LUMEN ET VIRTUS
ISSN: 2177-2789

ANESTHETIC EVALUATION IN OBESE PREGNANT WOMEN: REFLECTIVE PERSPECTIVES ON SAFETY AND CHALLENGES

https://doi.org/10.56238/levv16n46-090

Submitted on: 02/27/2025 **Publication date:** 03/27/2025

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ABSTRACT

This reflective study analyzes the anesthetic challenges in obese pregnant women, addressing technical, pharmacological and ethical aspects. The methodology was based on a narrative review of recent scientific literature, with a careful selection of articles published between 2019 and 2024 in databases such as PubMed, SciELO, and LILACS. The analysis was structured in three axes: (1) physiological and anatomical changes that interfere with obstetric anesthesiology, (2) technical and ethical challenges in anesthetic management, and (3) impacts on maternal and neonatal outcomes. Obesity makes it difficult to perform neuraxial blocks, increases the risk of anesthetic failures, and complicates intraoperative monitoring. In addition, it influences the pharmacokinetics of anesthetics, requiring dosage adjustments and close monitoring. In the postoperative period, there is a higher incidence of respiratory complications, venous thromboembolism, and inadequate pain control, reinforcing the need for multimodal protocols and a multiprofessional approach. It is concluded that the individualization of anesthetic management and the improvement of evidence-based guidelines are essential to minimize risks and optimize maternal-fetal safety. Continuous staff training and the adoption of advanced strategies, such as

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ultrasound to guide blockages and preventive measures for complications, are key to improving obstetric outcomes.

Keywords: Maternal obesity. Obstetric anesthesia. Gestation. Regional anesthesia. Anesthetic safety.

INTRODUCTION

Obesity has emerged as a major global public health problem, affecting millions of women of reproductive age. Its prevalence in pregnant women has been growing alarmingly, especially in developed and developing countries, where a sedentary lifestyle, combined with inadequate eating habits, intensifies the problem. Obesity in pregnant women is associated with a broad spectrum of obstetric, perinatal, and anesthetic complications, making it a significant challenge for the health team during prenatal and intrapartum care (World Health Organization, 2022).

Pregnancy in obese women involves physiological risks that affect not only maternal health, but also that of the fetus. Alterations such as increased cardiac output, reduced pulmonary compliance, and elevated peripheral vascular resistance are common features in these cases. These changes, added to the increase in body mass index (BMI), directly influence the choice and effectiveness of anesthetic techniques employed during obstetric procedures, such as cesarean sections and normal deliveries with epidural analgesia (Grieger et al., 2021).

Thus, the assessment of anesthetic risk in obese pregnant women is a crucial step to minimize complications and improve maternal-fetal outcomes. From an anesthetic point of view, maternal obesity is related to a higher probability of technical difficulties and intraoperative and postoperative complications. The distribution of excessive body fat interferes with the identification of anatomical points for puncture, increasing the risk of failures in the administration of regional anesthetics. In addition, obesity is associated with a significant increase in the risk of respiratory complications, such as hypoventilation, atelectasis, and difficulty with ventilation or tracheal intubation. It is known that obese pregnant women have a higher incidence of adverse events during anesthetic procedures, such as Mendelson's syndrome, which involves aspiration of acidic gastric contents due to delayed gastric emptying (Mushambi; Athanassoglou; Kinsella, 2020).

Another relevant aspect is the relationship between obesity and associated morbidities, such as gestational diabetes mellitus and hypertension. These conditions exponentially increase anesthetic risks, requiring greater attention from the multidisciplinary team during anesthesia. Intensive monitoring of hemodynamic and respiratory parameters is essential in these cases, considering the impact of high BMI on the pharmacokinetics and pharmacodynamics of anesthetics. This underscores the importance of personalizing anesthetic management, ensuring that the dosage and techniques employed are tailored to the patient's individual characteristics (American Society of Anesthesiologists, 2023).

Obese pregnant women often require cesarean sections, as obesity is associated with a higher prevalence of dystocia, labor failures, and fetal macrosomia. These factors increase the demand for anesthesia in surgical procedures, increasing the exposure of these women to anesthetic risks. The use of general anesthesia, for example, is often avoided due to the risk of difficult intubation and severe respiratory complications. On the other hand, regional anesthesia, such as spinal and epidural anesthesia, is widely preferred, despite the technical challenges involved, such as the difficulty in locating the intervertebral spaces and the increased risk of accidental puncture of the dura mater (Chandvale; Abdelmotieleb; Clayton, 2023).

