Trauma Update

**ARTHROSCOPIC SUTURE FIXATION OF DISPLACED TIBIAL EMINENCE FRACTURES**

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Fractures of the tibial eminence were first described by Poncet in 1875. They often have been reported in children and adolescents, and are increasing in frequency in adults, especially those involved with athletics.

Meyers and McKeever proposed a classification of intercondylar eminence fractures based on the degree of displacement. Type I fractures are characterized by no or minimal displacement and no limitation of knee extension. In Type II fractures, the anterior one third to one half of the fragment is lifted upward, while the posterior border acts as a hinge and still maintains contact with the proximal surface of the tibia. Type III fractures are completely separated, and the entire fragment is displaced upward and often rotated. Meyers and McKeever reported a preponderance of Type II fractures in adults.

While avulsion fractures of the tibial intercondylar eminence have been well described and classified, there has been disagreement about the indications and methods of fixation in displaced (Type II and III) tibial eminence fractures. Open modes of reduction and fixation do cause some morbidity. Recently, arthroscopic surgery has provided a new treatment option, but the techniques are demanding.

We describe a method of arthroscopic reduction and suture fixation of an avulsion fracture of the tibial eminence. This method reestablishes the length of the anterior cruciate ligament (ACL) and restores stability to the knee.

**CASE REPORT**

A 33-year-old woman presented with an acute knee hemarthrosis after a fall hyperextending the knee. On physical examination, she exhibited a Grade III Lachman and anterior drawer sign with no associated varus or valgus instability. Radiographs revealed a 2 cm x 3 cm displaced Type III fracture of the tibial eminence (Fig 1). Closed reduction after aspiration failed to yield an anatomic reduction.

Arthroscopic examination confirmed a large, avulsed fragment of the tibial eminence, which was displaced proximally 1 cm with laxity of the attached ACL (Fig 2). The fracture line extended into the weight bearing surface of the lateral tibial plateau, and the anterior horn of the lateral meniscus was blocking reduction of the fracture fragment. Cartilage and small bony debris were evacuated from the joint.

An ACL tibial guide was used to arthroscopically manipulate and anatomically reduce the displaced fracture fragment (Fig 3). Two Kirschner wires were inserted through the guide from the proximal tibia into the base of the fragment to provide provisional stabilization. The Capponi suture punch was used to place eight 2-0 PDS sutures into the base of the ACL (Fig 4). A 3.5 mm hole was drilled, with a cannulated drill placed over one of the previously inserted Kirschner wires, through the proximal tibia into the base of the fragment just anterior to the ACL. The sutures were then passed through the tibial tunnel and tied over a 4.5 mm cortical screw with the knee in extension (Fig 5). The knee was placed through a full range of motion and the stability of the fixation evaluated arthroscopically (Fig 6). The knee was placed in a knee immobilizer in extension for 3 weeks. Range of motion exercises were started and weight bearing was initiated at 6 weeks.

The patient's fracture was healed radiographically at 7 weeks (Fig 7). Her range of knee motion at that time was from 0° to 135° and she

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DISCUSSION

Bakalam and Wilppula aspirated the hemarthrosis to relieve pain in their patients. They then manipulated the knee into extension to reduce displaced (Type II and III) fractures. They carefully avoided hyperextension so that a taut ACL would not displace the fracture fragment. They postulated that reduction was maintained by the femoral condyles and fat pad.

Meyers and McKeever treated reduced Type II fractures in a long leg cast in 20° of flexion for 8 to 12 weeks. In Type III fractures, they...
recommend operative reduction, secured with absorbable sutures from the base of the ACL into the adjacent portion of the lateral meniscus. They attributed the 10 poor results in their series of 70 patients to inadequate fracture reductions or associated ligamentous injury.

Many orthopedists favor open reduction and internal fixation of displaced tibial eminence fractures, especially if closed reduction fails, is uncertain, or is delayed. The fracture usually is easily reduced by removing interposed debris, fat pad, and/or the anterior horn of the lateral meniscus. Sutures, wire loops, Kirschner wires, and cannulated screws have each been used for fixation. Sullivan et al reported a case of Type III tibial eminence fracture untreated for 2 years that had a successful outcome after open reduction and Mersilene sutureting.

McLennan reported his successful experience with arthroscopically assisted reduction of 35 displaced tibial eminence fractures. He evaluated the reduction with the knee extended. If the reduction was stable, he immobilized the knee in extension for 3 weeks. This was followed by 3 more weeks of immobilization with the knee in 20° of flexion prior to rehabilitation and weight bearing. If reduction was not stable, McLennan secured the reduced tibial eminence with two crossed K-wires and followed the same treatment regimen. He noted a high incidence of associated medial collateral ligament injury (10/35) in his series.

VanLoon and Mante described a technique utilizing a tibial cruciate guide to reduce the avulsion fragment and direct the placement of one or two 3.5 mm cortical lag screws. Range of motion exercises were started immediately and the screws were removed several months after healing. They believed an arthroscopic examination of the knee was merited in these patients to assess the degree of displacement and stability of the fracture. They pointed out that accurate radiographic assessment of the fragment is not easy and the distinction between Types II and III is not always clear. They also believed that arthroscopic surgery was important in the detection of common associated lesions, particularly in adults.

**Conclusion**

Arthroscopic surgery is a useful adjunct in patients with displaced tibial eminence fractures. The fracture is anatomically reduced under direct vision. This not only restores the length and integrity of the ACL, but also is important when the fragment is large and may involve part of the weight bearing surface of the tibia. A cruciate tibial guide is very effective in manipulating the fracture and in directing the placement of Kirschner wires into the base of the fracture fragment for temporary or definitive fixation. Cortical lag screws or multiple suture fixation, as we have shown, provides secure fixation and allows earlier but controlled range of motion exercises, compared to closed nonoperative management techniques. Arthroscopy also enables the surgeon to evaluate the knee for any additional associated injury.

**References**


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