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REVIEW ARTICLE

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Effects of dexmedetomidine and remifentanil on nutritional status in patients undergoing bariatric surgery: a systematic review

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Abstract

Introduction: In patients with obesity and mineral and vitamin deficiencies, the distribution of anesthetics occurs in the peripheral fat compartment, which is enlarged, delaying recovery from anesthesia. Based on this information, the choice of substances with faster recovery, lower production of active metabolites, and predictable elimination is recommended for anesthesia in bariatric surgery. **Objective:** This systematic review aimed to analyze the effects of dexmedetomidine and remifentanil on hemodynamics and renal function in patients undergoing bariatric surgery with vitamin and mineral deficiencies. **Methods:** The systematic review rules of the PRISMA Platform were followed. The search was carried out from September to October 2025 in the Scopus, PubMed, Science Direct, SciELO, and Google Scholar databases. The quality of the studies was assessed using the GRADE instrument, and the risk of bias was evaluated according to the Cochrane instrument. **Results and Conclusion:** 136 articles were found. A total of 52 articles were evaluated, and 31 were included in this systematic review. Considering the Cochrane risk of bias tool, the overall assessment resulted in 18 studies with high risk of bias and 25 studies that did not meet GRADE and AMSTAR-2. Most studies showed homogeneity in their results, with X^2=87.9% >50%. It was concluded that in obese patients with mineral and vitamin deficiencies, total intravenous anesthesia with opioid restriction using dexmedetomidine reduces postoperative nausea, pain score, and the need for antiemetics and analgesics in the immediate postoperative period after bariatric surgery compared to the use of remifentanil. Furthermore, the better recovery profile after laparoscopic sleeve gastrectomy supports the use of intraoperative dexmedetomidine infusion as an anesthetic adjuvant versus remifentanil for this patient profile.

Keywords: Obesity. Bariatric surgery. Dexmedetomidine. Remifentanil. Nutrition. Hemodynamics. Kidney function.

Introduction

In patients with obesity and mineral and vitamin deficiencies, the distribution of anesthetics occurs in the peripheral fat compartment, which is enlarged, delaying recovery from anesthesia **[1]**. Based on this information, it is recommended to choose substances with faster recovery, lower production of active metabolites, and predictable elimination for anesthesia in bariatric surgery **[2,3]**.

Following this principle, remifentanil, with its characteristic extrahepatic metabolism (plasma and tissue esterases), which ensures rapid recovery, even after prolonged infusion, and has an elimination half-life of 9 to 10 minutes, is well indicated for anesthesia in obese patients **[4-6]**. Breen et al. **[7]** studied the effect of remifentanil infused over 72 hours in patients with renal failure, admitted to an intensive care unit, with no increase in the incidence of adverse effects and prolonged pharmacodynamic effects of the drug.

Several techniques have been used in the anesthesia of morbidly obese patients with

micronutrient deficiencies. Continuous infusion of dexmedetomidine for anesthesia in obese patients has been successfully used since 2002. This drug is an alpha-2 agonist with high affinity for the receptor (1620:1) **[8]**, reduces blood pressure and heart rate, has analgesic, hypnotic, and sedative effects **[9]**, with the particularity of not causing respiratory depression, even at high doses **[10]**. Another advantage is its ability to exhibit synergism with most inhaled anesthetics **[11]** and opioids **[12]**, reducing the number of drugs in anesthesia.

Experimental studies show that this drug acts on renal function, reducing the release of antidiuretic hormone and, consequently, increasing diuresis **[9]**. Furthermore, results from a clinical study showed that this drug acts not only on the distal renal tubules, but also on the proximal portion of the nephron, improving renal performance in the postoperative period of patients undergoing thoracotomy **[12-14]**. Sudré et al. **[15]**, in a comparative study between dexmedetomidine and remifentanil, used as adjuvants to the anesthetic technique (general/epidural) in bariatric surgery, involving 92 morbidly obese patients, evaluated anesthetic recovery and postoperative analgesia. This study showed the superiority of the remifentanil group over dexmedetomidine in terms of anesthetic recovery and postoperative analgesia.

Considering that obese individuals with renal insufficiency and malnutrition may experience improvement in renal function after bariatric surgery and nutrient and vitamin supplementation, this study aimed to analyze, through a systematic review, the effects of dexmedetomidine and remifentanil on hemodynamics and renal function in patients undergoing bariatric surgery and with vitamin and mineral deficiencies.

