Original Research Paper

Volume : 5 | Issue : 8 | August 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

Outcome of High Velocity Tibial Plateau Fractures Managed by Dual Plating

Medical Science

KEYWORDS : fracture, tibial plateau, dual plating, Honkonen Jarvinen criteria

Sukumaran Subbiah Subramanian	Associate professor of Orthopedics, Chengalpattu medical college, Chengalpattu, Tamilnadu
Anantharaman Chinnadurai	Associate professor of Orthopedics, Thoothukudi medical college, Thoothukudi, Tamilnadu, India.
*** Mugundhan Moongilpatti Sengodan**	Associate professor of Orthopedics, Coimbatore medical college, Coimbatore, Tamilnadu * Corresponding Author
Manojkumar R	Department of Orthopedics, Kilpauk medical college, Chennai, Tamilnadu, India

ABSTRACT

Schatzker's type V &VI fractures occur due to high velocity trauma. They contribute to 20 – 40 % of tibial plateau fractures. The use of Isolated Lateral Locking plate and Dual Plates is still a debate. The aim of this study is to prospectively analyze the clinical, functional and radiological outcome of high velocity tibial plateau fractures managed by dual plating. Our study reported Honkonen Jarvinen Clinical outcome to be 80.5% excellent and17% good. The functional outcome was 70.7 % excellent and 19.5 % good. The Radiological outcome showed 85.4 % excellent and 12.2 % good results.

INTRODUCTION

Tibial plateau fractures are intra-articular fractures of major weight bearing joint [1]. These fractures represent a wide spectrum of severity which ranges from simple injuries with predictable excellent outcome after non operative treatment to complex fracture patterns that challenge even most experienced surgeons [2].

Tibial plateau fractures represent approximately 1 % of fractures in adults [2]. These fractures occur commonly in 3rd to 5th decade [3]. Schatzker's type V &VI fractures occur due to high velocity trauma. They contribute to 20 – 40 % of tibial plateau fractures [2].They include bicondylar fractures & proximal metadiaphyseal dissociation fractures. In these fractures local soft tissue injury, compartment syndrome, associated ligament instability have to be looked for [3].

The controversy of surgical vs. conservative management for high velocity tibial plateau fractures is overcome by enlightening the goals for operative management which are anatomic reduction, restoration of articular congruity and alignment, stable fixation to allow early knee motion [4].

Among wide spectrum of operative management Dual plating via two incision is preferred technique as it has its own advantages when compared to other modalities of treatment such as Isolated Lateral locking plate, Hybrid external fixator, Ilizarov, LISS. Hence this study is done to emphasize the importance of double plating in management of Schatzker's type V &VI fractures based on Honkonen Jarvinen criteria.

AIM OF THE STUDY

The aim of this study is to prospectively analyze the clinical, functional and radiological outcome of high velocity tibial plateau fractures managed by dual plating at Govt. Kilpauk Medical College Hospital between August 2013 and August 2014.

REVIEW OF LITERATURE

Sarmiento et al in his study showed that bicondylar tibial plateau fractures with intact fibula when managed conservatively resulted in varus malalignment on weight bearing [2]. This led to origin of Operative management in tibial plateau fractures in early 1980's.Every Surgeon had his own criteria to operatively treat these fractures. Hence the need for classifying these fractures evolved [2]. Thus Schatzker's era (1970's) evolved with his major contribution to classifying tibial plateau fractures which remains central among other classifications.

Surgical treatment has now revolutionized in management of tibial plateau fracture [3]. The use of Isolated Lateral Locking plate and Dual Plates is still a debate. Patients treated with isolated lateral locking plate had high risk of loss of reduction and increased incidence of malunion [4&5].

Lasanianos et al showed that collapse of medial tibial plateau occurred in isolated lateral locking plate when he compared the biomechanical properties of intramedullary nail, dual plates and isolated lateral locking plates [6].

