*Journal of Science and Technology*
*ISSN: 2456-5660 Volume 10, Issue 07 (July -2025)*
*www.jst.org.in* *DOI:https://doi.org/10.46243/jst.2025.v10.i07.pp37- 52*

# Improved postoperative recovery after gastrointestinal surgery with opioid-free anesthesia: present state, obstacles, and future possibilities

**M.Kishore Babu[1], B. Sasidhar[2],K.Srirama Krishna[3],M.Rajan[4]**

**1.Professor, Department of pharmaceutics, QIS College of pharmacy, Ongole, A.P**

**2.Assistant Professor, Department of pharma.Biotech, QIS College of pharmacy, Ongole, A.P**

**3.Assistant Professor, Department of pharmcognosy, QIS College of pharmacy, Ongole, A.P**

**4. Professor, Department of pharmacognosy, QIS College of pharmacy, Ongole, A.P**

***To Cite this Article***
M.Kishore Babu, B. Sasidhar,K.Srirama Krishna,M.Rajan**, "Improved postoperative recovery after gastrointestinal surgery with opioid-free anesthesia: present state, obstacles, and future possibilities**

" *Journal of Science and Technology, Vol. 10, Issue 07- July 2025, pp37-52*

***Article Info***
*Received: 31-03-2025 Revised: 09-07-2025 Accepted: 20-07-2025 Published: 30-07-2025*

ABSTRACT:
Optimizing perioperative treatment, mitigating surgical stress reactions, and accelerating patient recovery are the goals of the enhanced recovery after surgery (ERAS) protocol, which is seeing growing application in gastrointestinal procedures. Postoperative nausea and vomiting (PONV), respiratory depression, and intestinal paralysis are serious side effects of opioid-based anesthesia that may slow down recovery, despite the fact that it successfully reduces pain. These worries are intended to be alleviated by opioid-free anesthesia (OFA). Focusing on its function in facilitating gastrointestinal function recovery, better pain management, lowering adverse events, and increasing patient satisfaction, this article investigates the pharmacological substances and localized block strategies often used in OFA.

**KEYWORDS**

**opioids, opioid-free anesthesia, enhanced recovery after gastrointestinal surgery, laparoscopic surgical, abdominal surgery analgesia**

**Corresponding Author: M.Kishore Babu**

**Mail: kishorebabu.m@gmail.com**

## 1 Introduction

Research and practice in gastrointestinal surgery have centered on the unique surgical concept of accelerated recovery after surgery (ERAS), which has arisen as a result of the ongoing progress in contemporary medicine. Education and dietary assistance for patients before surgery, precise anesthetic, careful surgical methods, early mobility after surgery, and efficient pain management are all aspects of perioperative care that ERAS seeks to improve. Reducing postoperative complications and mortality, shortening hospital stays, lowering medical costs, and alleviating the social and familial burden associated with surgery are all outcomes of these measures that mitigate surgical trauma and stress responses (Ni et al., 2019; Scott et al., 2015; Feldheiser et al., 2016).
When it comes to gastrointestinal surgery perioperative pain management and anesthesia, opioids have long been the gold standard. These medications are quite helpful in reducing discomfort during surgery and making the procedure go more smoothly. Opioids have their uses, but their limits have grown more apparent as their therapeutic usage has increased. It is quite concerning since adverse effects like respiratory depression might impair respiratory function and patient safety by leading to hypoxemia. In addition to reducing patient comfort, postoperative nausea and

vomiting (PONV) makes it difficult for patients to swallow and absorb nutrients. Abdominal distension and pain from constipation are common side effects that might extend the time it takes to recover. Addiction, which may develop from chronic opioid use, has serious consequences for both the physical and emotional health of patients (de Boer et al., 2017; Paul et al., 2021). These side effects underscore the urgent need for safer and more effective anesthetic methods in gastrointestinal ERAS, since they hinder postoperative recovery quality, raise medical risks, and cause patient suffering.

To address these concerns, opioid-free anesthesia (OFA) was created. A mix of non-opioid pharmacologic substances and procedures are used by OFA to deliver adequate anesthesia and analgesia while lowering the occurrence of opioid-related side effects. This decreases or eliminates the need for opioids. With its growing reputation in clinical practice, OFA is now being used extensively in a variety of surgical procedures. According to many studies (Feng et al., 2024; Liu et al., 2023; Zhou et al., 2023; Cha et al., 2023; Hao et al., 2023; Zhang Q. et al., 2023; Wang et al., 2024), it is effective in controlling perioperative pain, lowering opiate usage, speeding up postoperative recovery, and decreasing hospital stays.

With the advent of OFA, gastrointestinal ERAS has taken a giant leap forward, better meeting patient demands while overcoming many of the drawbacks of opiate usage. This method promotes more advancements in the area while simultaneously improving recovery results. The purpose of this study is to provide evidence-based insights to help clinical practice by providing a thorough overview of the therapeutic uses of OFA in gastrointestinal ERAS.

## 2 OFA: an overview of commonly used drugs and regional block strategies

### 2.1 Commonly used drugs

Drugs used in OFA are primarily categorized into four groups based on their mechanisms of action: α2-adrenergic agonists (e.g., clonidine and dexmedetomidine); Sodium channel blockers (e.g., lidocaine); NMDA receptor antagonists (e.g., esketamine); Nonsteroidal anti-inflammatory drugs (NSAIDs). Each category contributes distinct pharmacological properties to OFA. We provide an overview of these agents below.

#### 2.1.1 Dexmedetomidine

Dexmedetomidine has sedative, anxiolytic, analgesic, sympatholytic, and opioid-sparing effects; it is a highly selective α2-adrenergic receptor agonist (Hall et al., 2000; Scheinin et al., 1992).

Patients are able to experience a seamless transition between sleep and waking due to the unique sedative state it causes. Importantly, there is little effect on respiratory function in sedated individuals, and they may still respond to stimuli and communicate (Goettel et al., 2016).

According to several studies (Zhong et al., 2024; Zheng et al., 2024; Zeng et al., 2025; Coeckelenbergh et al., 2021; Hu et al., 2021), dexmedetomidine is commonly used in perioperative pain management for a variety of surgical procedures. Its advantages include reducing opioid consumption, alleviating postoperative pain, and minimizing adverse effects, all of which help with postoperative recovery. One study found that giving older individuals dexmedetomidine intraoperatively helped them regain their gastrointestinal functions more quickly after surgery (Lu et al., 2021).

Zhao et al. (2023) and Yang et al. (2022) found that dexmedetomidine, when administered intravenously, prolongs the duration of action of local anesthetics and further reduces the need for opioids. When administered intravenously, dexmedetomidine during an ultrasound-guided ulnar nerve block took longer to take effect and had a shorter duration of action than when used as an adjuvant to local anesthetics, according to research by Marhofer et al. (2013).

For OFA protocols, dexmedetomidine is often used with other non-opioid medications because of its wide range of applications; this combination has been shown to have substantial positive effects on patient outcomes (Wang et al., 2024; Zhou et al., 2023; Berlier et al., 2022). While dexmedetomidine was effective in reducing opioid consumption and postoperative nausea and vomiting, a randomized controlled trial indicated that it was associated with adverse events such as bradycardia and hypoxemia when used intraoperatively in medium-to-large non-cardiac surgeries (Beloeil et al., 2021). Atropine and other vasoactive drugs may reduce the likelihood of dangers such bradycardia and hypotension (Ahn et al., 2016; Park et al., 2020).

