

Anesthetic management of obese asthmatic patient undergoing knee arthroplasty

Made Suandika*, Martyarini Budi Setyawati, Rahmaya Nova Handayani, Awal Tunis Yantoro, Anton Suhendro, Indri Wijayanti

Program Studi Anestesiologi, Fakultas Kesehatan, Universitas Harapan Bangsa, Indonesia

*Corresponding author's email: madesuandika@uhb.ac.id

Accepted: 28 April 2026; revision: 27 September 2026; published: 30 September 2026

Abstract

Background: Obesity and asthma are significant risk factors that increase perioperative complications, particularly related to respiratory function and airway management in orthopedic surgery. Selecting an appropriate anesthetic technique is crucial to minimize these risks and improve patient outcomes.

Method: This study employed a descriptive case-based approach in a 60-year-old female patient diagnosed with grade IV knee osteoarthritis undergoing total knee replacement under spinal anesthesia. Data were collected from preoperative assessment, intraoperative monitoring, and postoperative evaluation.

Results: The patient had a body mass index of 35 kg/m² and a history of asthma with Mallampati class III airway. Spinal anesthesia was successfully administered at the L3–L4 level without complications. Intraoperatively, the patient developed shivering and mild respiratory discomfort, which were managed with active warming and supplemental oxygen. Hemodynamic parameters remained stable throughout the procedure. Postoperative recovery was uneventful, with expected residual motor blockade and no significant complications.

Conclusion: Spinal anesthesia is a safe and effective anesthetic technique in obese patients with asthma, as it reduces airway manipulation and minimizes respiratory complications. Proper perioperative management is essential to ensure optimal outcomes in high-risk patients.

Keywords: spinal anesthesia; obesity; asthma; knee replacement

INTRODUCTION

Total knee replacement (TKR) is considered the gold standard surgical intervention for patients with end-stage knee osteoarthritis, particularly those classified as Kellgren Lawrence grade IV. This procedure has been shown to significantly improve pain, functional mobility, and quality of life. With the increasing aging population, the demand for TKR has risen substantially worldwide, accompanied by a growing number of patients presenting with complex comorbid conditions (1).

Among these comorbidities, obesity represents a major global health concern and is highly prevalent in patients undergoing orthopedic procedures. Obesity, defined as a body mass index (BMI) ≥ 30 kg/m², is associated with significant physiological alterations, including reduced lung compliance, decreased functional residual

capacity, and increased oxygen consumption. These changes predispose patients to perioperative respiratory complications, hypoxemia, and difficulties in airway management (2). Furthermore, obesity is strongly correlated with anatomical challenges such as increased neck circumference and limited airway visualization, often reflected in higher Mallampati scores, thereby increasing the risk of difficult intubation (3).

In addition to obesity, asthma remains a critical consideration in anesthetic management. Asthma is characterized by chronic airway inflammation and hyperresponsiveness, which may lead to perioperative bronchospasm, particularly during airway manipulation and exposure to anesthetic agents. The incidence of perioperative respiratory complications is significantly higher in patients with poorly

controlled asthma, especially under general anesthesia involving endotracheal intubation (4). Therefore, minimizing airway instrumentation becomes a key strategy in reducing perioperative morbidity in such patients.

Regional anesthesia, particularly spinal anesthesia (subarachnoid block, SAB), has been widely advocated as a preferred anesthetic technique for lower limb orthopedic surgeries, including TKR. Compared to general anesthesia, SAB offers several advantages, such as reduced risk of airway-related complications, better postoperative analgesia, decreased thromboembolic events, and improved hemodynamic stability when appropriately managed (5). In patients with obesity and respiratory comorbidities, SAB provides a safer alternative by avoiding airway manipulation and reducing pulmonary complications.

However, despite its advantages, spinal anesthesia is not without risks. Complications such as intraoperative hypotension, shivering, and incomplete block may still occur and require prompt recognition and management. Shivering, in particular, is a common adverse effect associated with neuraxial anesthesia, resulting from thermoregulatory impairment and redistribution of body heat, which may increase oxygen consumption and patient discomfort (6).

