

EPIPHYSIS INJURY AROUND KNEE (FLEXION TYPE, SALTER-HARRIS TYPE 1)

Dr Smit Prajapati

3rd yr Orthopaedic Resident BJ Medical College Ahmedabad.

Dr Rahul Meena

Senior Resident In Orthopaedic At BJ Medical College Ahmedabad.

ABSTRACT

Introduction: Fractures of the proximal tibial and distal femur epiphysis rare. It has been estimated that fractures of the upper tibial and distal femur epiphysis account for 0.5-3.1% of all epiphyseal injuries.

Who had no neurovascular deficit, with fixed extension deformity at the left knee was treated early with closed reduction techniques. **Case Series:** We present a case of a adolescent child who develops injury while playing. The patient presented in emergency room with extremely swollen knee and soft tissue swelling (hemarthrosis), he was unable to lift his leg actively due to severe pain because of hamstrings spasm, and he had no wound over his left knee and had no other associated injuries. Plain radiographs were taken which revealed, separated proximal tibial and distal femur epiphysis (salter harris Type 1 injury) The epiphysis was anteriorly displaced fracture line extending beyond growth plate through metaphysis and tibial tuberosity also displaced anteriorly, no patellar fracture, radiograph also revealed no intra-articular fracture as joint appears congruent. Under spinal anesthesia, under all aseptic precautions traction was applied for few minutes, the fracture was reduced closed as the hamstring spasm gave way, reduction was confirmed under image intensifier in both AP and lateral planes, and joint congruity was examined. Post-operative patient was immobilized with nil weight bearing for 4 weeks, check X-rays taken, he was mobilized in wheelchair. After 4 weeks slab was removed, K-wires were removed, and partial weight bearing was started with rehabilitation for full range of motion of the left knee. At 6 weeks, both the knee joints appeared symmetrical with no abnormalities or limb length discrepancy or instability with knee from 0° to 140°, with full weight bearing. **Conclusion:** Although less commonly seen, Salter-Harris Type 1 injuries to proximal tibial and distal femur epiphysis, if managed early with closed reduction and fixation, excellent long-term results can be achieved.

KEYWORDS : Proximal tibial and distal femur epiphysis, salter harris type 1, adolescent injury.

INTRODUCTION

Injuries of the proximal tibial and distal femur epiphysis are rare. It has been estimated that fractures of the upper tibial and distal femur epiphysis account for 0.5-3.1% of all epiphyseal injuries [1, 2]. Popliteal artery, which runs posterior to epiphysis, may be disrupted during the injury but with closed reduction ischemia is reversible in the most cases (Fig. 1).

The Juvenile knee is frequently injured but this injury is relatively rare, rarity of this mode of injury is also known due to many anatomical peculiarities, insertion of semitendinosus directly over metaphysis, insertion of patellar tendon as separate center of ossification protecting epiphysis from avulsion strains, fibular and medial collateral ligaments inserting over the metaphysis, Most importantly varus-valgus forces around the knee directly transmits from femur to tibial metaphysis through collateral ligaments due to which distal femoral epiphysis injury being quite common as compared to proximal tibia.

Case Report 1

We present a case of a 16-year-old boy who while playing cricket on a road was hit by a car from behind; He was standing in knee flexed position approximately 10°, at the time of injury, his leg was fixed to the ground and his knee was pushed anteriorly and leg was fixed at the ground resulting in hyperextension injury at the left knee. He tried to bear weight following trauma but he collapsed.

The patient presented in emergency room with extremely swollen knee and soft tissue swelling (hemarthrosis), he was unable to lift his leg actively due to severe pain because of hamstrings spasm, and he had no wound over his left knee and had no other associated injuries.

On clinical examination, left knee was in hyperextension attitude, patient had edematous swelling and intra-articular effusion over the left knee with generalized tenderness over the knee, palpation revealed no fracture of the patella or disruption of quadriceps or patellar tendon, any movement at

the knee level provoked severe pain so were restricted, patient had palpable distal pulses, and had no sensory or motor loss distal to left knee.

Assessment of collateral ligaments, menisci could not be done as the patient was in extreme pain, but it did not reveal any significant abnormalities. Compartment pressures were evaluated clinically which did not reveal any significant increase.

