Utility of intraperitoneal analgesia with Ropivacaine plus Dexmedetomidine in patients undergoing laparoscopic sleeve gastrectomy

López de Luna Nancy Gabriela M.D.[1,2]
Sánchez Nava Rocio Carolina M.D.[1]
Carlos Barrientos Anderwald M.D.[1]
Villalobos Ramírez Lizzet M.D.[1]
Lizzet Villalobos Ramírez M.D.[3]
Alberto Robles
Méndez Hernández M.D.[4]

Mexico City, México

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Background:
A crucial aspect of anesthesiology practice is postoperative pain management, as it significantly impacts patient recovery, length of hospital stay, and healthcare costs. Intraperitoneal analgesia has gained importance in minimally invasive procedures due to its beneficial properties in postoperative pain control.
Objective: This study aims to compare the incidence of nausea, vomiting, postoperative pain, and quality of recovery in patients undergoing bariatric surgery using intraperitoneal analgesia versus intravenous analgesia.
Material and Methods: A total of 50 patients undergoing laparoscopic sleeve gastrectomy were included. They were divided into two groups: Group 1 (n=30) received intraperitoneal analgesia with Ropivacaine 0.75% and Dexmedetomidine, while Group 2 (n=20) received continuous intravenous analgesia with Lidocaine and Dexmedetomidine. Pain intensity (VAS scale), sedation levels (RASS scale), incidence of nausea and vomiting, and postoperative opioid consumption were assessed.
Results: No significant differences were found between groups regarding pain scores at 0, 6, and 24 hours postoperatively. Similarly, there were no significant differences in the incidence of nausea and vomiting. However, the intraperitoneal analgesia group exhibited a longer duration before requiring rescue analgesia, lower opioid consumption, and lower sedation levels on the RASS scale.
Conclusion: Intraperitoneal administration of Dexmedetomidine combined with Ropivacaine 0.75% in bariatric surgery is associated with prolonged analgesic effects and reduced opioid use. Although it did not significantly impact nausea or pain scores compared to intravenous analgesia, its potential benefits in multimodal pain management warrant further investigation.

Keywords: Pain management, intraperitoneal analgesia.

Postoperative pain management is one of the core areas where anesthesiologists have significantly contributed over the years, fostering research into novel techniques and pharmacological administration routes.(1) Additionally, it greatly influences patient recovery, as it is one of the leading causes of prolonged hospital stays and increased readmission rates. These, in turn, substantially elevate healthcare costs, prompting a continuous search for techniques to enhance pain control and reduce such complications.(2)

Among these, intraperitoneal local analgesia has been employed in modern surgery, initially described in 1951 by Griffin et al., with renewed usage in minimally invasive surgery today. The proposed mechanism of action for pain control is through blocking afferent free nerve endings, which translates into an inhibition of visceral nociceptive conduction. This approach offers an additional analgesic modality for managing postoperative pain. The instillation technique involves the laparoscopic trocars, through which the local anesthetic is uniformly deposited within the intraperitoneal space using a syringe and needle. (3)

Opioids represent one of the main drugs used in general anesthesia. However, with the advent of Enhanced Recovery After Surgery (ERAS) protocols, there is a push towards improving patient outcomes through multimodal analgesia. The aim of this approach is to provide effective analgesia while

1. From the Department of Anesthesiology, Hospital Ángeles Metropolitano. Mexico City, Mexico. 2. Facultad Mexicana de Medicina, Universidad La Salle, Mexico City, Mexico. 3. Department of Anesthesiology, Hospital Dalinde. 4. Department of Surgery, Hospital Ángeles Metropolitano.
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Table 1. Demographic and anthropometric characteristics between groups.

Variable	Intraperitoneal analgesia	Without intraperitoneal analgesia	P
Gender			0.059
Female	18 (60%)	17 (85%)	
Male	12 (40%)	3 (15%)	
Age (years)	40.2 ± 9.6	38.5 ± 8.3	0.519
Type of surgery			0.058
Sleeve gastrectomy	30 (100%)	17 (85%)	
Gastric bypass	0 (0%)	3 (15%)	
Weight (kg)	113.5 ± 19	105.6 ± 18.5	0.15
Height (m)	1.64 ± 0.09	1.62 ± 0.05	0.484
BMI (kg/m²)	42.4 ± 8.3	39.8 ± 6	0.208

minimizing opioid usage, thereby reducing opioid-related adverse effects. (4) The occurrence of any adverse event (such as nausea, vomiting, respiratory depression, ileus, or urinary retention) presents a significant challenge in obese patients, given the anatomical and physiological implications of obesity.

