CASE REPORT

Low Dosage Regional Anesthesia for Bladder Tumors in Aortic Stenosis Patient

Emmysri Ninta Karina B. Pinem, Maha Swardwipayana Putra Thedja, Max Norman Poddala, Ida Bagus Gede Dwi Dharmayana

Department of Anesthesiology and Intensive Therapy, Wangaya General Hospital, Denpasar, Indonesia

✉Correspondence: Emisri170595@gmail.com

ABSTRACT

Background: Aortic stenosis (AS) is a narrowing of the heart's aortic valve. The most common cause of AS in adults is degenerative calcification of the aortic valve, which increases with age. Most patients with AS experience gradual increase in obstruction over many years and will remain asymptomatic until the 6th to 8th decade of life. The prognosis being poor when symptoms appear. Patients with AS present a challenge of hemodynamic disturbance for anesthesiologists. The use of regional anesthesia in patients with severe AS is contraindicated because of the sympatholytic effect which causes loss of vascular tone and a significant reduction in cardiac output.

Case: A 77 years old male with a height of 155 cm and a weight of 35 kg with moderate aortic stenosis (EF 65%), ventricular heart disease (VHD), hypertensive heart disease (HHD), heart failure (HF) with therapy, underwent bladder tumor surgery with low dose regional anesthesia using bupivacaine 0.5% heavy 7.5 mg (1.5 ml) with adjuvant fentanyl 25 mcg with total volume 2 ml regional block was achieved within 5 minutes and hemodynamically stable perioperatively. There was no acute HF or worsening of postoperative hemodynamics.

Discussion: The main principle of anesthesia in AS patient is to avoid tachycardia, maintain sinus rhythm and avoid a decrease in systemic vascular resistance (SVR) which will cause compensation in the form of an increase in heart rate, thereby making the heart work harder, avoiding hypovolemia and fluid overload.

Conclusion: Low dose regional anaesthesia can become an option. In cases of AS due to fewer side effects, with more stable haemodynamics compare with convensional regional anaesthesia. This condition may need furthere studies.

Keywords: aortic stenosis; bupivacaine; hemodynamic; regional anesthesia: spinal

INTRODUCTION

Aortic stenosis (AS) is a narrowing of the heart's aortic valve. The most common cause of AS in adults is degenerative calcification of the aortic valve, which increases with age.[1,2] Most patients with AS experience gradual increase in obstruction over many years and will remain asymptomatic until the 6th to 8th decade of life. The prognosis being poor when symptoms appear. If not treated, the development of this condition can trigger the heart over time and can lead to a various number of life-threatening complications, including heart failure (HF). AS rarely occurs in people under 65 years of age without congenital abnormalities. The second most prevalent valve condition in the US is aortic stenosis. Present in about 5% of people over the age of 65 years and its frequency increases with age. A meta-analysis carried out in Taiwan, the United States, and Europe revealed a 12.4% population prevalence of AS and a 3.4% prevalence of severe AS in people over the age of 75 years. A more recent study showed relatively similar figures, with 4.3% suffering from severe AS in 70-year-olds in a cohort study in Iceland. The incidence rate of new AS was 5 per 1,000 per year, with the average age of initial participants being 60 years. AS is the second most common indication for heart surgery, and carries 80% risk of developing HF, valve replacement, and even death within 5 years. There is no effective therapy for this disease except aortic valve replacement surgery.[1,2]

Patients with AS present a challenge of hemodynamic disturbance for anesthesiologists. The use of regional anesthesia in patients with severe AS is contraindicated because of the sympatholytic effect which causes loss of vascular tone and a significant reduction in cardiac output.[3,4]

