

Opioid-Free Versus Opioid-Based Anaesthesia in General Surgery: A Randomised Comparative Study on Analgesia, Hemodynamics, and Recovery

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Abstract:

Introduction: Pain during general anaesthesia triggers tachycardia and hypertension. Opioids are widely used to blunt these responses but can cause nausea, vomiting, respiratory depression, and pruritus. Opioid-free anaesthesia (OFA) combines non-opioid agents to avoid these effects, whereas opioid-based anaesthesia (OBA) relies on opioids. This study compared OFA and OBA for perioperative analgesia, hemodynamic stability, and recovery.

Methods: The prospective randomised trial included 108 ASA I–II patients undergoing elective general surgery under general anaesthesia, were assigned to OBA group (n=54): Fentanyl 2 mcg/kg IV pre-intubation, then 0.5 mcg/kg/h infusion and OFA group (n=54): Dexmedetomidine 0.5 mcg/kg IV pre-intubation, then 0.5 mcg/kg/h infusion, with paracetamol 15 mg/kg IV and magnesium sulphate 15 mg/kg IV. Heart rate (HR) and mean arterial pressure (MAP) were monitored intraoperatively; postoperative HR, MAP, visual analogue scale (VAS) scores, rescue analgesia, extubation time, and adverse events were recorded over 24 hours.

Results: VAS scores were lower in OFA (3.160 ± 0.032) than OBA (3.684 ± 0.032) ($p < 0.001$). Rescue analgesia requirement was reduced in OFA (51.11 ± 16.10 mg) compared to OBA (117.22 ± 22.77 mg) ($p < 0.001$). Extubation time was shorter in OFA (11.87 ± 2.27 min) versus OBA (20.02 ± 2.28 min) ($p < 0.001$). Intraoperative HR and MAP were significantly lower in OFA, while SpO₂ remained comparable. No major perioperative complications were observed.

Conclusion: OFA with dexmedetomidine, magnesium sulphate, and paracetamol provides better postoperative analgesia, reduced opioid requirement, shorter extubation time, and more stable hemodynamics compared to fentanyl-based OBA. OFA represents a safe and effective alternative for selected surgical patients.

Key words: Analgesia; Anaesthesia; Hemodynamics; Opioids; Postoperative Pain; Recovery of Function.

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Introduction

Surgery frequently results in postoperative pain, which should be managed promptly and effectively to reduce patient suffering, promote healing and rehabilitation, and prevent complications.¹ Despite advances in pain management, 30–80% of patients still experience moderate to severe pain in the first postoperative day.^{2,3} Inadequate control can lead to central sensitization and chronic postsurgical pain.⁴

Opioids have long been central to balanced anaesthesia, providing analgesia and sedation during preinduction, induction, maintenance, and emergence, as well as for

postoperative pain relief. They are also used in acute and chronic pain syndromes.^{5,6} However, their use is associated with adverse effects including respiratory depression, bradycardia, hypotension, urinary retention, ileus, constipation, nausea, vomiting, pruritus, opioid-induced hyperalgesia, tolerance, dependence, and immune suppression. This necessitates careful, judicious use by anaesthesiologists.⁷⁻¹¹

Opioid-free anaesthesia (OFA) completely avoids opioids by employing combinations of non-opioid agents, while opioid-sparing anaesthesia (OSA) uses them minimally within multimodal regimens. Evidence suggests that avoiding opioids can improve outcomes in

specific surgical populations. Commonly used non-opioid agents include local anaesthetics, clonidine, dexmedetomidine, paracetamol, ketamine, gabapentin, magnesium sulphate, and dexamethasone. Although each has potential side effects, their use in sub-anaesthetic doses, particularly with advanced monitoring, can provide effective analgesia.¹²⁻¹⁶

Locoregional techniques are often integrated with OFA to further enhance analgesia and minimize opioid-related adverse effects. Certain patient groups—such as those with opioid addiction, chronic pain syndromes, obesity, obstructive sleep apnoea, cancer, or those undergoing colorectal ERAS procedures—derive particular benefit. In oncology, prolonged opioid use may impair immune function by reducing lymphocyte and macrophage precursors and suppressing T-cell-mediated immunity, strengthening the rationale for OFA/OSA.¹⁷⁻²⁰ Although several studies have compared OFA and opioid-based anaesthesia (OBA), the available literature remains limited, particularly in diverse surgical settings.

