The Outcome of Complex Tibial Plateau Fractures (Schatzker type V and VI) Treated with Dual Plates

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Abstract

Background: Isolated lateral locked plating does not provide sufficient fixation to resist collapse of the medial condyle in bicondylar tibial plateau fractures, leading to loss of axial alignment of the limb, producing varus deformity and poor long-term outcomes. Dual locked plating of bicondylar tibial plateau fractures are required to reduce the risk of mal-reduction and loss of reduction and prevents secondary post traumatic osteoarthritis. Hence we evaluated functional and radiological outcome of dual locking plates in proximal tibial plateau fractures Schatzker type V and VI.

Material & Methods: Twenty-two cases of tibial plateau fractures Schatzker type V and VI treated with dual locking plates, antero-lateral and medial buttress plating were evaluated for functional outcome using Knee Society Score and radiological outcome was evaluated for union and alignment by modified Rasmussen radiological assessment score.

Results: A total of 22 patients with mean age 34 years (range 22 to 49 years) were included in the study. 16 were male and 6 were female. The mean delay in surgery was 5.3 days (range 3 to 9 days). All Fractures were united at mean duration of 14.4 weeks, and the mean time to full weight-bearing was 12 weeks. The mean range of knee motion was 121°. The mean knee severity score was 85. 18 patients had excellent results, 2 had good results, 1 had fair result and 1 had poor result as per Knee severity score. As per Rasmussen radiological assessment score 20 had excellent and one each had good and fair results and none of the patient had poor results. Two with superficial infection and one had hardware prominence but none of the patients had non-union, arthritis or secondary loss of reduction.

Conclusion: Schatzker type V and VI fractures require double plate fixation for optimal stability, which prevents secondary loss of reduction and varus/valgus collapse of the fracture and provides excellent radiological and function outcome.

Keywords: Tibial plateau fracture, dual locking plate, Knee severity score

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Introduction

Tibial plateau fractures are high energy fractures and remain challenge to orthopaedic surgeons [1]. Early techniques of osteosynthesis emphasized anatomical reduction and rigid fixation of fractures. Isolated lateral locked plating does not provide sufficient fixation to resist collapse of the medial condyle, leading to loss of axial alignment of the limb, producing varus deformity and poor long-term outcomes. Studies have indicated that dual locked plating of bicondylar tibial plateau fractures reduces the risk of mal-reduction and loss of reduction

and hence prevents secondary post traumatic osteoarthritis [2,3]. The tibial plateau fractures are associated with severe soft tissue injury and application of dual plate by two approaches and two incisions will add to the soft tissue damage already present from the injury [4]. Minimal invasive techniques can decrease this surgeon related morbidity. Thus we evaluated functional and radiological outcome of dual locking plates in proximal tibial plateau fractures Schatzker type V and VI.

Material and Methods:

Twenty-two cases of bicondylar tibial plateau fractures treated with dual locking plates were included in our study after ethical committee clearance and written consent by the patients. Tibial plateau fractures Schatzker type V and VI with age more than 18 years, closed fractures or open Gustilo Anderson type I were included in this study [5,6]. Tibial plateau fracture Schatzker I to IV, pathological fracture, open fracture type II or more, associated with neurovascular injury or age less than 18 years were excluded from the study.

All the patients underwent X-ray of involved limb and 3D CT Scan for detailed study of fracture pattern. At the time of admission, all patients were evaluated for their general condition, routine blood investigations and chest X-ray. Limb was kept elevated and cold fomentation was encouraged to reduce edema and swelling. Surgery was differed in patients with swelling and blisters till wrinkles appeared over the skin.

All tibial plateau schatzker type V and VI fractures were operated under spinal anesthesia under C arm control under tourniquet, only after the swelling was reduced. In all cases the anatomic reduction of the articular surface was achieved and temporary fixed with k wires after confirmation by C arm in both the views. The depressed fragment was elevated in all the cases. Following this in all cases a buttress plate was applied on the medial side or posteromedial side to buttress medial or posteromedial fragment through posteromedial approach. Another locking hockey plate was applied on the over anterolateral side by minimal invasive methods via standard lateral approach, by sliding the plate in the submuscular plane.

