

Effectiveness of Multimodal Analgesia versus Opioid-Based Analgesia in Postoperative Pain Management

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Abstract

Background: Postoperative pain remains a major determinant of early recovery, patient comfort, mobilization, and hospital resource use. Opioids provide effective analgesia but are limited by nausea, vomiting, sedation, pruritus, respiratory depression, and delayed functional recovery. Multimodal analgesia combines agents and techniques acting through different pain pathways to improve analgesia while reducing opioid exposure. The objective is to compare the effectiveness and safety of multimodal analgesia with opioid-based analgesia in postoperative pain management. **Material and Methods:** This prospective comparative study included 60 postoperative patients at Kamineni Institute of Medical Sciences, Narketpally, Telangana, India, from August 2024 to July 2025. Patients were divided into Group M receiving multimodal analgesia and Group O receiving opioid-based analgesia, with 30 patients in each group. Pain was assessed using the visual analogue scale at 2, 6, 12, and 24 hours after surgery. Rescue analgesic requirement, time to first rescue analgesia, opioid consumption, adverse effects, patient satisfaction, and hospital stay were recorded. **Results:** Baseline demographic and clinical variables were comparable between the groups. Group M had significantly lower mean VAS scores at 2, 6, 12, and 24 hours. Rescue analgesia was required in 26.7% of patients in Group M and 60.0% in Group O. Time to first rescue analgesia was longer in Group M, and total opioid consumption was lower. Nausea, vomiting, sedation, and pruritus were more frequent in Group O. Patient satisfaction was higher and hospital stay was shorter in Group M. **Conclusion:** Multimodal analgesia provided superior postoperative pain control with reduced opioid requirement, fewer opioid-related adverse effects, higher patient satisfaction, and shorter hospital stay compared with opioid-based analgesia.

Keywords: Multimodal analgesia; opioid analgesia; postoperative pain; visual analogue scale; rescue analgesia; opioid-sparing analgesia.

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INTRODUCTION

Postoperative pain is a frequent clinical problem that influences early recovery, respiratory effort, sleep, mobilisation, and overall patient satisfaction. Even with improvements in anaesthesia and surgical care, a substantial proportion of patients continue to experience moderate to severe pain after surgery, particularly during the first 24 hours.^[1,2] Inadequate analgesia increases sympathetic activation, delays ambulation, impairs pulmonary function, and contributes to prolonged hospital stay. It also has a role in the transition from acute postoperative pain to persistent postsurgical pain in susceptible patients.^[3-5] Therefore, effective pain management is not limited to comfort alone; it is an essential component of perioperative quality, safety, and recovery.

Opioid analgesics have traditionally been central to postoperative pain management because of their strong analgesic efficacy. However, exclusive or excessive reliance on opioids is associated with important adverse effects such as nausea, vomiting, sedation, pruritus, urinary retention, ileus, respiratory depression, and delayed mobilization.^[3,4] These adverse drug events increase the need for monitoring, prolong hospital stay, raise treatment costs, and reduce patient satisfaction.^[6] Concerns regarding opioid tolerance, hyperalgesia, and persistent postoperative opioid use have

further strengthened the need for safer opioid-sparing strategies in routine surgical practice.^[5,6]

Multimodal analgesia is based on the principle that postoperative pain is mediated through multiple peripheral and central pathways. Combining analgesics and techniques with different mechanisms of action produces additive or synergistic analgesia while reducing the dose-related toxicity of individual agents. Non-opioid analgesics such as paracetamol and nonsteroidal anti-inflammatory drugs, regional anaesthesia techniques, local wound infiltration, adjuvant drugs, and limited rescue opioids are commonly included in multimodal regimens. The concept of balanced analgesia was established several decades ago and has become a key element of enhanced recovery pathways because it improves pain scores, decreases opioid consumption, and facilitates early functional recovery.^[7-11]

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Although the benefits of multimodal analgesia are widely recognised, institutional adoption varies according to surgical profile, drug availability, monitoring resources, and clinician preference. Evidence from individual centres is useful for refining postoperative analgesic protocols, improving bedside implementation, and encouraging rational opioid stewardship in daily surgical practice. The present study was undertaken with the objective of comparing multimodal analgesia with opioid-based analgesia in postoperative patients. The primary objective was to compare postoperative pain scores between the two groups. The secondary objectives were to compare rescue analgesic requirement, time to first rescue analgesia, total opioid consumption, adverse effects, patient satisfaction, and length of hospital stay.

