

Combined Sciatic, Femoral, and Obturator Nerve Blocks for Ankle Surgery in a Patient with Severe Pulmonary Hypertension—A Case Report

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Abstract

We report a patient with severe pulmonary arterial hypertension (PAH) undergoing tibio-talo-calcaneal fusion due to Charcot joint. Despite the advancement in the management of PAH, the risks of anesthesia, surgery, and postoperative morbidity and mortality still remain high. A 46-year-old female was presented with severe PAH and end stage renal disease requiring hemodialysis three times a week. Ultrasound-guided sciatic, femoral, and obturator nerve blocks were performed with 0.5% levobupivacaine 15 ml, 10 ml, and 5 ml, respectively. All the blocks were successful, and the patient underwent uneventful anesthesia and surgery. In addition, the postoperative pain control lasted for 15 h and the patient was discharged on POD 5 without any complications. Therefore, ultrasound-guided sciatic, femoral, and obturator nerve blocks are valuable alternative to the general or neuraxial anesthesia in patients with severe pulmonary hypertension.

Keywords

Femoral Nerve Block, Obturator Nerve Block, Sciatic Nerve Block, Severe Pulmonary Hypertension, Ultrasound-Guided

1. Introduction

Pulmonary arterial hypertension (PAH) is a disease marked by progressive increase in pulmonary vascular resistance leading to right ventricular failure and death, and is defined as the mean pulmonary arterial pressure (mPAP) greater than 25 mmHg at rest or 30 mmHg during exercise confirmed by right heart ca-

theterization. Among the etiologies of PAH, connective tissue disease, congenital heart disease, and idiopathic PAH account for the majority [1]. The increased pressures in the pulmonary arteries render the right heart more difficult to properly pump blood, and in severe cases, PAH can lead to right heart failure. Symptoms associated with PAH include shortness of breath, chest pain, arrhythmias, fatigue, dizziness, etc. [1] [2] [3]. The incidence of pulmonary arterial hypertension is reported to be 1.9 patients per million people, annually, and the mortality rate is estimated as 7 per 100 people [4].

Along with the progress of medical treatment, many patients with PAH show improved symptoms and survival rates resulting in the increased chance for these patients to present for various types of surgery. However, despite the advanced surgical and anesthetic management, the risks of perioperative morbidity and mortality still remain substantially high. While general and regional anesthesia carries potential risks, optimal selection and careful anesthetic management are warranted for these patients.

Herein, we report a patient with severe PAH who underwent a successful regional anesthesia with ultrasound-guided sciatic, femoral, and obturator nerve blocks for tibio-talo-calcaneal fusion due to Charcot joint.

2. Case Report

A 46-year-old woman (154.8 cm, 48 kg) was admitted for tibio-talo-calcaneal fusion due to Charcot joint of her left ankle. The patient was referred to the tertiary medical care because of high risks of the anesthesia and surgery. The patient was diagnosed with PAH four years ago and has been receiving medical treatments including calcium channel blocker, β -blocker, antiplatelet drug, oral hypoglycemic agent and insulin therapy. Her present illness showed no associated symptoms such as exertional dyspnea, peripheral edema or chest pain. She had end stage renal disease (ESRD) secondary to diabetes mellitus and has been undergoing hemodialysis via arteriovenous graft 3 days a week since 2008. She was a hepatitis C virus carrier without hepatic manifestations. There was no family history of PAH for this patient.

Preoperative echocardiogram (ECG) showed normal sinus rhythm and right axis deviation. Transthoracic Doppler echocardiography (TTE) showed right ventricular systolic pressure (RVSP) value of 79.2 mmHg estimated by adding the peak systolic regurgitant flow velocity of tricuspid valve to the assumed right atrial pressure of 10 mmHg [5] [6]. It also showed dilated pulmonary artery and enlarged right ventricular cavity size. However, both the right and left ventricular systolic functions were normal without regional wall motion abnormality and the left ventricular ejection fraction was 59%. To evaluate the PAH more accurately, the right heart catheterization was performed. The result showed the pulmonary arterial pressure of 85/50/23 mmHg (systolic/mean/diastolic) and negative pulmonary vasodilator test using nitric oxide (NO) and oxygen (O₂) (Table 1). Pulmonary function test (PFT) showed severe restrictive pattern with

Table 1. Patient characteristics and hemodynamic parameters.

