Case Report

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Delayed Popliteal Artery Injury after Blunt Trauma: Presentation and Successful Management

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Abstract

Injury to popliteal artery mostly occurs with fracture, dislocation and penetrating trauma. Isolated blunt trauma in absence of other injuries makes it difficult to diagnose. Thus, high rate of complications such as amputation are reported in injury to popliteal artery cases. In this article successful revascularisation of a patient with delayed popliteal artery injury presentation associated with compartment syndrome is reported. Emphasis is laid on vascular reperfusion injury and significance of vascular examination in blunt trauma which helps in prevention of amputation and morbidity.

Keywords: Popliteal artery; trauma; compartment syndrome; delayed diagnosis; revascularisation.

INTRODUCTION

Vascular injuries to lower limb accounts for approximately 5% of all trauma cases in trauma centre.[1] Injury to popliteal artery in specifically, remain uncommon, accounting for 0.2% of all trauma but is catastrophic injury with aproportionally high morbidity.[1] Lower extremity blunt trauma has a high rate of association from 28% to 46% of injury to the popliteal artery in the form of laceration, occlusion, transection, perforation, arteriovenous fistula, or endothelial injury.[2] Anatomic relationship of popliteal artery to femur, tibial plateau, knee joint apparatus and its ligamentous fixation makes it easily susceptible to injury with blunt trauma of extremity.[3] Injury to popliteal artery is often associated with, tibial plateau fracture, dislocation of knee and supracondylar femur fractures.[4] Any impediment in diagnosing lead to ischemic injury with often leads to amputation in most cases. This case reports an infrequent case of blunt injury to knee leading to popliteal artery rupture with compartment syndrome as comorbid condition not associated with any fracture or dislocation and its delayed successful vascular repair surgery without ischemia reperfusion injury or serious complications even after 40 hours of injury.

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CASE REPORT

A 17-year-old male patient presented to emergency with severe pain in his right knee after he fell from motorcycle two days ago. Physical examination revealed swelling over the right leg with paleness, anesthesia, coldness of foot and absent dorsalis pedis, tibialis posterior pulses. Radiological x-ray rules out fracture and dislocation, routine investigation complete blood profile, renal

profile coagulation profile was normal, creatine phosphokinase (cpk) levels were on higher side with vitals blood pressure (bp) 118/84 mm of hg, pulse rate 102/min, saturation (spo_2) 100%. Doppler ultrasound was done bedside and it shows absence of flow below popliteal artery with patent popliteal vein. Femoral arteriography was done which revealed occluded popliteal artery at the level of the knee joint (Fig. 1). Patient was shifted to operation theater and immediately medial and lateral fasciotomy was done under spinal anesthesia. Surgery was uneventful throughout intraoperative period vitals remained stable and patient was shifted to surgical intensive care unit for further monitoring and management. Fluid resuscitation with isotonic bicarbonate (75 milliequivalents of bicarbonate to one litre of 5% dextrose) was given and urine output was maintained at 100 to 150 ml /hr. On post operative day 2 as cpk levels showed a declining trend with persisting symptoms without pedal pulses patient was planned for revascularisation and condition was discussed with patient attendants, since they still want revascularisation procedure to save the limb and were not giving consent for amputation patient was shifted to operation theatre for surgical revascularisation of popliteal area. Pre-operatively fluid resuscitation was done with isotonic bicarbonate solution vitals were bp 110/78, pulse rate 98 /min and normal temperature. After application of monitors general anesthesia was given to patient. ECG monitoring, temperature, invasive arterial monitoring and central venous pressure line for central venous pressure (cvp) monitoring was done in addition to standard monitoring. Necrosed muscle mass was removed surgically and patient was shifted to prone position for popliteal revascularisation. Popliteal artery was found ruptured with intact popliteal vein and it was repaired with short saphenous vein graft. Injection of heparin 5000 units was given intravenously. Throughout surgery vitals remained stable with 150 ml /hr urine output. Arterial blood gas was done after revascularisation which was normal and patient was extubated and shifted to surgical intensive care unit. Patient maintained vitals and perfusion of limb was observed with ankle stiffness and numbness at discharge.