Obesity is also associated with a higher risk of postoperative complications, such as surgical site infection, venous thromboembolism, and chronic pain. It is important to highlight that obesity alters the inflammatory and immune response, prolonging recovery time and increasing the likelihood of reinterventions. In addition, inadequate pain management in the postoperative period can compromise the patient's functional and emotional recovery, negatively impacting her quality of life and interaction with the newborn (González-Tascón; Díaz; García, 2021).

Preanesthetic evaluation in obese pregnant women is a crucial opportunity to identify risk factors and establish management strategies. This step should include the evaluation of the airway, hemodynamic and respiratory parameters, and the identification of associated comorbidities. The anesthetic team should work in an integrated manner with other health professionals, promoting maternal-fetal safety and reducing the risks of complications during delivery (Patel; Habib, 2021).

In addition, nonpharmacological approaches, such as the use of noninvasive ventilation in the management of obstructive sleep apnea, have been shown to be effective in reducing respiratory complications in obese pregnant women. Strategies such as proper positioning during anesthesia, the use of ultrasound to guide punctures, and the judicious choice of medications also play a key role in anesthetic safety (Rana *et al*., 2020).

Despite advances in anesthetic practice, obesity remains one of the main challenges faced by obstetric anesthesiology. It is essential that management strategies are continuously improved and based on up-to-date scientific evidence. In addition, it is essential that the continuing education of the multiprofessional team is strengthened, ensuring the implementation of high-quality care centered on maternal-fetal safety. Thus, understanding the specificities of anesthetic risk assessment in obese pregnant women is essential to promote safer and more effective interventions.

The complexity of this issue requires a holistic and multidisciplinary approach, which goes beyond the anesthetic technique, involving aspects such as the humanization of care, effective communication between teams, and the individualization of therapeutic strategies. In this way, it is possible to contribute to the reduction of maternal and neonatal morbidity and mortality rates, in line with the principles of safety and quality recommended by international obstetric guidelines.

In view of this, this study seeks to analyze, in a reflexive way, the main challenges and implications of anesthetic risk assessment in obese pregnant women, based on current scientific evidence and maternal-fetal safety principles.

METHODOLOGY

This is a reflexive study, which seeks to carry out a critical and in-depth analysis of the assessment of anesthetic risk in obese pregnant women. This type of study is characterized by the interpretation and theoretical discussion of the main concepts and practices related to the theme, using scientific literature and clinical guidelines as a basis for reflection (Barbosa; Nobrega-Therrien, 2020).

The study adopts a qualitative and reflective approach, whose purpose is to propose a theoretical analysis based on recent scientific evidence, connecting the clinical challenges of obstetric anesthesiology in obese pregnant women with the principles of maternal-fetal safety. This format allows for a critical discussion of the main problems, management strategies, and gaps in clinical practice.

The bibliographic survey is the main technique for data collection, aiming to support critical reflection based on recent studies and guidelines. To this end, the search was carried out in the *Medical Literature Analysis and Retrievel System Online* (Medline) databases via PubMed, *Scientific Electronic Library Online* (SciELO), Latin American and Caribbean Literature on Health Sciences (LILACS), and Google Scholar, covering articles published between 2019 and 2024. In addition, Health Sciences Descriptors – DeCS – "maternal obesity", "obstetric anesthesia", "obese pregnant women", and "anesthetic risks in pregnancy" were used, combined by Boolean operators (AND, OR) to refine the results.

The inclusion criteria involved primary studies, systematic and integrative reviews, and clinical guidelines that addressed anesthetic risks in obese pregnant women, published in Portuguese, English, or Spanish, available in full, and that presented relevant theoretical discussions. On the other hand, case reports, letters to the editor, dissertations, theses, and articles outside the scope of the research were discarded, as well as publications that were not available for free.

