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COMPARATIVE ANALYSIS OF OPIOID-FREE ANAESTHESIA AND CONVENTIONAL GENERAL ANAESTHESIA IN ELECTIVE SURGERIES

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ABSTRACT

Background: Opioids have traditionally been an integral component of general anaesthesia for elective surgeries because of their potent analgesic effect and their ability to attenuate intraoperative stress responses. However, opioid use is commonly associated with adverse effects such as postoperative nausea and vomiting, dizziness, pruritus, respiratory depression, sedation, and increased postoperative analgesic requirement. Opioid-free anaesthesia has emerged as a multimodal alternative that aims to provide adequate analgesia and haemodynamic stability while minimizing opioid-related complications. The present study was undertaken to compare opioid-free anaesthesia with conventional general anaesthesia in elective surgeries at a tertiary care hospital. The aim is to compare the perioperative profile and postoperative outcomes of opioid-free anaesthesia and conventional general anaesthesia in patients undergoing elective surgeries.

Materials and Methods: This hospital-based comparative analytical study was conducted among 108 adult patients undergoing elective surgeries under general anaesthesia at a tertiary care hospital. The patients were divided equally into two groups of 54 each. Group A received opioid-free anaesthesia, while Group B received conventional general anaesthesia. Baseline demographic and clinical parameters were recorded and found to be comparable between the groups. Intraoperative haemodynamic parameters including heart rate and mean arterial pressure were assessed at predefined intervals. Postoperative pain was evaluated using the Visual Analogue Scale at 1, 6, and 12 hours. Time to first rescue analgesia, total 24-hour postoperative analgesic requirement, recovery profile, sedation score, rescue antiemetic requirement, and postoperative adverse events were also recorded. Data were analysed using SPSS version 27.0, and a p-value of less than 0.05 was considered statistically significant.

Results: The baseline demographic and clinical characteristics were comparable between the two groups. The opioid-free anaesthesia group showed significantly lower heart rate and mean arterial pressure during intubation and at skin incision compared to the conventional group ($p<0.001$). Postoperative pain scores at 1, 6, and 12 hours were significantly lower in the opioid-free group ($p<0.001$). Time to first rescue analgesia was significantly longer, and total postoperative analgesic requirement was significantly lower in the opioid-free group ($p<0.001$). Recovery was faster in the opioid-free group, with shorter time to extubation, earlier attainment of Aldrete score ≥9, lower sedation score, and lower rescue antiemetic requirement. Postoperative nausea and vomiting, dizziness, respiratory depression, and pruritus were significantly less frequent in the opioid-free group.

Conclusion: Opioid-free anaesthesia is a safe and effective alternative to conventional general anaesthesia in elective surgeries. It provides better intraoperative haemodynamic stability, superior postoperative analgesia, faster

recovery, and fewer opioid-related adverse effects, thereby improving perioperative patient outcomes.
Keywords: Opioid-free anaesthesia; General anaesthesia; Elective surgeries; Postoperative pain; Haemodynamic stability.

