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Original Research Article

COMPARATIVE CLINICAL OUTCOMES OF OPIOID-FREE AND OPIOID-SPARING ANESTHESIA IN MAJOR SURGERIES: A PROSPECTIVE COMPARATIVE STUDY

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ABSTRACT

Background: Opioids have traditionally been the cornerstone of perioperative analgesia in major surgeries because of their potent analgesic efficacy and ability to attenuate surgical stress responses. However, opioid administration is associated with several adverse effects including postoperative nausea and vomiting (PONV), respiratory depression, sedation, ileus, delayed recovery, opioid-induced hyperalgesia, and the risk of persistent postoperative opioid dependence. Growing concerns regarding opioid-related complications and the ongoing opioid crisis have led to increasing interest in opioid-minimization strategies such as opioid-free anesthesia (OFA) and opioid-sparing anesthesia (OSA). **Aim:** To compare the clinical outcomes of opioid-free anesthesia and opioid-sparing anesthesia in patients undergoing major surgeries at Kumaran Medical Center, Coimbatore. **Materials and Methods:** This prospective randomized comparative study was conducted among 60 patients undergoing elective major surgeries under general anesthesia. Patients were divided into two groups of 30 each. Group OFA received opioid-free anesthesia using multimodal non-opioid analgesic agents including dexmedetomidine, ketamine, lidocaine, magnesium sulphate, and regional anesthesia techniques without intraoperative opioid administration. Group OSA received opioid-sparing anesthesia with reduced-dose opioids combined with multimodal analgesia. Parameters assessed included postoperative pain scores, total opioid consumption, incidence of postoperative nausea and vomiting, respiratory complications, hemodynamic stability, recovery profile, and duration of hospital stay. **Results:** The OFA group demonstrated significantly lower postoperative opioid requirements and reduced incidence of postoperative nausea and vomiting compared with the OSA group. Early postoperative recovery and patient satisfaction were improved in the OFA group. However, episodes of bradycardia and hypotension were more frequently observed in patients receiving opioid-free anesthesia. The OSA group provided effective analgesia with improved intraoperative hemodynamic stability while significantly reducing opioid consumption compared with conventional opioid-based anesthesia. **Conclusion:** Both opioid-free anesthesia and opioid-sparing anesthesia are effective alternatives to conventional opioid-based anesthetic techniques in major surgeries. Opioid-free anesthesia offers superior reduction in opioid-related adverse effects and postoperative opioid requirements, whereas opioid-sparing anesthesia provides balanced analgesia with better hemodynamic stability. Individualized multimodal analgesic strategies may optimize perioperative outcomes and enhance postoperative recovery.

INTRODUCTION

Effective perioperative pain management is an integral component of modern anesthetic practice and plays a major role in improving postoperative recovery, reducing morbidity, and enhancing patient satisfaction following major surgical procedures.[1] Traditionally, opioids have been widely used as the cornerstone of intraoperative and postoperative analgesia because of their potent analgesic efficacy

and their ability to attenuate surgical stress responses.[2] However, despite their clinical effectiveness, opioids are associated with several adverse effects including postoperative nausea and vomiting (PONV), respiratory depression, excessive sedation, ileus, constipation, urinary retention, opioid-induced hyperalgesia, delayed mobilization, and prolonged hospital stay.[3,4] Furthermore, increasing perioperative opioid exposure has contributed to concerns regarding persistent postoperative opioid use and the growing global opioid crisis.[5]

In recent years, there has been a paradigm shift toward multimodal analgesic strategies aimed at minimizing opioid consumption while maintaining effective pain control and improving postoperative outcomes.[6] Enhanced Recovery After Surgery (ERAS) protocols strongly advocate opioid minimization as an important strategy for facilitating faster recovery, reducing postoperative complications, and promoting early ambulation.[15] Consequently, opioid-free anesthesia (OFA) and opioid-sparing anesthesia (OSA) have emerged as important alternatives to conventional opioid-based anesthesia techniques.[4,7]

