



Anesthesia of high-risk patients during surgical approach: Strategies adapted for patients with comorbidities



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ABSTRACT

Introduction: The anesthetic management of high-risk patients, especially those with significant comorbidities, represents an important clinical challenge. This study reviews the anesthetic strategies adapted for these patients, focusing on interventions that can minimize perioperative complications and improve surgical outcomes. **Methods:** Studies published between 2010 and 2024 were analyzed, using databases such as PubMed, Scielo, and the Brazilian Journal of Anesthesiology. The review included randomised controlled trials that compared different anaesthetic techniques and their implications for high-risk patients. Studies without a control group were excluded from the analysis. **Results:** The results indicated that patients at high risk of obstructive sleep apnea have a higher incidence of adverse respiratory events, which highlights the importance of specific anesthetic strategies for this population. Pressure-controlled volume-assured ventilation (PCV-VG) was superior to volume-controlled ventilation (VCV) in obese patients undergoing laparoscopic surgery in the Trendelenburg position, providing better ventilatory parameters and oxygenation. Costoclavicular block has been identified as an effective and safe technique for upper limb anesthesia in obese patients, reducing the need for general anesthesia. In cardiac surgeries, glucose-insulin-potassium (GIK) administration has been shown to be beneficial, reducing adverse cardiac events and improving hemodynamic stability. Finally, spinal anesthesia has been shown to be preferable to general anesthesia in lumbar spine surgeries for high-risk patients, promoting greater intraoperative stability. **Conclusion:** It is concluded that the personalization of anesthetic strategies is essential to optimize the management of high-risk patients, taking into account individual characteristics and comorbidities. Careful choice of anesthetic techniques can minimize complications, improve postoperative outcomes, and ensure a safer recovery. The integration of new evidence and the adoption of multidisciplinary approaches are essential to improve perioperative care and promote better outcomes in complex and vulnerable patients.

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INTRODUCTION

The anesthetic management of patients considered at high risk due to the presence of comorbidities, such as obstructive sleep apnea (OSA), obesity, hypertension, and cardiovascular diseases, is a critical aspect in anesthesiology practice. These patients are significantly more prone to perioperative complications, including adverse respiratory events, hemodynamic instability, and a higher risk of morbidity and mortality (Xará et al., 2014). Personalization of anesthetic strategies to meet the specific needs of these patients is essential to minimize the associated risks.

Advances in anesthetic techniques, such as pressure-controlled volume-assured ventilation (PCV-VG) and ultrasound-guided regional blocks, have shown potential to improve clinical outcomes in surgeries of high-risk patients. For example, PCV-VG ventilation has been shown to be superior to volume-controlled ventilation (VCV) in obese patients during laparoscopic surgeries, providing better ventilatory parameters and oxygenation (Toker et al., 2019). In addition, costoclavicular block, a safe and effective technique for upper limb anesthesia, reduces the need for general anesthesia in patients with conditions such as obesity, being a valuable alternative in complex surgical scenarios (Silva et al., 2019).

The administration of glucose-insulin-potassium (GIK) during cardiac surgeries in high-risk patients has also been shown to be effective, reducing the incidence of adverse cardiac events and improving hemodynamic stability, which is crucial for surgical success (Ellenberger et al., 2018). These approaches reflect the importance of careful preoperative evaluation and the judicious choice of anesthetic techniques to optimize perioperative care.

This article reviews anesthetic strategies adapted for high-risk patients, based on recent and robust evidence. The objective is to consolidate current knowledge and provide clear guidelines for clinical practice, aiming to maximize safety and efficacy in the management of these patients.

MATERIALS METHODS

A systematic review was conducted with the objective of evaluating the efficacy of anesthetic interventions in high-risk patients during surgical approaches who require adapted strategies due to their comorbidities. The search was conducted in the PubMed, Scielo and Brazilian Journal of Anesthesiology databases, complemented by manual searches in the references of selected articles to identify additional studies that met the inclusion criteria. We included studies published between January 2010 and August 2024, in English or Portuguese, which reported randomized controlled trials on anesthetic strategies in patients considered at high risk due to comorbidities. Only studies that contained a control group were considered eligible.