Objective: 1. To compare analgesic requirement at first postoperative hour based on VAS score in patients undergoing general surgery between opioid free anaesthesia and opioid based anaesthesia groups 2. To assess extubation time, VAS score, hemodynamics, total analgesic requirement till 24 hours and complications if any.

Materials and methods:

Study design: A double blinded Randomized Control Trial

Study participants: Patients admitted in a tertiary care hospital undergoing elective surgeries for a duration of 60-120 minutes under General anaesthesia.

Study duration: The study was conducted over a period of one year, including patient recruitment, perioperative assessment, data collection, and postoperative follow-up.

Sample size calculation:

Post operative analgesic consumption was taken as an outcome of interest for the purpose of sample size calculation. From Bakan et al²⁵, we calculated the sample size to be 48 subjects per group to detect mean difference of 45mcg and standard deviation of 94mcg in group A and standard deviation of 59mcg opioid consumption in group B, 80 % power with an alpha error of 0.05 to reject null hypothesis. Considering the dropouts to be 10%, we take 54 subjects per group to make up a total of 108 participants using Open Epi software.

Sampling technique: Consecutive sampling.

Inclusion criteria: This study included patients aged 18-65 years of both genders, with ASA physical status classification I or II, who were scheduled for elective surgeries under general anaesthesia.

Exclusion criteria: Patients were excluded if they had a known allergy to the study drugs, had used opioids within one month prior to surgery, had chronic opioid addiction, were pregnant or lactating mothers, had

cardiac insufficiency, or had mental incapacity to comprehend pain assessment or psychiatric disease.

Withdrawal criteria: Patients with reactions to the study drugs were withdrawn from the study and treated accordingly to the routine protocol

Rescue criteria: Inj ketorolac 30mg IV.

Randomization details: Computerised Block Randomisation

Data collection: All the patients were examined one day prior to the surgery and their laboratory results were reviewed. Pre medication with Ranitidine 150 mg and Perinorm 10 mg were given. The patients included in the study received necessary information about the study and were requested to give their written consent. On arrival to operation room, vascular access was obtained on the back of the hand using 18G cannula and 10ml/kg/hour Ringer lactate infusion was started. Following, the transfer to the operation room, 0.01mg/kg IV midazolam was administered. ASA specified monitoring were instituted which includes ECG, heart rate (HR), systolic (SBP), diastolic (DBP) and mean (MAP) arterial pressures. Blood pressure was monitored with automatic non-invasive blood pressure measurements and peripheral oxygen saturation (SpO₂) was monitored via pulse oximetry and baseline parameters were recorded. Recruited patients were divided into two groups and study drug was prepared by anaesthesiologist who was not involved in the study.

1. Group A –Opioid based anesthesia (Patients in Group A received OBA)

2. Group B – Opioid free anesthesia (Patients in Group B received OFA)

Preoxygenation with 100% O₂ was done for 3 minutes before induction of anaesthesia. In both the groups, patients were premedicated with inj.Glycopyrrolate 0.2 mg/kg, inj.Midazolam 0.04mg/kg. In Group A, anaesthesia was induced with fentanyl 2mcg/Kg infusion diluted in a 20ml syringe given over 10 mins and propofol 2.5 mg/kg and patients were paralysed with intravenous vecuronium 0.1 mg/kg to facilitate endotracheal intubation. Patients were manually ventilated for 3 minutes with bag and mask ventilation. After 3 minutes, qualified anaesthesiologist performed the laryngoscopy and intubation using Macintosh laryngoscope and appropriate sized endotracheal tube was inserted. After intubation, 100ml of 0.9% normal saline is infused over 20 minutes as placebo. Patients were maintained with 1 MAC sevoflurane +N₂O (50%)+O₂ (50%), fentanyl 0.5 mcg/kg/hr as infusion. Injection vecuronium bromide 0.025 mg/kg was given intermittently to maintain adequate paralysis.

