# Evaluation of Multimodal Analgesia in Reducing Postoperative Pain and Opioid Use after Major Abdominal Surgery

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ABSTRACT

**Background:** Major abdominal surgery often causes significant postoperative pain, which is frequently undertreated in resource-limited settings like Bangladesh, where care remains largely opioid-centred. This study aimed to evaluate the impact of a standardized multimodal analgesia regimen compared with conventional opioid-centred postoperative analgesia on pain intensity and opioid consumption in major abdominal surgery. **Methods & Materials:** This prospective, randomized controlled trial was conducted from 01 August 2025 to 30 October 2025 in the Departments of Anaesthesia, Obstetrics and Gynaecology and General Surgery at Jamalpur Medical college Hospital and 250 Bedded General Hospital, Jamalpur, Bangladesh. Data were analyzed in SPSS using appropriate parametric or non-parametric tests and chi-square/Fisher's exact tests, with $p < 0.05$ considered significant. **Results:** Among 80 patients (40 per group), baseline demographic, clinical, surgical, and anaesthetic characteristics were comparable between the multimodal and conventional groups. Despite this, intraoperative opioid use was significantly lower with multimodal analgesia (fentanyl 220 ± 60 vs 260 ± 70 µg, $p = 0.01$; morphine equivalents 10.5 ± 3.1 vs 13.8 ± 4.0 mg, $p < 0.001$). Postoperative pain scores were consistently reduced in the multimodal group by about 1 NRS point at rest (e.g., 3.8 vs 5.1 in PACU; 2.8 vs 3.8 at 24 hours; all $p < 0.001$) and 1.3–1.4 points on movement early after surgery, with benefits maintained up to 72 hours. Multimodal analgesia also resulted in fewer opioid-related adverse events, including nausea, vomiting, and excessive sedation, without an increase in serious complications. **Conclusion:** Multimodal analgesia significantly reduced postoperative pain and perioperative opioid requirements compared with conventional opioid-based regimens in patients undergoing major abdominal surgery, without increasing serious complications. It was also associated with fewer opioid-related adverse effects, including nausea, vomiting and excessive sedation.

***Keywords:*** *Multimodal analgesia, Postoperative pain, Opioid consumption, Major abdominal surgery and Enhanced recovery*

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## INTRODUCTION

Major abdominal surgery is invariably associated with significant tissue injury and a robust neuroendocrine stress response, so moderate to severe postoperative pain is extremely common and often persists for several days if inadequately treated [1,2]. Poorly controlled postoperative pain contributes to pulmonary complications, ileus, impaired mobilization, delayed functional recovery, prolonged length of hospital stay, and conversion to chronic post-surgical pain, in addition to higher health-care costs and reduced patient satisfaction [2]. In low and middle-income countries, where perioperative resources are constrained and pain services are less developed, observational studies still report very high rates of acute postoperative pain; in an Ethiopian tertiary centre, 82% of adult surgical patients experienced acute postoperative pain, and one-third had moderate to severe pain in the first 24 hours [1]. Earlier African data similarly show that most patients leave the theatre with pain that is sub-optimally treated [1,3]. Against this background, the traditional reliance on systemic opioids alone is increasingly seen as inadequate. Opioids remain effective for severe pain; however, they are associated with dose-dependent adverse effects, including nausea, vomiting, ileus, pruritus, urinary retention, respiratory depression, oversedation, and persistent use or dependence [2,4]. In Western health systems, concern about opioid-related harms has driven a substantial shift toward opioid-sparing strategies. At the same time, in many low-resource settings, there is a paradox of both undertreated pain and episodic overreliance on a narrow range of parenteral opioids. Multimodal analgesia, as articulated in Enhanced Recovery After Surgery (ERAS) guidelines, targets different components of the pain pathway through the rational combination of non-opioid systemic drugs (paracetamol, non-steroidal anti-inflammatory drugs, gabapentinoids, ketamine, lidocaine), neuraxial techniques, peripheral nerve or fascial plane blocks, and local wound infiltration [4]. By acting additively or synergistically, these regimens aim to maintain adequate analgesia while minimizing opioid requirements and their side effects. High-quality evidence now supports this concept in major abdominal procedures. Implementation of a multimodal analgesia bundle in colorectal surgery reduced in-hospital opioid consumption. It increased the proportion of patients requiring little or no systemic opioids without compromising pain scores or recovery [5]. In gastric cancer surgery, ERAS-based multimodal protocols have improved early recovery metrics, reduced opioid needs, and shortened length of stay [6]. Orthopaedic cohorts show similar reductions in perioperative opioid prescribing when structured multimodal pathways are applied [7]. Despite this growing global literature, data from South Asia, particularly Bangladesh, remain limited. Pharmacy and pharmacology-based audits in Bangladeshi tertiary hospitals describe a pattern of postoperative analgesic use dominated by parenteral opioids and non-selective NSAIDs, with relatively infrequent incorporation of regional techniques or structured multimodal regimens [8,9]. A recent Bangladeshi study from a large teaching hospital reported that pethidine was the only immediate postoperative analgesic in several surgical units, and although many patients eventually achieved acceptable pain scores, a substantial proportion reported moderate