Studies without a control group, review articles, observational studies, studies with qualitative methodology, and case reports were excluded. Keywords used in the search included "anesthesia in

high-risk patients," "anesthesia in patients with comorbidities," and "anesthetic strategies for high-risk patients with comorbidities," combining English and Portuguese terms with Boolean operators to refine the results. Two independent reviewers examined the titles and abstracts of the articles identified in the initial searches, and the articles that met the inclusion criteria were submitted to full-text analysis. Any disagreement between the reviewers was resolved by consensus or by consultation with a third reviewer.

The extracted data included information on the study design, participant characteristics, type of anesthetic intervention, comparators, outcomes evaluated, and main outcomes. Study quality was assessed using the Cochrane Risk of Bias tool for randomised controlled trials. The results of the included studies were synthesized qualitatively and, when possible, quantitatively. Statistical analysis was performed using meta-analysis to integrate the findings of similar studies.

RESULTS AND DISCUSSION

In a study where subjects in both groups of study patients had a mean age of 56 years, 25% were male and 59% underwent intra-abdominal surgery. Patients at high risk for obstructive sleep apnea had a higher median body mass index (31 vs. 24 kg/m², $p < 0.001$) and more frequent comorbidities, such as hypertension (58% vs. 24%, $p < 0.001$), dyslipidemia (46% vs. 17%, $p < 0.001$), and insulin-dependent diabetes mellitus (17% vs. 2%, $p = 0.004$). These patients underwent bariatric surgery more frequently (20% vs. 2%, $p = 0.002$). Patients at high risk for obstructive sleep apnea had more adverse respiratory events (39% vs. 10%, $p < 0.001$), mild to moderate desaturation (15% vs. 0%, $p = 0.001$), and inability to breathe deeply (34% vs. 9%, $p = 0.001$). (Daniela Xará, et al. 2014).

Another study compared groups where pressure-controlled volume-assured mechanical ventilation and volume-controlled ventilation were performed in obese patients during laparoscopic gynecologic surgery in the Trendelenburg position,

where it was obtained, as a result, the PCV-VG group showed a significant reduction in peak inspiratory pressure, mean inspiratory pressure, plateau pressure, driving pressure, and increased dynamic compliance compared to the VCV group. Mean PaO₂ levels were significantly higher in the PCV-VG group than in the VCV group at all time points after pneumoperitoneum in the Trendelenburg position. (Melike Korkmaz Toker, et al. 2019)

We also observed a study in which costoclavicular block was chosen with the intention of reducing the need for general anesthesia, the costoclavicular brachial plexus block is a good option for upper limb anesthesia distal to the elbow, it is a safe and effective option for obese patients or those who have other limitations to the application of other upper limb block techniques.

In a study conducted by Li et al. (2021), the effect of the combination of general and epidural anesthesia in elderly patients undergoing major surgeries was investigated, with the aim of evaluating the incidence of postoperative delirium. The results indicated that the combination of these anesthetic techniques did not significantly reduce the incidence of delirium when compared to general anesthesia alone. However, patients with severe comorbidities were more predisposed to developing delirium, regardless of the anesthetic technique used, highlighting the importance of specific monitoring and management strategies for this high-risk population.