Methods

Study Design

This study followed an international model for systematic review, adhering to the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) guidelines. Available at: http://www.prisma-statement.org/?AspxAutoDetectCookieSupport=1. Accessed on: November 9, 2025. The methodological quality standards of AMSTAR 2 (Assessing the methodological quality of systematic reviews) were also followed. Available at: https://amstar.ca/. Accessed on: November 9, 2025.

Research Strategy and Sources

The literature search process was conducted from September to October 2025 and developed using Scopus, PubMed, Science Direct, SciELO, and Google Scholar, encompassing scientific articles from various periods to the present day. The following health science descriptors (DeCS/MeSH Terms) were used: *"Obesity. Bariatric surgery. Dexmedetomidine. Remifentanil. Nutrition. Hemodynamics. Kidney function"*, and using the Boolean operator "and" between MeSH terms and "or" between historical findings.

Study Quality and Risk of Bias

Quality was classified as high, moderate, low, or very low regarding the risk of bias, clarity of comparisons, precision, and consistency of analyses. The most evident highlight was for systematic review articles or meta-analyses of randomized clinical trials, followed by randomized clinical trials. Low-quality evidence was attributed to case reports, editorials, and brief communications, according to the GRADE instrument. The risk of bias was analyzed according to the Cochrane instrument through the analysis of the Funnel Plot (Sample size versus Effect size), using Cohen's d test.

Results and Discussion

Summary of Findings

As a corollary to the literature search system, it was found A total of 136 articles were submitted for eligibility analysis, and subsequently, 31 studies were selected to compose the results of this systematic review. The listed studies presented medium to high quality (Figure 1), considering the level of scientific evidence of studies in study types such as meta-analysis, consensus, randomized clinical trials, prospective, and observational studies. Biases did not compromise the scientific basis of the studies. According to the GRADE instrument, most studies showed homogeneity in their results, with X^2=87.9%>50%. Considering the Cochrane tool for risk of bias, the overall assessment resulted in 18 studies with a high risk of bias and 25 studies that did not meet the GRADE and AMSTAR-2 criteria.

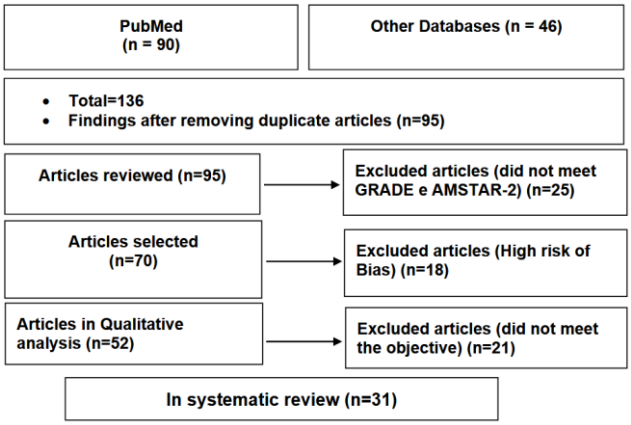

Figure 1. Flowchart showing the article selection process. Source: Own authorship.

Figure 2 presents the results of the risk of bias of the studies using the Funnel Plot, showing the calculation of the Effect Size (Magnitude of the difference) using Cohen's d test. Precision (sample size) was determined indirectly by the inverse of the standard error (1/Standard Error). This graph showed a symmetrical behavior, not suggesting a significant risk of bias, both between studies with small sample sizes (lower precision) shown at the bottom of the graph and in studies with large sample sizes shown at the top.

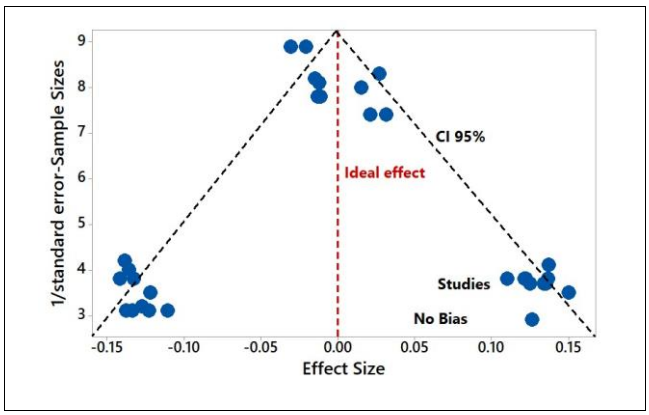

Figure 2. The symmetrical funnel plot does not suggest a risk of bias among the small sample size studies shown at the bottom of the graph. Studies with high confidence and high recommendation are shown above the graph (n=31 studies). Source: Own authorship.