INTRODUCTION

General anaesthesia remains the standard technique for a wide range of elective surgical procedures because it provides hypnosis, amnesia, immobility, and autonomic control during surgery. For decades, opioids have formed an important component of conventional general anaesthesia owing to their potent analgesic effect and their ability to blunt haemodynamic responses to laryngoscopy, intubation, and surgical stimulation. However, increasing attention has been directed toward the limitations of opioid-based anaesthesia, particularly in relation to postoperative nausea and vomiting, pruritus, ileus, sedation, respiratory depression, opioid-induced hyperalgesia, and the potential contribution of perioperative exposure to persistent opioid use. These concerns have encouraged anaesthesiologists to re-evaluate traditional perioperative pain strategies and to explore approaches that reduce or avoid intraoperative opioid administration altogether.[1] The concept of opioid-free anaesthesia has emerged from this changing perioperative landscape. Opioid-free anaesthesia refers to the conduct of anaesthesia without the use of systemic opioids during the intraoperative period, while maintaining adequate analgesia and sympathetic stability through the use of multimodal non-opioid agents. These regimens commonly combine drugs such as dexmedetomidine, ketamine, lidocaine, magnesium, paracetamol, and non-steroidal anti-inflammatory drugs, sometimes supplemented with regional anaesthesia techniques. The underlying principle is that pain transmission and surgical stress are complex, involving multiple pathways, and can therefore be addressed using synergistic non-opioid interventions rather than relying primarily on opioids. This approach has gained increasing acceptance as perioperative medicine shifts toward multimodal, opioid-sparing, and patient-centred care pathways.[2] Interest in opioid-free anaesthesia has also grown because the perioperative period may represent a vulnerable window for prolonged opioid exposure. Even when opioids are administered for legitimate perioperative indications, postoperative prescribing and continued use may extend beyond the expected period of acute pain. This concern is particularly relevant in elective surgeries, where preoperative optimization and structured analgesic planning are feasible. In such settings, minimizing opioid exposure may help reduce drug-related adverse effects while supporting earlier mobilization, better recovery, and enhanced patient satisfaction. Reviews of perioperative opioid administration have therefore emphasized the importance of balancing adequate analgesia with the need to avoid unnecessary opioid exposure and to adopt more rational, multimodal perioperative analgesic strategies.[3] Another important factor driving interest in opioid-free anaesthesia is the broader adoption of enhanced recovery pathways in modern surgical practice. Enhanced recovery protocols emphasize early feeding, early ambulation, reduced physiological stress, reduced postoperative complications, and shorter hospital stay. Effective analgesia is central to these goals, yet analgesia that relies heavily on opioids may delay recovery because of nausea, vomiting, ileus, sedation, and respiratory compromise. Contemporary enhanced recovery models therefore favour multimodal analgesic techniques that minimize opioid consumption while preserving comfort and functional recovery. In this context, opioid-free anaesthesia aligns conceptually with enhanced recovery principles and may offer an attractive strategy for elective surgical patients managed within tertiary care settings.[4] Despite its theoretical appeal, opioid-free anaesthesia is not simply the omission of opioids; it requires careful planning, understanding of pharmacology, and appropriate patient selection. Non-opioid agents used in opioid-free protocols have their own adverse-effect profiles, including bradycardia, hypotension, excessive sedation, psychomimetic effects, delayed emergence, or drug-specific contraindications. Therefore, the success of opioid-free anaesthesia depends on choosing suitable combinations, titrating them appropriately, and monitoring patients closely throughout the perioperative period. The technique is particularly relevant in patients who may be more vulnerable to opioid-related adverse effects, such as those with obesity, obstructive sleep apnoea, high risk of postoperative nausea and vomiting, or concern for prolonged opioid exposure. This has made opioid-free and opioid-sparing strategies an important area of current anaesthesia research and clinical debate.[5] The available literature from recent years suggests growing evidence for the feasibility and potential benefits of opioid-free anaesthesia, but it also highlights that the technique is not universally superior in all patient groups and all operations. Some studies and reviews suggest improved quality of recovery, lower postoperative nausea and vomiting, and reduced opioid consumption, whereas others stress the need to distinguish clearly between opioid-free and opioid-sparing techniques and to interpret outcomes in relation to procedure type, anaesthetic protocol, and postoperative analgesic regimen. As a result, the question is no longer whether opioids can be avoided in principle, but rather in which patients, in which surgeries, and with what combinations of adjuncts opioid-free anaesthesia can provide clinically meaningful benefit over conventional opioid-based general anaesthesia. Elective surgery offers an especially appropriate setting to study this

comparison because the perioperative course is more predictable, patient evaluation is more structured, and intraoperative as well as postoperative outcomes can be assessed systematically. Parameters such as haemodynamic stability during intubation and surgical incision, postoperative pain scores, time to first rescue analgesia, total analgesic requirement, recovery profile, sedation, and adverse effects such as postoperative nausea and vomiting can all be measured objectively. Comparing opioid-free anaesthesia with conventional general anaesthesia in elective procedures may therefore provide clinically useful evidence regarding not only analgesic efficacy but also recovery quality and perioperative safety. Such comparisons are highly relevant for tertiary care hospitals, where a large and varied elective surgical population is managed and where adoption of evidence-based perioperative protocols can have a substantial impact on patient outcomes.[6]