Fig. 1: Femoral Arteriography

DISCUSSION

Most common cause of vascular injury in lower limb is penetrating trauma. Blunt trauma, road side accidents, fall from height and crush injuries are

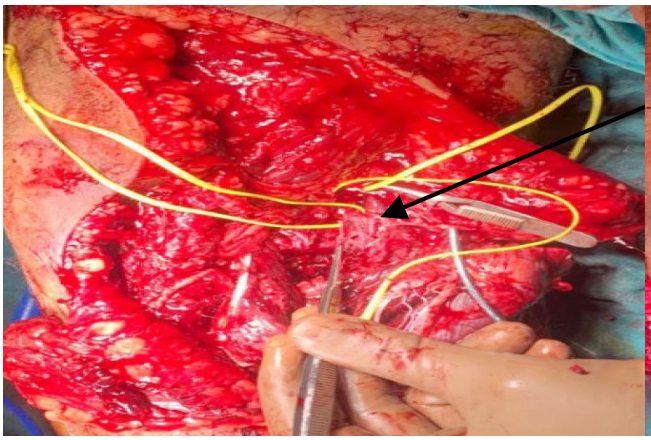

Fig. 2: Arrow showing popliteal artery injury

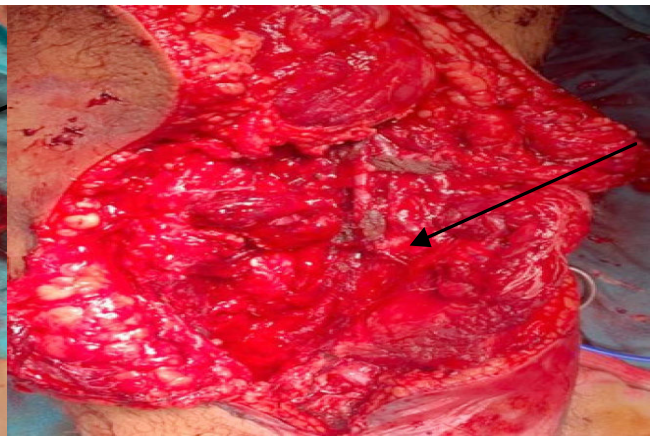

Fig. 3: Arrow showing popliteal artery repair

other causes of vascular injury in lower limb.[5] Blunt trauma in popliteal area causes rupture of vascular intima leading to thrombi formation causing vascular occlusion and popliteal artery injury.[2,4] Popliteal artery injuries due to blunt trauma not associated with fracture and dislocation are difficult to diagnose, some signs of distal ischemia such as pain, pallor, motor and sensory dysfunction present late and this might delay appropriate timely diagnosis and management.[6] Diagnosis and immediate intervention is needed to save the limb and mortality as popliteal artery injuries are associated with grave prognosis.[7] Collateral vessels around the knee joint may cause delayed symptom presentation and thus diagnosis failure. Review of literature also accentuate that peripheral pulses may be present initially in patients with trauma to the popliteal artery. Initial physical examination is therefore very important to assess the vascular status but also repeated examination over the ensuing hours and days is required.[8,9] If needed, imaging such as Doppler, MRI, angiography or CT angiography of the vessel must be done and evaluated promptly.[10] Irreversible ischemia can occur in 6 to 8 hours leading to amputation of limb and long-term morbidity. In popliteal artery injury cases amputation rates are as high as 30 to 60%.[11] Artery rupture can lead to compartment syndrome which occurs due to raised tissue pressure in a non-expansive space that can lead to significant morbidity and mortality.[12] Fasciotomy is the treatment of choice to save limb and life in compartment syndrome as was done earlier in our case.[13] In revascularisation surgery paradoxical tissue response followed by return of prefusion and concomitant reoxygenation known as ischemia reperfusion injury can occur.[14] Endothelial cell dysfunction, vasodilatation and vasoconstricting factor imbalance, higher vascular permeability, complement system and coagulation activation can lead to ischemia reperfusion injury. Systemic inflammatory response syndrome (SIRS) and most devastating multi organ dysfunction syndrome (MODS) occur as a sequela.[15] Muscle cell liquefactive necrosis with lactic acid, myoglobin, superoxide, creatine kinase, potassium ion accumulation in effected limb occurs as a result of prolonged ischemia.[16] After revascularisation these metabolites perfuse throughout the body leading to hyperkalemia, arrhythmia, pulmonary edema, metabolic acidosis, myoglobinuria and in severe cases, it can cause mortality from heart and renal failure. Thus, prognosis after the revascularization is determined by ischemia–reperfusion injury.[17] General anesthesia is the anesthesia of choice in limb ischemia as it decelerates the cellular utilization of glucose, oxygen and also oxidativeneutrophil metabolism is restrained which is associated with ischemia reperfusion injury, more importantly normothermia, volume control is better maintained in general anesthesia.[18] Central venous catheterization should be considered for CVP monitoring to guide fluid therapy and for the infusion of inotropic drugs as was done in this case. Adequate urine volume was maintained with forced diuresis to prevent renal injury. Also, serial arterial blood gas monitoring was done to detect metabolic acidosis. Many factors affect the clinical outcome such as extent of soft tissue damages, pre-existing arterial disease, capacity of collaterals and ischemia time.[19] Ischemia time is most important as it is foretell of cell death but the tolerance period varies among patients which depend upon severity of the ischemia and the presence of collateral flow.[20] In this case report patient had delayed revascularisation almost 40 hrs after injury. He had minimal soft tissue damage also necrotic tissue was debrided and dead skeletal tissue was removed surgically before revascularisation that might have prevented ischemic reperfusion injury, also adequate urine output was maintained with hemodynamic stability. Return of peripheral saturation in post operative period indicates successful outcome.

