Section: Anaesthetiology

Original Research Article

OPIOID-FREE ANAESTHESIA FOR LAPAROSCOPIC SURGERIES

Vasukinathan Arockia Muthu[1], I.Sudarson[2], Ramya Gnanasekar[3], J.Edward Johnson[4]

[1]Professor, Department of Anaesthetiology, Kanyakumari Medical Mission Research Centre, Muttom, Tamilnadu, India.
[2]Senior Resident, Department of Emergency Medicine, Virudhunagar Medical College Hospital, Tamilnadu, India.
[3]Assistant Professor, Department of Anaesthesiology, Kanyakumari Government Medical College, Tamilnadu, India.
[4]Professor, Department of Anaesthesiology, Kanyakumari Government Medical College, Tamilnadu, India.

Received : 16/04/2025
Received in revised form : 05/06/2025
Accepted : 26/06/2025

Keywords:
Opioid-free anaesthesia, Dexmedetomidine, Laparoscopic surgery, Postoperative pain, Haemodynamic stability.

Corresponding Author:
Dr. Ramya Gnanasekar,
Email: drramyags@gmail.com

DOI: 10.47009/jamp.2025.7.4.8

Source of Support: Nil,
Conflict of Interest: None declared

Int J Acad Med Pharm
2025; 7 (4); 38-43

ABSTRACT

Background: Opioid-free anaesthesia (OFA) is emerging as a viable alternative to traditional opioid-based anaesthesia (OBA) that aims to reduce opioid-related complications through a multimodal analgesic approach. This study compared the efficacy of dexmedetomidine-based OFA and fentanyl-based OBA in laparoscopic surgeries, focusing on postoperative analgesia, intraoperative haemodynamics, and rescue analgesic use. **Material and Methods:** A prospective, controlled study was conducted on 70 patients undergoing elective laparoscopic surgeries, who were divided into two groups: the OFA group (n=35) receiving dexmedetomidine and ketamine and the OBA group (n=35) receiving fentanyl. Intraoperative haemodynamic parameters were recorded at predefined intervals. Postoperative pain was assessed using the Visual Analogue Scale (VAS) over 24 h. Tramadol usage was recorded as a measure of the rescue analgesic requirement. **Result:** The demographic characteristics were comparable between the groups. The OFA group showed significantly lower VAS scores at all time points, especially at 24 h (0.2 vs. 1.2). Tramadol requirement was substantially lower in the OFA group: only one patient required tramadol at 12 hours compared to nine in the OBA group ($p = 0.003$), and 0 patients at 24 hours compared to three in the OBA group. Additionally, 34 patients in the OFA group required no tramadol, versus 23 in the OBA group. The haemodynamic parameters, including heart rate and mean arterial pressure, were comparable but more stable in the OFA group. The SpO_2 levels remained stable in both groups. **Conclusion:** Dexmedetomidine-based OFA provides superior postoperative analgesia and reduces opioid consumption while maintaining haemodynamic stability, supporting its use in laparoscopic procedures.

INTRODUCTION

Opioids have traditionally been a key component of anaesthetic practice, contributing significantly to effective intraoperative and postoperative pain relief.[1] They exert their effects through binding to opioid receptors distributed throughout the central and peripheral nervous systems, thereby altering pain perception and producing strong analgesic effects.[2] Despite their benefits, opioid administration is associated with several known adverse effects such as respiratory depression, constipation, nausea, urinary retention, vomiting, and pruritus, all of which can impair recovery and compromise patient safety.[1] Furthermore, the ongoing global opioid crisis marked by rising cases of dependence, misuse, and related health complications has led to a critical reassessment of opioid use in perioperative settings.[3]

Opioid-free anaesthesia (OFA) has gained recognition as an effective alternative to traditional opioid-based methods.[4] It marks a significant shift in achieving analgesia by using a multimodal approach with non-opioid agents that act on different nociceptive pathways.[5] Common drugs included in OFA protocols are dexmedetomidine, ketamine, lidocaine, magnesium sulphate, and gabapentinoids, which work together to provide adequate analgesia, sedation, and haemodynamic control.[6] This strategy reduces opioid-related side effects and supports enhanced recovery protocols.