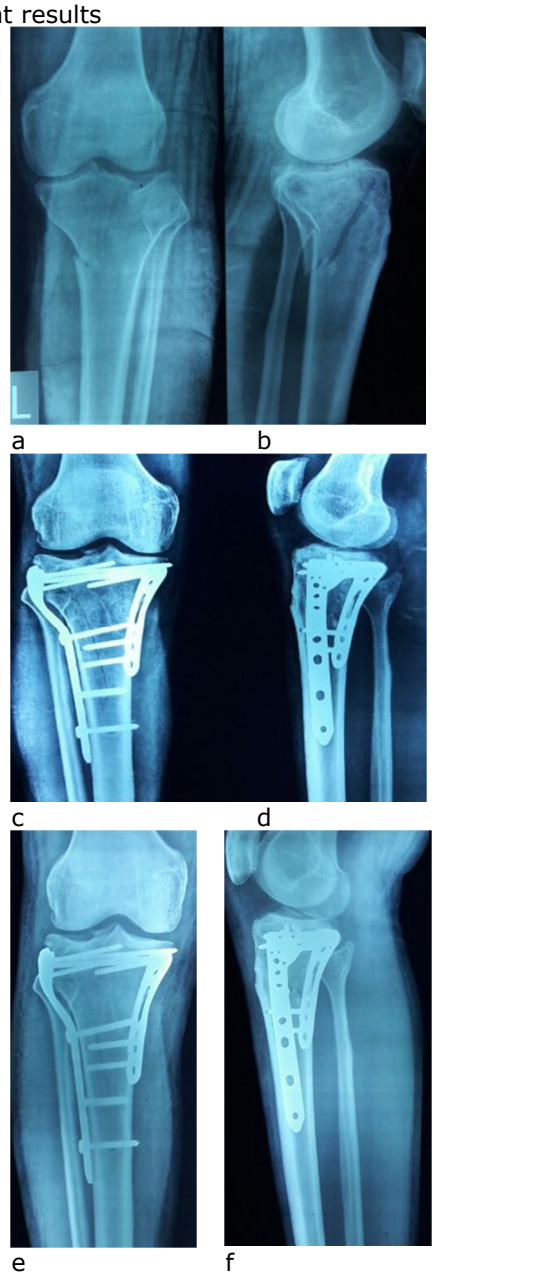
Post-operatively, an above knee slab support was given. Check dress was done after 48 hours of surgery. Sutures and slab support was removed at two weeks. After that active and active assisted physiotherapy and range of motion exercises were encouraged. All patients were followed up for a period ranging from 14 weeks to 40 months. Functional outcome was evaluated using Knee Society Score and radiological outcome was evaluated for union and alignment by modified Rasmussen radiological assessment score and by Paley criteria [7,8]. According to Paley et al. an increase of 5° malalignment or an articular depression of 2 mm compared with the first postoperative radiograph was defined as secondary loss of reduction [8].

Results

A total of 22 patients of tibial plateau schatzker type V and VI with mean age 34 years (range 22 to 49 years) were included in the study. 16 were male and 6 were female. Right side was involved in 14 case and left side in 8 cases. The mean delay in surgery was 5.3 days (range 3 to 9 days).

All fractures were united at mean duration of 14.4 weeks, and the mean time to full weight-bearing was 12 weeks. At the final follow-up visit, no patients showed knee instability; the mean range of knee motion was 121°. The mean knee severity score of the series was 85. Amongst all patients, 18 patients had excellent results, 2 had good results, 1 had fair result and 1 had poor result as per Knee severity score. As per Rasmussen radiological assessment score 20 had excellent and one each had good and fair results and none of the patient had poor results (fig 1). There was no change in the radiological findings between their immediate postoperative and final follow-up X-rays. All patient had good reduction (articular step <2mm) except one patient with double plates, in whom there was 4 mm articular step.

Fig 1. Pre-operative, immediate post-operative and 6 months followup X rays AP (a, c & e) and lateral (b, d & f) view of 35 year old male patient with Schatzker type VI fracture treated with dual plates. Clinical photographs (g,h & i) at 6 months showing excellent results



Complications were seen in three cases, two with superficial infection which healed with antibiotics and one had hardware prominence which required removal after union. None of our case had non-union, arthritis or secondary loss of reduction.

