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Intravenous Nalbuphine as Rescue Analgesia for Intraoperative Visceral Pain During Laparoscopic Surgery Under Segmental Spinal Anaesthesia: A Six-Patient Case Series

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Abstract

Background

Segmental spinal anaesthesia has emerged as a feasible alternative to general anaesthesia for selected laparoscopic procedures. Despite an adequate sensory block, intraoperative visceral pain during pneumoperitoneum and visceral manipulation remains a significant challenge and may necessitate conversion to general anaesthesia. Nalbuphine, a mixed κ-opioid receptor agonist and μ-opioid receptor antagonist, possesses favourable analgesic properties for visceral pain with a lower incidence of respiratory depression. This case series evaluates the effectiveness of intravenous nalbuphine as rescue analgesia for intraoperative visceral pain during laparoscopic surgery performed under segmental spinal anaesthesia.

Methods

This prospective case series included six adult ASA physical status I patients undergoing elective laparoscopic surgery under segmental spinal anaesthesia between May and July 2026 at a tertiary teaching hospital. Carbon dioxide pneumoperitoneum was maintained at an intra-abdominal pressure of ≤12 mmHg in all patients. Intravenous nalbuphine (0.1 mg/kg) was administered when clinically significant intraoperative visceral pain developed. Pain intensity was assessed using the Numerical Rating Scale (NRS). Haemodynamic parameters, Ramsay Sedation Score, adverse events, need for conversion to general anaesthesia, and patient and surgeon satisfaction scores were recorded.

Results

All six patients experienced rapid and clinically significant relief of visceral pain following intravenous nalbuphine administration, with pain scores decreasing to NRS 0–1 within five minutes. No patient required conversion to general anaesthesia. Haemodynamic parameters remained stable, and no episodes of respiratory depression or serious opioid-related adverse events were observed. Patient and surgeon satisfaction scores were uniformly high.

Conclusion

Intravenous nalbuphine may serve as an effective and safe rescue analgesic for intraoperative visceral pain during laparoscopic surgery performed under segmental spinal anaesthesia. Larger prospective comparative studies are warranted to validate these preliminary observations.

Keywords: Nalbuphine; Segmental spinal anaesthesia; Laparoscopic surgery; Visceral pain; Rescue analgesia; Regional anaesthesia

Introduction

Laparoscopic surgery is traditionally performed under general anaesthesia because carbon dioxide pneumoperitoneum, peritoneal stretching, and visceral traction frequently produce discomfort that may not be completely abolished by neuraxial blockade alone. Nevertheless, advances in regional anaesthesia have renewed interest in segmental spinal anaesthesia as an alternative technique for carefully selected laparoscopic procedures. Potential advantages include avoidance of airway instrumentation, reduced postoperative nausea and vomiting, superior postoperative analgesia, earlier mobilisation, and improved patient satisfaction.

Despite an adequate sensory block, intraoperative visceral pain remains one of the principal limitations of laparoscopic surgery under spinal anaesthesia. Visceral nociception originates primarily from traction on the peritoneum and mesentery and is often poorly controlled by local anaesthetic blockade alone. Effective management of this pain is crucial to maintain patient comfort, optimise surgical conditions, and avoid unnecessary conversion to general anaesthesia.

Nalbuphine is a synthetic opioid with mixed receptor activity, acting as a κ-receptor agonist and μ-receptor antagonist. Its pharmacological profile makes it particularly attractive for the management of visceral pain[1, 2] because it provides effective analgesia while exhibiting a ceiling effect for respiratory depression and a lower incidence of pruritus compared with pure μ-opioid agonists. Although nalbuphine has been widely studied in perioperative analgesia, evidence regarding its use as rescue analgesia for intraoperative visceral pain during laparoscopic surgery under segmental spinal anaesthesia remains limited.

This prospective six-patient case series describes our initial clinical experience with intravenous nalbuphine administered for intraoperative visceral pain during laparoscopic procedures performed under segmental spinal anaesthesia[3].We evaluated its effectiveness in reducing pain intensity, maintaining haemodynamic stability, avoiding conversion to general anaesthesia, and improving overall patient and surgeon satisfaction.

