



## PROXIMAL TIBIAL EPIPHYSIS FRACTURE IN A 14-YEAR-OLD FEMALE : A CASE STUDY

### Orthopaedics

**Dr Sidhant Rana** Civil Hospital Kangra, Himachal Pradesh

**Dr Sapna Dhiman\*** Civil Hospital Shahpur, Himachal Pradesh. \*Corresponding Author

### ABSTRACT

Proximal epiphysis fractures of the tibia are rare, representing 0.5 to 3.0% of all epiphyseal injuries. These injuries can damage the popliteal vessels, affecting the blood supply of the lower limb, as well as the nerves below the knee. Epiphyseal growth arrest is also a potential complication, leading to various angular deformities. We present a case of a 14-year-old female with a posteriorly displaced Salter-Harris type II fracture of the proximal epiphysis of the left tibia who was treated conservatively with closed reduction and cast immobilization.

### KEYWORDS

Proximal epiphysis fractures, Tibia, Closed reduction.

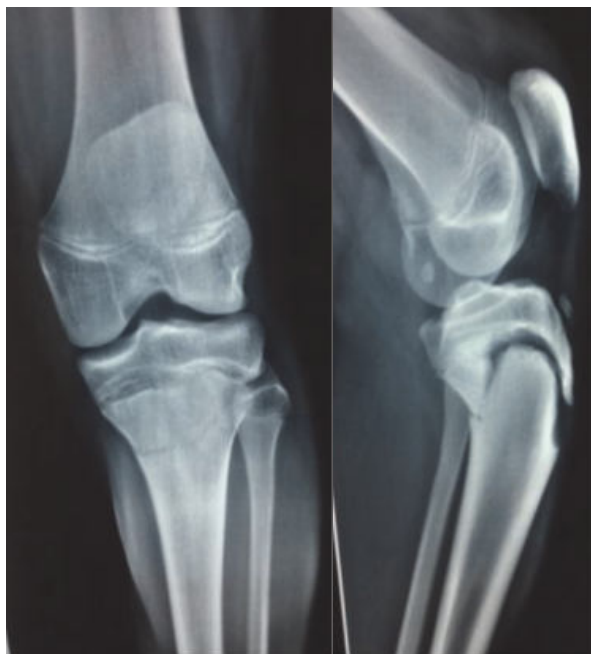
### INTRODUCTION

Tibial tuberosity avulsion fractures are rare. This rarity is due to the anatomy of the collateral ligaments which are inserted distally into the metaphysis protecting the epiphysis. This type of injury can threaten the limb circulation, secondary to vascular compromise or compartment syndrome, and it should be treated as an urgent situation. The goal of treatment is anatomical reduction and stabilisation in order to prevent significant soft tissue injury, malunion, and growth arrest<sup>1</sup>.

### Case Presentation

A 14-year-old female presented to the emergency with an injured left tibia. The patient reported a fall from stairs, which caused the injury. The left knee was held in 100 degrees of flexion with complete inability to extend the knee or bear weight. On examination, there was swelling over the proximal tibia and on palpation there was tenderness on the proximal end of the tibia. No neurovascular impairment was identified. The patient was able to actively move her ankle, as well as her toes, and both posterior tibialis artery and dorsalis pedis artery were palpable.

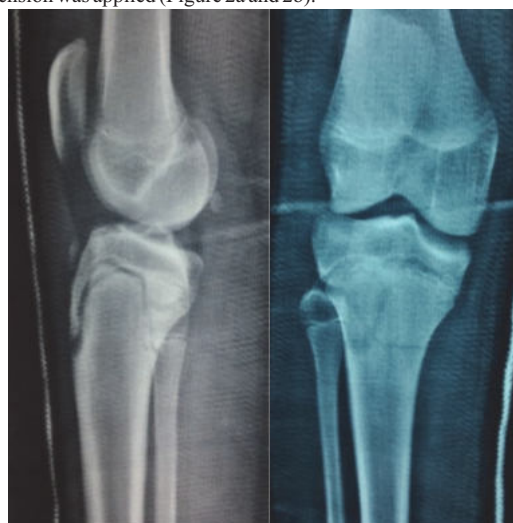
From the radiographs, a displaced flexion type Salter-Harris type II fracture of the proximal tibia epiphysis was identified (Figure 1a and 1b).



**Figure 1a and 1b: Anteroposterior and lateral views of the fracture.**

A closed reduction of the fracture was performed by extending the knee and putting strong pressure over the tibial tubercle. Stability of the fracture was verified, as there was no displacement at 90 degrees of knee flexion. After reduction, the dorsalis pedis artery and the posterior tibial artery were palpable. Since there was no displacement with that degree of flexion, percutaneous pinning of the fracture was not

performed and only a circumferential cast with the knee in full extension was applied (Figure 2a and 2b).