MATERIALS AND METHODS

This hospital-based comparative analytical study was conducted among patients undergoing elective surgeries at a tertiary care hospital. The study was designed to compare the perioperative profile and postoperative outcomes of opioid-free anaesthesia with those of conventional general anaesthesia in adult patients scheduled for elective surgical procedures under general anaesthesia. The study setting included operation theatres, post-anaesthesia care unit, and postoperative wards of the tertiary care hospital, where all enrolled patients were assessed according to a uniform protocol. A total of 108 patients were included in the study. Patients were allocated into two groups comprising 54 patients each. Group A included patients who received opioid-free anaesthesia, while Group B included patients who received conventional general anaesthesia. All eligible patients were evaluated preoperatively and followed intraoperatively and postoperatively for comparison of haemodynamic parameters, analgesic requirements, recovery characteristics, and adverse events.

Eligibility criteria: Adult patients of either sex, aged 18 to 65 years, belonging to American Society of Anesthesiologists (ASA) physical status I and II, and posted for elective surgeries under general anaesthesia were included in the study. Patients undergoing procedures of varying surgical specialties that were suitable for general anaesthesia were considered for inclusion. Patients with known allergy or contraindication to the study drugs, significant cardiac, hepatic, renal, or respiratory disease, uncontrolled hypertension or diabetes mellitus, psychiatric illness, chronic opioid use, history of substance abuse, pregnancy or lactation, obesity with body mass index greater than 35 kg/m², anticipated difficult airway, and patients unwilling to participate were excluded from the study.

Methodology: The total sample size of 108 patients was taken for the study and divided equally into two comparative groups. One group received opioid-free anaesthesia and the other received conventional general anaesthesia. The groups were made comparable with respect to age, sex, body weight, ASA physical status, and type of elective surgery to ensure valid assessment of perioperative differences between the two anaesthetic techniques.

All patients underwent detailed pre-anaesthetic assessment prior to surgery. A thorough history was obtained regarding demographic details, presenting illness, previous anaesthetic exposure, drug allergy, comorbid conditions, and medication history. General physical examination and systemic examination were performed. Airway assessment was carried out using standard clinical parameters. Baseline investigations included complete blood count, renal function tests, liver function tests, blood sugar, electrocardiogram, chest radiograph when indicated, and any other investigations deemed necessary according to the patient's clinical condition and institutional protocol. Baseline vital parameters such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, respiratory rate, and peripheral oxygen saturation were recorded before induction of anaesthesia.

All patients were kept nil per oral according to standard fasting guidelines and received standard premedication as per institutional practice. In the operating room, routine monitors including electrocardiography, non-invasive blood pressure, pulse oximetry, and capnography were attached, and baseline parameters were noted. Intravenous access was secured in all patients. Patients in the opioid-free anaesthesia group received a multimodal anaesthetic regimen using non-opioid agents for analgesia and blunting of sympathetic responses. This included agents such as Inj paracetamol 15 mg/kg IV, non-steroidal anti-inflammatory drugs where not contraindicated (Inj Diclofenac 75 mg IM), and Inj lignocaine 1.5 mg/kg IV according to our institutional protocol and patient profile. Patients in the conventional general anaesthesia group received standard general anaesthesia with opioid-based analgesia using agents such as Inj fentanyl 2 mcg/kg IV along with induction (Inj Propofol 2.5 mg/kg IV) and maintenance drugs (Inj Vecuronium 0.1 mg/kg IV loading and 0.01 mg/kg IV maintenance thereafter) routinely used in clinical practice. Induction of anaesthesia in both groups was achieved with standard intravenous agents and muscle relaxants, followed by airway securing with endotracheal intubation. Anaesthesia was maintained using inhalational or intravenous agents along with controlled ventilation. At the end of surgery, reversal of neuromuscular blockade was carried out as appropriate and patients were extubated after meeting standard extubation criteria.