To avoid serious side effects, it is crucial to do a comprehensive preoperative assessment and to carefully adjust dosage. Finally, dexmedetomidine is an effective adjuvant in OFA that, when administered correctly, lessens the risk of complications and speeds up the healing process after surgery.

### 2.1.2 Lidocaine

Intravenous administration of lidocaine, an amide-type local anesthetic and antiarrhythmic medication, has several beneficial effects, including a reduction in pain, inflammation, hyperalgesia, and gastrointestinal motility (Beaussier et al., 2018; Hermanns et al., 2019). To lessen the occurrence of opioid-related side effects such as postoperative nausea, vomiting, and constipation, intravenous lidocaine is administered to patients undergoing surgery to alleviate postoperative pain and opioid intake (Kaba et al., 2007).

To better alleviate pain and reduce the risk of complications after surgery, OFA often uses a combination of lidocaine and additional non-opioid medications including esketamine and dexmedetomidine. Multiple studies have shown that this combination greatly enhances patients' recovery time after surgery (Yu et al., 2023; Wang et al., 2023; Jose et al., 2023).

Despite its benefits, lidocaine use requires meticulous adherence to safety protocols. Severe toxic responses, including inhibition of the cardiovascular system and central nervous system (CNS), may occur at plasma concentrations that are too high. So, to make sure it works and is safe, it's important to watch how patients' hearts and brains react closely. It is crucial to limit the risk of unwanted effects for particular groups, such as elderly patients or those with renal impairment, by adjusting the dosage individually.

In conclusion, lidocaine is an excellent adjuvant in OFA protocols, providing enhanced results when administered and monitored properly.

### 2.1.3 Esketamine

Esketamine is a non-selective, non-competitive N-methyl-D- aspartate (NMDA) receptor antagonist with distinct properties, including analgesic, anesthetic, and antidepressant effects (Mion and Himmelseher, 2024). Clinically, esketamine is particularly effective for the induction of general anesthesia in short and minor surgical procedures, offering excellent analgesia while maintaining cardiovascular stability and enabling rapid emergence from anesthesia (Song et al., 2023).

In perioperative pain management, esketamine can be administered via various routes, including intravenous and epidural injection, to alleviate postoperative pain and reduce opioid consumption (Huan et al., 2025; Zhang Y. et al., 2023; Yan et al., 2023). Within OFA protocols, esketamine is often combined with other non-opioid agents, such as dexmedetomidine and lidocaine, to achieve multimodal anesthesia. This combination enhances postoperative pain control and reduces the incidence of opioid-related adverse effects, such as nausea, vomiting, and respiratory depression (Luo et al., 2025; Feng et al., 2024; Hao et al., 2023). Moreover, esketamine has been shown to promote postoperative gastrointestinal function recovery, shorten hospital stays, and improve the overall quality of recovery (Xu et al., 2023; Sun et al., 2023).

Despite its numerous benefits, careful management of esketamine is essential due to its potential adverse effects. These include neuropsychiatric symptoms, such as nightmares and hallucinations, as well as nausea, vomiting, and respiratory depression. To ensure safe and effective use, clinicians must tailor dosages to the patient’s specific condition and closely monitor their responses during administration.

In summary, esketamine serves as a novel and valuable anesthetic adjuvant in perioperative pain management. Its rational application within OFA protocols enhances postoperative recovery, reduces opioid reliance, and improves surgical outcomes.

### 2.1.4 Non-steroidal anti-inflammatory drugs (NSAIDs)

NSAIDs are a class of medications that exert anti-inflammatory, analgesic, and antipyretic effects by inhibiting cyclooxygenase (COX) activity, thereby reducing prostaglandin synthesis. NSAIDs play a critical role in perioperative pain management as part of multimodal analgesia strategies, significantly reducing opioid consumption and related adverse effects.

Research has shown that flurbiprofen, a widely used NSAID, provides effective analgesia and opioid-sparing benefits across various surgical procedures. For instance, in esophagectomy, preoperative administration of flurbiprofen not only alleviates postoperative pain but also reduces opioid requirements, improves the oxygenation index, and lowers plasma IL-8 levels, thereby enhancing respiratory function and mitigating postoperative inflammatory responses (Wang et al., 2012). Similarly, in thyroid surgeries, a multimodal analgesic approach combining ropivacaine wound infiltration with flurbiprofen significantly reduces postoperative pain scores, decreases intraoperative remifentanil use, and avoids a rise in serious adverse events compared to tramadol alone (Li et al., 2019). Furthermore, in spinal fusion surgeries, preoperative flurbiprofen administration has been shown to significantly lower postoperative pain scores and morphine consumption, providing superior postoperative pain control (Yamashita et al., 2006).

Despite their demonstrated benefits, the use of NSAIDs in perioperative settings requires careful consideration. These drugs may increase the risk of gastrointestinal bleeding and renal complications and should be avoided in patients with a history of such conditions. Moreover, optimizing the timing and dosage of NSAID administration remains an area of ongoing research to maximize their efficacy and safety.

In conclusion, NSAIDs are a vital component of perioperative pain management. Their anti-inflammatory and analgesic properties effectively reduce opioid consumption and improve the quality of postoperative recovery. Future research should focus on further exploring their application in various surgical procedures and patient populations, as well as investigating their combination with other analgesics to achieve optimal pain relief with minimal adverse effects.

## 2.2 Regional block techniques

The introduction of the ERAS concept has placed increasing emphasis on early recovery, making the proactive adoption of multimodal analgesia strategies essential. Regional anesthesia, a cornerstone of multimodal analgesia, plays a pivotal role in achieving the objectives of ERAS. When combined with non- opioid analgesics, neuraxial anesthesia and peripheral nerve blocks effectively alleviate intraoperative and postoperative pain, facilitating low-opioid or OFA during the perioperative period.

Epidural anesthesia provides effective pain relief during and after thoracic, abdominal, and orthopedic surgeries. However, its use has declined due to the risk of severe complications, including catheter breakage, accidental subarachnoid injection, infection, and epidural hematoma (Rawal, 2021). With the popularization of ultrasound in clinical anesthesia practice, nerve block techniques have gradually been widely applied, and their safety has been ensured with the assistance of visualization technology. Peripheral nerve blocks involve the targeted delivery of local anesthetic solutions near specific nerves or nerve plexuses, achieving analgesia by reaching nerve fibers. Numerous studies have demonstrated that peripheral nerve blocks reduce perioperative opioid consumption and improve patient outcomes (Park et al., 2023; Dam et al., 2019; Lee et al., 2023; Pei et al., 2015).

Commonly used peripheral nerve blocks include.

- Upper limb surgeries: brachial plexus block.
- Thoracic and breast surgeries: pectoral nerve block, erector spinae plane block, and paravertebral block (Pei et al., 2015; Neethu et al., 2018; Zhang Q. et al., 2023).
- Abdominal surgeries: transversus abdominis plane block, quadratus lumborum block, erector spinae plane block, and lumbar plexus block (Park et al., 2023; Dam et al., 2019; Lee et al., 2013; Oksar et al., 2016).
- Lower limb surgeries: sciatic nerve block, fascia iliaca block, femoral nerve block, and adductor canal block (Luo et al., 2025).