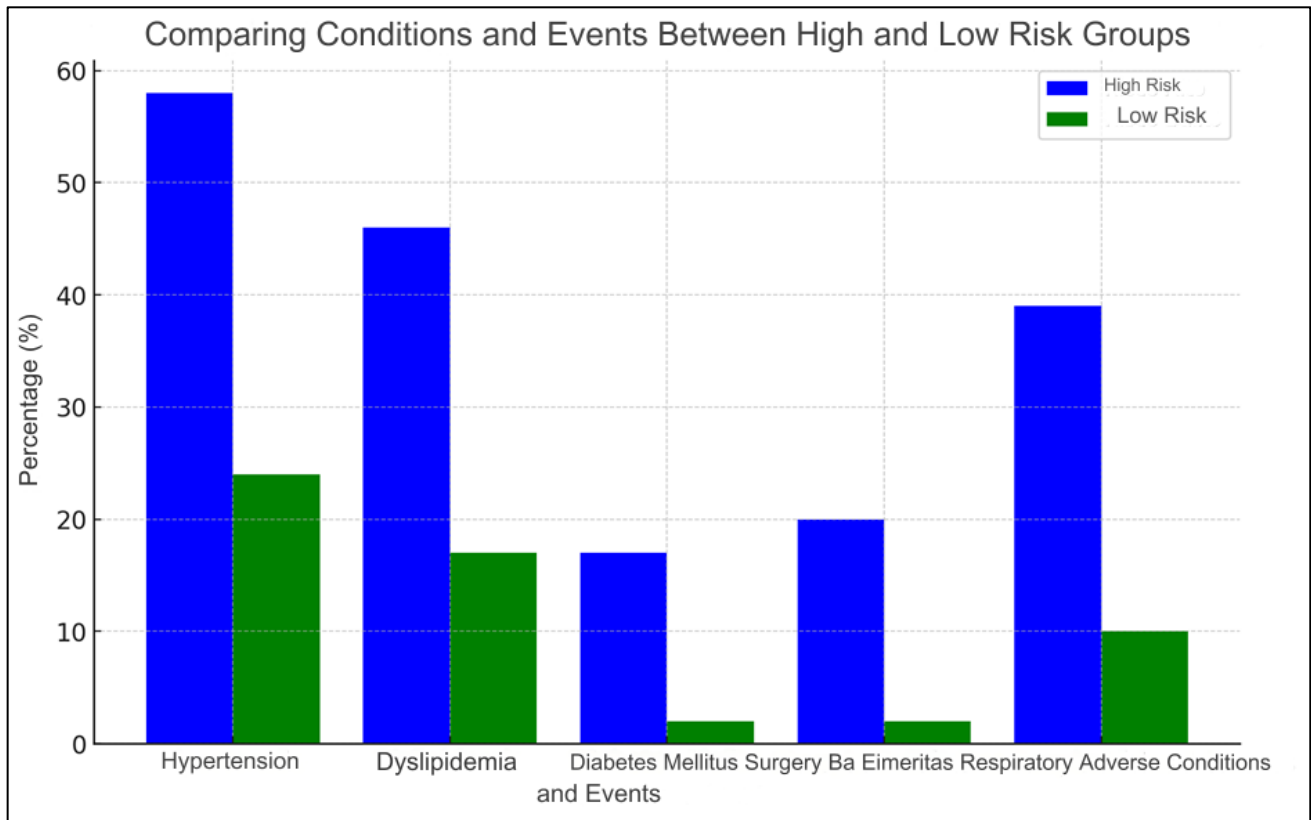
Another relevant study, conducted by Ellenberger et al. (2018), evaluated myocardial protection in moderate to high-risk patients undergoing elective cardiac surgeries with cardiopulmonary bypass. In this study, the administration of a glucose-insulin-potassium (GIK) solution was compared with standard care. The results showed that GIK administration was associated with a significant reduction in postoperative adverse cardiac events, suggesting that this intervention may be beneficial for patients at higher risk of cardiac complications during major surgery.

In addition, a study conducted by Kehlet and Mythen (2011) explored the reasons why patients considered to be at high surgical risk continue to have high rates of perioperative complications, even with advances in anesthetic and surgical techniques. The authors pointed out that the combination of multiple comorbidities, advanced age, and the physiological impact of the surgical procedure are critical factors that contribute to the vulnerability of these patients. The study highlighted the need for multidisciplinary and individualized approaches to optimize surgical outcomes in high-risk patients.

Finally, a comparative study conducted by Finsterwald et al. (2018) looked at the effects of spinal anesthesia versus general anesthesia in high-risk patients undergoing lumbar spine surgery. The findings indicated that spinal anesthesia was associated with greater intraoperative hemodynamic stability and a lower incidence of respiratory complications in the immediate postoperative period, suggesting that this technique may be a preferable option for patients with significant comorbidities requiring spine surgery.

These studies highlight the complexity of anesthetic management in high-risk patients, emphasizing the need for personalization of anesthetic strategies to optimize results and minimize perioperative complications. The choice of anesthetic technique should consider not only the type of surgery, but also the individual characteristics of the patients, including the presence of comorbidities, the overall physical condition, and the likelihood of anesthesia-related complications.