MATERIALS AND METHODS

Study design and setting: This prospective comparative study was conducted in the Department of Anaesthesiology at Kamineni Institute of Medical Sciences, Narketpally, Telangana, India. The study period was from August 2024 to July 2025. The study evaluated postoperative analgesic outcomes among patients receiving either a multimodal analgesia regimen or an opioid-based analgesia regimen after elective surgical procedures. The study was planned in accordance with standard clinical principles for postoperative pain assessment and perioperative analgesic monitoring.^[1,6,12]

Study population and sample size: A total of 60 postoperative patients were included. Patients were divided into two equal groups of 30 each. Group M received multimodal analgesia, and Group O received opioid-based analgesia. The sample size was based on feasible enrolment during the defined study period, expected postoperative case load, and the ability to complete uniform follow-up until 24 hours after surgery. All enrolled patients completed the study and were included in the final analysis.

Eligibility criteria: Adult postoperative patients who underwent elective surgery under institutional anaesthesia protocols and were clinically stable for postoperative pain assessment were included. Patients with known allergy to study-related analgesic drugs, chronic opioid use, severe hepatic or renal dysfunction, altered sensorium, inability to report pain score, postoperative mechanical ventilation, or incomplete follow-up data were excluded. Patients with contraindications to nonsteroidal anti-inflammatory drugs or regional/local analgesic techniques were managed according to safety protocols and were not included in the multimodal

arm when protocol completion was not possible.

Analgesic regimen: In Group M, analgesia was delivered through a multimodal approach that combined non-opioid analgesics with local or regional analgesic techniques whenever clinically appropriate, with opioid drugs reserved for rescue analgesia. The regimen commonly included paracetamol, a nonsteroidal anti-inflammatory drug when not contraindicated, local infiltration or regional block as per surgical and anaesthetic plan, and rescue opioid administration when pain exceeded the predefined threshold. In Group O, postoperative pain control was primarily opioid based, using institutional opioid dosing protocols, with additional non-opioid medication only when clinically indicated. All patients received routine postoperative monitoring.

Outcome assessment: Pain intensity was measured using the visual analogue scale at 2, 6, 12, and 24 hours after surgery. Rescue analgesia was administered when pain score exceeded the institutional rescue threshold or when the patient reported unacceptable pain despite scheduled medication. Time to first rescue analgesia, number of rescue analgesic doses, and total opioid consumption were documented. Opioid use was expressed as morphine equivalent dose. Adverse effects including nausea, vomiting, sedation, pruritus, and respiratory depression were recorded. Patient satisfaction was assessed using a 10-point score, and length of hospital stay was calculated in days.

Statistical analysis: Data were entered into a spreadsheet and analysed using standard statistical methods. Continuous variables were expressed as mean and standard deviation, while categorical variables were expressed as frequency and percentage. Intergroup comparison of continuous variables was performed using the independent sample t-test. Categorical variables were compared using the chi-square test or Fisher exact test when required. A p-value less than 0.05 was considered statistically significant.

RESULTS

A total of 60 postoperative patients were included in the study. Patients were divided into two equal groups: Group M received multimodal analgesia, and Group O received opioid-based analgesia. Each group included 30 patients. All enrolled patients completed the study and were included in the final analysis.

The baseline demographic and clinical characteristics were comparable between the two groups. The mean age was 44.6 ± 12.8 years in Group M and 45.9 ± 13.1 years in Group O. Male patients constituted 56.7% in Group M and 53.3% in Group O. No statistically significant difference was observed between the groups with respect to age, sex distribution, body weight, ASA physical status, or duration of surgery, as shown in [Table 1].

Table 1: Baseline demographic and clinical characteristics of the study population

Variable	Group M (n=30)	Group O (n=30)	p-value
Age, years	44.6 ± 12.8	45.9 ± 13.1	0.698
Male/Female	17/13	16/14	0.795
Body weight, kg	66.4 ± 9.7	67.1 ± 10.2	0.786
ASA I	12 (40.0%)	11 (36.7%)	0.791
ASA II	18 (60.0%)	19 (63.3%)	0.791
Duration of surgery, minutes	82.5 ± 18.6	85.2 ± 20.1	0.591

Postoperative pain scores were lower in the multimodal

analgesia group at all assessed time intervals. The difference

was most evident during the early postoperative period. At 2 hours, the mean VAS score was 3.1 ± 0.9 in Group M compared with 4.4 ± 1.1 in Group O. At 6 hours, the mean VAS score was 2.8 ± 0.8 in Group M and 4.0 ± 1.0 in Group

O. The difference remained statistically significant at 12 and 24 hours also. The detailed comparison of postoperative VAS scores is presented in [Table 2].

