Bilateral Popliteal Artery Dissection Following Crush Injury

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Received: 08-31-2014
Accepted: 09-05-2014
Published: 10-07-2014
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Abstract

Popliteal artery injuries are associated with increased rates of amputation. Factors often cited that affect the rate of limb salvage include length of ischemic time and definitive repair, and the development of compartment syndrome. Common concomitant orthopaedic injuries often include dislocations and ligamentous damage. We present an unusual case of successful limb salvage after bilateral popliteal artery dissection with occlusion of the distal vessels and prolonged ischemic time. The patient recovered with minimal residual neurological deficits and an almost complete functional outcome.

Introduction

Popliteal artery injuries are associated with increased rates of amputation. Factors often cited that affect the rate of limb salvage include length of ischemic time and definitive repair, and the development of compartment syndrome [1]. Common concomitant orthopaedic injuries often include dislocations and ligamentous damage [2]. We present an unusual case of successful limb salvage after bilateral popliteal artery dissection with occlusion of the distal vessels and prolonged ischemic time. This case illustrates the need for timely referral and transfer to a vascular service when a high index of limb perfusion compromise is suspected.

Case study

A 59 year old woman was referred to our vascular service from a regional hospital 12 hours following a low-velocity anterior-posterior crush injury between the blade of a backhoe and a steel shed at the level of her knees.

She presented haemodynamically stable with a small laceration to the lateral aspect of her left knee. Lower limb X-rays performed demonstrated no obvious fractures. She was an otherwise fit woman with no significant medical history.

On examination, there was mild swelling on both knees with marked pain, and unstable knee joints. Bounding pulsations of her popliteal arteries were palpable above the level of the knee. No pulses were palpable in both feet and they appeared cold and pale. Sensation was reduced in her right foot, with a foot drop developing. Significant anteroposterior joint laxity was evident while lateral stability was maintained. Her Mangled Extremity Severity Score (MESS) was 6, which was border line for the consideration of a salvageable limb [3].

A CT Angiogram was performed by the referring hospital only when evidence of lower limb malperfusion developed. This demonstrated occlusion of both popliteal arteries. (Figure 1–3D reconstruction from CT angiogram)
demonstrating bilateral popliteal artery dissection with transection). We recommended urgent transfer of this patient to our unit for further management.

**Mangled Extremity Severity Score (MESS)**

<table>
<thead>
<tr>
<th>Type</th>
<th>Characteristics</th>
<th>Injury</th>
<th>Points</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low energy</td>
<td>stab wound, simple closed fx, small-caliber GSW</td>
<td>1</td>
</tr>
<tr>
<td>2</td>
<td>Medium energy</td>
<td>Open/multilevel fx, dislocation, moderate crush</td>
<td>2</td>
</tr>
<tr>
<td>3</td>
<td>High energy</td>
<td>shotgun, high-velocity GSW</td>
<td>3</td>
</tr>
<tr>
<td>4</td>
<td>Massive crush</td>
<td>Logging, railroad, oiling accidents</td>
<td>4</td>
</tr>
</tbody>
</table>

**Shock Group**

| 1    | Normotensive    | BP stable | 0 |
| 2    | Transiently     | BP unstable in field but responsive to fluids | 1 |
| 3    | Hypotensive     | SBP <90mmHg in field and responsive to IV fluids | 2 |

**Ischemia Group**

| 1 | None | Pulsatile, no signs of ischemia | 1 |
| 2 | Mild | Diminished pulses without signs of ischemia | 2 |
| 3 | Moderate | No dopplerable pulse, sluggish cap refill, paresthesia, diminished motor activity | 3 |
| 4 | Advanced | Pulseless, cool, paralyzed, numb without cap refill | 4 |

**Age Group**

| 1 | <30yo | 0 |
| 2 | >30 <50 | 1 |

**MESS score:** six or less consistent with a salvageable limb. Seven or greater amputation generally the eventual result.

