

Outcome of Minimal Invasive Lateral Buttressing in Proximal Metaphyseal-Articular Tibial Fractures

¹MUHAMMAD HANIF, ²RAZA ELAHIRANA, ³TANVIR AFZAL, ⁴MUHAMMAD USMAN KHALID, ⁵SAIF-UR-REHMAN, ⁶YAWARANIS

¹Associate Professor Department of Orthopedics FJMU/SGRH,² Assistant Professor Department of Orthopedics FJMU/SGRH,³Post Graduate Resident Department of Orthopedics SGRH, ⁴Senior Registrar Department of Orthopedics Mayo Hospital⁵Post Graduate Resident Department of Orthopedics SGRH⁶Professor of Orthopedics FJMU/SGRH, Lahore.

Correspondence to: Muhammad Hanif, Associate Professor Department of Orthopedics FJMU/SGRH, Lahore.

ABSTRACT

Background: Management of comminuted bicondylartibial plateau fractures remains a difficult task for the surgeons and mode of treatment is controversial. Open reduction and internal fixation may result in major wound problems. Our study evaluated the functional outcome of minimally invasive plating in high energy tibial plateau fractures.

Materials and Methods: 31 patients having Schatzker type V and VI were treated with minimally invasive technique and were followed up in outpatient department. Radiographs were obtained and functional outcome was determined by the Oxford Knee Score criteria.

Results: Patients were followed up to 20th postoperative week and at the end of the final follow up radiographic union was seen in all patients. Oxford Knee Score was excellent in 21 patients, good in 7 patients and moderate in 3 patients. The patients in moderate category were those which had fasciotomy done for compartment syndrome following injury. No complication regarding soft tissue was seen.

Conclusions: Minimal Invasive Percutaneous Plate Osteosynthesis produces excellent radiological and functional outcome in proximal tibial fractures

Keywords: Minimal invasive, High energy, Proximal tibia

INTRODUCTION

Bicondylar proximal tibial fractures are associated with high energy trauma. The severity of injury not only affects the metaphyseal-articular region of proximal tibia but also badly damage the soft tissue envelope of the bone. The soft tissue injury makes the surgical management challenging for the surgeons and at times controversial regarding the method of treatment.^{1,2,3}

Different surgeons have adopted different methods for the management with the common aim i.e anatomical restoration of articular surface, achieving mechanical alignment and early mobilization of the joint. Ilizarov fixator¹, hybrid external fixation⁴, external and limited internal fixation², arthroscopic assisted operative management⁵, internal fixation with dual plates⁶ and use of 1/3 tubular plate for restoration of postero medial column⁷, all have been documented in the literature with merits and demerits of each.

The aim of this study was to evaluate the functional outcome of minimally invasive buttress

plating in Schatzker type V and VI with the hypothesis that it has very good functional outcome since minimal soft tissue damage is the key factor of this method.

MATERIAL AND METHOD

A descriptive case series was conducted in the department of Orthopedic Surgery of Fatima Jinnah Medical College/ Sir Ganga Ram Hospital Lahore from June 2014 to December 2015. 31 patients presenting with high energy trauma resulting into metaphyseal-articular fractures of proximal tibia and treated by minimally invasive technique were evaluated. Schatzker type I to IV were excluded from the study. Fractures with extensive soft tissue injury, Gustilo-Anderson type III and associated vascular injury were also excluded from the study.

Demographic data, mechanism of injury and classification of fracture were documented. Investigations including routine hematological and radiography were done. In a few cases 3D CT scan was also done to understand the fracture

geometry. All patients were operated by single surgical team within 72 hours of injury. 3 out of 31 patients had developed compartment syndrome which was managed by fasciotomies. However, minimal invasive fixation was carried on and fasciotomy wounds were closed subsequently.

Preoperative antibiotics (Cefoperazone Sodium 1g, Sulbactam Sodium 1g and Amikacin 500mg) were given preoperatively and continued 72 hours postoperatively. Patients were discharged on the second postoperative day and were followed up on regular basis in outpatient department. Patients who developed compartment syndrome had hospital stay till the wounds were closed gradually.

Operative Procedure

Patients were operated under spinal anesthesia, in supine position and over a radiolucent table. Tourniquet was applied in all patients. Traction was applied and the fracture geometry reassessed under image intensifier. Procedure was initiated by paying attention to the posteromedial column of the proximal tibia. This column (which was broken in majority of the cases) was restored by a posteromedial incision, limited soft tissue dissection and application of 1/3rd tubular plate and 3.5mm screws.