The role of OFA in laparoscopic surgeries is especially relevant, as these procedures, while

ISSN (O): 2687-5365; ISSN (P): 2753-6556

minimally invasive and associated with advantages such as less blood loss, shorter hospital stays, and reduced risk of infection, are still linked with considerable postoperative pain.[7] This pain arises from multiple sources, including incisional (parietal) pain, visceral pain from organ handling and pneumoperitoneum, and referred shoulder pain due to diaphragmatic irritation from CO_2 insufflation.[8] Because of this multifaceted pain pattern, a multimodal analgesic plan such as OFA is important to improve patient comfort and outcomes in the early recovery period.

Among OFA agents, dexmedetomidine, a highly selective α_2-adrenergic receptor agonist introduced in 1999 for its sedative properties, has gained considerable clinical attention.[9] It has demonstrated anaesthetic and opioid sparing effects, with pre-induction administration shown to reduce the requirement for isoflurane and fentanyl. Subsequent studies support its intraoperative use at doses of 0.5–1 μ/kg, linking dexmedetomidine to decreased opioid consumption and lower postoperative nausea and vomiting, without compromising haemodynamic stability.[10]

This study evaluated the efficacy of opioid-free anaesthesia with dexmedetomidine compared to fentanyl-based anaesthesia in laparoscopic surgeries, focusing on recovery enhancement, haemodynamic stability, and postoperative opioid sparing.

Objectives

Postoperative pain was evaluated using the Visual Analogue Scale (VAS) over 24 hours, along with the assessment of intraoperative haemodynamic parameters, duration of postoperative analgesia, and total analgesic consumption within the first 24 hours.

MATERIALS AND METHODS

This prospective randomised controlled study was conducted in the Department of Anesthesiology and the Department of General Surgery at Kanyakumari Government Medical College, Asaripallam, Tamil Nadu, for one year, from August 2023 to July 2024. Ethical approval was secured from the Institutional Ethics Committee prior to study initiation, and written informed consent was obtained from all participants.

Inclusion and exclusion criteria

The study included patients aged 20–70 years who were scheduled to undergo laparoscopic surgeries under general anaesthesia and were classified as American Society of Anaesthesiologists Physical Status (ASA PS) I or II. Patients were excluded if they refused to participate, had a body mass index (BMI) > 35 kg/m², had a known allergy to any of the medications used, exhibited cognitive dysfunction, had major cardiac, renal, or hepatic disorders, or if there was a conversion to open surgical technique or a need for continued postoperative ventilation.

Methods

The study population consisted of two groups, each comprising 35 patients. The control group (opioid-based analgesia, OBA group) received fentanyl, whereas the opioid-free anaesthesia (OFA) group was administered intravenous ketamine and dexmedetomidine infusions. Standard intraoperative monitoring included electrocardiography, pulse oximetry, and noninvasive blood pressure measurement. Following preoxygenation with 100% oxygen, general anaesthesia was induced with intravenous propofol (2 mg/kg), lignocaine (1.5 mg/kg), and succinylcholine (1.5 mg/kg), followed by endotracheal intubation and atracurium (0.3–0.6 mg/kg). Maintenance included nitrous oxide (0.5 L/min), oxygen (0.5 L/min), sevoflurane (1%), and intermittent atracurium.

During the maintenance phase, the OBA group received intravenous fentanyl (100 mcg bolus), followed by a continuous infusion (0.5–1 mcg/kg/h). The OFA group received an intravenous bolus of ketamine (0.5–2 mg/kg) and dexmedetomidine (1 mcg/kg over 10 minutes), followed by continuous infusions of dexmedetomidine (0.4–0.7 μg/kg/h), ketamine (1–2 mg/kg/h), and lidocaine (1.5 mg/kg/h). Haemodynamic parameters were recorded at baseline (pre-induction) and 5, 10, 15, 30, and 60 minutes post-induction. All patients received 1 g intravenous paracetamol at the end of the procedure.

In the OBA group, intraoperative hypertension was managed with fentanyl boluses (0.5 μg/kg). In both groups, intra-abdominal pressure was maintained between 12 and 15 mmHg, and end-tidal CO_2 was kept below 35 mmHg. Postoperatively, pain scores, vital signs, and adverse effects were assessed at 0, 2, 4, 6, 12, and 24 hours. Rescue analgesia with 1 g intravenous paracetamol was administered for a visual analogue scale (VAS) score greater than 5, and intravenous tramadol (50 mg) was given for VAS scores between 8 and 10. Time to first analgesic request and total analgesic consumption were recorded.