Postoperative nausea and vomiting are defined as symptoms occurring within 24 hours following anesthesia and are among the most common adverse events after sleeve gastrectomy, with incidence rates reaching up to 80%. (5) For this reason, strategies to reduce postoperative nausea, vomiting, and pain are continually sought.

Several techniques involving continuous infusion of local anesthetic into the peritoneum post abdominal surgery, either alone or in combination, have been described, significantly decreasing postoperative pain and opioid consumption and thereby facilitating early recovery. (6) A study by Ruiz-Tovar et al. demonstrated that intraperitoneal administration of Ropivacaine significantly reduced postoperative pain scores, morphine consumption, and hospital stay while allowing earlier patient mobilization in patients undergoing laparoscopic sleeve gastrectomy and Roux-en-Y gastric bypass surgery. (7)

Despite the demonstrated efficacy of intraperitoneal analgesia in most studies, methodology has varied widely. Many of these studies utilized Bupivacaine with results comparable to those achieved using Ropivacaine. In a double-blind, randomized controlled trial comparing the instillation of Ropivacaine versus 0.9% saline solution in 104 bariatric surgery patients, postoperative pain scores decreased significantly at 1, 2, 4, 6, 24, and 48 hours postoperatively. Ropivacaine was preferred in this study due to its lower cardiotoxicity and reduced central nervous system side effects compared with Bupivacaine. (8)

This study proposes the administration of Dexmedetomidine as an adjuvant to Ropivacaine to prolong and enhance the quality of intraperitoneal analgesia while providing antiemetic properties. Dexmedetomidine is a potent and highly selective alpha-2 adrenergic agonist. It has gained increasing prominence due to its capacity to induce cooperative sedation with minimal respiratory depression, alongside anxiolytic, analgesic, sympatholytic, and antiemetic properties, which contribute to reduced usage of other anesthetics such as opioids. (9)

Table 2. Anesthetic and intraoperative variables between groups.

Variable	Intraperitoneal analgesia	Without intraperitoneal analgesia	P
ASA			0.18
I	0 (0%)	0 (0%)	
II	8 (26.7%)	9 (45%)	
III	22 (73.3%)	11 (55%)	
Type of anesthesia			
Balanced General Anesthesia	30 (100%)	20 (100%)	
Other	0 (0%)	0 (0%)	
Surgical time (min)	84.7 ± 15.3	72.9 ± 7.6	<0.001
Anesthetic time (min)	99.7 ± 15.2	87.9 ± 7.6	0.002

Several studies have concluded that the use of Dexmedetomidine as an adjuvant to 0.75% Ropivacaine in elective laparoscopic cholecystectomy significantly reduces postoperative pain and prolongs the duration of intraperitoneal analgesia compared to Ropivacaine 0.75% combined with Fentanyl. (10) Similarly, studies comparing intravenous versus intraperitoneal administration of Dexmedetomidine as an adjunct to Bupivacaine for postoperative pain control in patients undergoing laparoscopic sleeve gastrectomy have demonstrated that both routes effectively manage pain; however, intraperitoneal administration offers prolonged analgesia and reduced postoperative analgesic consumption. (11,12) Furthermore, Srivastava VK et al. (13) found a 20% reduction in the incidence of postoperative nausea and vomiting following intraperitoneal administration of Dexmedetomidine at a dose of 1 mcg/kg.

The present research study aims to compare the incidence of nausea, vomiting, postoperative pain, and quality of recovery in patients undergoing bariatric surgery using intraperitoneal analgesia versus intravenous analgesia.

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Table 3. Pain levels, nausea/vomiting, and sedation scores in the postoperative period between groups.