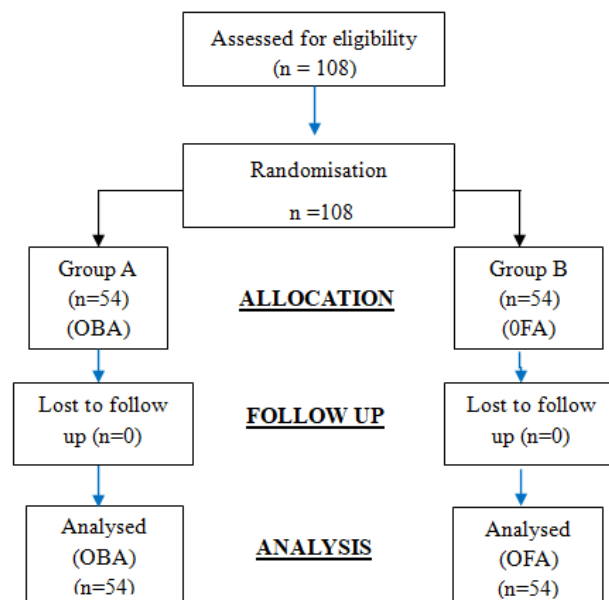
In Group B, after a loading dose of dexmedetomidine 0.5 mcg/kg over 10 mins in a syringe pump anaesthesia was induced with propofol 2.5 mg/kg, followed by intravenous vecuronium 0.1 mg/kg and maintained with continuous infusion of dexmedetomidine 0.5 mcg/kg/hr. Inj paracetamol 15mg/kg and inj magnesium sulphate 15mg/kg given IV after intubation in 100ml NS. At the end of surgery, neuromuscular blockade was reversed

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using intravenous neostigmine (0.05 mg/kg) and glycopyrrolate (0.01 mg/kg). Patient was extubated when there was adequate spontaneous ventilation (tidal volume >4 ml/kg). Heart rate, mean arterial pressure, respiratory rate, and saturation were recorded intraoperatively. Ondansetron (4 mg i.v.) was administered 20 min before the end of the operation in both the groups.

Extubation time is defined as the time from stopping maintenance infusion to patient extubation. On arrival in the recovery room, patients were asked to rate their pain using VAS rulers with slide indicator with 0–10 analog scale attached in front, with '0' mark corresponding to no pain and '10' mark representing worst imaginable pain. Patients were monitored for postoperative pain and any analgesic requirement at 15min, 30min, 45min, 1hr, 2hrs upto 4 hrs and every 4 hourly for a period of 24 h. Any patient showing VAS ≥ 4 at any point of time was administered intravenous ketorolac initially as a bolus of 30 mg slowly over 2–3 minutes and if required an additional dose of 30 mg after 30 min. Time of first rescue analgesic and total rescue analgesic consumed 24hrs postoperatively were noted. Adverse effects of the drugs, if any, were evaluated. Demographic characteristics of the patients, Intra operative hemodynamic parameters, and time of first rescue analgesia, Analgesic requirement for 24hours post operative period, extubation time was noted. The data was collected during intraoperative period from monitors. Parameters like blood pressure, mean arterial pressure, heart rate, spo2, respiratory rate were also noted (Figure 1).

Figure 1: Consolidated Standards of Randomized Control trail flow chart



Statistical analysis: The demographic and clinical characteristics of the patients were recorded and analysed using SPSS version 20. Descriptive statistics were used to summarize the study variables. Continuous variables were expressed as mean $\pm$ standard deviation (SD), while categorical variables were expressed as frequency and percentage. Continuous variables such as heart rate, systolic blood pressure, diastolic blood pressure, mean arterial pressure, and total postoperative analgesic requirement were compared between the two groups using the independent (unpaired) t-test. VAS pain scores between the two groups were compared using the Mann–Whitney U test. Time to first rescue analgesic requirement was analysed using the Kaplan–Meier method and compared between the two groups using the log-rank test. A p-value of <0.05 was considered statistically significant.

Ethical consideration: The study was conducted after obtaining approval from the Institutional Ethics Committee. Written informed consent was obtained from all participants after explaining the study. Participation was voluntary, confidentiality was maintained, and participants were informed of their right to withdraw at any time without consequences. The collected data were used solely for research purposes.

Results:

A total of 108 ASA physical status I–II patients scheduled for elective surgical procedures under general anaesthesia were enrolled in this prospective randomized controlled trial. Patients were allocated equally into two groups: Group A, which received opioid-based anaesthesia (OBA) using fentanyl, and Group B, which received opioid-free anaesthesia (OFA) with dexmedetomidine, magnesium sulphate, and paracetamol. Each group consisted of 54 patients. Baseline demographic and clinical characteristics were comparable between groups, with no statistically significant differences in mean age (OBA: 41.04 $\pm$ 12.27 years vs. OFA: 41.61 $\pm$ 12.93 years, $p = 0.813$), gender distribution, ASA grading, or Mallampati airway classification (Table 1).