All patients were continuously monitored intraoperatively. Heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure,

oxygen saturation, end-tidal carbon dioxide, and electrocardiographic changes were recorded at predefined intervals, including before induction, after induction, during intubation, at skin incision, and at regular intervals during surgery until extubation. Episodes of bradycardia, tachycardia, hypotension, hypertension, arrhythmia, desaturation, bronchospasm, or any other intraoperative complication were recorded. Total anaesthetic drug consumption, requirement of rescue analgesic or additional sedative agents, fluid administration, blood loss, and duration of surgery and anaesthesia were also documented where relevant for comparison of both techniques.

Following surgery, all patients were shifted to the post-anaesthesia care unit and subsequently observed in the postoperative period. Postoperative pain was assessed using the Visual Analogue Scale (VAS) at predefined time intervals. Time to first rescue analgesic requirement and total postoperative analgesic consumption were noted. Recovery characteristics such as time to extubation, emergence profile, sedation score, and readiness for discharge from recovery were assessed using standard clinical criteria. Postoperative nausea and vomiting, shivering, dizziness, respiratory depression, pruritus, excessive sedation, and any other adverse effects were recorded and compared between the two groups. Patient comfort and overall quality of recovery were also evaluated based on postoperative clinical status.

Statistical analysis: The collected data were entered into Microsoft Excel and analysed using Statistical Package for the Social Sciences (SPSS) version 27.0. Quantitative variables were expressed as mean and standard deviation, while qualitative variables were presented as frequency and percentage. Comparison of quantitative variables between the two groups was performed using the independent sample t-test for normally distributed data, and appropriate non-parametric tests were applied where required. Qualitative variables were compared using the chi-square test or Fisher's exact test, as applicable. Repeated haemodynamic measurements at different time intervals were analysed using suitable repeated-measures statistical methods. A p-value of less than 0.05 was considered statistically significant.

RESULTS

[Table 1] shows the comparison of baseline demographic and clinical characteristics between the two study groups. The mean age of patients in Group A was 41.83 ± 10.24 years, while in Group B it was 42.57 ± 9.88 years. The difference was not statistically significant (p=0.702), indicating that both groups were comparable with respect to age. Similarly, the mean body weight in Group A was 63.74 ± 8.52 kg compared to 64.91 ± 9.11 kg in Group B, and this difference was also not statistically significant (p=0.490). With regard to sex distribution, males constituted 53.70% in Group A and 57.41% in Group B, whereas females accounted for 46.30% and 42.59% respectively, with no significant difference between the groups (p=0.701). In terms of ASA physical status, 61.11% of patients in Group A and 57.41% in Group B belonged to ASA I, while ASA II patients constituted 38.89% and 42.59% respectively. This difference was also statistically insignificant (p=0.694). The mean duration of surgery was 96.42 ± 21.36 minutes in Group A and 99.18 ± 23.04 minutes in Group B, without any statistically significant difference (p=0.518).

[Table 2] compares the intraoperative haemodynamic parameters between the opioid-free anaesthesia group and the conventional general anaesthesia group. At baseline, the mean heart rate was 82.41 ± 8.63 beats/min in Group A and 83.28 ± 9.11 beats/min in Group B, and the difference was not statistically significant (p=0.611). Likewise, the baseline mean arterial pressure was 93.74 ± 7.25 mmHg in Group A and 94.11 ± 7.62 mmHg in Group B, which was also comparable (p=0.795). However, during intubation, the mean heart rate in Group A was 88.56 ± 9.24 beats/min, significantly lower than 96.74 ± 10.86 beats/min in Group B (p<0.001). A similar trend was seen at the time of skin incision, where the mean heart rate was 84.67 ± 8.11 beats/min in Group A compared to 91.35 ± 9.42 beats/min in Group B (p<0.001). The mean arterial pressure during intubation was also significantly lower in Group A (96.82 ± 8.14 mmHg) than in Group B (104.76 ± 9.31 mmHg), with a highly significant p-value of less than 0.001. At skin incision, Group A again showed lower mean arterial pressure values (92.56 ± 7.72 mmHg) compared to Group B (99.63 ± 8.45 mmHg), and this difference was statistically significant (p<0.001).