Subsequently, with longitudinal traction, valgus or varus force and using point reduction clamps, articular surface was anatomically restored as much as possible. Reduction was confirmed through C-arm images. Sometimes the depressed fragments had to be elevated with the help of K wires or a Hohman through an incision not more than 1 cm.

The reduced fragments were stabilized temporarily with the help of K wires and later permanently with screws through the plate.

A small incision was made on the anterolateral aspect of the proximal tibia to slide the buttress plate. With the help of periosteum elevator, the tibialis anterior was elevated subperiosteally to make room for the plate to slide in. Confirming the placement of plate in the correct position a stab incision was made over the hole just distal to the fracture and a 4.5mm cortical screw was applied to fix the plate temporarily. It was followed by application of locking screws in the metaphyseal area and in the cortical bone distal to the fracture. (Fig.1)

Longest possible plate was applied and distance between the two screws was kept as

much wide as possible so that the soft tissue in between two screws remained intact.

The proximal wound was closed over a drain and the stab wounds made for insertion of screws were kept open so as to allow drainage of the fluid in the respective subcutaneous space (Fig.2). Dressing was done with sterilized cotton and crepe bandage and back slab was applied.



Fig.1: Application of Locking plate in the submuscular plane with a long stem



Fig.2: Stab wounds for the application of screws in the shaft

Follow up

Patients were discharged from hospital within 48 hours of surgery with the advice of non weight bearing and isometric quadriceps exercises. Patients were called on 7th to 10th postoperative day for removal of stitches. Back slab was removed after 4 weeks and active range of motion exercises advised. Weight bearing was advised

according to the progress of union of the fracture assessed radiographically.

All patients were regularly followed up on 4th, 8th, 12th, 16th and 20th week postoperatively and radiographs were obtained in each visit. The Oxford Knee Score criteria⁸ was obtained for each patient and results were formulated. (Table 1)

Oxford Knee Score	Grade
0-19	Poor
20-29	Moderate
30-39	Good
40-48	Excellent

RESULTS

34 patients with proximal tibial fractures of Shatzker V and VI were operated in our institute from June 2014 to December 2015. Three patients were lost in followup and therefore the remaining 31 (n= 31) were included in the study and were followed up till the 20th postoperative week. 23 were male and 8 were female with the age ranging from 18 to 65 (mean 35 years). Road Traffic Accident was the mode of injury in all the patients.

Three patients developed compartment syndrome. Fasciotomy was done on emergency basis but internal fixation was done in the same setting with minimal soft tissue handling. All three patients had low Oxford Knee Scores as compared to rest of the patients in the study. Fasciotomy wounds were closed with dermatraction over an average period of 14 days.

All patients were operated within 72 hours of injury. All surgeries were done with fluoroscopic assistance. Posteromedial column restoration was done in 22 patients as a first step in the procedure. Rest of the 9 patients was managed by lateral buttressing plate fixation only.

All 31 patients in our study showed radiological signs of union i.e visible bony bridges across fracture lines within 6 to 22 weeks (average 12 weeks). 21 patients had knee ROM 120° and above and excellent Oxford Knee Score. 7 patients had good score and 3 had moderate score. None of the patients had poor score nor was any soft tissue complication seen. (Fig.3) There was statistically insignificant difference, when stratified the outcome for various age and gender groups (p>0.05).



Fig. 3 : Good range of motion at 20th postoperative week

DISCUSSION

High-energy proximal tibial fractures have always remained a challenge for orthopaedic surgeons because of multiple factors. Soft tissue and vascular trauma along with bony injury, displacement of the fractured fragments, availability of C arm, post-surgical complications like wound infection and loss of motion are a few factors which make the management very challenging. Above all the experience and expertise of the operating surgeon is a key factor in the management^{9,10}

Open reduction and internal fixation techniques are associated with very high wound complication rate particularly in cases where both condyles are being managed through a single midline incision.¹¹

Many alternate methods were adopted to avoid these complications and for a better outcome but each has its own advantage and disadvantage. In this study, efficacy of yet another method of treatment was assessed. The primary focus in this study was over the integrity of the periosteum as we believe that it has the pivot role in the healing process. Retention of the periosteum *in situ* around

a fracture site results in rapid infilling with woven bone, as rapidly as in two weeks^{12,13,14}

Restoration of articular surface was done in this procedure followed by stabilization of fracture fragments without disturbing the periosteum. Traditional incisions were avoided and locking plate was applied in the submuscular plane. Number of screws was kept to minimum and stability was achieved by using plates with long stems.