Opioid-free anesthesia refers to the complete elimination of opioids during the perioperative period by utilizing combinations of non-opioid analgesic agents and regional anesthesia techniques.[4] Commonly used agents in OFA protocols include dexmedetomidine, ketamine, lidocaine, magnesium sulphate, acetaminophen, nonsteroidal anti-inflammatory drugs (NSAIDs), and regional nerve blocks.[5,8] These agents act through multiple pharmacological pathways to provide analgesia, reduce central sensitization, and attenuate neuroendocrine stress responses associated with surgery.[9] In contrast, opioid-sparing anesthesia aims to minimize rather than completely eliminate opioid use by combining reduced doses of opioids with multimodal non-opioid adjuncts to achieve adequate analgesia while reducing opioid-related adverse effects.[10]

Major surgeries such as abdominal, thoracic, Orthopedic, bariatric, vascular, and oncological procedures are commonly associated with severe postoperative pain and significant physiological stress responses.[11] Effective perioperative analgesia in these patients is essential to improve recovery outcomes, reduce pulmonary complications, facilitate early mobilization, shorten hospital stay, and enhance overall patient comfort and satisfaction.[12] Both OFA and OSA have shown promising results in improving postoperative recovery and reducing opioid-related complications; however, their comparative efficacy and safety remain subjects of ongoing clinical research.[1,2]

Several randomized controlled trials and systematic reviews have evaluated opioid-minimization strategies in major surgeries.[2,3] Studies have demonstrated that opioid-free anesthesia can significantly reduce postoperative opioid requirements, incidence of PONV, and respiratory complications while improving recovery profiles.[6] However, certain studies have also reported increased incidence of bradycardia and hypotension associated with dexmedetomidine-based OFA protocols.[1] Similarly, opioid-sparing anesthesia has been shown to provide effective analgesia with better hemodynamic stability and fewer opioid-related adverse effects compared with traditional opioid-based anesthesia techniques.[7,13]

Although increasing evidence supports the use of multimodal opioid-minimization strategies, there remains considerable variability in anesthetic protocols, patient populations, and outcome measures across different studies.[14] Therefore, determining the optimal anesthetic approach for major surgeries remains an important clinical challenge. Hence, the present study was conducted at Kumaran Medical Center, Coimbatore, among 60 patients undergoing major surgeries to compare opioid-free anesthesia and opioid-sparing anesthesia with respect to postoperative pain control, opioid consumption, perioperative complications, recovery profile, and overall clinical outcomes.[15]

Aim

To compare the clinical outcomes of opioid-free anesthesia and opioid-sparing anesthesia in patients undergoing major surgeries at Kumaran Medical Center, Coimbatore, with respect to postoperative pain control, opioid consumption, perioperative complications, and recovery profile.

Objectives

Primary Objective

1. To compare postoperative pain scores between patients receiving opioid-free anesthesia and opioid-sparing anesthesia during major surgeries.

Secondary Objectives

1. To compare perioperative opioid consumption between the two groups.
2. To assess the incidence of postoperative nausea and vomiting (PONV).
3. To evaluate respiratory complications in the postoperative period.
4. To compare intraoperative hemodynamic stability between the study groups.
5. To assess recovery characteristics including time to ambulation and duration of hospital stay.
6. To evaluate overall patient satisfaction following surgery.

MATERIALS AND METHODS

Study Design

The present study was designed as a prospective randomized comparative study conducted among patients undergoing elective major surgeries under general anesthesia at Kumaran Medical Center, Coimbatore. Patients were divided into opioid-free anesthesia (OFA) and opioid-sparing anesthesia (OSA) groups, and perioperative as well as

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postoperative outcomes were compared between the two groups.

Study Place

The present study was conducted at Kumaran Medical Center, Coimbatore, Tamil Nadu, India, among patients undergoing elective major surgical procedures under general anesthesia.