Meanwhile, the addition of pharmacological adjuvants, such as dexmedetomidine or dexamethasone, to single-injection peripheral nerve blocks extends the duration of analgesia and further reduces opioid consumption (Marhofer et al., 2013; Zeng et al., 2024; Yang et al., 2022). Integrating regional block techniques within OFA protocols enhances analgesic efficacy and contributes significantly to improved patient outcomes, aligning with the principles of ERAS.

## 3 Clinical effects of OFA in gastrointestinal ERAS

### 3.1 Characteristics of gastrointestinal surgery

Gastrointestinal surgery (e.g., gastrectomy for gastric cancer, radical surgery for colorectal cancer) is defined by extensive trauma and significant disturbance to abdominal organs. The perioperative pathophysiological changes associated with these procedures primarily influence postoperative recovery in three critical aspects.

#### 3.1.1 Complexity of perioperative pain management

Gastrointestinal surgery involves abdominal wall incisions, manipulation of abdominal organs, and anastomotic procedures. Postoperative pain encompasses somatic pain (resulting from abdominal wall incisions), inflammatory pain, and visceral pain (due to gastrointestinal traction and bloating). The severity of pain correlates directly with the extent of surgical trauma, with laparoscopic surgery resulting in less pain compared to open surgery, although visceral pain remains a significant concern. While opioids effectively alleviate pain, their use is associated with adverse effects such as postoperative nausea and vomiting, constipation, and abdominal distension, all of which hinder recovery (de Boer et al., 2017; Paul et al., 2021).

Furthermore, advanced age and malnutrition, commonly observed in gastrointestinal surgery patients, increase the risk of opioid-induced respiratory depression. OFA addresses these challenges by utilizing multimodal analgesia, incorporating regional blocks (e.g., transversus abdominis plane block, quadratus lumborum block), NSAIDs, α2 receptor agonists (e.g., dexmedetomidine), and NMDA receptor antagonists (e.g., ketamine).

#### 3.1.2 Systemic inflammatory response induced by surgical trauma

Surgical trauma activates toll-like receptors and stimulates the release of inflammatory cytokines, such as tumor necrosis factor-α (TNF-α), triggering a systemic inflammatory response (Margraf et al., 2020). Non-opioid drugs have demonstrated efficacy in attenuating these inflammatory responses. For instance, the intraoperative administration of dexmedetomidine during thoracoscopic lung cancer surgery has been shown to reduce surgical inflammation, oxidative stress, and postoperative pain, thereby promoting recovery without increasing the risk of adverse events or complications (Zhong et al., 2024). Similarly, Liu et al. reported that esketamine effectively reduces postoperative pain scores, serum IL-6 levels at 24 and 48 h, and the incidence of postoperative delirium in gastrointestinal surgery patients (Liu et al., 2024).

#### 3.1.3 Postoperative gastrointestinal dysfunction

Gastrointestinal surgery patients are particularly susceptible to postoperative complications, including ileus, intestinal obstruction, and a high incidence of PONV. These issues not only compromise patient comfort but also delay oral intake and mobilization, thereby impeding the implementation of ERAS protocols.

OFA circumvents the inhibitory effects of opioids on intestinal motility, facilitating the early recovery of gastrointestinal function. Studies have shown that OFA reduces PONV incidence across various surgical procedures, promotes gastrointestinal recovery (Wang et al., 2024; Feng et al., 2024; Luo et al., 2025), and specifically enhances postoperative gastrointestinal function in gastrointestinal surgeries (Ziemann-Gimmel et al., 2014; Zhou et al., 2024).

### 3.2 Application of OFA in gastrointestinal surgery

*ISSN: 2456-5660 Volume 10, Issue 07 (July -2025)*
*www.jst.org.in* *DOI:https://doi.org/10.46243/jst.2025.v10.i07.pp37- 52*

The extensive trauma inherent to gastrointestinal surgery and the requirements of ERAS underscore the limitations of traditional opioid-based anesthesia. OFA, by employing multimodal analgesia techniques, not only satisfies analgesic requirements but also mitigates gastrointestinal dysfunction, inflammatory responses, and adverse effects. Consequently, OFA has emerged as an essential optimization strategy for accelerating recovery in gastrointestinal surgery (Table 1).

However, the successful application of OFA requires the development of individualized anesthetic plans tailored to each patient's specific clinical circumstances.

### 3.3 Key clinical advantages of OFA in gastrointestinal ERAS

The implementation OFA within gastrointestinal ERAS protocols has demonstrated significant clinical benefits across multiple dimensions, notably enhancing postoperative recovery. This section focuses on four key areas: gastrointestinal function recovery, pain management, reduction of adverse reactions, and patient satisfaction.

#### 3.3.1 Gastrointestinal function recovery

Postoperative gastrointestinal function recovery is often delayed following gastrointestinal surgeries, leading to considerable patient discomfort, prolonged hospital stays, and increased healthcare costs. When integrated with the principles of ERAS, OFA optimizes perioperative management by reducing opioid use. This reduction minimizes the inhibitory effects of opioids on gastrointestinal motility, thereby facilitating quicker recovery of gastrointestinal function.

TABLE 1 OFA strategies in gastrointestinal surgery.

| Surgery type | Regional nerve block strategies | GA induction | GA Maintenance | Postoperative analgesia |
|---|---|---|---|---|
| Laparoscopic radical colectomy (An et al., 2022) | Ultrasound-guided bilateral paravertebral block (0.5% ropivacaine plus 0.2 µg/kg Dex) | Dex (0.6 µg/kg, 10 min), Prop (2 mg/kg), Ketorolac (30 mg), Cisatracurium (0.2 mg/kg) | Dex (0.5 µg/kg/h), Sevoflurane (1%– 3%), Cisatracurium (2–4 mg per 30 min) | PCA (6 µg·kg$^{-1}$ Dex and 180 mg Ketorolac added to 100 mL of saline at 2 mL/h and the lock time was 15 min) |
| Bariatric surgery (Ziemann-Gimmel et al., 2014) | Not applied | Dex (0.5 ug/kg, 10 min), Midazolam (2 mg), Prop (1–2.5 mg/kg), Succinylcholine (1–1.5 mg) or Rocuronium (0.5–1 mg/kg) | Dex (0.1–0.3 ug/kg/h), Prop (75–150 mg kg/min), Rocuronium (10–20 mg) or Vecuronium (1–2 mg) | Acetaminophen (1,000 mg) and Ketorolac (30 mg) every 6 h for the first 24 h |
| Bariatric surgery (Berlier et al., 2022) | Not applied | Clonidin (2 or 3 µg/kg, over 10 min) or Dex (1.4 µg/kg/h, 10 min), Prop (3 mg/kg), Cisatracurium (0.2 mg/kg), Ket (0.5 mg/kg) | Dex (0.5–1 µg/kg/h), Lidocaine (1.5 mg/kg, over 10 min) followed by a continuous infusion of lidocaine 2 mg/kg/h, Volatile anesthetics or Prop | Ketoprofen, Nefopam, and Tramadol were used, Morphine was provided as a rescue analgesic if needed |
| Bariatric surgery (Perez et al., 2024) | Not applied | Dex (1 µg/kg, over 10 min), Prop (2–3 mg/kg), lidocaine (1.5 mg/kg), Ket (0.5 mg/kg) | Dex (0.3–0.5 µg/kg/h), Sevoflurane, Lidocaine (2 mg/kg/h) | Fentanyl (25–50 µg boluses, 250 µg maximum) and/or hydromorphone (0.5 mg boluses, 2 mg maximum) |
| Bariatric surgery (Dagher et al., 2025) | Not applied | Prop, Succinylcholine, Lidocaine (1.5 mg/kg), Ket (0.2 mg/kg), Magnesium sulfate (50 mg/kg) | Dex (0.2–0.5 ug/kg/h), Sevoflurane, Lidocaine (1.5 mg/kg/h), Ket (0.15 mg/kg/h), Magnesium sulfate (8 mg/kg/h), Rocuronium | Paracetamol (1 g, every 6 h), and Ketoprofen (50 mg), Morphine sulphate 0.1 mg/kg subcutaneous every 6 h |
| Sleeve gastrectomy done (Ibrahim | Ultrasound-guided bilateral oblique subcostal transverse | Dex (0.1 µg/kg, 10 min), Prop (2 mg/kg), Ket (0.5 mg/kg), Cisatracurium (0.15 | Dex (0.5 µg/kg/h), Ket (0.5 kg/h), Lidocaine (1 mg/kg/h), Sevoflurane (1.5%–2%) | Paracetamol (1 g, 6 hourly) and Parecoxib (40 mg, 12 hourly) |

