Intraperitoneal analgesia versus intravenous analgesia with local anesthetic and dexmedetomidine for postoperative pain control in bariatric surgery

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Background:
Introduction: Laparoscopic surgery has become increasingly popular for general and bariatric procedures due to its advantages, yet postoperative pain management remains a challenge. This study aimed to evaluate the effectiveness of intraperitoneal anesthesia with dexmedetomidine for postoperative pain control in laparoscopic bariatric surgery, comparing it to intravenous administration.
Methodology: A randomized, prospective, blind clinical trial was conducted with adult patients scheduled for bariatric surgery. Participants were randomly assigned to receive either intraperitoneal or intravenous analgesia at the end of the surgery. Demographic data, surgical and anesthetic times were recorded, and postoperative pain was assessed using the Visual Analog Scale (VAS). Paracetamol and parecoxib were administered as standard treatment, and tramadol rescue requirements were recorded.
Results: The study found that intraperitoneal analgesia resulted in longer surgical and anesthetic durations compared to intravenous administration. No significant differences in pain perception were found between the groups, with most patients reporting mild pain. The need for pain management rescues was low and not significantly different between groups. Conclusion: These findings suggest that both intraperitoneal and intravenous analgesia are effective for postoperative pain control in laparoscopic bariatric surgery. Intraperitoneal administration of local anesthetic with dexmedetomidine may be a viable option to minimize opioid use and associated adverse effects in these procedures.

KEYWORDS: Bariatric surgery, intraperitoneal analgesia, intravenous analgesia, postoperative pain.

Laparoscopic surgery has become the preferred method for conducting many general and bariatric procedures[1]. Managing postoperative pain following laparoscopic surgeries remains a significant challenge. Despite being a minimally invasive procedure with various advantages over open surgery, many patients experience moderate to intense pain levels during the initial stages of the postoperative period. This frequently occurring pain peaks in the first hours after the procedure and can lead to other postoperative complications[2]. Previous studies suggest that the etiology of postoperative pain in patients undergoing laparoscopic surgery is typically multifactorial, generally consisting of visceral pain, parietal pain from diaphragm trauma, abdominal cavity distension, peritoneum pain, and incision pain[3]. Various techniques have been used to alleviate postoperative pain and manage post-laparoscopic surgery pain. However, the need for postoperative opioids is common, despite their many associated adverse effects. It has been demonstrated that the intraperitoneal administration of local anesthetics alone or in combination with opioids or α2 agonists such as dexmedetomidine minimizes postoperative pain following laparoscopic surgeries[4,5]. Local anesthetic agents provide antinociception by affecting nerve membrane-associated proteins and inhibiting the release and action of prostaglandins, which stimulate nociceptors and cause inflammation[2]. α2-adrenergic agonists have been increasingly used for their sympatholytic, sedative, anesthesia-sparing, and hemodynamic stabilizing properties. Dexmedetomidine is a highly selective α2 adrenergic receptor agonist with sedative and analgesic properties and lacks a respiratory depressant effect[6]. Thus, the aim of this research is to determine the analgesic efficacy of intraperitoneal versus intravenous administration of local anesthetic with dexmedetomidine in controlling postoperative pain in laparoscopic bariatric surgery.

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Variables		Group IV n= 21	Group IP n= 17	*p*
Age in years media (±SD)		36.14 (±10.96)	41.18 (±10.96)	.168
Sex	**Femenine** n (%)	18 (85.72%)	11 (64.70%)	.129
	Masculine n (%)	3 (14.28%)	6 (35.30%)	
Initial weight in kg med (±SD)		109.71 (19.76)	120.45 (21.71)	.120
Initial BMI (kg/m²) med (±SD)		41.16 (6.00)	46.69 (9.33)	**.044**
ASA	**Score 2** n (%)	8 (38.10%)	5 (29.42%)	.416
	Score 3 n (%)	13 (61.90%)	12 (70.58%)	
Surgical time (min) med (RIC)		72.00 (68.00-81.50)	76.00 (71.00-86.00)	.330
Anesthesia time (min) med (RIC)		87.00 (83.00-96.50)	91.00 (87.00-101.00)	.282
Type of Surgery	**Sleeve** n (%)	17 (81.00%)	15 (88.20%)	.440
	Bypass n (%)	4 (19.00%)	2 (11.80%)	

Table 1. Demographic characteristics and perioperative data. *IV: intravenous analgesia; IP: intraperitoneal analgesia; med: median; IQR: interquartile range.*