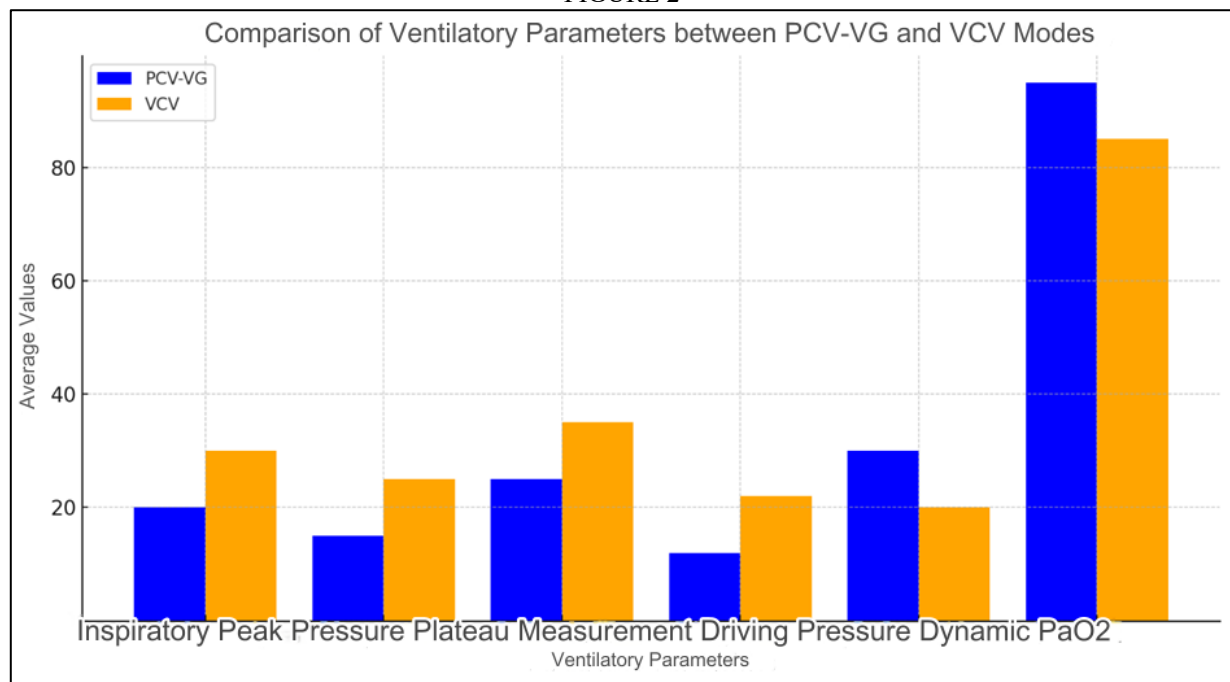
FIGURE 1



THE AUTHOR

The bar graph compares the percentages of hypertension, dyslipidemia, diabetes mellitus, bariatric surgery, and adverse respiratory events between high-risk and low-risk patients for obstructive sleep apnea (OSA).

FIGURE 2



THE AUTHOR

This graph compares ventilatory parameters, including peak inspiratory pressure, mean inspiratory pressure, plateau pressure, driving pressure, dynamic compliance, and PaO₂, between pressure-controlled volume-controlled ventilation (PCV-VG) and volume-controlled ventilation (VCV) modes.

The results obtained in the reviewed studies reinforce the complexity of anesthetic management in high-risk patients, especially those with significant comorbidities. Data analysis showed that patients at high risk of obstructive sleep apnea (OSA) have a higher prevalence of adverse respiratory events in the perioperative period, as demonstrated in the study by Xará et al. (2014). This finding underlines the need for careful preoperative evaluation and adapted anesthetic strategies to minimize respiratory complications, particularly in patients with elevated body mass indexes and multiple comorbidities. The implementation of specific protocols for the management of these patients can be crucial for the reduction of adverse events.

In the context of mechanical ventilation in obese patients, the study by Toker et al. (2019) showed that pressure-controlled volume-assured ventilation (PCV-VG) offers significant advantages compared to volume-controlled ventilation (VCV), including lower inspiratory pressures and greater dynamic compliance. These results suggest that PCV-VG should be considered as the technique of choice in obese patients undergoing laparoscopic surgeries in the Trendelenburg position, where changes in respiratory mechanics are particularly challenging. The superiority of PCV-VG in maintaining adequate levels of arterial oxygenation also highlights its usefulness in surgical scenarios involving gas insufflation in the abdomen.