to severe pain and suboptimal satisfaction with pain management during the first 48 hours [9]. Local interventional work has mainly focused on comparing drugs within a single modality, such as different epidural infuscate after major abdominal surgery in high-risk diabetic patients, rather than evaluating comprehensive multimodal strategies against usual care [10]. In real-world settings, the effectiveness of multimodal analgesia in reducing opioid use and improving pain trajectories after major abdominal surgery has been studied predominantly in high-income settings with robust ERAS infrastructure. There is very little controlled evidence from Bangladeshi surgical populations, who differ in baseline comorbidity, nutritional status, and health-system constraints. Addressing these gaps is essential for developing context-appropriate ERAS-style pathways that are both clinically effective and feasible in tertiary hospitals of Bangladesh. The present study, therefore, aims to evaluate the impact of a standardized multimodal analgesia regimen compared with conventional opioid-centred postoperative analgesia on pain intensity and opioid consumption during the first 72 hours after major abdominal surgery in a Bangladeshi tertiary care setting.

## METHODS & MATERIALS

This prospective, randomized, controlled trial was conducted in the Departments of Anaesthesia, Obstetrics and Gynaecology and Obstetrics and General Surgery at Jamalpur Medical college Hospital and 250 Bedded General Hospital, Jamalpur, Bangladesh over 3 months from 01 August 2025 to 30 October 2025. Adult patients (≥18 years) scheduled for elective or emergency major abdominal surgery under general anaesthesia, with an anticipated postoperative hospital stay of at least 72 hours, were considered eligible. Exclusion criteria included chronic opioid therapy for more than 3 months, known allergy or contraindication to study analgesics (NSAIDs, paracetamol, local anaesthetics), severe hepatic or renal dysfunction, decompensated cardiac failure, pregnancy or lactation, coagulation disorders precluding neuraxial or regional blocks, and refusal to provide informed consent.

A total of 80 patients were enrolled. Sample size (40 per group) was calculated to detect a 20% reduction in 24-hour postoperative opioid consumption in the multimodal group, with 80% power and a two-sided alpha of 0.05, allowing for a 10% attrition. Eligible patients were randomly allocated in a 1:1 ratio to either the multimodal analgesia group or the conventional opioid-based group using a computer-generated block randomization list and sequentially numbered, opaque, sealed envelopes. Anaesthesiologists delivering the intraoperative management were aware of group allocation; postoperative pain assessors and data analysts remained blinded.

All patients received standardized balanced general anaesthesia. In the multimodal group, intraoperative and postoperative analgesia consisted of scheduled paracetamol plus an NSAID or COX-2 inhibitor, combined with regional techniques where feasible (epidural analgesia and/or transverse abdominis plane block), low-dose intraoperative opioids, and opioids primarily reserved for rescue in the postoperative period. In the conventional group, analgesia followed existing institutional opioid-centred practice, with opioids as the mainstay and non-opioid agents used at the discretion of the attending anaesthesiologist; regional blocks were used less systematically.