Methods

This is a randomized, prospective, blind clinical trial. Included were patients admitted to the operating area for elective surgery, scheduled for bariatric surgery under general anesthesia, with the following inclusion criteria: adult patients (over 18 years of age), both sexes (male and female), ASA 1-3, body mass index (BMI) greater than or equal to 30 kg/m^2. Excluded were patients with any mental or psychiatric disorder, pediatric patients (under 18 years), patients with ASA 4 or patients undergoing combined anesthesia (general anesthesia with neuroaxial), allergy to local anesthetic, habitual opioid use, patients with echocardiographic evidence of severe cardiac disease, patients who did not sign informed consent for anesthesia, and patients who refused to participate in the study. All patients were transferred to the operating room without premedication. Upon arrival, electrocardiogram monitoring, non-invasive blood pressure, oxygen saturation (SpO2) were initiated, and initial values were recorded. Preoxygenation with 100% oxygen (O2) was performed for 3 minutes. Anesthetic induction was carried out with fentanyl 3mcg/kg, lidocaine 1mg/kg, Propofol 1.5mg/kg, rocuronium 0.6mg/kg, and orotracheal intubation was performed using fibroscopy. Maintenance was conducted with volume-controlled mechanical ventilation, with parameters to maintain normocapnia and adequate oxygen saturation, desflurane MAC 0.5-0.8, fluids as required by the patient.

At the start of the anesthetic procedure, surgical and anesthetic times, as well as adjuvants for each patient, were recorded. Upon conclusion of the surgical event, patients were randomly assigned to two different groups. In these groups, postoperative intraperitoneal or intravenous analgesia was administered according to their respective assignments.

Group 1: At the end of the surgical procedure, a dose of ropivacaine 150mg (20ml) + dexmedetomidine 20mcg + 10ml of saline solution was administered via laparoscopic surgery trocars.

Group 2: At the end of the surgical procedure, intravenous analgesia with lidocaine .2% 1.5mg/kg + dexmedetomidine 20mcg diluted in 100ml of saline solution for 12 hours was initiated.

After surgery, trocar wounds in all patients were infiltrated with ropivacaine .75% (10ml in total from all ports).

Once the surgical procedure was completed, the neuromuscular blocker was reversed with sugammadex 2mg/kg in all patients, and they were extubated without complications.

Patients were then transferred to the post-anesthesia recovery area, where non-invasive monitoring of blood pressure, heart rate, and oxygen saturation began, and they were subsequently moved to the ward.

In the post-anesthetic care unit and on the ward, postoperative pain of the study patients was monitored according to the Visual Analog Scale for Pain (VAS) at 0-2-6-12-24 hours after the surgical event, assessing the presence and intensity of pain, taking into account postoperative analgesia and the presence or absence of adverse effects. Likewise, the need for rescue with 100mg intravenous tramadol after the surgical event was recorded in case of VAS >5.

Both groups were administered scheduled paracetamol 1gr every 8hrs and parecoxib 40mg every 12hrs during the first 24 hrs postoperatively.

Out of a total of 40 patients, 2 were excluded due to BMI.

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Time (hours)	Group IV n= 21	Group IP n= 17	*p*
	M ± DE	M ± DE	
0 hrs	1.33 ± 1.27	1.47 ± 1.23	.740
4 hrs	2.05 ± .805	2.35 ± 1.27	.374
6 hrs	1.62 ± .590	1.71 ± .686	.677
12 hrs	.81 ± .68	.88 ± .78	.760
24 hrs	.95 ± .74	1.00 ± .70	.842

Table 2. Pain scores according to the VAS (Visual Analog Scale for pain)

Statistical analysis was performed using SPSS version 21.0. Quantitative variables were presented using mean and standard deviation (SD) or median and interquartile range (IQR), based on the assumption of normality. Qualitative data were expressed using absolute frequencies and percentages. For the comparison between groups in quantitative variables, the Student's t-test for independent samples was used, while for categorical variables, the Chi-square test was chosen with a p-value ≤0.05 considered statistically significant.

Results

A total sample of 38 participants was obtained with an average age of 38.39 ±11.10, of which 29 (76.3%) were women and 9 (23.7%) men. These were randomly assigned to 2 groups: the IV group corresponds to intravenous analgesia (21 participants) and the IP group to intraperitoneal analgesia (17 participants).

