

ORIGINAL ARTICLE

Comparison of postoperative pain with and without rectus sheath block in patients undergoing midline laparotomy.

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ABSTRACT... Objective: To compare mean postoperative pain with and without rectus sheath block in patients undergoing midline laparotomy. **Study Design:** Randomized Controlled Trial. **Setting:** Department of Surgery, Allied Hospital Faisalabad. **Period:** April '24 to September '24. **Methods:** We enrolled 84 patients aged 13–60 years undergoing elective or emergency midline laparotomy who were randomly assigned to two groups: Group A (RSB group) and Group B (non-RSB group). RSB was performed using a landmark-based technique with 0.25% bupivacaine. Pain intensity was measured at 1, 4, 12, and 24 hours following surgery using the Visual Analogue Scale (VAS). Rescue analgesic requirements were also recorded. **Results:** The RSB group showed significantly lower VAS scores at 1 hour (2.46 ± 0.73 vs. 4.56 ± 0.69 , $p = 0.000$) and 24 hours (4.51 ± 0.62 vs. 4.82 ± 0.74 , $p = 0.041$). Mean rescue analgesic doses were also significantly lower in the RSB group (1.12 ± 0.77 vs. 2.74 ± 1.13 , $p = 0.000$). Demographics were comparable across groups, with 63.1% males and 50% ASA I status. Findings align with 12 supporting studies, suggesting consistent benefit of RSB in terms of pain control and opioid-sparing effects. **Conclusion:** Landmark-guided rectus sheath block significantly reduces postoperative pain and opioid use in midline laparotomy. Its efficacy is comparable to ultrasound-guided methods and may be enhanced through preoperative timing and adjuvant use. RSB is a valuable tool, especially in settings lacking advanced imaging.

Key words: Analgesia, Bupivacaine, Midline Laparotomy, Postoperative Pain, Regional Anesthesia, Rectus Sheath Block.

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INTRODUCTION

A laparotomy, routinely performed by general surgeons¹, entails opening the abdomen to examine internal organs and determine the appropriate course of action. Midline laparotomies, in particular, are often followed by considerable postoperative discomfort due to the activation of neuroendocrine stress mechanisms.² Postoperative pain management not only eases patient suffering but also enhances the economic efficiency of care delivery. Nevertheless, a universally effective and optimal strategy has yet to be identified.³⁻⁷ Multimodal analgesia—encompassing both pharmacologic and non-pharmacologic treatments—is fundamental to achieving satisfactory postoperative pain control in abdominal operations. The Rectus Sheath Block (RSB) is a widely practiced method for delivering analgesia in patients undergoing open abdominal surgery.⁸

Schleich originally described the Rectus Sheath Block in 1899, focusing on the administration of local anesthetic into the anatomical space located between the posterior surface of the rectus abdominis muscle and its enveloping sheath.⁹ The anesthetic deposited in this virtual space is theorized to distribute cranio-caudally, thereby anesthetizing the terminal branches of the intercostal nerves before their emergence from the rectus sheath.¹⁰ The ventral branches of thoracic nerves T6 to T12 supply the central anterior abdominal wall. These nerves course within the potential space between the rectus abdominis and the posterior rectus sheath, typically entering the muscle near its medial border. In the absence of ultrasound guidance, particularly in resource-constrained environments, the Rectus Sheath Block can be executed using a landmark-based blind technique.¹¹

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A study on the effectiveness of rectus sheath block after midline laparotomy reported that RSB is a useful postoperative analgesia. There was a notable difference in pain levels between the groups, which reached statistical significance. At first hour postoperative pain was 2.54 ± 0.67 in RSB group and 4.65 ± 0.78 in patients without RSB. At the end of 24 hours pain was 4.46 ± 0.46 in RSB group and 4.89 ± 0.87 in without RSB group.¹²

There is limited evidence in the literature regarding the efficacy of rectus sheath blocks for postoperative pain relief in midline laparotomy cases. So, the purpose of this study is to compare between pain in patients undergoing midline laparotomy with and without RS block. The technique with better pain management will be recommended in future to minimize postoperative morbidity in patients.

METHODS

This randomized controlled trial was conducted in the Department of Surgery, Allied Hospital Faisalabad, over a duration of six months (April'24 to September'24) following the approval of the synopsis by the Ethical Review Committee (Reference No.48.ERC/FMU/2023-24-415, Dated: 29/03/2024).

