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Ultrasound-guided peripheral nerve blocks in high-risk patients, requiring lower limb (Above and below knee) amputation

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Case Report

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Ultrasound-guided peripheral nerve blocks in high-risk patients, requiring lower limb (Above and below knee) amputation

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ABSTRACT

A case series of five high-risk patients with lower limb ischemia, sepsis, altered coagulation, and multi-organ dysfunction requiring emergent or urgent lower limb amputation is presented. Use of peripheral nerve blocks for below and above knee amputations is quite uncommon which provides better hemodynamic stability and pain management, especially in the very sick patients. The surgeries were successfully carried out under ultrasound-guided combined femoral and sciatic nerve blocks. All five patients obtained adequate level of block at the area of amputation. There were no complications related to anesthetic management. Patients remained hemodynamically stable and pain-free during surgery and postoperatively. Combined femoral-sciatic nerve block under ultrasound guidance is safe and satisfactory alternative anesthetic technique for such patients.

Key Words: Femoral nerve block, peripheral nerve block, ropivacaine, sciatic nerve block, sepsis, ultrasound

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INTRODUCTION

The patients requiring emergency or urgent lower limb amputation due to poor circulation usually present with cellulitis, sepsis, multi-organ dysfunction, and comorbid conditions. Such patients may serve as a particular challenge to anesthesiologists. Neuraxial blocks are precluded because of coagulopathy, systemic infection, and hemodynamic instability.[1] General anesthesia can be catastrophic due to profound hypotension and myocardial depression at induction. These patients almost always required mechanical ventilation postoperatively for tachypnea and respiratory compensation.

Use of peripheral nerve blocks for below knee amputation (BKA) and above knee amputation (AKA) are not very common which actually have advantage of cardiovascular stability and pain relief intra- and postoperatively, especially in the very sick patients.[2] We are reporting five patients for urgent or emergent lower limb amputations that were successfully carried out under ultrasound-guided peripheral nerve blocks (US PNB).

CASE REPORT

The first patient was a 67-year-old male, American Society of Anesthesiologists (ASA) Grade IV, history of recent myocardial infarction, diabetes mellitus, chronic kidney disease, anemia (9.3 g/dl), hyponatremia (127 mmol/L), and dyskinesia. The patient was receiving aspirin and clopidogrel. Laboratory investigations showed white blood cell (WBC) 21.8 × 10E9/L, serum potassium (K+) 5.2 mmol/L, and creatinine 7.5 mg/dl. Electrocardiography (ECG) showed ST depression in lead V1–V6 with sinus tachycardia. The patient developed right diabetic foot with septicemia, requiring right BKA.

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The second patient was a 52-year-old male, ASA IV, known case of hypertension, diabetes mellitus, chronic kidney disease (dialysis dependent), and with recent atrial fibrillation episodes, for which he was receiving amiodarone. He had a history of parapneumonic effusion and had undergone left video-assisted thoracoscopy, decortication and chest tube insertion, and left BKA due to diabetic foot 1-month back. This time he presented with right gangrenous foot wound, anemia, altered consciousness, lower respiratory tract infection, and sepsis. Laboratory investigations showed hemoglobin (Hb) 8 g/dl, WBC 15.8 × 10E9/L, creatinine 5.5 mg/dl, K+ 5.2 mmol/L, and international normalized ratio (INR) of 1.2. Chest X-ray showed volume loss and haziness in the left lung and two chest tubes. Echo findings were moderate to severely reduced left ventricular function with ejection fraction of 25%–30%. The patient was scheduled to undergo left BKA.

The third patient was a 72-year-old female with hypertension, diabetes mellitus, anemia, and adrenal insufficiency. She presented with right leg gangrene, hyponatremia, drowsiness, and sepsis. The patient was bedbound for 3 months and had second-degree bed sores. Her investigation workup showed Hb 7.5 g/dl, WBC 21.2 × 10E9/L, Na^+ 128 mmol/L, and INR of 1.1. ECG showed sinus tachycardia with occasional premature ventricular contractions. Chest X-ray showed basal atelectasis. The patient was scheduled to undergo right AKA.

