SSR Institute of International Journal of Life Sciences
ISSN (O): 2581-8740 | ISSN (P): 2581-8732
Kumar *et al*., 2025
doi: 10.21276/SSR-IIJLS.2025.11.4.6

Case Series

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Single Shot Femoral and Popliteal Block in Management of Diabetic Foot Ulcers in High-Risk Patients: Case Series

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Received: 12 Feb 2025/ Revised: 24 Apr 2025/ Accepted: 17 Jun 2025

ABSTRACT

Background: Diabetic Foot Ulcers (DFU) are a significant complication of diabetes mellitus, affecting approximately 34% of individuals with diabetes during their lifetime. DFUs precede 84% of diabetes-related lower-limb amputations and are associated with high morbidity and mortality. Anaesthetic management is critical in ensuring safe surgical intervention, particularly in patients with comorbidities such as cardiovascular disease, chronic kidney disease, and poorly controlled diabetes.

Methods: Five high-risk patients with DFUs undergoing surgical debridement were included. Ultrasound-guided femoral and popliteal nerve blocks with Inj. Bupivacaine 0.5% and lignocaine 2% were given.

Results: All five patients demonstrated favourable outcomes with the use of regional anaesthesia. Peripheral nerve blocks ensured stable perioperative conditions, effective pain control, and reduced reliance on systemic opioids. No major perioperative complications were observed.

Conclusion: This case series evaluates the effectiveness of single-shot femoral and popliteal blocks as alternative anaesthetic techniques for managing diabetic foot ulcers in patients where spinal or general anaesthesia is contraindicated. A multidisciplinary approach, including patient education, infection control, and systemic optimisation, is essential for optimal outcomes.

Key-words: Diabetic foot ulcers (DFUs), Regional anaesthesia, Peripheral nerve blocks (PNB), Popliteal nerve block, Femoral nerve block

INTRODUCTION

Diabetic Foot Ulcers (DFU) represent a significant and life-threatening complication of diabetes mellitus, affecting approximately 34% of individuals with diabetes during their lifetime [1].

How to cite this article
Kumar BMA, Supriya N, Ashoka SC, Prashantha KHM, Devi S. Single Shot Femoral and Popliteal Block in Management of Diabetic Foot Ulcers in High-Risk Patients: Case Series. SSR Inst Int J Life Sci., 2025; 11(4): 7839-7843.

Access this article online
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These ulcers are a precursor to 84% of all diabetes-related lower-limb amputations, highlighting their severe impact on morbidity and mortality [2]. The annual incidence of DFUs among diabetic patients is approximately 2%, with a prevalence ranging from 4% to 10% [3]. Notably, 15–20% of moderate to severe infected ulcers require amputation, and the five-year mortality rate for patients with DFUs is approximately 30%, rising to 70% following an above-the-foot amputation [4].

For anesthesiologists, managing patients with DFUs presents unique challenges due to the frequent presence of comorbid conditions such as cardiovascular disease,

doi: 10.21276/SSR-IIJLS.2025.11.4.6

chronic kidney disease, and poorly controlled diabetes. These comorbidities increase the risk of perioperative complications and necessitate careful planning to ensure hemodynamic stability and optimal postoperative recovery [5].

Anaesthetic management plays a pivotal role in the multidisciplinary approach required for effective limb salvage. By ensuring stable perioperative conditions, facilitating surgical intervention, and minimising systemic stress, anaesthesiologists contribute significantly to the success of DFU treatment [6]. This case series explores the application of regional anaesthesia techniques, such as peripheral nerve blocks, in high-risk patients undergoing surgical intervention for DFUs. It highlights how tailored anaesthetic strategies can optimise patient outcomes by reducing perioperative complications and promoting recovery.

CASE PRESENTATIONS

CASE 1

A 70-year-old male, classified as ASA Class III, presented with a diabetic foot ulcer requiring emergency surgical intervention. His medical history included Type 2 Diabetes Mellitus and Hypertension for 20 years, chronic kidney disease (CKD) for 7 years, and newly diagnosed Hypothyroidism. The patient was also diagnosed with Ventricular Bigeminy and Peripheral Vascular Disease, highlighting his multiple comorbidities that complicated the clinical picture. The patient also gives a history of a previous surgery to the spine with instrumentation, which was performed 10 years ago.

Pre-operative investigations revealed significant abnormalities, including severe anaemia with haemoglobin at 6.8 g/dl, elevated urea (73 mg/dl), and creatinine (2.64 mg/dl), indicating compromised renal function. ECG findings showed a wide QRS complex with premature ventricular contractions (PVCs), and echocardiography demonstrated dilated right atrium and right ventricle, with a reduced ejection fraction (EF) of 30%, signifying poor cardiac function.

Given the patient's high risk for general anaesthesia and prior lumbar spine surgery, making it unsuitable for spinal anaesthesia, a regional anaesthesia approach was adopted. Under aseptic precautions, a right-sided femoral and popliteal nerve block was performed using a combination of 0.5% Bupivacaine and 2% Lignocaine (30 ml total volume). The blocks were adequate to facilitate the procedure, ensuring minimal hemodynamic fluctuations and improved patient safety.