- Plain radiographs were taken which revealed, separated proximal tibial epiphysis (salter harris Type 1 injury) The epiphysis was anteriorly displaced fracture line extending beyond growth plate through metaphysis and tibial tuberosity also displaced anteriorly. The proximal fibular epiphysis fragment was displaced anteriorly with no injury to femoral epiphysis and no patellar fracture, Radiograph also revealed no intra-articular fracture as joint appears congruent (Fig. 2 and 3).
- Patient's left lower limb was immobilized and he was immediately shifted to the operation theatre (4 h interval following trauma).
- Under spinal anesthesia, under all aseptic precautions traction was applied for few minutes, the fracture was reduced closed as the hamstring spasm gave way, reduction was confirmed under image intensifier in both anteroposterior and lateral planes, and joint congruity was examined.
- Proximal fibular epiphysis also snapped back in place.

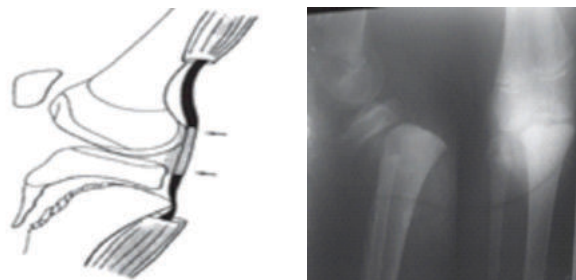


Fig: 1 Schematic diagram Fig-2 Radiograph at presentation



Fig-3 Clinical picture

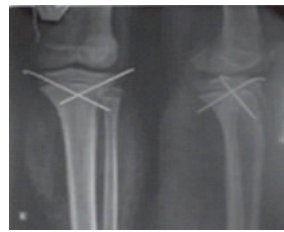


Fig-4 Radiograph after OT



Fig-9 Radiograph at 1month follow-up



Fig-10 Clinical Picture at 1 month follow-up

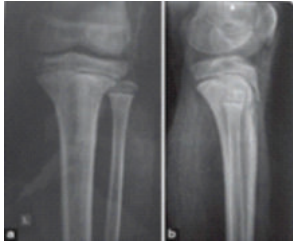


Fig-5 Radiograph 4 weeks follow up K -wire Removed



Fig-6 Clinical picture at 1 year follow-up

Case Report 2

We present a case of a 10-year-old boy who had h/o fall down from height as he was fell down with knee in full extension so that knee joint goes into hyper extension resulting in hyperextension injury at the left knee. He tried to bear weight following trauma but he collapsed.

The patient presented in emergency room with extremely swollen knee and soft tissue swelling

On clinical examination, left knee was in hyperextension attitude, patient had edematous swelling and intra-articular effusion over the left knee with generalized tenderness over the knee, palpation revealed no fracture of the patella or disruption of quadriceps or patellar tendon, any movement at the knee level provoked severe pain so were restricted, patient had palpable distal pulses, and had no sensory or motor loss distal to left knee. Compartment pressures were evaluated clinically which did not reveal any significant increase.

- Plain radiographs were taken which revealed, separated proximal tibial epiphysis (salter harris Type 1 injury) The epiphysis was anteriorly displaced fracture line extending beyond growth plate through metaphysis and tibial tuberosity also displaced anteriorly. no injury to femoral epiphysis and no patellar fracture, Radiograph also revealed no intra-articular fracture as joint appears congruent (Fig. 2 and 3).
- Patient's left lower limb was immobilized and he was immediately shifted to the operation theatre (6 h interval following trauma).
- Under spinal anesthesia, under all aseptic precautions traction was applied for few minutes, the fracture was reduced closed as the hamstring spasm gave way, reduction was confirmed under image intensifier in both anteroposterior and lateral planes, and joint congruity was examined.



Fig-7 Radiograph at presentation



Fig-8 Radiograph after post OT

Case Report 3

A case of a 6-year-old girl who while playing some other child hit her from anteriorly on the knee ; at the time of injury, her leg was fixed to the ground and his knee was pushed anteriorly and leg was fixed at the ground resulting in hyperextension injury at the left knee.She tried to bear weight following trauma but he collapsed.

The patient presented in emergency room with extremely swollen knee and soft tissue swelling (hemarthrosis) she had no wound over his left knee and had no other associated injuries.

On clinical examination, left knee was in hyperextension attitude, patient had edematous swelling and intra-articular effusion over the left knee with generalized tenderness over the knee, palpation revealed no fracture of the patella or disruption of quadriceps or patellar tendon, any movement at the knee level provoked severe pain so were restricted, patient had palpable distal pulses, and had no sensory or motor loss distal to left knee. Compartment pressures were evaluated clinically which did not reveal any significant increase.

