

Case Report

Avulsion Fractures of the Bilateral Tibial Tuberosity in an Adolescent: A Case Report and Literatures Review

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Abstract: Bilateral tibial tuberosity avulsion fractures are rare and occur mainly in adolescent males during vigorous quadriceps contraction especially during aggressive contact sports activities. So far, only ten simultaneous bilateral tibial tuberosity fractures have been reported. We report the case of a 14-year-old male who avulsed both tibial tuberosities when he landed on his knee after a fall while playing football. Diagnostic imaging demonstrated Ogden Type IIA fractures. He underwent bilateral open reduction and screw fixation the next day. Closed reduction and percutaneous fixation has been proposed by some literatures, however the intraoperative findings in this patient have prevented anatomical reduction of the fracture sites because of a flap of periosteum impinged in both fracture gaps. Therefore, purpose of this case report is to display its rarity and which had successfully treated differently from the previously reported cases.

Keywords: Tibial Tuberosity Avulsion Fracture, Open Reduction, Cannulated Cancellous Screw

1. Introduction

Tibial tuberosity avulsion fractures (TTAF) typically occur in adolescent males by avulsion of the bony insertion of the patellar tendon, caused by sudden violent contraction of the quadriceps muscles [1]. There seems to be an association with pre-existing Osgood-Schlatter disease [2]. Tibial tuberosity fracture account for 0.4%-2.7% of all physeal injuries [3]. Simultaneous bilateral TTAF is extremely rare, with only 10 such cases reported in the literature so far [7]. The prognosis is usually excellent if proper treatment is given. In 1980, Ogden proposed the classification of these fractures that is commonly used today [2]. Accordingly, type I is a fracture of the distal tibial tubercle without involvement of the growth plate. Type II fractures extend along the growth plate proximally, whereas type III fractures include the proximal tibial ossification centre extending into the knee joint. There are three subgroups of A or B, with a possible of intraarticular involvement as well as comminution of fragments [2]. We report the case of a 14-year-old male patient with bilateral

closed fracture of type IIA TTAF who required open reduction and fixation.

2. Case Report



Figure 1. Radiographs of bilateral knee at presentation in AP and lateral view.

A 14-year-old boy presented to our emergency department with bilateral severe knee pain with swelling after fall during a football match in school. He weighed 90 kg with an athletic

body habitus. A loss of knee extension capacity was noticed during the initial physical examination. Anteroposterior (AP) and lateral radiographs of both knees revealed an avulsion fracture in the anterior aspect of the tibial plateau without involvement of the articular surface, the distal tip of the fragments being hinged upward, respectively Figure 1.

Preoperatively, we decided to perform primary open reduction and internal fixation if an initial attempt of closed reduction was unsuccessful. In effect, the severely dislocated fragment on the right side could not be reduced in anatomic position under image intensifier guidance, therefore the skin was incised using an anterolateral parapatellar incision. Intraoperatively on right side, a large flap of periosteum was found interposed into the fracture gap (Figure 2). The periosteal flaps were elevated, the fragments were easily reduced and osteosynthesis was performed using two cannulated cancellous screws 4.0mm on right side and only single cannulated cancellous screw 4.0mm on left side due to small fragment (Figure 3).

The patient tolerated well post operation and was immobilized in a cylinder cast for 6 weeks. He was progressively mobilized with non-weight bearing crutches for 8 weeks and allowed weight bearing as tolerable. He was asymptomatic and without postoperative complication at his recent check-up at 6 months after surgery in our clinic.



Figure 2. Arrows showed periosteal flap were elevated and fragments were easily reduced and two cannulated screws inserted over the right tibial tuberosity.



Figure 3. Postoperative radiographs after open reduction and fixation with two cannulated screws on the right and single cannulated screw left.

3. Discussion

The avulsion fracture of the tibial tuberosity is an uncommon injury of the knee, which predominantly occurs in adolescence, mainly male. The age range corresponds to the time of growth plate closure and maturation of the fibrocartilaginous attachment of the tuberosity. The injury usually happens during sports activities, especially during contact sports such as football and basketball [1,7]. The mechanism of this avulsion fracture is described as passive flexion of the knee against contracted quadriceps muscles or violent active extension [1]. When the tensile forces of the quadriceps complex against the patellar tendon insertion overcome the cohesive forces within the apophyseal cartilage an avulsion fracture of the tibial tubercle may occur [4]. In our case, the possible mechanisms of action of injury are abrupt knee flexion with quadriceps contraction, typical of jump landing or sudden quadriceps contraction with a fixed foot.

The tibial tubercle physis progressively fuses from posterior to anterior, making it vulnerable to injury during the transitional phase of closure. Fusion of this physis is completed at the age of 13–15 years in females, and 15–19 years in males [3]. Complications of TTAF include compartment syndrome, most likely as a result of bleeding from the anterior tibial recurrent artery, as well as knee stiffness, patella alta, and genu recurvatum with leg length discrepancy but adverse results are infrequent [1,2]. However, growth disturbance is rare, as these fractures usually occur near the end of physal closure.

The first classification system was introduced by Watson-Jones [9]. Type I is an avulsion of a small portion of the tibial tuberosity, distal to the physis of the proximal tibia; Type II involves the whole physis, but does not extend to the knee joint; Type III corresponds to avulsion that extends proximally to the knee growth plate. Ogden and Southwick [10] modified the original classification by creating a more accurate definition of the specific fracture patterns and suggesting treatment for each types of fractures. Ryu and Debenham [11] added a Type IV, which is a fracture of the tibial tuberosity that extends posteriorly along the proximal tibial growth plate and creates an avulsion of the entire proximal epiphysis. Subsequently, Franklin et al. [12] added a Type C, for fractures with associated avulsion of the patellar ligament. Finally, McKoy and Stanitski [13] added a Type V which also described by Curtis [14], which consisted of a fracture Type III B with Y configuration.

The treatment is based on the amount of displacement and associated injuries [8]. Non-displaced fractures can be treated non-operatively with cast immobilization. For Ogden type IA and IIA fractures, an attempt at closed reduction can be made. In type IB, IIB, and III fractures, open reduction and internal fixation are generally, but not universally recommended [5]. In non-comminuted, slightly displaced type II and III fractures, some surgeon may be tempted to perform closed reduction with percutaneous screw fixation, as suggested by Ozkayin and Aktuglu. However, as demonstrated in our patient, the interposition of a large periosteal flap prevented an optimal

anatomic reduction. This complication was first described by Hand in 1971 [6]. Since then, others have noted similar findings [3]. Complications may include bursitis over prominent screw heads, which may need early screw removal.

4. Conclusion

In this case, we emphasize the point that with most of these fractures, primary open reduction should be performed if an initial attempt at closed reduction does not lead to correct adaptation of the fragments. Most authors suggest osteosynthesis by placement of cancellous screws. As demonstrated in our patient, this is also our preferred method. This method lessens the time needed for plaster immobilization of the knee, allows for an earlier return to sports activities, and has consistently resulted in an excellent prognosis.

Consent

As per international standard or university standard, patient's written consent has been collected and preserved by the authors.

Ethical Approval

It is not applicable.

Competing Interests

Authors have declared that no competing interests exist.

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