The collected data were organized and analyzed based on the interpretative and reflective approach of the authors. The interpretation of the findings was guided by three main axes: physiological and anatomical changes in obese pregnant women, which interfere with obstetric anesthesiology and include technical difficulties, pharmacokinetic changes, and increased intraoperative complications; the technical and ethical challenges in anesthetic management, with emphasis on the choice between general and regional anesthesia and the associated risks; and the impacts on maternal and neonatal outcomes, with emphasis on postoperative complications, such as surgical site infection, venous thromboembolism, and difficulties in postpartum recovery.

The data were interpreted in the light of international guidelines, such as those published by the *American Society of Anesthesiologists* (ASA) and the Brazilian Society of Anesthesiology (SBA), as well as theories of anesthetic management in obesity. This approach allowed the integration of theoretical and clinical findings, promoting a critical reflection on anesthesiological practices in obese pregnant women. To ensure methodological rigor, the study followed the recommendations for reflective qualitative research.

Methodological rigor was ensured by the careful selection of the scientific sources used, prioritizing peer-reviewed studies and recognized clinical guidelines. The transferability of the findings was ensured through the theoretical discussion applicable to different scenarios of obstetric anesthesiology, while the reliability was reinforced by the detailed record of the methodological procedures, allowing replication and future validation of the study.

REFLECTIVE ANALYSIS

OBESITY, PREGNANCY AND COMPLICATIONS IN OBSTETRIC ANESTHESIOLOGY

Obesity is considered a disease that is part of the group of Chronic Non-Communicable Diseases (NCDs), which are difficult to define, generating controversies in relation to their name, whether as non-infectious diseases or chronic non-communicable diseases, the latter being the most used definition. Therefore, obesity, as it is not an infectious disease, not even transmitted and epidemiologically belonging to the new health panorama of developed countries, can indeed be considered an NCD (Borba, 2022).

In this scenario, obesity is a disease, classified as such in the International Classification of Diseases (ICD). It corresponds to the excessive accumulation of body fat, which can reach degrees capable of affecting health. In addition, it stands out with great prevalence in developed countries, affecting men and women of all races and ages,

reducing quality of life and presenting high rates of diseases and deaths (Donini et al., 2020).

During pregnancy, obesity is defined as a condition that causes a series of physiological and anatomical changes, which significantly interfere with anesthetic management. These changes not only complicate the performance of anesthetic procedures, but also increase the risk of intraoperative and postoperative complications. Understanding these changes is critical for the safety of the mother and fetus during the perioperative period (Vasconcellos *et al*., 2022).

Parallel to this, obesity can be defined, in a simplified way, as excess body fat, in the form of adipose tissue, resulting from a positive energy balance, which harms the health of individuals. It is also known that the origin of obesity is multifactorial, and encompasses both environmental and genetic factors, however, its genesis is directly linked to the sedentary lifestyle pattern adopted by the individual (Donini *et al.*, 2020).

According to Carvalho *et al*., 2021, obese pregnant women have physiological changes that affect multiple systems, including cardiovascular, respiratory, endocrine, and gastrointestinal. The increase in adipose tissue, especially in the abdominal region, results in greater compression of the diaphragm, reducing functional residual capacity (FRC) and lung compliance. This can lead to more rapid hypoxemia during apnea, especially in situations of difficult intubation or failure of ventilation.

In addition, obesity is associated with an increased oxygen demand and work of breathing, which can exacerbate respiratory muscle fatigue during childbirth or in surgical procedures. In the cardiovascular system, obesity promotes an increase in cardiac output to compensate for the greater metabolic demand of adipose tissues. This overloads the heart, predisposing the pregnant woman to myocardial dysfunctions, arterial hypertension and congestive heart failure.

Increased peripheral vascular resistance and activation of the renin-angiotensin-aldosterone system contribute to fluid retention and hemodynamic instability during anesthesia. During delivery, these changes can exacerbate hypotension after neuraxial block, making it difficult to maintain uteroplacental perfusion and increasing the risk of fetal distress (American Society of Anesthesiologists, 2023).

Despite having intensified in recent years, obesity has always been present in the history of humanity. In the past, it was observed only in individuals of the nobility, however, it became epidemic in the twentieth century and spread around the globe in order to become pandemic in the twenty-first century. However, this fact is due to the industrialization process in which foods have become ultra-processed and full of saturated fats, in addition

to having high caloric indexes and, combined with the industrialization process, which has resulted in a busy and sedentary lifestyle, in which the individual does not have time to eat properly or to exercise any physical activity (Vasconcellos *et al.,* 2022).

