

# Femoro-Distal Bypass in a 5-year old with Blunt Popliteal Artery Trauma: Considerations in a Limited Resource Setting

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## Abstract

Blunt popliteal vascular injury in the paediatric population is exceedingly rare and in advanced trauma centres the management can be challenging. A case of blunt popliteal artery trauma in a 5 years old requiring distal bypass using reversed saphenous vein is herein described. It is noteworthy to mention the difficulties experienced in a limited resource setting, including limitations in small rural hospitals, inefficient timely transfer to specialised centres, inadequate numbers of highly trained surgeons in subspecialties such as microvascular surgery and finally ineffective support and rehabilitative services.

**Keywords:** Blunt injury, paediatric trauma, popliteal artery

## INTRODUCTION

Blunt popliteal vascular injury in the paediatric population is rare and even in advanced trauma centers the management can be challenging. The world literature gives solutions and management is widely accepted as regards revascularisation via popliteal artery bypass using reversed vein. The challenges are related to the age of the patients, vessel calibre, tendency for re-stenosis and spasm and difficulty in exploration. We herein highlight the difficulties in a limited resource setting in the Caribbean region.

## CASE REPORT

A 5-year-old male presented with a crush injury to the left lower limb involving a brick wall falling on the popliteal fossa. The patient was taken to a rural hospital and referred to orthopaedics. Swelling around the popliteal fossa was significant with the circumferential diameter at the tibial tuberosity measuring 28 cm on the affected limb and 21 cm on the normal limb. Knee flexion was limited with significant pain on dorsiflexion. Radiographs confirmed no fractures, however, the distal pulses were absent clinically and on hand-held Doppler. Acute compartment syndrome was diagnosed and a

transfer to a tertiary center arranged after urgent fasciotomies done.

Transfer was delayed due to ambulance availability issues. On arrival at the paediatric hospital, the vital signs were stable with the blood pressure 112/35 and a pulse of 145 per minute. The child was relatively comfortable, with a swollen, bruised left popliteal fossa and fasciotomies noted [Figure 1]. There was limited movement, reduced sensation and the limb cool to touch. Clinically, the femoral pulse was present, however, the popliteal and distal pulses were impalpable and pulse oximetry unreadable. Computed tomography (CT) angiography revealed an abrupt cut off of the distal superficial femoral artery at the adductor hiatus extending into the popliteal artery. There was a reconstitution of flow at the level of the tibioperoneal trunk with three-vessel runoff. The geniculate vessels were noted to be feeding the distal vessels around the knee joint [Figure 2]. There was no vascular service available at the time and a Vascular Surgeon at the Capital City Hospital in Port of

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**Figure 1:** Medial and lateral fasciotomy incisions done at rural hospital before transfer



**Figure 2:** Computed tomography angiography showing an abrupt cut-off of the flow of the distal superficial femoral and popliteal arteries to the tibioperoneal trunk with collateral filling by the geniculate vessels



**Figure 3:** A significant haematoma involving the popliteal fossa, extending to the medial thigh compartment and leg

Spain was contacted and had to come across to perform revascularisation on the limb.

Surgical exploration was undertaken approximately 20 h after trauma due to all the delays. Operative findings included a significant haematoma involving the popliteal fossa, extending to the medial thigh compartment and leg [Figure 3]. A challenging exploration revealed an injured popliteal vein, which was partially over-sewn with 6.0 polypropylene sutures. The popliteal artery was in spasm and difficult to locate due to its small calibre with surrounding haematoma. The musculature of the calf was still viable. A left femoroposterior tibial artery bypass was performed with reversed great saphenous vein graft from the superficial femoral artery just above the adductor hiatus and to the posterior tibial artery just distal to the tibioperoneal trunk [Figure 4]. Recovery was successful but prolonged to facilitate fasciotomy closure with limited rehabilitative services. Full function and limb salvage were achieved to date [Figures 5 and 6].