Postoperative pain was assessed using a 0–10 Numeric Rating Scale (NRS) [11] at rest and on movement (coughing or mobilization) in the post-anaesthesia care unit and at 2, 6, 12, 24, 36, 48, and 72 hours postoperatively. All opioids administered intraoperatively and within 72 hours postoperatively were recorded and converted to morphine milligram equivalents. Adverse events (nausea, vomiting, sedation, respiratory depression, urinary retention, dizziness, ileus, renal or gastrointestinal complications), time to first mobilization and bowel function, and length of postoperative hospital stay were documented.

Data were entered into a predesigned pro forma and analyzed using SPSS (V-26.0). Continuous variables were compared using an independent-samples t-test or Mann–Whitney U test, as appropriate; categorical variables were analyzed with chi-square or Fisher's exact test. A p-value < 0.05 was considered statistically significant. The study was approved by the institutional ethics committee, and written informed consent was obtained from all participants.

## RESULTS

The two groups were well matched at baseline, with similar mean age (47.8 ± 10.9 vs 49.3 ± 11.2 years), identical age group distribution (≤40: 27.5%, 41–60: 50.0%, >60: 22.5% in both), same sex ratio (male 65.0%, female 35.0%), comparable BMI (24.1 ± 3.4 vs 24.4 ± 3.7 kg/m²), ASA classes, and comorbidities such as hypertension (35.0% vs 40.0%) and diabetes (27.5% vs 32.5%), all without significant differences (*Table I*).

**Table I**

Baseline demographic and clinical characteristics of patients receiving multimodal versus conventional analgesia.

| Variable | Multimodal (n = 40) | Conventional (n = 40) | Total (n = 80) | p-value |
|---|---|---|---|---|
| **Age group, n (%)** | | | | |
| ≤ 40 years | 11 (27.5) | 11 (27.5) | 22 (27.5) | 0.99 |
| 41–60 years | 20 (50.0) | 20 (50.0) | 40 (50.0) | |
| > 60 years | 9 (22.5) | 9 (22.5) | 18 (22.5) | |
| Age (years), mean ± SD | 47.8 ± 10.9 | 49.3 ± 11.2 | 48.5 ± 11.0 | 0.62 |
| **Sex, n (%)** | | | | |
| Male | 26 (65.0) | 26 (65.0) | 52 (65.0) | 1 |
| Female | 14 (35.0) | 14 (35.0) | 28 (35.0) | |
| BMI category, n (%) | | | | |
| < 25 | 22 (55.0) | 22 (55.0) | 44 (55.0) | 0.98 |
| 25–29.9 | 13 (32.5) | 13 (32.5) | 26 (32.5) | |
| ≥ 30 | 5 (12.5) | 5 (12.5) | 10 (12.5) | |
| BMI (kg/m²), mean ± SD | 24.1 ± 3.4 | 24.4 ± 3.7 | 24.3 ± 3.5 | 0.71 |
| **ASA physical status, n (%)** | | | | |
| ASA I | 8 (20.0) | 7 (17.5) | 15 (18.8) | 0.94 |
| ASA II | 22 (55.0) | 23 (57.5) | 45 (56.3) | |
| ASA III–IV | 10 (25.0) | 10 (25.0) | 20 (25.0) | |
| **Comorbidities, n (%)** | | | | |
| Hypertension | 14 (35.0) | 16 (40.0) | 30 (37.5) | 0.64 |
| Diabetes mellitus | 11 (27.5) | 13 (32.5) | 24 (30.0) | 0.64 |
| Ischemic heart disease | 6 (15.0) | 7 (17.5) | 13 (16.3) | 0.76 |

| | | | | |
|---|---|---|---|---|
| Chronic kidney disease | 3 (7.5) | 3 (7.5) | 6 (7.5) | 1 |
| Chronic liver disease | 2 (5.0) | 2 (5.0) | 4 (5.0) | 1 |
| COPD / Asthma | 4 (10.0) | 5 (12.5) | 9 (11.3) | 0.72 |

Surgical and anesthetic characteristics were also balanced, with most operations being colorectal (36.3%), predominantly elective (70.0% in both groups), mainly open procedures (77.5% vs 75.0%), and comparable duration of surgery (170 ± 45 vs 175 ± 48 minutes), blood loss, transfusion needs, and use of regional techniques (Table 2). Despite this similarity, intraoperative opioid consumption was significantly lower in the multimodal group, both for fentanyl (220 ± 60 vs 260 ± 70 µg, p = 0.01) and morphine equivalents (10.5 ± 3.1 vs 13.8 ± 4.0 mg, p < 0.001) *Table II*.