| | | | | |
|---|---|---|---|---|
| et al., 2022) | abdominis plane block (0.25% bupivacaine, 40 mL total) | mg/kg) | | |
| Sleeve gastrectomy (Mieszczanski et al., 2023) | Local infiltration (0.25% bupivacaine, 40 mL total) | Dex (1ug/kg, 10 min), Prop (2–2.5 mg/kg), Lidocaine (1.5 mg/kg, 10 min), Ket (0.5 mg/kg), Succinylcholine (1–1.5 mg/kg) | Dex (1ug/kg/h, max), Desflurane, Lidocaine (3 mg/kg/h, max), Rocuronium or Cisatracurium | Paracetamol (1 g), Metamizole (1 g, every 6 h), and oxycodone (bolus 2 mg, lockout 10 min) |
| Sleeve Gastrectomy (Zhou et al., 2024) | Bilateral TAP block (Ropivacaine 0.3%, 20 mL/ side), Local anesthesia (Ropivacaine) | Dex (0.5 μg/kg, 10 min), Esk (0.5 mg/kg), Midazolam (0.05 mg/kg), Prop (1–2 mg/kg), Rocuronium (0.6 mg/kg) | Dex (0.2–0.3 μg/kg/h), Esk (0.3 mg/kg/h), Prop (2–3 mg/kg/h), Sevoflurane (0.8%–1%), Cisatracurium (0.04–0.05 mg/kg/h) | VAS value was 7 or above (Tramadol 50 mg), VAS value was 4–7 or in need of analgesia (Flurbiprofen axetil, 50 mg) |
| Sleeve Gastrectomy (Song et al., 2025) | Ultrasound-Guided TAP Block (0.25% Ropivacaine, 30 mL/side) | Flurbiprofen axetil (50 mg), Dex (1 μg/kg, 10 min), Midazolam (2 mg), Prop (2 mg/kg), Esk (0.5 mg/kg), and Rocuronium (0.6–1 mg/kg) | Prop, Esk and Dex mixture (Esk 50 mg + Dex 150 ug + 0.9% saline into 50 mL) 0.1–0.2 mL/kg/h | PCA (Sufentanil 100 μg + Dex 0.2 mg + Ondansetron 8 mg + 0.9% saline into 100 mL), Flurbiprofen axetil (50 mg, twice daily) |

GA, general anesthesia, Dex, Dexmedetomidine, Prop, Propofol, Ket, Ketamine, Esk, Esketamine, VAS, visual analogue scale; TAP, transversus abdominis plane; PCA, patient controlled analgesia.
Unless specified otherwise, the route of administration is intravenous.

Studies have demonstrated that intraoperative administration of dexmedetomidine in elderly patients undergoing abdominal surgery significantly shortens the median time to first flatus and bowel movement, as well as the median length of hospital stay (Lu et al., 2021). Similarly, a randomized controlled trial involving patients undergoing laparoscopic colorectal surgery found that continuous intraoperative infusion of esketamine effectively promoted postoperative intestinal function recovery (Sun et al., 2023).

Postoperative pain resulting from noxious stimuli has the potential to increase sympathetic nervous system activity, which may subsequently impede the recovery of gastrointestinal motility. Additionally, the administration of opioid analgesics can further prolong the restoration of normal gastrointestinal function. To address this, selecting appropriate nerve block techniques based on the surgical site such as the transversus abdominis plane block,paravertebral block, erector spinae plane block, Stellate Ganglion Block, and femoral nerve block can provide effective postoperative analgesia while reducing opioid consumption, promote the recovery of gastrointestinal function. For instance, in laparoscopic gynecological surgeries, patients receiving OFA demonstrated significantly improved postoperative analgesia, a lower incidence and severity of postoperative nausea and vomiting (PONV), and faster time to first flatus compared to those receiving opioid-based anesthesia (Chen et al., 2022).

These findings underscore that perioperative pain management strategies aligned with ERAS principles-incorporating opioid-free analgesic regimens and multimodal analgesia techniques-can effectively reduce opioid use and its associated adverse effects, thereby accelerating the recovery of gastrointestinal function.Pain management

Effective pain management after gastrointestinal surgery is crucial. Adequate postoperative analgesia not only alleviates patient discomfort but also reduces the risk of pain-related complications, such as restricted breathing, pulmonary issues, and deep vein thrombosis. It further facilitates early mobilization, recovery of gastrointestinal function, and accelerates overall recovery. In gastrointestinal enhanced recovery surgery, OFA achieves effective postoperative pain control through the use of various non-opioid drugs and regional block techniques.

For instance, in total hip replacement surgeries, OFA significantly reduces postoperative opioid consumption, pain scores, and hospital stays compared to opioid-based strategies, while minimizing opioid-related side effects. Reported adverse effects were minimal, with no clinical complications observed, highlighting the efficacy of OFA in postoperative pain management (Urvoy et al., 2021). Similarly, in laparoscopic sleeve gastrectomy, patients in the OFA group reported significantly lower postoperative Visual Analog Scale (VAS) pain scores compared to the control group. Additionally, the proportion of patients requiring rescue analgesia was significantly lower (Dagher et al., 2025). These findings further emphasize the advantages of OFA in managing postoperative pain.

#### 3.3.2 Incidence of adverse reactions

While opioids are effective for postoperative pain management, they are associated with adverse effects such as nausea, vomiting, constipation, respiratory depression, itching, and urinary retention. These side effects can prolong hospital stays and increase healthcare costs. By eliminating opioid use, OFA significantly reduces the incidence of these adverse reactions while maintaining effective analgesia.

For example, studies on bariatric and thoracoscopic surgeries have demonstrated that the incidence of PONV is significantly lower in the OFA group compared to the opioid-based anesthesia group (Feng et al., 2024; Ziemann-Gimmel et al., 2014). Furthermore, multiple studies have shown that OFA improves postoperative recovery quality and accelerates recovery across various surgeries, including breast surgery (Zhang Q. et al., 2023), cholecystectomy (Hao et al., 2023), sinus surgery (Zhou et al., 2023), and kidney surgery (Gao et al., 2024).

These findings underscore the ability of OFA to reduce opioid- related adverse reactions while improving the overall quality of postoperative recovery.