Major Clinical Findings

Patients with obesity and nutritional deficiencies undergoing bariatric and metabolic surgery require personalized perioperative pain management. The authors Nair et al. (2025) **[16]** analyzed the analgesic efficacy and safety of two adjuvants used in general anesthesia, remifentanil and dexmedetomidine, in this patient population. 24-hour opioid consumption and recovery room pain scores were comparable between the two groups (mean difference (MD): 0.23; 95% CI: -1.42 to 1.89, p= 0.78; and MD: 0.04; 95% CI: -0.48 to 0.57, p=0.87, respectively). Postoperative nausea and vomiting were significantly lower in the dexmedetomidine group (OR: 2.55; 95% CI: 1.60 to 4.07, p< 0.0001), a finding confirmed by sequential analysis of clinical trials. Analgesic efficacy, measured by 24-hour opioid consumption and recovery room pain scores, appears comparable between remifentanil and dexmedetomidine. However, the incidence of postoperative nausea and vomiting was significantly lower in the dexmedetomidine group.

Patients with obesity with mineral and vitamin deficiencies undergoing bariatric and metabolic surgery have a high probability of respiratory depression and may require admission to an intensive care unit or semi-intensive care unit. The authors investigated the efficacy and safety of remifentanil in bariatric and metabolic surgery. The results neither support nor refute the use of remifentanil in patients undergoing bariatric and metabolic surgeries compared with other non-opioid medications such as dexmedetomidine **[17]**.

In general, after the analysis of clinical studies on the effects of dexmedetomidine and remifentanil on renal function in patients with nutritional deficiencies undergoing bariatric surgery, it was shown that with the use of remifentanil, from M0-control (before anesthetic induction) to M1 (after anesthetic induction) and from M1 to M2 (after surgical incision), there was a reduction in the average clearance values in all variables, indicating that the renal function of the obese patient had a physiological response compatible with the effect of anesthetic-surgical stress. With the use of dexmedetomidine, the mean sodium and osmolar clearance values increased from M0 to M1, suggesting better preservation of renal function in this phase of bariatric surgery. In addition, creatinine clearance at M1 and urine volume at M2 indicated better initial glomerular and distal tubular function in this group, respectively **[1-4]**.

A retrospective clinical study conducted by the authors Nam et al. 2022 **[18]** investigated whether total intravenous anesthesia with opioid restriction using dexmedetomidine as a substitute for remifentanil can reduce postoperative nausea and vomiting in bariatric surgery and in patients with mineral and vitamin deficiencies. Electronic medical records of adult patients undergoing laparoscopic bariatric surgery between January and December 2019 were reviewed. Patients were divided into two groups according to the agents used for anesthesia: Group D, propofol and dexmedetomidine; Group R, propofol and remifentanil. A total of 134 patients were included in the analyses. The frequency of postoperative nausea was significantly lower in Group D than in Group R up to 2 h after discharge from the post-anesthesia care unit (PACU) (p=0.005 in the PACU, p=0.010 2 h after PACU discharge), but failed to significantly reduce the high overall incidence rates of 60.5% and 65.5%, respectively (p=0.592). The postoperative pain score was significantly lower in Group D up to 6 h after PACU discharge. The rates of administration of rescue antiemetics and analgesics in the PACU were significantly lower in Group D than in Group R.