The study included 84 patients, aged between 13 and 60 years, who were scheduled to undergo elective or emergency midline abdominal laparotomy and were classified as ASA I or II. The sample size was calculated using the OpenEpi calculator for comparison of two means, assuming a 5% level of significance, 80% power, an anticipated mean postoperative pain score of 4.46 ± 0.467 in the RSB group, and 4.89 ± 0.877 in the non-RSB group, resulting in 42 patients per group. Non-probability consecutive sampling was employed to recruit eligible patients.

Eligible participants included male and female patients aged 13–60 years who were scheduled for emergency/elective midline laparotomy and also classified according to ASA I/II. Exclusion criteria comprised psychiatric illness, prior paramedian laparotomy, coagulopathies, peripheral neuropathy, obstructive sleep apnea, and chronic pain syndromes. Patients who provided written informed

consent were randomized into two groups using a random number table to ensure unbiased group allocation. Group A underwent midline laparotomy with rectus sheath block (RSB), while Group B underwent midline laparotomy without RSB. All surgical procedures were performed by consultants with at least three years of post-fellowship experience. For patients in Group A, the RSB was performed using the landmark technique. A point 3 cm lateral to the midline was identified, and a short bevel 5 cc needle was inserted through the skin and anterior rectus sheath until firm resistance was felt. Following confirmation of negative blood aspiration, 20 ml of 0.25% bupivacaine was administered into the posterior rectus sheath on both the left and right sides to achieve effective bilateral analgesia.

Postoperatively, all patients received ketorolac injections as standard analgesia. Rescue analgesia consisting of tramadol and Maxolone was administered as needed. Pain intensity was assessed using the VAS on various intervals i.e. 1, 4, 12 and 24 hours postoperatively. The number of rescue analgesic doses required during the 24-hour postoperative period was also recorded. All relevant demographic, clinical, and procedural data were documented on a predesigned proforma. SPSS version 25 was used for statistical analysis. Means and standard deviations were calculated for continuous variables like age, BMI, incision length, surgical duration, and pain scores. Frequencies and percentages were used to describe categorical variables such as gender, ASA class, and surgery type. An independent sample t-test compared postoperative pain scores between groups. To account for effect modifiers—including age, gender, BMI, surgery type, incision size, and duration—stratification was applied, followed by post-stratification t-tests with $p < 0.05$ as a threshold of significance.

RESULTS

In our study involving 84 patients who underwent midline laparotomy, the distribution of categorical demographic and clinical variables was assessed. The majority of the participants (63.1%) were aged between 13 and 40 years, while 36.9% were in the older age group of 41 to 60 years. Males constituted 63.1% of the sample, with females making up the

remaining 36.9%. Regarding physical health status, exactly half of the participants (50%) were classified as ASA I, and the other half as ASA II, indicating a balanced distribution in terms of anesthesia risk stratification. In terms of the type of surgery, 41.7% underwent elective procedures while a larger proportion, 58.3%, underwent emergency laparotomies. These distributions reflect a diverse surgical cohort, allowing for a reliable comparison of postoperative outcomes across varied clinical scenarios.

The continuous variables were analyzed to understand the overall clinical profile of the participants, suggesting a relatively young to middle-aged adult sample with mean $\pm$ sd 35.93 $\pm$ 13.94 years for age and for 25.53 $\pm$ 2.72 kg/m² BMI, falling within the upper range of the normal category. The average incision length during surgery was 14.59 $\pm$ 2.92 cm, indicative of typical midline laparotomy exposure. Surgery duration averaged 123.24 minutes, with a standard deviation of 35.79 minutes. These values confirm that patients underwent standard-length operations with considerable homogeneity in procedural complexity. When comparing the surgery duration between the RSB and No-RSB groups specifically, it was found that the RSB group had a mean duration of 126.29 $\pm$ 37.15 minutes, while the No-RSB group had a mean of 120.19 $\pm$ 34.55 minutes, ($p = 0.438$) indicating comparable surgical times across both groups and ruling out procedure length as a confounding factor for pain outcomes.