While Ilizarov fixation and Hybrid external fixation seems reasonable methods of fixation of these fractures , there are a few problems including the insufficient fracture reduction [7], inconvenience of an external fixator that requires careful maintenance , possibility of pin tract infections , joint capsule penetration with resultant septic arthritis [5], subsequent collapse of fracture fragments [6],and prolonged hospitalization [4].However they are useful in the treatment of open Schatzker's type 5 and 6 tibial plateau fractures [6].

Dual Plating is preferred over other techniques as it has several advantages [5, 7-15]:

- Better visualization of fracture fragments, especially posteromedial fragment and articular surface.
- Dual incision reduces wound complications.
- Both lateral and medial column is fixed to obtain stability.
- Achieves interfragmentary compression.
- Rigid construct.

Tul B Pun et al in his study reported the outcome of 17

tibial plateau fractures. Nine of which were managed by dual plating and 8 managed by hybrid ex fix. Based on Honkonen Jarvinen Criteria all patients could walk, climb stairs, jump, 90% could squat, 50% could duck walk, 85% had plateau tilt <5°, 92 % had articular step off < 2 mm. No major infection [6].

Ebrahim Ghayem Hassankhani et al in his study reported 22 patients with tibial plateau fractures treated with dual plating. The outcome was assessed based on knee society score.86.4 % had excellent, 9.1% had good,4.5 % had fair and no one showed poor results [4]. G.Thiruvengita Prasad et al in his study reported 40 patients fixed with double plating and based on oxford knee society score 30 patients had excellent and 10 patients had good outcome respectively [8].

Yong Zang et al in his study reported 41 patients fixed with double buttress plate and 38 patients fixed with lateral locking plate and buttress plate. The mean Hospital for Special Surgery Score was 77.9 ± 9.4 and 79 ±7.9 respectively [7].

Chang Wug Oh et al in his study reported 23 unstable proximal tibia fractures treated with double plating.21 patients had excellent and radiographic results, 1 patient had shortening (1 cm) ,2 cases had mild varus malalignment (<10°), 1 case had superficial infection which improved with implant removal, no deep infection occurred [9].

MATERIALS AND METHODS

Our study is a prospective study conducted at Kilpauk Medical College Hospital between August 2013 and August 2014. We included Schatzker's Type V &VI tibial plateau fractures in skeletally mature adults less than 60 years. We have excluded open fractures, pathological fractures, pre-existing joint disease and other types of tibial plateau fractures.

Forty one patients were included in the study who satisfied these criteria. The mean age was 32.5 with a range from 20 to 54 years. There was a male predominance (73%). Left tibia was involved in 68% of cases. Schatzker's type VI was more common in our series (32 out of 41). The average period from day of injury to surgery was 5.3 days with a range between 0 to 9 days.

MANAGEMENT PROTOCOL

The injured lower limb was immobilized in above knee splint and if delay of more than 2 days for surgery is anticipated, Calcaneal pin traction was applied. Clinical signs of soft tissue recovery included decreased swelling, absence of fracture blisters, wrinkling of skin around proximal tibia.

Surgical procedure:

The patient in supine position with folded pillow under knee and a sand bag under ipsilateral gluteal region for anterolateral approach and a sand bag under contralateral hip with figure of four position of ipsilateral leg for posteromedial approach. Femoral distractor if needed was used. First indirect fracture reduction was achieved with longitudinal traction, under C-arm guidance. Percutaneous K wires were used to hold the fragments in reduction.

We typically fix medial tibial condyle first. If medial condyle is comminuted we fix lateral condyle to achieve length. Through posteromedial approach to proximal tibia with approximately 6cm incision over posteromedial border of proximal tibia. After opening subcutaneous fat, the long saphenous vein and saphenous nerve identified and preserved. Pes anserinus expansions identified. Tibia approached after incising pes anserinus longitudinally in the line of skin incision. The gastrocnemius muscle was gently freed from posteromedial surface by blunt dissection.