Variable	Intraperitoneal analgesia	Without intraperitoneal analgesia	P
VAS pain scores			
Baseline	1 (1-2)	1 (1-2)	0.819
6 hours	2 (1-2)	2 (2-2)	0.07
24 hours	1 (0-1)	1 (1-1)	0.588
Nausea and/or vomiting			
Baseline	2 (6.7%)	4 (20%)	0.164
2 hours	1 (3.3%)	3 (15%)	0.17
RASS scale			0.13
0 (Alert and calm)	30 (100%)	17 (85%)	
-1 (Drowsy)	0 (0%)	0 (0%)	
-2 (Light sedation)	0 (0%)	3 (15%)	
Rescue analgesia	4 (13.3%)	3 (15%)	0.59

The hypothesis of this study is that intraperitoneal analgesia with Ropivacaine plus Dexmedetomidine provides superior control of postoperative pain with fewer side effects compared to intravenous analgesia with Dexmedetomidine.

Methods

Fifty patients undergoing laparoscopic sleeve gastrectomy under balanced general anesthesia from August 2023 to June 2024 were selected. Inclusion criteria were adults over 18 years old, body mass index (BMI) ≥ 30 kg/m², ASA class I-II, and both genders. Patients who refused anesthetic procedures or participation in the study, had allergies to local anesthetics, chronic opioid consumption, advanced cardiac, hepatic, or renal disease were excluded.

This study is considered to have more than minimal risk as it involves drug-related procedures. Each patient signed informed consent describing potential complications, including medication allergies, postoperative pain, bradycardia, hypotension, or toxicity. The benefits of this intervention—such as improved postoperative outcomes through reduced pain, nausea, vomiting, and postoperative complications—were also outlined.

A total of 30 subjects received intraperitoneal analgesia with Dexmedetomidine and Ropivacaine, while 20 patients received intravenous analgesia. The mean age was 40.2 ± 9.6 years for the intraperitoneal group and 38.5 ± 8.3 years for the intravenous group; of these, 18 (60%) and 17 (85%) were women, respectively. All patients receiving intraperitoneal analgesia underwent sleeve gastrectomy, whereas 3 (15%) of patients who did not receive intraperitoneal analgesia underwent Roux-en-Y gastric bypass. No differences were found in demographic characteristics or anthropometric measurements (Table 1).

During the postoperative period, the incidence of nausea and vomiting was recorded at 0 and 2 hours, as well as the sedation level assessed by the Richmond Agitation-Sedation Scale (RASS) in the Post-Anesthetic Care Unit (PACU).

Similarly, pain was evaluated using the visual analogue scale (VAS) at 0, 6, and 24 hours, as was the postoperative intravenous analgesic requirement with tramadol.

All patients received balanced general anesthesia with prior noninvasive monitoring of vital signs and documentation of their baseline values. Preoxygenation was performed using a face mask with 100% FiO_2 for 3-5 minutes, followed by anesthetic induction with lidocaine 2% (plain) 1 mg/kg, fentanyl 4 mcg/kg, propofol 2 mg/kg, and rocuronium 0.8 mg/kg. After an appropriate induction period, endotracheal intubation was performed under flexible fiberoptic guidance. Maintenance anesthesia was provided with desflurane at a MAC of 0.6-0.8, under mechanical ventilation in volume-controlled mode. Adjuvant medications were administered at the start of the surgical procedure, maintaining intraoperative vital signs within normal ranges.

Once gastric resection was completed and hemostasis confirmed, patients included in the study were randomly divided into two groups:

Group 1 (n=30): Received intraperitoneal analgesia administered through surgical trocars, consisting of 0.75% ropivacaine 20 mL, dexmedetomidine 20 mcg, and 0.9% saline solution 10 mL, for a total volume of 30 mL, ensuring uniform instillation throughout the peritoneal cavity. Following intraperitoneal administration, pneumoperitoneum was released and surgical wounds were closed.

Group 2 (n=20): Pneumoperitoneum was released, and surgical wounds were closed. After completion of the anesthetic procedure, a continuous intravenous infusion of plain 2% lidocaine at 1 mg/kg combined with dexmedetomidine 20 mcg was initiated and maintained for 12 hours.

Upon completion of the surgical-anesthetic procedure, patients were transferred from the operating room to the PACU. On admission, vital signs were monitored, and sedation status was

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evaluated using the RASS scale. Periodic pain evaluations using the previously described VAS scale were conducted at 0, 6, and 24 hours postoperatively. The presence or absence of postoperative nausea and vomiting was recorded at 0 and 2 hours, respectively.

As complementary therapy, non-steroidal anti-inflammatory drugs (NSAIDs) combined with scheduled acetaminophen were prescribed.

