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CASE REPORT

Ultrasound-guided Adductor Canal and Popliteal Sciatic Nerve Blocks as Sole Anesthesia for Below-Knee Amputation in a Septic Patient

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ABSTRACT

Background: Septic patients requiring urgent below-knee amputation (BKA) represent a particularly high-risk anesthetic population due to vasoplegia, myocardial dysfunction, and multiorgan impairment. In this setting, general anesthesia may exacerbate cardiovascular depression, while neuraxial techniques risk profound sympathectomy-induced hypotension.

Case: A 53-year-old man with sepsis secondary to a diabetic foot ulcer, complicated by chronic kidney disease and severe anemia, required urgent BKA. An ultrasound-guided adductor canal block with 2% lidocaine and a popliteal sciatic nerve block with 0.5% levobupivacaine were performed. Adequate surgical anesthesia was achieved without airway instrumentation or intraoperative opioid administration. The 90-minute procedure was completed with stable hemodynamics and no significant fluctuations. Postoperative pain scores remained below 3/10 during the first 12 hours under an opioid-free multimodal regimen. The patient's septic condition improved, and he was discharged on postoperative day four without major complications.

Discussion: In septic patients, avoiding systemic vasodilation and myocardial depression is critical. PNBs provide targeted neural blockade while preserving sympathetic tone, potentially reducing intraoperative hypotension. Ultrasound guidance enhances precision and safety, making PNBs a viable primary anesthetic option in selected high-risk patients

Conclusion: Ultrasound-guided peripheral nerve blocks can provide effective surgical anesthesia with hemodynamic stability in septic patients undergoing urgent BKA, supporting their role as a strategic alternative in vulnerable populations.

Keywords: Adductor canal block, below-knee amputation, peripheral nerve block, popliteal sciatic block, sepsis.

INTRODUCTION

Below-knee amputation (BKA) in patients with septic diabetic foot ulcers presents substantial anesthetic challenges. Hemodynamic instability, anemia, and chronic kidney disease significantly increase perioperative risk and restrict anesthetic options. Neuraxial anesthesia may precipitate severe hypotension due to sympathetic blockade, whereas general anesthesia may exacerbate cardiopulmonary depression and necessitate airway manipulation, potentially leading to further hemodynamic compromise. Careful risk stratification and an integrated multimodal perioperative strategy are therefore essential. This includes preoperative hemodynamic optimization, the planned use of regional anesthetic techniques, and layered intraoperative monitoring employing non-invasive modalities throughout the surgical and recovery periods.

Ultrasound-guided peripheral nerve blocks (PNBs) have been increasingly utilized for lower-limb amputations in high-risk patients. These techniques preserve hemodynamic stability, avoid respiratory impairment, and substantially reduce perioperative opioid requirements. Case series involving high-risk patients undergoing below- or above-knee amputations have demonstrated that combinations of femoral and popliteal sciatic nerve blocks can be safely performed in individuals with sepsis, coagulopathy, and multi-organ dysfunction, with stable intraoperative hemodynamics and satisfactory analgesia.[1]

Beyond the immediate perioperative period, patients undergoing amputation are at risk of developing chronic post-amputation pain and phantom limb pain (PLP). Epidemiological data indicate that PLP affects approximately 50–80% of amputees, and many patients also experience residual limb pain. Evidence from randomized controlled trials suggests that continuous peripheral nerve blocks (CPNBs) significantly increase the likelihood of clinically meaningful improvement in PLP compared with placebo, possibly by attenuating central sensitization.[2,3]

This report describes the anesthetic management of a septic patient with significant comorbidities undergoing BKA, emphasizing hemodynamic stabilization and strategies aimed at reducing both acute and chronic postoperative pain.

CASE

A 53-year-old man presented with a seven-day history of progressive left lower-limb pain attributed to a chronic diabetic foot ulcer. Two days prior to hospitalization, he experienced painful oral ulcers limiting oral intake to liquids, in addition to nausea, watery diarrhea, and generalized weakness. His medical history was significant for type 2 diabetes mellitus diagnosed three years earlier, managed with metformin 500 mg twice daily. He had previously undergone left foot amputation due to diabetic ulceration. Uncontrolled hypertension was present. No history of ischemic heart disease, asthma, or drug allergy was reported.

On examination, his vital signs were: blood pressure, 172/93 mmHg; heart rate, 93 beats/min; respiratory rate, 23 breaths/min; temperature, 37.2°C; and SpO_2, 96%. He was alert and compos mentis, with redness, swelling, and tenderness of the left lower limb. Laboratory evaluation prior to surgery revealed severe anemia, leukocytosis, thrombocytosis, hypoalbuminemia and decreased renal function with an estimated glomerular filtration rate of 38 mL/min/1.73 m², consistent with stage 3 chronic kidney disease (Table 1). Chest radiography showed cardiomegaly. Electrocardiography

