

Case Report

Limb revascularization after segmental femur fracture in children

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Abstract

A 10-year-old girl after a road traffic accident presented with an open displaced segmental fracture of left femur (mid-shaft and supracondylar fractures) with acute lower limb ischaemia. The leg was clinically viable. Intra-operative femoral arteriogram which performed after immediate skeletal stabilization with Küntscher nailing and Kirschner wire fixation, showed occlusion of superficial femoral artery at mid-shaft level with good run-off. A 3cm contused and thrombosed segment of the superficial femoral artery was excised and repaired with reversed saphenous vein interposition graft. Good distal circulation was established. Prophylactic left leg fasciotomy showed viable all three muscle compartments. She was discharged after two weeks with healed wounds and full weight bearing started after eight weeks at follow up.

Among uncommon paediatric limb injuries, femur fracture is the most common major traumatic injury in children. Flexible intra-medullary nailing or fixation with Küntscher nails with supplementary Kirschner wires are the treatment options in case of a segmental fracture of femur in children. Peripheral vascular injuries in children are rare. Vascular injuries associated with femur fractures can give rise to devastating complications, if unrecognized, therefore require prompt early intervention. Only one case of vascular repair in children with venous interposition graft is reported in literature. Limb revascularization following segmental femur fracture in children has never been reported and requires urgent attention of radiological, orthopaedic and vascular surgical teams.

Key words: Acute limb ischaemia, Intra-operative arteriogram, Limb revascularization, Segmental femur fracture, Vascular trauma in children, Venous grafts

Introduction

Vascular injuries following limb trauma in paediatric population is uncommon. Only one case has been reported where vascular repair was done under the age of 15 years¹. Revascularization in a

10 year old child after segmental femur fracture has never been reported. It is a diagnostic as well as therapeutic challenge, in both a vascular surgical and orthopaedic surgical point of view.

Case report

A 10-year-old girl was transferred to The National Hospital of Sri Lanka from a Base Hospital placed 60 kilometers away, four hours after a road traffic accident. She had a Gustilo-Anderson type II open displaced segmental fracture of left femur (mid-shaft and supracondylar) (Figure 1) and Gustilo-Anderson type IIIA open undisplaced fracture of the left second metatarsal. Left lower limb was cold and distal pulses were absent. Toe movement and limb skin sensation were preserved. She was haemo-dynamically stable.

Immediate skeletal stabilization was done after adequate wound debridement with Küntscher nailing of mid-shaft fracture and Kirschner wire fixation of supracondylar fracture of the femur (Figure 2). Distal pulses did not appear after fixation. Intra-operative left femoral arteriogram was done, revealing occlusion of the superficial femoral artery at mid-shaft level with good run-off (Figure 2).

Left superficial femoral artery was explored. A three centimeter contused and thrombosed segment of the superficial femoral artery was identified. The segment was excised and the artery was repaired with reversed saphenous vein interposition graft. Good distal blood flow was established after eight hours of the injury. Prophylactic left leg lateral four compartmental fasciotomy was performed and all three muscle compartments were viable. The fasciotomy wound was approximated by a continuous nylon thread applied to the skin edges, in three stages by post-operative day eight (Figure 3). All sutures were removed after two weeks and her orthopaedic management was continued as an out-patient. Left lower limb was immobilized with an above knee POP back cast for six weeks. Follow up x-ray at eight weeks showed adequate fracture healing and full weight bearing was commenced.

Discussion

Paediatric limb injuries are relatively uncommon. Femur fractures are the most common major traumatic injuries treated by pediatric orthopaedic surgeons¹. Femur fractures are typically associated

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with blunt trauma in road traffic accidents, falls and sports injuries². The age, the anatomy of the epiphyseal plates and the length of hospital stay play an important role in treating femur fractures in children³. Current modalities used to treat femur fractures include various forms of traction, immediate and late spica casting, elastic intramedullary nailing, external fixation, plate fixation, and conventional rigid intra-medullary nailing for older children and adolescents². Children in school-age are preferably treated with elastic intra-medullary nails (Figure 4) or sub-muscular plating^{3,4,5,6}.