The fracture fragments visualized, reduced under c arm guidance. If there was articular depression a bone punch was used to elevate the depressed portion and the void was filled with bone graft .The reduced fragments were fixed with tibial buttress plate, recon plate or semi tubular plate. The lateral condyle fracture was approached antero laterally. A curved incision was made starting 5 cm proximal to joint line curving the incision anteriorly over Gerdy's tubercle and extend it distally 1cm lateral to anterior border of tibia. Joint capsule was incised. Tibialis anterior was elevated by blunt dissection. Under C arm guidance, fracture reduced and fixed with Proximal Tibia Lateral Locking Compression Plate. Articular depression if present was elevated and the defect was packed with cancellous graft harvested from iliac crest.

Active knee mobilization was encouraged as tolerated from second Post-operative day. Patient was allowed non weight bearing crutch walking. Patient was reviewed every 4 weeks and X rays were taken every month for first 6 months to assess union. Partial weight bearing was started after 8 weeks. Full weight bearing was allowed after radiological evidence of bony union. After 6 months patients were reviewed every 3 months. The Clinical, Functional and Radiological assessment was done based on Honkonen Jarvinen Criteria [figure 1-4].

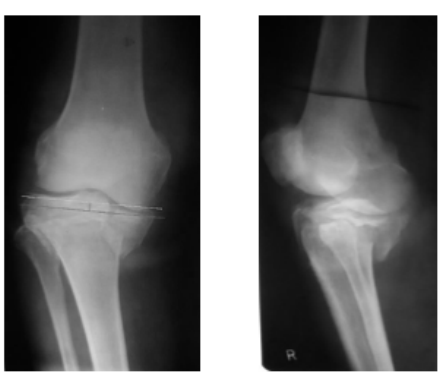

Figure 1. Preoperative X-rays

Figure 1. Preoperative X-rays

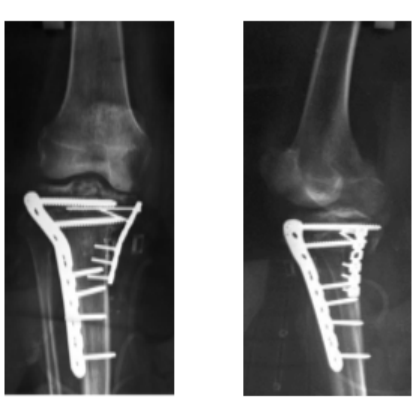

Figure2. Immediate Post-operative X-rays

Volume : 5 | Issue : 8 | August 2016 • ISSN No 2277 - 8179 | IF : 3.508 | IC Value : 69.48

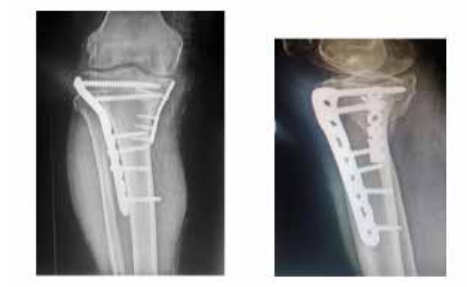

Figure3. At one year follow up X-rays

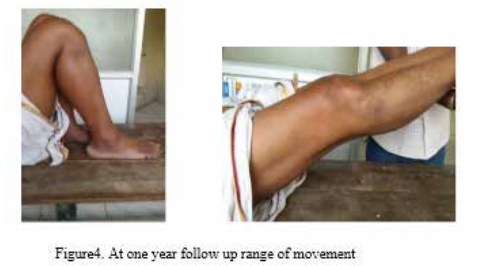

Figure4. At one year follow up range of movement

RESULTS

Bone Grafting was required in 19 patients (46%) to fill metaphyseal defect. Time required for union ranged from 11 to 16 weeks with average being 12.9 weeks. Honkonen Jarvinen Criteria was used for evaluating clinical, functional and radiographic results. None of the patients had extension lag. The average knee flexion was 125.9° with range from 95° to 135°. The average thigh atrophy was 0.5 cm with range from 0 – 1 cm. There was grade1 antero posterior instability in 8 patients.

