



Treatment of Schatzker Type III Tibial Plateau Fractures: Report of an Alternative, Percutaneous Technique and Brief Review of the Literature

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Abstract

Schatzker III Tibial Plateau Fractures (TPF) reduction and stabilization is still a challenging procedure. We present an alternative, percutaneous surgical technique. With an antero-medial transverse incision at the level of the tibial metaphysis, under fluoroscopic control, an osteotome is advanced from medial to lateral, under the depressed fragments, reducing the articular surface of the lateral TP anatomically, without create a significant void and preserving the lateral wall. Final fixation is achieved with screws placed from lateral to medial in a percutaneous fashion, parallel to the articular surface to hold fragments in a rafting way. Open surgical techniques hidden many pitfalls and several new reduction options have been described; some simple but invasive using bone tamps and bone graft that increase surgical trauma, others reliable and safe, but demanding and difficult to reproduce, needing good arthroscopic skills or special and expensive instrumentation, not always available in the operating theatre. We prefer a medially based percutaneous metaphyseal bone access using two simple flat low profile instruments such as osteotomes, that preserve bone and vascularization during the reduction maneuvers, minimizing the above mentioned risks, for the treatment of Schatzker type III TPF.

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Keywords: Tibial plateau fractures; Schatzker III; Percutaneous surgery; Technique

Abbreviations: TPF; Tibial plateau fractures; MCL; Medial collateral ligament; ROM; Range of motion

Introduction

Tibial plateau fractures (TPF) are consequence of high-energy trauma in young patients or a lower-energy trauma due to osteoporosis, in the elderly population, increasingly involved in high-risk sports like skiing [1]. Anatomic reduction and fixation, restoration joint congruency and stability and ultimately, prevention of degenerative osteoarthritis is the goal in the treatment of these fractures. In Schatzker type III TPF reduction is a challenging procedure, due to integrity of the lateral condylar wall and many pitfalls hidden in conventional open surgical

technique [2]. Several new treatment options have been described for the management of these fractures, some simple but invasive using bone tamps and bone graft that increase surgical trauma [3], others reliable and safe but demanding and difficult to reproduce, needing good arthroscopic skills [4-5] or special and expensive instrumentation, not always available in the operating theatre [6-7]. In this article we describe an alternative, percutaneous surgical technique, preserving soft tissues, limiting the need of bone grafting or cement stabilisation, in the management of Schatzker type III TPF.



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Surgical technique

The surgery can be performed under general or peripheral anesthesia. The patient is positioned supine with the hip and knee slightly bent and the articular surface of the tibial plateau perpendicular to the floor. A non sterile tourniquet is placed on the affected side. The controlateral limb is secured in a leg holder to enable the C-arm for an Antero-Posterior (AP) and lateral (LL) view. The limb is then draped and prepared in a sterile fashion. Arthrocentesis for evacuation of hemarthrosis, if necessary, and clinical stability tests under anesthesia are performed prior incision. If meniscal tears are suspected, in case of young patients, an arthroscopy can be done, to assess these pathologies.

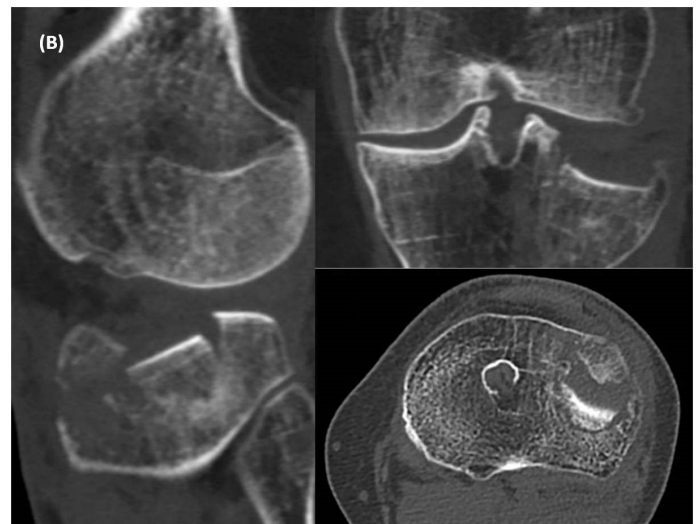
Typically a 2 cm antero-medial transverse incision is made at the level of the tibial metaphysis preserving the large insertion of the Medial Collateral Ligament (MCL) and parallel to the articular surface (**Figure 1**). A straight 20 mm large Lambotte osteotome is advanced, like in open wedge high tibial osteotomy, just under the depressed articular area of the lateral tibial plateau, taking care to preserve the lateral wall. In the next step Lambotte osteotome is substituted with a straight 20 mm large polygonal handle osteotome that ensures firm handgrip (in case of small diameter knee a 15 mm osteotome is to be used). Once below the depressed area with the flat face of the osteotome, a gentle counter force and smooth rotational movements reduce the articular surface, without create a significant void, taking care not to penetrate the joint. The procedure is followed step by step with accurate fluoroscopic images in AP and LL views. Care should be taken to safely identify and visualize fluoroscopically the top edge contour line of the depression area, in order to recognize the optimum level of the joint congruence in both AP and LL views. Important tip is an accurate position of the flat face of the osteotome 1 cm under the depressed area and almost parallel to it in order to elevate the entire portion of the subchondral cancellous bone. Once satisfied with reduction, one or two guide K-wires are advanced, from the lateral