The fourth patient was a 46-year-old male, known case of hypertension, diabetes mellitus, anemia, history of cerebrovascular accident, and diabetic nephropathy. He presented with right diabetic leg wound, altered level of consciousness, and sepsis. His laboratory workup showed Hb 10.7 g/dl, WBC 27.1 × 10E9/L, platelet count 70,000, lactic acid 3.9 mmol/L, creatinine 1.4 mg/dl, and INR 1.5. His blood pressures were borderline low. He required right AKA.

The fifth patient was a 67-year-old male known case of uncontrolled diabetes mellitus, anemia, ischemic heart disease (status post coronary artery bypass grafting last year), and Bell's palsy. He was bedbound for 2 months and presented with the gangrenous right foot. His echo showed ejection fraction of 20% with severely reduced left ventricular systolic and diastolic dysfunction. His laboratory workup showed Hb 8.8 g/dl, WBC 24.4 × 10E9/L, and INR 1.3. He required right BKA.

Two of these patients died on the 5th and 8th day after surgery. Septic shock and multi-organ failure led to cardiac arrest which affirmed that they were severely ill and use of peripheral nerve block was a good alternative to general anesthesia as hemodynamics were well-preserved intraoperatively. Other three patients stayed in special care unit after surgery and then discharged home in stable condition.

Peripheral nerve block technique

The peripheral nerve blocks were given under ultrasound guidance. Patients received their usual doses for associated systemic illness till the morning of surgery. Clopidogrel was stopped in one patient a week before. No sedative/anxiolytic premedication was given. In the operating room, standard monitoring (ECG, noninvasive blood pressure, and oxygen saturation) was applied. We put invasive arterial line in three patients (first, second, and third cases) as they had cardiovascular compromise and labile blood pressures. Supplemental oxygen through facemask was given at 5–8 l/min. Titrated doses of midazolam (0.5–1 mg) and/or fentanyl (10–50 μg) were given for mild sedation to make the patient comfortable during the procedure. Safe dose of ropivacaine was calculated with 2.5–3 mg/kg. All other necessary preparations for US PNB were taken into account.

For sciatic nerve block, the patient was placed in lateral decubitus position with operative side upward and exposed. Scout scan was done to locate the nerve. The sciatic nerve was blocked by subgluteal approach in AKA with curvilinear and at popliteal fossa in BKA with linear probe [Figure 1]. After taking all aseptic measures and local anesthetic skin infiltration, Stimuplex (B. Braun Medical Inc. Germany) 22-gauge, 100-mm needle was inserted and guided by hydrodissection. Following negative aspiration for blood, total local anesthetic volume (ropivacaine 0.375% 20 mL with lignocaine 2% 5 mL) was given above and below the nerve. Lignocaine was added to enhance the speed of block.

For femoral nerve block, the patient was placed in supine position. Preliminary scan was done at inguinal ligament to locate the nerve, artery, and vein [Figure 2]. After taking aseptic measures, femoral nerve was approached through same nerve block needle with linear ultrasound probe and ropivacaine 0.25% 20 mL was given around the nerve in 5-mL aliquots. For AKA, additional 10 mL of 0.25% ropivacaine was given to block obturator nerve, which is located at the level of femoral crease. With the patient supine, the leg is slightly abducted and externally rotated. The ultrasound transducer is placed to visualize the femoral vessels. The transducer is advanced medially along the crease to identify the adductor muscles and their fasciae. The needle is advanced to position the needle tip between the adductor brevis and adductor magnus muscles, and local anesthetic is injected.

After the procedure, the patient was assessed for sensory and motor blockade every 5 min till the patient declared ready for surgery. Only one patient with AKA complained about moderate pain on medial side of thigh, for which