Study Duration

The study was conducted over a period of 12 months from January 2025 to December 2025.

Study Population

The study population consisted of patients undergoing elective major surgical procedures under general anesthesia at Kumaran Medical Center, Coimbatore, who fulfilled the inclusion and exclusion criteria of the study.

Sample Size

A total of 60 patients undergoing elective major surgeries under general anesthesia were included in the study. Patients were randomized into two groups using computer-generated random allocation with 30 patients in each group.

- **Group A (Opioid-Free Anesthesia Group):** 30 patients
- **Group B (Opioid-Sparing Anesthesia Group):** 30 patients.

The sample size was calculated based on previous studies evaluating postoperative pain scores and opioid consumption between opioid-free and opioid-sparing anesthesia techniques. Assuming a power of 80%, alpha error of 5%, and expected moderate effect size, a minimum sample size of 27 patients per group was required. Considering possible dropouts, 30 patients were included in each group.

Inclusion Criteria

1. Patients aged between 18 and 65 years.
2. Patients undergoing elective major surgical procedures under general anesthesia.
3. Patients belonging to American Society of Anaesthesiologists (ASA) physical status I and II.
4. Patients willing to participate in the study and provide written informed consent.
5. Patients undergoing abdominal, Orthopedic, thoracic, bariatric, vascular, or oncological surgeries.
6. Patients with stable hemodynamic status preoperatively.

Exclusion Criteria

1. Patients with known allergy or hypersensitivity to study drugs.
2. Patients with chronic opioid use or opioid dependence.
3. Patients with severe hepatic, renal, cardiovascular, or respiratory disease.
4. Patients with psychiatric illness or cognitive impairment affecting pain assessment.
5. Pregnant and lactating women.
6. Patients undergoing emergency surgical procedures.
7. Patients with American Society of Anaesthesiologists (ASA) physical status III and above.

Preoperative Assessment

All patients underwent detailed preoperative anesthetic evaluation prior to surgery. A thorough medical history including previous anesthesia exposure, drug allergies, comorbid illnesses, medication history, and opioid use was obtained. General physical examination and systemic examination were performed in all patients. Airway assessment was carried out using Mallampati grading, mouth opening, neck mobility, and thyromental distance. Baseline vital parameters including heart rate, blood pressure, respiratory rate, and oxygen saturation were recorded. Routine laboratory investigations such as complete blood count, renal function tests, liver function tests, blood sugar levels, ECG, and chest X-ray were performed wherever indicated. Patients were classified according to the American Society of Anaesthesiologists (ASA) physical status classification. Written informed consent was obtained from all patients before inclusion in the study.

Group Allocation

After obtaining informed consent and confirming eligibility criteria, the selected patients were allocated into two groups comprising 30 patients each based on the anesthetic technique administered during surgery.

Group A – Opioid-Free Anesthesia Group (OFA) (n = 30)

Patients in this group received opioid-free anesthesia using dexmedetomidine loading dose of 1 µg/kg over 10 minutes followed by infusion at 0.2–0.7 µg/kg/hour, ketamine 0.5 mg/kg IV bolus followed by infusion at 0.1–0.2 mg/kg/hour, lidocaine infusion at 1.5 mg/kg/hour, magnesium sulphate 30–50 mg/kg IV, intravenous paracetamol 1 g, and NSAIDs whenever indicated. Regional anesthesia techniques were used wherever applicable. No intraoperative opioids were administered in this group.

Group B – Opioid-Sparing Anesthesia Group (OSA) (n = 30)

Patients in this group received reduced-dose opioids using fentanyl 1–2 µg/kg intravenously along with multimodal non-opioid analgesic adjuncts including dexmedetomidine, ketamine, paracetamol, NSAIDs, and regional anesthesia techniques whenever indicated.

