ORIGINAL ARTICLE

Effectiveness of Rectus Sheath Block on Postoperative Analgesia in Scheduled Midline Laparotomy under General Anaesthesia

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Abstract

Background: Midline laparotomy, a widely performed surgical procedure, is associated with significant postoperative pain that may delay recovery, prolong hospital stay and also lead to adverse surgical outcomes. As a part of multimodal analgesia, Rectus Sheath Block (RSB) may be a simple effective alternative that minimize postoperative complications and promote earlier recovery. The Objective of this study was to evaluate the effectiveness of RSB on postoperative pain relief in scheduled midline laparotomy under General Anaesthesia.

Methods: This study was carried out from July 2024 to July 2025 in the General Surgery and MIS operation theatre (OT) in the department of Anaesthesia, Analgesia & Intensive Care Medicine, Bangladesh Medical University. Participants were randomly allocated into two groups: Group-R received ultrasound-guided rectus sheath block (RSB) with 0.3 mL/kg of 0.25% bupivacaine on each side of abdomen before surgical incision while Control Group-C received same volume of Normal Saline as placebo. Postoperative pain intensity was assessed by visual analogue scale (VAS), measured immediately in the postanaesthesia care unit (PACU) and at 3, 6, 12, and 24 postoperative hours. Rescue opioid analgesia as Morphine (0.05 mg/kg IV) was given when pain intensity by VAS ≥4. First analgesic request time (minutes), total Morphine consumption (mg) in 24 hours, frequency of postoperative vomiting, perioperative haemodynamic parameters (HR, SBP, DBP, MAP and SpO_2) and patient's satisfaction (based on a questionnaire graded on 5-Points Likert scale) were recorded.

Results: A total of 60 patients were included in this interventional study based on the selection criteria. Immediate postoperative pain score in the PACU were significantly lower in Group-R (VAS 6.10 ± 1.38) compared to Group-C (VAS 7.11 ± 1.24), p = 0.0045. Pain scores at other time points (3, 6, 12 and 24 hours) were comparable between both groups. Time to first analgesic request in minutes was significantly longer in Group-R (121 ± 10.3 minutes) than in Group-C (36 ± 6.8 minutes), p < 0.001. Total Morphine consumption in 24 hours in mg was lower in Group-R compared to Group-C (13.83±2.89 vs 15.70±2.70, p = 0.012), frequency of vomiting was reduced in Group-R (13.3% vs 23.33%) though not statistically significant, p = 0.317. Haemodynamic parameters (HR, SBP, DBP, MAP and SpO_2) remained stable and comparable throughout 24 hours of the perioperative period. patient's satisfaction scores did not differ significantly (10% vs 3.3%, p = 0.3) between both groups but more patients were unsatisfied in Group-C compared to Group-R with a statistical significance (13.3% vs 36.7%, p = 0.03).

Conclusion: RSB administered prior to surgical incision provides effective immediate postoperative pain relief following scheduled midline laparotomy under General Anaesthesia.

Keywords: Rectus Sheath Block, Postoperative Analgesia, Midline Laparotomy, General Anaesthesia, Regional block

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Introduction

Laparotomy also known as celiotomy, is a surgical procedure involving a large incision or cut through the abdominal wall to gain access into the peritoneal cavity. With the availability of minimally invasive surgery (MIS) and laparoscopy, the frequency of laparotomies has markedly declined. Elective laparotomy is still necessary for complex surgical conditions that require a large incision including gastrointestinal, colorectal, gynecological and urological surgeries. In some lower and middle-income countries, elective laparotomies may constitute a larger proportion of all surgeries due to limited access to advanced MIS technologies[1].

Compared to elective procedures, emergency laparotomies carry a significantly increased risk of mortality. According to the 9th report of the National Emergency Laparotomy Audit (NELA), between December 2021 and March 2023, a total of 27,863 patients underwent emergency laparotomy for bowel surgery across 173 hospitals in England and Wales, with an in-hospital mortality rate of 9.3%.

Midline laparotomy is an extremely painful procedure. Approximately 75% of surgical patients experience moderate to severe acute postoperative pain. Despite this high prevalence, less than half of the patients report adequate postoperative pain relief. Inadequate postoperative pain control may lead to adverse physiological effects in the immediate postoperative period with risk of developing chronic post-surgical pain syndrome. Better postoperative pain management enhances early mobilization with decreasing incidence of postoperative pulmonary complications and deep venous thrombosis. It also improves the wound healing process and promotes postoperative recovery with restoration of normal activities[2].

