Case Report

Case Report of a Tibial Plateau Fracture Extending Through the Tibial Diaphysis after Low Energy Injury in a Patient with Rheumatoid Arthritis

Jeremy D Podolnick* and Jeffrey V Dermksian
Department of Orthopaedic Surgery, Mount Sinai-St.Luke’s Roosevelt Hospital Center, USA

Abstract
Introduction: The combination of tibia plateau and shaft fractures, previously reported as type of “bifocal” tibia fracture, is a rare injury.1 The majority of tibia plateau fractures and bifocal tibia fractures occur after high-energy trauma.2,3 The treatment of these injuries varies depending on type, mechanism of injury, and patient characteristics.

Case Presentation: We report the case of one patient who sustained a Schatzker VI tibial plateau fracture with extension through the tibial diaphysis after a low-energy injury, likely due to her history of Rheumatoid Arthritis (RA) treated with Methotrexate (MTX) and Prednisone. The patient was initially managed with external fixation to allow for soft tissue resuscitation followed by open reduction and internal fixation. The fracture went on to fully unite.

Conclusion: Bifocal tibia fractures are a challenging entity. There is sparse literature regarding the treatment of this type of injury. We have found only one review of bifocal tibia fractures and one paper reporting on the treatment of noncontiguous ipsilateral tibia plateau and shaft fractures. To our knowledge, no prior case reports have been published regarding this injury.

ABBREVIATIONS
RA: Rheumatoid Arthritis; MTX: Methotrexate

INTRODUCTION

Tibia plateau fractures and tibia shaft fractures present challenges to the treating Orthopaedic surgeon. Optimal treatment requires anatomic reduction of the joint, proper alignment of the lower extremity, and early motion to prevent stiffness. These fractures may be associated with significant soft tissue damage, and tibia plateau fractures may be associated with injury to the ligaments and menisci of the knee. Severe complications may be seen with these injuries, especially after higher grade fractures [1]. Surgical treatment options include traction, temporary or definitive external fixation, and unicortylar or bicondylar plating with or without intramedullary nailing [2].

Rheumatoid Arthritis is described as a chronic, systemic, inflammatory disorder of unknown origin primarily affecting joints. Rheumatoid Arthritis negatively affects the bone mineral density in all patients. This occurs through disease dependent mechanisms as well as associated patient factors. Methotrexate is one drug used in the treatment of RA. Methotrexate interferes with DNA synthesis, repair, and cellular replication; however, the exact therapeutic mechanism of action in RA is unknown [3]. Multiple studies have shown the adverse effects of MTX on bone metabolism. Increased calcium excretion, inhibition of osteoblast proliferation, stress fractures and decreased bone mineral density are associated with MTX therapy [3]. These affects of MTX have been shown to be exacerbated with the concomitant use of corticosteroids [4].

We present the rare case of a 58 year old postmenopausal female with RA being treated with MTX and Prednisone who sustained a high grade tibial plateau fracture extending through the majority of the tibia diaphysis after a low-energy mechanism...
of injury. We will discuss the probable cause of the injury as well as our treatment algorithm.

CASE PRESENTATION

A 58-year-old female presented to our Emergency Department for evaluation of right lower extremity pain after stepping from a curb. The patient has a past medical history of hypertension, type II diabetes mellitus, pulmonary embolism, coronary artery disease, neuropathic pain, and RA diagnosed approximately seven years prior. The patient has been treated with MTX and Prednisone. The patient stated that she takes Prednisone during RA flares, and recently had taken it for the past ten days. The patient had been receiving Methotrexate 15 mg weekly for the past two months after a three month hiatus and subsequent worsening of RA symptoms.

On exam, the patient exhibited diffuse tenderness throughout the right lower extremity. She was neurovascularly intact and her compartments were soft. Radiographs [Figures 1-3] demonstrated a bicondylar tibial plateau fracture with lateral subluxation of the lateral tibia plateau and extension of the fracture through the diaphysis of the tibia. The fracture was reduced and a splint was applied. A computed tomography scan with contrast was obtained to evaluate the fracture pattern and potential vascular injury [Figure 4]. The study was negative for vascular injury.

After discussion of the treatment options, an external fixator was placed that spanned the tibia. Two pins were placed in the femur and two were placed through the calcaneus to create a delta frame construct, and one pin was placed in the first metatarsal to maintain dorsiflexion of the foot. After adequate soft tissue resuscitation, the patient underwent an open reduction and internal fixation of her fracture. A standard antero-lateral incision was used to access the proximal tibia. The articular cartilage defect of the lateral tibial plateau was elevated and the void was filled with cancellous bone chips. A Stryker 20 hole proximal lateral tibia locking plate was applied using a minimally invasive plate osteosynthesis (MIPO) technique [Figure 5 and 6].