Intraoperative Monitoring

All patients were monitored intraoperatively using standard anesthetic monitoring protocols. Continuous monitoring included electrocardiography (ECG), heart rate, non-invasive blood pressure (NIBP), peripheral oxygen saturation (SpO_2), respiratory rate, and end-tidal carbon dioxide ($EtCO_2$). Hemodynamic parameters were recorded at baseline and at regular intervals throughout the surgical procedure. Intraoperative monitoring also included assessment of anesthetic depth, fluid

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administration, oxygenation, and ventilation status. Any episodes of hypotension, bradycardia, desaturation, arrhythmias, or other intraoperative complications were noted and managed appropriately according to standard anesthetic guidelines.

Postoperative rescue analgesia was provided using intravenous tramadol 50–100 mg whenever VAS score exceeded 4. Total rescue opioid consumption during the first 24 postoperative hours was recorded.

Outcome Measures

Primary Outcome Measure

The primary outcome measure of the study was postoperative pain assessment using the Visual Analog Scale (VAS) score at predefined postoperative intervals to compare the analgesic efficacy of opioid-free anesthesia and opioid-sparing anesthesia in patients undergoing major surgeries.

Secondary Outcome Measures

The secondary outcome measures included total perioperative opioid consumption, incidence of postoperative nausea and vomiting (PONV), respiratory complications defined as respiratory rate less than 10 breaths/minute, oxygen saturation below 92%, or need for supplemental oxygen support, and intraoperative hemodynamic stability including changes in heart rate and blood pressure. Recovery characteristics including time to ambulation, duration of postoperative hospital stay, and overall patient satisfaction regarding pain management and postoperative recovery were also evaluated.

Postoperative Assessment

All patients were monitored postoperatively in the recovery room and surgical ward for pain relief, hemodynamic stability, and postoperative complications. Postoperative pain was assessed using the Visual Analog Scale (VAS) at regular intervals. Patients were observed for postoperative nausea and vomiting (PONV), respiratory depression, sedation, oxygen desaturation, and other adverse effects. Hemodynamic parameters including heart rate, blood pressure, respiratory rate, and oxygen saturation were recorded periodically. Total postoperative opioid requirement, time to ambulation, duration of hospital stay, and patient satisfaction regarding pain management were also assessed and documented.

Statistical Analysis

The collected data were entered into Microsoft Excel and analyzed using Statistical Package for Social Sciences (SPSS) software version 26.0 (IBM Corporation, Armonk, NY, USA). Continuous variables were expressed as mean ± standard deviation (SD), while categorical variables were expressed as frequency and percentage. Comparison between the two study groups was performed using the independent Student's t-test for continuous variables and Chi-square test or Fisher's exact test for categorical variables wherever appropriate. A p-value of less than 0.05 was considered statistically significant.

Ethical Considerations

The study was conducted after obtaining approval from the Institutional Ethics Committee of Kumaran Medical Center, Coimbatore. The study protocol was explained in detail to all patients, and written informed consent was obtained prior to participation in the study. Confidentiality of patient information was strictly maintained throughout the study period. The study was conducted in accordance with the ethical principles of the Declaration of Helsinki and institutional guidelines for biomedical research involving human participants.

RESULTS

A total of 60 patients undergoing elective major surgeries were included in the study and divided equally into two groups: Group A (Opioid-Free Anesthesia) and Group B (Opioid-Sparing Anesthesia), with 30 patients in each group. Both groups were comparable with respect to demographic characteristics including age, gender distribution, body mass index (BMI), and ASA physical status.

The demographic characteristics of the study population including age, gender distribution, body mass index (BMI), and ASA physical status were comparable between the two groups, and no statistically significant difference was observed ($p > 0.05$).

