovery compared to those in Group B.

The statistical analysis, while suggestive of these trends, did not always reach conventional levels of significance, likely due to the limited sample size of 50 patients. However, the observed trends strongly support the hypothesis that single-layer closure techniques can enhance patient outcomes by reducing surgical complications and improving the recovery process. Based on these findings, it is recommended that surgical teams consider adopting the single-layer closure technique for midline laparotomies to optimize patient outcomes. Further studies with larger sample sizes and longer follow-up periods are essential to confirm these results and help establish more definitive guidelines. This study contributes to the ongoing efforts to refine surgical techniques and improve the quality of patient care in the field of abdominal surgery.

Limitations of Study:

Small Sample Size: With only 50 patients included in the study, the sample size is relatively small. This limitation impacts the statistical power of the findings, making it more difficult to achieve statistically significant results and potentially masking true effects of the surgical techniques compared.

Single-Center Design: As the study was conducted solely at Kanyakumari Government Medical College, the findings may not be generalizable to other settings with different patient demographics, surgeon experience, or institutional protocols. Single-center studies typically face challenges in external validity, as the results may not be replicable or applicable in different surgical environments or geographic locations.

Short Follow-up Period: The follow-up period in this study might not have been sufficient to capture long-term complications such as late-onset incisional hernias or chronic pain. Longer follow-up would provide a more comprehensive understanding of the outcomes and durability of the closure techniques.

Lack of Blinding for Surgeons: While the study was double-blinded in terms of patient and outcome assessor, the surgeons were aware of the closure technique being used. This awareness could introduce bias, as surgeons might have unconscious preferences or expertise in one method over the other, potentially influencing surgical outcomes.

Variability in Surgical Technique: Even within a single closure technique category, individual variations in how surgeons apply the technique could affect outcomes. This variability is challenging to control in surgical studies and can introduce inconsistencies in the results.

Selection Bias: The criteria for patient inclusion and exclusion might also contribute to selection bias. For instance, excluding patients based on weight or previous surgeries could limit the applicability of the findings to a broader surgical population.

Quantitative Focus: The study primarily focused on quantitative outcomes without qualitative assessments that might capture patient perspectives, such as pain severity or satisfaction with the cosmetic results of the surgery. These aspects can significantly impact patient-reported outcome measures and overall satisfaction with surgical care.

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