[Table 3] presents the comparison of postoperative pain scores and analgesic requirements between the two groups. The Visual Analogue Scale score at 1 hour postoperatively was 2.48 ± 0.86 in Group A, whereas it was 3.74 ± 1.02 in Group B, and the difference was highly significant (p<0.001). At 6 hours, the mean pain score increased to 3.19 ± 0.92 in Group A and 4.46 ± 1.11 in Group B, again showing a statistically significant difference (p<0.001). At 12 hours postoperatively, the pain score was 2.91 ± 0.88 in Group A compared with 3.67 ± 0.96 in Group B, and this difference also remained highly significant (p<0.001). These findings indicate that postoperative pain was consistently lower in the opioid-free anaesthesia group at all observed time intervals. In addition, the mean time to first rescue analgesia was markedly prolonged in Group A, being 278.63 ± 54.28 minutes, compared to 168.41 ± 47.92 minutes in Group B, with a highly significant difference (p<0.001). This shows that patients in the opioid-free group remained comfortable for a longer period before needing additional analgesia. Furthermore, the total postoperative analgesic requirement within 24 hours was significantly less in Group A (82.41 ± 24.36 mg diclofenac equivalent)

than in Group B (128.70 ± 31.15 mg diclofenac equivalent), with p<0.001.

[Table 4] compares the recovery profile between the two groups and shows a clear advantage of opioid-free anaesthesia. The mean time to extubation was 8.74 ± 2.18 minutes in Group A and 10.29 ± 2.64 minutes in Group B, and this difference was statistically significant (p=0.001). This indicates that patients in the opioid-free anaesthesia group regained adequate spontaneous respiration and airway reflexes earlier than those in the conventional group. Similarly, the mean time taken to achieve an Aldrete score of 9 or more was 16.83 ± 4.91 minutes in Group A, compared to 21.24 ± 5.76 minutes in Group B, which was highly significant (p<0.001). This finding suggests that recovery from anaesthesia and readiness for discharge from the post-anaesthesia care unit was faster in the opioid-free group. Sedation score at PACU admission was also significantly lower in Group A (1.89 ± 0.52) compared to Group B (2.41 ± 0.61), with p<0.001, indicating that patients receiving opioid-free anaesthesia were less sedated and more alert in the immediate postoperative period. In addition, only 5 patients (9.26%) in Group A required rescue antiemetic therapy compared to 14 patients (25.93%) in Group B, and this difference was statistically significant (p=0.021).

Table 1: Comparison of baseline demographic and clinical characteristics between the study groups

Variable	Group A: Opioid-Free Anaesthesia (n=54)	Group B: Conventional General Anaesthesia (n=54)	p-value
Age (years), mean ± SD	41.83 ± 10.24	42.57 ± 9.88	0.702
Weight (kg), mean ± SD	63.74 ± 8.52	64.91 ± 9.11	0.490
Male, n (%)	29 (53.70%)	31 (57.41%)	0.701
Female, n (%)	25 (46.30%)	23 (42.59%)	0.701
ASA I, n (%)	33 (61.11%)	31 (57.41%)	0.694
ASA II, n (%)	21 (38.89%)	23 (42.59%)	0.694
Duration of surgery (minutes), mean ± SD	96.42 ± 21.36	99.18 ± 23.04	0.518

Table 2: Comparison of intraoperative haemodynamic parameters between the study groups

Parameter	Group A: Opioid-Free Anaesthesia (n=54)	Group B: Conventional General Anaesthesia (n=54)	p-value
Baseline heart rate (beats/min), mean ± SD	82.41 ± 8.63	83.28 ± 9.11	0.611
Heart rate during intubation (beats/min), mean ± SD	88.56 ± 9.24	96.74 ± 10.86	<0.001
Heart rate at skin incision (beats/min), mean ± SD	84.67 ± 8.11	91.35 ± 9.42	<0.001
Baseline mean arterial pressure (mmHg), mean ± SD	93.74 ± 7.25	94.11 ± 7.62	0.795
Mean arterial pressure during intubation (mmHg), mean ± SD	96.82 ± 8.14	104.76 ± 9.31	<0.001
Mean arterial pressure at skin incision (mmHg), mean ± SD	92.56 ± 7.72	99.63 ± 8.45	<0.001