Traditionally, opioids have been the cornerstone of acute postoperative pain management. Opioid induced Post Operative Nausea and Vomiting (PONV) and slowing of gastrointestinal motility delays early mobilization and enteral feeding. overall, due to increasing concerns over opioid-related adverse effects, multimodal analgesia has become a key component of the Enhanced Recovery After Surgery (ERAS) protocol. A multimodal approach is recommended, typically including paracetamol, NSAIDs, regional anesthesia techniques, and short acting opioids used only as rescue medication. ERAS, first introduced by Kehlet for intestinal surgery, has since been widely adopted across various surgical disciplines. It reduces opioid-induced side effects such as nausea, vomiting, and gastrointestinal dysmotility, all of which interfere with early mobilization and delay enteral feeding[3].

In fact, the utilization of multimodal analgesia is to effectively alleviate pain and minimize adverse effects associated with opioids. Paracetamol is a suitable analgesic for mild to moderate pain control in acute phase after surgery and has also a low risk profile. Use of NSAIDs is generally avoided in surgical patients at high risk of Acute Kidney Injury (AKI) and has many contraindications. Results of a Systematic review and meta analysis indicate that postoperative NSAID use is associated with anastomotic leakage following gastrointestinal surgeries[4].

Epidural analgesia is an established analgesic modality in midline laparotomy but is associated with several limitations. Contraindications such as coagulopathy and sepsis, along with risks of hypotension, reduced splanchnic perfusion, and potential anastomotic hypoperfusion, limit its use. Placement of epidural catheter requires skilled anesthetists and carries a 20–30% failure rate[5]. Other side effects such as motor blockade, nausea and vomiting, pruritus, and shivering can be troublesome. Though rare, serious complications such as epidural hematoma or abscess can be catastrophic .Furthermore, with the increased use of anticoagulation and evolving ERAS protocols have reduced reliance on epidural techniques[6]. Again, lumber epidural analgesia is often discouraged as it often does not provide adequate segmental analgesia for a midline abdominal incision, frequently causing urinary retention and lower limb sensory and motor blockade. Thus, it delays mobilization and increasing the risk of falls[7].

Contemporary multimodal strategies focus more on managing incisional rather than visceral pain, which has led to the development of the abdominal field

block. Transversus Abdominis Plane (TAP) block has gained popularity for postoperative pain management in abdominal surgeries. However, it may not provide reliable analgesia for incisions extending above the umbilicus, making it less suitable for midline laparotomy[8].

Rectus sheath block (RSB) is a safer, easy and cost-effective technique which ensures denser analgesia than TAP (transversus abdominis plane) block. Schleich first described RSB in 1899, aiming at the deposition of local anesthetic (LA) in the virtual space between the posterior wall of the rectus abdominis muscle and its sheath. The anesthetic injected into this space is proposed to spread freely up and down and to block the anterior branches of the thoracoabdominal intercostal nerves (T7- T11) before they leave the rectus sheath[9]. It has also an excellent analgesic modality for post laparotomy intensive care patients where epidural catheters are not feasible. RSB catheters can be placed with minimal risk of complications in critically ill patients. Thereby it allows timely weaning of sedation and early extubation[10]. RSB has better hemodynamic control, with avoidance of epidural catheter prevents discomfort and ensures early mobilization. RSB has also been described as a sole anesthetic technique for umbilical repair surgery[11]. It can be performed blindly using landmarks when there is no access to ultrasound in a low resource setting[9].

With the advent of ultrasound (USG) guidance, regional anaesthesia and analgesia techniques have undergone considerable refinement. USG visualization of anatomical structures increases both the safety and quality of regional blocks through optimal needle placement. USG guided RSB have gained popularity due to their relatively high rate of success and low rate of complications. Although large case series describe the use of RSB in gynecological cancer surgery, urological and colorectal surgeries, there is a paucity of randomized clinical trials evaluating this technique[12]. Thus, the aim of this study was to evaluate the effectiveness of single-shot rectus sheath block (RSB) before surgical incision for postoperative pain relief in the first 24 hours of midline laparotomy under General Anaesthesia.

