Avulsion Fracture of the Tibial Tuberosity Requiring Meniscal Repair: A Case Report

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Case Report

Avulsion Fracture of the Tibial Tuberosity Requiring Meniscal Repair: A Case Report
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Abstract
Avulsion fractures of the tibial tuberosity are uncommon injuries. A 16-year-old male sustained injuries to his right knee joint after jumping from stairs and landed on his feet with his right knee forced into flexion. X-ray photographs showed a type III avulsion fracture of the tibial tuberosity. On the next day of the injury, open reduction and internal fixation, followed by arthroscopy was performed. The fracture fragment was fixed with three 5.0 mm cannulated cancellous screws. The torn anterior portion of medial meniscus was repaired with 3-0 Polydioxyanone (PDS) using outside-in sutures and the torn midportion of medial meniscus was repaired using the FasT-Fix meniscal repair system. Eight months after the injury, removal of the screws and arthroscopy were undertaken. The medial meniscus was completely healed. The range of motion was full at the knee joint. Meniscal suture should be strongly considered for type III avulsion fractures of the tibial tuberosity in adolescents.

Key words: Avulsion fracture · Tibial tuberosity · Open reduction and internal fixation · Meniscal repair

Introduction
Avulsion fractures of the tibial tuberosity are uncommon injuries, usually occurring in adolescents1–4. The incidence has been reported to be 0.4% to 2.7% of all epiphyseal injuries and < 1% of all physeal injuries5–6. The classification of these fractures has been discussed by several authors. Ogden et al7 modified the classification of Watson-Jones8, dividing it into three types. In type I, the fracture crosses the secondary ossification center level with the posterior border of the inserting patellar tendon. In type II, the fracture line runs along the junction of the primary and secondary ossification centers of the proximal tibial epiphysis. In type III fractures, the fracture line extends into the articular surface across the primary ossification center. We herein report a case of a type III avulsion fracture of the tibial tuberosity that required meniscal sutures. Informed consent has been obtained from the patient or his family for publication, including any necessary photographs.

Case report
A 16-year-old male jumped from the stairs and landed on his feet with his right knee forced into flexion. He experienced sudden pain in the right knee and was unable to bear weight on his right leg. He was transferred to our hospital. On examination, the patient’s right knee joint was found to be swollen with hemarthrosis and crepituation over the tibial tuberosity. X-ray images revealed an avulsion fracture of the tibial...
Avulsion fracture of tibial tuberosity

Fig. 1  X-ray photographs of the right knee joint on the day of the injury. The X-ray photographs revealed a type III avulsion fracture of the tibial tuberosity. The quadriceps muscle was contracted proximally during flexing the knee, therefore the tibial tuberosity was fractured (arrows).

Fig. 2  MRI of the right knee joint on the day of the injury. A high-intensity area was detected in the medial meniscus.

Fig. 3  X-ray photographs of the right knee joint after surgery.

Fig. 4a  The medial meniscus was torn longitudinally in the red-white zone in the pars intermedia. The fracture line was identified using arthroscopy (arrows).

Fig. 4b  The torn medial meniscus was sutured with 3-0 PDS using outside-in sutures and the FasT-Fix meniscal repair system. The fracture was reduced and fixed anatomically (arrows).
Avulsion fractures of the tibial tuberosity are uncommon injuries. They usually occur during athletic events in adolescents. These injuries have been described as resulting from sudden forced flexion of the knee against a strongly contracted quadriceps or sudden violent quadriceps contraction acting across a flexed knee during which the foot stabilizes concentrated forces in the area of the tibial tuberosity.²

There are few reports of avulsion fractures of the tibial tuberosity treated with meniscal repair (Table 1).³,¹⁰⁻¹². Type III avulsion fractures of the tibial tuberosity are intra-articular fractures of the proximal tibia. Therefore, it is necessary to conduct thorough physical and MRI examinations.

Fig. 5 Eight months after the injury. The medial meniscus had completely healed.
in order to determine whether meniscal and ligament injuries are combined or not\textsuperscript{13}. If there is any suspicion of a combined injury of the knee, arthroscopy should be performed. Our case highlights the need for a high index of suspicion of meniscal tears when treating avulsion fractures of the tibial tuberosity.

The most common mechanism of meniscal injury is a twisting injury with the foot anchored on the ground. However, the relationship between the injury mechanism and the pattern of meniscal tear in avulsion fractures of the tibial tuberosity is still unknown. Meniscal tear may occur in both medial and lateral side in avulsion fractures of the tibial tuberosity. The medial meniscus is more commonly injured than the lateral meniscus in sports activity. The difference of injury mechanism between medial meniscal tear and lateral meniscal tear associated with avulsion fractures of the tibial tuberosity is still unknown.

Meniscal suturing has been reported to obtain good clinical outcomes\textsuperscript{14–19}. Avulsion fractures usually occur in adolescents, and meniscal tears in skeletally immature adolescents have greater reparative potential. Therefore, attempts at meniscal repair should be strongly considered in patients with type III avulsion fractures of the tibial tuberosity. Fixation of the avulsion of the tibial tuberosity is generally performed using screws\textsuperscript{2,8,10}. We performed rigid fixation of the fracture using three cannulated screws. Therefore, we were able to initiate CPM the day after surgery.

Howarth et al\textsuperscript{20} reported that a tibial tubercle avulsion fracture types III or V will likely have intra-articular pathology, specifically capsular avulsion or coronary ligament disruption and less commonly meniscal tears. He described the repair of capsular avulsion or coronary ligament disruption using suture anchors. In our case, no obvious capsular avulsion or coronary ligament was detected, therefore, medial meniscal repair was undertaken using sutures and the FasT-Fix meniscal repair system.

In conclusion, we herein reported a case of a type III avulsion fracture of the tibial tuberosity that required meniscal sutures. Arthroscopic treatment is mandatory for type III avulsion fractures of the tibial tuberosity.

References


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内側半月板損傷を合併した脛骨粗面骨折の1例

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我々は、内側半月板損傷を合併した脛骨粗面骨折の1例を経験したので報告する。

症例：16歳男性。階段3段を飛び下り際に転倒し受傷した。膝関節痛を自覚し、歩行不戦となった。同日受診となった。X線にて脛骨粗面骨折（Watson-Jones III型）の診断であった。MRIにて内側半月板損傷を疑う所見を認めた。

受傷翌日、骨接合術ならびに関節鏡手術を施行した。骨折部は5.0mm CCS3本にて固定した。続いて関節鏡視を行うと、内側半月板の前節・中節部の実質部に縦断裂を認めた。中節部はall inside法で縫合し、前節部は3-0PDSを用いてoutside-in法で縫合した。ACL、PCLには明らかな断裂は認めなかった。術後6週後より部分荷重を開始し、術後10週目より全荷重とした。術後8ヶ月時点で、膝関節可動域は屈曲140°、伸展0°と改善し、抜釘術ならびに関節鏡を施行した。縫合した内側半月板は修復していた。

脛骨粗面骨折に半月板損傷を合併した報告は少ない。本症例では、骨折型とMRI所見から内側半月板損傷を診断し、縫合術を行った。Watson-Jones III型の脛骨粗面骨折では半月板縫合を考慮する必要がある。