CONCLUSION

Early diagnosis and revascularisation of arterial injury is required to prevent morbidity and mortality. In case of blunt trauma to knee vascular injury should be kept in differential diagnosis even if bony radiological examination is normal. Delayed revascularisation surgery in presence of collaterals can have positive outcomes even if associated with compartment syndrome. Thus, multidisciplinary approach in vascular injury helps in reducing morbidity and mortality.

REFERENCES

1. Sciarretta JD, Perez-Alonso AJ, Ebler DJ, Mazzini FN, Petrone P, Asensio-Gonzalez JA. Popliteal vessel injuries: complex anatomy, difficult problems and surgical challenges. Eur J Trauma Emerg Surg.2012;38(4):373–391.
2. Chapman JA. Popliteal artery damage in closed injuries of the knee. J Bone Joint Surg Br. 1985; 67:420-423.

3. Abou-Sayed H, Berger DL. Blunt lower-extremity trauma and popliteal artery injuries. *Arch Surg*. 2002; 137:585–589.
4. Kim JW, Sung CM, Cho SH, Hwang SC. Vascular injury associated with blunt trauma without dislocation of the knee. Yonsei Med J. 2010; 51:790-792.
5. Subasi M, Cakir O, Kesemenli C, Arslan H, Necmioglu S, Eren N. Popliteal artery injuries associated with fractures and dislocations about the knee. Acta Orthop Belg. 2001; 67:259-266.
6. Wagner WH, Calkins ER, Weaver FA, Goodwin JA, Myles RA, Yellin AE. Blunt popliteal artery trauma: one hundred consecutive injuries. J Vasc Surg. 1988 May;7(5):736-43.
7. Macedo FIB, Sciarretta JD, Salsamendi J, Karmacharya J, Romano A, Namias N. Repair of an acute blunt popliteal artery trauma via endovascular approach. Ann Vasc Surg 2015;29(2): 366.e5-366.e10.
8. Hollis JD, Daley BJ. 10-year review of knee dislocations: is arteriography always necessary? J Trauma 2005; 59:672-5.
9. Welling RE, Kakkasseril J, Cranley JJ. Complete dislocations ofthe knee with popliteal vascular injury. J Trauma 1981; 21:450-3.
10. Kirby L, Abbas J, Brophy C. Recanalization of an occluded popliteal artery following posterior knee dislocation. Ann Vasc Surg 1999; 13:622-4.
11. Harrell DJ, Spain DA, Bergamini TM, Miller FB, Richardson JD. Blunt popliteal artery trauma: a challenging injury. Am Surg. 1997; 63:228-233.
12. Songur M, Zehir S, Oz II, Kalem M. Gluteal compartment syndrome secondary to superior gluteal artery injury following pelvis fracture: A case report and review of literature. Turkish J Emerg Med. 2016; 16:31–3.
13. Farber A, Tan T-W, Hamburg NM, Kalish JA, Joglar F, Onigman T, *et al*. Early fasciotomy in patients with extremity vascular injury is associated with decreased risk of adverse limb outcomes: a review of the National Trauma Data Bank. Injury 2013;43(9):1486–91.
14. Eltzschig HK, Eckle T. Ischemia and reperfusion–from mechanismto translation. Nat. Med. 2011; 17: 1391–401.
15. Collard CD, Gelman S. Pathophysiology, clinical manifestations and prevention of ischemia-reperfusion injury. Anesthesiology 2001; 94:1133–8.
16. McCord JM. Oxygen-derived free radicals in postischemictissue injury. N Engl J Med 1985; 312: 159-63.
17. Haimovici H. Muscular, renal and metabolic complicationsof acute arterial occlusions: myonephropathic-metabolicsyndrome. Surgery 1979; 85: 461-8.
18. Cuzzocrea S, Reiter RJ. Pharmacological action of melatoninin shock, inflammation and ischemia/ reperfusion injury. Eur.J. Pharmacol. 2001; 426: 1 -10.
19. Shi L. The delayed management of main arterialinjuries in extremity trauma: surgicalchallenges and outcomes. Pak J Med Sci.2013;29(1):64–7.
20. Huynh TTT, Pham M, Griffin LW, Villa MA,Przybyla JA, Torres RH, *et al*. Moore FA.Management of distal femoral and poplitealarterial injuries: an update. Am J Surg2006; 192:773–8.