Therefore, this study aims to describe the perioperative anesthetic management of an obese patient with asthma undergoing total knee replacement under spinal anesthesia using a case-based clinical approach, and to evaluate perioperative outcomes.

METHOD

This study employed a descriptive case-based approach conducted in the operating room of a secondary referral hospital. The subject was a 60-year-old female patient diagnosed with grade IV knee osteoarthritis who underwent total knee replacement.

Preoperative data were collected through structured history taking using the AMPLE framework (Allergies, Medications, Past medical history, Last meal, and Events)

and a systematic physical examination using the 6B framework (Blood, Breathing, Brain, Bladder, Bowel, and Bone). The assessment included the patient's medical history, medication and allergy history, fasting status, airway and respiratory examination, cardiovascular status, neurological function, urinary and gastrointestinal assessment, and musculoskeletal condition. Additional clinical data were obtained from intraoperative anesthesia monitoring records and postoperative recovery assessments.

Spinal anesthesia was performed at the L3–L4 intervertebral space using a 25-gauge spinal needle under aseptic conditions. The procedure was successfully completed on the first attempt without any reported needle-related complications. The intrathecal anesthetic consisted of Levica 20 mg (4 mL at a concentration of 5 mg/mL), with fentanyl as an adjuvant at a reported dose of 0.25 µg. Intravenous ondansetron 4 mg was administered as the sole premedication. Standard perioperative monitoring included noninvasive blood pressure, heart rate, respiratory rate, and peripheral oxygen saturation (SpO₂).

The surgical procedure commenced at 09:00 and was completed at 11:00, resulting in a total operative duration of 120 minutes. Estimated intraoperative blood loss was approximately 200 mL, and the patient received 1,500 mL of Ringer's lactate solution. The patient was transferred to the recovery room at 11:05 for postoperative monitoring.

Data were analyzed descriptively and compared with current anesthesiology guidelines and evidence-based literature to evaluate clinical outcomes (11).

RESULTS

The patient was a 60-year-old female with a body mass index of 35 kg/m² and a medical history of asthma. Preoperative airway assessment revealed Mallampati class III, with stable baseline vital signs (blood pressure 136/61 mmHg, heart rate 65 beats/min, respiratory rate 17 breaths/min, and oxygen saturation [SpO₂] 100%). The patient was classified as ASA physical status

II. The patient was classified as American Society of Anesthesiologists (ASA) Physical Status II based on the presence of class II obesity (BMI 35.0 kg/m²) and a history of asthma assessed as controlled by the attending anesthesiologist. Preoperative evaluation showed regular spontaneous breathing without accessory respiratory muscle use, a respiratory rate of 17 breaths/min, and peripheral oxygen saturation of 100%. Although wheezing was detected on pulmonary auscultation, no acute respiratory distress was documented. These findings were considered consistent with mild systemic disease without documented substantial functional limitation, supporting the recorded ASA II classification.

Spinal anesthesia was successfully administered at the L3–L4 intervertebral space without procedural complications. During the intraoperative period, the patient developed shivering accompanied by a subjective sensation of coldness. Additionally, mild respiratory discomfort was observed, with SpO₂ maintained at 98–99%.

These conditions were managed with active warming using a blanket and administration of supplemental oxygen at 4 L/min via nasal cannula. Following these interventions, the patient's symptoms improved.

Hemodynamic parameters remained stable throughout the procedure, with no evidence of hypotension or desaturation. Postoperatively, the patient demonstrated residual motor blockade (Bromage score 2), consistent with the expected effects of spinal anesthesia, and recovered without significant complications.

DISCUSSION

The anesthetic management of obese patients with concomitant asthma undergoing total knee replacement presents a complex interplay of respiratory, anatomical, and physiological challenges. Both conditions independently contribute to increased perioperative morbidity, and their coexistence further amplifies the risk of adverse outcomes. Therefore, anesthetic decision-making must be carefully tailored to minimize these risks.