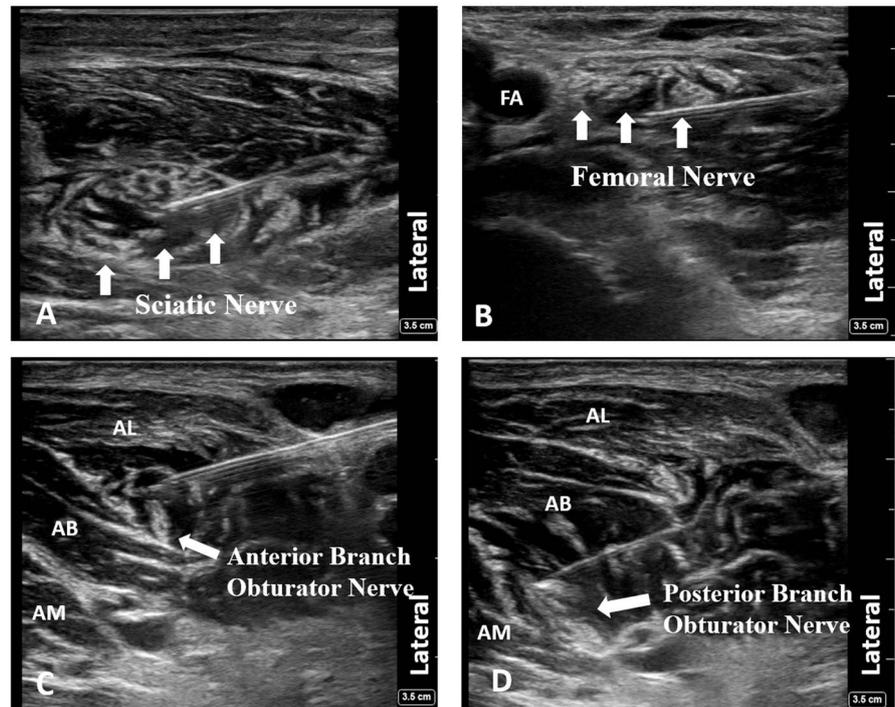
F/46, (154.9 cm, 48 kg)				
TTE				
Right ventricular systolic pressure, mmHg	79.2			
Left ventricular ejection fraction, %	59%			
Cardiac catheterization				
Pulmonary artery pressures, mmHg (systolic/mean/diastolic)	85/50/23			
Hemodynamic parameters				
	Baseline	1 h after surgery	End of surgery	POD 1
Blood pressures, mmHg (systolic/mean/diastolic)	142/82/50	155/92/55	170/102/60	123/75/58
Heart rates, beat/min	53	60	65	77

Abbreviation: TTE, transthoracic Doppler echocardiography.

decreased forced expiratory volume in 1 second (43%), forced vital capacity (47%) and diffusing capacity of the lungs for carbon monoxide (44%). Arterial blood gas analysis at room air showed pH 7.347, PaCO₂ 39.8 mmHg, and PaO₂ 52.8 mmHg. Her chest radiography and chest computerized tomography (CT) revealed no signs of pulmonary thromboembolism. After extensive work ups, the patient was finally diagnosed with severe idiopathic PAH in the absence of connective tissue disease, congenital heart and lung diseases.

For the patient's anesthetic management, the regional anesthesia comprising the sciatic, femoral, and obturator nerve blocks was planned for her ankle surgery. The obturator nerve block was also selected because of intended tourniquet application at the distal thigh. The ultrasound-guided nerve blocks were performed in the block room. The patient's basic monitoring included electrocardiogram, pulse oximetry and noninvasive blood pressure. After administering 1 mg of midazolam to minimize patient's discomfort, an invasive blood pressure monitoring was achieved with 22 gauge angiocatheter at right radial artery after local injection. The oxygen was delivered through a facial mask at 4L/min.

The patient was placed in the right lateral decubitus position, and the ultrasound-guided sciatic nerve block was performed at the proximal one third thigh level. After sterile skin preparation with a solution of chlorhexidine 2% in isopropyl alcohol 70% and skin infiltration with 2 ml of 1% lidocaine, a sterile 100 mm 22 G insulated nerve stimulating needle (PAJUNK[®], Geisingen, Germany) was inserted in-plane technique using linear transducer (8 - 12 MHz) until the needle tip was adjacent to the sciatic nerve, and appropriate needle position was confirmed at a threshold current less than 0.5 mA. After negative aspiration test for blood, 15 ml of 0.5% levobupivacaine was slowly injected while observing perineural spread of local anesthetics (**Figure 1(A)**). Next, the patient was placed in supine position with the leg slightly abducted and externally rotated. After the sterile skin preparation and local infiltration, the femoral nerve block was per-



Abbreviations: FA, femoral artery; AL, adductor longus muscle; AB, adductor brevis muscle; AM, adductor magnus muscle.