Table 1: Demographic Characteristics of Study Population

Variables	Group A (OFA) (n=30)	Group B (OSA) (n=30)	p-value
Age (years)	44.8 ± 10.2	46.1 ± 9.8	0.62
Male/Female	18/12	17/13	0.79
BMI (kg/m²)	25.4 ± 3.1	26.0 ± 3.4	0.48
ASA I/II	16/14	15/15	0.79

Notes: Data are expressed as mean ± standard deviation (SD) for continuous variables and frequency (number) for categorical variables. BMI – Body Mass Index; ASA – American Society of Anaesthesiologists physical status classification. p-value > 0.05 indicates that there was no statistically significant difference between the two groups, demonstrating that both groups were comparable with respect to baseline demographic characteristics.

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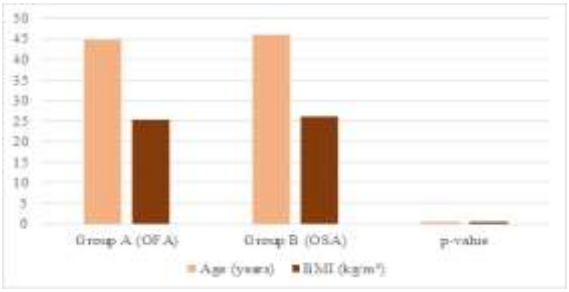

Figure 1: Demographic Characteristics of the Study Population in Opioid-Free Anesthesia (OFA) and Opioid-Sparing Anesthesia (OSA) Groups

Figure Notes: Data are expressed as mean ± standard deviation (SD) for continuous variables and frequency (number of patients) for categorical variables. BMI = Body Mass Index; ASA = American Society of Anaesthesiologists physical status classification. No statistically significant difference was observed between the two groups ($p > 0.05$), indicating that the baseline demographic characteristics were comparable.

Postoperative pain was assessed using the Visual Analog Scale (VAS) at different postoperative intervals. Patients in the OFA group demonstrated significantly lower pain scores during the early postoperative period at 2, 6, and 12 hours when compared with the OSA group. However, at 24 hours postoperatively, the difference in pain scores between the two groups was not statistically significant.

Table 2: Comparison of Postoperative Pain Scores (VAS)

Time Interval	Group A (OFA)	Group B (OSA)	p-value
2 Hours	3.2 ± 0.8	4.1 ± 1.0	0.01
6 Hours	3.8 ± 0.9	4.5 ± 1.1	0.02
12 Hours	3.5 ± 0.7	4.0 ± 0.9	0.04
24 Hours	2.9 ± 0.6	3.2 ± 0.8	0.11

Notes: Data are expressed as mean ± standard deviation (SD). Postoperative pain was assessed using the Visual Analog Scale (VAS) at different postoperative intervals. Lower VAS scores indicate better analgesia. $p < 0.05$ was considered statistically significant. Patients in the opioid-free anesthesia group demonstrated significantly lower postoperative pain scores during the early postoperative period compared with the opioid-sparing anesthesia group.

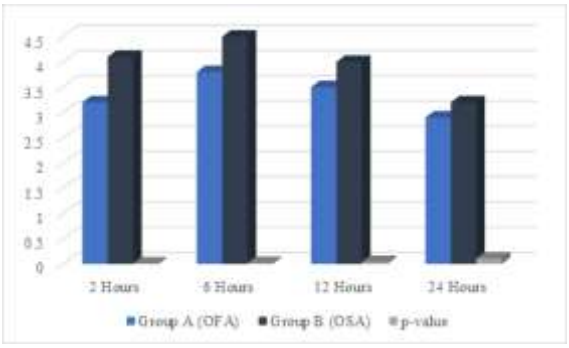

Figure 2: Comparison of Postoperative Pain Scores (VAS) Between Opioid-Free Anesthesia (OFA) and Opioid-Sparing Anesthesia (OSA) Groups

Figure Notes: Data are expressed as mean ± standard deviation (SD). Postoperative pain was assessed using the Visual Analog Scale (VAS) at 2, 6, 12, and 24 hours after surgery. Lower VAS scores indicate better postoperative analgesia. Patients receiving opioid-free anesthesia demonstrated significantly lower postoperative pain scores during the early postoperative period compared with patients receiving opioid-sparing anesthesia. A p-value of < 0.05 was considered statistically significant.