Reduction of articular surface was achieved in most of the cases but in a few cases slight step of 2 mm or less was seen. However, this did not affect the final functional outcome. Slight articular incongruity is tolerated because of the presence of menisci^{15,16}

Restoration of posteromedial column and lateral plating has been done by other authors as well with promising results. Prasad⁸ restored the lateral column by curvilinear long incision and using buttress plate subperiosteally after stabilizing the medial column. He reported a case of common peroneal nerve palsy and another with delayed wound gapping which required secondary closure after debridement.

In our series, we had no soft tissue complications. The surgical wounds healed in time except for the fasciotomy wounds which were closed gradually by dermotraction.

CONCLUSION

It is concluded that minimal invasive percutaneous plate osteosynthesis in high energy tibial plateau fractures produce excellent to good functional outcome and minimal soft tissue complication. Restoration of articular surface and stable fixation is essential of early knee mobilization and integrity of periosteum is mandatory for speedy bone healing.

REFERENCES

1. Dendrinis GK, Kontos S, Katsenis D, Dalas A. Treatment of high-energy tibial plateau fractures by the Ilizarov circular fixator. *J Bone Joint Surg Br* 1996;78:710-7.
2. Marsh JL, Smith ST, Do TT. External fixation and limited internal fixation for complex fractures of the tibial plateau. *J Bone Joint Surg Am* 1995;77:661-73.
3. Stamer DT, Schenk R, Staggers B, Aurori K, Aurori B, Behrens FF. Bicondylartibial plateau fractures treated with a hybrid ring external fixator: A preliminary study. *OrthopTrauma* 1994;8:455-61.

4. Gaudinez RF, Mallik AR, Szporn M. Hybrid external fixation of comminuted tibial plateau fractures. *ClinOrthopRelat Res* 1996;328:203-10
5. Buchko GM, Johnson DH. Arthroscopy assisted operative management of tibial plateau fractures. *ClinOrthopRelat Res* 1996;332:29-36.
6. Prasad GT, Kumar TS, Kumar RK, MurthyGK, Sundaram N. Functional outcome of Schatzker type V and VI tibial plateau fractures treated with dual plates. *Indian J Orthop* 2013;47 issue 2:188-94.
7. Rana RE, Akhtar MS, Hanif M, Saeed KM. Restoration of posteromedial cortex with additional antiglide plate in bicondylar tibial plateau fracture fixation: radiographic and clinical outcome. *Pak J Med Health Sci* 2014; 8(3):606-608.
8. Dawson J, Fitzpatrick R, Murray D, Carr A. Questionnaire on the perceptions of patients about total knee replacement. *J Bone Joint Surg Br.* 1998 Jan;80(1):63-9
9. FernandezDL. Anterior approach to the knee with osteotomy of the tibial tubercle for bicondylartibial fractures. *J Bone Joint Surg Am* 1988;70:208-19.
10. Moore TM. Fracture-dislocation of the knee. *ClinOrthopRelat Res* 1981;156:128-40
11. Moore TM, Patzakis MJ, Harvey JP. Tibial plateau fractures: Definition, demographics, treatment rationale, and long term results of closed traction management or operative reduction. *J Orthop Trauma* 1987;1:97-119
12. Knothe UR, Dolejs S, Matthew Miller R, Knothe Tate ML. Effects of mechanical loading patterns, bone graft, and proximity to periosteum on bone defect healing. *J Biomech.* 2010;43:2728-2737.
13. Knothe Tate ML, Ritzman TF, Schneider E, Knothe UR. Testing of a new one-stage bone-transport surgical procedure exploiting the periosteum and bone transport for repair of long bone defects. *J Bone Joint Surg Am.* 2007;89:307-316.
14. 87. Knothe Tate ML, Dolejs S, McBride SH, Matthew Miller R, Knothe UR. MultiscaleMechanobiology of De Novo Bone Generation as well as Remodeling & Adaptation of Autograft - An Integrative Review. *J MechBehav Biomed Mater.* 2011;4:829-840.
15. Buckwalter JA, Brown TD. Joint injury, repair, and remodeling: roles in posttraumatic osteoarthritis. *ClinOrthop* 2004;423:7-16.
16. Lundy DW, Albert MJ. Pearls and pitfalls in the treatment of tibial plateau fractures. *AAOS Now Sep.* 2007;1:21.