Discussion:

In tibial plateau fractures, to preserve normal knee function, treatment must aim to re-establish joint stability, alignment, and articular congruity to ensure a full range of motion. In complex tibial plateau fractures, it is mandatory to anatomically reduce the articular part of the fracture in order to prevent the secondary arthritis and achieve a stable articular and metaphyseal fixation to facilitate the fracture healing regardless which treatment option is selected [1]. Moreover, soft tissue complications can be largely minimized by staging the treatment of the patient. Treatment with hybrid external fixator to treat tibial plateau fractures have shown fewer complications of soft tissues compared with internal fixation, but reports have shown that the use of a hybrid external fixator can cause joint infection [9,10].

The LCP system a new concept in plate osteosynthesis that attempts to combine the advantages of minimally invasive surgical approaches utilizing anatomically pre-shaped plates with the screws that lock into the plate forming the fixed angle device. The locking screws provide a fixed angle device at each screw plate interface [3,4]. The locking plate system combined with indirect reduction technique limits the surgical trauma inflicted while stabilizing the fracture. Studies have shown that a lateral locking plate is not always sufficient to protect the fracture from collapse, and an additional medial plate is necessary to further stabilize the fracture and prevent subsidence of medial fragment [3,11]. Horwitz et al compared the mechanical stability of fixation of an unstable bicondylar tibial plateau fracture with several different fixation techniques in a cadaveric model and found better results with fixation with a lateral buttress plate with an anteromedial antiglide plate [12].

We evaluated the outcome of dual locking plates for Schatzker type V and VI tibial plateau fractures in 22 patients and found that more than 90% patients have excellent functional and radiological outcome.

David Barei et al on treating 41 bicondylar tibial plateau fractures with dual incisions and medial and lateral plates found that accurate reduction could be achieved in only half of the complex fractures [13]. In our study we were able to achieve good reduction almost all the cases which is the reason for excellent results in our series. Jiang et al compared 43 patients of bicondylar fracture tibia with dual plates and 41 patients with LISS plates and found no statistically significant differences in adequate reduction rates of the articular surface, union rate or radiographic healing time, infection, between the Dual Plate (DP) group and the LISS group [4]. LISS plate group showed significantly higher cases of malalignment of the proximal tibia most frequently involving deformity in the sagittal plane compared to DP group. But secondary loss of reduction and loss alignment was comparable in both the groups. But study by Gosling et al in 62 tibial plateau fractures treated with single LISS plate showed 16 patients had substantial loss of reduction [3].

Z Yu et al treated 62 patients of tibial plateau fractures with double plates [14]. At the final follow-up visit, no patients showed knee instability and no statistically significant difference in the functional outcomes was observed between their 6-months and final follow-up visits; or in the radiological findings between their immediate postoperative and final follow-up examinations in terms of alignment. We also, in our study did not found change in the radiological findings between their immediate postoperative and final follow-up X-rays. All patient had good reduction (articular step <2mm) except one patient and this reduction was maintained in the long term follows also.

Dual plate is not without complications, and it has its own complication like infection, hardware related complications, thromboembolism and compartment syndrome, whereas single plate has fewer complication rates like varus collapse [13,14]. But in our study we did not encountered any compartment syndrome or thromboembolism, but two patients had superficial infection which healed with antibiotics and one had hardware prominence which required removal after union.

Our study has several limitations like fewer patients, shorter followup and lack of randomization. Even articular reduction can't be precisely evaluated on plain radiographs; Computed tomography study is required to accurately evaluate articular reduction instead.

Conclusion:

Locking plate fixation is preferred treatment option for complex tibial plateau fractures with excellent radiological and function outcome, especially complex fractures like Schatzker type V and VI fractures which require double plate fixation for optimal stability. This double plate configuration prevents secondary loss of reduction and varus/ valgus collapse of the fracture. Satisfactory surgical restoration of the articular component of these injuries guides the patient outcomes. We concluded that a satisfactory articular reduction with use of the described surgical technique positively affects patient outcome. Satisfactory reduction can be achieved even in the patients with more severe injuries for better radiological and clinical outcome.

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