Regarding the comparison by analgesia group (Table 1), it was found that for the ASA score (American Society of Anesthesiologists' risk classification), participants were only found in scores 2 and 3, where, for the IV group: there were 8 and 13 participants, while for the IP group: there were 5 and 12, respectively. IP analgesia had a longer surgical duration compared to IV; similarly with the anesthetic time.

As shown in Table 2, across all analyzed time intervals (0, 4, 6, 12, and 24 hours), the IP group reported a higher perception of pain compared to the IV group; however, no significant differences were found between the groups.

Only 3 rescues for pain management were implemented during the first 24 hours (with 1 rescue for the IV group and 2 for the IP group). No statistically significant differences were found (Table 3).

Rescue	Group IV n= 21	Group IP n= 17	*p*
Presence f (%)	1 (4,76%)	2 (11,76)	.419
Abscence f (%)	20 (95,24%)	15 (88,23%)	

Table 3. Rescues for pain management in the first 24 hours

Discussion

The International Federation for the Surgery of Obesity and Metabolic Disorders (IFSO) compiled information on bariatric surgeries reported globally. In that report, demographic data were investigated, recording that most patients undergoing bariatric

surgeries are middle-aged women[7]. These results are consistent with those obtained in the current research.

Furthermore, in the same IFSO report^8, it was established that the average BMI before surgery in the Mexican population was around 45 kg/m^2, indicating grade III obesity. Gibson et al. conducted a study comparing body adiposity index (BAI) with BMI in women with obesity before and after gastric bypass surgery, finding that the average BMI before and after the surgical procedure was 46.5 and 40.2 kg/m^2, respectively[8]. In the present research, the average BMI prior to surgery is similar to those previously mentioned studies, with an average of 41.16 kg/m^2 for the IV group and 46.69 kg/m^2 for the IP group.

Globally, the most popular bariatric surgery is the gastric sleeve, followed by gastric bypass, and in third place, the gastric band[7]. These statistics present a pattern similar to that established by reports from the Mexican College of Surgery for Obesity and Metabolic Diseases, A.C. (CMCOEM)[9]. Likewise, the results obtained in the present research show that the majority of participants (81%) underwent gastric sleeve surgery, while a minority (19%) underwent gastric bypass.

As previously mentioned, dexmedetomidine has sedative and analgesic properties, however, literature demonstrates it also has additional benefits related to pain perception[10,11], inflammatory response[12], and on the hemodynamic response to pneumoperitoneum[13].

Various studies have assessed the analgesic efficacy of dexmedetomidine on pain perception, anesthetic time, and the number of rescues; however, most have been performed on cardiac surgeries[14,15] and cholecystectomies[16,17]. In the case of studies on cardiac surgeries, inconsistent results have been demonstrated, as they also integrate the search for effects of the drug on intensive care stay, serious complications, and mortality reduction[14,15]

Chilkoti et al. conducted a randomized double-blind study on adult patients undergoing laparoscopic cholecystectomy under general

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anesthesia. Aiming to determine the analgesic efficacy of dexmedetomidine administered intravenously (IV) and intraperitoneally (IP) (both at low doses), they found that the IV group had higher sedation scores compared to the IP group[11]. They also presented the average pain scores, finding that the IV and IP groups were comparable at various time points. As observed in the results of the present study, the pain averages between both groups are slightly different, with the IP group experiencing higher pain perception.

Conclusions

Regarding the anesthesiological risk classification (ASA), the majority of participants were at levels 2 and 3 in both groups, with no significant differences between them.

It was observed that surgical time and anesthetic time were longer in the IP group compared to the IV group. Most patients in both groups reported mild pain (less than 3 points on the VAS scale) at different time points (0, 4, 6, 12, and 24 hours). No statistically significant differences were found between the two groups in terms of pain perception.

A total of 3 pain management rescues were implemented during the first 24 hours, with a slight difference in frequency between the two groups, but without statistically significant differences. In this study, there is not enough evidence to assert that there are significant differences in surgical time and anesthetic time between the two compared groups.

Furthermore, it is suggested that the administration of dexmedetomidine, whether intravenously or intraperitoneally, does not seem to significantly influence pain perception in patients undergoing bariatric surgery at the postoperative times examined. However, it's important to consider that other factors, such as perioperative pain management and individual response to the drug, may influence pain perception and should be considered in future research.

Conflicts of interest

The authors have no conflicts of interest to declare.

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