Table 1: Demographic variables of the study participants (N = 108)

Variables		Group		Total	Chi-square test(p value)
		A (OBA)	B (OFA)		
Sex	Female	25	19	44	0.240
	Male	29	35	64	
ASA*	1	26	30	56	0.441
	2	28	24	52	
Mallampati grading	1	13	5	18	0.096
	2	27	29	56	
	3	13	18	31	
	4	1	2	3	

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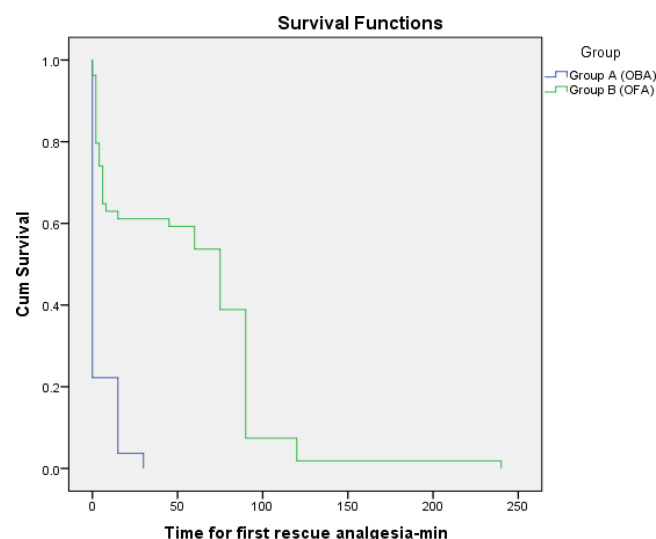
Postoperative pain was assessed using the visual analogue scale (VAS) at multiple time intervals. Repeated Measures ANOVA demonstrated consistently higher VAS scores in the OBA group compared to the OFA group (3.684 ± 0.032 vs. 3.160 ± 0.032 , $p < 0.001$), indicating superior analgesia with the OFA regimen. Furthermore, the time to first rescue analgesia was significantly shorter in the OBA group, as shown by survival analysis using the Log Rank (Mantel-Cox) test ($p < 0.001$) (Table 2, Figure 2). This suggests that OFA prolonged postoperative analgesia and reduced the immediate need for supplemental pain relief.

Table 2: Comparison of time for first rescue analgesia (min) among groups (N = 108)

Means and Medians for Survival Time (time for first rescue analgesia)								
Group	Mean				Median			
	Estimate	SE	95%Confidence Interval		Estimate	SE	95%Confidence Interval	
			Lower Bound	Upper Bound			Lower Bound	Upper Bound
Group A (OBA)	3.889	1.063	1.806	5.972	0.000	0.000	0.000	0.000
Group B (OFA)	56.259	6.634	43.256	69.262	75.000	9.770	55.851	94.149
Overall	30.074	4.194	21.854	38.294	4.000	1.833	.408	7.592

Log Rank (Mantel-Cox); $pvalue < 0.001$

Figure 2: Figure of comparison of time for first rescue analgesia (min) among groups (N = 108)



Emergence from anaesthesia was assessed by extubation time, which was significantly prolonged in the OBA group ($p = 0.001$), indicating that patients in the OFA group experienced faster recovery of airway reflexes and consciousness. Intraoperative and postoperative

hemodynamic parameters were monitored closely. Analysis revealed a significantly higher mean heart rate in the OBA group (83.080 ± 1.166 bpm) compared to the OFA group (75.771 ± 1.346 bpm, $p < 0.001$) (Figure 3).

Mean arterial pressure (MAP) was also marginally but significantly higher in the OBA group (93.376 ± 0.584 mmHg vs. 91.667 ± 0.595 mmHg, $p = 0.043$) (Figure 4). These findings indicate that OFA was associated with greater hemodynamic stability during the perioperative period.

