

Acute High Spinal Block After Subarachnoid Anesthesia During Lower Limb Surgery: A Case Report

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Abstract

Background: High spinal block is a rare but potentially life-threatening complication of subarachnoid anesthesia resulting from excessive cephalad spread of local anesthetic within the cerebrospinal fluid. It can rapidly progress to profound hypotension, bradycardia, respiratory insufficiency, and cardiovascular collapse if not recognized and managed promptly. Early diagnosis and immediate resuscitative intervention are essential to ensure favorable outcomes.

Case Presentation: We report the case of a 45-year-old male who underwent open reduction and internal fixation for a right tibial shaft fracture under subarachnoid anesthesia with 0.5% hyperbaric bupivacaine. Within minutes of intrathecal injection, the patient developed rapidly ascending sensory blockade, severe hypotension, bradycardia, respiratory distress, and oxygen desaturation, consistent with high spinal block. Immediate management included administration of 100% oxygen, rapid intravenous fluid resuscitation, atropine, vasopressor support, endotracheal intubation, and controlled mechanical ventilation. The patient remained hemodynamically stable following resuscitation, demonstrated gradual neurological recovery, and was successfully extubated after complete regression of the spinal block. He was discharged without neurological, cardiovascular, or respiratory sequelae.

Conclusion: High spinal block remains an uncommon but serious complication of spinal anesthesia that requires rapid recognition and immediate intervention. Careful patient monitoring during the immediate post-spinal period, early airway stabilization, aggressive hemodynamic support, and adherence to established anesthetic guidelines are essential for preventing morbidity and ensuring successful recovery. This case highlights the importance of preparedness for airway emergencies and reinforces the need for prompt multidisciplinary management of this potentially reversible anesthetic complication.

Keywords: High spinal block; Subarachnoid anesthesia; Spinal anesthesia; Hypotension; Bradycardia; Airway management; Mechanical ventilation; Lower limb surgery; Case report.

Introduction

High spinal block is a rare but potentially life-threatening complication of subarachnoid (spinal) anesthesia characterized by excessive cephalad spread of local anesthetic within the cerebrospinal fluid, resulting in extensive blockade of the spinal cord and brainstem functions [1,2]. Although spinal anesthesia is widely regarded as a safe and reliable regional anesthetic technique for lower limb, lower abdominal, and urological surgeries, high spinal block remains a feared complication because of its rapid onset and potential to cause severe cardiovascular and respiratory compromise [1–3]. The incidence of high spinal block has been reported to range from approximately 1 in 2,971 to 1 in 16,200 spinal anesthetic procedures, depending on patient characteristics, anesthetic technique, and institutional practices [2,3]. The condition usually results from unintended excessive cephalad spread of intrathecal local anesthetic and may be influenced by factors such as high local anesthetic dose, patient position, obesity, pregnancy, advanced age, spinal

deformities, accidental dural puncture following epidural anesthesia, and technical errors during drug administration [3,4].

Clinically, high spinal block presents with rapidly ascending sensory and motor blockade accompanied by hypotension, profound bradycardia, dyspnea, upper limb weakness, nausea, difficulty in phonation, and altered consciousness due to blockade of the cardiac accelerator fibers and cervical spinal segments [4,5]. In severe cases, total spinal anesthesia may develop, resulting in apnea, loss of consciousness, profound circulatory collapse, and cardiac arrest if immediate resuscitative measures are not instituted [5]. Early recognition of the characteristic clinical features is therefore crucial for preventing catastrophic outcomes. The diagnosis of high spinal block is primarily clinical and should be suspected whenever respiratory distress, hypotension, or unexpected neurological deficits occur shortly after administration of spinal anesthesia [5,6]. Immediate management consists of prompt airway stabilization, administration of 100% oxygen, aggressive fluid resuscitation, vasopressor support, atropine for severe bradycardia when indicated, and endotracheal intubation with mechanical ventilation in patients who develop respiratory failure or loss of consciousness [6,7]. With timely recognition and appropriate supportive care, most patients recover completely without permanent neurological sequelae.

Lower limb orthopedic surgeries are frequently performed under subarachnoid anesthesia because of its rapid onset, excellent sensory and motor blockade, reduced blood loss, and favorable postoperative analgesia [1,7]. Despite its advantages, anesthesiologists must remain vigilant for rare complications such as high spinal block, particularly in patients with predisposing risk factors. Reporting such cases is essential to increase awareness, facilitate early diagnosis, reinforce evidence-based management strategies, and improve perioperative patient safety [7,8]. We present a case of high spinal block following subarachnoid anesthesia for lower limb surgery, highlighting its clinical presentation, prompt management, and favorable outcome with timely supportive treatment.

