

Femoral Shaft Fracture with Popliteal Artery Injury: A Case Report of a Gunshot Wound

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Abstract: This study reports the case of a 28-year-old male patient with a femoral shaft fracture and popliteal artery injury following a gunshot wound. Initial evaluation revealed the absence of pedal pulse and delayed capillary refill, with radiography performed to confirm the fracture and Doppler ultrasound for vascular assessment. The patient had a dynamic condylar screw (DCS) plate installed during a previous surgery, adding complexity to the treatment. Surgical intervention included repair of the femoral artery and vein and popliteal artery anastomosis. This report highlights the importance of early diagnosis, including the use of Doppler ultrasound to detect typical vascular injuries, and a multidisciplinary approach to ensure restored perfusion and prevent postoperative complications.

Keywords: Femoral Fracture; Vascular Injury; Gunshot Trauma; Doppler; Postoperative Complications.



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1. Introduction

The vascular supply of the femur is ensured by the femoral artery and its deep branches, with the popliteal artery being responsible for distal perfusion at the level of the adductor hiatus [1]. Femoral fractures associated with vascular injuries are rare events, typically resulting from high-energy traumas such as motor vehicle accidents and gunshot wounds and are associated with a high risk of severe complications [2]. In cases of vascular injury, Doppler ultrasound is an essential diagnostic tool for identifying arterial impairments, as it provides detailed information about blood flow and the exact location of the injury [3]. This report aims to highlight the particularities of the diagnostic and therapeutic approach in a complex case of femoral shaft fracture with popliteal artery injury in a patient with a pre-existing orthopedic implant, emphasizing the role of Doppler ultrasound in diagnosing the typical changes associated with vascular injury.

2. Case Report

A 28-year-old male patient sustained a gunshot wound (5.56 caliber rifle) to the left thigh. Upon admission, he presented with a large hematoma in the affected region, which partially controlled bleeding due to compression of the popliteal artery. Initial evaluation showed a heart rate of 71 bpm, normal blood pressure, and oxygen saturation of 100%.

Arterial blood gas analysis revealed compensated metabolic alkalosis. Physical examination identified the absence of pedal pulse, delayed capillary refill (>2 seconds), and reduced temperature in the distal limb, suggesting ischemia.

Radiography (Figure 1) revealed a femoral shaft fracture and deformation of a previously implanted dynamic condylar screw (DCS) plate. For detailed vascular assessment, a triphasic Doppler ultrasound was performed, showing typical signs of arterial injury, including turbulent and bidirectional flow, as well as a significant reduction in the distal resistance index, characterizing popliteal artery involvement [4]. These findings are consistent with arterial injuries and are crucial for identifying pseudoaneurysms or areas of reduced flow indicative of partial or total obstruction of the affected artery [5]. Confirmation of vascular impairment necessitated immediate surgical intervention.

Figure 1. Radiograph of the left thigh showing a femoral fracture and deformation of the DCS plate. Additionally, fragments of the firearm projectile are visible.



The patient underwent surgery (Figure 2) involving proximal repair of the femoral artery and vein, along with popliteal artery anastomosis (Figure 3). In the postoperative period, satisfactory perfusion of the limb was observed. After one week of hospitalization, the patient showed full recovery and was referred to orthopedics for the planned replacement of the DCS plate.

3. Discussion

Femoral fractures associated with vascular injuries present a significant surgical challenge, particularly in cases involving high-energy projectile trauma. Rapid identification of vascular injury is essential to minimize the risk of complications, with Doppler ultrasound serving as a critical diagnostic tool [6]. Doppler imaging allows visualization of blood flow and the identification of characteristic patterns, such as turbulent and bidirectional flow and the absence of distal flow in obstructive injuries, aiding in differentiating arterial injuries from other types of impairment [7].

Figure 2. Image showing the distal and proximal stumps of the popliteal artery, sectioned during surgery.