Figure 3: Figure of heart rate among groups (N = 108)

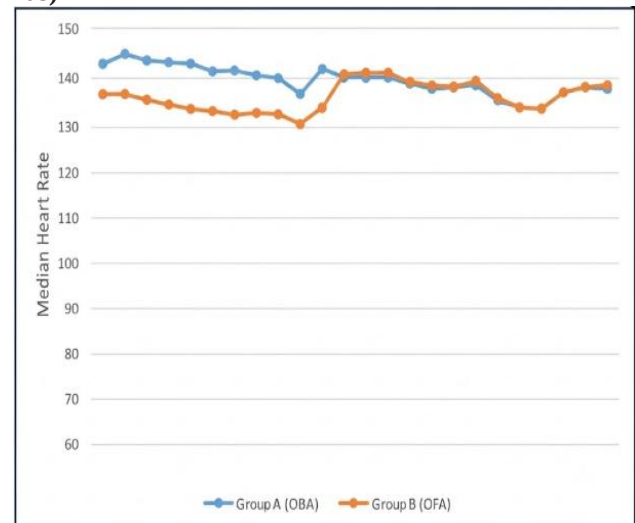
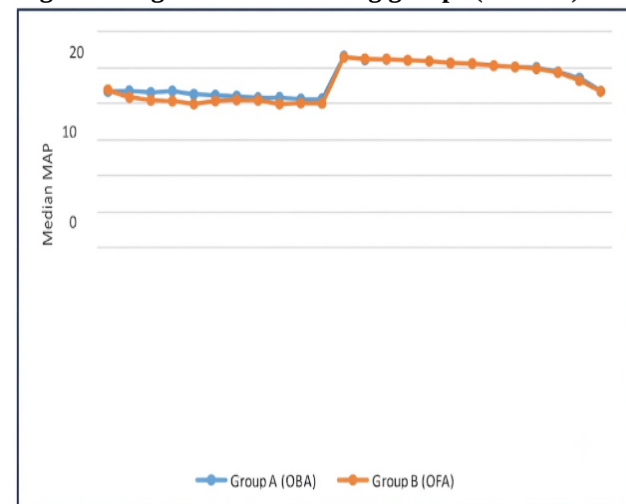
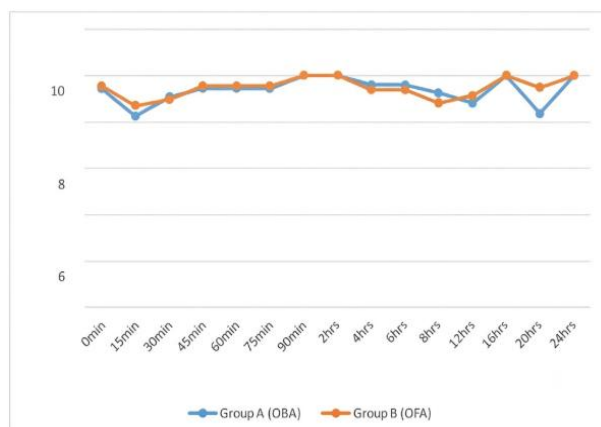


Figure 4: Figure of MAP among groups (N = 108)



Oxygen saturation remained consistently high and comparable in both groups throughout the intraoperative and postoperative periods (OBA: $99.694 \pm 0.024\%$ vs. OFA: $99.738 \pm 0.024\%$, $p = 0.192$) (Figure 5), suggesting that the avoidance of opioids did not compromise respiratory function.

Figure 5: Figure of comparison of SPO2 among groups (N = 108)



In summary, compared with OBA, OFA provided lower postoperative pain scores, extended analgesia duration, faster emergence from anaesthesia, and oxygenation. These results support OFA as a safe and effective alternative to conventional opioid-based anaesthesia in suitable surgical patients improved hemodynamic stability, without affecting.