Sample size calculation

Sample size estimation was based on the formula for comparing two independent group means, assuming equal variance, 5% significance ($Z_{a/2} = 1.96$), 80% power ($Z_\beta = 0.842$), equal distribution, and a clinically significant difference (D). A total of 70 participants (35 per group) were determined using the following formula: $2 \times ((Z_{a/2} + Z_\beta) \times \sigma / D^2$.

Statistical Analysis

Data were analysed using IBM SPSS Statistics version 21.0. Continuous variables were presented as mean ± standard deviation and compared using the independent samples t-test. Categorical variables were expressed as frequencies and percentages, and analysed with the chi-square test or Fisher's exact test, as appropriate. A p-value < 0.05 was considered statistically significant.

ISSN (O): 2687-5365; ISSN (P): 2753-6556

RESULTS

The gender distribution revealed a predominance of males in both groups, with 62.86% in the opioid group and 54.29% in the opioid free group ($p = 0.627$). Age distribution was comparable, with the majority of participants in both groups falling within the 31–50 years category (57.14% vs. 54.29%; $p = 0.381$). The mean age was slightly higher in the opioid group (44.14 ± 10.09 years) compared to the opioid-free group (41.80 ± 12.06 years) ($p = 0.381$). Mean BMI values were also similar between the groups (24.03 ± 2.65 vs. 24.63 ± 2.45; $p = 0.329$). ASA Class I predominated in both groups (74.29% vs. 68.57%; $p = 0.791$). The mean duration of surgery was longer in the opioid group (81.29 ± 26.27 min) than in the opioid-free group (70.14 ± 20.92 min) ($p = 0.054$). Postoperative tramadol requirements were significantly higher in the opioid group at 12 h (9 vs. 1; $p = 0.003$), whereas more patients in the opioid-free group required no additional tramadol (34 vs. 23) (Table 1).

Table 1: Demographic, clinical, and postoperative analgesic parameters between groups

		Opioid Group (N, %)	Opioid-Free Group (N, %)	P-value
Gender	Male	22 (62.86%)	19 (54.29%)	0.627
	Female	13 (37.14%)	16 (45.71%)	
Age (years)	<30	4 (11.43%)	6 (17.14%)	0.381
	31–50	20 (57.14%)	19 (54.29%)	
	>50	11 (31.43%)	10 (28.57%)	
BMI (kg/m²)		24.03 ± 2.65	24.63 ± 2.45	0.329
ASA Class	I	26 (74.29%)	24 (68.57%)	0.791
	II	9 (25.71%)	11 (31.43%)	
Duration of Surgery (minutes) (Mean ± SD)		81.29 ± 26.27	70.14 ± 20.92	0.054
Postoperative Tramadol Dose	At 12 hours	9	1	0.003
	At 24 hours	3	0	
	Nil	23	34	

The opioid group showed consistently higher mean HR than the opioid-free group from induction to 30 min (67.914 vs. 64.97 bpm), with significant differences ($p < 0.05$). At 60 min, the difference was not significant (66.486 vs. 65.257 bpm) ($p = 0.144$). The highest mean heart rate was observed at 5 min in the opioid group (75.514 ± 2.605 bpm) (Figure 1).

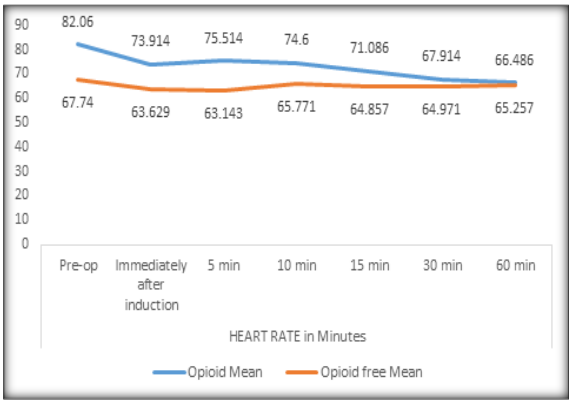

Figure 1: Preoperative HR between groups

SBP remained comparable between the opioid and opioid-free groups at most intervals, with no significant differences ($p > 0.05$), except at 10 min ($p < 0.001$) and 15 min ($p = 0.045$), where the opioid-free group showed higher values. Preoperative and immediate post-induction readings were similar, and both groups recorded identical values at 60 min (97.543 mmHg) (Figure 2).