Materials And Methods

Study Design and Setting

This prospective case series was conducted in the Department of Anaesthesiology, Kakatiya Medical College/MGM Hospital, Warangal and government medical college Mancherial,Telangana, India, between May 2026 and July 2026, after obtaining approval from the Institutional Ethics Committee. Written informed consent for anaesthesia and publication of anonymised clinical data was obtained from all participants.

Patient Selection

Six consecutive adult patients (18–60 years) with American Society of Anesthesiologists (ASA) Physical Status I scheduled for elective laparoscopic surgery under segmental spinal anaesthesia were included.

Inclusion Criteria

1. Age 18–60 years
2. ASA Physical Status I
3. Elective laparoscopic procedures
4. Willingness to undergo surgery under spinal anaesthesia
5. Provision of written informed consent

Exclusion Criteria

1. Patient refusal
2. Contraindications to spinal anaesthesia
3. Allergy to nalbuphine
4. Chronic opioid therapy
5. Significant cardiopulmonary disease
6. Pregnancy (except surgery for ectopic pregnancy)

Anaesthetic Technique

Standard fasting guidelines were followed. In the operating room, electrocardiography, non-invasive blood pressure, pulse oximetry, and end-tidal carbon dioxide (when applicable) were monitored continuously. Intravenous access was secured, and patients received appropriate preoperative intravenous crystalloid preload.

Segmental spinal anaesthesia was performed under strict aseptic precautions using hyperbaric bupivacaine. The dose was individualised according to patient characteristics and surgical requirements. Following confirmation of an adequate sensory block, laparoscopic surgery was commenced.

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Carbon dioxide pneumoperitoneum was created, and intra-abdominal pressure was maintained at ≤12 mmHg throughout the procedure to minimise diaphragmatic irritation while providing adequate surgical exposure.

Rescue Analgesia Protocol

Patients were continuously assessed for intraoperative visceral pain using the Numerical Rating Scale (NRS; 0–10).

When clinically significant visceral pain occurred, intravenous nalbuphine 0.1 mg/kg was administered slowly.

Pain intensity was reassessed five minutes after administration.

Outcome Measures

Primary Outcome

Reduction in NRS pain score following intravenous nalbuphine.

Secondary Outcomes

Haemodynamic stability

Ramsay Sedation Score

Requirement for rescue analgesia

Conversion to general anaesthesia

Adverse effects (hypotension, bradycardia, respiratory depression, nausea, vomiting, pruritus)

Patient satisfaction score (1–5)

Surgeon satisfaction score (1–5)

Data Collection

The following variables were recorded:

Demographic characteristics

BMI

Diagnosis

Surgical procedure

Duration of surgery

Dose of hyperbaric bupivacaine

Dose of nalbuphine

Maximum intraoperative NRS score

NRS score 5 minutes after nalbuphine

Ramsay Sedation Score

Time to first postoperative analgesic request

Adverse events

Patient and surgeon satisfaction scores

Case Presentations

Case 1

A 38-year-old woman (55 kg, 152 cm; BMI 23.8 kg/m²; ASA Physical Status I) with symptomatic cholelithiasis was scheduled for elective laparoscopic cholecystectomy under segmental spinal anaesthesia. Following an adequate neuraxial block, surgery proceeded uneventfully with carbon dioxide pneumoperitoneum maintained at an intra-abdominal pressure of ≤12 mmHg.

During gallbladder traction and visceral manipulation, the patient complained of intraoperative visceral pain with an NRS score of 6. Intravenous nalbuphine 5.5 mg (0.1 mg/kg) was administered slowly. Within 5 minutes, the pain score decreased to NRS 1, and surgery continued without interruption. Haemodynamic parameters remained stable throughout the procedure, and no respiratory depression, nausea, vomiting, or pruritus occurred. The Ramsay Sedation Score was 2. The first postoperative analgesic requirement occurred approximately 6 hours after surgery. Patient and surgeon satisfaction scores were both high.