The changes in the respiratory system are equally worrying. Obesity reduces pulmonary compliance and functional residual capacity, compromising alveolar ventilation and predisposing to perioperative hypoxemia. In addition, the increase in adipose tissue in the thoracic and abdominal regions limits diaphragmatic expansion, aggravating the predisposition to atelectasis and hypoventilation. The presence of obstructive sleep apnea, common in obese pregnant women, also contributes to a higher risk of hypercapnia and respiratory adverse events during the anesthetic period (Brockway *et al*., 2023).

Anatomically, excess adipose tissue makes it difficult to identify bone references that are essential for the puncture of neuraxial blocks, such as spinal and epidural anesthesia. In addition, epidural fat reduces the volume of cerebrospinal fluid, making the spread of the anesthetic less predictable and increasing the risk of incomplete or excessive blockages. Epidural venous engorgement, which is frequent in obese women, increases the probability of inadvertent vascular punctures and the formation of epidural hematomas, complications that can compromise analgesia and require additional interventions (Mushambi; Athanassoglou; Kinsella, 2020).

The altered metabolism of obese pregnant women also interferes with the pharmacokinetics of anesthetics. The lipid solubility of some drugs can result in prolonged accumulation in adipose tissue, modifying the duration and intensity of anesthetic effects. Decreased hepatic and renal blood flow can compromise the clearance of anesthetic agents and opioids, increasing the incidence of postoperative respiratory depression (Grieger *et al*., 2021).

ANESTHESIOLOGY IN THE FACE OF GESTATIONAL OBESITY

Obesity in pregnancy is a condition that presents significant challenges for anesthetic management, impacting both the health of the mother and the fetus. The increase in adipose tissue compromises the anatomical references that are crucial for performing anesthetic procedures, making venous and epidural access more complicated. Studies indicate that about 75% of obese pregnant women need multiple attempts to perform neuraxial blocks, and this difficulty is aggravated in women weighing more than 130 kg, where approximately 42% face failures in the introduction of the epidural catheter (Taylor; Dominguez; Habib, 2019).

The choice of anesthetic technique in obese pregnant women presents technical challenges that demand specific skills from the health team. Regional anesthesia, such as spinal and epidural anesthesia, is widely preferred due to less airway interference and lower risk of gastric aspiration. However, obesity makes it difficult to perform these blocks, due to the difficulty in locating the intervertebral spaces and the higher risk of catheter introduction failure (Grieger *et al*., 2021).

General anesthesia, in turn, is avoided in obese pregnant women due to the high risk of difficult airway, which can turn an emergency intubation into a critical situation. Obesity increases the incidence of failed intubation by up to three times, compared to normal-weight patients, due to the presence of a short neck, lower cervical mobility, and greater fat deposit in the pharyngeal tissue. The presence of delayed gastric emptying aggravates this scenario, increasing the risk of aspiration and Mendelson's syndrome during general anesthesia (Chandvale; Abdelmotieleb; Clayton, 2023).

From an ethical point of view, anesthetic management in obese pregnant women requires a rigorous and individualized evaluation, considering the specific risks of each patient. It is the responsibility of the health team to provide clear and accessible information about the benefits and risks of each anesthetic technique, promoting informed consent and the active participation of the pregnant woman in care decisions. Failure to adequately assess the risks related to obesity can compromise patient safety and generate significant ethical-legal implications (González-Tascón; Díaz; García, 2021).

In addition to the technical and ethical challenges, gestational obesity also directly impacts the pharmacokinetics and pharmacodynamics of anesthetics, requiring adjustments in the doses administered. The increase in adipose mass alters the distribution of fat-soluble drugs, prolonging their half-life and enhancing the sedative effects. In addition, increased glomerular filtration rate and plasma volume can modify the elimination of water-soluble drugs, making their action less predictable. This phenomenon reinforces the need for rigorous monitoring during and after anesthesia, ensuring maternal-fetal safety and minimizing the risks of respiratory depression and hemodynamic instability (El-Boghdadly *et al*., 2023).