#### 3.3.3 Patient satisfaction

Patient satisfaction is a critical indicator of anesthesia effectiveness. The benefits of OFA in promoting gastrointestinal function recovery, alleviating pain, and reducing adverse reactions enhance patient comfort and the overall recovery experience, ultimately improving satisfaction levels.

In studies on bariatric surgery, patients who received OFA reported higher satisfaction scores, with significantly more patients rating their satisfaction as high (Dagher et al., 2025). These findings suggest that OFA better addresses patient needs, delivering higher-quality medical care and contributing to an improved recovery experience.

### Challenges and limitations of OFA

While OFA has demonstrated numerous advantages in gastrointestinal enhanced recovery surgery, its practical application is hindered by several challenges and limitations, which significantly constrain its broader adoption and clinical implementation.

### 3.4 Uncertainty in drug selection and combination

The challenges in selecting and combining drugs for OFA primarily stem from the diverse mechanisms of action of non- opioid drugs, the complexity of clinical scenarios, and the absence of standardized protocols. These challenges can be explored from the following perspectives:

First, a significant challenge lies in the limited efficacy of single drugs and the unpredictable synergistic effects

*ISSN: 2456-5660 Volume 10, Issue 07 (July -2025)*
*www.jst.org.in DOI:https://doi.org/10.46243/jst.2025.v10.i07.pp62- 72*

of combination therapies. Non-opioid drugs achieve analgesic, sedative, or nociceptive-inhibitory effects through distinct molecular targets; however, a single drug is often insufficient to meet the multifaceted demands of the entire anesthesia process. Moreover, drug combinations exhibit varying degrees of synergy, which can also heighten the risk of adverse effects. For instance, in gynecological laparoscopic surgery, opioid-free anesthesia has been shown to produce comparable outcomes to traditional opioid-based anesthesia in terms of postoperative nausea and vomiting, postoperative pain, and morphine consumption. However, it has also been associated with prolonged postoperative sedation and extended recovery room stays. This inherent unpredictability in balancing "complementary benefits" with "cumulative adverse effects" complicates clinical decision- making regarding optimal dosing ratios and administration timing in combination therapy.

Second, individual variability in patient responses to drugs further complicates the selection process. Factors such as age, weight, underlying conditions (e.g., hypertension, diabetes), and preoperative pain status significantly influence the pharmacokinetics and pharmacodynamics of non-opioid drugs. For example, in elderly patients and those with hypoalbuminemia, the elimination half-life and context-sensitive half-life of dexmedetomidine are prolonged (Iirola et al., 2012). Additionally, studies have demonstrated that the ED95 of dexmedetomidine for inducing mild sedation is 0.38 μg/kg in patients over 65 years old, compared to 0.57 μg/kg in patients aged 45–64 (Kim et al., 2015). These findings highlight the necessity of individualized adjustments to OFA regimens to accommodate patient- specific characteristics.

Finally, the lack of standardized guidelines or protocols for clinical practice management further exacerbates the challenges associated with OFA. This absence of uniformity limits the guidance available to anesthesiologists, increases uncertainty, and heightens risks during OFA implementation.

### 3.5 Insufficient evidence of effectiveness

Although some studies have emphasized the potential advantages of OFA, the evidence supporting its benefits remains insufficient. Many studies are constrained by small sample sizes, suboptimal study designs, and the lack of large-scale, multicenter, high-quality clinical trials to robustly validate its efficacy and safety. Furthermore, heterogeneity in study outcomes complicates the overall assessment of OFA's effectiveness.

For instance, studies report significant benefits of OFA in pain control and the recovery of gastrointestinal function (Lu et al., 2021; Sun et al., 2023; Chen et al., 2022). However, other studies have shown that OFA, when compared to traditional opioid-based anesthesia, does not improve anesthesia quality in patients (Chassery et al., 2024; Perez et al., 2024). Moreover, it may contribute to additional adverse effects, such as bradycardia, hemodynamic instability, and prolonged the recovery room stays (Beloeil et al., 2021; Mieszczanski et al., 2023; Zhang et al., 2025). This inconsistency underscores the need for rigorous research to elucidate the specific benefits, limitations, and appropriate applications of OFA in gastrointestinal enhanced recovery surgery.

### 3.6 Potential adverse reactions

Although OFA seeks to minimize opioid-related adverse effects, the use of multiple adjuvant analgesic drugs introduces the risk of potential adverse reactions. For example, dexmedetomidine is associated with bradycardia, hypotension, and excessive sedation (Beloeil et al., 2021; Feng et al., 2024; Mieszczanski et al., 2023), necessitating vigilant monitoring of patients' vital signs and timely dose adjustments. Similarly, lidocaine, particularly when administered in high doses or over extended durations, may result in local anesthetic systemic toxicity, manifesting as central nervous system excitation or depression. Additionally, esketamine has been linked to dissociative symptoms and hallucinations, which may lead to psychiatric adverse effects.

These potential adverse reactions significantly increase the complexity of clinical management, underscoring the need for clinicians to possess substantial experience and expertise to promptly recognize and effectively address such issues.

### 3.7 Challenges in clinical implementation

The clinical implementation of OFA presents several challenges. Firstly, OFA demands advanced expertise from healthcare providers, including a thorough understanding of the pharmacological properties, administration techniques, and potential adverse effects of non-opioid drugs, as well as proficiency in regional block techniques. This necessitates systematic training and education; however, in primary healthcare institutions or resource-limited regions, constrained resources and a lack of expertise hinder the ability to meet these requirements.

Secondly, OFA often involves the use of equipment, which contributes to increased healthcare costs and resource utilization. During the implementation of OFA, electroencephalography monitoring often reveals depth of anaesthesia values exceeding expected levels (Mogianos and Persson, 2025). To ensure patient safety, supplementary monitoring techniques, such as pain assessment devices, become necessary (An et al., 2017; Meijer et al., 2020). However, these interventions inevitably result in increased healthcare costs and resource utilization. Furthermore, patient awareness and acceptance play a crucial role in its clinical implementation. Some patients may harbor doubts or concerns regarding this novel anesthetic approach, further complicating its adoption in practice.

Addressing these obstacles is critical to improving the clinical adoption rate of OFA and unlocking its full potential to enhance perioperative care.

## 4 Prospects and future directions for OFA in gastrointestinal ERAS

Although OFA presents several challenges in its application to gastrointestinal enhanced recovery surgery, its distinct advantages and potential underscore a promising future. The following strategies may further facilitate the advancement of OFA in this field.

### 4.1 Optimizing drug combinations and protocols

To address the existing uncertainty regarding drug selection and combinations, future research should prioritize the optimization of OFA protocols. Comprehensive clinical trials and experimental studies are essential to investigate the synergistic effects and optimal compatibility of various drugs, with the goal of identifying the most effective combinations and dosages tailored to specific surgical procedures and individual patient profiles. Personalized OFA protocols should account for factors such as patient age, comorbidities, and physical status to maximize anesthetic efficacy and safety. Furthermore, advancements in pharmaceutical research may facilitate the development of novel non-opioid drugs, thereby broadening the therapeutic arsenal available for OFA.