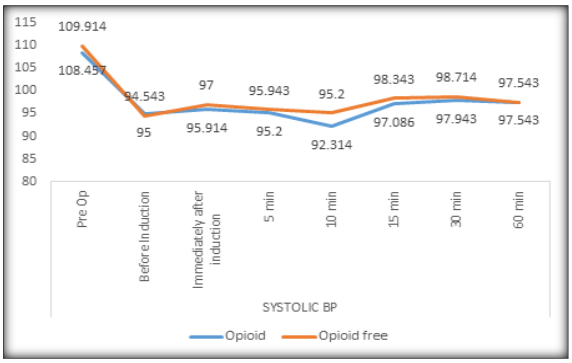

Figure 2: Preoperative comparison of SBP between groups

DBP was found to be significantly higher in the opioid group at several time points: before induction ($p < 0.001$), immediately after induction ($p < 0.001$), as well as at 5 minutes ($p = 0.049$), 10 minutes ($p < 0.001$), 15 minutes ($p < 0.001$), and 60 minutes ($p = 0.013$). There was no significant difference in DBP between the groups in the preoperative period ($p = 0.632$) and at 30 minutes ($p = 0.053$) (Figure 3).

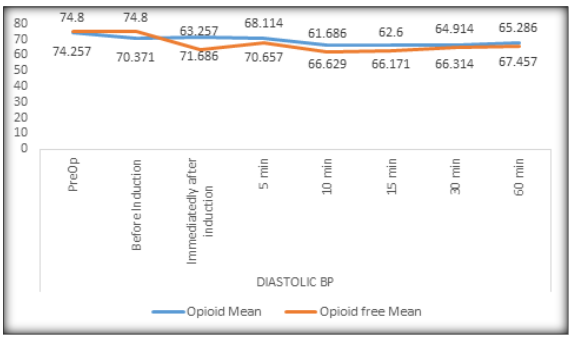

Figure 3: Preoperative comparison of DBP between groups

ISSN (O): 2687-5365; ISSN (P): 2753-6556

MAP was significantly higher in the opioid group immediately after induction ($p < 0.001$), at 10 minutes ($p < 0.001$), 15 minutes ($p < 0.001$), and 60 minutes ($p = 0.031$). No significant intergroup differences were noted preoperatively ($p = 0.335$), before induction ($p = 0.135$), or at 5 minutes ($p = 0.085$) and 30 minutes ($p = 0.195$) (Figure 4).

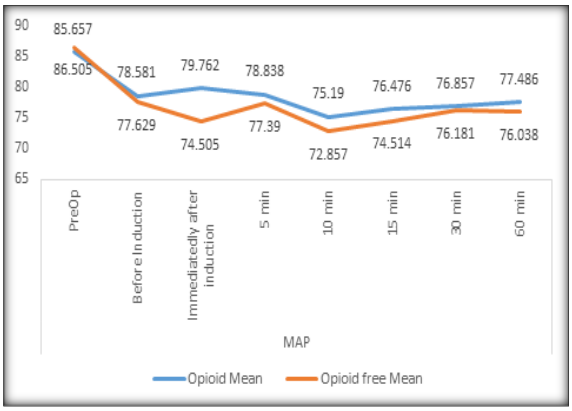

Figure 4: Perioperative comparison of MAP between groups

SpO_2 remained consistently high and comparable between the two groups from preop to 60 min. No significant differences were observed, with p-values ranging from 0.371 to 0.825. The mean SpO_2 values in both groups remained above 99% throughout the perioperative period (Figure 5).