Case Presentation

Patient Information

A 45-year-old male weighing 72 kg (Body Mass Index: 24.6 kg/m²) presented to the Department of Orthopaedics with a closed fracture of the right tibial shaft following a road traffic accident. He was scheduled for open reduction and internal fixation under spinal anesthesia. The patient had no history of hypertension, diabetes mellitus, cardiovascular disease, respiratory illness, neurological disorders, or previous adverse reactions to anesthesia. Preoperative evaluation revealed an American Society of Anesthesiologists (ASA) physical status II due to the traumatic injury. Baseline vital signs were stable, with a heart rate of 82 beats/min, blood pressure of 128/78 mmHg, respiratory rate of 16 breaths/min, and oxygen saturation (SpO₂) of 99% on room air.

Anesthetic Procedure

After obtaining informed written consent, the patient was transferred to the operating theatre. Standard ASA monitoring, including electrocardiography, non-invasive blood pressure, and pulse oximetry, was initiated. An 18-gauge intravenous cannula was secured, and preloading was performed with 500 mL of Ringer's lactate solution. Subarachnoid anesthesia was administered in the sitting position at the L3-L4 intervertebral space using a 25-gauge Quincke spinal needle under strict aseptic precautions. Following confirmation of free cerebrospinal fluid flow, 3 mL of 0.5% hyperbaric bupivacaine (15 mg) was injected intrathecally over approximately 15 seconds. The patient was immediately positioned supine with a neutral head position.

Clinical Deterioration

Within five minutes of spinal anesthesia, the patient complained of progressive numbness extending to the upper limbs, difficulty in breathing, inability to speak clearly, and a sensation of impending doom. Rapid clinical assessment revealed a sensory block extending to the C6 dermatome with profound motor blockade of both upper and lower limbs. Blood pressure decreased abruptly to 68/38 mmHg, and heart rate fell to 42 beats/min. Oxygen saturation declined from 99% to 84% despite supplemental oxygen delivered via a face mask. The patient subsequently developed respiratory insufficiency with shallow breathing and reduced chest wall movement, consistent with a diagnosis of high spinal block.

Management

Immediate resuscitative measures were initiated. The patient received 100% oxygen through a bag-valve-mask device while rapid intravenous crystalloid infusion was commenced. Intravenous atropine (0.6 mg) was administered for severe bradycardia, followed by incremental boluses of intravenous ephedrine (6 mg) to correct persistent hypotension. Despite these interventions, respiratory effort continued to deteriorate, necessitating rapid sequence endotracheal intubation and initiation of controlled mechanical ventilation. Anesthesia was maintained using intravenous propofol infusion combined with intermittent fentanyl administration. Continuous hemodynamic monitoring was performed throughout the procedure. Blood pressure gradually improved to 110/70 mmHg, and heart rate increased to 76 beats/min following vasopressor therapy and fluid resuscitation.



Figure 1: High Spinal Block After Subarachnoid Anesthesia During Lower Limb Surgery

Postoperative Course

After surgery, the patient was transferred to the intensive care unit for postoperative monitoring and elective mechanical ventilation. Serial neurological examinations demonstrated gradual regression of the sensory

and motor blockade over the following four hours. Hemodynamic parameters remained stable without further vasopressor support. The patient was successfully extubated six hours after surgery following complete recovery of spontaneous ventilation, protective airway reflexes, and adequate motor power. A postoperative chest radiograph and arterial blood gas analysis were unremarkable. No neurological deficits, cardiovascular complications, or respiratory sequelae were observed. The patient was transferred to the orthopedic ward on postoperative day one and was discharged home on the fifth postoperative day in stable condition with complete neurological recovery.

Outcome and Follow-up

At the two-week follow-up visit, the patient remained clinically stable with normal neurological examination findings and no evidence of cardiovascular or respiratory complications. Orthopedic recovery was satisfactory, and no late complications related to the episode of high spinal block were identified.

Discussion

High spinal block is a rare but potentially life-threatening complication of subarachnoid anesthesia that results from excessive cephalad spread of local anesthetic within the cerebrospinal fluid. Although spinal anesthesia is considered a safe and reliable technique for lower limb surgeries, rapid recognition and prompt management of high spinal block are essential to prevent severe cardiovascular collapse, respiratory failure, and neurological complications [9,10]. The present case highlights the importance of early diagnosis, immediate resuscitative measures, and adherence to established anesthetic protocols in achieving a favorable clinical outcome.