Methods

This prospective study was carried out from July 2024 to July 2025 in the General Surgery and MIS operation theatre (OT) in the department of Anaesthesia, Analgesia & Intensive Care Medicine, Bangladesh Medical University. Patient aged ≥18 years, ASA physical status I-II scheduled for midline laparotomy surgery under general anaesthesia were included in this study. Patients with history of allergy to study drugs (Bupivacaine and Morphine), local infection, severe coagulation disorders, previous history of midline laparotomy, any psychiatric and neurological illness and chronic opioid users were excluded from this study. The research proposal was reviewed and approved by Institutional Review Board (IRB). The socio-demographic data and clinical data were collected and recorded in a structured data collection sheet. Participants were randomly allocated into two groups: Group-R received ultrasound-guided rectus sheath block (RSB) with 0.3 mL/kg of 0.25% bupivacaine on each side of abdomen before surgical incision while Control Group-C received same volume of Normal Saline as placebo.

Study Procedures

Upon arrival in the operating room standard monitors were attached: non-invasive blood pressure (NIBP), electrocardiogram (ECG), heart rate (HR), peripheral Oxygen saturation (SpO_2), and end-tidal CO_2, ($EtCO_2$). Baseline hemodynamic parameters were recorded by a senior fellow resident doctor of the Department of Anaesthesia, Analgesia and Intensive care medicine. After 3–5 minutes of preoxygenation with 100% oxygen, general anesthesia was induced using: Fentanyl 2 μg/kg IV, Propofol 2 mg/kg IV and 2mg/kg Suxamethonium IV. Following confirmation of tracheal intubation, muscle relaxation was maintained with Vecuronium 0.08 mg/kg (loading dose), followed by intermittent boluses (0.01mg/kg) every 20 minutes or as required. Ventilation was provided using intermittent positive pressure ventilation (IPPV) with use of 1 of MAC Isoflurane and 30% Oxygen in 70% Nitrous Oxide (N_2O). IV Paracetamol 15 mg/kg was administered for preemptive analgesia 10minutes prior to surgical

incision. Crystalloid solutions (Hartmann's or Normal Saline) were used to correct preoperative deficits, maintenance, and ongoing losses. All the anaesthetic management except RSB was also conducted by the senior resident doctor.

Drug was prepared and labelled in separate syringes according to allocated code by a resident doctor. Once the patient became stable following induction of GA, the rectus sheath block (RSB) was performed prior to surgical incision by the investigator, under the guidance of a senior faculty anesthesiologist experienced in regional anesthesia:

Group-R (Rectus Sheath Block):

Drug: 0.3 mL/kg of 0.25% bupivacaine, not exceeding 2 mg per kg total dose.

Procedure: The patient was placed in the supine position with the abdomen exposed from the xiphoid process to the pubic symphysis, ensuring the abdominal muscles are relaxed. Skin was cleaned with antiseptic solutions (Chlorohexidine and povidone iodine) and allowed to dry. After proper draping, a high-frequency linear probe of 7.5 – 15 MHZ (Esaote S.p.A. MyLab™X6 Ultrasound System. Genoa, Italy, 2023) was used. The transducer was placed transversely on the anterior abdominal wall along the midline to identify hyperechoic linea alba, then moved laterally. On the screen, the layers were visualized sequentially from superficial to deep: skin and subcutaneous tissue appear as echogenic lines interspersed with hypoechoic fat, followed by the bright anterior rectus sheath. Beneath this lies the hypoechoic with echogenic striated rectus abdominis muscle, and then the posterior rectus sheath, which is another echogenic line. Below the arcuate line, the posterior sheath is absent, and the rectus muscle rests directly on the transversalis fascia and peritoneum. The peritoneum and underlying bowel loops can be seen as deeper, moving echogenic structures. The target plane for a rectus sheath block or diagnostic injection lies between the posterior surface of the rectus muscle and the posterior rectus sheath, which can be confirmed by injecting a small amount of saline to open the potential space (hydrodissection). A 22G block needle was inserted in-plane through the rectus abdominis muscle until it reached the fascial plane between the rectus muscle and its posterior sheath. Needle tip was visualized to prevent any inadvertent entry into peritoneum or vessel puncture. Color flow doppler was used to locate the inferior epigastric artery and vein. Correct needle placement was confirmed by hydrodissetion (the presence of anechoic fluid collection between rectus muscle and hyperechoic posterior rectus sheath with injection of 1 mL of sterile normal saline). After each negative aspiration for blood total 0.3 mL/kg of 0.25% bupivacaine was injected in aliquots. Injections were administered at four sites — approximately 2 cm lateral to the umbilicus on both the right and left sides, and an additionally about 2–3 cm below the umbilical level on each side.

Group-C (Control Group):

The same technique was used, but normal saline of equal volume was administered instead of bupivacaine.