External fixation is minimally invasive, but carries a risk of mal-union and re-fracture⁷. Intra-medullary nailing or fixation with Küntscher nails with supplementary Kirschner wires are the treatment options in case of a segmental fracture of femur⁸. Peripheral vascular injuries in children are rare and account for only 2% of all paediatric injuries⁹. The overall risk for arterial injury with a fracture or dislocation is 0.3% to 6.4%. Distal femur and proximal tibia fractures are at increased risk up to 20%^{10, 11}. Vascular injuries associated with femur fractures can give rise to devastating complications

like gangrene, sepsis and limb loss if unrecognized, therefore require prompt early intervention¹.

Vascular injury can be complete or partial transection, contusion with intimal damage and thrombosis, false aneurysm formation and arterio-venous fistula formation¹². Majority of vascular injuries in children following femur fractures were limited to vasospasm and false aneurysm formation, which were managed conservatively^{13, 14}. Only one case of thrombectomy and one case of vascular repair in children with venous interposition graft is reported in literature¹⁵. Limb revascularization following segmental femur fracture requires urgent attention of radiological, orthopaedic and vascular surgical teams.

Management includes; exclusion of life-threatening injuries, detection of vascular injury with hard signs and soft signs of vascular injury, assessment of limb viability, stabilization of fractures, re-assessment of vascular injury, intra-operative arteriogram, identifying the site of vascular injury, surgical exploration, and vascular repair as appropriate (Algorithm).



Figure 1



Figure 2

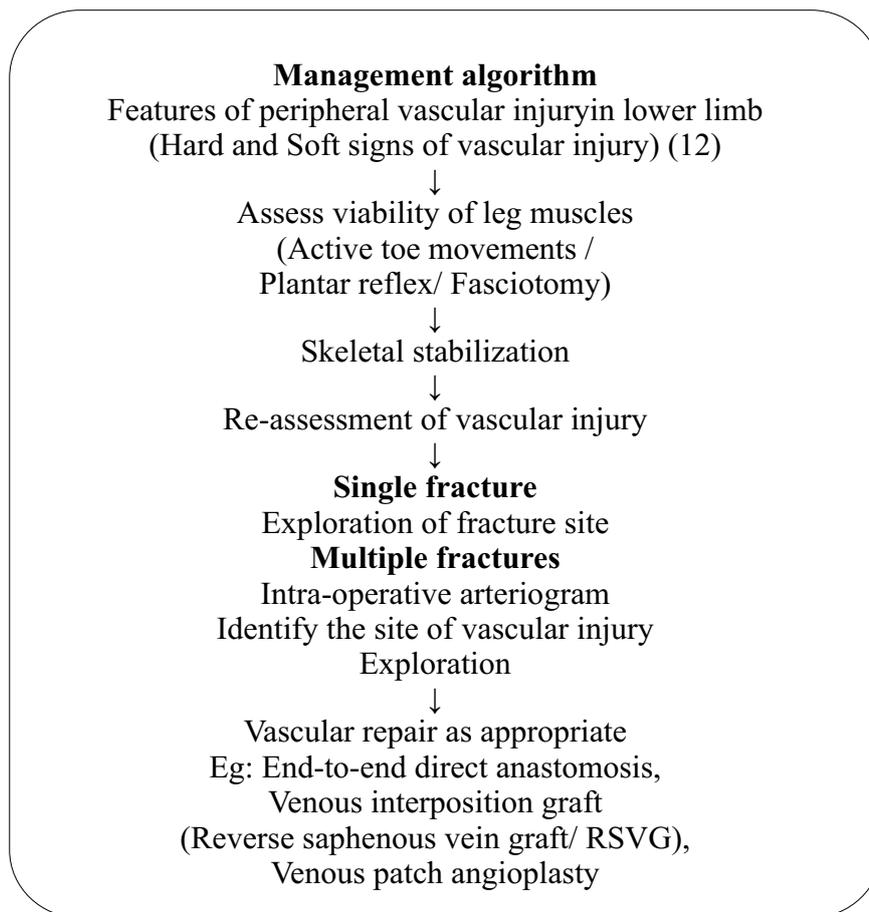


Figure 3



Figure 4

Figure 1: Lateral radiograph of left femur shows mid-shaft and supracondylar femur fractures, **Figure 2.** Intra operative arteriogram shows no flow in superficial femoral artery adjacent to the mid-shaft fracture site (Arrow), **Figure 4.** Antero-posterior and lateral radiographs of left femur showing fixation of a mid-shaft fracture with two titanium elastic nails, **Figure 3.** Fasciotomy wound was approximated by a continuous nylon thread applied to the skin edges



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