DISCUSSION

Opioids have long been a component of balanced general anaesthesia due to their analgesic, sedative, and anxiolytic properties.⁵ However, their use is associated with adverse effects such as respiratory depression, bradycardia, hypotension, urinary retention, postoperative ileus, and, with chronic use, dependence and addiction.^{7,8} Avoiding opioids in balanced anaesthesia has shown benefits across various surgeries and patient groups.¹³ Non-opioid alternatives include α_2 -adrenoceptor agonists, lidocaine, dexamethasone, ketamine, and magnesium.^{14,21} Successful opioid-free anaesthesia (OFA) requires familiarity with the pharmacodynamics and pharmacokinetics of these agents.⁴ Certain populations benefit especially from OFA—those with opioid addiction, obesity, obstructive sleep apnoea, chronic pain syndromes, or undergoing cancer or colorectal enhanced recovery surgeries.^{15,17,18}

OFA regimens use various drug combinations. In this randomized controlled trial, we compared opioid-based anaesthesia (OBA) using fentanyl with OFA using dexmedetomidine, magnesium sulphate, and paracetamol in ASA I–II patients undergoing general anaesthesia. The most common procedures were ENT surgeries (e.g., cortical mastoidectomy, functional endoscopic sinus surgery), laparoscopic upper gastrointestinal surgery, spine, and breast surgeries, all under 3 hours.

We enrolled 108 patients (54 per group), aged 18–65 years. Patients with drug allergies, opioid addiction, or recent opioid use were excluded. Groups were comparable in age, gender, ASA classification, and Mallampati grade.

The primary objective was to compare postoperative analgesic requirement at 1 hour using the visual analogue scale (VAS). VAS was recorded every 15 minutes up to 90 minutes, then at 2-hour intervals up to 8 hours, and every 4 hours up to 24 hours. Mean VAS scores were consistently higher in the OBA group, with statistically significant differences at 0, 15, 30, and 75 minutes, and at 4, 12, and 24 hours. Dexmedetomidine provided analgesia through α_2 -receptor-mediated inhibition of nociceptive transmission, paracetamol contributed additive analgesic effects, and magnesium sulphate prevented central sensitisation of nociceptors.^{22–24}

Rescue analgesia (ketorolac 30 mg IV) was given for VAS >3 or on patient request. OBA patients required significantly higher doses (117.22 ± 22.77 mg) than OFA patients. Similar findings were reported by Bakan et al.²⁵ where OFA with propofol, lidocaine, and dexmedetomidine reduced opioid use and pain scores compared to remifentanyl infusion. Bharadwaj et al.²⁶ found OFA prolonged time to first rescue analgesia and reduced total postoperative analgesic use in obese patients undergoing laparoscopic urological surgery, with shorter PACU stay due to fewer respiratory complications. Our findings align, with longer analgesia duration in OFA.

Soudi et al.²⁷ compared OFA with dexmedetomidine and ketamine to traditional fentanyl-based anaesthesia in bariatric surgery, reporting lower pain scores and opioid use in OFA, though extubation was delayed due to ketamine. In contrast, our OFA group had shorter extubation times (11.87 ± 2.27 min) than OBA (20.02 ± 2.28 min), likely because we excluded ketamine. Extubation time differences may also relate to our definition (time from infusion stop to extubation). Mansour et al.²⁸ in laparoscopic sleeve gastrectomy found OFA produced lower pain scores without significant hemodynamic differences. In our study, OBA patients had higher mean VAS scores (3.684 ± 0.032) than OFA (3.160 ± 0.032). We compared intraoperative and postoperative hemodynamics for 150 minutes intraoperatively and 24 hours postoperatively. Intraoperatively, heart rate was significantly higher in OBA (83.08 ± 1.17 bpm) than OFA (75.77 ± 1.35 bpm). Mean arterial pressure (MAP) differences were not significant intraoperatively but were slightly higher in OBA postoperatively. Both groups maintained hemodynamics within 20% of baseline. Magnesium sulphate likely contributed to stability through decreased anaesthetic requirements and improved postoperative pain control.²⁹ Turgut et al.³⁰ reported propofol–dexmedetomidine provided more stable hemodynamics and less analgesic requirement than propofol–fentanyl, which supports our results. Bahar et al in morbidly obese patients undergoing laparoscopic cholecystectomy found OFA reduced 24-hour ketorolac use and postoperative nausea/vomiting (PONV). None of our patients experienced PONV, bradycardia, or hypotension.³¹

In summary, compared to OBA, OFA with dexmedetomidine, magnesium sulphate, and paracetamol significantly reduced postoperative pain scores and rescue analgesic use, shortened extubation time, and provided more stable hemodynamics without compromising oxygenation or causing adverse effects. These findings support OFA as an effective alternative to OBA, offering prolonged analgesia and improved recovery profiles.

