

A Case Report: Combined Sciatic Nerve and Lumbar Plexus Nerve Block in A Patient with Acute Decompensated Heart Failure Undergoing Lower Extremity Surgical Debridement

Irma Lusiana Tantri¹, Natalia Frederika Darmawan Adji Saroso², Marielle Ancilla Domini², Veronica Wiwing²

¹Department of Anesthesiology, Siloam Hospitals Lippo Village, Tangerang, Banten, Indonesia

²Department of Medicine, Faculty of Medicine, Pelita Harapan University, Tangerang, Banten, Indonesia

Abstract

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Correspondance: Irma Tantri, Anesthesiology Department, Siloam Hospitals Lippo Village, Tangerang
E-mail: irma.tantri@uph.edu
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Background: Peripheral nerve block for lower extremity surgeries requires a minimum of two block injections. Although the combination of the lumbar plexus block and the sciatica block is a procedure that requires large doses of local anesthetic, which may induce cardiotoxicity, a recent study suggests that change in the hemodynamic system is not clinically significant.

Case Description: We report a case of a 53-year-old male presenting with a worsened shortness of breath two days before hospital admission. He also experienced a sudden high fever and pain on his right thigh. The patient had a history of Heart Failure (EF 28%) and Congestive liver disease and was diagnosed with right femur cellulitis with right phlegmon. Surgical debridement was planned to treat sepsis. Right lumbar plexus block and right sciatica block were performed as surgical anesthesia. The surgery duration was one hour, and the patient was transferred to the PACU. The patient was treated in ICU before being admitted to the general ward and was discharged on day three post-surgery.

Conclusion: The combination of Sciatic nerve and lumbar plexus nerve block is an effective anesthesia and analgesia technique for lower limb surgery in individuals with a severe heart condition.

Introduction

Peripheral nerve block is becoming a widely used regional anesthesia technique with aid from ultrasound guidance.¹

A minimum of two block injections of the lower extremity peripheral nerve block are required in, the lower extremity peripheral nerve block. This combination of two blocks requires a high dose of anesthesia drugs which may induce cardiotoxicity.

Anatomically lumbar plexus is located mainly in skeletal muscle; thus, injection of local anesthetics may increase the risk of high systemic absorption. The combination of lumbar plexus block and sciatic nerve block may also cause hemi-sympathectomy and vasodilation in the corresponding extremity that has been anesthetized. The decrease in arterial blood pressure may influence the cardiac index. Referring to de Leeuw's study, although this decrease was statistically significant, the arterial blood pressure

varied by less than 10%; thus, it does not correspond with the cardiac index. Therefore, this can be concluded that the change in the hemodynamic system is not clinically significant.²

Case Description

A 53-year-old male presenting with a worsened shortness of breath two days before hospital admission. He became persistently breathless, and the symptom worsened with activities. He complained of chest pain, palpitation, and yellowing on his skin and eyes. Recently he also experienced a sudden high fever and pain in his right thigh. His past medical history showed that he had a history of coronary artery disease (CAD) and underwent Percutaneous coronary intervention (PCI) three months prior.

The patient appeared dyspneic, icteric and was in pain. His temperature was 38.7 C, RR 26 breaths/min, PR 76 beats/min, and SpO₂ was 93% without O₂ supplementation. His physical examination revealed a murmur on the tricuspid valve and a gallop on cardiac auscultation. There was swelling and redness on the right lower extremity that was warm and tender to the touch.

Electrocardiography showed normal response Atrial Fibrillation (AF). Laboratory results demonstrated leukocytosis (16.640/ μ L), hyperbilirubinemia, prolonged APTT, and also increased Procalcitonin (6.53ng/mL) and CRP (43.4 mg/L). Echocardiography revealed LVH (Left Ventricular Hypertrophy) concentric EF (Ejection Fraction) 28% with decreased systolic function. The abdominal ultrasound finding was congestive liver disease, while the right lower extremity ultrasound displayed diffuse cutaneous-subcutaneous edema seen on the posteromedial proximal femur, anteromedial distal femur, and

posterolateral distal femur suggestive of cellulitis.

The patient was diagnosed with right femur cellulitis with right phlegmon, sepsis, Acute decompensated heart failure, Parenchymal icterus et causa congestive liver disease, normal response AF and stabilized CAD. The patient was symptomatically treated with analgesics and antipyretics. Pharmacological treatment included Digoxin, Aspirin, heparin, diuretics (Spironolactone, Furosemide), and Intravenous broad-spectrum antibiotics (Ampicillin-Sulbactam). The cardiologists advised treating sepsis immediately and suggested cardiac ablation or implantable cardioverter-defibrillator (ICD) placement on an outpatient basis for the management of the normal response Atrial Fibrillation. The surgeon scheduled a drainage incision on the cellulitis to clear the source of infections. Antiplatelet and anticoagulant were stopped temporarily five days before surgery.

The patient was fully conscious and cooperative on the day of surgery. Vital signs were within normal range. ECG revealed normal response AF.