HJ Clinical Outcome:

Criteria	Excellent	Good	fair	poor
Extension Lag	41(100 %)	-	-	-
Knee flexion	21 (51.2%)	16(39%)	4(9.8%)	-
Thigh Atrophy	37 (90.2%)	4(9.8%)	-	-
Instability	33 (80.5%)	8(19.5%)	-	-
Clinical outcome	33(80.5%)	7(17%)	1(2.5%)	

HJ Functional outcome:

Criteria	excellent	Good	Fair	Poor
Walking	41(100%)	-	-	-
Stair Climbing	39(95.1%)	2(4.9%)	-	-
Squatting	25(61%)	16(39%)	-	-
Jumping	21(51.2%)	12(29.3%)	6(14.6%)	2(4.9%)
Duck Walking	21(51.2%)	10(24.4%)	8(19.5%)	2(4.9%)
Functional outcome	29(70.7%)	8(19.5%)	3(7.3%)	1(2.5%)

HJ Radiological outcome:

Criteria	Excellent	Good	Fair	Poor
Plateau tilt	37(90.2%)	4(9.8%)	-	-
Varus /valgus tilt	41(100%)	-	-	-
Articular step off	34(83%)	7(17%)	-	-
Condylar widening	33(80.5%)	8(19.5%)	-	-
Joint space narrowing	31(75.6%)	8(19.5%)	2(4.9%)	-
Radiological outcome	35(85.4%)	5(12.2%)	1(2.4%)	-

Complications:

In our series 3 patients had superficial infection which improved with wound debridement, sterile dressing and intravenous antibiotics. And one patient had implant prominence of 4mm cancellous screw which was removed and revised with another screw.

DISCUSSION

Complex tibial plateau fractures still remain a challenge to most Orthopedic surgeons. Historically single incision technique for dual plating had high incidence of wound breakdown and infection [8].

With the advent of isolated lateral plating with locking compression plate the spectrum has shifted towards locking plate with medial fragment being stabilized by screws passed through lateral plate. Varus collapse in these patients raised the question of its sustainability and the reason found to be inadequate fixation of posteromedial fragment. This has paved way for dual plating via two incision technique [16-20].

A double incision Double plating technique is recommended by the Association for Osteosynthesis/Association for the Study of Internal Fixation for the treatment of complex tibial plateau fractures [7].

Locking plates provide fixed angle stability and we hypothesized that using lateral locking plates instead of buttress plate may help to prevent Secondary loss of reduction and alignment [6].

Our study reported Honkonen Jarvinen Clinical outcome to be 80.5% excellent and17% good. The functional outcome was 70.7 % excellent and 19.5 % good. The Radiological outcome showed 85.4 % excellent and 12.2 % good results.

Bone grafts were used in 18 of 41 (44%) patients after elevation of depressed articular surface. The mean time of union was 12. 9 weeks ranging from11to16weeks. Bone grafting did not contribute to faster healing as metaphyseal defects heal well without bone grafts. In the report published by Eggli et al bone grafting was employed in 11 of 14 patients [10]. There were no associated injuries in our patients.

CONCLUSION

From our study we conclude that, Posteromedial plating provides a buttress to posteromedial fragment and thereby prevents varus collapse. High velocity tibial plateau fracture can have excellent to good clinical, functional and radiological outcome if proper timing and surgical technique are followed.

