

Fluctuating pulse deficits associated with intimal arterial injury following gunshot wounds of the extremity — a sign not to be missed

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Summary

Gunshot wounds may result in intimal arterial injury without breach of the arterial wall integrity. Haemorrhage, haematoma and a pulse deficit are therefore not always found. We report on two cases of lower extremity gunshot wounds with temporal variations in the clinical and radiological assessment of the pedal pulses. In both cases surgical exploration revealed intact arterial vessel walls but significant intimal injury with overlying thrombus. We propose that the pulse deficits were due to distal thromboembolism. Subsequent clot lysis led to a return of the original pulse deficit. Variation in the distal pulses in patients with gunshot wounds of the extremities should alert one of the possibility of an intimal arterial injury; imaging of the vessels is therefore advised.

Arterial injury can be caused by penetrating or blunt trauma. Classic clinical signs of arterial injury include haemorrhage, haematoma, the presence of a bruit or thrill, and a pulse deficit.¹ Intimal damage alone, without breach of the arterial wall, can occur with blunt injury or high-velocity gunshot wounds.^{2,3} Classic clinical signs are often absent and a pulse deficit will only be found if there is occlusive thrombosis in the area of intimal damage or distal embolisation. We describe two cases of gunshot wounds to the extremity presenting with fluctuating pulse deficits.

Case 1

A 25-year-old man presented 12 hours after sustaining a gunshot wound to the right lower limb. The entrance wound was on the lateral knee and exit on the medial aspect. He had a cool, pulseless foot, with absent pedal pulses. The leg compartments were soft and motor function and sensation were intact. Four hours later, repeat examination revealed a return of the pedal pulses. During surgery for concomitant injuries, on-table angiography showed a linear filling defect in the

below-knee popliteal artery. Exploration revealed an intact vessel with a bluish discoloration seen in the lumen, and poor pulsation distally. Arteriotomy revealed an area of fractured intima with overlying thrombus. The area was debrided and repaired with a vein patch. Recovery was uneventful.

Case 2

A 23-year-old man presented 6 hours after sustaining a gunshot wound to the right lower limb. The entrance wound was along the proximal antero-medial thigh and exit in the postero-lateral calf. No pedal pulses were palpable, but the limb was viable. Four hours later repeat examination revealed a palpable posterior tibial pulse, but an absent dorsalis pedis pulse. Subsequent radiology-suite femoral angiography showed areas of stenosis in the superficial femoral artery along with areas of linear filling defects (Fig. 1). Distal views showed only the anterior tibial artery patent in continuity to the ankle (and not the posterior tibial artery).

On exploration five lateral tears to the femoro-popliteal vein were found; the superficial femoral artery was noted to be intact. However, multiple areas of contused artery were seen with a proximal area of spasm. Arteriotomy revealed a proximal area with subintimal haemorrhage, intimal flap and overlying thrombus (Fig. 2) and distally multiple areas of transverse intimal fracture with overlying thrombus (Fig. 3). Passage of a Fogarty embolectomy catheter returned a small amount of thrombus from the distal vasculature. The area of spasm was closed with a vein patch angioplasty and a superficial femoral artery to below-knee popliteal bypass was performed using saphenous vein harvested from the contralateral thigh. In addition, repair of the femoral vein and four-compartment fasciotomy were undertaken. The postoperative recovery was uneventful.

Discussion

Isolated intimal tears as a form of arterial injury were described over 45 years ago.⁴ By 1971, 58 cases had been