Table 2: Comparison of postoperative pain scores between the two groups

Time after surgery	Group M (n=30)	Group O (n=30)	p-value
2 hours	3.1 ± 0.9	4.4 ± 1.1	<0.001
6 hours	2.8 ± 0.8	4.0 ± 1.0	<0.001
12 hours	2.4 ± 0.7	3.3 ± 0.9	<0.001
24 hours	1.9 ± 0.6	2.7 ± 0.8	<0.001

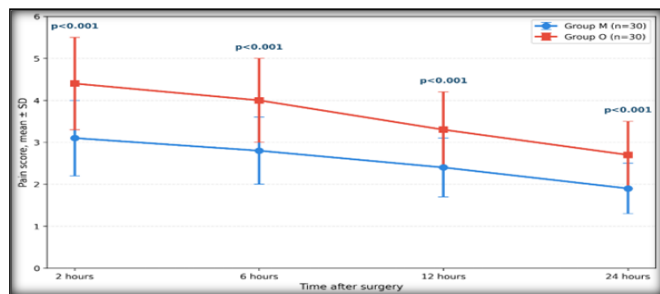


Figure 1: Comparison of postoperative pain scores between the two groups

The requirement for rescue analgesia was lower in Group M. Only 8 patients in the multimodal analgesia group required rescue analgesia, compared with 18 patients in the opioid-based analgesia group. The mean time to first rescue analgesia was longer in Group M than in Group O. Total postoperative opioid consumption and the number of rescue analgesic doses were also significantly lower in the multimodal analgesia group. These findings are summarised in [Table 3].

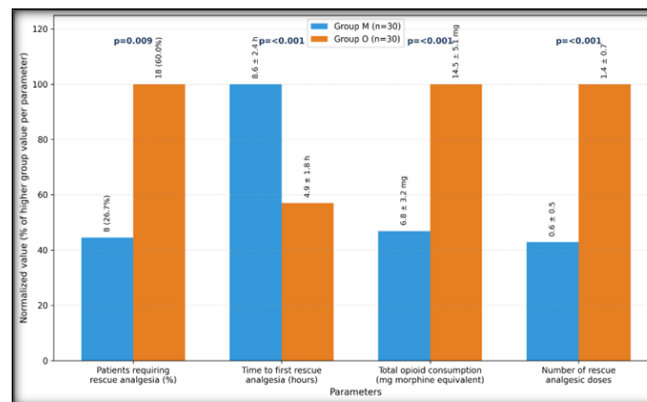


Figure 2: Analgesic requirement and opioid consumption

Adverse effects were more frequent in Group O. Nausea and vomiting occurred in 6 patients in Group O and 2 patients in Group M. Sedation and pruritus were higher in Group O, while no respiratory depression occurred in either group. Patient satisfaction was higher and hospital stay was shorter in Group M. These clinical outcomes are shown in [Table 4].

Table 3: Analgesic requirement and opioid consumption

Parameter	Group M (n=30)	Group O (n=30)	p-value
Patients requiring rescue analgesia	8 (26.7%)	18 (60.0%)	0.009
Time to first rescue analgesia, hours	8.6 ± 2.4	4.9 ± 1.8	<0.001
Total opioid consumption, mg morphine equivalent	6.8 ± 3.2	14.5 ± 5.1	<0.001
Number of rescue analgesic doses	0.6 ± 0.5	1.4 ± 0.7	<0.001

Table 4: Comparison of postoperative adverse effects and clinical outcomes

Outcome	Group M (n=30)	Group O (n=30)	p-value
Nausea and vomiting	2 (6.7%)	6 (20.0%)	0.129
Sedation	1 (3.3%)	5 (16.7%)	0.085
Pruritus	0 (0.0%)	3 (10.0%)	0.076
Respiratory depression	0 (0.0%)	0 (0.0%)	—
Patient satisfaction score	8.7 ± 0.9	7.5 ± 1.1	<0.001
Length of hospital stay, days	3.1 ± 0.8	3.8 ± 1.0	0.004

Overall, multimodal analgesia provided better postoperative pain control than opioid-based analgesia. It was associated with lower VAS scores, reduced rescue analgesic requirement, delayed need for first rescue analgesia, decreased total opioid consumption, fewer opioid-related adverse effects, higher patient satisfaction, and shorter hospital stay.