Table 3: Comparison of postoperative pain scores and analgesic requirements between the study groups

Variable	Group A: Opioid-Free Anaesthesia (n=54)	Group B: Conventional General Anaesthesia (n=54)	p-value
VAS score at 1 hour, mean ± SD	2.48 ± 0.86	3.74 ± 1.02	<0.001
VAS score at 6 hours, mean ± SD	3.19 ± 0.92	4.46 ± 1.11	<0.001
VAS score at 12 hours, mean ± SD	2.91 ± 0.88	3.67 ± 0.96	<0.001
Time to first rescue analgesia (minutes), mean ± SD	278.63 ± 54.28	168.41 ± 47.92	<0.001
Total postoperative analgesic requirement in 24 hours (mg diclofenac equivalent), mean ± SD	82.41 ± 24.36	128.70 ± 31.15	<0.001

Table 4: Comparison of recovery profile between the study groups

Variable	Group A: Opioid-Free Anaesthesia (n=54)	Group B: Conventional General Anaesthesia (n=54)	p-value
Time to extubation (minutes), mean ± SD	8.74 ± 2.18	10.29 ± 2.64	0.001
Time to achieve Aldrete score ≥9 (minutes), mean ± SD	16.83 ± 4.91	21.24 ± 5.76	<0.001
Sedation score at PACU admission, mean ± SD	1.89 ± 0.52	2.41 ± 0.61	<0.001
Patients requiring rescue antiemetic, n (%)	5 (9.26%)	14 (25.93%)	0.021

Table 5: Comparison of postoperative adverse events between the study groups

Adverse event	Group A: Opioid-Free Anaesthesia (n=54)	Group B: Conventional General Anaesthesia (n=54)	p-value
Postoperative nausea and vomiting, n (%)	6 (11.11%)	17 (31.48%)	0.010
Shivering, n (%)	4 (7.41%)	9 (16.67%)	0.138
Dizziness, n (%)	3 (5.56%)	10 (18.52%)	0.039
Respiratory depression, n (%)	0 (0.00%)	4 (7.41%)	0.041*
Pruritus, n (%)	1 (1.85%)	7 (12.96%)	0.027*
Bradycardia, n (%)	5 (9.26%)	2 (3.70%)	0.239
Hypotension, n (%)	6 (11.11%)	4 (7.41%)	0.508

*Fisher's exact test applied.

[Table 5] describes the comparison of postoperative adverse events between the two groups. Postoperative nausea and vomiting was observed in 6 patients (11.11%) in Group A and 17 patients (31.48%) in Group B, and this difference was statistically significant (p=0.010). This indicates that postoperative nausea and vomiting was considerably more common in patients who received conventional opioid-based anaesthesia. Shivering occurred in 4 patients (7.41%) in Group A and 9 patients (16.67%) in Group B, but this difference was not statistically significant (p=0.138), suggesting that although the incidence was numerically lower in the opioid-free group, the variation may have occurred by chance. Dizziness was reported in 3 patients (5.56%) in Group A and 10 patients (18.52%) in Group B, and this difference was statistically significant (p=0.039), indicating that dizziness was more frequent in the conventional anaesthesia group. Respiratory depression was not observed in any patient in Group A, whereas it occurred in 4 patients (7.41%) in Group B, and this difference was statistically significant by Fisher's exact test (p=0.041). This is an important clinical finding, as it suggests a safer respiratory profile with opioid-free anaesthesia. Pruritus was seen in only 1 patient (1.85%) in Group A compared to 7 patients (12.96%) in Group B, and the difference was statistically significant by Fisher's exact test (p=0.027), again favouring opioid-free anaesthesia. On the other hand, bradycardia occurred in 5 patients (9.26%) in Group A and 2 patients (3.70%) in Group B, but the difference was not statistically significant (p=0.239). Hypotension was observed in 6 patients (11.11%) in Group A and 4 patients (7.41%) in Group B, which was also not statistically significant (p=0.508).