There was lack of patient followup for more than 24 hours. We excluded ASA 3 and 4 & obese patients, thus limiting the findings on patients with multiple comorbidities. Our design omitted the use of target controlled infusion pump and advance monitoring like bispectral index / train of four due to financial constraints.

Conclusion

Opioid-free anaesthesia using dexmedetomidine, magnesium sulphate, and paracetamol provided superior postoperative analgesia, prolonged time to first rescue analgesia, faster extubation, and more stable hemodynamic parameters compared to opioid-based anaesthesia with fentanyl, without compromising oxygenation or increasing adverse effects. These findings suggest that OFA is a safe and effective alternative to conventional opioid-based techniques in selected patients undergoing general anaesthesia, offering enhanced recovery and improved perioperative outcomes.

References

1. Joshi GP, Kehlet H: Postoperative pain management in the era of ERAS: An overview. *Best Pract Res Clin Anaesthesiol* 2019; 33:259–67.
2. Coleman SA, Booker-Milburn J: Audit of postoperative pain control: Influence of a dedicated acute pain nurse. *Anaesthesia* 1996; 51:1093–6.
3. Harmer M, Davies KA: The effect of education, assessment and a standardised prescription on postoperative pain management. The value of clinical audit in the establishment of acute pain services. *Anaesthesia* 1998; 53:424–30.
4. Colvin LA, Bull F, Hales TG: Perioperative opioid analgesia: When is enough too much?: A review of opioid-induced tolerance and hyperalgesia. *Lancet* 2019; 393:1558–68.
5. Egan TD: Are opioids indispensable for general anaesthesia? *Br J Anaesth* 2019; 122:e127–35.
6. Alexander JC, Patel B, Joshi GP: Perioperative use of opioids: Current controversies and concerns. *Best Pract Res Clin Anaesthesiol* 2019; 33:341–51.
7. Wheeler M, Oderda GM, Ashburn MA, Lipman AG: Adverse events associated with postoperative opioid analgesia: A systematic review. *J Pain* 2002; 3:159–80.
8. Fletcher D, Martinez V: Opioid-induced hyperalgesia in patients after surgery: A systematic review and a

meta-analysis. *Br J Anaesth* 2014; 112:991–1004.

9. Levy B, Paulozzi L, Mack KA, Jones CM. Trends in opioid analgesic-prescribing rates by specialty, US, 2007–2012. *Am J Prev Med* 2015; 49: 409–13.
10. Neuman MD, Bateman BT, Wunsch H. Inappropriate opioid prescription after surgery. *Lancet* 2019; 393: 1547–57.
11. Lawal OD, Gold J, Murthy A, et al. Rate and risk factors associated with prolonged opioid use after surgery: a systematic review and meta-analysis. *JAMA Netw Open* 2020; 3: e207367.
12. Harbaugh CM, Nalliah RP, Hu H, Englesbe MJ, Waljee JF, Brummett CM. Persistent opioid use after wisdom tooth extraction. *JAMA* 2018; 320: 504–06.
13. Soffin EM, Lee BH, Kumar KK, Wu CL (2019) The prescription opioid crisis: role of the anaesthesiologist in reducing opioid use and misuse. *Brit J Anaesthesia* 122(6):e198–e208. <https://doi.org/10.1016/j.bja.2018.11.019>.
14. Briggs M, Dean KL. A qualitative analysis of the nursing documentation of post-operative pain management. *J Clin Nurs* 1998; 7:155–63.
15. Beloeil H: Opioid-free anaesthesia. *Best Pract Res Clin Anaesthesiol* 2019; 33:353–60.
16. Sultana A, Torres D, Schumann R. Special indications for opioid free anaesthesia and analgesia, patient and procedure related: Including obesity, sleep apnoea, chronic obstructive pulmonary disease, complex regional pain syndromes, opioid addiction and cancer surgery. *Best Pract Res Clin Anaesthesiol* 2017; 31:547–60.
17. Ziemann-Gimmel P, Goldfarb AA, Koppman J, Marema RT (2014) Opioid-free total intravenous anaesthesia reduces postoperative nausea and vomiting in bariatric surgery beyond triple prophylaxis. *Brit J Anaesthesia* 112(5):906–911. <https://doi.org/10.1093/bja/aet551>.
18. Thota RS, Ramkiran S, Garg R, Goswami J, Baxi V, Thomas M: Opioid free onco-anaesthesia: Is it time to convict opioids?: A systematic review of literature. *J Anaesthesiol Clin Pharmacol* 2019; 35:441–52.
19. Byrne K, Levins KJ, Buggy DJ: Can anaesthetic-analgesic technique during primary cancer surgery affect recurrence or metastasis? *Can J Anaesth* 2016; 63:184–92.
20. Wall T, Sherwin A, Ma D, Buggy DJ: Influence of perioperative anaesthetic and analgesic interventions on oncological outcomes: A narrative review. *Br J Anaesth* 2019; 123:135–50.
21. Frauenknecht J, Kirkham KR, Jacot-Guillarmod A, Albrecht E: Analgesic impact of intra-operative opioids vs. opioid-free anaesthesia: A systematic review and meta-analysis. *Anaesthesia* 2019; 74:651–62.
22. Beloeil H, Garot M, Lebuffe G, Gerbaud A, Bila