Perioperative opioid consumption was significantly lower in the OFA group compared with the OSA group. Patients receiving opioid-free anesthesia required minimal postoperative rescue opioids, whereas patients in the opioid-sparing group required comparatively higher postoperative opioid supplementation.

Table 3: Comparison of Perioperative Opioid Consumption

Parameter	Group A (OFA)	Group B (OSA)	p-value
Intraoperative Opioid Use (mg)	0	82.4 ± 12.5	<0.001
Postoperative Rescue Opioid Requirement (mg)	18.6 ± 5.2	34.8 ± 8.1	<0.001

Notes: Data are expressed as mean ± standard deviation (SD). Intraoperative opioid use and postoperative rescue opioid requirement were compared between the opioid-free anesthesia group and opioid-sparing anesthesia group. A p-value of < 0.05 was considered statistically significant. Patients in the opioid-free anesthesia group demonstrated significantly lower perioperative opioid consumption compared with the opioid-sparing anesthesia group.

The incidence of postoperative complications was compared between the two groups. Postoperative nausea and vomiting (PONV) occurred less frequently in the OFA group than in the OSA group, and the difference was statistically significant. Respiratory complications such as postoperative hypoventilation and oxygen desaturation were also lower in the OFA group, although the difference was not statistically significant. However, episodes of

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bradycardia and hypotension were more frequently observed in patients receiving opioid-free anesthesia.

Table 4: Comparison of Postoperative Complications

Complications	Group A (OFA)	Group B (OSA)	p-value
PONV	3 (10%)	9 (30%)	0.04
Respiratory Depression	1 (3.3%)	4 (13.3%)	0.16
Bradycardia	6 (20%)	2 (6.7%)	0.12
Hypotension	5 (16.7%)	2 (6.7%)	0.22

Notes: Data are expressed as frequency (number) and percentage (%). Postoperative complications including postoperative nausea and vomiting (PONV), respiratory depression, bradycardia, and hypotension were compared between the two study groups. A p-value of < 0.05 was considered statistically significant. The incidence of PONV was significantly lower in the opioid-free anesthesia group, whereas bradycardia and hypotension were observed more frequently in patients receiving opioid-free anesthesia.

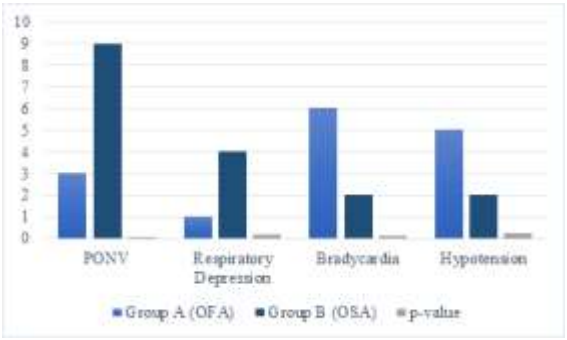

Figure 3: Comparison of Postoperative Complications Between Opioid-Free Anesthesia (OFA) and Opioid-Sparing Anesthesia (OSA) Groups

Figure Notes: Data are expressed as frequency (number of patients) and percentage (%). Postoperative complications including postoperative nausea and vomiting (PONV), respiratory depression, bradycardia, and hypotension were compared between the two study groups. Patients receiving opioid-free anesthesia demonstrated a significantly lower incidence of PONV compared with the opioid-sparing anesthesia group, whereas bradycardia and hypotension were observed more frequently in the opioid-free anesthesia group. A p-value of < 0.05 was considered statistically significant.

Recovery characteristics were better in the OFA group compared with the OSA group. Patients receiving opioid-free anesthesia demonstrated earlier ambulation, shorter duration of postoperative hospital stay, and higher patient satisfaction scores. These differences were statistically significant.