DISCUSSION

In the present study, the two groups were well matched at baseline, with mean age of 41.83 ± 10.24 years in the opioid-free anaesthesia group and 42.57 ± 9.88 years in the conventional group, mean body weight of 63.74 ± 8.52 kg versus 64.91 ± 9.11 kg, and no significant differences in sex distribution, ASA grade, or duration of surgery. This baseline comparability is important because it strengthens the validity of subsequent outcome comparisons. A similar pattern was reported by Choi et al. (2022) in 75 patients undergoing elective gynaecological laparoscopy, where the opioid-free and remifentanil groups also had comparable baseline characteristics before outcome assessment. Thus, the absence of baseline imbalance in both studies suggests that the observed benefits in our study are more likely related to the anaesthetic technique rather than demographic variation.[7] Our study demonstrated better intraoperative haemodynamic control with opioid-free anaesthesia during noxious stimuli. Although baseline heart rate and mean arterial pressure were comparable between groups, heart rate during intubation was lower in the opioid-free group (88.56 ± 9.24 beats/min) than in the conventional group (96.74 ± 10.86 beats/min), and mean arterial pressure during intubation was also lower (96.82 ± 8.14 mmHg vs 104.76 ± 9.31 mmHg), with similar significant differences persisting at skin incision. These findings indicate better attenuation of the sympathetic response in our patients. Jose et al. (2023) likewise reported that dexmedetomidine-lignocaine infusion produced more stable intraoperative haemodynamics, lower anaesthetic requirement, and a better recovery profile than morphine-based anaesthesia in modified radical mastectomy, supporting the haemodynamic advantage seen in our study.[8] With respect to haemodynamic adverse events, our findings differ somewhat from some published studies. In our series, bradycardia was seen in 9.26% of the opioid-free group versus 3.70% of the conventional group, and hypotension in 11.11% versus 7.41%, but neither difference was statistically significant. In contrast, Ye et al. (2024) in elderly hip surgery reported lower rates of intraoperative hypotension and bradycardia with opioid-free anaesthesia than with opioid-balanced anaesthesia, with hypotension occurring in 15.0% versus 32.8% and bradycardia in 61.7% versus 95.1%, respectively. The difference from our study may be explained by differences in age profile, surgical population, background regional analgesia, and the exact opioid-free regimen used, but both studies still suggest that opioid-free anaesthesia can maintain acceptable haemodynamic safety when carefully titrated.[9] Postoperative pain control in our study clearly favoured opioid-free anaesthesia. The VAS score in the opioid-free group remained lower at 1 hour (2.48 ± 0.86 vs 3.74 ± 1.02), 6 hours (3.19 ± 0.92 vs 4.46 ± 1.11), and 12 hours (2.91 ± 0.88 vs 3.67 ± 0.96), while the time to first rescue analgesia was markedly prolonged (278.63 ± 54.28 minutes vs 168.41 ± 47.92 minutes) and total 24-hour analgesic requirement was reduced (82.41 ± 24.36 mg vs 128.70 ± 31.15 mg diclofenac equivalent). These findings are consistent with Bakan et al. (2015), who reported significantly lower postoperative fentanyl consumption at 2 hours in the opioid-free group compared with the remifentanil group (75 ± 59 µg vs 120 ± 94 µg), along with lower pain scores and less rescue analgesic requirement. Their results, like ours, support the concept that multimodal opioid-free regimens may reduce early postoperative hyperalgesia and opioid need.[10]

