Case Report

Comminuted tibial tuberosity avulsion fracture associated with avulsion of patellar tendon: A case report

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Tibial tuberosity avulsion fractures associated with comminution and avulsion of the patellar tendon is a rare injury. Tibial tuberosity avulsion fracture occurs in young adolescents during sports activities with failure of extensor mechanism of the knee joint. Very few cases have been reported in the literature of such cases associated with comminution and avulsion of patellar ligament from tuberosity fragment. We present a case of a 15 years old male patient with this type of injury treated by screw fixation and tendon repair. He regained pain free full range of knee movement within a period of two months. Associated knee injuries such as of cruciate ligaments, collateral ligaments, meniscal injuries and osteochondral injuries should be ruled out by arthroscopy or MRI.

Key words: Tibial tuberosity fracture, comminution, patellar tendon avulsion, internal fixation, tendon repair.

INTRODUCTION

Tibial tuberosity avulsion fractures are uncommon injuries that occur usually in adolescents involved in sports activities. Incidence of this fractures account for 3% of all tibial fractures (Hand et al., 1971) and less than 1% of all physeal fractures (Bolesta and Fitch, 1986; Uppal and Lyne, 2007). The injury affects mainly males at the age group of 14 - 17 years. The male predominance may be due to the fact that males are more involved in sports and the delayed fusion of physis in males when compared to females (Bauer et al., 2005). It can be associated with other knee injuries like cruciate ligaments, collateral ligaments, meniscus (Takeuchi et al., 2015), and extensor mechanism injuries (Chow et al., 1990). However, avulsion fractures of the tibial tuberosity associated with avulsion of patellar ligaments are rare injury. A few cases have been reported in the literature (Frankl et al., 1990; Sié et al., 2011). We report a case treated by cancellous screw fixation and tendon repair.

CASE REPORT

A 15 years old male patient who was healthy with no previous medical or knee problem presented to the casualty with severe swelling of the left knee and difficulty in moving the left lower limb following a fall during a buggy jumping. Clinical examination showed swelling of the left knee, palpable defect at tibial tuberosity and a mobile high riding patella. Patient could not do an active knee extension. He had no other associated injuries and the contralateral knee was clinically normal. Plain X-rays of the left knee showed avulsed and rotated tibial tuberosity fragment, soft tissue shadow of buckled patellar tendon and patella alta (Figure 1). Fracture was classified as Type II B according to modified Ogden classification. The patient was planned for an open reduction and internal fixation.

The tibial tuberosity was approached through a midline longitudinal incision. It was found completely detached from tuberosity fragment with splintering in the middle and rotated 180 degrees with the fracture surface facing
Figure 1. Pre-operative X-ray shows fracture tibial tuberosity displaced and rotated.

Figure 2. Operative photograph showing the patellar tendon held with forceps and the tuberosity fragment separated flipped horizontally from its bed (forceps at corner).

The buckled patellar tendon was retrieved distally through the rent in the soft tissue and found to have a small bone fragment attached to its under surface. The tuberosity fragment was reduced anatomically and fixed with two 4 mm cancellous screws (Figure 4). The tendon was laid over the tuberosity fragment and repaired on either sides to the soft tissue by krackow stitches with No 1 Ethibond (Figure 3). The distal
pole of the tendon was reinforced with osteoperiosteal stitches. The wound was closed with a drain and above knee back slab was applied for four weeks. Patient was allowed partial weight bearing after two weeks. Graduated knee flexion exercises started after four weeks. Patient regained full range of active movement in two months. Screws were removed after two years when the patient came for removal. During removal, a small fleck of calcification in the tendon substance was also removed.
Discussion

Avulsion fractures of the tibial tuberosity occurs more during adolescent growth spurt. No casual relationship has been found with Osgood-Schlatter disease, though; an association with this condition has been suggested (Bolest and Fitch, 1986; Chow et al., 1990). Tibial tuberosity fractures were originally classified into 3 types by Watson-Jones which is modified to include additional types and subtypes. Type I is a fracture at distal portion of the ossification center of the tibial tubercle, type II is a fracture extending to junction of proximal tibial epiphysis, type III is a fracture extending in to the knee joint through proximal tibial epiphysis. Ogden et al. modified this classification by subdividing each type to A and B if associated with comminution and displacement of the fragment (Goodier et al., 1994; Steven et al., 2008). Type IV is a fracture extending posteriorly through the physis and displacing entire epiphysis with the tubercle. Frankel et al. (1990) sub grouped displaced tuberosity fractures with avulsion of patellar ligament as type C fractures (Frankel et al., 1990). Type V fracture are Y configuration fracture introduced by Mckoy and Stanitski (2008). Yee et al. (2012) added pure avulsion of the patellar ligament injury in adolescents as Type VI into classification (Yee et al., 2012) (Figure 5). However, pure avulsion of a ligament injury added to a fracture classification is controversial. According to modified classification, our case fit into Type II C fracture avulsion of tibial tuberosity.

The mechanism of injury is due to violent contraction of the quadriceps with knee extended as occurs in jumping or a sudden passive flexion of the knee while the quadriceps is in active contraction as found in falls or landing after a jump. With excessive traction force of the patellar ligament on the physis, perichondrium and periosteum, fracture of the tubercle occurs. With continuation of the force, the patellar ligament may get avulsed from the tubercle (Uppal and Lyne, 2007) and comminution of the fragment may be due to secondary fall on the knee after first insult.

The management of this injury is to restore the extensor mechanism of the knee joint by open reduction and internal fixation of the tuberosity fragment and repair of the patellar tendon. Internal fixation of tibial tuberosity fragment with 4 mm cancellous screws with periosteal suture repair provides a stable fixation. Some authors have fixed with stainless steel wires and staples (Kun-Chi Wu and Dah-Ching Ding, 2013; Sié et al., 2011). Other associated knee lesions like cruciate ligaments, collateral ligaments, meniscus (Takeuchi et al., 2015) and extensor mechanism injuries should be ruled out by arthroscopy or MRI (Bauer et al., 2005; Kenneth and Louis, 2007). Post operatively patients should be protected in above knee splint for 3 - 4 weeks followed by graduated active range of motion and strengthening exercises.

Complications of tibial tubercle fractures are relatively uncommon. However, compartment syndrome of the leg has been reported in association with this injury (Steven et al., 2008). It is important to monitor the patient to rule
out this complication. Other complications include loss of knee flexion, nonunion, malunion and prominent screws (Steven et al., 2008).

**Conclusion**

Displaced Tibial tuberosity fractures could be associated with comminution and avulsion of the Patellar ligament. Preoperative MRI could be valuable to diagnose associated patellar ligament avulsion, injuries of menisci, cruciate and collateral ligaments and to plan our surgery accordingly (Kenneth and Louis, 2007). Displaced tibial tuberosity fractures should be anatomically reduced and fixed and the avulsed ligament reconstructed to restore the extensor mechanism and to mobilize the patient early.

**REFERENCES**


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