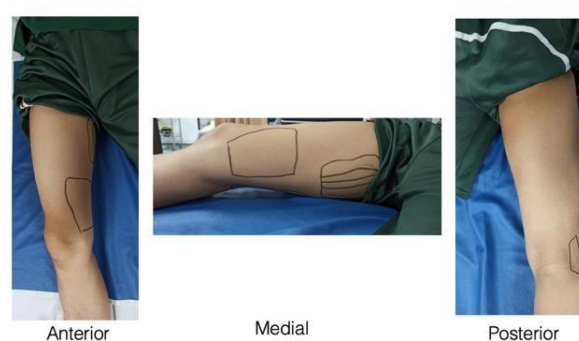


Figure 1. Patient's wound area

The patient was given an O₂ supplementation using 3 lpm nasal cannula. He was monitored with NIBP (Noninvasive Blood Pressure), ECG 3 lead, and pulse oximetry. Central Venous Catheter (CVC) and arterial blood

pressure monitoring were established under local anesthetic. The combination of the lumbar plexus block and the right sciatic block was performed using portable ultrasonography with 2-5MHz (Sonosite M-Turbo) transducer curved, nerve stimulator Pajunk MultiStim Sensor, 22G 10cm insulated needle (Stimuplex Ultra 360, B.Braun, Germany).



Figure 2. Right lumbar plexus block with shamrock method

Table 1. Lumbar Plexus Nerve and Sciatic Nerve Block

	Right Lumbar Plexus Block	Right Sciatic Block
Method	Shamrock method	Subgluteal approach
Position	Lateral decubitus (right foot above left foot)	Lateral decubitus
Probe location	Paramedian transverse scan above right iliac crest	Subgluteal (as level as greater trochanter and ischial tuberosity)
Needle insertion	In plane	In plane
Nerve stimulator	Quadriceps muscle twitch (+) 0.2-0.5 mA	Hamstrings muscle twitch (+)
Anesthetic agent	0.25% bupivacaine isobaric 20ml with epinephrin 1:200.000	0.25% bupivacaine isobaric 20 ml with epinephrin 1:200.00

The patient was placed in the lateral decubitus position. After aseptic antiseptic was given, local anesthetic using lidocaine 1% 2ml was injected into the insertion area.

The lumbar plexus block was performed using shamrock method. The ultrasound probe was placed above right iliac crest with the paramedian transverse scan technique. The needle is inserted with an in-plane approach at depth where transverse process is contacted. Nerve stimulator showed twitch response of the quadriceps muscle is elicited at 0.2-0.5 mA. Isobaric bupivacaine 0.25% 20 ml with epinephrine 1 : 200,000 were injected through a 22G insulated needle.

The right sciatic block was performed with the subgluteal approach. The ultrasound probe was placed transverse on the right gluteal crease to visualize the area between greater trochanter and ischial tuberosity. The needle is inserted in-plane from the lateral aspect of the ultrasound probe, and advanced toward the sciatic nerve. Nerve stimulator showed Hamstrings muscle twitch.

Isobaric bupivacaine 0.25% 20 ml with epinephrine 1 : 200,000 were injected through a 22G insulated needle once the needle tip is positioned adjacent to the nerve.

After the procedure was successfully performed, the patient denied palpitation, chest pain, or shortness of breath. The patient was monitored 20 – 25 minutes after; it was found that the blood pressure had decreased to 80/40mmHg, and there was an AF rapid response with a heart rate of 125 – 140 bpm found on ECG. The patient was given a bolus of 200 ml crystalloid and dobutamine drip with titrated dose. After that, the blood pressure increased to 90/60mmHg with ECG AF rapid response, and the heart rate decreased (105 – 110 bpm). The duration of the surgery was one hour, and then the

patient was transferred to the PACU (Post Anesthesia Care Unit).

In the PACU, vital signs were stable, and complaints were denied. The patient was treated in ICU before being admitted to the general ward and was discharged on day three post-surgery.

Discussion

According to the dermatomal, wound at the lower limb at the anterior, medial and posterior side are innervated by these nerves as follows, a) anterior: anterior cutaneous branch of the femoral nerve (anterior rami, posterior division of the Lumbar II – IV nerve root), b) medial: anterior division of the obturator nerve (anterior rami, ventral division of the Lumbar II – IV nerve root), and c) posterior part of the common peroneal nerve (anterior rami of the Lumbar IV – Sacral II nerve root). In this case Lumbar Plexus Block have the coverage of the anterior branch of the femoral cutaneous nerve and anterior division of the obturator nerve. Meanwhile the sciatic block will cover the common peroneal nerve.

According to study from Jogdand (2019), combination of the psoas compartment block (posterior plexus block) and sciatic block have the efficacy to block the sensory that is equivalent to continuous spinal anesthesia in the operation of the lower limb. Post operation analgesia also has a longer duration of pain relief in psoas compartment and sciatic block when compared to spinal anesthesia.³ Demirel et al (2014) also found that with the combination of L1 paravertebral, psoas compartment block and sciatic block have an extended initial time of analgesia need.⁴

According to the literature, combination of the lumbar plexus block and sciatic block, have a better hemodynamic status when compared to the patient received spinal anesthesia.^{4,5} In this

patient, 20 – 25 minutes after block, there is a decrease in blood pressure from 146/62 mmHg to 80/40 mmHg. Patient's ECG also showed a change from normal response atrial fibrillation with a heart rate of 82x/min into rapid response atrial fibrillation 125 – 140x/min.