The core objective of the study was to evaluate the effectiveness of rectus sheath block in controlling postoperative pain. Pain scores were measured using VAS at multiple postoperative intervals. At 1 hour postoperatively, patients in the RSB group reported a significantly lower mean pain score of 2.46 $\pm$ 0.73, compared to 4.56 $\pm$ 0.69 in the No-RSB group ($p = 0.000$), demonstrating a highly significant difference. This suggests that RSB provides substantial early postoperative analgesia. At 4 hours post-op, both groups reported similar mean pain scores — 3.19 $\pm$ 0.92 in the RSB group and 3.10 $\pm$ 0.82 in the No-RSB group ($p = 0.660$). This indicates that the initial benefit observed at 1 hour may not persist or may equalize due to other analgesics administered postoperatively. At 12

hours, a modest increase in pain was noted in both groups. The RSB group had a mean VAS score of 3.50 $\pm$ 0.86, while the No-RSB group had a slightly higher score of 3.72 $\pm$ 0.74, but the difference remained statistically non-significant ($p = 0.228$). Notably, at 24 hours postoperatively, pain scores again reflected a statistically significant intergroup difference. The RSB group reported a mean score of 4.51 $\pm$ 0.62, compared to 4.82 $\pm$ 0.74 in the No-RSB group ($p = 0.041$), indicating that rectus sheath block may still contribute to moderate pain relief even at a later time point.

Furthermore, when comparing the number of rescue analgesic doses required, patients in the RSB group needed significantly fewer additional pain medications, with a mean count of 1.12 $\pm$ 0.77 doses compared to 2.74 $\pm$ 1.13 in the No-RSB group ($p = 0.000$). This not only reinforces the analgesic effectiveness of the RSB technique but also suggests a potential reduction in opioid or non-opioid analgesic use, which may help reduce drug-related side effects and enhance overall patient recovery.

TABLE-I

Frequency distribution of categorical variables (N=84)

Variable	Group	Count	Percent
Age	13-40	53	63.1%
	41-60	31	36.9%
Gender	Male	53	63.1%
	Female	31	36.9%
ASA Status	I	42	50.0%
	II	42	50.0%
Surgery Type	Elective	35	41.7%
	Emergency	49	58.3%

FIGURE-1

Comparison of mean postoperative pain score

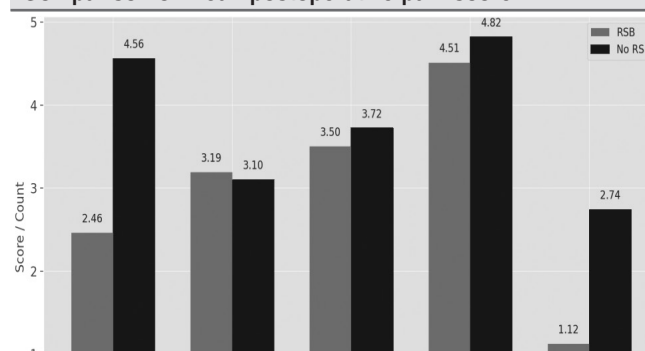


TABLE-II

Descriptive statistics for continuous variables of the participants

Variable	Mean	Standard Deviation	N
Age	35.93	13.94	84
BMI	25.53	2.72	84
Incision Length (cm)	14.59	2.92	84
Surgery Duration (min)	123.24	35.79	84
Surgery Duration (min)	126.29 ± 37.15	120.19 ± 34.55	0.438

TABLE-III

Comparison of mean postoperative pain with and without rectus sheath block in patients undergoing midline laparotomy

Variable	RSB Mean (±SD)	No RSB Mean (±SD)	P-Value
VAS 1hr	2.46 ± 0.73	4.56 ± 0.69	0.000
VAS 4hr	3.19 ± 0.92	3.10 ± 0.82	0.660
VAS 12hr	3.50 ± 0.86	3.72 ± 0.74	0.228
VAS 24hr	4.51 ± 0.62	4.82 ± 0.74	0.041
Rescue Analgesia Count	1.12 ± 0.77	2.74 ± 1.13	0.000

DISCUSSION

This randomized controlled trial investigated the effectiveness of rectus sheath block (RSB) for postoperative pain management in patients undergoing midline laparotomy. Our study demonstrated that RSB significantly reduced pain scores at 1 and 24 hours postoperatively and lowered the requirement for rescue analgesics. These outcomes were compared with various previous studies to provide context, highlight congruencies, and identify opportunities for optimization.

In our study, the majority of patients (63.1%) were aged between 13 and 40 years, and 63.1% were male. Half of the patients were ASA I and the other half ASA II. Emergency laparotomies made up 58.3% of cases. These characteristics mirror several other studies. For example, Sah et al¹³ included ASA I–II patients aged 18–60, closely matching our inclusion criteria. Kuldeep et al¹⁴ also enrolled patients within a similar ASA and age bracket. Hassan et al¹⁷ studied ASA I–II patients aged 18–65, while Teshome et al¹⁵ though not specifying ages, focused on adult emergency laparotomy cases. The similarity in patient selection reinforces the validity of comparisons and supports the applicability of our findings across a broad adult surgical population. However, some studies like Jeong et al¹⁶ included laparoscopic patients and extended the upper age limit to 75 years, which, while different in procedural

type, adds perspective to timing and technique.