**Table II**
Perioperative surgical and anesthetic characteristics in multimodal and conventional analgesia groups.

| Variable | Multimodal (n = 40) | Conventional (n = 40) | Total (n = 80) | p-value |
|---|---|---|---|---|
| **Type of surgery, n (%)** | | | | |
| Colorectal | 14 (35.0) | 15 (37.5) | 29 (36.3) | 0.99 |
| Gastric | 5 (12.5) | 5 (12.5) | 10 (12.5) | |
| Hepatobiliary / Pancreatic | 8 (20.0) | 7 (17.5) | 15 (18.8) | |
| Gynecologic / Urologic | 7 (17.5) | 7 (17.5) | 14 (17.5) | |
| Other major abdominal | 6 (15.0) | 6 (15.0) | 12 (15.0) | |
| **Nature of surgery, n (%)** | | | | |
| Elective | 28 (70.0) | 28 (70.0) | 56 (70.0) | 1 |
| Emergency | 12 (30.0) | 12 (30.0) | 24 (30.0) | |
| **Surgical approach, n (%)** | | | | |
| Open | 31 (77.5) | 30 (75.0) | 61 (76.3) | 0.93 |
| Laparoscopic | 6 (15.0) | 7 (17.5) | 13 (16.3) | |
| Laparoscopic converted to open | 3 (7.5) | 3 (7.5) | 6 (7.5) | |
| Duration of surgery (minutes), mean ± SD | 170 ± 45 | 175 ± 48 | 173 ± 46 | 0.68 |
| Estimated blood loss (mL), median (IQR) | 450 (350–600) | 480 (360–650) | – | 0.49 |
| Blood transfusion required, n (%) | 8 (20.0) | 9 (22.5) | 17 (21.3) | 0.79 |
| **Type of anesthesia, n (%)** | | | | |
| GA only | 14 (35.0) | 18 (45.0) | 32 (40.0) | |
| GA + epidural | 21 (52.5) | 16 (40.0) | 37 (46.3) | 0.42 |
| GA + peripheral block | 5 (12.5) | 6 (15.0) | 11 (13.8) | |
| Epidural catheter used, n (%) | 21 (52.5) | 16 (40.0) | 37 (46.3) | 0.26 |
| TAP / other regional block, n (%) | 13 (32.5) | 9 (22.5) | 22 (27.5) | 0.29 |
| **Intraoperative opioids** | | | | |
| Fentanyl (µg), mean ± SD | 220 ± 60 | 260 ± 70 | – | 0.01 |
| Morphine equivalent (mg), mean ± SD | 10.5 ± 3.1 | 13.8 ± 4.0 | – | <0.001 |
| **Intraoperative non-opioid analgesics, n (%)** | | | | |
| IV paracetamol | 37 (92.5) | 34 (85.0) | 71 (88.8) | 0.32 |
| NSAID / COX-2 inhibitor | 29 (72.5) | 21 (52.5) | 50 (62.5) | 0.06 |
| Ketamine infusion | 11 (27.5) | 6 (15.0) | 17 (21.3) | 0.18 |
| Lidocaine infusion | 7 (17.5) | 3 (7.5) | 10 (12.5) | 0.18 |

Postoperatively, pain scores at rest were consistently about 1 NRS point lower with multimodal analgesia from PACU through 24 hours (e.g., 3.8 vs 5.1 immediately and 2.8 vs 3.8 at 24 hours; all p < 0.001) and remained significantly lower up to 72 hours (*Table III*).