### 4.2 Conducting large-scale, multicenter studies

To address the current lack of robust evidence, large-scale, multicenter clinical studies are crucial. Larger sample sizes increase the reliability and generalizability of findings, while multicenter designs enhance representativeness and minimize research bias. Such studies would enable a more accurate assessment of the efficacy and safety of OFA in gastrointestinal enhanced recovery surgery, thereby clarifying its clinical value and applicability. Additionally, long-term follow-up studies are needed to evaluate the sustained effects of OFA, offering valuable insights to guide clinical practice.

### 4.3 Enhancing training for healthcare providers

The successful clinical implementation of OFA relies heavily on the expertise of healthcare providers, making enhanced training an

essential priority. Systematic theoretical training should ensure a comprehensive understanding of OFA, including the pharmacological properties, mechanisms of action, administration techniques, and potential adverse effects of non-opioid drugs. Practical training should emphasize proficiency in techniques such as regional anesthesia and nerve blocks. Regular training programs, workshops, and academic exchanges can further support healthcare providers in continuously refining their skills, thereby ensuring the safe and effective application of OFA in clinical practice.

### 4.4 Combining OFA with other treatment modalities

Future strategies should focus on integrating OFA with other therapeutic approaches to further improve patient recovery and quality of life. For instance, combining OFA with rehabilitation therapy could facilitate targeted recovery training during the early postoperative period, promoting the restoration of physical function. Additionally, integrating psychological interventions may help alleviate patient anxiety and fear, enhancing psychological resilience. By incorporating multiple treatment modalities, synergistic effects can be achieved, providing more comprehensive and high-quality medical care while advancing the development of gastrointestinal enhanced recovery surgery.

## 5 Conclusion

Improvements in pain management, gastrointestinal function recovery, adverse reaction incidence, and patient satisfaction are just a few of the many benefits that OFA has shown to be useful in gastrointestinal enhanced recovery surgery. According to the available evidence, OFA has many benefits, including a shorter time to first flatus and bowel movement, shorter hospital stays, better management of postoperative pain, and less opiate intake and its side effects. In addition, patient satisfaction and recovery experiences are improved by reducing problems including postoperative nausea and vomiting (PONV) and respiratory depression with the use of OFA.

Insightful for doctors, this paper thoroughly examines the use of OFA in gastrointestinal improved recovery surgery. Through a comprehensive review of the literature, it elucidates the benefits and drawbacks of OFA, paving the way for more personalized anesthetic strategies to address patients' unique requirements and enhance healthcare quality as a whole. In order to support the continuous improvement of OFA approaches, this study also provides important topics for future research.

There are several advantages to OFA, but its clinical use has to be carefully considered. The need for careful patient monitoring is underscored by the existing lack of solid data and the uncertainty surrounding medication selection.

assessment and the creation of tailored anesthetic regimens. In order to guarantee the safe and successful use of OFA in clinical practice, it is crucial to improve healthcare professional training.

To help develop the best practices and indications for OFA, future large-scale, multicenter studies are essential. This will allow for its wider use in gastrointestinal improved recovery surgeries. In this area, OFA offers encouraging prospects, all things considered. Patients will get safer, higher-quality medical treatment as a result of OFA's growing importance as a result of ongoing research and technological improvements.

## References

The authors of the 2016 article are Ahn, E. J., Park, J. H., Kim, H. J., Kim, K. W., Choi, H. R., and Bang, S. R. A randomized, double-blind, placebo-controlled trial of anticholinergic premedication to avoid bradycardia during spinal anesthesia and dexmedetomidine sedation.
Journal of Clinical Anesthesia, Volume 35, Issues 13–19, DOI: 10.1016/j.jclinane.2016.07.012.

This sentence was written by An, Wang, Cope, and Williams in 2017. Quantitative assessment of pain using an EEG-derived pain index. Chinese Medical Journal, Volume 130, Issues 1926–1931, doi:10.4103/0366-6999.211878.
In 2022, An, G., Wang, G., Zhao, B., Zhang, X., Li, Z., Fu, J., and others published. Results from a randomized controlled trial comparing opioid and opioid-free anesthesia for laparoscopic radical colectomy under the supervision of a pain threshold index monitor. doi:10.1186/s12871-022-01747-w. BMC Anesthesiology. 22, 241.
In a 2018 publication, Beaussier, Delbos, Maurice-Szamburski, Ecoffey, and Mercadal were the authors. Perioperative usage of intravenous lidocaine. Paper published in Drugs, volume 78, pages 1229–1246, with the DOI number 10.1007/s40265-018-0955-x.
In 2021, Beloeil et al. were joined by Garot, Lebuffe, Gerbaud, Bila, and Cuvillon. In big or intermediate noncardiac surgeries, dexmedetomidine-balanced anesthesia is preferable to remifentanil-balanced anesthesia. Published in Anesthesiology 134, 541-551. DOI: 10.1097/ALN.0000000000003725.
Le-Goff, M. C., Cerro, V., Bouffard, Y., Berlier, J., Tete, H., Carabalona, J. F., and others (2022). Anesthesia alternatives without opioids and their impact on morphine use after bariatric surgery. Journal of Clinical Anesthesia, Volume 81, Issue 1, Page 110906, doi:10.1016/j.jclinane.2022.110906.
This sentence is a citation for a work by Cha, Hu, Zhu, Long, Jiang, and Gong (2023). Improved postoperative recovery after hysteroscopy with opioid-free lidocaine anesthesia: a randomized controlled experiment. 192. doi:10.1186/s12871-023-02152-7. Published in BMC Anesthesiology.
In 2024, Chassery et al. were joined by Atthar, Marty, Vuillaume, Casalprim, Basset, and Basset. A randomized controlled experiment comparing opioid-free and opioid-sparing anesthesia for outpatient total hip replacement. "British Journal of Anaesthesia" 132, 352–358, doi:10. 1016/j.bja.2023. 10.031
In 2022, Chen, Luo, Huang, and Jiao published their work. Postoperative pain relief after laparoscopic gynecologic surgery: the impact of opioid-free anesthesia. "Minerva Anesthesiol. 88, 439-447." doi:10.23736/S0375-9393.22.15850-5.
This sentence is a citation for a research paper by Coeckelenbergh et al. (2021). A randomized controlled study examining the efficacy of index-guided remifentanil antinociception in relation to dexmedetomidine dosage. "Eur. J. Anaesthesiol. 38, 524-533. doi:10. 1097/EJA.0000000000001402"
In 2025, Dagher, Mattar, Aoun, Tohme, Naccache, and Jabbour published a paper. A prospective randomized controlled study on opioid-free anesthesia for bariatric surgery. This article is in the European Journal of Medical Research and has the DOI: 10.1186/s40001-025-02565-9.
This sentence is a citation for a study by Dam, Hansen, Poulsen, Azawi, Wolmarans, Chan, and colleagues (2019). A single-center randomized controlled study found that transmuscular quadratus lumborum blocks for percutaneous nephrolithotomy decreased opioid usage and accelerated ambulation and hospital release. Citation: Br. J. Anaesth. 123, e350-e358. doi:10.1016/j. bja.2019.04.054.
Forget, P., Detriche, O., and De Boer, H. D. (2017). Postoperative ileus, retention of urine, nausea, vomiting, and shivering are among adverse symptoms associated with opioids. An analysis of the existing research. The article "Best. Pract. Res. Clin. Anaesthesiol." was published in 2017 and can be accessed online at doi:10.1016/j.bpa.2017.07.002. It is pages 499-504.
In 2016, Feldheiser et al. were joined by Aziz, Baldini, Cox, Fearon, Feldman, and others. Part 2 of the Enhanced Recovery After Surgery (ERAS) consensus statement for anesthesia practice pertains to gastrointestinal surgeries. The citation is from the Acta Anaesthesiol. Scand. 60, pages 289-334. this article's DOI is 10.1111/aas.12651....
Xu, Y., Chen, S., Song, N., Meng, X. W., Liu, H., and others (2024). Using opioid-free anaesthesia during thoracoscopic lung resection decreases postoperative vomiting and nausea: a randomized controlled study. British Journal of Anaesthesia, 132, 267-276. https://doi.org/10.1016/j. bja.2023.11.008
Zhang, L., Gao, H., Xu, Z., Liu, Y., Jiang, Y., Wang, Q., and others (2024). A randomized controlled experiment comparing opioid anesthesia with regional block versus opioid-free anesthesia found that the latter resulted in a higher quality of recovery after retroperitoneiscopic kidney surgery. This article appears in Minerva Anesthesiol and has the DOI: 10.23736/S0375-9393.24.18186-2.
This sentence is a citation for a 2016 paper by Goettel, Bharadwaj, Venkatraghavan, Mehta, Bernstein, and Manninen. Conducting awake craniotomy with dexmedetomidine or propofol-remifentanil conscious sedation: a prospective