CASE

A-77 years old man with height of 155 cm and a weight of 35 kg was referred to the urology clinic with a diagnosis of bladder tumor. Patient complained of urine mixed with blood and pain that comes and go when urinating. The patient was consulted to the cardiologist for evaluation of preparation for surgery, aortic stenosis (AS) was accidentally discovered on echocardiography results. This patient was a case of unknown and asymptomatic aortic stenosis. When questioned further, it was true that the patient was stated healthy and was not undergoing any treatment. There is no history of malignancy or inherited diseases in the family. After being diagnosed with AS, the patient took furosemide 10 mg every 24 hours orally, spironolactone 12.5 mg every 24 hours orally and concor 1.25 mg every 24 hours orally. In the pre-anesthesia evaluation, it was found that the patient's general condition was good, but he looked pale and weak. On physical examination, the patient was compos mentis with a glasgow coma scale (GCS) score of E4V5M6 and pupils were isochore with a diameter of 3mm/3mm. Blood pressure was 136/70 mmHg, pulse rate was 90 times per minute, regular. Electrocardiography shows high voltage LV and echocardiography examination showed EF 65% left ventricular hypertrophy (LVH), AS moderate. Chest x-ray showed cardiomegaly with a cardio thoracic ratio (CTR) value of 65%. Pulmonary did not appear abnormal. Peripheral saturation examination with a value of 97% with room air. Lung sounds were vesicular without additional sounds. The strength of the four extremities were found to be 55555/55555 // 55555/55555, normal

muscle tone in the four extremities. Sensory stimulation in both lower extremities was within normal limits, pathological reflexes were not found. Ultrasound examination of the upper and lower abdomen showed that the right kidney pelvicalyceal system was dilated grade III-IV, the bladder wall appeared widened. The patient's preoperative supporting laboratory values were complete blood count (CBC) with hemoglobin (Hb) 7.2 g/dl, hematocrit (Hct) 25.5%, white blood cell (WBC) 6.63 x103/µL and platelet (PLT) 455 x103µL. Other examinations were within normal limits. After examination, the patient was assessed for American Society of Anesthesiologist (ASA) physical status 3 with geriatric central nervous system (CNS) problems with hearing loss, VHD AS Moderate and HHD HF with therapy. Patient was fasted from solid food 8 hours before surgery, drinking water was allow up to 2 hours before surgery. For the preparation, patient received 3 bags packed red cell (PRC) transfusion with 1 bag per day and was given premedication dexamethasone 5 mg intravenously (IV) and furosemide 20 mg intravenously (IV) in the inpatient ward. The patient received maintenance fluid therapy using ringer's lactate 500 ml per 24 hours with an intravenous cannula number 18 was installed. The anesthesia team had booked an intensive room for post-surgical treatment and preparation blood products.