**Table 1.** Mangled Extremity Severity Score

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**Figure 1.** 3-dimensional reconstruction of CT Angiogram at the Emergency Department prior to transfer to our Vascular Unit. Demonstrates bilateral popliteal artery dissection with transection.

Examination of the patient on arrival confirmed suspicion of vascular injury. Angiography found bilateral arterial intimal flaps (Angiogram images figs 2a RIGHT popliteal artery and 2b LEFT popliteal artery– big red arrows: Dissection with intimal flap, small red arrow in fig 2b: collateral flow). Moderate distal flow was demonstrated, explaining the mild nature of distal Ischemia. An attempt to pass a wire was not possible and resulted in contrast extravasation.

**Figure 2a.** Angiogram of Right popliteal artery showing no passage of guidewire to an intimal flap (large arrow) and popliteal artery dissection.

**Figure 2b.** Angiogram of Left popliteal artery also showing an intimal flap (large arrow) with prominent collaterals (small arrow).

With the operating theatres and the orthopaedic team alerted once endovascular treatment was unsuccessful, surgical exploration by our vascular team proceeded immediately. The medial approach was selected so that concomitant orthopaedic knee repair was facilitated. The
Focal extent of this trauma allowed an intact ipsilateral long saphenous vein to be harvested from the right medial thigh. The right popliteal artery was found to be partially transected and severely contused surrounded by significant haematoma. The contused edges were shortened and ligated. A technically more feasible reverse saphenous vein end-to-side anastomosis from the proximal right popliteal artery to the right distal politeal artery was performed.

A focal transection was found on the left side, together with more extensive soft tissue injury. A short segment reverse saphenous vein interposition graft (from the contralateral side) was used for the left sided repair. Soft tissue was well approximated over the grafts and the skin primarily closed. Distal pulses were palpable in both lower extremities at the completion of repairs. An ex-fix was also applied to the left knee to by our orthopaedic team prevent subluxation onto the graft during the initial operation. Post-operatively she demonstrated good pulses, with no signs of compartment syndrome developing after re-vascularisation.

Following the establishment of vessel patency, our orthopaedic team followed up with a delayed ligamentous repair [4]. Intra-operatively it was found that there were bilateral posterior and anterior cruciate ligament ruptures and a grade 3 medial collateral ligament tear on the right knee. Ligaments were then reconstructed to give a stable knee using a combination of autogenous and synthetic graft materials.

Discussion

The popliteal artery is a short vascular segment vulnerable to pathologic conditions such as atherosclerosis, aneurysms, emboli, trauma, entrapment syndromes and dissection. Without urgent surgical management, popliteal artery dissection with compromise to distal extremities will inevitably lead to ischemia and limb loss.

This patient originally presented to a regional hospital without a vascular surgical service. The consideration of adjunctive measurements could be utilized in the low resource settings—an Ankle-Brachial Pressure Index of less than 0.9 in a previously fit individual is considered vascular injury until proven otherwise. The total delay to definitive revascularization was about 16 hours—partly due to weather conditions, but the outcome for this case was unusual in that the patient made a good recovery with near restitution of full lower limb function.

Tominaga and colleagues [5] hold the view that in the presence of obvious extremity ischemia or haemorrhage, that angiography will only delay treatment. We felt that an endovascular attempt was helpful as it could either be definitive treatment or a bridging solution to purchase extra time for addressing other injuries. A covered stent could be used if contrast extravasation indicating vessel breech was visualized, otherwise a self-expanding stent could be used to treat limited dissection. The longevity of infra-inguinal endovascular solutions is till date limited and the patient can be considered for further therapy at a later stage.

The limited nature of this trauma afforded our team intact long saphenous venous conduits. As our surgical approaches opened the medial and posterior compartments of both limbs, the standard full fasciotomies were not completed although we monitored her anterior compartment closely on the ward.

At 3 month follow up, the patient demonstrated good vessel patency on the surveillance ultrasound scan, and was independently mobilising with a normal gait and no complaints of instability.

References