Another relevant aspect discussed is the use of costoclavicular block as an alternative to general anesthesia in obese patients, as reported by Silva et al. (2019). This block has been shown to be effective and safe, especially in patients who have limitations for the application of other block techniques. Its implementation can reduce the need for general anesthesia, which is particularly beneficial for patients at high risk of respiratory or cardiovascular complications.

In the study by Ellenberger et al. (2018), glucose-insulin-potassium (GIK) administration in moderate- to high-risk patients undergoing cardiac surgery was associated with a significant reduction in postoperative adverse cardiac events. This finding is consistent with the literature supporting the use of myocardial protection strategies in major surgeries. The improvement in hemodynamic stability observed with the use of GIK suggests that this intervention may be a valuable addition to perioperative management in high-risk cardiac patients.

Regarding spinal versus general anesthesia for lumbar spine surgeries in high-risk patients, the study by Finsterwald et al. (2018) highlighted the benefits of spinal anesthesia, including improved hemodynamic stability and lower incidence of respiratory complications in the immediate

postoperative period. These results indicate that spinal anesthesia may be preferable for certain patients, reducing the risk of complications associated with general anesthesia.

Taken together, these studies underline the importance of a personalized approach in the anesthetic management of high-risk patients. The choice of anesthetic techniques should be based on a careful evaluation of the individual characteristics of the patients, including the presence of comorbidities, the type of surgery, and the risk of perioperative complications. The implementation of adapted strategies can significantly improve surgical outcomes, minimizing complications and promoting a faster and safer recovery.

These findings also point to the continued need for research and development of new techniques and protocols that can offer greater safety and efficacy in the management of high-risk patients. The differences observed in the studies highlight the need for a greater understanding of the interactions between specific anesthetic techniques and the clinical conditions of patients, in order to optimize perioperative care and improve clinical outcomes.

FINAL CONSIDERATIONS

The reviewed studies and data presented in this analysis highlight the critical importance of a personalized anesthetic approach for high-risk patients undergoing surgical procedures. Early identification of risk factors, such as obstructive sleep apnea, obesity, and associated comorbidities, allows the implementation of adapted anesthetic strategies that can minimize perioperative complications and significantly improve clinical outcomes.

The findings suggest that pressure-controlled volume-assured ventilation (PCV-VG) and costoclavicular block are effective and safe techniques that should be considered in obese patients, where mechanical ventilation and upper extremity anesthesia present particular challenges. In addition, the administration of glucose-insulin-potassium (GIK) in cardiac surgeries and the choice of spinal anesthesia for lumbar spine procedures in high-risk patients have been shown to be beneficial, reinforcing the need for an individualized evaluation of the patient to optimize the choice of anesthetic technique.

These results highlight the complexity of the management of patients with multiple comorbidities and highlight the importance of a multidisciplinary approach that involves anesthesiologists, surgeons, and other health professionals in the development of care plans that meet the specific needs of each patient. Personalization of anesthetic strategies not only improves surgical outcomes but also contributes to a safer and more efficient recovery.

Finally, it is essential to continue investing in clinical research and in the constant updating of anesthetic protocols to keep up with technological and scientific innovations that can offer new opportunities to improve the safety and effectiveness of anesthetic management in high-risk patients.



Integrating new evidence into clinical practice is critical to enhancing perioperative care and ensuring better outcomes for these complex and vulnerable patients.