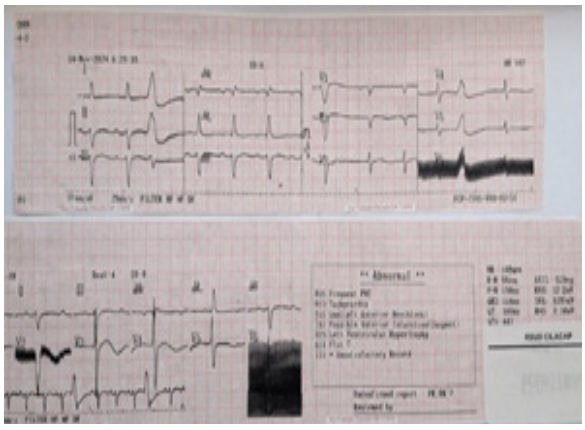

Figure 1. Pre-operative Electrocardiography

Table 1. Laboratory Findings

Test names	Values	Units
Complete blood count		
Haemoglobin	6.8	g/dL
White blood count	37100	/uL
Hematocrit	21.7	%
Platelet count	621000	/uL
Neutrophil-to-lymphocyte ratio	17.35	ratio
Renal function		
BUN	74.5	mg/dL
Serum creatinine	2.06	mg/dL
Liver function		
AST	9	U/L
ALT	7	U/L
Albumin	1.6	g/dL
Blood glucose	89	mg/dL
Electrolytes		
Sodium	134	mEq/L
Potassium	3.3	mEq/L
Chloride	102	mEq/L

BUN: blood urea nitrogen; AST: aspartate aminotransferase; ALT: Alanine aminotransferase

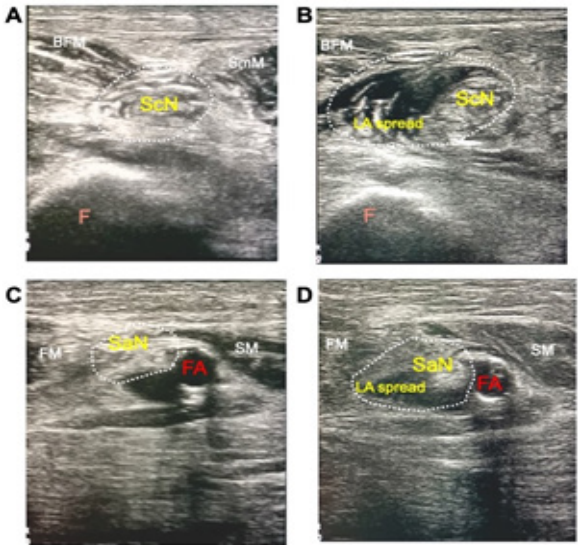

Figure 2. (A) Ultrasound image of Sciatic Nerve (ScN) before and (B) after LA injection; (C) Ultrasound image of Saphenous Nerve (SaN) before and (D) after LA injection in Adductor Canal Block. BFM, Biceps Femoris muscle; SmM, Semimembranosus muscle; SM, Sartorius muscle; VM, Vastus Medialis muscle.

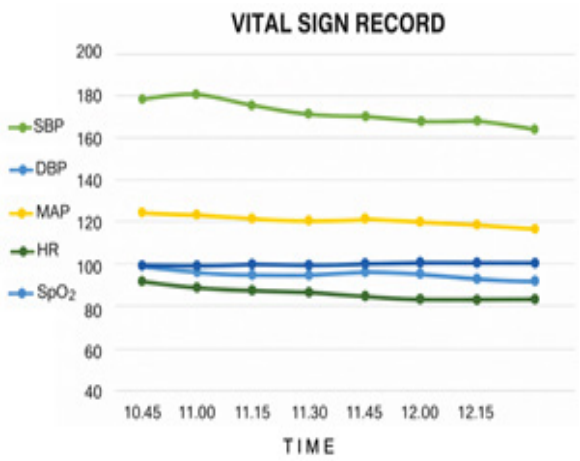

Figure 3. Stable Haemodynamic Parameters Throughout Surgery

demonstrated sinus tachycardia with frequent premature ventricular complexes, left ventricular hypertrophy, left anterior fascicular block, and findings suggestive of anterior ischemia (Figure 1).

Sepsis secondary to a diabetic foot ulcer was diagnosed in the context of type 2 diabetes mellitus, moderate chronic kidney disease, and severe anemia. The patient was indicated for urgent below-knee amputation. Given normal coagulation findings, ultrasound-guided peripheral nerve blocks were selected as the primary anesthetic strategy to preserve hemodynamic stability and reduce perioperative opioid requirements.

An ultrasound-guided adductor canal targeting saphenous nerve block was performed with 10 mL of 2% lidocaine, followed by a popliteal sciatic nerve block using 30 mL of 0.5% levobupivacaine (Figure 2). The total administered dose of local anesthetics was 350 mg, or 5.83 mg/kg. Adequate sensory blockade was confirmed before proceeding to surgery. The approximately 90-minute procedure was completed without intraoperative opioid supplementation or sedation. Hemodynamic stability was maintained throughout, with no clinically significant fluctuations, and the patient remained pain-free intraoperatively (Figure 3). The preoperative and postoperative appearance of the affected left lower limb is shown in Figure 4.