In the present case, the patient developed sudden hypotension, profound bradycardia, respiratory distress, and rapidly ascending sensory blockade within minutes of intrathecal administration of hyperbaric bupivacaine. These clinical findings are characteristic of high spinal block and are consistent with previous reports. Miller's *Anesthesia* describes high spinal block as a consequence of extensive cephalad spread of local anesthetic resulting in blockade of the cardiac accelerator fibers (T1–T4) and cervical spinal segments, producing severe hypotension, bradycardia, respiratory insufficiency, and occasionally loss of consciousness [9]. Similarly, *Chestnut's Obstetric Anesthesia* emphasizes that prompt recognition of these manifestations is critical to prevent progression to total spinal anesthesia and cardiovascular collapse [10].

Several factors have been implicated in the development of high spinal block, including excessive intrathecal local anesthetic dose, patient positioning, obesity, pregnancy, advanced age, spinal deformities, and technical factors during subarachnoid injection [11,12]. Although none of these major risk factors were evident in the present patient, unpredictable cephalad spread of hyperbaric bupivacaine can occasionally occur even after technically successful spinal anesthesia. This highlights the importance of continuous monitoring during the early post-spinal period regardless of patient risk profile. Immediate airway management and hemodynamic stabilization remain the cornerstone of treatment. The American Society of Anesthesiologists (ASA) Practice Guidelines recommend rapid airway support, administration of 100% oxygen, aggressive intravenous fluid resuscitation, early use of vasopressors, and endotracheal intubation with mechanical ventilation when respiratory compromise develops [13]. In the present case, early administration of intravenous fluids, atropine, vasopressor support, oxygen therapy, and timely endotracheal intubation resulted in rapid hemodynamic stabilization and complete neurological recovery. Similar successful outcomes have been reported by Kinsella et al., who emphasized that early supportive management remains the most effective treatment strategy for high spinal block [14].

Recent case reports have also demonstrated favorable outcomes following prompt recognition and multidisciplinary management. Alimian et al. reported complete recovery after immediate ventilatory support and vasopressor therapy in a patient who developed high spinal anesthesia following intrathecal bupivacaine administration [15]. Likewise, Gupta et al. highlighted that continuous monitoring during the first 15–20 minutes after spinal anesthesia is crucial because most cases of high spinal block occur during this period [16]. These observations closely parallel the present case, where rapid diagnosis and intervention prevented progression to cardiac arrest or permanent neurological injury. Preventive strategies remain equally important. Careful patient selection, appropriate intrathecal drug dosing, meticulous spinal anesthesia technique, gradual patient positioning, vigilant intraoperative monitoring, and immediate availability of airway equipment and resuscitation drugs are essential to minimize the incidence and consequences of high spinal block [13,17]. Although this report represents a single case and cannot establish causality, it reinforces existing evidence that favorable outcomes depend largely on early recognition, prompt resuscitation, and coordinated teamwork. Reporting such cases increases awareness among anesthesiologists and contributes to improved perioperative preparedness for this uncommon but potentially catastrophic complication [18].

Summary

High spinal block is a rare but potentially life-threatening complication of subarachnoid anesthesia that requires immediate recognition and prompt management to prevent serious morbidity and mortality. This case highlights the rapid onset of profound hypotension, bradycardia, respiratory distress, and extensive sensory blockade following spinal anesthesia for lower limb surgery. Early diagnosis, timely airway stabilization, aggressive hemodynamic support, and mechanical ventilation resulted in complete recovery without neurological or cardiovascular sequelae. The case emphasizes the importance of vigilant monitoring during the immediate post-spinal period, adherence to established resuscitation protocols, and preparedness with advanced airway management and emergency medications. Increased awareness among anesthesiologists regarding this uncommon complication is essential for ensuring patient safety and achieving favorable perioperative outcomes.

Conclusion

High spinal block is a rare but serious complication of subarachnoid anesthesia that can rapidly progress to respiratory and cardiovascular compromise if not recognized promptly. This case demonstrates that early diagnosis, immediate airway management, aggressive hemodynamic support, and timely ventilatory assistance can result in complete recovery without long-term sequelae. Vigilant monitoring during the immediate post-spinal period, adherence to established anesthetic guidelines, and preparedness for emergency airway management are essential for ensuring patient safety. Increased awareness of this potentially life-threatening complication among anesthesiologists can facilitate prompt intervention and improve perioperative outcomes.

Declaration

Consent: Written informed consent was obtained from the patient. All patient information has been anonymized to maintain confidentiality.

Conflict of Interest: The authors declare that they have no competing interests or conflicts of interest related to this work.

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