CASE REPORT PEER REVIEWED | OPEN ACCESS

Transected popliteal artery via gunshot wound: A case report

Trina Capelli, Erwin Rusli, Thomas Abbruzzese

ABSTRACT

Introduction: Popliteal artery transection is an uncommon injury but can be seen in traumas like gunshots, stabs, and complex fractures of the distal femur or proximal tibia. Although uncommon, these injuries carry the greatest risk of limb loss of any peripheral vascular injury. Timely hemostasis and repair are crucial to limb-salvage and overall survival, as lower extremity amputation is known to have very high mortality rates. We present a multiple gunshot wound patient who was found to have a completely transected popliteal artery injury and who underwent open surgical repair with interposition vein graft using the greater saphenous vein, ultimately resulting in two-vessel runoff and limb salvage.

Case Report: A 30-year-old man with no known past medical history presented to the hospital via private vehicle after being shot multiple times just prior to arrival. Obvious injuries noted were two gunshot wounds to the left hand with hemorrhage, two gunshot wounds to the right thumb without hemorrhage, one gunshot wound to the left upper quadrant, one gunshot wound to the left flank, and one to the right lower extremity in the posterior distal thigh with massive hemorrhage. He was emergently taken to the operating room where exploration of the right popliteal artery and vein was performed which revealed a completely transected popliteal artery. The bullet was found to be lodged in the distal femur. The left great saphenous vein was then harvested in order to use it to repair the right popliteal artery with an interposition vein bypass. Intraoperative angiogram confirmed 2-vessel runoff. A four-compartment fasciotomy was performed prophylactically to avoid compartment syndrome. Postoperatively, the patient was extubated on post-op day 1. On post-op day 7, he was transferred out of the ICU and underwent split thickness skin grafting to the right lower extremity fasciotomy wounds. On post-op day 18, he was discharged home with a walker and the ability to move all extremities. He has now recovered full ambulatory function.

Conclusion: Transection of popliteal artery should be considered in trauma patients with profuse lower extremity bleeding. In severe injuries and hemodynamically unstable patients, prompt hemostasis should be achieved and open surgical repair with an interposition vein graft should be considered for limb salvage.

Keywords: Gunshot wound, Popliteal artery, Trauma surgery, Vascular surgery

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INTRODUCTION

Popliteal artery transection is an uncommon injury but can be seen in traumas like gunshots, stabs, and complex fractures of the distal femur or proximal tibia [1, 2]. Although uncommon, these injuries carry the greatest risk of limb loss of any peripheral vascular injury [3]. Timely hemostasis and repair are crucial to limb-salvage and overall survival, as lower extremity amputation is

known to have very high mortality rates [4]. We present a multiple gunshot wound patient who was found to have a completely transected popliteal artery injury who underwent open surgical repair with interposition vein graft using the greater saphenous vein, ultimately resulting in two-vessel runoff and limb salvage.