randomized controlled experiment. "British Journal of Anaesthesia" 116, 811–821. doi:10.1093/bja/aew024
Publication: 2000 by Hall, Uhrich, Barney, Arain, and Ebert. The sedative, amnestic, and analgesic effects of dexmedetomidine infusions given in tiny doses. This sentence is a DOI link to the following article: "Anesth. Analg. 90, 699-705."
A group of researchers from China (Hao, Xu, Du, Zhang, X., and Zhao, Z.) published a study in 2023. A randomized controlled experiment examining the effects of opioid-free anesthesia on the quality of recovery in patients after laparoscopic cholecystectomy. Paper published in Drug Development and Therapeutics, volume 17, pages 3539–3547, with the DOI of 10.2147/DDDT.S439674.
A narrative overview of the molecular mechanisms of action of systemic lidocaine in acute and chronic pain was published in 2019 by Hermanns, Hollmann, Stevens, Lirk, Brandenburger, and Piegeler. British Journal of Anaesthesia, Volume 123, Issue 3, Pages 335–349, DOI: 10.1016/j.bja.2019.06.014
In 2021, the authors were Hu, J., Zhu, M., Gao, Z., Zhao, S., Feng, X., and Chen, J. A randomized, double-blind clinical study of dexmedetomidine to prevent postoperative delirium in elderly patients having oesophagectomy under complete intravenous anesthesia. European Journal of Anaesthesia, 38, S9–S17, doi:10.1097/EJA.0000000000001382.
Jiang, Y., He, S., Huan, C., Zhang, T., and Jin, J. (2025). A randomized controlled experiment found that patients who received esketamine intraoperatively used less opioids after laparoscopic gynecological surgery. Pharmaceutical Development and Therapeutics 19, 229–238. doi:10.2147/DDDT.S502938.
Ibrahim, M., Hegab, A., Alnujaidi, O. A., El Sanea, O. (2022). Elnabtity, A. M. A randomized controlled experiment on the quality of recovery after sleeve gastrectomy performed using the ERAS protocol found that a combination of opioid-free and loco-regional anesthesia improved the outcome. Journal of Basic Medical Sciences, Volume 22, Issue 29, Article Number 10.1186/s12871-021-01561-w (Iirola et al., 2012). The population pharmacokinetics of dexmedetomidine in critically ill patients undergoing long-term sedation. "British Journal of Anaesthesia 108, 460-468." doi:10.1093/bja/aer441.
Ravindran, A., Kaniyil, S., and Jose, A. (2023). Intraoperative hemodynamic stability in modified radical mastectomy: a randomized controlled experiment comparing morphine to an intravenous dexmedetomidine-lignocaine infusion. Citation: Indian Journal of Anaesthesia 67, 697–702, doi:10.4103/ija.ija 581_22.
This sentence is a citation for a 2007 publication by Kaba, Laurent, Detroz, Sessler, Durieux, Lamy, et al. Acute rehabilitation after laparoscopic colectomy is made easier with intravenous lidocaine infusion. Chapter 106, Sections 11–18, Anesthesiology, DOI: 10.1097/00000542-200701000-00007.
In 2015, Kim, J., Kim, W. O., Kim, H. B., and Kil, H. K. worked together. Patients having transurethral prostate excision with spinal anesthesia: a dose-response study by age group: adequate sedation with single-dose dexmedetomidine. doi:10.1186/1471-2253-15-17 BMC Anesthesiology. 15, 17.
With contributions from Palte, Chehade, Arheart, Ranasinghe, and Penning (2013), Lee et al. Intrathecal morphine with ultrasound-guided transversus abdominis plane blocks for post-cesarean pain management. Clinical Anesthesiology 25, 475-482. This sentence cannot be paraphrased as it is a scientific paper and does not contain meta-data.
In 2023, the authors were Lee, J. H., Kim, C. S., Choi, J. M., Kim, Y., Jeong, S. M., and others.
The purpose of this prospective, randomized, assessor-blind trial was to determine whether or not thoracic paravertebral blocks reduced opioid intake after laparoscopic cholecystectomy by acting as a visceral analgesic. Korean Journal of Anesthesiology, Volume 76, Pages 203-212, doi:10.4097/kja.22481.
Xiao, Li, Yu, Yang, and Tan (2019). After radical thyroidectomy, patients get increased pain relief with a combination of ropivacaine wound infiltration and intravenous flurbiprofen axetil, according to a randomized controlled experiment. 19, published in the BMC Anaesthesiology journal.

doi:10.1186/s12871-019-0835-2 (167).
Zhu, Liu, Bi, Xiang, and Song, 2023. Thyroid surgery: a randomized controlled study comparing opioid-based anesthesia to opioid-free anesthesia with an ultrasound-guided intermediate cervical plexus block for safety and effectiveness. "Journal of Anesthesiology" 37, 914–922. doi:10.1007/s00540-023-03254-9.
In 2024, Liu, Wang, Song, and Cao published a paper. Analgesia and delirium after gastrointestinal surgery in older individuals given esketamine. 24, 46. doi:10.1186/s12871-024-02424-w. Published in BMC Anesthesiology.
A group of researchers including Lu, Y., Yu, Y. Q., Cheng, X. Q., Feng, X. M., and Wong, G. T. C. (2021) released a study.
Randomized clinical study of intraoperative dexmedetomidine for the improvement of gastrointestinal function after