side in a percutaneous fashion, to hold fragments, passing just at the tip of the osteotome and below the compressed tibial plateau. Triangulation between the tip of the osteotome and K-wire ensures correct placement of the screws under the depressed area. Then, one or two partially threaded cannulated 6.5 mm cancellous screws are placed parallel to the articular surface to hold reduction in a rafting way with a washer. In case of important comminution, smaller diameter subchondral raft screws are additionally placed, to supplement fixation. Reduction can also be confirmed arthroscopically, especially when soft tissue injuries are highly suspected in case of articular depression greater than 11 mm [8].

Post-operative management includes the use of a hinged knee brace allowing Range Of Motion (ROM) from 0° to 40° for the first 3 weeks. After this period it is recommended to increase ROM by 10° every 5 days until full ROM is achieved. Clinical and radiological check is made every month until healing. No weight bearing is allowed for two months after surgery. Thereafter the patient starts with partial weight bearing achieving full weight bearing not earlier than three months from operation. Thromboprophylaxis with subcutaneous heparin has been given to all patients during that period.



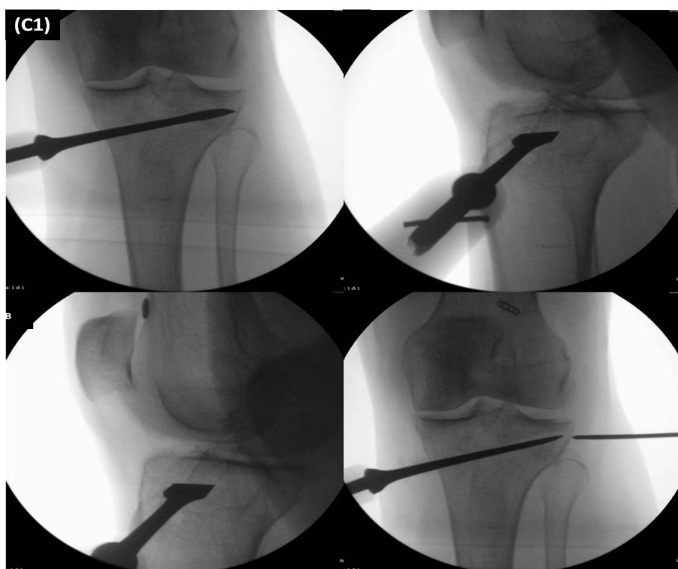
Case Figure: A



Case Figure: B



Case: A 61 year-old female with a displaced Schatzker III TPF, (A) pre-op x-rays, (B) computed tomography, (C1 and C2) accurate intraoperative fluoroscopic check (AP and LL views) of the reduction and stabilisation process, (D) final fluoroscopic check and x-rays after complete healing.



Case Figure: C1



Case Figure: C2



Case Figure: D

Discussion

In Schatzker type III TPF open reduction is a challenging procedure especially in osteoporotic bone. Excessive dissection due to integrity of the lateral condylar wall with higher risk of infection and difficulties in visualization and managing of the fragments are major drawbacks [2-3].

Minimally invasive techniques using bone tamp is a well known procedure. With a cortical window and fluoroscopic control, a bone tamp is advance under the depressed tibial plateau reducing the articular surface. However, this technique presents several pitfalls such us bone compression and comminution, due to multiple metaphyseal paths needed for the reduction, compromising stability [9].

All-arthroscopic reduction and internal fixation is also safe and reliable method but demanding, needing advanced arthroscopic skills, special instrumentation and adjustments not always available 4-5. Compartment syndrome could be a serious complication in difficult cases with prolonged arthroscopic assisted surgery time. In our experience arthroscopy is necessary when soft tissue injuries are highly suspected [10].

Tibioplasty is also a useful tool for the treatment of TP depression fractures. Fracture augmentation with cement allows early rehabilitation and spare the patients from bone auto-grafts. Major drawbacks are the expensive disposable instruments, the prolonged surgery and hospitalization time and the risk of articular cement leakage in multifragmented fractures [6-7]. Remove cement and fill the bone defect in case of knee arthroplasty after post-traumatic osteoarthritis is a concern.

We prefer a medially based minimally invasive metaphyseal approach that preserves the lateral wall minimizing the above mentioned risks. A flat instrument, like osteotome, is ideal to reduce the depressed fragments, eliminating the need for auto-grafts, especially in osteoporotic bone or fragmented articular surface. We recommend this technique in Schatzker type III TPF.

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Declaration of competing interest

The authors have no competing conflict of interest

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Informed consent

Informed consent was obtained from the patient for this study.

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