CASE REPORT

A 30-year-old man with no known past medical history presented to the hospital via private vehicle after being shot multiple times just prior to arrival. On arrival to the hospital, initial GCS was 10, heart rate was 116, blood pressure was 94/64, and he was able to state his name. By the time he reached the trauma bay, his GCS was 7 and he was unresponsive. He was immediately intubated. He had clear breath sounds bilaterally and was being mechanically ventilated, saturating 99%. He had weak femoral and radial pulses bilaterally, and no distal pulses in the right lower extremity. Obvious injuries noted were two gunshot wounds to the left hand with hemorrhage, two gunshot wounds to the right thumb without hemorrhage, one gunshot wound to the left upper quadrant, one gunshot wound to the left flank, and one to the right lower extremity in the posterior distal thigh with massive hemorrhage. While in the trauma bay, a right subclavian Cordis was placed and massive transfusion protocol was initiated. Two tourniquets were placed on the right lower extremity which controlled the hemorrhage. Chest X-ray confirmed placement of the endotracheal tube and Cordis without pneumothorax. Kidney, ureter, and bladder (KUB) confirmed bullet fragments with no free air (Figure 1A and B). Focused Assessment with Sonography for Trauma (FAST) exam was positive for free fluid in the pelvis. A left femoral arterial line was placed as well as a left femoral Cordis. A Foley was also placed with return of clear yellow urine. The patient was then emergently taken to the operating room. Between the trauma bay and completion of surgery, two full rounds of massive transfusion protocol were given. In the operating room, an exploratory laparotomy was performed due to the left upper quadrant gunshot wound. The only finding was 200 cc of blood in the pelvis which was thought to be secondary to the ballistic blast and subsequent bleeding from peritoneum without actual violation into the abdominal cavity. There was a large cleft in the lateral portion of the spleen, but no obvious laceration or bleeding. Attention was then drawn to the right lower extremity wound. Exploration of the right popliteal artery and vein was performed, and the right popliteal vein was ligated with heavy 2-0 silk ties proximally and distally. A second incision was made below the knee to dissect free the popliteal artery distally. The right popliteal artery was found to be completely transected and was ligated high below the knee to help prevent back-bleeding. At this time, the bullet was found to be lodged in the distal femur (Figure 2). The bullet was retrieved, and bone wax was placed over the deficit. The left great saphenous vein was then harvested in order to use it to repair the right popliteal artery with an interposition vein bypass. This bypass was performed in an end-to-side fashion using 6-0 Prolene suture. An intraoperative angiogram was performed through the right superficial femoral artery (SFA) using a 5-French micro-puncture kit, which showed a widely patent above knee SFA, patent vein graft, and two vessel run-off through the peroneal and posterior tibial arteries (Figure 3). A four-compartment fasciotomy was performed prophylactically to avoid compartment syndrome as blood flow had been cut off from lower leg for about 6 hours. A wound vac was placed over the fasciotomy incisions. The bilateral hand gunshot wounds were then addressed with washout and debridement of bilateral hands and repair of the right thumb radial digital nerve, radial digital artery, ulnar and radial digital nerve, and repair of the flexor pollicis longus tendon. Post-operatively, the patient was extubated on post-op day 1. He was found to have right lower extremity weakness without the ability to wiggle his toes. On post-op day 7, he was transferred out of the ICU and underwent split thickness skin grafting to the right lower extremity fasciotomy wounds. He was then taken back to the OR on post-op day 13 for concerns of a bleeding vein graft, which showed an old liquefied hematoma and a patent vein graft. On post-op day 18, he was discharged home with a walker and the ability to move all extremities. He has now recovered full ambulatory function.

DISCUSSION

Popliteal artery transection is a rare but serious life-threatening injury. According to the National Trauma Data Bank, the incidence of popliteal artery injury is <0.2% [3]. Mortality from popliteal artery injury is around 8% [4]. Popliteal artery injury can be from either blunt or penetrating trauma. Possible causes of popliteal artery injury include trauma via gunshot wound, stab wounds, open fractures, knee dislocations, and fractures of the distal femur or proximal tibia [1]. Patients with traumatic popliteal artery injuries can present with bleeding from penetrating wounds, cold limbs, mottled skin, decreased sensation, and decreased motor function in the affected limb [5]. Timely tourniquet placement for gross bleeding should be considered to minimize blood loss. Diagnosis of traumatic popliteal artery injury can be made by history, clinical exam, imaging via Doppler ultrasound, computed tomography (CT) angiography, and surgical exploration [5].

Treatment for traumatic popliteal artery injury can be either via open surgical technique or endovascular technique. Endovascular techniques are generally implemented in hemodynamically stable patients to treat vascular injuries such as thrombosis, pseudoaneurysm, dissection, hematoma and arteriovenous fistula, and have been demonstrated to be successful specifically in

instances of popliteal artery trauma in hemodynamically stable patients [6]. Different techniques in open surgical repair are determined based on the degree of injury. For example, a complete transection of the popliteal artery warrants interposition graft placement or interposition vein bypass. Injuries involving 50–75% of the vessel diameter can attempt to be repaired with patch angioplasty. Injuries involving less than 50% of the vessel diameter are amendable to primary repair. Smaller vessels that are injured may be amendable to ligation [7].

