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Case Report

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

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Keywords

- Tibia plateau fracture
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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.[1,2] 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 unicondylar 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.

Figure 1 (a) Anteroposterior view of the right proximal tibia showing the initial injury, (b) lateral view of the right proximal tibia showing the initial injury.

Figure 2 (a) Anteroposterior view of the right tibia showing the extent of the initial injury. (b) lateral view of the right tibia showing the extent of the initial injury.

Figure 3 (a) Anteroposterior view of the right ankle showing the extent of the initial injury in relation to the ankle joint, (b) lateral view of the right ankle showing the extent of the initial injury in relation to the ankle joint.

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.

Figure 4 CT scan of the tibia at the time of the initial injury. Top row shows images of the tibial plateau in the axial plane, middle row shows images of the proximal tibia in the coronal plane, bottom row shows images of the entire tibia in the sagittal plane.

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 area 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 algorhithm [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

Figure 5 (a) Anteroposterior view of the right tibia after surgical fixation, (b) lateral view of the right tibia after surgical fixation.

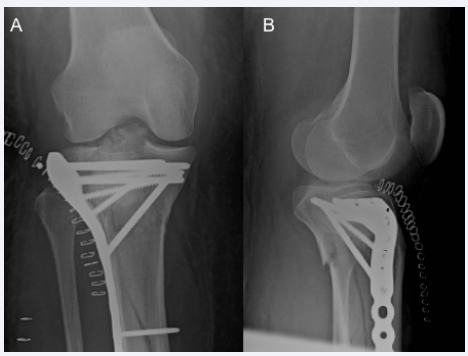

Figure 6 (a) Anteroposterior view of the right knee after surgical fixation, (b) lateral view of the right knee after surgical fixation.

Figure 7 (a) Anteroposterior view of the tibia approximately 14 months after surgical fixation, status post removal of prominent screws, (b) lateral view of the tibia approximately 14 months after surgical fixation, status post removal of prominent screws

or bicondylar plating. In Schatzker VI type fractures, the fracture pattern will dictate the need for single versus dual plating. There is sufficient evidence supporting the use of a single lateral plate in bicondylar fractures with minimal comminution and medial cortical contact [1].

Multiple studies have examined the integrity of a single lateral plate in high-grade injuries. Uhl et al. suggest that in certain fracture patterns, a single lateral locking plate is acceptable to maintain alignment and reduction [12]. Gosling et al. performed a biomechanical study comparing unicondylar locked plating to bicondylar plating. They found that in a cadaver model, there was no difference in vertical subsidence between the two groups [13]. Egol et al. concluded that a unilateral locking plate provides stable fixation of complex bicondylar fractures [11].

Substantial evidence exists for the use of a tibia plate for definitive fixation of tibia diaphyseal fractures. In 1976, Ruedi et al. published a series of closed and open tibia shaft fractures. Of the 323 closed tibial shaft fractures treated with a dynamic compression plating available for follow up, 317 had very good or good results [14]. Tibia plating using a locked plate with a MIPO technique has also been described. Williams and Schenk reported that 19 of 20 patients treated in this fashion had excellent results [15].

This high-grade fracture pattern was likely associated with the patient's history of RA treated by MTX and Prednisone. Methotrexate use has been associated with osteopathy – bone pain, osteoporosis and insufficiency fracture of the lower extremity. A variety of studies examining MTX have shown 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

1. Keating JF, Kuo RS, Court-Brown CM. Bifocal fractures of the tibia and fibula. Incidence, classification and treatment. J Bone Joint Surg Br. 1994; 76: 395-400.
2. Cole P, Levy B, Watson JT, Schatzker J. Tibial Plateau Fractures. In: Browner B, Levine A, Jupiter J, et al., editors. Skeletal Trauma. Philadelphia: WB. Saunders. 2009; 2201-2289.
3. Wijnands M, Burgers A. Stress fracture in long term methotrexate treatment for psoriatic arthritis. Ann Rheum Dis. 2001; 60: 736–739.
4. Meier L, van Tuyll van Sersooskerken A, Liberton E, Kleijn L, Westgeest T, Polak M, et al. Fractures of the proximal tibia associated with longterm use of methotrexate: 3 case reports and a review of literature. J Rheumatol. 2010; 37: 2434-2438.
5. Schatzker J, McBroom R, Bruce D. The tibial plateau fracutre: The Toronto experience 1968-1975. Clin Orthop Relat Res. 1979; 138: 94-104.
6. Muller ME, Nazarian S, Koch P, Schatzker J. The Comprehensive Classification of Fractures of Long Bones. Berlin: Spring-Verlag; 1990; 148-169.
7. Honkonen SE. Indications for surgical treatment of tibial condyle fractures. Clinical Orthopaedics and Related Research. 1994; 302: 199-205.
8. Lindsey RW, Blair SR. Closed Tibial-Shaft Fractures: Which Ones Benefit From Surgical Treatment? J Am Acad Orthop Surg. 1996; 4: 35-43.
9. Berkson EM, Virkus WW. High-energy tibial plateau fractures. J Am Acad Orthop Surg. 2006; 14: 20-31.
10. Egol KA, Tejwani NC, Capla EL, Wolinsky PL, Koval KJ. Staged management of high-energy proximal tibia fractures (OTA types 41): the results of a prospective, standardized protocol. J Orthop Trauma. 2005; 19: 448-455.
11. Egol KA, Su E, Tejwani NC, Sims SH, Kummer FJ, Koval KJ. Treatment

of complex tibial plateau fractures using the less invasive stabilization system plate: clinical experience and a laboratory comparison with double plating. J Trauma. 2004; 57: 340-6.

12. Uhl RL, Gainor J, Horning J. Treatment of bicondylar tibial plateau fractures with lateral locking plates. Orthopedics. 2008 May; 31: 473-477.

13. Gosling T, Schandelmaier P, Muller M, Hankemeier S, Wagner M, Krettek C. Single lateral locked screw plating of bicondylar tibial plateau fractures. Clin Orthop Relat Res. 2005; 439: 207-14.

14. Rüedi T, Webb JK, Allgöwer M. Experience with the dynamic compression plate (DCP) in 418 recent fractures of the tibial shaft. Injury. 1976; 7: 252-257.

15. Williams TH, Schenk W. Bridging-minimally invasive locking plate osteosynthesis (Bridging-MILPO): technique description with prospective series of 20 tibial fractures. Injury. 2008; 39: 1198-1203.

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