

Popliteal Artery Transection Associated with Blunt Knee Injury

Controversies in Management – A Case Report

JM Plummer, MEC McFarlane, KG Jones, DIG Mitchell

INTRODUCTION

Blunt popliteal artery injuries are associated with significant morbidity. They are rare, and compared to penetrating injuries, more energy is absorbed resulting in damage to integument, muscle and skeletal structures (1). Prompt diagnosis is critical and can be made in the majority of patients clinically. If there is doubt, angiography should be obtained. Even with adequate and timely revascularization, functional outcome is less than desirable, largely because of the associated soft tissue injuries. There are several pitfalls in management of this injury and the opportunity is taken to review an acceptable management path for this challenging clinical problem.

CASE REPORT

A twenty-eight year-old man presented to the University Hospital of the West Indies (UHWI) four hours after being involved in a motor bike accident. He rode his bike off a precipice and had an extrication time of two hours. He noticed a swollen, deformed left knee and prior to presentation developed paraesthesia of his left foot and leg. On examination in the Accident and Emergency Unit, he was found to be haemodynamically stable and significant findings were confined to the left lower limb. The knee was deformed from an obvious anterior dislocation and all pulses distal to the left femoral artery were absent. These pulses were also absent on Doppler examination. The left leg was cold, moderately swollen and there was loss of sensation in the L4-S1 distribution. He had no active movement at the left ankle joint.

A clinical diagnosis of anterior dislocation of the left knee with possible arterial injury and traction injuries to both tibial and peroneal nerves was made and the dislocation immediately reduced by the emergency room physicians. There was no return of pulses distally after successful reduction. He was then subjected to angiography of the left lower limb before exploration of the popliteal fossa. Radiographs of the knee showed no associated fractures and the angiogram showed abrupt cut-off at the popliteal artery. There was no extravasation of contrast. This was interpreted

as possible spasm or transection of the artery. Anti-coagulation was commenced and the patient was taken to the operating theatre for stabilization of the knee and exploration of the popliteal fossa. The knee was initially stabilized by cross Steinman pins through the distal femur and the tibial plateau.

Exploration revealed complete transection of the popliteal artery just above the bifurcation. The popliteal veins and the sciatic and tibial nerves were intact. There was extensive soft tissue damage to the ligamentous support and capsule of the knee joint including rupture of both anterior and posterior cruciate ligaments with associated medial collateral ligament tear. The transected vessel was mobilized, debrided and since, a tension free end-to-end anastomosis was not possible, a short segment of the contralateral saphenous vein was harvested and a reverse autogenous graft performed. Four-compartment fasciotomy was done and postoperatively pedal pulses were palpable. Anticoagulation was discontinued immediately postoperatively. The patient spent three weeks in hospital. He had return of some sensation but no improvement in motor function. About four months after his injury, he was still awaiting return of enough nerve function for the orthopaedic team to plan reconstruction of his ligaments around the knee. He is ambulant with the aid of non-weight bearing crutches.

DISCUSSION

Popliteal artery injuries are likely to result in limb loss more often than any other peripheral vascular injury, with blunt arterial injury accounting for a disproportionately high percentage of leg amputations (2). Whereas amputation rates in the second World War were 73% with a policy of ligation of popliteal artery injuries (3), improvements in resuscitation, surgical techniques, antibiotic use and rapid transportation have been proposed as reasons accounting for a lowering of amputation rates in current civilian populations. Still, amputation rates of 47% have been reported in recent series of blunt popliteal arterial injury (4). A policy of aggressive revascularization irrespective of the degree of threatening ischaemic damage can drastically reduce limb loss rates (5) but this policy leaves limbs with functional deficits. The recognition that blunt injuries resulting in fractures or dislocations around the knee are associated with an incidence of occult vascular injury that approaches 40% (3, 6) had initially lead to the liberal use of

From: Department of Surgery, Radiology, Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica, West Indies.