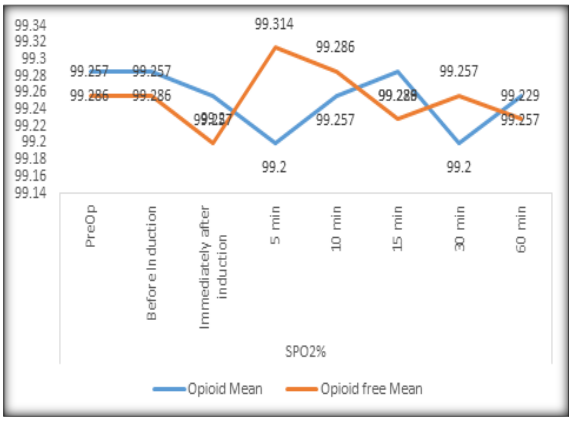

Figure 5: Perioperative comparison of SPO_2 between groups

Postoperative NRS scores were consistently higher in the opioid group than in the opioid-free group from preop to 60 min. The differences were significant throughout, with $p < 0.001$ from 0 to 24 h. Pain intensity decreased in both groups over time, but remained significantly lower in the opioid-free group. Postoperative NRS scores were consistently higher in the opioid group compared to the opioid-free group from 0 to 24 h ($p < 0.001$). Although pain intensity decreased progressively in both groups over time, it remained significantly lower in the opioid free group across all intervals (Figure 6).

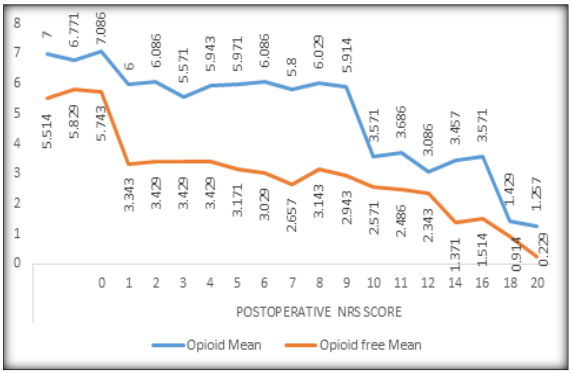

Figure 6: Postoperative NRS scores between groups

DISCUSSION

In the current study, both groups showed comparable demographic profiles. The opioid group had a slightly higher mean age (44.14 ± 10.09 years) than the opioid-free group (41.80 ± 12.06 years; $p = 0.381$), with a higher proportion of ASA I patients (74.29% vs. 68.57%; $p = 0.791$). BMI was similar (24.03 ± 2.65 vs. 24.63 ± 2.45 kg/m²; $p=0.329$), and surgery duration was slightly longer in the opioid group (81.29 ± 26.27 vs. 70.14 ± 20.92 min; $p = 0.054$). These findings align with Shalaby et al., who reported no differences in age (43.1 ± 10.6 vs. 43.3 ± 9.3 years; $p=0.928$), gender distribution (70%/30% vs. 67.5%/32.5%; $p=0.928$), ASA status (85% vs. 77.5%; $p=0.390$), BMI (27.2 ± 3.9 vs. 28.9 ± 4.1; $p=0.061$), or surgery duration (47.3 ± 4.12 vs. 48.2 ± 3.9 min; $p=0.318$). Patient demographics were evenly matched across groups, minimising baseline bias and ensuring valid outcome comparisons between opioid and opioid-free protocols.[11]

Haemodynamically, the opioid group had a higher preoperative heart rate (82.06 vs. 67.74 bpm), but both groups stabilised by 60 min (65.49 vs. 65.23 bpm). MAP decreased more significantly post-induction in the opioid-free group (75 vs. 80 mmHg) and stabilised by 60 min (76 vs. 78 mmHg). Chen et al. also observed a higher initial MAP in the OFA group (84.38 ± 11.08 vs. 79.00 ± 8.92 mmHg; $p = 0.022$), with no significant between-group differences in MAP or HR.[12] Ragupathy et al. reported no significant differences in HR (0.72 bpm; 95% CI: -3.92 to 5.63; $p = 0.72$) or DBP (0.064 mmHg; 95% CI: -0.26 to 8.96; $p = 0.06$) between groups. However, SBP ($p = 0.013$) and MAP ($p = 0.01$) were significantly lower in the conventional group.[13]

Similarly, Mahdy and Abdelwahab reported lower MAP in the OFA group ($p<0.05$).[14] Shalaby et al. confirmed superior stability with OFA at 30 min (HR 70 vs. 80 bpm; MAP 85 vs. 95 mmHg). SpO_2 was stable (~99%) in both groups. Also, An et al., who found no hypoxia or bradycardia with OFA.[11,15] Dexmedetomidine-based OFA maintained adequate oxygenation and offered better perioperative

