

## Upper tibial physeal fracture—a case report. Proposed mechanism of injury and classification

Sergio Crimaldi, Filippo Calderazzi, Luigi Becherucci and Alessandro Faldini

1st Department of Orthopaedics, University of Pisa, Italy

Correspondence: Sergio Crimaldi, via delle Tagliate S. Marco, IT-180 55100 Lucca, Italy. crimaldisergio@hotmail.com

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A 17-year-old man (height 182 cm, weight 70 kg) fell backwards during a football match. His left knee was flexed while the quadriceps remained contracted. In the Emergency Department, he held his knee flexed about 110°, the upper tibia was swollen (Figure 1), and no neurovascular deficit was noted. Radiographs showed a displacement of the proximal tibial epiphysis (Figure 2).

During general anesthesia, reduction was obtained by gentle traction and gradual extension of the knee. The unstable fracture was then fixed, using 2 crossed Kirschner wires above the physis (Figure 3). A plaster cast was applied with the knee flexed 10° and he was instructed to avoid weight bearing for 4 weeks.

The wires were removed after 1 month and he was allowed progressive weight bearing in the cast, with full weight bearing after 2 months. At 18 months, there was no evidence of growth disturbance and knee function was normal.

### Discussion

Only 0.5%–3% of all fractures affect the proximal

tibial epiphysis. This injury occurs after severe trauma (Salter and Harris 1963, Mudgal et al. 2000), and is due to specific anatomical features: the proximal tibial epiphysis, apart from a deeper and smaller bundle (Netter 1989), does not receive the insertions of the medial and lateral collateral ligaments, which insert distally, at the metaepiphyseal level. Therefore, varus/valgus trauma to the knee is not usually transmitted to the epiphysis. Our case can be classified as a Salter-Harris type 2 physeal fracture, but it has some uncommon characteristics.

First, a posterior displacement of the epiphysis is rare: usually the metaphysis is displaced posteriorly (Ryu and Debenham 1985, Merloz et al. 1987, Blanks et al. 1994, Mudgal et al. 2000), while the epiphysis maintains its relation with the distal femoral component.

Secondly, the injury is probably caused by a sudden, avulsive force on the tibial tuberosity, produced while the quadriceps femoris is contracted. Then it spreads backwards along the epiphyseal plate, “stripping” the epiphysis from the metaphysis and finally spreading below, and fracturing the posterior tibial metaphysis (Figure 4).



Figure 1. Definite swelling of the upper outline of the tibia.



Figure 2. The radiograph shows detachment and posterior displacement of the proximal tibial epiphysis.



Figure 3. Radiographic examination after surgery.

In addition to avulsion and shear forces, compression probably also occurred, due to the impact of the femoral condyle on the pysis. Closure of the proximal tibial pysis starts posteriorly, making the anterior part more vulnerable (Ryu and Debenham 1985, Blanks et al. 1994), and predisposing this age group to type 1 or 2 Salter-Harris injuries.

This may explain why this injury often affects people between 15 and 21 years of age. Before this detachment of the tibial tuberosity is commoner (Ogden et al. 1980, Blanks et al. 1994) because of the secondary ossification center of the tibial tuberosity. Since a slipped epiphysis of the proximal tibia and detachment of the tibial tuberosity are caused by the same kind of injury, it has been suggested that the former should be regarded as a fourth type in the Watson-Jones and Ogden classification (Ryu and Debenham 1985, Legaye and Lokietek 1991) (Figure 4).

No complications have been reported after this type of physeal fracture.

No competing interests declared.

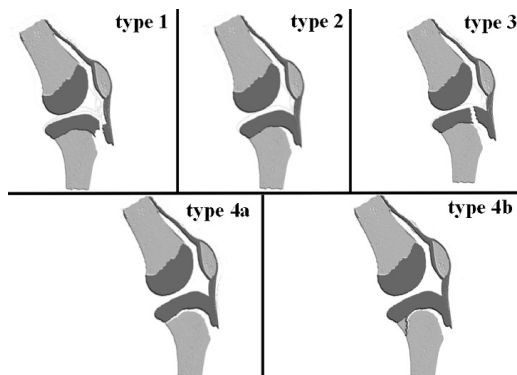


Figure 4. Since both a slipped epiphysis of the proximal tibia and detachment of the tibial tuberosity are caused by the same kind of injury, it has been suggested by Ryu that the former should be a fourth type in the Watson-Jones and Ogden classification.

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