Correspondence: Dr JM Plummer, Department of Surgery, Radiology, Anaesthesia and Intensive Care, The University of the West Indies, Kingston 7, Jamaica, West Indies. Fax: (876) 970-4302, e-mail: surradic@uwimona.edu.jm.

angiography to diagnose and guide surgical therapy. There is agreement that a high index of suspicion is critical and good clinical examination alone will accurately diagnose patients with significant arterial injuries warranting surgical exploration in up to 75% of cases. Patients with abnormal physical findings should be explored without need for angiography. These findings include absent distal pulses, pallor, decreased temperature and abnormal ankle systolic pressures. Thus the index case should have been subjected to immediate exploration without need for further investigations. Other hard signs such as arterial bleeding or an expanding haematoma are usually absent or difficult to assess in blunt popliteal arterial injury (7). Routine angiography in the absence of signs of arterial injury and the routine operative repair of clinically occult vascular injuries is controversial and of questionable benefit (6). Such vascular injuries include intimal flaps which have been shown in both blunt (8) and penetrating (9) popliteal arterial trauma not to require operative intervention in the majority of cases. While there continues to be the occasional patient requiring surgery from one of these lesions (7), this occurs infrequently with the majority becoming obvious in 48 to 72 hours from the time of the injury. Thus, serial clinical examination is justified for at least 48 hours in patients with intimal arterial lesions. In other words, a negative physical examination does reliably exclude vascular injury requiring surgery in patients with blunt injury (10-12). Physical examination can be combined with Doppler pressure measurements and the combination of an ankle brachial pressure index of > 0.9 and a normal physical examination can reliably exclude vascular injury that requires surgery (13, 14).

It is generally agreed that where there is doubt, angiography should be performed. Once a decision has been made about surgical exploration, standard techniques are followed. These include proximal and distal control, debridement and a tension free end-to-end anastomosis or reverse autogenous saphenous vein grafting from the contralateral vein. Blunt arterial injury will require a reverse saphenous graft in up to 60% of cases compared to 40% in cases of penetrating popliteal injuries (11). The use of the contralateral vein is important in the presence of concomitant popliteal vein injury. Polytetrafluoroethylene (PTFE) grafts (6mm) have also been used with acceptable results (5) although the unsuitability of PTFE for below knee reconstructions is a well accepted concept in arteriosclerotic vascular surgery (14). It is the opinion of the authors that PTFE is best avoided in the management of these injuries.

Another controversial issue in the operative repair is the sequence of repair. While it is generally agreed that vascular repair should take precedence over orthopaedic reconstruction (15), it may be delayed to facilitate stabilization in cases of extremely unstable skeletal lesions. In these uncommon cases, temporary intravascular shunts

may be rapidly constructed from intravenous lines or Foley catheters (if temporary Javid arterial shunts are not available) to establish pulsatile arterial flow until skeletal stabilization has been achieved. In one series of 22 patients (16) in which 50% had arterial reconstruction before orthopaedic stabilization, limb salvage was achieved in only 76%, and 50% of these cases were permanently disabled because of neurosensory/motor impairment. Thus, treatment must be individualized and a team approach is necessary with the simultaneous performance of various functions such as application of an external fixator whilst harvesting the contralateral saphenous vein. More elaborate orthopaedic work should be delayed until the patients have recovered from the acute episode. The importance of repair of associated venous injury in improving the chances of a good outcome is now generally accepted (2, 8, 17-19).

Other manoeuvres which are thought to compliment vascular repair include the liberal use of fasciotomy and embolectomy of the distal arterial tree with Fogarty catheters (4, 15, 16, 19). The decision to perform these procedures is usually a clinical one made by the surgeon at the time of exploration but fasciotomy can be done prior to exploration in the patient with excessive pain, firmness and neurologic deficit suggestive of compartment hypertension (20). Intravenous mannitol has also been used to reduce intracompartment pressures and reduce the risk of reperfusion injury (5, 20). The addition of systemic anticoagulation with heparin and local thrombolytic therapy has been proposed to improve limb salvage (17) and though the theoretical basis is sound, the results have not been convincing but warrant further study (2, 22).

The morbidity from blunt popliteal artery injury is high, with repeated operations being the norm. The prognosis is dependent on the associated soft tissue injuries and, as highlighted by this case report and others (10, 12, 13), limb salvage should not be the only indicator of outcome. Nevertheless, a decision to offer amputation should be made with caution as recent evidence suggests that patients at high risk for amputation have similar two-year functional outcome after reconstruction as do those who had primary amputations (23). Most patients prefer to retain their limb despite the morbidity of repeated surgical interventions.

In summary, early diagnosis and surgical intervention are essential for good outcome in patients with blunt popliteal arterial injury as time from injury to operation correlates inversely with the rates of limb salvage. Good clinical examination will detect the majority of patients requiring surgery and a team approach is often necessary. Even with optimal management, prognosis is often limited by the associated soft tissue damage.

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