Intraoperative monitoring in obese pregnant women requires specific equipment to ensure the accuracy of physiological measurements and anesthetic safety. Pulse oximetry may give inaccurate readings due to skin thickness and reduced perfusion in morbidly obese patients. Similarly, non-invasive blood pressure may be less reliable, requiring cuffs appropriate to the patient's arm size or the use of invasive methods, such as arterial catheterization. Mechanical ventilation also poses a challenge, as reduced functional

residual capacity and decreased chest compliance increase the propensity for hypoxemia, requiring careful ventilatory adjustments to avoid atelectasis and respiratory acidosis (Ashpole *et al.,* 2021).

In the postoperative period, the implications of anesthesia in obese pregnant women include a higher risk of respiratory complications, venous thromboembolism, and difficulty in pain control. Hypoventilation, exacerbated by the residual effect of anesthetics and diaphragmatic compression due to excess weight, requires continuous surveillance and, in some cases, prolonged ventilatory support. In addition, analgesia may be less effective due to pharmacokinetic changes, leading to the need for multimodal protocols, combining opioid and non-opioid drugs to ensure adequate pain control and reduce adverse effects, such as respiratory depression (Mossie; There; Tesema, 2022).

Anesthetic safety in gestational obesity requires a multidisciplinary approach, involving anesthesiologists, obstetricians, nurses and physiotherapists to ensure adequate delivery planning. Optimizing prenatal care, including glycemic control, encouraging mobility, and educating about anesthetic risks, is essential to reduce complications and improve maternal-fetal outcomes. Strategies such as simulating difficult airway management and training staff for early identification of signs of hemodynamic instability are essential to ensure safe and humanized care (Neuman *et al*., 2022).

From a neonatal point of view, children of obese mothers have a higher risk of macrosomia, shoulder dystocia, and metabolic complications, such as neonatal hypoglycemia. In addition, maternal obesity is associated with higher rates of preterm birth, which may require prolonged hospitalization in a neonatal intensive care unit (NICU) and increase the costs associated with perinatal care (Patel; Habib, 2021).

Postoperative recovery in obese pregnant women is often prolonged due to the higher incidence of chronic pain, early mobilization difficulties, and emotional problems such as anxiety and postpartum depression. These factors reinforce the importance of a multidisciplinary approach, which integrates medical, physiotherapeutic, and psychological care to improve maternal-fetal outcomes and ensure patients' quality of life (Rana *et al*., 2020).

Thus, the evaluation and anesthetic management of obese pregnant women should be conducted with a high degree of planning and caution, considering the anatomical, pharmacological, and physiological particularities of this population. The individualization of the anesthetic approach, combined with rigorous monitoring and multidisciplinary action, represents the best strategy to minimize risks and optimize obstetric care. Advances in research and development of safer anesthetic techniques for obese pregnant women

should continue to be a priority in obstetric anesthesiology, aiming to improve the quality of maternal and child care.

FINAL CONSIDERATIONS

The evaluation and anesthetic management of obese pregnant women represent significant challenges due to the anatomical, physiological, and pharmacological changes inherent to obesity. The complexity of these cases requires an individualized approach, considering factors such as technical difficulties in the administration of anesthesia, increased risks of respiratory and cardiovascular complications, and the need for pharmacokinetic adjustments. Regional anaesthesia remains the preferred choice despite technical difficulties, while general anaesthesia should be avoided whenever possible due to the high risk of airway complications.

Strategies such as the use of ultrasound to guide neuraxial blocks, multimodal analgesic protocols, and preventive measures for thromboembolic complications are essential to optimize maternal-fetal outcomes. Thus, the individualization of anesthetic management and the implementation of evidence-based guidelines are essential to minimize risks and promote safer and more effective obstetric care. The continuous training of the multidisciplinary team and the development of new anesthetic strategies should be a priority in the search for better results for obese pregnant women and their newborns.