Table 5: Comparison of Recovery Characteristics

Parameters	Group A (OFA)	Group B (OSA)	p-value
Time to Ambulation (hours)	10.2 ± 2.4	14.6 ± 3.1	0.001
Hospital Stay (days)	4.1 ± 1.0	5.3 ± 1.2	0.002
Patient Satisfaction Score	8.9 ± 0.7	7.8 ± 0.9	0.001

Notes: Data are expressed as mean ± standard deviation (SD). Recovery characteristics including time to ambulation, duration of postoperative hospital stay, and patient satisfaction score were compared between the opioid-free anesthesia group and opioid-sparing anesthesia group. A p-value of < 0.05 was considered statistically significant. Patients receiving opioid-free anesthesia demonstrated earlier ambulation, shorter hospital stay, and higher patient satisfaction scores compared with the opioid-sparing anesthesia group.

Overall, both anesthetic techniques provided adequate perioperative analgesia and favorable clinical outcomes. However, opioid-free anesthesia demonstrated was associated with reduced superior reduction in opioid-related adverse effects, postoperative opioid requirements, and enhanced recovery characteristics compared with opioid-sparing anesthesia.

DISCUSSION

The present study compared opioid-free anesthesia (OFA) and opioid-sparing anesthesia (OSA) in patients undergoing major surgeries with respect to postoperative pain control, opioid consumption, perioperative complications, and recovery characteristics.[1] The findings of the study demonstrated that both anesthetic techniques provided effective perioperative analgesia and favorable perioperative outcomes.[2] However, opioid-free anesthesia showed superior reduction in postoperative opioid requirement, postoperative nausea and vomiting (PONV), and improved early postoperative recovery compared with opioid-sparing anesthesia.[6]

Effective postoperative pain management remains one of the major goals of perioperative anesthetic care.[14] Traditionally, opioids have been extensively used for perioperative analgesia because of their

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potent analgesic efficacy and ability to suppress surgical stress responses.[2] However, opioid-related adverse effects including respiratory depression, nausea, vomiting, sedation, ileus, and opioid-induced hyperalgesia have prompted increasing interest in multimodal analgesic techniques aimed at minimizing opioid exposure.[3,11]

In the present study, postoperative pain scores assessed using the Visual Analog Scale (VAS) were significantly lower in the opioid-free anesthesia group during the early postoperative period.[1] The improved analgesia observed in the OFA group may be attributed to the synergistic effects of multimodal non-opioid agents such as dexmedetomidine, ketamine, lidocaine, magnesium sulphate, and regional anesthesia techniques.[5] These agents act through different pharmacological pathways to reduce nociceptive transmission and central sensitization, thereby improving perioperative analgesia.[8]

The present study also demonstrated significantly reduced perioperative opioid consumption in the opioid-free anesthesia group compared with the opioid-sparing anesthesia group.[2] Reduced opioid exposure is an important advantage because it may decrease opioid-related adverse effects and reduce the risk of persistent postoperative opioid use.[10] Similar findings have been reported in previous studies where opioid-free anesthesia significantly reduced postoperative opioid requirements and enhanced recovery profiles.[1,12]

Postoperative nausea and vomiting remain among the most common and distressing complications associated with opioid administration.[13] In the present study, the incidence of PONV was significantly lower in patients receiving opioid-free anesthesia compared with opioid-sparing anesthesia.[6] This reduction in PONV may be due to complete avoidance of opioids during the intraoperative period, leading to improved postoperative comfort and greater patient satisfaction.[7]

Respiratory complications such as postoperative hypoventilation and oxygen desaturation were observed less frequently in the opioid-free anesthesia group.[11] Opioid avoidance may reduce respiratory depression, particularly in high-risk patients such as obese individuals and patients with obstructive sleep Apnea.[10] Although the difference was not statistically significant, the findings support the potential respiratory benefits of opioid-free anesthesia techniques.[12]