Our results showed a statistically significant reduction in mean VAS scores at 1 hour (2.46 ± 0.73 vs. 4.56 ± 0.69, $p = 0.000$) and 24 hours (4.51 ± 0.62 vs. 4.82 ± 0.74, $p = 0.041$) in the RSB group. These findings align strongly with Teshome et al¹⁵ who reported significantly reduced numeric rating scores in the RSB group at all time intervals. Sah et al¹³ also demonstrated significantly lower VAS scores at multiple intervals including 1, 4, 8, 12, and 24 hours. When linked together, these studies establish a consistent pattern of RSB efficacy across both landmark-based and ultrasound-guided techniques. In terms of rescue analgesia, our study found that patients in the RSB group required fewer doses (1.12 ± 0.77) than those without RSB (2.74 ± 1.13), a finding echoed by Teshome et al¹⁵ and Kuldeep et al¹⁴ and Hassan et al.¹⁷ These studies, using either bupivacaine or ropivacaine (with or without ketamine), confirm that RSB significantly reduces opioid requirements.

Our study used a landmark-based technique with bupivacaine. Teshome et al¹⁵ similarly used landmark guidance, proving the technique's feasibility in resource-limited environments. In contrast, Sah et al¹³ and Laguduva et al¹⁸ employed ultrasound-guided RSB, which may offer greater precision. Their findings—superior pain control and reduced adverse

effects—suggest a benefit of image guidance, although our results show that landmark-based RSB is still highly effective. Regarding anesthetic agents, we used 0.25% bupivacaine. Kuldeep et al¹⁴ found ropivacaine to be superior in duration and patient satisfaction compared to bupivacaine and placebo. Hassan et al¹⁷ enhanced RSB with ketamine, reporting better pain scores and lower morphine consumption. These studies suggest that choice of agent and use of adjuvants can modulate block efficacy and may be explored in future trials.

Jeong et al¹⁶ assessed the timing of RSB in laparoscopic surgery and found that preoperative RSB reduced postoperative analgesic consumption more than postoperative RSB. Although our blocks were given intraoperatively, this evidence supports the concept of preemptive analgesia and encourages further study of RSB timing in open surgery. The value of regional anesthesia over systemic analgesia was also supported by Ersoy et al¹⁹ who compared TAP blocks with tramadol and found superior pain control and reduced opioid use in the TAP group. Though anatomically distinct, this study reinforces that abdominal wall blocks like RSB or TAP are more effective than systemic opioid-only protocols.

Our study has several strengths. It is a randomized controlled trial with a well-matched control group. It used a practical landmark-based technique, suitable for low-resource settings. It also captured pain scores at multiple postoperative intervals and measured rescue analgesic requirements objectively. Including both elective and emergency surgeries enhances its generalizability. Our study did not assess secondary outcomes such as PONV and patient satisfaction, which were considered in Sah et al¹³ and Laguduva et al.¹⁸ We also used only bupivacaine, without comparing other agents or adjuvants as done by Kuldeep et al¹⁴ and Hassan et al.¹⁷ Moreover, the absence of ultrasound may limit block consistency, and pain assessments were not blinded. A gender-based subgroup analysis was not performed, though 63.1% of participants were male.

CONCLUSION

Our findings, in light of various studies, confirm that rectus sheath block is an effective modality

for postoperative pain management in midline laparotomy. It reduces early and late postoperative pain and minimizes opioid requirements. The literature further supports that RSB's effectiveness can be influenced by the technique (landmark vs. ultrasound), choice of anesthetic agent, timing of administration, and addition of adjuvants. Future studies should address these variables, evaluate patient-centered outcomes, and explore the feasibility of ultrasound guidance in low-resource environments to enhance RSB's utility.

CONFLICT OF INTEREST

The authors declare no conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

1	Isha Nasar: Data collection, analysis, writing.
2	Muhammad Saleem Iqbal: Discussion writing.
3	Safwan Ahmad Khan: Writing.
4	Muhammad Zeshan Zaib: Literature review, data entry.
5	Sadia Riaz: Data analysis.
6	Muhammad Faisal Bilal Lodhi: Proof reading.