REFERENCES

- Daniela Xará, Júlia Mendonça, Helder Pereira, Alice Santos, Fernando José Abelha; Eventos respiratórios adversos após anestesia geral em pacientes com alto risco de síndrome da apneia obstrutiva do sono, *Brazilian Journal of Anesthesiology*, Volume 65, Issue 5, 2015, Pages 359-366, ISSN 0034-7094, <https://doi.org/10.1016/j.bjan.2014.02.008>.
- Melike Korkmaz Toker, Basak Altıparmak, Ali İhsan Uysal, Semra Gumus Demirbilek; Comparação entre ventilação garantida por volume controlado por pressão e ventilação controlada por volume em pacientes obesos durante cirurgia laparoscópica ginecológica na posição de Trendelenburg, *Brazilian Journal of Anesthesiology*, Volume 69, Issue 6, 2019, Pages 553-560, ISSN 0034-7094, <https://doi.org/10.1016/j.bjan.2019.09.003>.
- Grazielle Rodrigues Silva, Danielle Gonçalves Borges, Iuri Ferreira Lopes, Roberto Araújo Ruzi, Paulo Ricardo Rabello de Macedo Costa, Beatriz Lemos da Silva Mandim; Bloqueio costoclavicular guiado por ultrassonografia como alternativa para anestesia de membro superior em paciente obeso, *Brazilian Journal of Anesthesiology*, Volume 69, Issue 5, 2019, Pages 510-513, ISSN 0034-7094, <https://doi.org/10.1016/j.bjan.2019.01.004>.
- Bokoch, M. P., VEGA-1 trial investigators. (2023). General anaesthesia in adult patients undergoing major noncardiac surgery: A multicentre, open-label, cluster-randomised, crossover, feasibility, and pilot trial. *British Journal of Anaesthesia*. Elsevier. <https://www.sciencedirect.com/science/article/pii/S0007091223000624>
- Evered, L. A., Chan, M. T. V., Han, R., Chu, M. H. M., & Others. (2021). Anaesthetic depth and delirium after major surgery: A randomised clinical trial. *British Journal of Anaesthesia*. Elsevier. <https://www.sciencedirect.com/science/article/pii/S0007091221004931>
- Calvo-Vecino, J. M., Ripollés-Melchor, J., & Others. (2018). Haemodynamic therapy on postoperative complications in low–moderate risk surgical patients: A multicentre randomised controlled trial (FEDORA trial). *British Journal of Anaesthesia*. Elsevier. <https://www.sciencedirect.com/science/article/pii/S0007091217542075>
- Lenze, E. J., Avidan, M. S., & ENGAGES Research Group. (2019). Guided anesthetic administration on postoperative delirium among older adults undergoing major surgery: The ENGAGES randomized clinical trial. *JAMA*. <https://jamanetwork.com/journals/jama/article-abstract/2724026>
- Li, Y. W., Li, H. J., Zhao, B. J., Guo, X. Y., Feng, Y., & Others. (2021). Delirium in older patients after combined epidural–general anesthesia or general anesthesia for major surgery: A randomized trial. *Anesthesiology*. <https://pubs.asahq.org/anesthesiology/article-abstract/135/2/218/115865>
- Ellenberger, C., Sologashvili, T., Kreienbühl, L., & Others. (2018). Myocardial protection by glucose–insulin–potassium in moderate-to high-risk patients undergoing elective on-pump cardiac surgery: A randomized controlled trial. *Anesthesia & Analgesia*. https://journals.lww.com/anesthesia-analgesia/fulltext/2018/04000/myocardial_protection_by_glucose_insulin_potassium.11.aspx
- Kehlet, H., & Mythen, M. (2011). Why is the surgical high-risk patient still at risk? *British Journal of Anaesthesia*. <https://academic.oup.com/bja/article-abstract/106/3/289/323283>



Finsterwald, M., Muster, M., Farshad, M., Saporito, A., & Others. (2018). Spinal versus general anesthesia for lumbar spine surgery in high-risk patients: Perioperative hemodynamic stability, complications and costs. *Journal of Clinical Anesthesia*.
<https://www.sciencedirect.com/science/article/pii/S0952818017311790>

Ferreira, G. S. R., de Almeida, J. P., Landoni, G., & Others. (2018). Effect of a perioperative intra-aortic balloon pump in high-risk cardiac surgery patients: A randomized clinical trial. *Critical Care Medicine*.
https://journals.lww.com/ccmjournals/fulltext/2018/08000/effect_of_a_perioperative_intra_aortic_balloon.30.aspx

Short, T. G., Campbell, D., Frampton, C., Chan, M. T. V., & Others. (2019). Anaesthetic depth and complications after major surgery: An international, randomised controlled trial. *The Lancet*.
[https://www.thelancet.com/journals/lancet/article/PIIS0140-6736\(19\)32315-3/abstract](https://www.thelancet.com/journals/lancet/article/PIIS0140-6736(19)32315-3/abstract)