Postoperative pain was systematically assessed using the Numeric Rating Scale, with

Figure 4. Preoperative and postoperative appearance of the left lower limb. (A) Preoperative appearance of the diabetic foot ulcer; (B) postoperative appearance following below-knee amputation

Figure 5. Ultrasound-guided adductor canal and popliteal sciatic nerve blocks provided adequate surgical anesthesia for urgent below-knee amputation in a high-risk septic patient, with stable intraoperative hemodynamic parameters and controlled postoperative pain.

scores ranging from 0 to 2 during the first 12 hours after surgery. An opioid-free multimodal analgesic regimen was maintained throughout postoperative management. The patient demonstrated progressive clinical improvement, with stabilization of septic parameters. No major anesthetic- or surgery-related complications were observed. The patient was discharged in stable condition on postoperative day four.

DISCUSSION

This case demonstrates the deliberate use of ultrasound-guided peripheral nerve blocks—specifically the combination of adductor canal and popliteal sciatic nerve blocks—as the primary anesthetic strategy for urgent below-knee amputation in a septic patient with multiple comorbidities. In this context, regional anesthesia was selected to mitigate the substantial hemodynamic risks associated with general and neuraxial techniques.

Sepsis is characterized by vasodilation, altered vascular responsiveness, and potential myocardial dysfunction, rendering patients highly susceptible to perioperative hypotension. Neuraxial anesthesia may exacerbate this instability through sympathectomy, while general anesthesia can further depress cardiovascular function and necessitate airway manipulation in physiologically fragile individuals. Peripheral nerve blocks provide a focused anesthetic approach with minimal sympathetic blockade and without the need for airway instrumentation, potentially reducing perioperative hemodynamic and respiratory disturbances. Previous reports have described the successful use of ultrasound-guided peripheral nerve blocks in selected high-risk patients undergoing lower-extremity surgery, including patients with sepsis and significant comorbidities.[4-8]

A major limitation of PNBs is the potential for incomplete sensory blockade, particularly when used as the sole anesthetic technique for major procedures such as below-knee amputation. BKA involves multiple peripheral nerve territories, including the tibial, common peroneal, saphenous, sural, and other cutaneous nerves. An adductor canal block primarily targets the saphenous nerve and provides sensory blockade of the medial aspect of the lower leg, whereas a popliteal sciatic nerve block covers the major posterior and lateral components. Therefore, combining these blocks is necessary to achieve adequate surgical anesthesia.[9]

The combined use of popliteal sciatic and adductor canal blocks provides comprehensive sensory anesthesia of the lower leg while preserving quadriceps motor strength. Compared with traditional femoral nerve block, the adductor canal approach better maintains motor function without compromising analgesic efficacy. For below-knee amputation, this combination allows targeted anesthesia of the operative field with limited systemic drug exposure. In the present case, the procedure

was completed without intraoperative opioid administration, hemodynamic parameters remained stable, and postoperative pain scores were consistently low. These findings reinforce the physiologic advantages of regional techniques in carefully selected septic patients. [10]

Beyond perioperative hemodynamic stability, regional anesthesia may also influence postoperative pain trajectories. Amputation carries a high risk of phantom limb pain and chronic residual limb pain, partly mediated by persistent nociceptive input and central sensitization. Although long-term follow-up was not available in this case, the potential role of regional anesthesia in modulating post-amputation pain warrants further investigation. Previous studies have suggested that regional anesthesia may be associated with improved perioperative outcomes in patients undergoing lower-extremity amputation, including shorter hospital stays and lower rates of mortality, pulmonary complications, and acute kidney injury, compared with general anesthesia.[1,11-13] Although long-term follow-up was not available in this case, the opioid-free perioperative course and low early postoperative pain scores suggest a favorable short-term recovery profile.

Despite the successful outcome, several limitations should be acknowledged. The use of multiple PNB techniques increases cumulative exposure to local anesthetics and may consequently increase the risk of local anesthetic systemic toxicity (LAST), particularly in patients with renal dysfunction, metabolic disturbances, or critical illness. Therefore, careful calculation of the total local anesthetic dose, appropriate selection of local anesthetic agents, and vigilant monitoring for signs of toxicity are essential.[14] As a single case report, these findings cannot be generalized to all patients with sepsis undergoing BKA. Furthermore, long-term outcomes, particularly the development of phantom limb pain, were not systematically assessed. Finally, successful implementation of ultrasound-guided regional anesthesia requires appropriate technical proficiency and familiarity with sonoanatomy and close perioperative monitoring, which may limit its broader application in settings where appropriate regional anesthesia expertise is not readily available.[15]

CONCLUSION

To concludeThis case supports the potential use of ultrasound-guided peripheral nerve blocks as a physiologically favorable alternative to general or neuraxial anesthesia in carefully selected septic patients undergoing below-knee amputation. Careful patient selection, technical proficiency, and multidisciplinary coordination are essential. When applied appropriately, this strategy may enhance perioperative stability while enabling effective, opioid-free analgesia.

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