- J, Cuvillon P, Dubout E, Oger S, Nadaud J, Becret A, Coullier N, Lecoœur S, Fayon J, Godet T, Mazerolles M, Atallah F, Sigaut S, Choinier PM, Asehnoune K, Roquilly A et al (2021) Balanced Opioid-free Anesthesia with Dexmedetomidine versus Balanced Anesthesia with Remifentanyl for Major or Intermediate Noncardiac Surgery. *Anesthesiology* 134(4):541–551. <https://doi.org/10.1097/ALN.0000000000003725>.
21. Lavand'homme P, Estebe JP. Opioid-free anesthesia: a different regard to anesthesia practice. *Curr Opin Anaesthesiol.* 2018;31(5):556–61.
22. Kamibayashi T, Maze M. Clinical uses of alpha2-adrenergic agonists. *Anesthesiology.* 2000;93(5):1345–9.
23. Sinatra RS, Jahr JS, Reynolds LW, Viscusi ER, Groudine SB, Payen-Champenois C. Efficacy and safety of single and repeated administration of 1 gram intravenous acetaminophen injection (paracetamol) for pain management after major orthopedic surgery. *Anesth Analg.* 2005;101(2):400–6.
24. Lysakowski C, Dumont L, Czarnetzki C, Tramèr MR. Magnesium as an adjuvant to postoperative analgesia: a systematic review of randomized trials. *Anesth Analg.* 2007;104(6):1532–9.
25. Bakan M, Umutoglu T, Topuz U, Uysal H, Bayram M, Kadioglu H, et al. Opioid-free total intravenous anesthesia with propofol, dexmedetomidine and lidocaine in patients undergoing laparoscopic cholecystectomy: a prospective, randomized, double-blind study. *Braz J Anesthesiol.* 2015;65(3):191–9.
26. Bharadwaj S, Bharadwaj A, Singh I, Gupta S, Jain A, Yaddanapudi S. Opioid-free anaesthesia prolongs analgesia and reduces postoperative opioid requirement in obese patients undergoing laparoscopic urological surgery. *Indian J Anaesth.* 2021;65(2):123–9.
27. Soudi K, Ebrahimian F, Khajavi MR, Alizadeh F, Khoramian M, Movafegh A. Comparison of opioid-free anesthesia with dexmedetomidine and ketamine and traditional opioid anesthesia in bariatric surgery: a randomized double-blind clinical trial. *Anesth Pain Med.* 2022;12(3):e122363.
28. Mansour MA, Mahmoud AA, Sakr SA. Opioid-free anesthesia in laparoscopic sleeve gastrectomy: a randomized controlled study. *Egypt J Anaesth.* 2020;36(1):146–52.
29. Fawcett WJ, Haxby EJ, Male DA. Magnesium: physiology and pharmacology. *Br J Anaesth.* 1999;83(2):302–20.
30. Turgut N, Turkmen A, Gokkaya S, Altan A. Propofol–dexmedetomidine and propofol–fentanyl anesthesia in outpatient cystoscopy: a randomized double-blind clinical trial. *Anesth Analg.* 2008;106(1):151–6.
31. Bahar M, Mirmohammad-Sadeghi M, Hashemian M, Memary E, Amini S, Kargar H, et al. Opioid-free anesthesia with dexmedetomidine in morbidly obese patients undergoing laparoscopic cholecystectomy: a randomized clinical trial. *Anesth Pain Med.* 2022;12(5):e122817.