An observational clinical study evaluated the impact of intraoperative dexmedetomidine versus remifentanil on postoperative pain, as well as the improved recovery profile in patients scheduled for laparoscopic sleeve gastrectomy (LSG). A total of 40

adult patients with a body mass index (BMI) >35 kg/m2 were divided into two equal groups: dexmedetomidine group (D) and remifentanil group (R). In the post-anesthesia care unit (PACU) and for 24 hours in the ward, patients were assessed for pain scores and other recovery characteristics. In the PACU, the mean values of the numerical rating scale (NRS) were 4.26±1.97 vs. 4.15±1.9, and the median values of morphine consumption were 4 vs. 1 mg in groups D and R, respectively (p>0.05). The number of patients who developed tremors was 0 vs. 6 in groups D and R, respectively (p <0.05). The median values of the sedation and agitation scale (SAS) were 4 vs. 4 (p <0.05), the frequency of postoperative nausea and vomiting (PONV) was 1 vs. 6 (p >0.05) in groups D and R, respectively. The median values of length of hospital stay (LOS) were 1 vs. 1 day in groups D and R, respectively (p >0.05) **[19]**.

Regarding age range, according to Sharma et al. **[20]**, patients over 50 years of age have 5 times more risk of developing acute renal failure than young individuals, because, with advancing age, there is a decline in the glomerular filtration rate. Egan et al. **[21]** recommended the ideal weight for the use of remifentanil in obese patients. However, it is worth adding the practical ease of using the dose used of 0.1 µg.kg-1.min-1 (which was obtained after several simulations, when it was concluded that this dose is very close to that obtained by the ideal weight formulas). Furthermore, the use of dexmedetomidine was based on actual weight, and since this was a blinded study, remifentanil would also have to be used based on actual weight. Regarding dexmedetomidine, there are no pharmacokinetic studies in obese individuals using actual weight calculation based on pharmacodynamic effects.

In addition, poor patient positioning on the operating table, according to Lagandre et al. **[22]**, represents the cause of rhabdomyolysis in obese people, causing points of higher pressure and consequent cell damage with the release of intracellular content. Belleville et al. **[23]** found hyperglycemia after administration of dexmedetomidine in volunteers. Glycemia can be the result of the action of several stress-related hormones (adrenaline, norepinephrine, cortisol and others) and insulin. In this series, glycemia resulted from the ability of the anesthetics dexmedetomidine and remifentanil to block the stress response and from dexmedetomidine to inhibit insulin secretion in the pancreas. Fagerholm et al. **[24]** defined, in a study in rats, the role of the alpha 2a subtype in inhibiting insulin release by pancreatic β cells and the consequent hyperglycemia and the action of dexmedetomidine in this process.

Regarding plasma concentration of antidiuretic hormone (ADH), it is known that alpha2 agonist drugs promote increased diuresis **[25]**. This increase may be due to inhibition of ADH secretion **[26]** or decreased tubular action **[27]**. In experimental studies, alpha2 receptors have been identified in areas of the kidney **[28]**. Rouch et al. **[27]** identified prostaglandin E2 in rats as the second messenger in the mechanism responsible for ADH inhibition in the medullary collecting duct. The mechanisms related to ADH inhibition may be related to hemodynamic factors, such as increased blood pressure **[29]** and central venous pressure **[30]** or central blockade of supraoptic secretory cells **[31]**. Nascimento et al **[13]** observed in dogs that dexmedetomidine inhibited ADH secretion in a dose-dependent manner, suggesting direct central inhibition of the drug.

Also, intraoperative remifentanil is associated with increased postoperative analgesic needs and opioid consumption **[1]**. Dexmedetomidine has characteristics that suggest it may replace intraoperative remifentanil during general anesthesia, but the existing literature has reported conflicting results. Thus, a meta-analysis study was conducted to investigate whether general anesthesia, including dexmedetomidine, would result in less postoperative pain than general anesthesia, including remifentanil. Twenty-one randomized clinical trials, including 1309 patients, were identified. Pain scores at rest two hours postoperatively were lower in the dexmedetomidine group, with a mean difference (95% CI) of -0.7 (-1.2 to -0.2), I2 = 85%, p = 0.004 and moderate quality of evidence. Secondary pain outcomes were also significantly better in the dexmedetomidine group. Postoperative hypotension, tremor, and nausea and vomiting rates were at least twice as frequent in patients who received remifentanil. The time to request analgesia was longer, and the use of postoperative morphine and rescue analgesia was lower with dexmedetomidine, while bradycardia episodes were similar between the groups. There is moderate evidence that intraoperative dexmedetomidine during general anesthesia improves pain outcomes during the first 24 hours after surgery when compared to remifentanil, with fewer side effects **[2]**.