Obesity significantly alters respiratory physiology through multiple mechanisms. The reduction in functional residual capacity (FRC), expiratory reserve volume, and lung compliance leads to early airway closure and ventilation–perfusion mismatch, predisposing patients to rapid oxygen desaturation even during short periods of hypoventilation (2,12). Additionally, increased intra-abdominal pressure and reduced diaphragmatic excursion further compromise pulmonary mechanics. From an airway perspective, obesity is strongly associated with difficult airway predictors, including increased neck circumference, excessive soft tissue deposition, and higher Mallampati classification, all of which increase the likelihood of difficult mask ventilation and intubation (3). These anatomical and physiological factors underscore the importance of minimizing airway manipulation whenever feasible.

Asthma further exacerbates perioperative risk due to chronic airway inflammation and heightened bronchial hyperresponsiveness. Mechanical stimulation of the airway, particularly during laryngoscopy and endotracheal intubation, can precipitate bronchospasm, increased airway resistance, and impaired gas exchange (4,13). Moreover, perioperative stress, anesthetic agents, and inadequate depth of anesthesia may further trigger bronchoconstriction. Consequently, strategies that avoid airway instrumentation are strongly favored in patients with reactive airway disease.

In this context, spinal anesthesia (subarachnoid block, SAB) offers a physiologically advantageous alternative to general anesthesia. By eliminating the need for airway manipulation, SAB significantly reduces the risk of bronchospasm and airway-related complications. In addition, neuraxial anesthesia has been associated with improved postoperative pulmonary outcomes, reduced opioid consumption, and enhanced recovery profiles in orthopedic surgery (6,14). The successful use of SAB in this case aligns with current evidence supporting its safety and efficacy in high-risk respiratory patients.

Despite these advantages, spinal anesthesia is not without limitations. One of the most common complications observed is perioperative shivering, which was evident in this patient. The pathophysiology of shivering following neuraxial anesthesia is multifactorial, primarily involving impairment of central thermoregulation due to sympathetic blockade and redistribution of core heat to the peripheral compartment (8,15). This phenomenon results in a decrease in core body temperature, triggering involuntary muscular activity to generate heat. Clinically, shivering is not merely a discomfort issue; it significantly increases oxygen consumption, carbon dioxide production, and cardiac workload, which may be particularly detrimental in patients with limited cardiopulmonary reserve (9).

In this case, shivering was effectively managed using non-pharmacological warming measures, including active external warming. However, current evidence suggests that pharmacological agents such as dexmedetomidine, tramadol, and meperidine provide superior control of shivering by modulating central thermoregulatory pathways (16,17). The absence of pharmacological intervention in this case highlights an opportunity for optimizing perioperative care based on evidence-based practice.

The occurrence of mild respiratory discomfort during the intraoperative period may be attributed to the patient's underlying asthma. Although spinal anesthesia avoids direct airway manipulation, it does not completely eliminate respiratory risk. Factors such as anxiety, altered respiratory mechanics, or high neuraxial block levels may contribute to subjective dyspnea. The prompt administration of supplemental oxygen and continuous monitoring ensured adequate oxygenation and patient stability, reflecting appropriate intraoperative management.

Postoperative recovery in this patient was uneventful, with stable hemodynamic parameters and expected residual motor blockade (Bromage score 2), consistent with the pharmacodynamic profile of spinal anesthesia (18). Adequate monitoring during

the recovery phase is essential to ensure complete neurological recovery and prevent complications such as falls or delayed mobilization.

Overall, this case reinforces the importance of individualized anesthetic planning in patients with multiple comorbidities. The successful application of spinal anesthesia in this patient supports its role as a safe and effective technique in minimizing airway-related and respiratory complications. However, optimal outcomes depend not only on the choice of anesthetic technique but also on comprehensive perioperative assessment, anticipation of potential complications, and timely, evidence-based interventions.

CONCLUSIONS

Spinal anesthesia represents a safe and effective anesthetic technique for obese patients with asthma undergoing total knee replacement, as it minimizes airway manipulation and reduces the risk of perioperative respiratory complications. The presence of obesity and reactive airway disease necessitates careful anesthetic planning due to altered respiratory physiology and increased airway difficulty.