Case 2

A 27-year-old woman (50 kg, 150 cm; BMI 22.2 kg/m²; ASA I) underwent laparoscopic appendicectomy under segmental spinal anaesthesia. Pneumoperitoneum was maintained at ≤12 mmHg.

During bowel manipulation, she developed moderate visceral pain (NRS 4). Intravenous nalbuphine 5 mg (0.1 mg/kg) was administered, resulting in rapid improvement to NRS 1 within 5 minutes. No additional analgesic or conversion to general anaesthesia was required. The intraoperative course remained haemodynamically stable without opioid-related adverse effects. Both patient and surgeon reported excellent satisfaction.

Case 3

A 29-year-old woman (60 kg, 152 cm; BMI 26.0 kg/m²; ASA I) with an ectopic pregnancy underwent

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laparoscopic management under segmental spinal anaesthesia.

During manipulation of the adnexa, the patient experienced visceral pain (NRS 4). Intravenous nalbuphine 6 mg (0.1 mg/kg) was administered, resulting in rapid pain relief to NRS 1 within 5 minutes. Surgery was completed successfully without the need for conversion to general anaesthesia. No adverse events were recorded, and postoperative recovery was uneventful.

Case 4

A 55-year-old man (70 kg, 156 cm; BMI 28.8 kg/m²; ASA I) underwent elective laparoscopic cholecystectomy.

Despite an adequate sensory block and low-pressure pneumoperitoneum, severe visceral pain (NRS 8) developed during gallbladder traction. Intravenous nalbuphine 7 mg (0.1 mg/kg) was administered as rescue analgesia. Owing to persistent discomfort and anxiety, an additional 1 mg intravenous midazolam was administered. Pain improved to NRS 1, allowing successful completion of surgery without conversion to general anaesthesia. Haemodynamic stability was maintained throughout the procedure, and no postoperative respiratory complications occurred.

Case 5

A 20-year-old man (65 kg, 152 cm; BMI 28.1 kg/m²; ASA I) underwent laparoscopic appendicectomy under segmental spinal anaesthesia.

Moderate visceral pain (NRS 5) occurred during bowel manipulation. Intravenous nalbuphine 6.5 mg (0.1 mg/kg) resulted in rapid pain relief to NRS 1 within 5 minutes. No rescue anaesthetic technique or conversion to general anaesthesia was required. The postoperative period was uneventful, with satisfactory analgesia and high patient satisfaction.

Case 6

A 31-year-old man (85 kg, 165 cm; BMI 31.2 kg/m²; ASA I) underwent bilateral laparoscopic varicocelectomy under segmental spinal anaesthesia.

During dissection and visceral traction, he experienced intraoperative visceral pain (NRS 5). Intravenous nalbuphine 8.5 mg (0.1 mg/kg) was administered, producing complete pain relief (NRS 0) within 5 minutes. Surgery was completed without conversion to general anaesthesia or significant adverse events. Both patient and surgeon expressed excellent satisfaction with the anaesthetic technique.

Results

A total of six consecutive adult patients underwent laparoscopic surgery under segmental spinal anaesthesia during the study period (May–July 2026). The study included three females and three males with a mean age of 33.3 ± 12.5 years and a mean BMI of 25.2 ± 3.5 kg/m².

The procedures included laparoscopic cholecystectomy (n = 2), laparoscopic appendicectomy (n = 2), laparoscopic management of ectopic pregnancy (n = 1), and bilateral laparoscopic varicocelectomy (n = 1). Carbon dioxide pneumoperitoneum was maintained at an intra-abdominal pressure of ≤12 mmHg in all cases.

All patients developed intraoperative visceral pain despite an adequate neuraxial block. The median peak intraoperative NRS score before nalbuphine administration was 5 (range 4–8). Following intravenous nalbuphine (0.1 mg/kg), pain scores decreased to NRS 0–1 within 5 minutes in every patient.

No patient required conversion to general anaesthesia. Haemodynamic variables remained stable throughout the procedures, and no episodes of respiratory depression, oxygen desaturation, excessive sedation, nausea, vomiting, pruritus, or urinary retention were observed. One patient with severe visceral pain (Case 4) received an additional 1 mg intravenous midazolam for anxiolysis, after which surgery proceeded uneventfully.

