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Case Report Open Access

Surgical Treatment of Traumatic Injury of the Artery and Popliteal Vein - A Case Report

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Introduction

Popliteal artery injury is associated with high energy injury, including knee dislocation and complex tibial plateau fractures or supracondylar femur fractures. Delay in its diagnosis is the leading cause of amputation in this limb-threatening injury and the failure to revascularize within 6–8 hours results in an unacceptably high amputation rate [1,2].

Popliteal injury war wounds can bleed severely and historically have high rates of amputation, now we know that surviving depends on prompt diagnosis, this is essential for limb salvage and function [1,3]. This paper describes a case of traumatic injury of the knee associated with vascular injury.

Case Report

A 42 year-old man was referred to our hospital four hours after being hit by a truck. The patient was evaluated according to the guidelines of Advanced Trauma Life Support (ATLS®). There was no brain, abdominal or thoracic injuries and shock. In the physical examination there was an arterial bleeding from the wound and an expanding hematoma in the left leg showed signs of paleness, coldness, anesthesia, tibialis posterior, dorsalis pedis and popliteal arterial pulses were not felt. The patient was transfused 2 units of blood for hematocrit <25%, and as his general condition deteriorated was undertaken immediately to the operating room for vascular and orthopedic management. Radiographs showed multiple fractures (Figure 1) from both legs and angiography revealed a stop at the left popliteal artery and that there was no pathway to distal flow. Using the standard operative approaches we performed proximal and distal vascular control through a medial access in the left leg. Exploration revealed complete transection of the popliteal artery and vein just above the arterial trifurcation. The injured vessels were isolated and the exact extent of vascular damage established. A Fogarty catheter was used to retrieve the thrombus; both proximal and distal arterial lumen were flushed with heparinized saline solution, than we did a temporary endoluminal shunt for both vascular popliteal injuries to decrease the duration of ischemia two hours after the patient arrived at the hospital (Figure 2). The orthopedic fixations than was undertaken after shunting proceeding for vascular reconstruction and the sciatic and tibial nerves were intact (Figure 3). Repair of the damaged vessel took precedence in the presence of limb ischemia, mobilization of the vascular ends and subsequent anastomosis with 6/0 interrupted prolene sutures was performed in the popliteal vein by end-to-end venorrhaphy (Figure 4). A larger gap was bridged with a reverse saphenous vein graft to treat the popliteal artery. Repair of the injured vessel was undertaken and after through debridement of the injured soft tissues, four compartment fasciotomy was done.

Successful repair was assessed by the return of distal pulses at the end of the operation. The patient received intravenous systemic heparinization during surgery and continued for a period of 5 days prophylactic. The patient received intravenous preoperative prophylactic antibiotics, which were continued postoperatively.

He was subjected to Doppler examination along with a daily bedside clinical evaluation that showed good patency of the vessels and confirmation of blood flow to the extremity. During the post-operational period, no complications developed in the wound and the patient has been followed for a period of six months up to now with Doppler and doing a progressive rehabilitation physiotherapy program.

Discussion

Although uncommon overall, the incidence of popliteal artery injury varies widely by setting, location, and predominant injury mechanism [4]. The most common cause of vascular injuries in the extremities is respectively penetrating trauma, blunt trauma including traffic accidents or falls and crush injuries [5]. Whereas amputation rates in the second World War were 73% with a policy of ligation of popliteal artery injuries, improvements in resuscitation, surgical techniques, antibiotic use and rapid transportation have been proposed

Figure 1: Distal femur fracture from the left leg.

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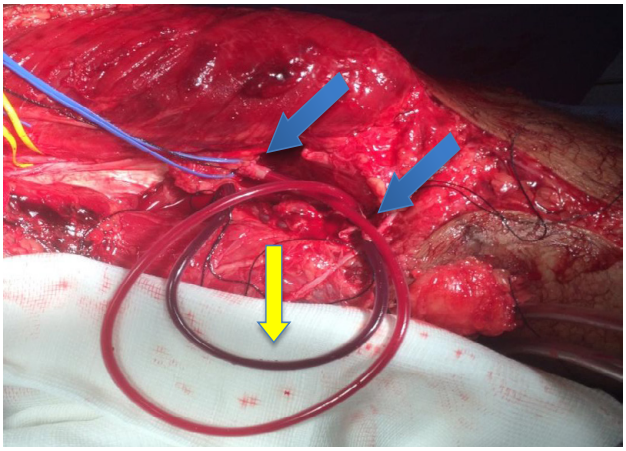

Figure 2: Proximal and distal popliteal artery (blue arrow) and venous shunting (yellow arrow).

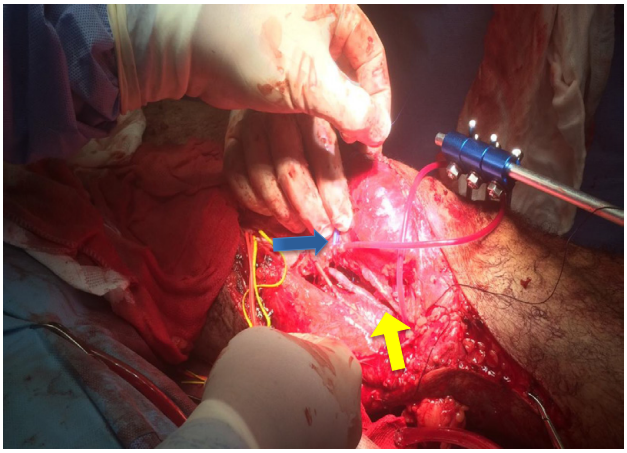

Figure 3: Venous flux restored (yellow arrow) and arterial reconstruction after orthopedic Fixation.