Patients were monitored using ASA standard monitoring (NIBP, HR, SpO_2, ECG, $EtCO_2$). Intraoperative monitoring was recorded by a fellow resident doctor of the department at regular intervals. Ondansetron 0.1 mg/kg IV was administered 30 minutes before reversal. Neuromuscular blockade was reversed using Neostigmine 0.05 mg/kg and IV Atropine 0.02 mg/kg IV. Patients were extubated once they were fully awake and then transferred to the Post-Anesthesia Care Unit (PACU).

Pain was assessed using the VAS scale (0–10) on deep breathing confirmed by auscultation at the following time points: Immediate at PACU, 3 hours, 6 hours, 12 hours and 24 hours postoperatively. On demand analgesic as Morphine 0.05 mg/kg IV slowly was administered when VAS ≥4. Pain was reassessed after 10 minutes and repeated as needed, not to exceed 0.2mg/kg.

Ondansetron 0.1mg/kg IV was used on demand for any episode of vomiting, recurrent nausea or single episode of severe nausea, IV Paracetamol 15 mg/kg was continued 8-hourly from the point of starting operation for postoperative analgesia in both groups.

An anesthesia fellow resident recorded intraoperative data (patient demographics-age, sex, ASA class, height, weight, BMI, duration of surgery and

anesthesia, Indication and types of surgery, baseline and postoperative hemodynamic parameters -HR, SBP, DBP, MAP and SpO_2) and another fellow resident doctor recorded postoperative data within the first 24 hours postoperative period such as VAS scores on deep breathing at defined time intervals, first analgesic request time (minutes), total Morphine consumption (mg) after 24 hours, frequency of postoperative vomiting, hemodynamic parameters (HR, SBP, DBP, MAP, SpO_2) and patient satisfaction by Likert scale.

Statistical analysis:

After data collection, the questionnaires were checked for consistency and completeness. Data was entered in Microsoft Excel to generate a Master sheet. The data were entered, cleaned and re-coded using Statistical Package for Social Sciences (SPSS) version 25. Missing data were checked through frequency run. It was assumed that the result was comparable one with other studies and after completion result was prepared for publication and dissemination of ideas. Quantitative variables were presented as mean ± standard deviation (SD) and Median (IQR), then analyzed using Student's t-test (Normal distribution) or the Mann-Whitney U test (Skewed distribution), depending on the distribution of the data. Qualitative variables were presented as frequency and percentage, then analyzed using the chi-square test or Fisher's exact test. A p-value of <0.05 was considered statistically significant.

Results

Total 60 patients were randomly allocated into 2 groups: Group-R and Group-C. Group-R received a single-shot RSB with 0.3ml/kg of 0.25% bupivacaine on either side of abdomen, while Group-C received a similar volume of normal saline as placebo, both performed under ultrasound guidance by the investigator before surgical incision.

The table I compares the age distribution between Group-R and Group-C, each comprising 30 participants. The mean age was 52.47 years in Group-R and 53±10 years in Group-C. Sex distribution was also comparable, with males forming the majority in both groups (76.7% in Group-R vs. 73.3% in Group-C). The table presents a comparison of BMI categories, between Group-R and Group-C, each consisting of 30 participants, most participants in both groups were of normal weight (73.3% in Group-R vs. 76.7% in Group-C). Mean BMI was similar between groups (21.00 vs. 21.53) suggesting no substantial anthropometric differences between the groups. Statistical analysis showed no significant differences between the groups for either parameter (p>0.05).

Table: I. Demographic and clinical characteristics of the study participants (n = 60)

Variables	Types of participants	
	Group-R (30)	Group-C (30)
Age (in years)	52.47±13.75	53.10±14.74
Sex (n%)		
Male	23(76.7%)	22(73.3%)
Female	7(23.3%)	8(26.7%)
BMI (kg/m^2)	21.00±3.13	21.53±2.50

Values are presented as Mean±SD (standard deviation) for numerical data (Age and BMI), frequency and percentage for categorical data (Sex and ASA class). p value obtained using unpaired t test for numerical data and chi square test for categorical data. p value<0.05 is significant.

Regarding ASA class, in Group-R, 22 participants (73.3%) were classified as ASA class I, while 8 participants (26.7%) were ASA class II. Similarly, in Group-C, 23 participants (76.7%) were ASA class I, and 7 participants (23.3%) were ASA class II. The most common conditions were carcinoma of the colon (66.67% vs 70% in Group-R and Group-C respectively) followed by gastrointestinal stromal tumor (23.33% vs. 16.67%), subacute intestinal obstruction (10% vs 13.33%). Here most of the surgeries are right hemicolectomy comprising 66.67% in Group-R and 76% in Group-C followed by Resection and anastomosis (23.3% vs 16.7%), Left hemicolectomy (10% vs 3.3%) and Hartman procedure (6.7% vs 3.3%) in Group-R and Group-C respectively.