Before analyzing the results obtained in the clearances, it should be noted that obesity acts on the kidney in a way that conserves water and sodium, with an increase in circulating plasma volume at the expense of renal water retention. In the pathophysiology of obesity-related glomerulopathy, mechanisms have been proposed that point in this direction. Extrinsic compression of the kidney by visceral fat causes an increase in medullary interstitial

hydrostatic pressure and, consequently, compression of the loop of Henle and vasa recta, slowing flow in the renal tubule and vasa recta, favoring increased tubular reabsorption of sodium and consequent volume expansion **[32]**.

Hormonal factors are also postulated. Leptin secreted by adipocytes can activate the renin-angiotensin-aldosterone system and the sympathetic nervous system **[33]**. Insulin resistance, associated with visceral obesity, can affect blood pressure by activating the sympathetic nervous system and causing increased sodium reabsorption, as well as blocking the vasodilatory response of nitric oxide **[34]**. Despite several renal alterations, few studies have attempted to study renal function in the perioperative period of bariatric surgery.

Nguyen et al. **[35]** investigating the hormonal response in morbidly obese patients (BMI 40-60) undergoing laparoscopic or open gastroplasty, found no significant difference in hormonal response (aldosterone, renin, antidiuretic hormone) after 2 hours of gastroplasty. On the other hand, Ortega et al. **[36]**, in non-obese individuals referred for cholecystectomy, found, after 1 hour of surgery, a higher plasma concentration of ADH in the group that underwent laparoscopy compared to the open group.

Creatinine clearance corresponds to the measurement of the glomerular filtration rate, indicating the proximal function of the kidney. This rate is directly related to renal flow, which is maintained by systemic blood pressure, and is directly influenced by neuro-humoral discharge in response to stress. Frumento et al. **[14]** found higher creatinine clearance in the group that used epidural dexmedetomidine compared to the control group, when used for post-thoracotomy analgesia. The authors attributed this result to the blockade of the neuroendocrine response to stress **[37]**, minimizing the systemic vasoconstrictor response, as well as decreasing the release of norepinephrine by presynaptic receptors located in the kidney **[38]**. Urea clearance can be used as a measure of the glomerular filtration rate. However, this measure is not used, as urea undergoes tubular reabsorption **[39,40]**.

Considering that obese individuals with renal insufficiency represent a challenge for the anesthesiologist, research on the effect of the anesthetics studied here on the hormonal response and consequent renal function in the perioperative period is necessary, as studies show the occurrence of renal insufficiency after gastroplasty and indicate risk factors such as BMI > 50 **[20]**, previous chronic kidney disease, long surgical time, intraoperative hypotension **[41]**, hyperlipidemia **[31]**, preoperative use of angiotensin-converting enzyme inhibitors or angiotensin receptor blockers.

Finally, research evaluating the incidence of acute renal failure in the postoperative period and in a large number of patients undergoing non-cardiac surgery found nine independent risk factors, one of which was a body mass index (BMI) greater than 32 and mineral and vitamin deficiency **[42]**.

Limitations

For a more accurate assessment of the results, further randomized controlled clinical trials with robust sample sizes are needed to analyze the effects of dexmedetomidine or remifentanil in nutritionally deficient patients undergoing bariatric surgery.

Conclusion

It was concluded that in obese patients with mineral and vitamin deficiencies, total intravenous anesthesia with opioid restriction using dexmedetomidine reduces postoperative nausea, pain score, and the need for antiemetics and analgesics in the immediate postoperative period after bariatric surgery compared to the use of remifentanil. Furthermore, the better recovery profile after laparoscopic sleeve gastrectomy supports the use of intraoperative dexmedetomidine infusion as an anesthetic adjuvant versus remifentanil for this patient profile.

CRediT

Author contributions: **Conceptualization**; **Data curation**; **Formal Analysis**; **Investigation; Methodology**; **Project administration; Supervision**; **Writing - original draft**; **Writing-review & editing**- Paulo Henrique Caires Lima Bazalia and Beatriz Caires Lima Bazalia.

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No additional data are available.

Conflict of Interest

The authors declare no conflict of interest.

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Application of Artificial Intelligence (AI)

Not applicable.

Peer Review Process

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