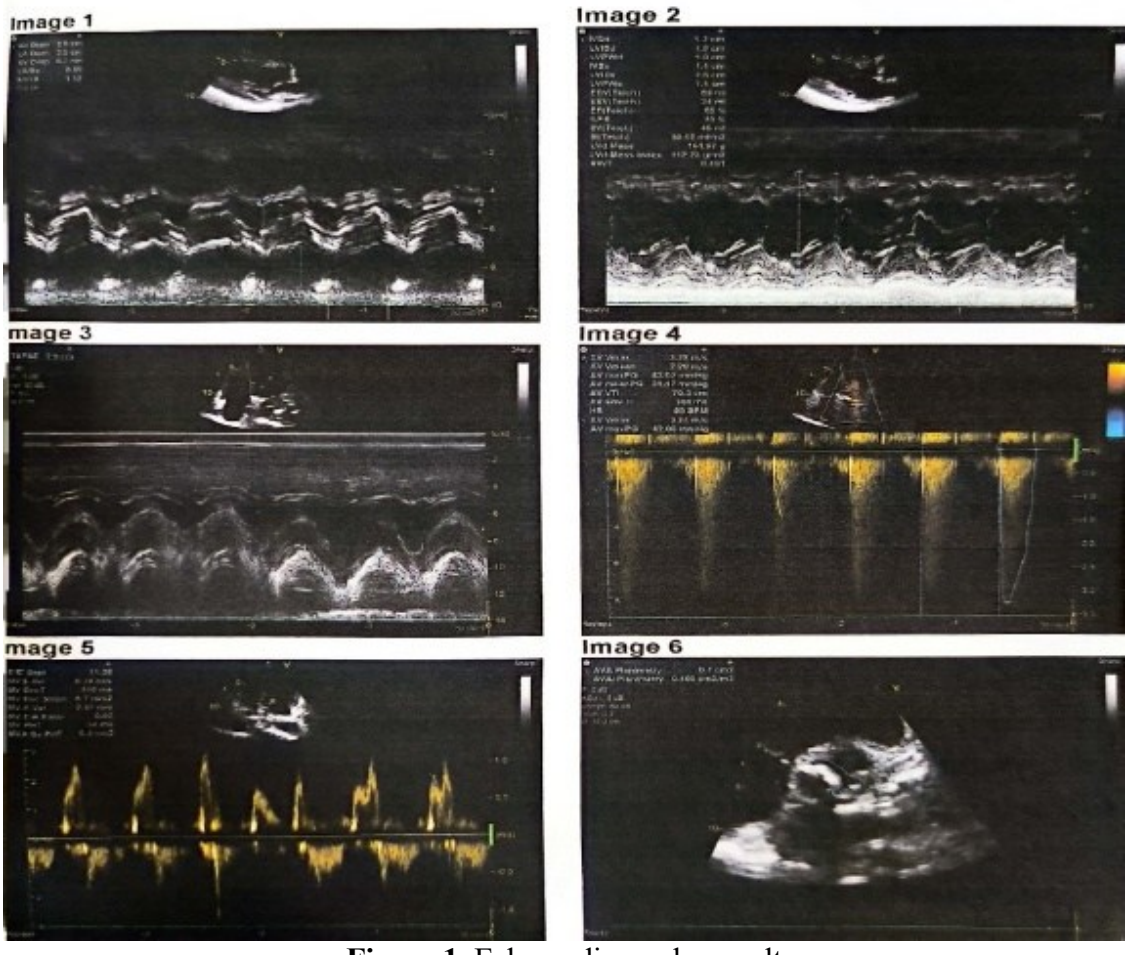


Figure 1. Echocardiography result

DISCUSSION

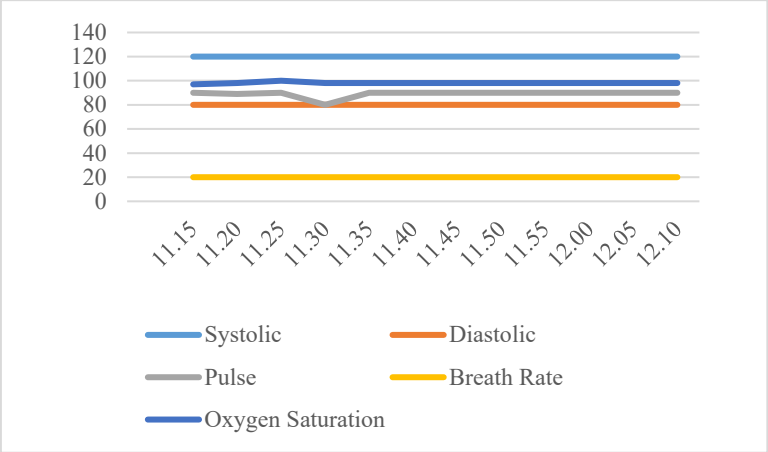
In all forms of AS, limited valve mobility causes left ventricular outflow tract obstruction in a slowly progressing process. To compensate the increases in left ventricular afterload, concentric hypertrophy and fibrosis occur, whereby wall tension remains constant despite increasing afterload. This remodeling process causes stiffness and thus limited ventricular compliance. Furthermore, a decrease in relative capillary density (constant capillary number with increasing muscle mass) leads to reduced myocardial perfusion. Even small increases in cardiac load can therefore deplete perfusion and exacerbate existing ventricular oxygen deficiency. Even in the absence of coronary heart disease (CHD), these mechanisms lead to an increased risk of perioperative myocardial ischemia. Up to 70% of patients with AS also have CHD, further increasing the risk of ischemia.[5]