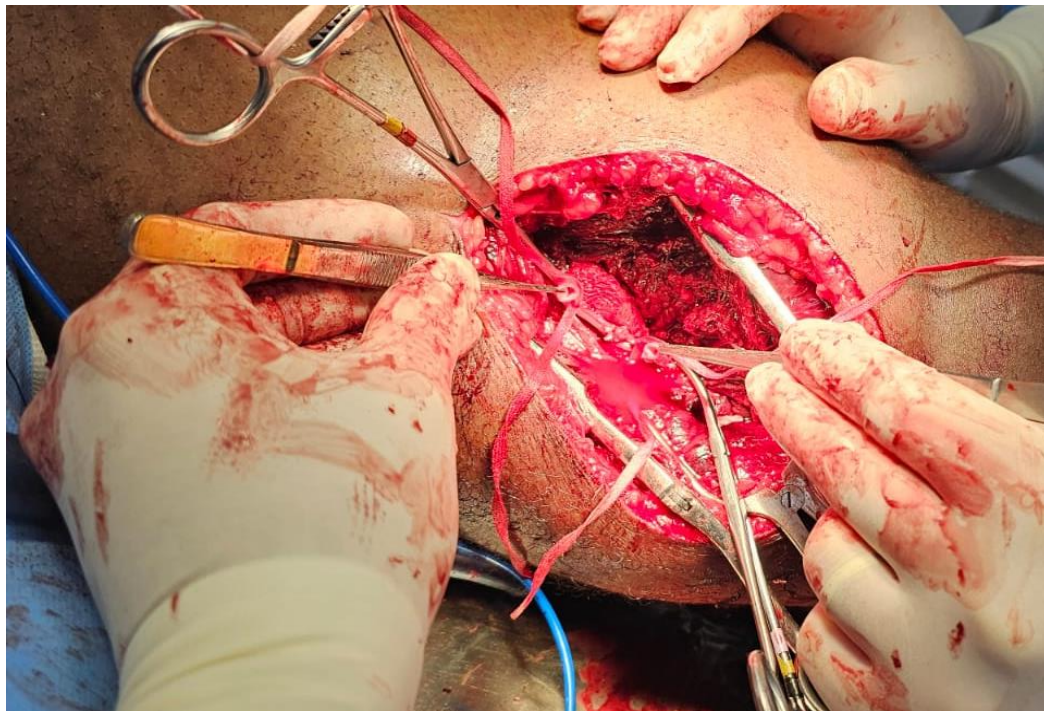
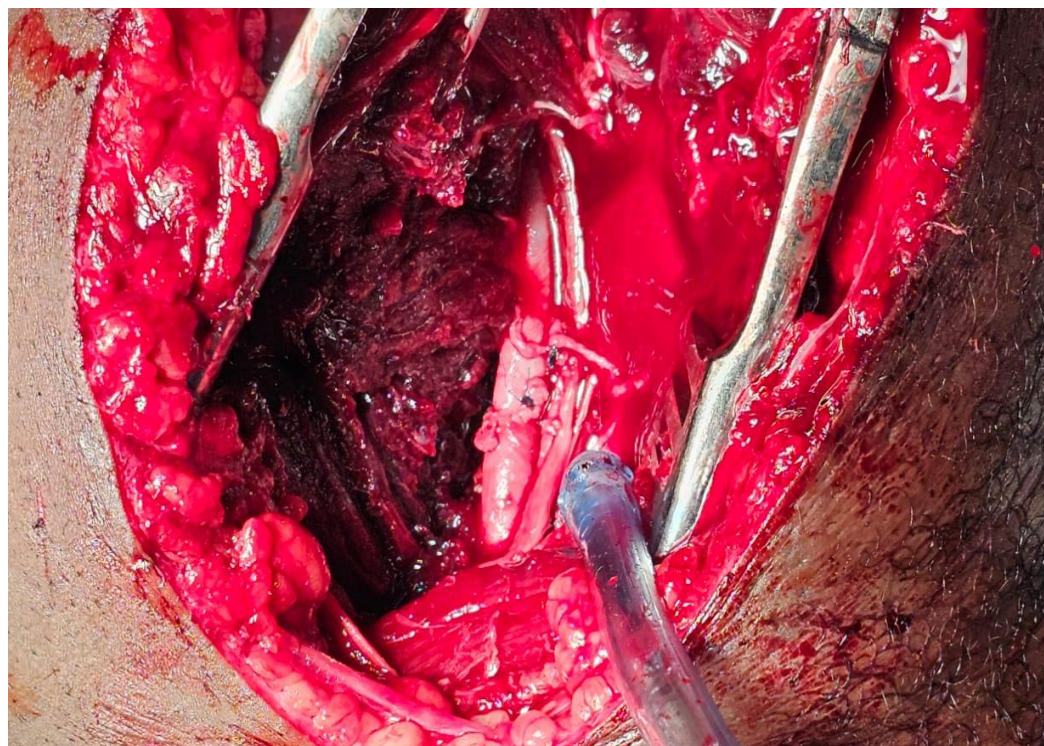


Figure 3. Surgical image of the popliteal artery anastomosis, with restored blood flow.



In the postoperative period, patients with vascular injuries face increased risks of complications, including tissue necrosis, compartment syndrome, thrombosis, and infections, particularly due to potential delays in restoring adequate perfusion [8]. These complications can be exacerbated by the presence of pre-existing orthopedic implants, such as the DCS plate, which may interfere with surgical manipulation and increase the risk of additional damage and site infections [9]. Reperfusion syndrome, which occurs after

blood flow is restored to previously ischemic areas, is another potentially severe complication that can lead to edema, free radical release, and endothelial damage [10].

The use of a multidisciplinary approach and prompt diagnosis with Doppler ultrasound enabled a successful surgical plan, minimizing postoperative complications in this case. Studies indicate that rapid surgical intervention, preceded by accurate diagnostic evaluation, is critical for favorable outcomes in patients with arterial injuries and associated fractures [11].

4. Conclusion

This case highlights the importance of early diagnosis and immediate surgical intervention in femoral fractures associated with vascular injuries. The use of Doppler ultrasound as a diagnostic tool was crucial in identifying the typical characteristics of arterial injury and guiding surgical planning. Immediate restoration of blood flow is essential to prevent severe complications such as tissue necrosis, compartment syndrome, and the risk of amputation. Delays in intervention are associated with a higher likelihood of complications, including permanent limb damage. A multidisciplinary approach and rapid response are critical to reducing these risks and ensuring a better prognosis. This case demonstrates the importance of Doppler ultrasound and swift, coordinated management in the successful recovery of severe vascular injuries associated with complex fractures.

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