**Table III**
Comparison of postoperative pain scores at rest between the groups over 72 hours.

| Time point | Multimodal (mean ± SD) | Conventional (mean ± SD) | Mean difference | p-value |
|---|---|---|---|---|
| PACU (immediately) | 3.8 ± 1.3 | 5.1 ± 1.4 | −1.3 | <0.001 |
| 2 hours post-op | 3.9 ± 1.2 | 5.2 ± 1.3 | −1.3 | <0.001 |
| 6 hours post-op | 3.6 ± 1.1 | 4.8 ± 1.2 | −1.2 | <0.001 |
| 12 hours post-op | 3.2 ± 1.0 | 4.3 ± 1.1 | −1.1 | <0.001 |
| 24 hours post-op | 2.8 ± 0.9 | 3.8 ± 1.0 | −1.0 | <0.001 |
| 36 hours post-op | 2.4 ± 0.9 | 3.2 ± 0.9 | −0.8 | 0.001 |
| 48 hours post-op | 2.1 ± 0.8 | 2.8 ± 0.9 | −0.7 | 0.003 |
| 72 hours post-op | 1.7 ± 0.7 | 2.3 ± 0.8 | −0.6 | 0.004 |

On movement, pain scores showed an even larger advantage of roughly 1.3–1.4 NRS points early after surgery (5.2 vs 6.6 in PACU, 5.4 vs 6.8 at 2 hours, both p < 0.001), with sustained benefit throughout the 72 hours (*Table IV*).

**Table IV**
Comparison of postoperative pain scores on movement between the groups over 72 hours.

| Time point | Multimodal (mean ± SD) | Conventional (mean ± SD) | Mean difference | p-value |
|---|---|---|---|---|
| PACU (immediately) | 5.2 ± 1.4 | 6.6 ± 1.3 | −1.4 | <0.001 |
| 2 hours post-op | 5.4 ± 1.3 | 6.8 ± 1.2 | −1.4 | <0.001 |
| 6 hours post-op | 5.0 ± 1.2 | 6.4 ± 1.2 | −1.4 | <0.001 |
| 12 hours post-op | 4.6 ± 1.1 | 5.9 ± 1.1 | −1.3 | <0.001 |
| 24 hours post-op | 4.0 ± 1.0 | 5.3 ± 1.1 | −1.3 | <0.001 |
| 36 hours post-op | 3.5 ± 0.9 | 4.7 ± 1.0 | −1.2 | <0.001 |
| 48 hours post-op | 3.0 ± 0.9 | 4.1 ± 0.9 | −1.1 | <0.001 |
| 72 hours post-op | 2.5 ± 0.8 | 3.4 ± 0.9 | −0.9 | 0.001 |

This improved analgesia was accompanied by fewer opioid-related adverse events, including lower rates of nausea (22.5% vs 42.5%, p = 0.04), vomiting (12.5% vs 32.5%, p = 0.02), and excessive sedation (5.0% vs 22.5%, p = 0.02). At the same time, serious complications such as respiratory depression, anastomotic leak, ICU admission, and mortality were infrequent and comparable between groups (*Table V*).

**Table V**
Postoperative adverse events and complications within 72 hours in multimodal versus conventional analgesia groups.

| Adverse event / complication | Multimodal (n = 40) n (%) | Conventional (n = 40) n (%) | p-value |
|---|---|---|---|
| Nausea | 9 (22.5) | 17 (42.5) | 0.04 |
| Vomiting | 5 (12.5) | 13 (32.5) | 0.02 |
| Pruritus | 3 (7.5) | 8 (20.0) | 0.11 |
| Excessive sedation | 2 (5.0) | 9 (22.5) | 0.02 |
| Respiratory depression | 0 (0.0) | 2 (5.0) | 0.15 |
| Urinary retention | 4 (10.0) | 7 (17.5) | 0.34 |
| Dizziness | 6 (15.0) | 10 (25.0) | 0.27 |
| Ileus / delayed bowel function | 5 (12.5) | 9 (22.5) | 0.25 |
| Gastrointestinal bleeding | 0 (0.0) | 1 (2.5) | 0.31 |
| Acute kidney injury | 1 (2.5) | 2 (5.0) | 0.56 |
| Local anesthetic toxicity signs | 0 (0.0) | 0 (0.0) | – |
| Wound infection | 4 (10.0) | 5 (12.5) | 0.73 |
| Anastomotic leak | 1 (2.5) | 2 (5.0) | 0.56 |
| Unplanned ICU admission | 3 (7.5) | 5 (12.5) | 0.46 |
| Reoperation | 1 (2.5) | 2 (5.0) | 0.56 |
| In-hospital mortality | 0 (0.0) | 1 (2.5) | 0.31 |