Patients with severe AS were relatively contraindicated to do a regional anesthesia (RA), because the patients with severe AS could increase morbidity and mortality risk. The sympathetic effects of RA in aortic stenosis patient with reduced cardiac reserve could cause significant hemodynamic problems due to decreased of vascular tone, and cardiac output was reduced, which cause hypotension and reduced the coronary perfusion. However, according to research by Bundgaard-Nielsen et al. and Guay J., there are a number of issues associated with general anesthesia (GA), including induction-induced hypotension, broad variations in hemodynamics, pulmonary difficulties, cardiac dysrhythmias, and stress hormone levels. A study meta-analysis by Guay et al. showed that the risk of perioperative pneumonia and the mortality rate were both significantly decreased by 2.5% when RA was used alone as opposed to GA (with or without adjuvant RA). Regarding this, a study by White et al. showed that in high-risk patients, there was an inverse relationship between hypotension, mortality, and the lowest doses of intrathecal local anesthetic. Studies by Ben-David et al. have demonstrated that patients with stenosis heart disease can benefit greatly from this method, with the low-dose subarachnoid block group requiring fewer vasopressors than the standard-dose subarachnoid block group.[6,7]

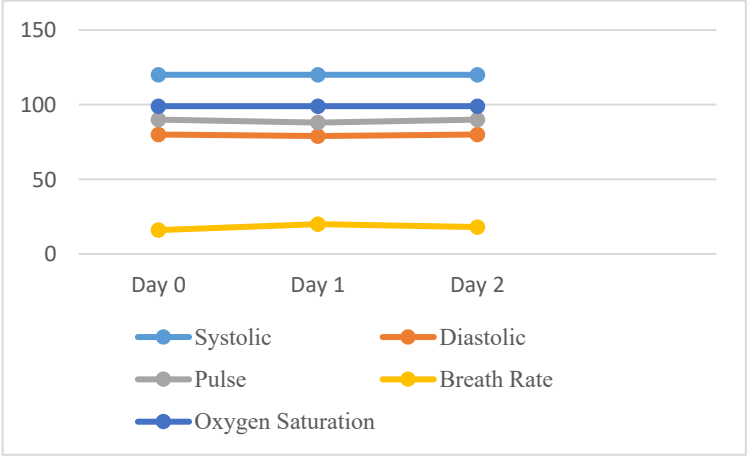
Although there is a theory that stated regional anesthesia techniques are still contraindicated for patients with aortic stenosis, this technique is chosen considering that the clinical status is well-conditioned. Patients can still lay on their backs with oxygen saturation using room air of 97-99%. The main principles of anesthesia in aortic stenosis patients are to avoid tachycardia, maintain sinus rhythm conditions and avoid a decrease in SVR which will cause compensation in the form of an increase in heart rate thereby making the heart work harder, avoiding hypovolemia and fluid overload.[8]

Premedication midazolam 1 mg intravenously (IV) was given in the preparation room to reduce the patient's anxiety. When he entered the operating room, the patient's heart rate was 80 per minute with sinus rhythm, blood pressure 120/79 mmHg and SpO2 97-99%. The patient was positioned left lateral and then aseptic procedure was carried out. Block is performed at L3-L4 with a Quincke 27G spinal needle inserted midline through Tuffier's line. Bupivacaine 0.5% heavy was used as much as 7.5 mg (1.5 ml) with adjuvant fentanyl 25 mcg with a total volume of 2