Table II: Postoperative pain intensity assessment by VAS score on deep breathing in 24 hours (n = 60)

Time (hours)	Types of participants		p value
	Group-R (30)	Group-C (30)	
Immediate at PACU	6.10±1.38	7.11±1.24	0.045
3	3.23±1.54	4.18±1.24	0.57
6	3.45±1.63	4.16±1.69	0.75
12	3.65±1.45	3.63±1.40	0.95
24	2.50±0.60	2.83±0.67	0.88

Values are presented as Mean±SD(standard deviation). p value obtained using unpaired t test for parametric data. p value<0.05 is significant. PACU- Post Anaesthesia Care Unit

This table II shows deep breathing pain scores of VAS (expressed as Mean ± SD) in two groups of 30 participants each, measured at different time intervals after arrival in the postanaesthesia care unit (PACU). It revealed that VAS scores progressively declined over 24 hours in both groups. Immediate at PACU, Group-R reported a significantly lower score (6.10±1.38) compared to Group-C (7.11±1.24), with a p value of <0.0045, indicating statistically significance. At 3 hours, the pattern remained similar, with no statistically significance difference (3.23±1.54 vs. 4.18±1.24). By 6 hours, both groups recorded nearly the same scores (3.45±1.63 vs. 4.16±1.69). At 12 hours, the groups continued to show almost equal values (3.65±1.45 vs. 3.63±1.40). Finally, at 24 hours, the scores were again comparable (2.50±0.60 vs. 2.83±0.67).

The duration of analgesia between two groups of 30 participants each. Group-R had a mean duration of 121 minutes, while Group-C had a mean of 66 minutes with a p value<0.05, indicating statistically significant difference between the two groups. Mean total Morphine use higher in Group-C 15.70mg vs. Group-R 13.83mg, with a statistically significant difference (p<0.05).

Figure 1 shows heart rate (beats per minute) between Group-R and Group-C, each with 30 participants, measured at baseline, intraoperatively, and postoperatively. At baseline, both groups had almost identical heart rates (84.37 ± 10.22 vs. 87.60 ± 11.20, p=0.83). During the intraoperative period, no significant differences were seen at baseline, 15, 30, 45, 60, 120, or 240 minutes, although Group-C tended to have slightly higher mean values. In the postoperative period, heart rates were similar between the groups across all time points (Baseline,3h, 6 h, 12 h, and 24 h), with no statistically significant differences (all p values >0.05).

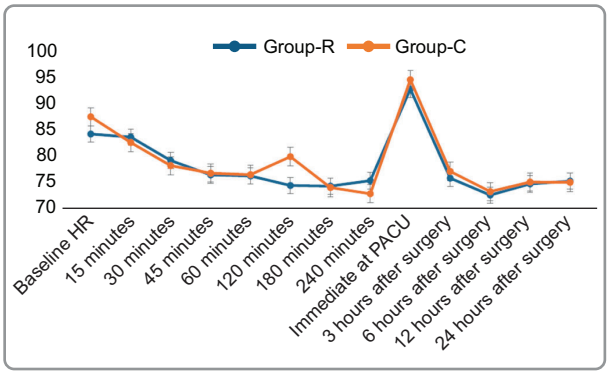

Figure 1: Changes of heart Rate (bpm) between Group-R and Group-C in the perioperative period

Figure 2 shows mean arterial pressure (MAP mmHg) in Group-R and Group-C (30 participants each), recorded at baseline, intraoperatively, and postoperatively. At baseline, MAP values were similar between the groups (Mean 88± 10.55 vs 92± 7.75, p value=0.82). During the intraoperative period MAP remained stable in both groups with no significant differences at 15, 30, 45, 60, 120, 180, and 240 minutes. In the postoperative period, MAP initially rose in both groups (101.30 ± 21.60 vs. 102.40 ± 12.84 at 0 min). Over the next 24 hours, MAP gradually declined but remained comparable