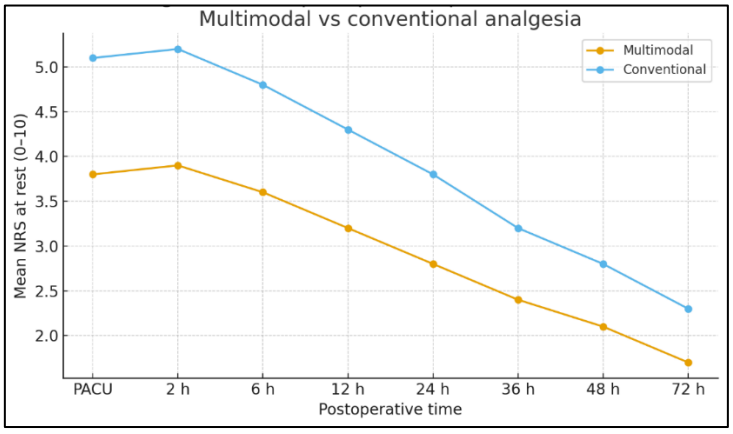


**Figure 1** Mean postoperative pain scores at rest (NRS 0–10).

In *Figure 1* compares mean NRS pain scores (0–10) between multimodal and conventional analgesia at different postoperative time points. Pain scores are consistently lower in the multimodal analgesia group compared to the conventional group from PACU to 72 hours. In both groups, pain scores gradually decrease over time, with the multimodal approach demonstrating better pain control throughout the postoperative period.

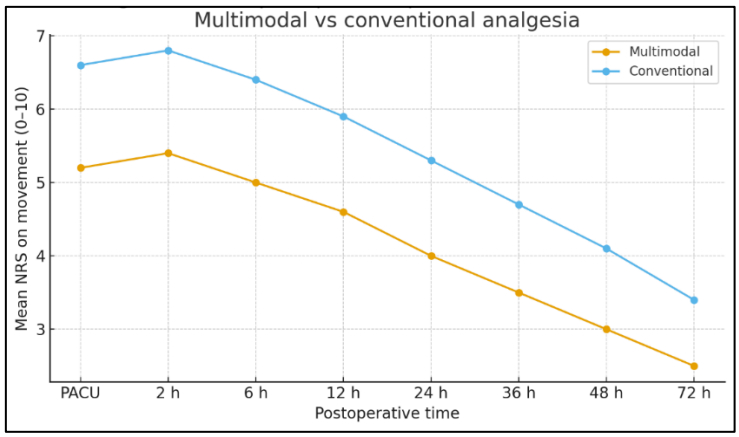


**Figure 2** Mean postoperative pain scores on movement (NRS 0–10).

The figure shows mean pain scores during movement (NRS 0–10) from the PACU to 72 hours postoperatively for patients receiving multimodal versus conventional analgesia. Pain scores decrease over time in both groups, but remain consistently lower in the multimodal analgesia group, indicating better postoperative pain control compared with conventional analgesia.

