

High Spinal Anesthesia in Total Knee Replacement

Febri Ahmad Belinda¹, Hery Budi Sumaryono²

¹Residency Program of Anesthesiology and Intensive Therapy, Medical Faculty, Universitas Sebelas Maret, Surakarta, Indonesia

²Department of Anesthesiology and Intensive Therapy, Dr. Soeharso Orthopedic Hospital, Sukoharjo, Indonesia

ABSTRACT

Background: Osteoarthritis (OA) is the most common degenerative disease at people aged 63-70 years. Human ageing is associated with an increase in weakness around the joints, decreased joint flexibility, calcification of cartilage, and decreased chondrocyte function. Total knee replacement (TKR) is performed to treat pain and immobilisation in osteoarthritis patients. This procedure is done with spinal anaesthesia.

Case: A 73 years old man diagnosed with bilateral OA and underwent TKR. The patient had left knee pain six months ago with a history of high blood pressure. If blood pressure <160/90 mmHg subarachnoid block was planned. The patient entered the operating room with an intravenous (IV) line of ringer lactate 10 dpm. Preoperatively, the patient was given ranitidine 50 mg IV and ondansetron 4 mg. The anaesthetic agent was hyperbaric bupivacaine 0.5% 15 mg + fentanyl 25 µg; the patient was hemodynamically monitored and maintained with O₂ 4 lpm. After 45 minutes of spinal anesthesia, the patient experienced respiratory distress, so we placed a masked and intubated the patient with endotracheal tube (ETT) 7.0. It is suspected that the patient had high spinal anesthesia.

Conclusion: A 73-year-old man has been subjected to regional spinal anesthesia with total knee replacement surgery. However, spinal anesthesia failed and was converted to general anesthesia with ETT, with a duration of operation of 4 hours, hemodynamically stable, postoperatively the patient was admitted to the high care unit.

Keywords: high care unit, high spinal anesthesia, osteoarthritis, total knee replacement

Correspondence:

Febri Ahmad Belinda,
MD*

Residency Program of
Anesthesiology and Intensive
Therapy, Medical Faculty,
Universitas Sebelas Maret,
Surakarta, Indonesia
e-mail:
fab.noerudin@gmail.com



Received: March 2022, **Revised:** May 2022, **Published:** May 2022

How to cite this article: Belinda, FA, HB Sumaryono. High spinal anesthesia in total knee replacement. *Journal of Anaesthesia and Pain*. 2022;3(2):34-36. doi: 10.21776/ub.jap.2022.003.02.03

INTRODUCTION

Osteoarthritis (OA) is a degenerative joint disease in which the entire structure of the joint undergoes pathological changes, which is characterized by damage to the hyaline cartilage of the joints, increased thickness and sclerosis of the bone plates, growth of osteophytes at the joint edges, stretching of the joint capsule, and signs of inflammation. The Framingham study showed that 27% of people aged 63–70 years had radiographic evidence of knee OA, which increased to 40% at age 80 or older.¹

Total Knee Replacement (TKR) is a surgical procedure in which an abnormal knee joint is replaced with artificial materials. Indications for TKR are severe pain and functional disability due to damage to the joint surface due to arthritis (osteoarthritis, rheumatoid arthritis, post-traumatic arthritis) and bleeding into the joints, such as in hemophilia patients.² The TKR procedure has been performed in more than 500,000 cases in the United States. From 2000 to 2006, the average TKR health service ratio in the United States increased from 5.5 to 8.7 per 1000 patients. Since

2000, one of the hospitals in Indonesia has performed the most TKR procedures in Southeast Asia region.³

Many orthopedic surgical procedures employ regional anesthesia, which provides intraoperative anesthesia and postoperative pain management. Patients undergoing orthopedic surgery are at risk for deep vein thrombosis. Spinal or subarachnoid block (SAB) is a regional anesthetic technique performed by injecting local anesthetic drugs into the subarachnoid space in the lumbar vertebral 2-5 region using a technique (midline/median or paramedian) with a tiny spinal needle to obtain dermatome-level block or analgesia and skeletal muscle relaxation.⁴

When spinal anesthesia is performed, complications that may occur are high spinal anesthesia, commonly referred to as total spinal. The dangers which can arise due to this complication are hypotension, respiratory arrest, decreased consciousness, motor paralysis, and if not treated immediately, cardiac arrest can also occur.⁵

CASE

A 73 years old man came with complaints of left knee pain six months ago. The patient has had a history of hypertension since ten years ago. The patient had never had any surgery before. The patient was diagnosed in the orthopedic department with bilateral knee osteoarthritis, and a left TKR was performed. The anesthesiological diagnosis was a 73-year-old man with bilateral knee osteoarthritis pro left TKR with physical status American Society of Anesthesiologist (ASA) II. If the patient's blood pressure is <160/90mmHg, we plan SAB.