Figure 1. (A) Sciatic nerve block, (B) Femoral nerve block, (C) Anterior branch of the obturator nerve block, (D) Posterior branch of the obturator nerve block.

formed at the inguinal crease level by advancing 100 mm 22 G insulated nerve stimulating needle in-plane from the lateral to medial direction toward the femoral nerve. The fascia iliaca was punctured and the needle tip was placed adjacent to the femoral nerve. The proper needle tip position was confirmed by the motor response of quadriceps muscles elicited by a threshold current less than 0.5 mA. Once aspiration was negative for blood, the 10 ml of 0.5% levobupivacaine was perineurally injected (**Figure 1(B)**). After femoral nerve block, the transducer was moved medially along the inguinal crease and identified the adductor muscles and both the anterior and posterior branches of the obturator nerve. First, the needle was advanced toward the anterior branch and 2.5 ml of 0.5% levobupivacaine was injected (**Figure 1(C)**) followed by 2.5 ml of 0.5% levobupivacaine around posterior branch (**Figure 1(D)**). All the blocks were successful and the surgical anesthesia was achieved after 40 minutes.

The patient was then transferred to the operating room. Her initial blood pressure was 142/82/50 mmHg (systolic/mean/diastolic) and heart rate was 53 per minute. The tourniquet was placed on her left distal thigh and the pressure was maintained at 300 mmHg. Midazolam 1 mg was injected followed by continuous infusion of remifentanyl (range 0.5 ~ 0.7 mcg/kg/min). Her vital signs were stable throughout the operation. The surgery lasted for 170 minutes and the patient was transferred to the intensive care unit (ICU) for the close observation. The patient's vital signs were stable in the ICU, and on POD 1, she was

transferred to the general ward. The hemodynamic parameters are shown in **Table 1**. The nerve blocks provided an adequate postoperative pain control for 15 hours. On postoperative day 5, the patient was discharged without complications.

Two months later, the patient was re-admitted for the hardware removal and incision and drainage of her previously operated left ankle due to infection. Again, the sciatic, femoral, and obturator nerve blocks were performed with 0.5% levobupivacaine 7 ml, 13 ml, and 5ml, respectively. The patient underwent uneventful surgery (120 min) and postoperative recovery, and she was discharged on POD 20 after the infection control. The patient was followed up for 5 months after the surgery and showed no evidence of complications.

3. Discussion

The patients with PAP have high risks of cardiopulmonary complications after various noncardiac surgeries and the echocardiographic pulmonary arterial systolic pressure over 70 mmHg indicate significantly increased chance for postoperative complications including right ventricular failure, persistent postoperative hypoxia, coronary ischemia, and higher in-hospital mortality [7] [8]. In our patient, the pulmonary arterial systolic pressure was above 80 mm Hg, highly suggestive of increased risks of cardiopulmonary adverse events. In addition, various harmful conditions including hypoxia, hypercapnia, acidosis, pain and other surgical stresses during anesthesia and surgery could further exacerbate already increased pulmonary arterial pressure and lead to cardiovascular collapse.

The central neuraxial anesthesia is the most commonly performed method of anesthesia in lower extremity surgeries. However, systemic hypotension associated with spinal anesthesia can induce abrupt decrease in coronary perfusion of right ventricle, eventually leading to right ventricular failure in vulnerable patients. Therefore, a single-shot intrathecal anesthetic technique is generally avoided in hemodynamically compromised patients. Instead, epidural anesthesia or combined spinal-epidural anesthesia with low dose local anesthetics might be favored over spinal anesthesia in high risk patients [9]. However, regardless of the types of neuraxial anesthesia, there is still the risk of systemic hypotension caused by sympathetic blockade despite appropriate fluid administration and vasopressor use. In addition, the general anesthesia might not also be suitable for high risk patients because hemodynamic fluctuations can also occur in various time points including immediately after tracheal intubation, surgical incision and during the emergence [10].

Recently, the ultrasound-guided peripheral nerve blocks have gained great interest and might be considered as a valuable anesthetic option in patients with severe cardiovascular diseases. For example, Tantry *et al.* [11] reported two successful anesthetic cases managed with combined femoral and sciatic nerve blocks for a patient with severe rheumatic valvular heart disease and pulmonary hyper-

tension undergoing emergent thrombo-embolectomy. Similarly, in our patient, the obturator nerve block was added to sciatic and femoral nerve blocks to relieve tourniquet pain in addition to surgical anesthesia. Agreeably, McNamee *et al.* [12] demonstrated that the obturator nerve block resulted in improvement of postoperative analgesic effects and reduced requirement of opioid analgesics when it was added to combined femoral and sciatic nerve blocks.

4. Conclusion

The peripheral nerve blocks comprising sciatic, femoral, and obturator nerve blocks might be considered as the alternative anesthetic choice to general or neuraxial anesthesia in patients with severe pulmonary hypertension undergoing lower extremity surgeries.

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