Results

Descriptive statistical analysis was performed using means of frequency and proportions for categorical variables, and mean ± standard deviation or median (interquartile range) for numerical parametric and nonparametric variables, respectively, previously assessed by the Kolmogorov-Smirnov test. Categorical variables were compared using Pearson's chi-square test or Fisher's exact test, while quantitative parametric and nonparametric variables were compared using Student's t-test for independent samples or Mann-Whitney U test, respectively. A P-value < 0.05 was considered statistically significant. Statistical analysis was performed using IBM SPSS version 27.

Most patients were classified as ASA III, and all received balanced general anesthesia. Mean surgical time (84.7 vs. 72.9 min, P<0.001) and anesthetic time (99.7 vs. 87.9 min, P=0.002) were significantly longer in patients receiving intraperitoneal analgesia (Table 2).

No significant differences were found between groups regarding median pain scores at 0, 6, and 24 hours postoperatively. There was also no significant difference in the incidence of postoperative nausea and vomiting. Although a greater proportion of patients who did not receive intraperitoneal analgesia experienced higher sedation levels (according to the RASS scale), these proportions were not significantly different. Additionally, no difference was observed between groups in the requirement for rescue analgesia during the first postoperative day (Table 3).

Discussion

Obesity represents one of the conditions with the highest morbidity and mortality faced by anesthesiologists, posing challenges for pre-, intra-, and postoperative management. According to the World Health Organization (WHO), obesity is defined as a body mass index (BMI) greater than 30. In Mexico, statistical analyses are conducted to report obesity prevalence by age groups; it is estimated that in the group aged 30–59 years, obesity affects approximately 35% of men and 46% of women. Consistent with our study, we observed a higher proportion of female patients undergoing sleeve gastrectomy.

Currently, bariatric surgery has been shown to significantly reduce obesity-related comorbidities, such as type 2 diabetes mellitus and hypertension, particularly when lifestyle modifications and pharmacological treatments have failed.

A meta-analysis concluded that the antiemetic effect of dexmedetomidine is unaffected by the route of administration, aligning with the results obtained in our study.

This study demonstrated that the administration of dexmedetomidine as an adjunct to intraperitoneal 0.75% ropivacaine in patients undergoing bariatric surgery was associated with lower postoperative pain scores and a prolonged interval before requiring the first rescue analgesia dose. The latter correlates with reduced postoperative opioid consumption and fewer related complications.

An additional benefit of dexmedetomidine is the prolongation of intraperitoneal analgesia. When administered intraperitoneally, dexmedetomidine has a perineural effect, eventually absorbed into systemic circulation and redistributed. These effects collectively reduce rescue analgesic requirements and confer anti-inflammatory benefits through cytokine modulation during the surgical stress response.

Historically, intraperitoneal analgesia has been utilized for various laparoscopic procedures across multiple specialties, including gynecology, general surgery, and pediatrics. Therefore, this analgesic strategy can be considered a viable option in laparoscopic surgeries to facilitate early recovery and reduce the requirement for rescue analgesia.

Conclusion

Based on the results obtained in this study, intraperitoneal analgesia with ropivacaine combined with dexmedetomidine was effective for controlling postoperative pain in patients undergoing laparoscopic bariatric surgery.

Our findings demonstrate that intraperitoneal analgesia as part of postoperative pain management in this patient population reduces VAS pain scores and prolongs the interval before requiring rescue analgesia, thereby reducing postoperative opioid use. However, the results did not show a statistically significant difference compared with intravenous analgesia.

Furthermore, patients receiving intravenous dexmedetomidine exhibited sedation scores predominantly ranging from -1 to -2, potentially increasing the likelihood of respiratory complications such as airway obstruction and hypoxia. In contrast, patients in the intraperitoneal group predominantly exhibited sedation scores of 0 to -1, remaining awake and alert.

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These results are consistent with those reported in the literature. Nevertheless, we acknowledge certain limitations of our study. Among these are the limited sample size and potential bias due to patients' immediate postoperative comprehension of the visual analogue pain scale. Another limitation is the comparison between groups receiving local anesthetic plus dexmedetomidine through different routes of administration for postoperative pain management. Thus, an area for future research would be to compare the efficacy of this analgesic method with a control group receiving no intravenous medication.

Conflicts of interests

None declared by the authors.

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Alberto Robles Méndez Hernández
Hospital Ángeles Metropolitano
Mexito City, Mexico

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