References

1. J. Schatzker, "Fractures of the Tibial Plateau," in the *Rational Of Operative Fracture Care*, 2005, pp. 447-469.
2. J.L Marsh, "Tibial Plateau Fractures," in *Rockwood and Green's*
3. *Fracture in Adults*, Wolters Kluwer, 2015, pp. 2303-2367.
4. Mathew.I.Rudloff, "Fractures of the Lower Extremity," in *Campbell's Operative Orthopaedics*, Elsevier, 2013, pp. 2668-2724.
5. E. Hassankhani, F. Kashani and G. Hassankhani, "Treatment of Complex Proximal Tibial Fractures (TypesV & VI of Schatzker's Classification) by Double Plate Fixation with Single Anterior Incision," *Open Journal of Orthopedics*, Vol. 3 No. 4, 2013, pp. 208-212
6. Pelser PC. Controversies in the management of tibial plateau fractures. SA orthop. j. 2010 Jan ; 9(3): 75-82

7. Pun TB, Krishnamoorthy VP, Poonnoose PM et al. Outcome of Schtazkers type 5 and type 6 fractures .Indian J Orthop. 2014 Jan;48(1):35-41
8. Y. Zhang et al "Treatment of Complicated Tibial Plateau fractures with Dual Plating via 2 incision technique," *Orthosupersite.com; volume 35; number 3,* 2012.
9. Prasad GT, Kumar TS, Kumar RK et al. Functional outcome of Schatzker type V and VI tibial plateau fractures treated with dual plates. Indian journal of orthopaedics. 2013;47:188–94
10. Chang-Wug Oh , Jong-Keon Oh , Hee-Soo Kyung et al. "Double plating of unstable proximal tibial fractures using minimally invasive percutaneous osteosynthesis technique," *Acta Orthopaedia ; 77 (3)* , pp. 524-530, 2006.
11. S. Eggli, M. J. Hartel, S. Kohl, U. Haupt, A. K. Exadaktylos and C. Roder, "Unstable Bicondylar Tibial Plateau Fractures: A Clinical Investigation," Journal of Orthopaedic Trauma, Vol. 22, No. 10, 2008, pp. 673-679.
12. Barei D, Nork S, Mills W, Heley MB, Benirschke SK (2004) Complications associated with internal fixation of high-energy bicondylar tibial plateau fractures utilizing a two-incision technique. J Orthop Trauma 18:649–657
13. Musahl V, Tarkin I, Kobbe P, New Trends and technique in open reduction and internal fixation of fractures of tibial plateau J Bone Joint Surg Br. 2009 Apr;91(4):426-33.
14. Barei DP, Nork SE, Mills WJ et al. Functional outcomes of severe bicondylar tibial plateau fractures treated with dual incisions and medial and lateral plates. J Bone Joint Surg Am. 2006; 88:1713–21.
15. M. Ehlinger, M. Rahme, B, K. Moor, et al. Reliability of Locked Plating in Tibial Plateau fractures with medial component. Orthopaedics & Traumatology: Surgery & Research, 2012, Volume 98, Issue 2, pp173.
16. Ricci, WM.; Rudzki, JR. Borrelli Jr R. Treatment of complex proximal tibia fractures with less invasive skeletal stabilization system, *J Orthop Trauma* , vol. 18(8) pp521-52, sep 2004.
17. Phisitkul, Phinit; Mckinley, Todd O; Nepola, James V; et al "Complications of locking plate fixation in complex proximal tibial injuries," *J Orthop Trauma,* vol. 21(2), pp. 83-91, 2007.
18. Higgins, Thomas F; Klatt, Joshua; Bachus, Kent N "Biomechanical Analysis of Bicondylar tibial plateau fixation: how does lateral locking plate fixation compare to dual plate fixation?" *J ortho Trauma,* vol. 21(5), pp. 301-6, 2007.
19. Ratcliff, Jennifer R; Werner, Fred W; Green, Jason K et al. "Medial buttress versus Lateral locked plating in a cadaver medial tibial plateau fracture model," *J Orthop Trauma* , vol. 21, no. 7, pp. 444-448 ,2007.
20. Higgins T, Kemper D, Klatt J Incidence and morphology of the posteromedial fragment in bicondylar tibial plateau fractures. J Orthop Trauma 23:45–51, 2009.
21. Weil Y, Gardner M, Boraiah S, Helfet D, Lorich D. Posteromedial supine approach for reduction and fixation of medial and bicondylar tibial plateau fractures. J Orthop Trauma 22:357–362, 2008.