Immediately postoperatively, the patient was allowed to begin range of motion of both the ankle and knee, but was kept non-weight bearing. Weight bearing was begun at 3 months. Additionally, the MTX and Prednisone were not resumed immediately postoperatively and were to restarted at the discretion of the patient’s Rheumatologist.

The patient went on to heal this fracture. She did develop screw site irritation and the offending screws were subsequently removed in an uncomplicated operation.

DISCUSSION

Tibia plateau and shaft fractures include a variety of fracture patterns and can present a challenge to the treating Orthopaedic surgeon. Different classifications have been described for tibia plateau fractures, including the AO/OTA and Schatzker classification, and for tibia diaphyseal fractures, including the AO/OTA classification. No classification scheme has been described for contiguous fracture patterns.
The Schatzker classification system, developed in 1979, describes tibia plateau fracture patterns and serves to guide operative treatment [5]. This fracture pattern of the tibia plateau can be classified as a Schatzker VI. Historically, Schatzker VI injuries, a bicondylar fracture involving the medial and lateral tibia plateaus and complete separation of the articular surface from the diaphysis, have carried a significant risk of complication, including wound dehiscence and compartment syndrome, largely due to the fact that this injury is sustained after high-energy injury [1]. The AO/OTA classification of long bone fractures is a reproducible classification scheme with some indication of prognosis. In this case, the tibia plateau fracture is classified as a 41-C3 and the tibia shaft fracture is classified as a 42-C3. This reflects the separation of the articular surface from the diaphysis and the multiple fragments in the tibia diaphysis [6].

Bifocal tibia injuries are a relatively rare entity and present a high degree of complexity for optimal treatment. Keating reports a case-series of combined tibia plateau and shaft fractures treated with a combination of intramedullary nailing, plating, pinning, and closed treatment; however, there is no well defined treatment algorithm [2]. The operative indications of all tibia plateau fractures may include articular depression of > three mm, condylar displacement of > five mm, varus/valgus instability, and medial and/or bicondylar fractures [7]. Indications for operative treatment of tibia shaft fractures include coronal angulation > five degrees, sagittal angulation > ten degrees, rotation > five degrees, shortening > one cm, displacement > 50%, and severe comminution [8]. These operative indications should be evaluated in the context of the clinical picture of the patient.

High-energy and complex fractures of the tibial plateau and shaft are usually associated with significant soft tissue compromise that may not tolerate the added trauma of acute surgical intervention. The use of temporary external fixation has become commonplace in the treatment of complex tibia fractures to allow for soft tissue resuscitation [1,9]. Temporary external fixation provides bony stability, increased mobilization of the patient, and an environment conducive to soft tissue recovery [9]. Multiple studies have shown that temporary external fixation offers improved outcomes when compared to immediate open reduction and internal fixation, and there is a low rate of complications associated with the external fixator [10]. In one study evaluating 57 fractures, complications associated with the temporary external fixator included deep wound infection (5%), non-union (4%), and knee stiffness (5%) [10].

Major concerns of the operative management of Schatzker VI type fractures are fracture reduction, restoration of the articular surface, restoration of the mechanical axis of the tibia and minimizing damage to the soft tissues [1]. Reduction may be accomplished through single or dual incisions using unicondylar...
that it may cause increased bone resorption, inhibit osteoblast proliferation, and reduce bone formation [3]. In a review of current literature, it is reported that the combination of MTX with a corticosteroid caused greater loss of bone mineral density in the lumbar spine than MTX use alone [4]. Long term MTX use in patients with inflammatory arthritis has also been reported to cause fragility fractures. These fractures typically occur in the long bones of the legs, femoral neck, and pelvis [3]. Fractures that occur in the tibia have typically been reported to occur in the distal tibia, but the proximal tibia may also be affected [4].

This rare case illustrates a high-grade bifocal tibia fracture after a low-energy mechanism of injury in a patient with RA with a history of MTX and Prednisone use. Multiple case reports have described stress fractures in RA patients who take MTX, a relatively rare complication. We propose that the patient’s history of RA treated with MTX and Prednisone led to altered bone architecture causing this high grade bifocal tibia fracture after a low-energy mechanism of injury. There has been little published regarding the surgical treatment of patients with bifocal tibia fractures. This case reports the successful treatment of a patient who sustained a high-grade tibial plateau and shaft fracture with a lateral locking plate used to buttress the tibial plateau fracture and bridge the tibial shaft fracture performed through a minimally invasive technique.

**REFERENCES**

11. Egol KA, Su E, Tejwani NC, Sims SH, Kummer FJ, Koval KJ. Treatment of tibial plateau fractures: a biomechanical study comparing unicondylar locked plating to bicondylar plating.