This event may be caused by the pre-existing congestive liver disease that patient had, that the local anesthesia agent disposition. Congestive liver disease itself related to the heart failure that patient had that cause patient's stroke volume is low that caused the hemodynamic to be unstable. Lowered blood circulation will cause the vascularization to the liver decreased and hepatocellular dysfunction. In addition to that, big volume of the local anesthesia agent and block at the highly vascularized area will cause increase in the local anesthesia agent absorption. Other probability that may cause the hypotension in the patient is the probable epidural spread that following the lumbar plexus block. However, previous study showed that Shamrock technique in the lumbar plexus block is a technique that will reduce the risk of epidural spread. This technique increased the visibility, and the position of the needle tip does not head to the neural foramina so it will reduce the risk of epidural distribution. One of the disadvantages of the CSLPB (Combined Sciatic Nerve and Lumbar Plexus Nerve Block) is the required time to the anesthesia preparation. Adali et al (2011) compared the required time to prepare for lumbar plexus block and sciatic block compared to spinal anesthesia in patients underwent lower limb orthopedic operation and it showed that in patients with spinal anesthesia had a significantly shorter time for preparation ($p < 0.001$).⁵

Another study by Demirel et al (2014) also showed that in patients receiving combination of the lumbar plexus, sciatic block and paravertebral L1 block has a longer time for preparation compared to spinal anesthesia in patients underwent

hemiarthroplastyoperation ($p < 0.001$).⁴ On the other hand, Adali et al (2011) shows that even though it took a longer time for preparation, it has a comparable surgeon-patient's satisfaction in the two groups.⁵

Lumbar plexus block and sciatic block have a highly vascularized area, so we need to add epinephrine 1:200.000 local anesthetic agent to detect early intravascular injection. Local anesthetic agent is given slowly with a repeated aspiration every 5 ml. To prevent local anesthetic toxicity in the patient, local anesthetic agent administration in a big volume (20 ml) at each lumbar plexus and sciatic block has been calculated and should not exceed 3 mg/kg (Bupivacaine).

According to the study to find the prospective dose-finding in patients with ASA I, II or stable ASA III that used Dixon's up-and-down sequential method. In patient receiving lumbar plexus block with Ropivacaine 0.5% 20.4 ml will be effective in 50% patients, meanwhile 36.0ml will be effective in 95% patients. If the motoric block of the femoral nerve is not mandatory, 25.8 ml (95% CI 18.6 – 33.1) is adequate to block the sensory in 95% patients.⁷

There is two plane that can be used in lumbar plexus block with ultrasound guidance, sagittal and transverse plane. According to the expert, anatomically transverse plane is better in visualizing the structure. Paramedian transverse (PMTS) and Shamrock techniques use the transversal plane with ultrasound guidance. Pangthipumpai et al (2019) compared the PMTS and Shamrock technique in visualizing the related anatomy. The Shamrock technique significantly can visualize the lumbar plexus (89.1%) compared to PMTS (60.9%) ($p = 0.002$). Advantage of the PMTS technique is that it could visualize the articular process more clearly compared to Shamrock technique. However in the Shamrock technique, other than the lumbar plexus, we could see other

structure such as inferior vena cava, quadratus lumborum muscle clearly.⁸

There are several approach to sciatic nerve block, such as anterior approach, parasacral, transgluteal, infragluteal, lateral, posterior subgluteal, infra-gluteal-parabiceps, proximal femur of the popliteal fossa.⁹ In this patient, the chosen method is the subgluteal approach. Subgluteal space, where the sciatic nerve located is a distinct bordered space. Subgluteal space can be identified with ultrasound as level as greater trochanter and ischiadicum tuberosity as a hypoechoic area between the perimysium of the gluteus maximus and quadratus femoris muscle. Local anesthetic agent that is injected to the subgluteal space with ultrasound guidance is effective to block the sciatic nerve. There is also several other advantages in using subgluteal approach, such as 1) easier to insert the needle into the subgluteal space with the ultrasound guide, 2) needle tip position can be confirmed using 2- 3 ml saline to see the distension of the subgluteal space, 3) easier to insert continuous catheter to the subgluteal space, 4) subgluteal injection can also block the posterior cutaneous femoral nerve that innervates the sensory of the posterior aspect of the femoral region and 5) in this area, there is no main blood vessels to minimize the vascular complications.⁹

Conclusion

The combination of Sciatic nerve and lumbar plexus nerve block is an effective anesthesia and analgesia technique for lower limb surgery in individuals with a severe heart condition. (ASA III).

This procedure should be performed under ultrasound guidance and nerve stimulator to identify the targeted nerve that is located deep and the structure around it so that it will reduce the complication risk (intravascular injection).

The determination of volume, local anesthetic agent concentration, and block approach should be tailored according to the patient's condition to reduce the risk of

its toxicity and spread to the epidural space, especially in patients who underwent lumbar plexus block.

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Irma Lusiana Tantri