

# Tibial Tuberosity Avulsion Fracture and Open Proximal Tibial Fracture in an Adult

## *A Case Report and Literature Review*

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**Abstract:** A displaced tibial tuberosity avulsion fracture associated with an open extra-articular proximal tibial diaphyseal fracture is an uncommon fracture pattern. This case report describes the successful management of such a fracture pattern in a 45-year old male using an open reduction and lag screw fixation of the tuberosity with a minimally invasive reduction and plate fixation of the proximal tibial diaphyseal fracture. A literature search was done to determine the expected clinical outcome of this fracture pattern.

This is the first reported adult case of an avulsion fractures of the tibial tuberosity associated with an open proximal tibial diaphyseal fracture successfully treated by an anatomical reduction and fixation of the avulsion fracture of the tibial tuberosity combined with minimally invasive percutaneous plate osteosynthesis of the proximal tibial diaphyseal fractures.

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### INTRODUCTION

Avulsion fractures of the tibial tuberosity in the adult are extremely rare with only 3 reported cases.<sup>1–3</sup> It has not been reported with proximal tibial diaphyseal fractures. Because of the associated soft tissue injury with these proximal tibial fractures, a displaced tuberosity fracture creates a problem in fracture management.<sup>4–6</sup> Both fractures require operative management but the avulsion fracture will need an anatomical reduction to assure proper knee function.<sup>7,8</sup> The operative management of the high energy proximal tibia fracture has been associated with a high complication rate especially with the soft tissue healing and infection.<sup>9–11</sup> As a result this fracture maybe best treated with a minimally invasive technique. This report of a 45-year old male with a high energy open proximal tibial fracture associated with a displaced tibial tuberosity fracture that has been successfully managed with a planned

open reduction and screw fixation of the tuberosity and a minimally invasive technique for the tibial diaphyseal fracture.

### Case Report

A 45-year-old man was hit on the left proximal tibia in a traffic accident. His knee was in a state of flexion and internal rotation before the traffic accident occurred, and heavy items (such as woods or metal) directly hit him on the left proximal tibia. The patient felt immediate anterior knee and proximal tibial pain, and there was a bleeding laceration (about 8 cm) on the lateral side of the injured proximal tibia. He was unable to stand and was sent to the emergency department after the wound was dressed. (The Ethics Committee of Tengzhou Central People's Hospital approved the study. Informed written consent was obtained from the patient). In the emergency room he had left anterior knee swelling, a proximal tibial deformity, loss of active knee extension, and severe pain to palpation along the proximal tibial and anterolateral tibial tuberosity. No neurovascular deficit was noted. Roentgenographic examination revealed a tibial tuberosity avulsion fractures similar to a Type I (Watson-Jones)<sup>12</sup> with internal rotation displacement of the fracture fragment combined with a proximal tibial and fibula fracture (Figure 1). A debridement of the open fracture was performed and the laceration was closed. The leg was splinted till the soft tissues were healed and swelling was resolved. On the 10th day postinjury the proximal tibial fracture was treated with a locked proximal tibial plate inserted with a minimally invasive technique while the tuberosity fracture was reduced and fixed with 2 lag screws (Figure 2). The incision extended from Gerdy Tubercle to the tibial tuberosity. This allowed for the insertion of the locked plate and reduction and fixation of the tuberosity. On the 4th day following fixation the open fracture wound broke down, but the bacteria culture was negative. This wound was dressed and closed on the 14th postoperative day from fixation and by 6 weeks had finally healed. Radiographs at 3 months showed resorption of both fracture fragments of the proximal tibial fracture and this fractures eventually healed by 12 months (Figures 3, 4).

A medical and endocrinological examination was performed with negative results and no systemic diseases and predisposing factors were found during patient's hospitalization. Rehabilitative exercises and progressive weight bearing were begun according to the imaging results. He had full range of motion in left knee after 12 weeks. The patient was allowed full weight bearing at 6 months, and at 12 months after operation he was asymptomatic with a full range of motion and good strength and has returned to work with no limitations (Figure 5).

### DISCUSSION

The avulsion fracture of the tibial tuberosity is regarded as a substantial injury to the extensor mechanism as the patellar