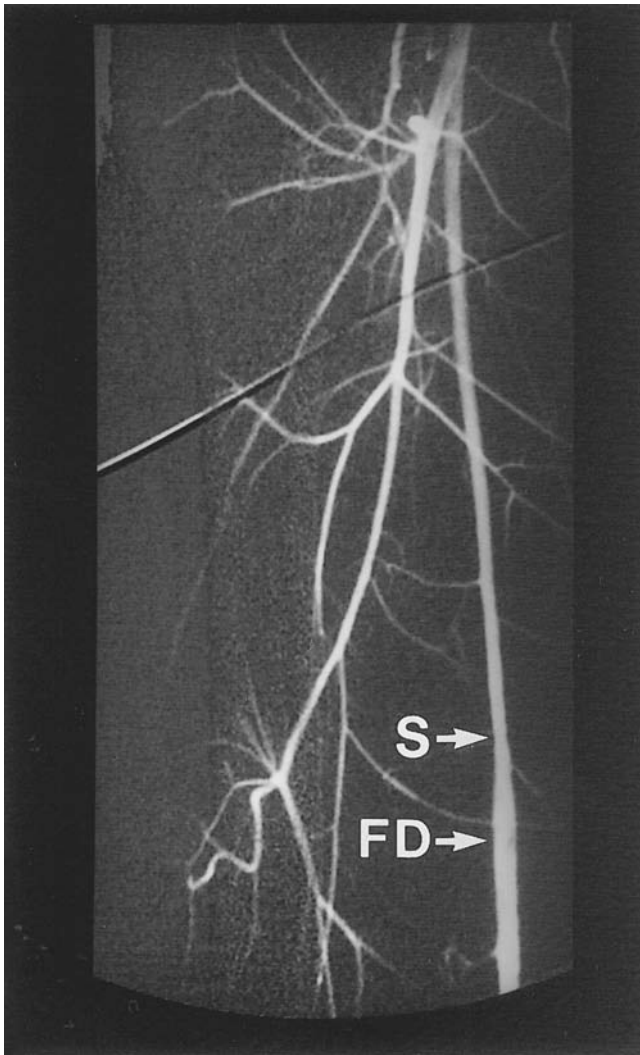


Fig. 1. Femoral angiogram (case 2) demonstrating an area of spasm (S) and a linear filling defect (FD) in the superficial femoral artery.

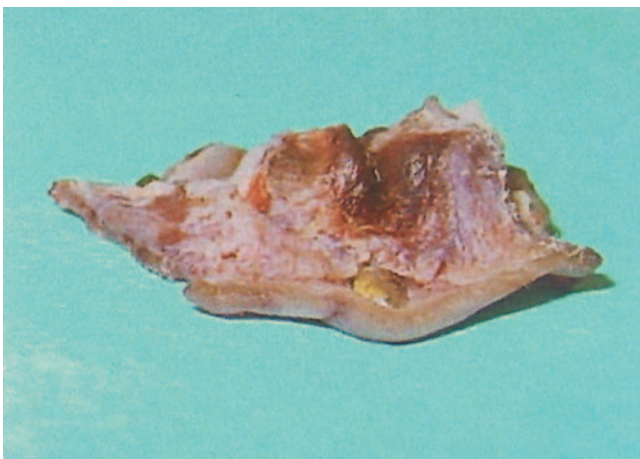


Fig. 2. Resected specimen of the femoral artery corresponding to FD in Fig. 1 showing subintimal haemorrhage, intimal damage and overlying thrombus.



Fig. 3. Specimen of the distal femoral/proximal popliteal artery demonstrating multiple areas of transverse fractures of the intima with exposed media.

recorded in the literature. Distraction injury to the artery can occur with blunt trauma associated with fractures or dislocations, or with gunshot wounds.

Gunshot wounds, inflicted by handgun or rifle, cause injury by direct force (crush) and by temporary cavitation (stretch).⁵ The latter may cause stretching of the artery not unlike popliteal artery injury associated with blunt knee dislocation.^{4,6,7} This may result in complete arterial disruption or a circumferential tear of the inelastic intima, subintimal dissection with flap formation and distal thrombosis. The temporary cavity also oscillates and produces significant pressure waves travelling at the speed of sound, that may cause remote injury.^{8,9} Experimentally, shock waves have been shown to produce vascular and nerve injury.¹⁰

Our experience with civilian gunshot injuries in close proximity to major arteries has led us to recognise two types of arterial injury, viz. subintimal haemorrhage with an intimal flap and adherent thrombus or multiple transverse fractures of the intima with adherent thrombus. The latter inevitably involves the arterial wall closest to the bullet tract and would be consistent with a shock wave type of injury.

The classic signs of haematoma and haemorrhage are often absent in this type of injury; this is not surprising because the integrity of the arterial wall is still intact. Thrombosis may occur on the exposed media or downstream of a raised flap. Propagation of thrombus leads to acute or delayed arterial occlusion. Angiographic findings include the presence of a band-like defect with decreased density of contrast distally or vessel occlusion without extravasation.¹¹ Duplex scanning may also be useful in making the diagnosis.

Controversy exists regarding the need for intervention for intimal injuries. Some authors advocate a 'wait-and-see' approach while others stress the importance of repair of these injuries.¹²⁻¹⁴ The policy at our institution is one of immediate repair of intimal injury. This is because of the high patient load and poor patient return for follow-up assessment. The proponents of a non-operative approach for minimal vascular injury have an almost 10% rate of delayed vascular repair.¹⁵

We propose that the fluctuating pulse deficits seen in these two patients are explained by distal thromboembolism and subsequent clot lysis, resulting in the return of the pulse. Spasm is also a possible diagnosis, but should only be diagnosed following angiographical examination or exploration. The finding of a variance in the pulse status in patients with gunshot wounds of the extremities should alert one to the possibility of intimal injury. Imaging of the vessels is advised and exploration undertaken if arterial injury is seen.

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