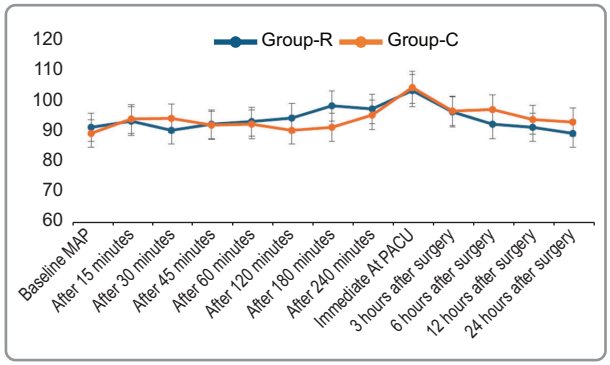

Figure 2: Mean Arterial Pressure (MAP) between Group-R and Group-C in the perioperative period

between groups. At 6 hours, Group-C showed a somewhat higher mean (97.50 ± 8.74 vs. 92.83 ± 10.52, p=0.67) but did not achieve statistical significance. At 3, 12, and 24 hours, differences were small and insignificant.

This figure 3 presents peripheral oxygen saturation (SpO_2) values in Group-R and Group-C (30 participants each), recorded at baseline, during intraoperative periods, and postoperatively. At baseline, mean SpO_2 was nearly identical between the groups (98.07 ± 0.58 vs. 97.17 ± 0.70, p=0.89). Throughout the intraoperative period, both groups maintained high oxygen saturation values, mostly above 97%, with no statistically significant differences. In the postoperative period, oxygen saturation remained consistently high in both groups. At 0 minutes, Group-R and Group-C showed means of 98.30 ± 0.84 and 98.40 ± 0.72 respectively. Across 1, 3, 6, 12, and 24 hours, both groups maintained SpO_2 close to 98%, with no meaningful differences.

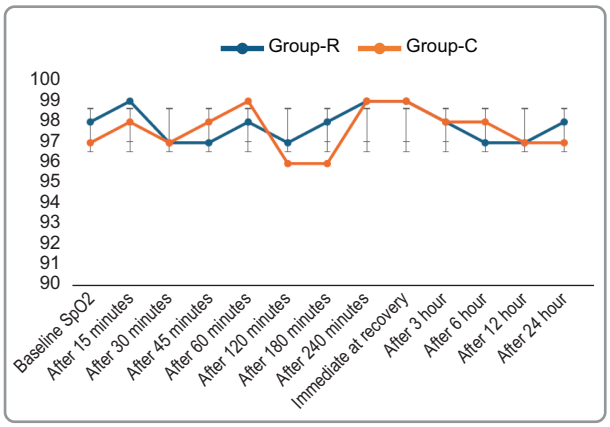

Figure 3: Peripheral Oxygen Saturation (SpO_2) between Group-R and Group-C in the perioperative period.

The table III presents patients' satisfaction levels in Group-R and Group-C, each with 30 participants. In Group-R, 13.3% were unsatisfied, 76.7% were neutral, and 10.0% were satisfied, while in Group-C, 36.7% were unsatisfied, 60.0% were neutral, and 3.3% were satisfied. More patents in Group-C were unsatisfied compared to Group-R with a statistically significant difference (p = 0.03). Though more patients in Group-R were satisfied compared to Group R, but the difference was not statistically significant (p = 0.3). Most of the patients in both groups were neutral and there is no statistically significant difference.

Table: III: Patient's satisfaction by 5-points Likert scale between the study group (n = 60)

Patient satisfaction	Types of participants		P value
	Group-R (30)	Group-C (30)	
Very unsatisfied	0%	0%	
Unsatisfied	4(13.3%)	11(36.7%)	0.03
Neutral	23(76.7%)	18(60.0%)	0.16
Satisfy	3(10.0%)	1(3.3%)	0.3
Very satisfied	0%	0%	

Values are presented as frequency and percentage over the columns. p value obtained using chi square test and fisher's exact test for categorical data. p value<0.05 is significant

Discussion

Acute postsurgical pain (APSP) affects approximately 75% of surgical patients, yet fewer than half achieve satisfactory pain relief. The intensity of APSP is influenced by patient demographic factors such as age, sex, and body mass index (BMI); younger individuals and females tend to experience higher pain levels, while a higher BMI is also recognized as a significant risk factor[13]. Inadequate pain control can trigger harmful physiological responses and increase the risk of developing chronic postsurgical pain syndrome (CPSP). Although opioids have traditionally been the mainstay for managing postoperative pain, their side effects and the growing concern over opioid-related morbidity have driven the adoption of multimodal analgesic strategies. Among these, regional abdominal blocks such as the rectus sheath block (RSB) provide a practical and effective method for improving postoperative analgesia following midline laparotomy[14].