ISSN (O): 2687-5365; ISSN (P): 2753-6556

haemodynamic stability than traditional opioid anaesthesia; thus, OFA reduced rescue analgesic use. In terms of analgesia, the opioid-free group had consistently lower pain scores at all intervals (e.g., time 3: 3.3 vs. 5.8; time 24: 0.2 vs. 1.2). Soudi et al. found that OFA was superior at 30 min and 1 h, with fluctuating statistical differences through 24 h.[16] Ragupathy et al. observed significantly lower VAS scores at rest and during movement with a longer duration of analgesia (13.8 ± 6.7 vs. 6.7 ± 2.2 h).[13] Techanivate et al. also reported lower VRS scores in the DEX group (3, 2, 2 vs. 5, 4, 3).[17] Similarly, Hublet et al. (NRS 0 [0–2] vs. 3 [2–4]), and Mahdy and Abdelwahab supported the better analgesic efficacy of OFA. OFA consistently demonstrated superior postoperative pain control, with early reduction in scores and longer-lasting analgesic effects than opioid-based protocols.[18,14]

Regarding tramadol use, the opioid-free group required fewer doses at 12 and 24 h (1 vs. 9; 0 vs. 3), with more patients requiring no doses (34 vs. 23). Similarly, Bhardwaj et al. found (63.6 ± 68.5 mg vs. 225 ± 48.4 mg; $p < 0.001$) and Tripathy et al., who reported lower VAS scores and reduced tramadol use (50 mg vs. 100–150 mg; $p < 0.05$). OFA substantially reduced the need for rescue analgesics, demonstrating opioid-sparing benefits without compromising analgesic effectiveness.[19,20]

Our study supports the use of opioid-free anaesthesia, particularly dexmedetomidine-based protocols, as a safe and effective alternative for laparoscopic surgeries. It ensures better haemodynamic control, superior postoperative pain relief, and reduced opioid consumption without compromising oxygenation or increasing the risk of complications. These outcomes support the growing role of OFA in multimodal analgesia and enhanced recovery.

Limitations

Its non-randomised design and single-centre setting may introduce selection bias and limit generalisability. The relatively small sample size may have limited the statistical power to detect subtle differences or infrequent complications. The absence of blinding could influence subjective outcomes, such as pain scores. The inclusion of various laparoscopic procedures introduces heterogeneity in surgical stimuli and pain perception. The short 24 h follow up period did not allow for the assessment of long-term analgesic efficacy or delayed complications.

CONCLUSION

Dexmedetomidine-based opioid-free anaesthesia provided superior postoperative analgesia, evidenced by significantly lower pain scores and reduced tramadol use compared to conventional fentanyl-based anaesthesia. Intraoperative haemodynamic stability was comparable or improved in the opioid-free group, with no significant differences in oxygen saturation or adverse effects. These results indicate that dexmedetomidine-based opioid-free anaesthesia is a safe and effective approach for laparoscopic surgeries, facilitating enhanced recovery while limiting opioid-associated complications.