Emergency surgical debridement was performed to remove infected and necrotic tissue, aiming to prevent further progression of the infection. Post-operatively, the patient was managed with targeted antibiotic therapy for infection control and close monitoring of his renal and cardiovascular status.

CASE 2

A 57-year-old male, categorised as ASA Class III, presented with a wound on the right leg requiring surgical intervention. The patient had a 10-year history of Diabetes Mellitus, complicated by Acute Coronary Syndrome (NSTEMI), CKD for 6 months, and a history of chronic smoking and tobacco chewing. These comorbidities placed him at a higher risk for perioperative complications and poor wound healing.

On investigation, laboratory findings showed anaemia with a haemoglobin level of 8.8 g/dl, an elevated HbA1C of 8%, and mildly elevated creatinine levels at 1.28 mg/dl, indicating suboptimal glycemic control and renal impairment. Echocardiography revealed an ejection fraction (EF) of 35-40%, moderate mitral and tricuspid regurgitation, left ventricular hypertrophy (LVH), and Grade 3 diastolic dysfunction, suggesting compromised cardiac function.

Given his high-risk status, neuraxial anaesthesia produces hypotension, which may precipitate myocardial ischemia, regional anaesthesia was chosen for the procedure. Ultrasound-guided right-sided popliteal and femoral nerve blocks were performed using 0.5% Bupivacaine and 2% Lignocaine. This approach provided adequate analgesia, ensuring a safer anaesthetic course for a patient with significant cardiac and renal comorbidities.

The patient underwent surgical debridement to remove necrotic tissue, followed by the application of vacuum-assisted closure (VAC) therapy to promote granulation tissue formation and accelerate wound healing. Post-operatively, the patient was closely monitored, with targeted antibiotic therapy initiated for infection control. Glycemic management was optimised through insulin therapy to ensure improved wound healing outcomes. Regular follow-ups were planned to assess wound progress and prevent recurrence.

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CASE 3

A 65-year-old female, classified as ASA Class IV, presented with a severe diabetic foot ulcer and systemic signs of sepsis. Her medical history was significant for uncontrolled Diabetes Mellitus, Ischemic Heart Disease (IHD) status post-CABG, a recent Acute Myocardial Infarction (3 months prior), and long-standing Hypertension. These conditions, coupled with sepsis, placed her at an extremely high perioperative risk.

Preoperative laboratory investigations revealed profound anaemia with haemoglobin at 6.4 g/dl, leukocytosis with a WBC count of 24,000/µL, and hyponatremia (Na: 126 mmol/L), consistent with ongoing infection and systemic inflammation. Echocardiography showed severe cardiac compromise, with an ejection fraction (EF) of 25%, severe ventricular dysfunction, and a dilated left ventricle, indicative of poor cardiac output and advanced heart failure.

Given her critical condition and high anaesthetic risk of spinal anaesthesia due to reduced ejection fraction, regional anaesthesia was selected as the safest approach. Under ultrasound guidance, left-sided femoral and popliteal nerve blocks were administered using 0.5% Bupivacaine and 2% Lignocaine. This provided adequate analgesia while minimising hemodynamic stress, which was essential given her severe cardiovascular instability.

The patient underwent emergency debridement to remove necrotic and infected tissue. The procedure was performed with meticulous attention to minimising blood loss due to her anaemia and sepsis. Post-operatively, the patient was closely monitored in a critical care setting for signs of sepsis recovery and hemodynamic stabilisation. Antibiotics were tailored to address the underlying infection, and supportive therapy, including fluid management and electrolyte correction, was implemented.

CASE 4

A 52-year-old male, categorised as ASA Class III, presented with a gangrenous right foot ulcer and disorientation at the time of admission. The patient had a history of uncontrolled Diabetes Mellitus for 5 years, which contributed to his current condition. His disorientation was likely due to metabolic derangements caused by severe hyperglycemia and systemic infection. He is a known case of chronic obstructive pulmonary disease and is on irregular treatment.

Preoperative investigations revealed moderate anaemia with haemoglobin at 10g/dl, a markedly elevated WBC count of 25,400/µL, and gross hyperglycemia with a GRBS of 330 mg/dl. Urine ketone bodies were positive, and arterial blood gas analysis showed a pH of 7.12 and serum bicarbonates of 16mmol/l indicating diabetic ketoacidosis as a potential contributing factor to his presentation.

Considering his clinical status, elevated risk spinal anaesthesia may lead to respiratory depression in patients with compromised lung function, regional anaesthesia was deemed the safest approach. Ultrasound-guided right-sided popliteal and femoral nerve blocks were administered using a combination of 0.5% Bupivacaine and 2% Lignocaine. The blocks ensured adequate anaesthesia for the procedure while minimising systemic hemodynamic stress.