## DISCUSSION

The present randomized study among 80 patients undergoing major abdominal surgery demonstrates that a structured multimodal analgesia protocol meaningfully reduced both postoperative pain scores and perioperative opioid requirements compared with conventional opioid-centric care, without increasing major complications. Pain at rest and on movement was consistently lower by approximately 0.7–1.4 VAS points from PACU to 72 hours, and intraoperative opioid exposure (fentanyl and morphine equivalents) was significantly reduced in the multimodal group. Opioid-related adverse effects such as nausea, vomiting and excessive sedation were also less frequent, while serious events, ICU admission, reoperation and mortality were rare and comparable between groups. These findings align with current enhanced recovery after surgery (ERAS) concepts, which place multimodal, opioid-sparing strategies at the center of perioperative care after open and laparoscopic abdominal procedures [12,13]. Our results are consistent with the broader evidence that adding non-opioid agents (paracetamol, NSAIDs/COX-2 inhibitors, ketamine, lidocaine) and regional techniques to systemic opioids improves analgesia and reduces opioid use after major abdominal surgery [12-14]. Hughes et al. showed that, within ERAS pathways for open abdominal surgery, neuraxial techniques yielded better pain scores and faster bowel recovery. However, overall morbidity and length of stay were similar to alternative regimens [12]. Wilson and Jones likewise emphasized that no single technique is universally superior; instead, combinations of systemic and regional approaches tailored to patient and surgical factors are recommended [13]. Recent narrative and scoping reviews reinforce that multimodal regimens achieve clinically relevant opioid sparing and fewer opioid-related side effects across diverse surgical populations [14,15]. Our magnitude of opioid reduction and pain relief is comparable to that reported when multimodal “bundles” are implemented in colorectal ERAS programs. ERAS-aligned multimodal pathways in laparoscopic colorectal cancer surgery similarly report lower early pain scores, earlier bowel function and shorter hospital stay compared with historical or less protocolized care [16-18]. In elderly colorectal cancer patients, Huang et al. showed that thoughtfully designed multimodal strategies (paracetamol, NSAIDs, regional blocks, adjuvants) improved pain control with acceptable safety, supporting their use even in higher-risk populations [17]. Our finding of reduced nausea, vomiting and sedation in the multimodal group echoes these series, where opioid minimization translated into fewer cardiopulmonary and gastrointestinal complications [5,17-19]. Trials focusing specifically on opioid-sparing or opioid-free concepts in major abdominal surgery also support our findings. Jipa et al. demonstrated that adding ketamine and lidocaine infusions or epidural analgesia to standard opioid–paracetamol/metamizole regimens reduced VAS scores and both intra- and postoperative opioid requirements in major abdominal procedures [20]. In open liver surgery, Tsai et al. showed that combining IV-PCA with abdominal wall nerve blocks achieved analgesia comparable to thoracic epidural, with similar or lower opioid use and no delay in bowel recovery [21]. Consistent with our use of epidural and peripheral blocks as components of multimodal care, Kitagawa et al. reported that TAP block plus systemic multimodal analgesia was non-inferior to epidural analgesia after laparoscopic colon cancer surgery and was associated with fewer neuraxial-related adverse events [22]. The balance between neuraxial and non-neuraxial techniques is important. Older economic and comparative studies found thoracic epidural and continuous wound infiltration to be cost-effective alternatives to IV morphine PCA after abdominal surgery, while a Cochrane review concluded that epidural provides slightly better acute pain relief than IV-PCA but at the cost of more hypotension, pruritus and technique failure [23, 24]. Our protocol, which mixes neuraxial, peripheral and systemic non-opioid options, reflects this shift towards flexible, resource-sensitive multimodal strategies rather than a single dominant technique. Evidence from Bangladesh and other low- and middle-income settings also supports the feasibility of such regimens. Haider et al. found that TAP block as part of multimodal analgesia for total abdominal hysterectomy significantly reduced morphine consumption and prolonged time to first analgesic request, without increasing adverse events [25]. Rectus sheath block added to multimodal regimens after midline laparotomy has likewise been shown to reduce opioid requirements and improve pain scores [26]. Extensive population-based data from over 1.3 million hysterectomies confirm that adding one, two, or three non-opioid modalities to opioids incrementally reduces serious complications, opioid

prescription and length of stay, underscoring the dose–response benefit of more intensive multimodal strategies [19].

## LIMITATIONS

The absence of a signal for increased serious complications in our small sample is reassuring. However, larger multicenter trials are needed to confirm effects on functional recovery, length of stay and long-term outcomes, and to define the optimal mix of systemic and regional techniques for resource-limited tertiary hospitals.

## CONCLUSION

Multimodal analgesia significantly reduced postoperative pain scores and perioperative opioid consumption compared with conventional opioid-based regimens in patients undergoing major abdominal surgery, without increasing serious complications. The multimodal protocol was also associated with fewer opioid-related adverse effects, such as nausea, vomiting and excessive sedation, and modestly improved early recovery parameters. These findings support the routine adoption of pragmatic, opioid-sparing multimodal analgesia within perioperative pathways for major abdominal surgery in the Bangladeshi tertiary care setting.

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## CONFLICT OF INTEREST

None declared

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