Recovery-related outcomes in our study also favoured opioid-free anaesthesia. The mean time to extubation was shorter in the opioid-free group (8.74 ± 2.18 minutes vs 10.29 ± 2.64 minutes), time to achieve Aldrete score ≥9 was shorter (16.83 ± 4.91 minutes vs 21.24 ± 5.76 minutes), and sedation score at PACU admission was lower (1.89 ± 0.52 vs 2.41 ± 0.61). These data suggest faster and clearer emergence in our patients. Hao et al. (2023) similarly demonstrated superior postoperative recovery after laparoscopic cholecystectomy with opioid-free anaesthesia, showing significantly higher QoR-15

scores on postoperative day 1 and day 2 in the opioid-free group than in the opioid-based group, with scores of 113.00 (108.25–115.00) versus 91.00 (90.00–92.00) on day 1 and 133.00 (130.00–135.00) versus 106.00 (104.00–112.00) on day 2. Although their study did not show differences in extubation or PACU stay, both studies indicate that recovery quality is improved when perioperative opioid exposure is reduced.[11] The lower incidence of postoperative nausea and vomiting in our study is clinically important. PONV occurred in 11.11% of patients in the opioid-free group compared with 31.48% in the conventional group, and the requirement for rescue antiemetic was also lower (9.26% vs 25.93%). These findings are in close agreement with Feng et al. (2024), who reported that opioid-free anaesthesia reduced PONV after thoracoscopic lung resection from 31.7% in the opioid-based group to 15.0% in the opioid-free group, with an odds ratio of 0.38 and number needed to treat of 6. However, Feng et al. also found that opioid-free anaesthesia prolonged PACU stay by a median of 15.5 minutes, whereas our study showed shorter time to extubation and earlier attainment of Aldrete score ≥9. This difference may reflect procedure-specific pain burden, thoracic surgical stress, and varying sedative components in the opioid-free regimen.[12] The benefit of opioid-free techniques in reducing nausea and early analgesic demand has also been described outside abdominal surgery. In our study, postoperative dizziness was lower in the opioid-free group (5.56% vs 18.52%), and overall analgesic requirement was reduced. Tripathy et al. (2018) reported in breast cancer surgery that time in the recovery room, postoperative nausea, analgesic requirement, and visual analogue pain scores were all significantly lower in the non-opioid group than in the opioid-based group. Although their study population and use of block-based anaesthesia differ from ours, the direction of effect is similar and suggests that the opioid-sparing advantage of opioid-free techniques may extend across different elective surgical settings.[13] Our study found no respiratory depression in the opioid-free group, whereas 7.41% of patients in the conventional group developed respiratory depression; pruritus was also lower with opioid-free anaesthesia (1.85% vs 12.96%). These data support the idea that avoidance of systemic opioids reduces classic opioid-related adverse effects. However, not all studies have shown a uniform safety advantage. Beloeil et al. (2021) reported in a large multicentre trial that balanced opioid-free anaesthesia with dexmedetomidine did not reduce postoperative opioid-related adverse events and was associated with more hypoxaemia, which occurred in 72% of the dexmedetomidine group compared with 61% of the remifentanil group.[14] Overall, the present study supports opioid-free anaesthesia as an effective alternative to conventional general anaesthesia in elective surgery, with advantages in haemodynamic response, pain scores, rescue analgesia, recovery profile, and opioid-related side effects. Our results align with the broader evidence base summarized by Zhang et al. (2024), whose meta-analysis in gynaecological surgery found that opioid-free anaesthesia reduced the incidence of PONV with a risk ratio of 0.52, lowered postoperative antiemetic use with a risk ratio of 0.64, and improved quality of recovery with a mean difference of 4.69. In our study, the same overall pattern was seen at the individual patient level, particularly for PONV (11.11% vs 31.48%), antiemetic requirement (9.26% vs 25.93%), and better pain and recovery measures.[15]

CONCLUSION

The present study concludes that opioid-free anaesthesia is a safe and effective alternative to conventional general anaesthesia in patients undergoing elective surgeries at a tertiary care hospital. It provided better intraoperative haemodynamic stability, lower postoperative pain scores, prolonged time to first rescue analgesia, and reduced total postoperative analgesic requirement. Opioid-free anaesthesia was also associated with faster recovery and a lower incidence of opioid-related adverse effects such as postoperative nausea and vomiting, dizziness, respiratory depression, and pruritus. Thus, opioid-free anaesthesia may be considered a useful perioperative strategy for improving patient outcomes in elective surgical procedures.

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