In this study, we assessed the analgesic effectiveness of RSB in patients undergone scheduled midline laparotomy under general anaesthesia. This prospective interventional study was conducted in the General surgery and MIS (Minimally Invasive Surgery) operation theatre under the department of

Anaesthesia, analgesia and intensive care medicine, Bangladesh Medical University (BMU), Dhaka. Adult patients aged 18 or above with ASA physical statuses 1 and 2 were included in the study. This study assigned patients into two treatment arms: Group-R received rectus sheath block (RSB) with 0.3ml/kg 0.25% bupivacaine while Group-C received same volume of normal saline as placebo instead of bupivacaine.

Regarding demographic and clinical characteristics (Age, Sex, BMI, ASA class) both Group-R and Group-C were comparable. Ensuring these similar distributions between the groups helps minimizes bias caused by variations in preoperative health conditions.

In the present study, the majority of patients underwent surgery for a diagnosis of carcinoma of the colon followed by gastrointestinal stromal tumor (GIST) and subacute intestinal obstruction. All the patients operated were from the departments of surgical oncology and general surgery in Bangladesh Medical University. In case of types of surgery, most operations performed were right hemicolectomy (due to carcinoma caecum, ascending and transverse colon), resection and anastomosis (due to GIST), Palliative Hartman procedure when anastomosis is not feasible (due to carcinoma sigmoid colon) and rarely left hemicolectomy (due to carcinoma of descending and sigmoid colon).

In this present study, though different types of surgeries were performed due to different indications the mean anesthesia and surgery durations were comparable between both groups with no significant differences (p=0.34 and p=0.45).

This study findings revealed that VAS scores progressively declined over 24 hours in both groups but upon arrival at PACU in the immediate post operative period, pain level was lower in Group-R compared to Group-C and this difference reached statistical significance (p=0.0045) indicating effective pain control. At other evaluation times there were no significant differences between both groups. Melesse et al., (2020) found that VAS score was significantly lower in the RSB group compared to the non-exposed group, with p values less than 0.05, indicating better pain control with RSB during the early postoperative period[8,15]. However, at 10, 12, and 24 hours, the differences in VAS scores between the two groups were not statistically significant, suggesting that the analgesic benefit of RSB was more pronounced in the first 8 hours after surgery. Another author Chekol et al., (2019)[16] mentioned RSB lowers pain intensity (VAS scores) during the first eight hours after surgery compared to the group that did not receive RSB with a p value at 8 hour 0.01. The results are similar because all the studies evaluated pain in the immediate postoperative period, when the effect of rectus sheath block (RSB) is strongest, and found that RSB provided better pain relief in the early hours after surgery.

In this study, the time to first analgesic was significantly longer in Group-R compared to the Group-C, with a p-value of <0.001. This means patients who received RSB experienced longer pain relief before the requirement of first analgesic. In contrast, the control group required analgesic much earlier. These results are consistent with findings from Allene (2020)[17] where the RSB group showed delayed request of analgesic compared to the non-RSB group with a significant difference (p=0.003). Similarly, Melesse et al. (2020)[8] showed first analgesic request was prolong in RSB group with p < 0.001. Our findings also align with Chekol et al. (2019)[16], who reported a longer time to first analgesic request in the RSB group compared to the non-exposed group with statistically significance (p ≤0.001). All the studies support the effectiveness of RSB in delaying the need for additional pain relief after surgery.

In this study, total Morphine consumption within the first 24 hours postoperatively was significantly lower in the Group-R compared to the Group-C, with a statistically significant difference (p = 0.012). This suggests that rectus sheath block (RSB) effectively reduces opioid requirements in the early postoperative period. These findings are consistent with Bakshi et al. (2016)[12], who reported a significant reduction in

postoperative Morphine use in patients undergoing gynecological oncology surgery with LA (local anaesthetic) group compared to NS (Normal saline) group ($p < 0.001$). Similarly, Melesse et al. (2020)[8] found lower tramadol requirements following emergency midline laparotomy in the RSB group in comparison to Nonexposed group ($p = 0.003$), further supporting the analgesic efficacy of RSB. Allene (2020)[17] also reported decreased postoperative opioid consumption in the RSB group ($p = 0.002$) correlating with delayed time to first analgesic request and lower pain scores. Together, these studies reinforce the role of RSB in multimodal analgesia protocols, contributing to improved pain control in abdominal surgeries.