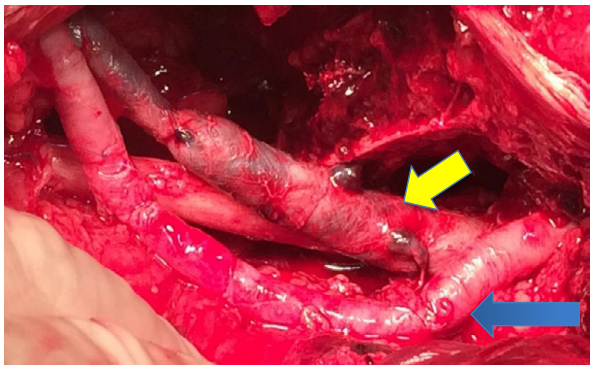

Figure 4: Final result after venous (yellow arrow), arterial popliteal reconstruction (blue arrow).

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 [2,3,6,7].

The incidence of combined vascular injury and skeletal fractures is reportedly 0.3% to 6.4%. 8,9,10 Authors believe that the arterial repair should be performed first to restore circulation to the limb before orthopedic stabilization is addressed. Sometimes, however, massive musculoskeletal trauma renders a limb so unstable that external fixation must be accomplished before the vascular procedure [7-10]. In patients who have injuries to the sciatic nerve and the posterior tibial nerve the early amputation rates in were around the order of 20%, but many of these patients will end up with amputations later on 2. In our patient the sciatic and tibial nerves were intact.

Compartment syndrome, a clinical condition resulting from increased tissue pressure in a non-expansible tissue space may occur in the setting of lower extremity trauma and is associated with significant morbidity and mortality [11,12]. Early fasciotomy is associated with improved outcomes in patients with lower extremity vascular trauma treated with surgical intervention and may reduce amputation rates in extremity injury as we did in our patient [11]. After the relevant arterial segment is controlled, the back-flow and in-flow are assessed, and an embolectomy catheter is routinely passed distally and proximally. The insertion of arterial shunts at this stage is not routinely used for all vascular surgeons [13].

Selective use of intraluminal shunts and rapid installation of an external fixator can minimize limb ischemia in this setting, thus allowing an unhurried orthopedic and vascular repair.[13,14]. We considered the possibility to repair the vascular reconstruction before orthopedic fixation, but temporary intraluminal shunting is value when the limb is severely ischemic as our patient. We did both venous and arterial shunting, allowing early restoration of limb perfusion, avoiding ischemic damage and distal thrombosis [14-17]. In an experimental model, venous shunting, when compared with venous ligation, offered less resistance to vascular flow through the arterial shunt and allowed a more efficient limb venous drainage than simple vein ligature [18].

Venous repair was performed by end-to-end venorrhaphy after orthopedic fixation. Popliteal venous injuries can be repaired with minimal downside in a good early patency rate [1,2,8,17,19]. Ekim et al. [17] concluded that transient venous patency allows both, establishment of venous and lymphatic collateralisation [17], alternatively, venous ligation should be considered only in unstable patients who refuse blood transfusion (Jehovah's witnesses) and shocked patients with other critical traumatic lesions.

Data showed that limb revascularizations in both military and civilian populations were mostly done by autogenous bypass [17]. Popliteal arterial trauma carries the greatest risk of limb loss of any peripheral vascular injury and new methods to determine limb viability in the mangled extremity are needed [2,17,20]. Critical mangled extremities may be best treated by early amputation; successful limb salvage may be obtained in most blunt and penetrating popliteal arterial injuries [2,20].

Popliteal artery injury with early identification of limbs at risk, shown to be beneficial to do: early four compartment fasciotomy, temporary intra-luminal shunting, definitive repair of concomitant venous injuries [21]. A worst - case study, showed comparable results to historical controls regarding limb salvage rates (71% for Iraq vs. 56-69% for the Vietnam War). Thirty-day survival (98%), 4-year amputation-free survival (67%), and complication-free rates (35%) fill knowledge gaps [22]. Banderker et al. [23] concluded in his work that the most significant factors associated with the high amputation rate of 37.5% were an ischemic time longer than 7 hours, and the presence

of a compartment syndrome [23]. Pourzand et al. [24] highlights the importance of transport to repair and repair of associated venous injury when possible are necessary to optimize limb salvage. Delays in surgery, extensive soft tissue defect, compound tibia-fibula fracture, and other factors are associated with high amputation rate following popliteal artery injury [24].

Early diagnosis and prompt surgical intervention are essential for good outcome in patients with popliteal injury as time from injury to operation correlates inversely with the rates of limb salvage. Clinical examination will detect the majority of patients requiring urgent surgery and a quickly approach is often necessary [2,6,7,8,9,18-24].

In conclusion, this case demonstrates that early revascularization restores circulation and can prevent amputation as the first approach.

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