REFERENCES

1. American Society of Anesthesiologists. (2023). Guidance for the perioperative management of the morbidly obese surgical patient. https://secure.library.leicestershospitals.nhs.uk/PAGL/Shared%20Documents/Perioperative%20Management%20of%20Morbidly%20Obese%20Surgical%20Patient%20UHL%20ITAPS%20Guideline.pdf

2. Barbosa, E. da S., & Nobrega-Therrien, S. M. (2021). Proposições sobre a ressignificação do cuidado de enfermagem: Um estudo teórico-reflexivo. Revista Enfermagem em Foco, 11(5), 1–11. http://revista.cofen.gov.br/index.php/enfermagem/article/view/4188

3. Borchardt, P. R. T., et al. (2024). Intercorrências no manejo da anestesia em pacientes obesos: Uma revisão de literatura. Brazilian Journal of Implantology and Health Sciences, 6(7), 2041–2050. https://bjihs.emnuvens.com.br/bjihs/article/view/2641/2837

4. Caetano, A. M., & Schmidt, A. P. (2021). Challenges in obstetric anesthesia. Brazilian Journal of Anesthesiology, 71(4), 1–2. https://www.scielo.br/j/bja/a/yMvJT7Ld9Dmp9LfNQS7BDGB/?lang=en

5. Cavalcante, E. R. B., et al. (2019). Síndrome da apneia obstrutiva do sono e sua relação com o sobrepeso materno e riscos ao neonato. Revista Femina, 47(7), 433–435. https://fi-admin.bvsalud.org/document/view/pwx34

6. Chandvale, A., Abdelmotieleb, M., & Clayton, R. (2023). Anaesthesia in obese patients. Anaesthesia & Intensive Care Medicine, 24(10), 573–577. https://doi.org/10.1016/j.mpaic.2023.07.002

7. González-Tascón, C. C., Díaz, E. G., & García, I. L. (2021). Epidural analgesia in the obese obstetric patient: A retrospective and comparative study with non-obese patients at a tertiary hospital. Brazilian Journal of Anesthesiology, 71(3), 258–263. https://www.scielo.br/j/bja/a/gdzP3XkqStqrnVXTSv6VYjB/

8. Grieger, J. A., et al. (2021). A review of maternal overweight and obesity and its impact on cardiometabolic outcomes during pregnancy and postpartum. Therapeutic Advances in Reproductive Health, 15, 1–8. https://doi.org/10.1177/2633494120986544

9. Kasodekar, S., & Nathroy, A. (2024). Informed consent in obstetric anesthesia. In Peripartum care of the pregnant patient (pp. 363–369). Springer. https://doi.org/10.1007/978-3-031-62756-9_44

10. Liu, Z., & Zhu, J. (2024). Advances in epidural labor analgesia for obese parturients. Journal of Pain Research, 17, 4141–4147. https://doi.org/10.2147/JPR.S496714

11. Magouliotis, D. E., et al. (2021). Airway management in obese patients. Brazilian Journal of Anesthesiology, 71(3), 302–314. https://www.scielo.br/j/bja/a/ychNJf6JNVyRdcy7jqXGRKc/?format=pdf&lang=en

12. Mossie, A., Ali, S. A., & Tesema, H. G. (2022). Anesthetic implications of morbid obesity during pregnancy: A literature-based review. International Journal of Surgery Open, 40, 2–8. https://doi.org/10.1016/j.ijso.2022.100447

13. Mushambi, M. C., Athanassoglou, V., & Kinsella, S. M. (2020). Anticipated difficult airway during obstetric general anaesthesia: Narrative literature review and management recommendations. Anaesthesia, 75(7), 945–961. https://doi.org/10.1111/anae.15007

14. Patel, S. D., & Habib, A. S. (2021). Anaesthesia for the parturient with obesity. BJA Education, 21(5), 180–186. https://doi.org/10.1016/j.bjae.2021.01.001

15. Rana, S., et al. (2020). Ultrasound-assisted subarachnoid block in obese parturient: Need of the hour. Saudi Journal of Anaesthesia, 14(2), 228. https://doi.org/10.4103/sja.SJA_630_19

16. Taylor, C. R., Dominguez, J. E., & Habib, A. S. (2019). Obesity and obstetric anesthesia: Current insights. Local and Regional Anesthesia, 12, 111–124. https://doi.org/10.2147/LRA.S186209

17. Thaer, V. S. (2024). Obesity and anesthesia: Challenges in the perioperative period. Missouri Medicine, 121(2), 156–163. https://pubmed.ncbi.nlm.nih.gov/38694600/

18. World Health Organization. (2022). Obesity and overweight. https://www.who.int/news-room/fact-sheets/detail/obesity-and-overweight