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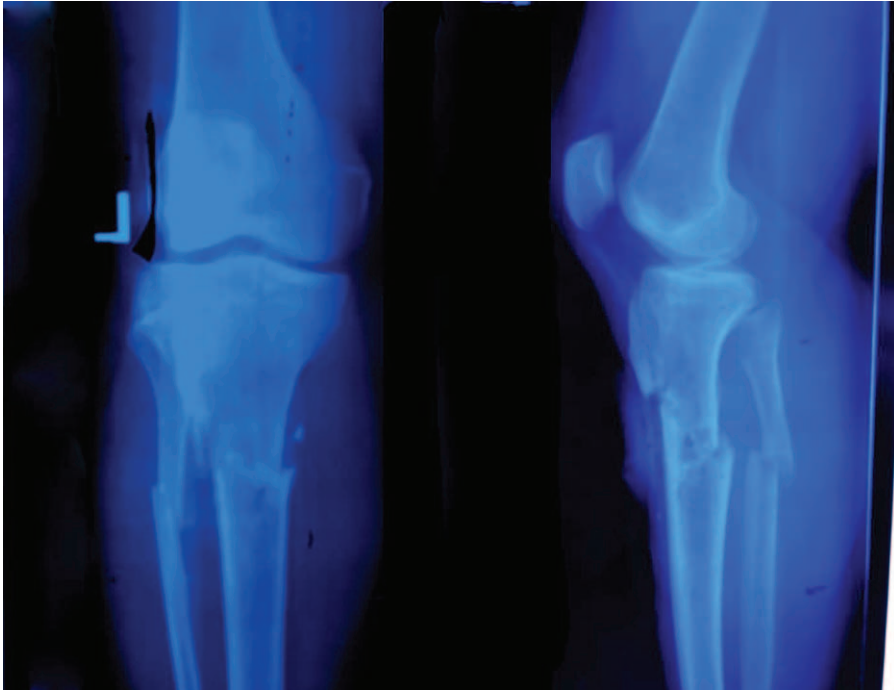
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**FIGURE 1.** Preoperative anteroposterior and lateral film radiographs of the left knee showing tibial tuberosity avulsion fracture and proximal tibial fracture.



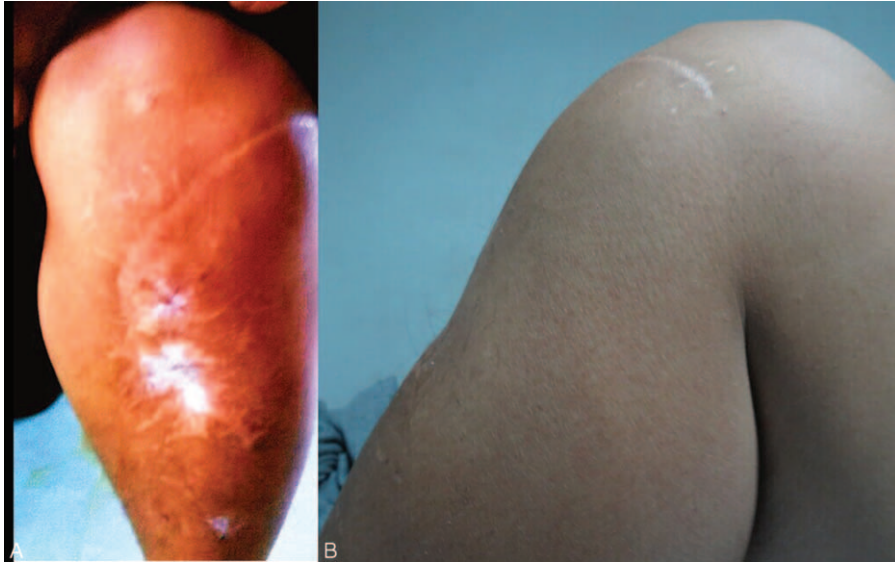
**FIGURE 2.** Postoperative anteroposterior and lateral film radiographs in 2 days after operation.



**FIGURE 3.** Postoperative anteroposterior and lateral film radiographs in 3 months after operation showed absorption of tibial fracture fragments for the cut of the patients at the time of injured breakdown.



**FIGURE 4.** Postoperative anteroposterior and lateral film radiographs in 12 months showed that fractures eventually healed.



**FIGURE 5.** The left knee appearance at 12 months postoperatively was showed in (A), the left knee function at 12 months postoperatively was showed in (B).

tendon is attached to the tibial tuberosity. Biomechanically, the degree of flexion of the knee at the time of injury was considered closely related to the fracture pattern and the size of the avulsed fragments. We believed that the tibial tuberosity avulsion fracture should be considered an intraarticular fracture, because a malunion will affect the trajectory of the patella resulting in patellar subluxation and poor extension power. Consequently an anatomical reduction and stable fixation is required to assure it heals anatomically. We used a minimally invasive lateral surgical approach to the tibia and extended to the tibial tubercle to achieve these goals. The screws should be inserted angular to the proximal tibia, which can increase the screw holding force. Nonsurgical treatments may cause fracture malunion, anterior knee pain, and even patellar dislocation. Despite a locking compression plate combined with minimally invasive percutaneous plate osteosynthesis techniques to prevent the blood supply of the fracture from being destroyed, a wound dehiscence and the proximal tibia fractures experienced fragment resorption and sclerosis but ultimately healed. The main factors of bone healing were as follows, first, the blood supply of proximal of tibia was better than the distal. Second, by 3 months, the fibula fracture had almost healed relieving some of stress from the tibial plate and helped to ensure the stability of the construct and provided a better environment for tibial fracture healed. Third, at the same time the patient's skin healed, we recommend the use of a minimally invasive lateral surgical approach to the proximal tibia with extension to the tibial tubercle to allow stable fixation of both fractures so early range of motion can be started to avoid the development of a knee arthrofibrosis and stiffness.

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