This study revealed that the frequency of vomiting was lower in the Group-R compared to Group-C, although the difference was not statistically significant ($p = 0.317$). This suggests a trend toward reduced vomiting with rectus sheath block, possibly due to decreased opioid consumption. Similarly, in a randomized, double-blind trial by Cheng et al. (2024)[3], there was no statistically significant difference in the incidence of postoperative nausea and vomiting between the groups ($p=0.619$). In contrast, Elbahrawy and El-Deeb (2016)[5] reported a statistically significant reduction in postoperative nausea and vomiting in the RSB group compared to the MMA group ($p = 0.037$). Consistent with this, Bakshi et al. (2016)[12] also found a significantly lower frequency of postoperative vomiting in the RSB group ($p = 0.001$). Allene (2020)[17] supported these results, showing reduced opioid use and fewer vomiting episodes in the RSB group, $p = 0.037$. Our study did not find a significant difference, but the Group-R had a lower percentage of patients experiencing vomiting after surgery. The overall evidence from related studies suggests that RSB may help in minimizing opioid-related side effects like vomiting in abdominal surgeries and enhances early recovery.

In this study, heart rate between Group-R and Group-C were similar throughout the perioperative period. There were no significant differences at baseline, during surgery, or postoperatively. Although Group-C showed slightly higher heart rates at some intraoperative points, these differences were not statistically significant. This suggests that the intervention did not affect heart rate during or after surgery. In the immediate postoperative period heart rate increased in both group and there are no significant differences, it may be due to extubation reflex in awake patients. Similarly, Teshome et al. (2021)[9] reported no significant difference in heart rate during the postoperative period.

Again, MAP values remained similar between Group-R and Group-C across all perioperative time points, with no statistically significant differences ($p > 0.05$). Minor variations were noted, such as slightly higher postoperative MAP at 6 hours in Group-C, though this was not significant ($p = 0.57$). Systolic blood pressure (SBP) remained stable and comparable between Group-R and Group-C throughout the perioperative and postoperative periods, with no statistically significant differences at any time point (all $p > 0.05$). Group-C showed slightly higher SBP at several intervals, especially postoperatively, but this was not clinically significant. Diastolic blood pressure (DBP) remained stable and statistically comparable between Group-R and Group-C throughout the perioperative period (all $p > 0.05$). Although Group-C showed slightly higher DBP values postoperatively, particularly at 3 and 6 hours, the differences were not statistically significant. SBP, DBP and MAP showed an increasing trend immediately at PACU, it may be due to extubation reflex in awake patients. Overall, both groups maintained stable MAP, SBP, DBP within normal physiological limits, indicating comparable hemodynamic stability. These findings suggest that RSB does not affect haemodynamics.

Peripheral oxygen saturation (SpO_2) remained consistently high and comparable between Group-R and Group-C throughout the perioperative period, with no statistically significant differences ($p > 0.05$). Both groups maintained SpO_2 values within the normal physiological range at all measured time points

In our study, more patients in Group-R were satisfied compared to Group-C but this difference was not statistically significant (p = 0.08) However, a greater proportion of patients in Group C reported dissatisfaction compared to the patients in Group R, demonstrating a statistically significant difference (p = 0.03). It suggests that patients who received the rectus sheath block may have had a better overall experience after surgery. This aligns with other studies, like Elbahrawy and El-Deeb (2016)[5] (p = 0.037), which showed that improved pain relief with RSB can increase patient satisfaction.

This study supports RSB as an effective multimodal analgesia for midline laparotomy, showing improvements in initial postoperative pain scores, delayed analgesic request and significantly reduced 24-hour Morphine use, lower dissatisfaction. Though not statistically significant, it also had a lower incidence of vomiting and a higher patient satisfaction rate. Its consistency with international data highlights RSB as a safe, effective, and resource-friendly alternative, especially where epidurals are contraindicated[15-18].

Conclusion

In summary the results of this study suggest that rectus sheath block (RSB) performed before the surgical incision is effective for immediate postoperative pain relief following scheduled midline laparotomy under general anaesthesia. Therefore, RSB may be recommended as a part of multimodal analgesia in scheduled midline laparotomy.

Declaration

Ethics approval: The study was approved by the Institutional Review Board of BMU (Reg. no.5293; BSMMU/2025/365). Informed written consent was taken from the participants before inclusion.

Author contributions

Conception and development of the idea MAA, AKMA
Writing MAA
Data analysis MAA, SRA, FZP
Data collection PS, SK, MSA, MAM, NHK
Review and Editing AKMA

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