The median Ramsay Sedation Score was 2, with one patient achieving a score of 3 following additional midazolam. The mean time to first postoperative analgesic request was approximately 5.7 hours. Patient and surgeon satisfaction scores were high across all six cases.

Discussion

This prospective case series demonstrates that intravenous nalbuphine (0.1 mg/kg) provided

rapid and effective rescue analgesia for intraoperative visceral pain during laparoscopic surgery performed under segmental spinal anaesthesia. All six patients experienced clinically significant pain relief within

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five minutes of nalbuphine administration, none required conversion to general anaesthesia, and no major opioid-related adverse effects were observed.

Laparoscopic surgery has traditionally been performed under general anaesthesia because carbon dioxide pneumoperitoneum, peritoneal stretching, and visceral traction frequently produce discomfort that may not be completely abolished by neuraxial blockade. However, increasing interest in opioid-sparing anaesthesia and enhanced recovery pathways has led to renewed use of segmental spinal anaesthesia for selected laparoscopic procedures. The principal limitation of this technique remains intraoperative visceral pain.

In our series, pneumoperitoneum was maintained at ≤12 mmHg in all patients, consistent with low-pressure laparoscopic practice. Despite this, all patients developed visceral pain during traction or manipulation of intra-abdominal viscera. This observation suggests that visceral pain is multifactorial and cannot be prevented solely by reducing intra-abdominal pressure. Peritoneal stretch, mesenteric traction, and organ manipulation likely contribute significantly to pain generation even when a satisfactory somatic block has been achieved.

Nalbuphine[4, 5,6]possesses a unique pharmacological profile as a κ-opioid receptor agonist and μ-opioid receptor antagonist. Activation of κ-receptors provides effective visceral analgesia[7], while μ-receptor antagonism limits respiratory depression and reduces the incidence of pruritus compared with pure μ-opioid agonists. These characteristics make nalbuphine an attractive rescue analgesic for patients undergoing laparoscopic surgery under neuraxial anaesthesia.

A notable finding in this series was the rapid reduction in pain scores to NRS 0–1 within five minutes after intravenous nalbuphine in every patient. Haemodynamic stability was maintained throughout the procedures, and no patient required conversion to general anaesthesia. One patient with severe pain (NRS 8) received an additional 1 mg of intravenous midazolam for anxiolysis after nalbuphine. The surgery was completed successfully without further intervention, indicating that while nalbuphine was effective in all cases, selected patients with severe discomfort may benefit from carefully titrated adjunctive sedation.

No episodes of respiratory depression, oxygen desaturation, clinically significant hypotension, bradycardia, postoperative nausea and vomiting, or pruritus were observed. These findings are consistent with the known safety profile of nalbuphine and support its use in carefully monitored patients undergoing laparoscopic surgery under regional anaesthesia.

The high patient and surgeon satisfaction observed in this series reflects the ability to continue surgery without conversion to general anaesthesia while maintaining adequate comfort and favourable operating conditions. Although encouraging, these observations should be interpreted cautiously because of the small sample size and the descriptive nature of this study.

Limitations

This study has several limitations. The sample size was small, there was no control group, and only ASA I patients were included. Different laparoscopic procedures were represented, which may have different pain characteristics. Consequently, these findings should be regarded as hypothesis-generating rather than definitive. Larger prospective comparative studies are required to determine the optimal role of intravenous nalbuphine in this clinical setting.

Conclusion

Intravenous nalbuphine at a dose of 0.1 mg/kg provided rapid, effective, and well-tolerated rescue analgesia for intraoperative visceral pain during laparoscopic surgery performed under segmental spinal anaesthesia. In this six-patient prospective case series, nalbuphine was associated with prompt pain relief, maintenance of haemodynamic stability, avoidance of conversion to general anaesthesia, and high patient and surgeon satisfaction. These preliminary findings support further evaluation in larger controlled studies.

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