Extensive surgical debridement of the foot was performed to remove all necrotic and infected tissues, which were likely contributing to his systemic inflammatory response. Post-operatively, the patient was closely monitored for glycemic stabilisation and infection control. Intensive insulin therapy was initiated to control his blood glucose levels, and broad-spectrum antibiotics were administered to target the underlying infection.

CASE 5

A 51-year-old male, ASA Class III, presented with a left diabetic foot ulcer complicated by severe infection. The patient had a history of Diabetes Mellitus for 3 years but reported irregular adherence to medications. Notably, the patient was also HIV-positive and HBsAg-positive, placing him at an elevated risk for infections and coagulopathies.

Laboratory investigations revealed haemoglobin at 15.9 g/dl, an elevated INR of 2.5, indicating a significant coagulation abnormality, and fasting blood sugar (FBS) at 260 mg/dl, reflecting poor glycemic control. Urine ketone bodies (UKB) were also positive, suggesting ongoing metabolic derangement.

Given the elevated INR and coagulopathy, 2 pints of fresh frozen plasma (FFP) were transfused preoperatively to optimise coagulation abnormalities and prevent excessive bleeding.

To minimise risks associated with general anaesthesia and deranged INR values contraindicating neuraxial

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blocks, ultrasound-guided regional anaesthesia was performed. A left-sided popliteal and femoral nerve block was administered using a combination of 0.5% Bupivacaine and 2% Lignocaine (30 ml). This provided sufficient anaesthesia for the planned procedure while avoiding systemic complications.

The patient underwent surgical debridement and fasciotomy to address the extensive soft tissue infection. Post-operatively, the patient was managed with targeted antibiotics, infection control measures, and close monitoring of coagulation parameters and glycemic status.

DISCUSSION

The management of DFUs presents significant challenges, particularly in patients with multiple comorbidities such as cardiovascular disease, CKD, and uncontrolled diabetes. These conditions not only complicate the surgical intervention required to treat DFUs but also necessitate careful anaesthetic management to minimise hemodynamic instability and enhance postoperative recovery.

Peripheral nerve block (PNB) anaesthesia has become a preferred technique for high-risk patients undergoing surgical interventions for DFUs. Compared to general anaesthesia, PNB avoids systemic effects such as hypotension, myocardial depression, and renal hypoperfusion, which can be life-threatening in hemodynamically compromised individuals. PNB provides superior hemodynamic stability, reduced intraoperative opioid use, and improved analgesic outcomes in diabetic patients undergoing lower-limb procedures [7]. These benefits are particularly crucial for patients with severe cardiovascular dysfunction, where minimising physiological stress is essential for survival.

Regional anaesthesia techniques, such as ultrasound-guided popliteal and femoral nerve blocks, offer several advantages. These include effective sensory and motor blockade, enhanced pain control, and a reduction in perioperative complications often associated with general anaesthesia. Prolonged postoperative analgesia achieved through these blocks further decreases the reliance on systemic opioids, thereby mitigating risks such as respiratory depression and renal compromise. Another study highlighted that regional anaesthesia not only facilitates functional restoration in diabetic patients but also reduces perioperative complications, making it a valuable approach in managing high-risk individuals undergoing procedures like surgical debridement [8].

Patients presenting with DFUs often exhibit systemic complications such as sepsis, electrolyte imbalances, and poorly controlled hyperglycaemia, all of which impact anaesthetic management. Effective perioperative management requires preoperative stabilisation of vital functions, stringent infection control, and correction of metabolic derangements. Tight glycemic control is particularly critical, as hyperglycemia exacerbates tissue damage, delays wound healing, and increases infection risk. The need for preoperative optimisation, including glycemic stabilisation, to improve surgical outcomes has been emphasised [9]. Continuous glucose monitoring and perioperative insulin therapy play pivotal roles in preventing glycemic extremes during surgery.

Many patients with DFUs also suffer from cardiovascular compromise, including reduced ejection fraction, ischemic heart disease, and arrhythmias, making them high-risk candidates for general anaesthesia. In such cases, PNB anaesthesia eliminates the need for airway manipulation, reduces myocardial stress, and prevents sudden fluctuations in blood pressure. These advantages are particularly relevant in patients with CKD, where maintaining renal perfusion is paramount. The effectiveness of regional anaesthesia, such as femoral and popliteal nerve blocks, in providing anaesthesia while avoiding the systemic complications of general or spinal techniques has been supported by various studies [10]. Additionally, comparative studies suggest PNB may reduce postoperative infection and ICU stay duration in diabetic foot surgeries [11]. Moreover, block-based anaesthesia improves microvascular perfusion, which enhances wound healing in high-risk diabetic patients [12].

CONCLUSIONS

This case series examines the efficacy of single-shot femoral and popliteal block in the management of diabetic foot ulcers and can be used as an alternative for anaesthetic management in patients where spinal anaesthesia or general anaesthesia is contraindicated or poses intraoperative risks due to associated conditions. A multidisciplinary approach with patient education, infection control, and systemic optimisation is vital for successful outcomes.

doi: 10.21276/SSR-IIJLS.2025.11.4.6

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