Looking at a study using data from the National Trauma Data Bank to compare outcomes of open versus endovascular repair, results showed similar short-term clinical outcomes and hospitalization lengths between the two groups, and a lower rate of fasciotomy in the endovascular group [7]. In this study, open repair included ligation of vessel, primary repair, or interposition graft. Endovascular repair included insertion of non-drug-eluting peripheral vessel stent, and endovascular repair [7]. This study shows that an endovascular approach appears to be a safe alternative to traditional open repair in selected patients, especially in those who are hemodynamically stable and have less severe injury [7]. Given that our patient was severely injured and not hemodynamically stable, an open approach to treatment of the transected popliteal artery injury was chosen. An open approach was also chosen for our patient due to the retained bullet that warranted wound exploration and bullet extraction. An open technique allowed for direct visualization of the bullet's trajectory. Given that the popliteal artery was completely transected, an open approach also allowed for a successful interposition vein bypass repair using the great saphenous vein. Although endovascular repair is associated with lower rates of fasciotomy, the patient's clinical condition warranted a fasciotomy regardless of open surgical versus endovascular approach due to a lack of blood flow to the right foot for over 6 hours by the time blood flow was restored [5]. Regardless of the approach used to repair the popliteal artery injury, amputation rates are around 28% for blunt popliteal artery injuries versus 11% for penetrating popliteal artery injuries [8].

As previously stated, a four-compartment fasciotomy was performed due to lack of blood flow to the right leg for over 6 hours. Reviews of the National Trauma Data Bank have shown that fasciotomies performed within 8 hours of open vascular repair are associated with a four-fold lower risk of amputation, which leads to improved outcomes [9].

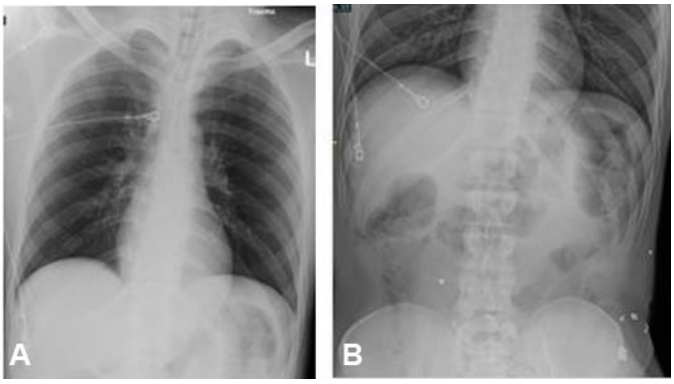

Figure 1: (A) Chest X-ray showing ET tube in good position. (B) KUB showing left Cordis in place without pneumothorax. Bullet fragments noted with no free air.


Figure 2: X-ray showing bullet in distal femur.


Figure 3: Intraoperative completion angiogram with two vessel run-off in peroneal and posterior tibial arteries.

CONCLUSION

Transection of popliteal artery should be considered in trauma patients with profuse lower extremity bleeding. In severe injuries and hemodynamically unstable patients, prompt hemostasis should be achieved and open surgical repair with an interposition vein graft should be considered for limb salvage.

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Author Contributions

Trina Capelli – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Erwin Rusli – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

Thomas Abbruzzese – Conception of the work, Design of the work, Acquisition of data, Analysis of data, Interpretation of data, Drafting the work, Revising the work critically for important intellectual content, Final approval of the version to be published, Agree to be accountable for all aspects of the work in ensuring that questions related to the accuracy or integrity of any part of the work are appropriately investigated and resolved

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Conflict of Interest
Authors declare no conflict of interest.

Data Availability
All relevant data are within the paper and its Supporting Information files.