- Plain radiographs were taken which revealed, separated distal femur epiphysis (salter harris Type 1 injury) The epiphysis was anteriorly displaced fracture line extending beyond growth plate through metaphysis no injury to tibial epiphysis and no patellar fracture, Radiograph also revealed no intra-articular fracture as joint appears congruent (Fig. 11)
- Patient's left lower limb was immobilized and he was immediately shifted to the operation theatre (8 h interval following trauma).
- Under spinal anesthesia, under all aseptic precautions traction was applied for few minutes, the fracture was reduced closed as the hamstring spasm gave way, reduction was confirmed under image intensifier in both anteroposterior and lateral planes, and joint congruity was examined.



Fig-11 Radiograph at presentation

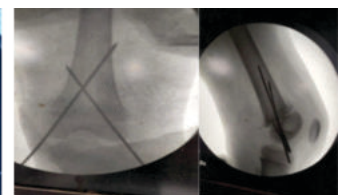


Fig-12 Radiograph after post OT

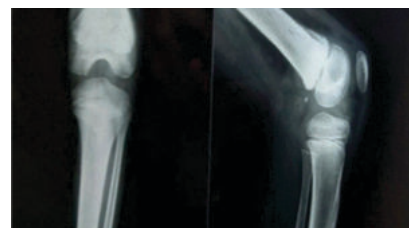


Fig-13 Radiograph at 1 month follow-up and k wire removed

DISCUSSION

In the all cases, the mechanism of injury was twisting force with the foot fixed to the ground. The knee capsule and cruciate ligaments withstood the force but the physal plate failed. This resemble to the adult dislocated knee where the ligaments fail before the bone. Clinical features include the inability to lift the leg because of pain and because of hamstring spasm. Hyperextension of the knee should be avoided because of the possibility of popliteal artery injury [3]. Rotational force has resulted in a fracture through the growth plate, as opposed to ligamentous injury. This may be because with the patient's body weight acting through the extended knee, the proximal tibial and distal femur epiphysis becomes the focus through which the rotational force acts.

Clinically, there was an internal rotation deformity and this is in contrast to the expected appearance of the knee when the mechanism of injury has been the more commonly described shearing, avulsing splitting, or crushing. The treatment consisted of accurate closed reduction and stabilisation with heavy K-wires and slab. Had the fracture extended into the joint surface (Salter-Harris Types III or IV), open reduction to gain articular congruity would have been carried out [3].

Analysis of five series of these types of injuries, published by Burkhart and Peterson [2], Poulsen *et al.* [4], Rhemrev *et al.* [5], Wozasek *et al.* [2], and Gautier *et al.* [6] gives a total of 84 patients of whom 63 were males and 21 were females.

There were 15 Salter-Harris Type I injuries, 19 Type II injuries, 24 Type III injuries, 22 V injuries (one case was bilateral Type IV fractures [2], four Type V injuries and one fracture described as "recurvatum and valgus" [7].

Mode of epiphysis separation include, direct violence (Burkhart and Peterson, 1979) intra-articular shearing stresses (Aitken and Ingersoll, 1956; Burkhart and Peterson, 1979; Salter and Harris, 1963) [8] avulsion strains transmitted by the patellar tendon (Burkhart and Peterson, 1979; Hutchinson, 1894) or by an abnormally large insertion of the medial collateral ligament into the epiphysis (Aitken and Ingersoll, 1956) [8]. The cruciate ligaments seem to play no part in the causation of these injuries (Aitken and Ingersoll, 1956; Burkhart and Peterson, 1979) [8]. Complications include ligamentous injuries [4], vascular complications [7] including compartment syndrome, knee instability, and growth disturbance [4, 6]. Growth disturbance, as defined by deformities of more than 25 mm in length, or more than 50 of angulation, has been reported to occur in more than 25% of cases of proximal tibial injuries in children, when a meta-analysis of published series was performed [6]. Gautier *et al.*, in a study of six children with proximal tibial injuries reports that the most consistent clinical deformity was recurvatum, with a resultant effect on the range of motion of the knee [6].

CONCLUSION

Although less commonly seen, Salter-Harris Type I injuries to proximal tibial and distal femur physis, if managed early with closed reduction and fixation, excellent long-term results can be achieved.

Clinical Message

Proximal tibial and distal femur epiphyseal injuries are rare to be seen but early diagnosis, and neurovascular status evaluation is of utmost importance. Immediate management in the form of reduction and re-evaluation of the neurovascular status is crucial and is beneficial for the patient.

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