Despite these advantages, episodes of bradycardia and hypotension were more commonly observed in the opioid-free anesthesia group.[1] These hemodynamic changes are likely related to the sympatholytic effects of dexmedetomidine used as part of the OFA protocol.[4] Similar findings have been reported in previous studies evaluating dexmedetomidine-based opioid-free anesthesia regimens.[1] In contrast, opioid-sparing anesthesia provided comparatively better intraoperative hemodynamic stability while still significantly reducing opioid exposure.[9]

Recovery characteristics including time to ambulation, duration of hospital stay, and patient satisfaction scores were significantly improved in the opioid-free anesthesia group.[15] Earlier ambulation and shorter hospital stay may be attributed to reduced sedation, lower incidence of PONV, decreased gastrointestinal dysfunction, and improved overall recovery profile associated with opioid minimization strategies.[7]

The findings of the present study support the growing role of multimodal opioid-minimization strategies in modern perioperative care and Enhanced Recovery After Surgery (ERAS) protocols.[15] Both opioid-free anesthesia and opioid-sparing anesthesia represent effective alternatives to conventional opioid-based anesthesia techniques.[4] However, the choice of anesthetic strategy should be individualized based on patient characteristics, type of surgery, comorbid conditions, and institutional expertise.[3]

The present study has certain limitations. The sample size was relatively small and the study was conducted at a single center, which may limit the generalizability of the findings. In addition, inclusion of different types of major surgeries may have influenced postoperative pain perception and recovery characteristics. Further large-scale multicenter randomized controlled trials are required to establish standardized protocols and evaluate long-term outcomes associated with opioid-free and opioid-sparing anesthesia techniques.[12]

Overall, the present study demonstrates that opioid-free anesthesia is an effective and promising alternative to opioid-sparing anesthesia in major surgeries, providing superior reduction in opioid-related adverse effects and enhanced postoperative recovery while maintaining adequate perioperative analgesia.[1,6]

CONCLUSION

The present study demonstrated that both opioid-free anesthesia (OFA) and opioid-sparing anesthesia (OSA) are effective alternatives to conventional opioid-based anesthesia techniques in patients undergoing major surgeries. Both approaches provided adequate perioperative analgesia and favorable clinical outcomes while significantly reducing perioperative opioid exposure. Patients receiving opioid-free anesthesia showed lower postoperative opioid requirements, reduced incidence of postoperative nausea and vomiting (PONV), earlier ambulation, shorter duration of hospital stay, and improved patient satisfaction compared with the opioid-sparing anesthesia group.

Despite these advantages, opioid-free anesthesia was associated with a comparatively higher incidence of bradycardia and hypotension, whereas opioid-sparing anesthesia provided better intraoperative hemodynamic stability while still effectively

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reducing opioid consumption and related adverse effects. Overall, both OFA and OSA represent effective multimodal analgesic strategies in modern perioperative care. However, the choice of anesthetic technique should be individualized based on patient characteristics, type of surgery, associated comorbidities, and institutional expertise. Further large-scale multicenter studies are recommended to establish standardized protocols and evaluate long-term outcomes associated with opioid-minimization strategies.

Limitation

The present study has certain limitations. The study was conducted at a single center with a relatively small sample size of 60 patients, which may limit the generalizability of the findings. Different types of major surgeries were included, which could have influenced postoperative pain scores and recovery outcomes. The study evaluated only short-term perioperative and postoperative outcomes, and long-term follow-up was not performed. Chronic postoperative pain and long-term opioid dependence were not assessed. Individual variability in pain perception and response to analgesic agents may also have affected the results. In addition, hemodynamic responses to different anesthetic drugs may have influenced intraoperative parameters. Further large-scale multicenter studies are required to validate the findings and establish standardized protocols for opioid-free and opioid-sparing anesthesia techniques.

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Conflict of Interest

The authors declare no conflict of interest.

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