DISCUSSION

The present study demonstrated that multimodal analgesia

was more effective than opioid-based analgesia for postoperative pain management. Patients receiving multimodal analgesia had significantly lower VAS scores at 2, 6, 12, and 24 hours after surgery. The early reduction in pain score is clinically important because the immediate postoperative period is associated with inflammatory nociception, anxiety, restricted movement, and increased demand for rescue analgesics. These findings support the principle that targeting multiple pain pathways provides more stable analgesia than relying mainly on opioids.^[7,8]

The lower rescue analgesic requirement in the multimodal group

further strengthens the analgesic benefit observed in this study. Only 26.7% of patients in Group M required rescue analgesia compared with 60.0% in Group O. The time to first rescue analgesia was also longer in the multimodal group, indicating prolonged comfort and better background pain control. Earlier studies and meta-analyses have shown that adding non-opioid analgesics such as paracetamol, NSAIDs, or COX-2 inhibitors to opioid regimens reduces morphine consumption and improves postoperative analgesic outcomes.^[9] Similar opioid-sparing benefits are also described in enhanced recovery pathways, where multimodal analgesia is considered a core perioperative component.^[10,11] Total opioid consumption was markedly lower in Group M. This outcome has practical clinical relevance because opioid-related adverse effects often limit recovery even when pain relief is achieved. In the present study, nausea and vomiting, sedation, and pruritus were numerically higher in the opioid-based group. Although some adverse-effect comparisons did not reach statistical significance, the direction of effect was consistent with the known opioid safety profile. Opioid adverse drug events have been associated with increased monitoring needs, prolonged hospitalisation, and greater healthcare costs.^[13,14] Reduced opioid exposure therefore represents both an analgesic and safety advantage. Patient satisfaction was significantly higher in the multimodal analgesia group. Satisfaction after surgery is influenced not only by pain intensity but also by alertness, ability to mobilise, gastrointestinal comfort, and confidence in recovery. The shorter hospital stay observed in Group M suggests that improved analgesia and reduced opioid burden contributed to smoother postoperative recovery. The findings are aligned with recommendations that postoperative pain management should be individualised, multimodal, and opioid-sparing whenever feasible.^[7] For institutions with diverse surgical workloads, a structured multimodal protocol can improve consistency of care while preserving opioid use for patients requiring rescue analgesia.

The study adds local evidence from a tertiary care setting and supports routine use of multimodal analgesia in eligible postoperative patients. The results also highlight the need for systematic pain scoring, documentation of rescue analgesic use, and monitoring of adverse events as quality indicators in postoperative care. Wider implementation requires staff training, protocol-based prescribing, recognition of contraindications to non-opioid drugs, and regular audit of pain outcomes.

Limitations: This was a single-centre study with a modest sample size, limiting wider generalisation. Surgical procedures were not stratified by intensity of tissue trauma, and blinding was not performed. Pain scores were assessed only during the first 24 postoperative hours. Procedure-specific analgesic components were not analysed separately. Longer follow-up for persistent pain, functional recovery, and post-discharge opioid use was not included.

CONCLUSION

Multimodal analgesia was more effective than opioid-based analgesia for postoperative pain management in this study. It

produced lower pain scores throughout the first 24 postoperative hours, reduced the need for rescue analgesia, prolonged the time to first rescue analgesic dose, and decreased total opioid consumption. Patients receiving multimodal analgesia also had fewer opioid-related adverse effects, better satisfaction scores, and shorter hospital stay. These findings support the incorporation of structured multimodal analgesic protocols into routine postoperative care. Opioids should remain available for rescue analgesia, but primary reliance on opioids alone should be avoided when safe non-opioid and regional analgesic options are suitable. Regular audit of pain scores can guide protocol refinement.

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Conflicts of interest

There are no conflicts of interest.

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