**Figure 2a and 2b: Post reduction x-rays.**

Patient was hospitalized for observation of limb neurovascular status. Fracture remained in a satisfactory position 2 weeks after reduction and a full femur-tibia-ankle cast in 10 degrees of knee flexion was applied. 3 weeks after injury, radiographs of the fracture were still satisfactory. 6 weeks after injury, fracture position was satisfactory with radiographic evidence of healing (Figure 3a and 3b) and the cast was removed, encouraging active range of motion of the knee<sup>2</sup>.



**Figure 3a and 3b: X-rays 6-week post reduction.**

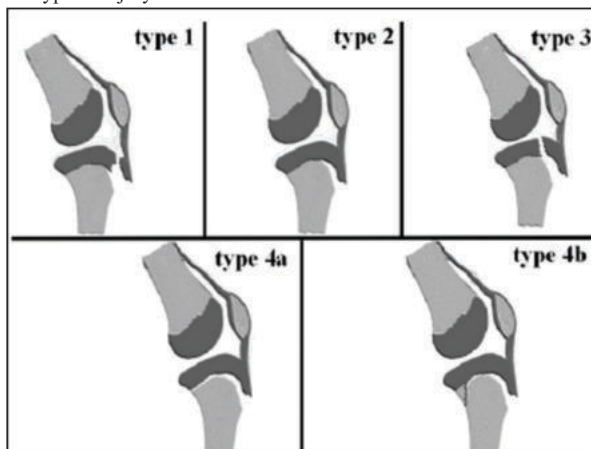
8 weeks after injury, the patient achieved full range of motion, and full weight bearing was allowed. MRI scan was planned but the patient refused for the same. Patient's follow-up was continued with serial radiographs at 6 months and 12 months in order to detect early signs of growth arrest or angular deformity and genu recurvatum and no abnormality was seen.

## DISCUSSION

Avulsion fractures of the tibial tubercle and their expansion to the tibial epiphysis are rare. These injuries can damage the vascular supply of the limb, making close monitoring of limb perfusion crucial<sup>3</sup>. An avulsion force, while the quadriceps femoris is contracted, usually separates the anterior portion of the proximal tibial epiphysis<sup>1,4</sup>.

Closure of the proximal tibial physis starts posteriorly and the anterior part fuses lastly. This characteristic explains why this type of fracture affects mainly adolescents and young people between 14 and 18 years of age whose anterior portion of the proximal tibial epiphysis is more vulnerable and is predisposed to type 1 or type 2 Salter-Harris injuries<sup>1</sup>.

Ogden et al. described three types of tibial tuberosity avulsion fractures: type I, where small fragment is displaced upwards, type II, where entire tongue formed by the tibial tuberosity is hinged upwards, and type III, where the line of fracture passes upwards and backwards across the proximal articular surface of the tibia<sup>5</sup>. Ryu and Debenham expanded the classification including a type IV injury<sup>6</sup>. It involves an avulsion fracture of the proximal tibial tubercle which spreads backwards along the epiphyseal plate (Figure 4). Our case belongs to the type IV injury.



It is well known that a hyperextension injury that results in posterior displacement of the tibia shaft may cause vascular compromise<sup>3,7</sup>.

However, an avulsion injury of the proximal tibial epiphysis, similar to the presented case, may have less potential to damage the limb's vascular supply, because the periosteum on the posterior surface of the tibia remains intact and protects the popliteal vessels<sup>8</sup>. Another cause of poor outcome of the fractures of the proximal tibial epiphysis is physis growth arrest, which can lead to limb length discrepancy or angular deformity, particularly genu recurvatum in flexion type tibial tuberosity avulsion fractures<sup>9</sup>. Gentle anatomical reduction and stabilisation of these fractures with the least physis violation are the main goal of the treatment.

Inoue et al. described 4 cases of flexion type tibial epiphysis fracture, which were treated with closed reduction and cast immobilization and no major complications occurred<sup>8</sup>. Vyas et al. presented 5 cases with the same type of fracture that were treated uneventfully by conservative means and they concluded that these injuries can be safely managed with closed reduction and cast immobilization in a position of knee extension<sup>10</sup>. Blanks et al. and Sułko et al. also presented good results after conservative treatment of flexion type proximal tibial epiphysis fractures and they proposed closed reduction and cast immobilization as an essential management for this type of injury<sup>11,12</sup>.

In our case, no displacement occurred at 90 degrees of knee flexion after closed reduction, and thus percutaneous pinning was not performed, as pins can potentially violate the physis. We think that although pins can secure the reduction, it is not absolutely necessary to

apply them, unless the fracture is unstable in flexion or neurovascular impairment occurs.

## CONCLUSION

This is a case of a young adolescent female with a flexion type displaced proximal epiphyseal fracture of the left tibia. The patient was treated with a closed reduction and cast immobilization in extension with no complications such as neurovascular impairment, compartment syndrome, or re-displacement. Fracture healing in a good position and full range of motion were achieved 8 weeks after injury.

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