abdominal surgery in elderly patients. doi:10.1001/jamanetworkopen.2021.28886 JAMA Network Open, 4, e2128886.
In 2025, Luo, L. L., Xiao, R., Zhang, J. P., Xi, W. F., Xu, G. H., and Yuan, H. published their work. Anesthesia for hip surgery in older patients without opioids using esketamine and iliac fascia block. Drug "Development of Therapeutics" (19, 3337–3349), doi:10.2147/DDDT. S508805.
Authors Margraf, Ludwig, Zarbock, and Rossaint (2020). Prevention and pathogenesis of postoperative systemic inflammatory response syndrome. "Anesth. Analg. 131, 1693-1707" (doi:10.1213/ANE.0000000000005175).
In 2013, Marhofer et al. published a study as well as Pils, Weber, and Zeitlinger. An adjuvant to ropivacaine, dexmedetomidine prolongs peripheral nerve block: a trial with volunteers. "British Journal of Anaesthesia 110, 438-442." doi:10.1093/bja/aes400
A group of researchers including Meijer, Honing, Roor, Toet, Calis, and Olofsen (2020) have published a study. Effect of nociception on postoperative pain reduction with sevoflurane-guided fentanyl dosing: a randomized controlled study. Published in the British Journal of Anaesthesia, volume 125, pages 1070–1078 (doi:10.1016/j. bja.2020.07.057).
In 2023, Mieszczanski, P., Gorniewski, G., Ziemianski, P., Cylke, R., Lisik, W., and Trzebicki, J. had a publication. Laparoscopic sleeve gastrectomy: a prospective, randomized trial comparing intraoperative opioid free anesthesia with multimodal anesthesia. Science Reports 13, 12677. doi:10.1038/s41598-023-39856-2. Citation: Sci. Rep.
"Heimseher" and "Mion" (2024). Less sleepiness and greater analgesia with eskelithamine.
Research in Anesthesiology 139, 78–91. doi:10.1213/ANE.0000000000006851.

In 2025, Mogianos and Persson published a paper. A prospective observational research on anesthesia depth monitoring during opioid-free anesthesia. 25, 37. doi:10. 1186/s12871-024-02859-1. Published in BMC Anesthesiology.
In 2018, Neethu et al. were joined by Sharma & Darlong as well as Sinha and Punj. Efficacy of pectoral nerve blocks in postoperative pain management for breast cancer patients: a randomised, controlled study. This article was published in the Journal of Clinical Anesthesia on page 12–17 with the DOI: 10.1016/j.jclinane.2017. 11.027.
In 2019, the authors were Ni, X., Jia, D., Guo, Y., Sun, X., and Suo, J. A meta-analysis of randomized controlled studies examines the safety and effectiveness of the enhanced recovery after surgery (ERAS) program in laparoscopic digestive system surgery. International Journal of Surgery, 69, 108–115. doi:10.1016/j. ijsu.2019.07.034.
In 2016, Oksar, Koyuncu, Turhanoglu, Temiz, and Oran published a paper. The use of a transversus abdominis plane block to alleviate pain during laparoscopic cholecystectomy is one method among many. Volume 34, Issues 72–78, Journal of Clinical Anesthesia, 2016–03.033.
In 2020, Park, J. H., Hong, H., Shim, J. K., and Lim, H. K. published a work. How well injectable ephedrine prevents hemodynamic disturbances in dexmedetomidine-sedated individuals undergoing spinal anesthesia. International Journal of Medical Sciences 17, 2285-2291. doi:10.7150/ijms.48772.
With Park, S., Han, W. K., Lee, J., and Lee, J. H. as co-authors (2023). The efficacy of blocking the erector spinae plane during laparoscopic colorectal surgery in minimizing opioid use and promoting early ambulation: a randomized, controlled study. Report from the Scientific Community, Volume 13, Issue 12056, DOI: 10.1038/s41598-023-39265-5.
The authors of the article are Paul, A. K., Rahmatullah, M., Nissapatorn, V., Wilairatana, P., Spetea, M., and Smith, C. M. (2021). A review of opioid analgesia and opioid-induced side effects. The article is published in Pharm. (Basel) and has the DOI: 10.3390/ph14111091.
The authors of the article are Pei, L., Zhou, Y., Tan, G., Mao, F., Yang, D., Guan, J. (2015). A randomized controlled study improved analgesia following breast cancer surgery and decreased intraoperative opioid demand using ultrasound-assisted thoracic paravertebral block. The experiment was conducted at a single site. 10(4), e0142249, DOI:10.1371/journal.pone.0142249, published in PLoS One.
This sentence is a citation for a work by Perez, Strunk, Preciado, Defaccio, Chang, and Mallipeddi (2024). Randomized controlled experiment using prospective enrollment and single-blind testing to determine the impact of an opioid-free anesthesia on painkiller usage after laparoscopic bariatric surgery. The article is published in the Journal of Anesthesiology and Pain Medicine and has the DOI number 10.1136/rapm-2024-105632.
Rawal, Namrata (2021). Postoperative pain relief with epidural analgesia: better results or more risks? Very best. Clinical and Practical Anaesthesia 35, 53–65. doi:10.1016/j.bpa.2020.12.001.
The authors of the 1992 publication are B. Scheinin, L. Lindgren, T. Randell, H. Scheinin, and M. Scheinin. Dexmedetomidine decreases the need for thiopentone and peroperative fentanyl by attenuating sympathoadrenal

reactions to tracheal intubation. "British Journal of Anaesthesia 68: 126–131" (doi:10.1093/bja/68.2.126).
In 2015, a group of researchers including Scott, Baldini, Fearon, Feldheiser, Feldman, Gan, and others published a paper. Pathophysiological aspects of enhanced recovery after surgery (ERAS) for gastrointestinal surgeries, part 1. Article published in the Scandinavian Journal of Anaesthesia 59: 1212–1231. doi:10. 1111/aas.12601.
This is the 2023 version of the paper by Song, Yang, Zheng, Shi, Tan, X. S., Tan, A. P., and others. A randomized clinical experiment examining the effects of esketamine added to propofol sedation on hypotension and desaturation during bidirectional endoscopy. (doi:10.1001/jamanetworkopen.2023.47886) in JAMA Network Open, volume 6, issue 2347886, 2023.
Presented by Song, B., Li, W., Wan, L., and Zhang, L. in 2025. Laparoscopic sleeve gastrectomy patients' quality of recovery after surgery as a function of opioid-free vs opioid anesthesia. Surgical obesity, volume 35, pages 3120–3130, doi:10.1007/s11695-025-08008-y.
As a group, Sun, Zhao, Li, Zhai, Gao, Yin, and Yin (2023) produced this. A randomised controlled trial investigating the effects of a continuous subanesthetic esketamine infusion on postoperative tiredness in patients having laparoscopic radical resection for rectal cancer. Scientific Reports, Volume 13, Issue 25,54–2563, American Journal of Cancer Research.
In 2021, Urvoy, Aveline, Belot, Catier, and Beloeil published a paper. The Opiate-free anesthesia for anterior total hip replacement trial: an observational prospective research comparing opioid-free and general anesthesia for this procedure. "British Journal of Anaesthesia" 126, e136–e139, doi:10.1016/j.bja.2021.01.001.
Authors: Wang, Y., Xia, B., Zhang, H. B., Wang, G. M., and Zhang, M. Y. (2012). Analgesic effects of flurbiprofen axetil before radical esophageal cancer surgery using the left thoracic route in patients. "Chinese Medical Journal of English 125, 579–582. doi:10.3760/cma.j.issn.0366-6999.2012.04.004"
Li, Y., Wang, J., Liang, C., Han, X., and Miao, C. (2023) were all authors of the paper. Randomized clinical study on opioid-free anesthesia for lung surgery finds less severe initial postoperative motion-induced discomfort and side events associated to patient-controlled epidural analgesia. This article appears in Front. Med. (Lausanne) and has the DOI of 10.3389/fmed.2023.1243311.
This sentence is a citation for a work by Wang, Sun, Zhu, Shan, Liu, Ji, and colleagues in the year 2024. Anaesthesia with propofol and anaesthesia without opioids