REFERENCES

1. Rullo L, Morosini C, Lacorte A, Cristani M, Coluzzi F, Candeletti S, et al. Opioid system and related ligands: from the past to future perspectives. J Anesth Analg Crit Care 2024;4:70. https://doi.org/10.1186/s44158-024-00201-2
2. Herman TF, Cascella M, Muzio MR. Mu receptors. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025; https://www.ncbi.nlm.nih.gov/books/NBK551554/.
3. Dydyk AM, Jain NK, Gupta M. Opioid use disorder: Evaluation and management. StatPearls, Treasure Island (FL): StatPearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK553166/
4. Baek SY, Kim JW, Kim TW, Han W, Lee DE, Ryu KH, et al. Opioid-free anaesthesia with a mixture of dexmedetomidine, ketamine, and lidocaine in one syringe for surgery in obese patients. J Int Med Res 2020; 48:300060520967830. https://doi.org/10.1177/0300060520967830.
5. Sampognaro G, Harrell R. Multimodal postoperative pain control after orthopaedic surgery. Stat Pearls, Treasure Island (FL): Stat Pearls Publishing; 2025. https://www.ncbi.nlm.nih.gov/books/NBK572072/
6. Kaniyil S, Haley C. Opioid-free anaesthesia. WFSA Resource Library 2021.2025 Jun 6 https://resources.wfsahq.org/atotw/opiod-free-anaesthesia/.
7. Buia A, Stockhausen F, Hanisch E. Laparoscopic surgery: A qualified systematic review. World J Methodol 2015; 5:238–54. https://doi.org/10.5662/wjm.v5.i4.238.
8. Shi Z. Laparoscopic vs. open surgery: A comparative analysis of wound infection rates and recovery outcomes. Int Wound J 2024;21: e14474. https://doi.org/10.1111/iwj.14474.
9. Gertler R, Brown HC, Mitchell DH, Silvius EN. Dexmedetomidine: a novel sedative-analgesic agent. Proc (Bayl Univ Med Cent) 2001; 14:13–21. https://doi.org/10.1080/08998280.2001.11927725.
10. Kaye AD, Chernobylsky DJ, Thakur P, Siddaiah H, Kaye RJ, Eng LK, et al. Dexmedetomidine in enhanced recovery after surgery (ERAS) protocols for postoperative pain. Curr Pain Headache Rep 2020; 24:21. https://doi.org/10.1007/s11916-020-00853-z.
11. Shalaby M, Abdalla M, Mahmoud AS. Nonopioid versus Opioid Based General Anaesthesia Technique for Laparoscopic Cholecystectomy. Egypt J Hosp Med 2018. https://doi.org/10.12816/EJHM.2018.13612.
12. Chen L, He W, Liu X, Lv F, Li Y. Application of opioid-free general anaesthesia for gynaecological laparoscopic surgery under ERAS protocol: a non-inferiority randomised controlled trial. BMC Anesthesiol 2023; 23:34. https://doi.org/10.1186/s12871-023-01994-5.
13. Ragupathy R, Prabhu SCG, Thiyagarajan D, Anto V. Opioid-free anaesthesia for laparoscopic surgeries - A prospective non-randomised study in a tertiary care hospital. Indian J Anaesth 2022; 66:207–12. https://doi.org/10.4103/ija.ija_785_21.
14. Mahdy EAME, Abdelwahab ZM. Comparative study between opioid-free anaesthesia and opioid-based anaesthesia in obese patients undergoing abdominal laparoscopic surgery? Effective and safe analgesia challenge: A randomised double-blinded study. Egypt J Hosp Med 2024; 97:4261–7. https://doi.org/10.21608/ejhm.2024.395543.
15. An G, Wang G, Zhao B, Zhang X, Li Z, Fu J, et al. Opioid-free anaesthesia compared to opioid anaesthesia for laparoscopic radical colectomy with pain threshold index monitoring: a randomised controlled study. BMC Anesthesiol 2022; 22:241. https://doi.org/10.1186/s12871-022-01747-w.
16. Soudi AM, Hammad RA, ElShafie MA, Ahmed IMAS, Alhadidy MA. Comparing opioid-free general anaesthesia to traditional balanced general anaesthesia regarding the achievement of enhanced recovery in laparoscopic bariatric

ISSN (O): 2687-5365; ISSN (P): 2753-6556

surgeries. Ain-Shams J Anaesthesiol 2022;14. https://doi.org/10.1186/s42077-022-00218-1.
17. Techanivate A, Dusitkasem S, Anuwattanavit C. Dexmedetomidine compared with fentanyl for postoperative analgesia in outpatient gynecologic laparoscopy: A randomised controlled trial. J Med Assoc Thai 2012;95(3):383–390. https://mahidol.elsevierpure.com/en/publications/dexmedetomidine-compare-with-fentanyl-for-postoperative-analgesia?utm_source=chatgpt.com
18. Hublet S, Galland M, Navez J, Loi P, Closset J, Forget P, et al. Opioid-free versus opioid-based anaesthesia in pancreatic surgery. BMC Anesthesiol 2022; 22:9. https://doi.org/10.1186/s12871-021-01551-y.
19. Bhardwaj S, Garg K, Devgan S. Comparison of opioid-based and opioid-free TIVA for laparoscopic urological procedures in obese patients. J Anaesthesiol Clin Pharmacol 2019; 35:481–6. https://doi.org/10.4103/joacp.JOACP_382_18.
20. Tripathy S, Rath S, Agrawal S, Rao PB, Panda A, Mishra TS, et al. Opioid-free anaesthesia for breast cancer surgery: An observational study. J Anaesthesiol Clin Pharmacol 2018; 34:35–40. https://doi.org/10.4103/joacp.JOACP_143_17.

ISSN (O): 2687-5365; ISSN (P): 2753-6556