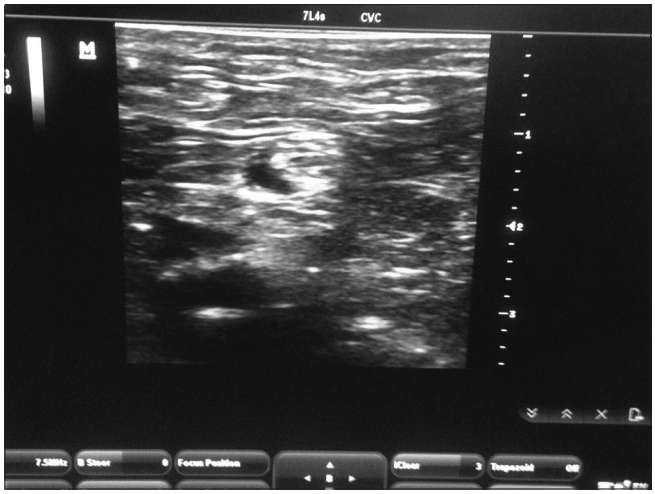

Figure 1: Popliteal sciatic nerve block for below knee amputation

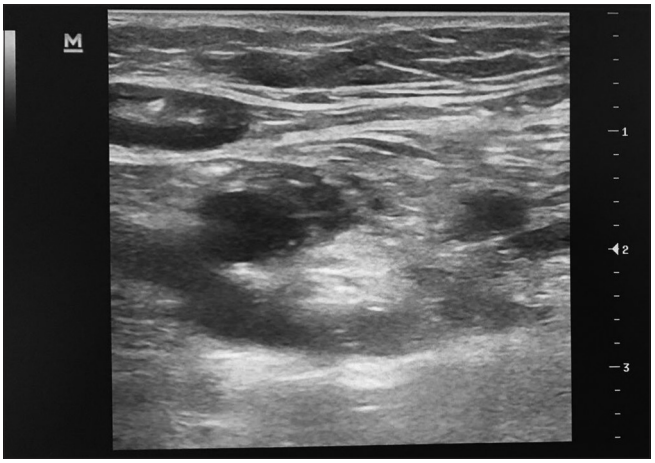

Figure 2: Femoral nerve block

lignocaine 1% 5 mL was infiltrated at incision site. All patients were successfully managed with peripheral nerve blocks, and they remained hemodynamically stable and pain-free postoperatively. All five patients obtained adequate level of block at the area of amputation. There were no complications related to anesthesia. They remained hemodynamically stable and comfortable during whole procedure. The fourth patient was delirious and required low-dose Propofol infusion (25 μg/kg/min) for mild sedation. His symptoms of delirium resolved and he remained comfortable throughout the procedure.

DISCUSSION

There is not many published literature on lower limb amputations under peripheral nerve blocks. Baddoo[3] published a case series of 10 AKAs in which they used landmark technique of "three in one femoral nerve block" and Labat's approach of sciatic nerve block by, but they had encountered partial block failure in three cases. One reason for this is lack of ultrasound, which has transformed the current regional anesthesia practice.

Cardiac dysfunction and hemodynamic instability are the consequence of severe sepsis and may consist of cardiac contractility impairment, reduced cardiac index, and reduced ejection fraction.[4] Anesthetic drugs usually reduce myocardial contractility and induce vasodilation by direct action on heart and vasculature. They generally worsen the condition of patient with sepsis.[5] Neuraxial anesthesia (spinal and epidural) may lead to hypotension due to sympathetic blockade and deteriorate the already compromised cardiovascular function that will be difficult to reverse.[1]

US PNB is a safe alternative for such patients.[6] The use of ultrasonography may facilitate more rapid block onset and prolong block duration, with the added advantages of a decrease in drug dosage and a reduction in the incidence of local anesthetic toxicity.[7] Lower volumes of drug can be used when using this technique and complications are rare.[8] In a very recent case report, Kumar *et al*. reported their experience of a successful management of a case of methicillin-resistant *Staphylococcus aureus* positive right lower limb cellulitis for AKA under combined nerve blocks.[9] They attributed this success due to use of ultrasound. We successfully conducted US PNB in all five patients, and our experience was very good. We used ropivacaine for the block as its less cardiotoxic and onset of action is faster than bupivacaine.[10] The duration of postoperative analgesia is although shorter for ropivacaine as compared to bupivacaine. All our patients had postoperative pain relief of about 6–7 h.

The present case series affirms that a combined femoral-sciatic nerve block under ultrasound guidance is safe and satisfactory alternative anesthetic technique for lower limb amputation in high-risk patients.

Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest

There are no conflicts of interest.

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