ml injected into the sub-arachnoid space, then the patient was placed in a dorsal lithotomy position immediately after injection. Bromage 3 score is achieved in 57-68 seconds, Bromage 2 in 80-100 seconds and Bromage 1 is achieved in 120-135 seconds after insertion. The height of block Thoracal 6 was reached in 5 minutes. Incision time 30 minutes to 35 minutes. Hemodynamics after intrathecal injection of bupivacaine and fentanyl are stable. Hemodynamic fluctuations were minimal, consistent with the patient's initial hemodynamics and there was no significant intraoperative blood loss. The patient's oxygen saturation before regional anesthesia was 97-99% with room air and during the operation the patient used a 2 lpm nasal cannula. During the surgery, there were no significant haemodynamic disturbances, shortness of breath, dizziness and vomiting. No significant complaints were found in recovery period. After surgery, treatment was carried out in the intensive care unit (ICU). During treatment in the ICU, the patient's hemodynamic condition was stable, no complaints were found. Post-operative pain management with fentanyl 100 mcg in 50 cc Nacl given 2.1cc/hour using a syringe pump combined with paracetamol 500 mg/6 hours orally. After intensive care 24 hours in the ICU, the patient was return to in patient ward and discharged on the 3rd day after surgery.



Graph 1. Hemodynamic durante-op



Graph 2. Hemodynamic post-op

Base on pre- anesthesia evaluation regional anesthesia technique was chosen. Patients could lay on his backs with oxygen saturation 97–99% using room air. Reduced systemic vascular resistance (SVR) and delayed onset of hypotension are two minor systemic adverse effects of low dosages of hyperbaric bupivacaine plus fentanyl that result in a sufficient block during regional anesthesia. Low dose of bupivacaine with opiod as an adjuvant is a strategy to maintain a stable hemodynamics during regional anesthesia for bladder tumour surgery. There was no episode of hypotension or desaturation during the operation in this case report. The motoric and sensoric impulses was block because the effect of intratecal anesthetic that interfere the voltage-gated doium channels. The degree of sensory and motor block depends on the technique, medication agent and dose administered. Interacting with opioid receptors in the dorsal horn of the spinal cord, opioids injected into the intrathecal space will selectively produce an analgesic effect. This may reduce the dose and supraspinal effects of local anesthetics, including respiratory depression, hypotension, sedation, nausea, and vomiting. The main location of opioid receptors is in the gray matter of the substantia gelatinosa. This is the anatomical basis for selective analgesia after intrathecal opioids are administered.[9,10,11]

Intrathecal opioids will selectively block stimulus transmission from nociceptive afferent A, δ and C nerve fibers by forming bonds to opioid receptors in the presynapse and postsynapse. Post-synaptically, opioids will increase the conduction of potassium ions, increasing the hyperosmolarity of ascending neurons without evoking somatosensory or motor effects. Presynaptic effects include the release of spinal adenosine which plays an important role as a specific analgesic mediator.[12,13]

Together with bupivacaine, fentanyl reduces pain thresholds while preventing an increase in sympathetic and motor blockage. Numerous studies support the usefulness of opioids in regional anesthesia for aortic stenosis bladder tumor surgery. Lipophilic opioids, including fentanyl, have been shown in earlier research to hasten the onset and duration of bupivacaine blocks as well as prolong the duration of postoperative analgesia. Due to redistribution, the combination of both has a comparatively shorter duration of action (2–4 hours intrathecally and epidurally), with an onset rate of 5 minutes intrathecally and 10 minutes epidurally. It had no active metabolites and was 800 times more soluble in fat than morphine. Additionally, due to its high fat solubility, it also attaches to opioid receptors in the dorsal horn of the spinal cord rapidly. Because of its quick onset, it is an excellent analgesic during the surgery of bladder tumors.[13,14,15]

Until now regional anesthesia in patients with aortic stenosis is still contraindicated. In this patient, regional anesthesia was performed by fulfilling the things that must be considered in anesthesia with aortic stenosis, the aim of avoiding tachycardia, maintaining sinus rhythm conditions and avoiding a decrease in SVR, avoiding hypovolemia and fluid overload.[8] As well as the previous studies, low-dose regional anesthesia does not cause hemodynamic changes and fentanyl as an adjuvant has the effect of prolonging analgesia and adequate motor block.

CONCLUSION

Low dose regional anaesthesia can become an option. In cases of aortic stenosis due to fewer side effects, with more stable haemodynamics compare with convensional regional anaesthesia. this condition may need furthere studies.