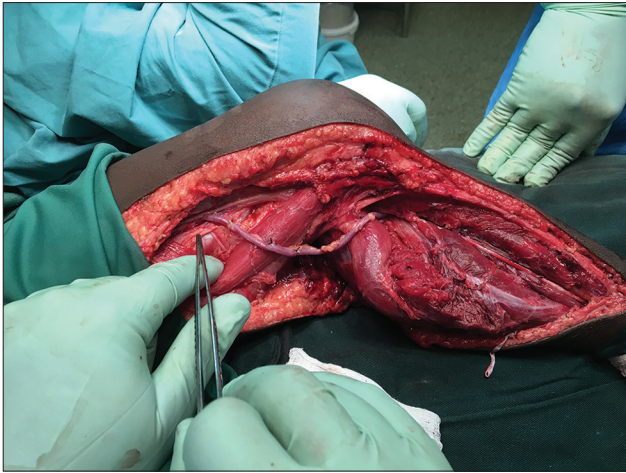
## DISCUSSION

The management of vascular trauma in children is challenging, rare and exploration complex. A PubMed review of blunt popliteal artery trauma in the paediatric population was done. One of the first articles on the topic was published in the *Journal of Trauma*, 1979 wherein a 20-year retrospective analysis of 53 cases was conducted with an average age of 10 years. The most frequent sites of trauma were the brachial or superficial femoral artery and the inferior vena cava. Any patient with an injury in proximity to a major vessel, haematoma formation, audible bruit or palpable thrill underwent prompt arteriography or immediate operative exploration of the injury site. No patient required amputation and most of the repairs were done by primary closure or segmental resection and end-to-end anastomosis. Of note, interposition vein grafts and substitute conduits were used in four patients with more extensive injuries and the mortality rate was 13%. They recommended a triad for successful management by a high index of suspicion, performance of aggressive diagnostic studies and prompt surgical intervention.<sup>[1]</sup>

In 1990, an article describing seven popliteal artery injuries (four blunt and three penetrating) was published. All patients underwent arteriography (four pre-operative and three intra-operative). Treatment included two primary repairs, four vein graft bypasses and one fasciotomy. The anastomoses were spatulated and sutured in an interrupted fashion and there were no deaths, amputations or reoperations.<sup>[2]</sup>

In 2000, an article describing a single case of popliteal artery pseudoaneurysm following arthroscopic meniscectomy in a child was described. The workup included colour Doppler and CT angiography and the injury repaired surgically by a posterior approach using a vein patch plasty.<sup>[3]</sup>

In 2012, it was noted that vascular trauma is uncommon in children but may be complex and presents a challenge to the surgeon with long-term implications. Children also have



**Figure 4:** Femoroposterior tibial artery bypass with reversed great saphenous vein graft from the superficial femoral artery just above the adductor hiatus to the posterior tibial artery just distal to the tibioperoneal trunk



**Figure 5:** Fasciotomy wounds healing by second intention after temporary vacuum-assisted dressing



**Figure 6:** Closure of fasciotomy wounds and return of full function

the major advantage of a rich collateral circulation as was demonstrated in this case. They concluded that growth and developmental considerations must be borne in mind when making surgical decisions.<sup>[4]</sup>

Later on, three cases of popliteal artery injury in paediatric patients with blunt trauma, penetrating injury and a Salter-Harris I fracture were described and highlighted the complexity of repair in paediatrics due to the fragility of the tissues, small calibre of vessels and low incidence.<sup>[5]</sup> Other articles support these theories and state that vascular trauma in paediatric patients involves several technical challenges, such as vasospasm, small vessel diameter and high amputation rates.<sup>[6,7]</sup>

Two recent studies published in 2020<sup>[8,9]</sup> reinforce the previous literature and highlight that common femoral artery injuries are associated with increased risk of mortality and popliteal artery injuries are associated with a higher amputation risk.

Finally, a recent article describes stenting in femoropopliteal blunt trauma. The authors state that the major factors affecting outcome are related to the small vessel size or vessel spasm, a higher risk of infection, a tendency for restenosis and rapid body growth. It was noted that endovascular procedures are minimally invasive; however, the stent's fate is the Achilles's heel of the technique and carries a high failure rate.<sup>[10]</sup>

### Declaration of patient consent

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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### Conflicts of interest

There are no conflicts of interest.

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