The patient entered the operating room with an 18G IV line installed with a 10 dpm ringer lactate infusion. Preoperatively, the patient was given ranitidine 50 mg IV and ondansetron 4 mg, and the patient fasted 8 hours before surgery. Intraoperatively, the patient was positioned in a sitting position with the puncture point VL 4-5 with hyperbaric bupivacaine 0.5% 15 mg + fentanyl 25 mg with a rate of injection of 0.5ml/second. After injecting the agents, the autonomic, sensory, and motoric blockage were evaluated. Around 5 minutes after injection, the blood pressure was observed to decrease from 153/83 mmHg to 143/67 mmHg, and the painful sensation had been reduced. Then, the patient was asked to lift both legs, and the patient admitted to feeling heavy when lifting the legs. No numbness and chest tightness were observed. During the operation, the patient was maintained with O₂ 4 lpm. After 45 minutes of anesthesia, the patient had difficulty breathing, and an endotracheal tube (ETT) 7.0 was installed with the maintenance of sevoflurane, O₂, and N₂O. The operation lasted for approximately 4 hours. Bleeding was +200 ml, urine output was +600 ml, and the fluid balance was +320 ml. The patient was admitted to the High care unit (HCU) for hemodynamic monitoring postoperatively. The postoperative analgesia agent was fentanyl 300 mg in 50 ml of NaCl at a rate of 5 ml/hour, and if necessary, ondansetron 4 mg/8 hours was administered.

DISCUSSION

Based on the case discussed previously, the patient had high spinal despite cerebrospinal fluid CSF (+). The patient was lying in a flat supine position without a head-down or head-up

position right after the subarachnoid injection. High spinal is defined as a significant complication of neuraxial anesthesia. Several things can be done to recognize the condition of high spinal anesthesia, according to Table 1.⁶ In this case, the patient had an increased respiratory rate. The patient's breathing was observed preoperatively, post-puncture, and during surgery. After 45 minutes of anesthesia, the patient first complained about numbness in the thoracic, bilateral volar area, and almost the tip of his fingers. Furthermore, the patient experienced an increase in respiratory rate due to respiratory depression because the anesthesia reached a higher level and decreased consciousness. We had confirmed that all of the symptoms were not caused by any other reasons since we did not apply any sedative drugs to the patient (e.g., benzodiazepines group, opioid, or ketamine). One possibility that can cause high spinal anesthesia is the patient's position. When the rotation and curvature of the patient's spine are not appropriate and the patient's position is wrong, the spread of anesthetic agents can exceed the anesthetic target. Thus, an anesthetic assistant is required to position the patient.⁷

Another possible cause is the direction of needle insertion used for puncture. In the midline approach, insertion begins at the midline, the mid-way between the posterior spine and the needle at exact angles. If the needle changes direction to the cephalad, the spread of the anesthetic agent can spread to a higher anesthetic level.⁸

The management of this condition is to intubate and ventilate after administration ephedrine immediately. Ephedrine is preferred over phenylephrine because cardiac deafferentation is more likely to occur under high spinal anesthesia conditions than simple spinal hypotension.⁶

CONCLUSION

Regional anesthesia with spinal anesthesia has been performed on a 73-year-old man with total knee replacement surgery. However, the spinal anesthesia failed and was converted to general anesthesia with ETT. The duration of the surgery was 4 hours, with stable hemodynamics, and postoperatively the patient was admitted to the HCU.

Table 1. Manifestations that may refer to high spinal⁶

Symptoms	Respiratory system	Cardiovascular system	Diagnosis
A weak cough or early signs of dyspnea	<ul style="list-style-type: none"> RR >12-15 per minute SpO₂ > 95% Function is at the preoperative status 	Hypotension and no bradycardia	High spinal is unlikely.
Progressive dyspnea Weak handgrip strength (C8/T1) Can't touch nose (C5/C6) Ineffective cough	<ul style="list-style-type: none"> RR: 12-15 per minute SpO₂ < 95% Function diminished 	Hypotension and no bradycardia	Early signs of high spinal anesthesia
Unable to speak	<ul style="list-style-type: none"> Hypoventilation SpO₂ < 90% Function poor 	Hypotension ± bradycardia	High spinal anesthesia is likely.
Unable to speak	<ul style="list-style-type: none"> Apnea 	Hypotension ± bradycardia	High spinal anesthesia is established

ACKNOWLEDGMENT

-

CONFLICT OF INTEREST

None

REFERENCES

1. Amoako AO, Pujalte GGA. Osteoarthritis in young, active, and athletic individuals. *Clin Med Insights Arthritis Musculoskeletal Disord.* 2014;7:27-32. doi:10.4137/CMAMD.S14386
2. Foran JRH, Fischer SJ. Total Hip Replacement. OrthoInfo- AAOS. *OrthoInfo.aaos.org*. <https://orthoinfo.aaos.org/en/treatment/total-hip-replacement/>. Accessed May 19, 2022.
3. Steinhaus ME, Christ AB, Cross MB. Total Knee Arthroplasty for Knee Osteoarthritis: Support for a Foregone Conclusion? *HSS J.* 2017;13(2):207-210. doi:10.1007/s11420-017-9558-4
4. Mangku G, Senapathi TGA. *Buku ajar ilmu anestesia dan reanimasi*. Jakarta: Indek; 2010.
5. Pardo M, Miller RD. *Basics of Anesthesia E-Book*. Elsevier Health Sciences; 2017.
6. Van Rensburg G, Van Dyk D, Bishop D, et al. The management of high spinal anaesthesia in obstetrics: suggested clinical guideline in the South African context. *South African J Anaesth Analg.* 2016;22(2): S1-S5.
7. Fettes PDW, Jansson J-R, Wildsmith JAW. Failed spinal anaesthesia: mechanisms, management, and prevention. *Br J Anaesth.* 2009;102(6):739-748.
8. Tarkkila P. Complications associated with spinal anaesthesia. In: *Complications of Regional Anesthesia*. Springer; 2007:149-166.