REFERENCES

1. C. L. Putra, M. Yoselin, and R. N. Ngantung, "STENOSIS AORTA DENGAN KOMPLIKASI GAGAL JANTUNG: A CASE REPORT AND REVIEW OF THE LITERATURE." [Online]. Available: http://jurnalmedikahutama.com
2. B. A. Carabello, "Introduction to aortic stenosis," *Circulation Research*, vol. 113, no. 2. pp. 179–185, Jul. 05, 2013. doi: 10.1161/CIRCRESAHA.113.300156.
3. V. Tsampasian *et al.*, "Management of asymptomatic severe aortic stenosis: a systematic review and meta-analysis," *Open Heart*, vol. 9, no. 1. BMJ Publishing Group, May 17, 2022. doi: 10.1136/openhrt-2022-001982.
4. Strumia *et al.*, "68 1% Chloroprocaine spinal anesthesia for short duration surgical procedures," BMJ, Sep. 2021, p. A37.1-A37. doi: 10.1136/rapm-2021-esra.68.
5. S. Billig *et al.*, "Anesthesia for aortic valve stenosis: Anesthesiological management of patients with aortic valve stenosis during noncardiac surgery," *Anaesthesiologie*, 2024, doi: 10.1007/s00101-024-01380-x.
6. Coviello *et al.*, "Low-dose spinal and opioid-free anesthesia in patient with Severe Aortic Stenosis and SARS-CoV-2 infection: Case report," *Clin Case Rep*, vol. 9, no. 8, Aug. 2021, doi: 10.1002/ccr3.4192.
7. M. Rana, "Aortic Valve Stenosis: Diagnostic Approaches and Recommendations of the 2021 ESC/EACTS Guidelines for the Management of Valvular Heart Disease –A Review of the Literature," *Cardiol Cardiovasc Med*, vol. 06, no. 03, 2022, doi: 10.26502/fccm.92920267.
8. "Morgan and Mikhail's Clinical Anesthesiology, 6th edition-1 (1)".
9. B. Agarwal, D. F. Stowe, R. K. Dash, Z. J. Bosnjak, and A. K. S. Camara, "Mitochondrial targets for volatile anesthetics against cardiac ischemia-reperfusion injury," *Front Physiol*, vol. 5 AUG, 2014, doi: 10.3389/fphys.2014.00341.
10. E. A. Bruder, I. M. Ball, S. Ridi, W. Pickett, and C. Hohl, "Single induction dose of etomidate versus other induction agents for endotracheal intubation in critically ill patients," *Cochrane Database of Systematic Reviews*, vol. 2017, no. 6. John Wiley and Sons Ltd, Jan. 08, 2015. doi: 10.1002/14651858.CD010225.pub2
11. R. Hartono and D. P. Husodo, "Anestesi Spinal Dosis Rendah Untuk Pasien Operasi Sesar dengan Stenosis Mitral Berat Low Dose Spinal Anesthesia For Caessarian Section Delivery in Patient with Severe Mitral Stenosis," 2018.
12. N. Hidayat, Y. Uyun, and D. Y. Bisri, "Anestesia Spinal Dosis Rendah untuk Seksio Sesarea pada Pasien Mitral Stenosis Berat."
13. W. Istanto Nurcahyo, "Anestesi Regional pada Pasien dengan Penyakit Jantung/ Hemodinamik Tidak Stabil Regional Anesthesia for Patient with Heart Disease/ Unstable Hemodynamics," 2019.

14. C. Uhlig *et al.*, "Effects of volatile anesthetics on mortality and postoperative pulmonary and other complications in patients undergoing surgery: A systematic review and meta-analysis," *Anesthesiology*, vol. 124, no. 6, pp. 1230–1245, Jun. 2016, doi: 10.1097/ALN.0000000000001120.
15. Prasad, A. Ghosh, and T. Nag, "Regional anaesthesia in a patient with aortic stenosis for bladder tumour resection," *Indian J Anaesth*, vol. 61, no. 5, p. 441, 2017, doi: 10.4103/ija.IJA_109_17.