In this case, spinal anesthesia provided stable hemodynamic conditions and satisfactory perioperative outcomes, despite the occurrence of minor complications such as shivering and mild respiratory discomfort, which were successfully managed. These findings highlight the importance of comprehensive preoperative assessment, appropriate selection of anesthetic technique, and vigilant intraoperative and postoperative monitoring.

An individualized, evidence-based approach remains essential to optimize patient safety and improve clinical outcomes in high-risk populations undergoing orthopedic surgery.

ACKNOWLEDGEMENTS

The author would like to express sincere gratitude to the clinical instructors and operating room staff for their support and assistance during the perioperative management of this case. Appreciation is also

extended to the academic supervisor for guidance and valuable input in the preparation of this manuscript.

REFERENCES

1. Sloan M, Premkumar A, Sheth NP. Projected volume of primary total joint arthroplasty in the United States. *J Bone Joint Surg Am*. 2018;100(17):1455–60.
2. De Jong A, Wrigge H, Hedenstierna G, et al. How to ventilate obese patients in the operating room. *Anesthesiology*. 2019;130(5):822–35.
3. Ahmad I, El-Boghdady K, Bhagrath R, et al. Difficult airway society guidelines for awake tracheal intubation in adults. *Anaesthesia*. 2020;75(4):509–28.
4. Global Initiative for Asthma (GINA). Global strategy for asthma management and prevention. 2023.
5. Smetana GW, Lawrence VA, Cornell JE. Preoperative pulmonary evaluation. *Ann Intern Med*. 2019;171(1):ITC1–16.
6. Johnson RL, Kopp SL, Burkle CM, et al. Neuraxial vs general anesthesia for total hip and knee arthroplasty: a meta-analysis. *Anesthesiology*. 2020;132(2):397–408.
7. Memtsoudis SG, Cozowicz C, Bekeris J, et al. Anaesthetic care of patients undergoing primary hip and knee arthroplasty. *Anesthesiology*. 2019;130(6):1039–50.
8. Sessler DI. Perioperative thermoregulation and heat balance. *Anesthesiology*. 2016;125(5):1003–5.
9. De Witte J, Sessler DI. Perioperative shivering: physiology and pharmacology. *Anesthesiology*. 2018;129(4):756–77.
10. American Society of Anesthesiologists. Standards for basic anesthetic monitoring. 2022.
11. Butterworth JF, Mackey DC, Wasnick JD. Morgan & Mikhail's Clinical Anesthesiology. 6th ed. New York: McGraw-Hill; 2020.
12. Pelosi P, Croci M, Ravagnan I, et al. Respiratory system mechanics in obese patients. *Br J Anaesth*. 2018;120(5):1060–9.
13. Warner DO. Perioperative management of patients with asthma. *Anesthesiology*. 2017;127(3):532–45.
14. Memtsoudis SG, Sun X, Chiu YL, et al. Perioperative outcomes after neuraxial anesthesia. *Br J Anaesth*. 2020;124(3):243–52.
15. Yi JW, Lee BJ, Han JH, et al. Incidence and risk factors of shivering after spinal anesthesia. *Br J Anaesth*. 2018;121(6):1325–31.
16. Park SM, Mangat HS, Berger K, Rosengart AJ. Efficacy of dexmedetomidine for prevention of shivering. *BMC Anesthesiol*. 2021;21:98.
17. Zhang Y, Wong KC, Chan MT. Pharmacological prevention of shivering. *Medicine (Baltimore)*. 2019;98(13):e14921.
18. Kehlet H, Joshi GP. Enhanced recovery after surgery in orthopedic procedures. *Lancet*. 2017;389(10089):152–64.
19. Apfelbaum JL, Hagberg CA, Connis RT, et al. 2022 ASA difficult airway guidelines. *Anesthesiology*. 2022;136(1):31–81.
20. World Health Organization. Obesity and overweight. 2021.
21. Miller RD, Eriksson LI, Fleisher LA, et al. Miller's Anesthesia. 9th ed. Philadelphia: Elsevier; 2020.