ORIGINAL ARTICLE

Outcome of 1/3rd Tubular Plate Used as an Antiglide Implant in Bicondylar Tibial Plateau Fracture

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ABSTRACT

To determine the clinical and functional outcome of 1/3rd tubular plate used as an antiglide implant in bicondylar tibial plateau fracture. It was a six months descriptive case series done at orthopedic surgery department Unit-II in Mayo Hospital Lahore, from January 2015 to July 2015. Total 170 patients (128 males and 42 females) were included in this study. Mean age of patients were 36.62±9.67 years. The Body Mass Index (BMI) of 29 (17.1%) patients was obese and for rest of 82.9% was non-obese. After three months, the articular surface depression was excellent in majority of the patients (137; 80.6%) patients, satisfactory in 22 (12.9%) patients and poor in only 11 (6.5%) patients. According to Oxford Knee Score, at 03 months 141 (82.9%) were having excellent result, 15 (8.8%) patients with good results, moderate in 6 (3.5%) and poor in 8 (4.7%) patients. So we conclude that using 1/3rd tubular plate as an antiglide plate in bicondylar tibial plateau fracture addressing posteromedial column produces excellent outcome regarding articular surface with few soft tissue complications.

Keywords: 1/3rd tubular plate, Antiglide implant, union, oxford knee score

INTRODUCTION

Tibial Plateau fractures (proximal tibial fractures) are a complex group of injuries that involves of the most important and major weight bearing joint of the human body[1]. Tibial Plateau fractures constitute 01% of the all fractures in younger and 08% in elders. More than 50% of patients who presented with a tibial plateau fracture are older than 50 years of age[2]. This increase in frequency of tibial plateau fractures in old ages especially in females are due to increase prevalence of post-menopausal osteoporosis[2].

In tibial plateau fractures the extent of soft tissue injury dictates surgical approach and soft tissue swelling dictates the time of definitive procedure[3]. Tibial plateau fractures can be fixed by different methods like with a single plate (unilateral fixation), external fixator (hybrid or simple), dual plate or less invasive stabilizing system (LISS)[4]. The basic principle of fixation is to accurately align the fracture fragments and to maintain this position until the fracture is united. All the patients either having simple fracture or complex one may presents with serious complications or good results. Traction and long casting with immobilization does not reduce the articular surface properly and lack stability, leading to non-union, knee stiffness collapsed articular surface and unacceptable deformities[5].

Prasad GT et al reported functional outcome using Oxford Knee Score criteria in patients with type V/VI fracture. They reported 16(40%) patients had scores between 40 and 48 (showing excellent results). Sixteen patients (40%) had scores between 30 and 39 (good results) and 8(20%) patients between 20 and 29 (moderate)[6]. Another study reported post operative satisfactory-to-excellent results (in terms of maximal joint depression/ fracture reduction) were achieved in 94.4% patients[7] and poor results in 6% patients.

The rationale of this study is to evaluate functional and radiological outcome of 1/3rd tubular plate used as an antiglide implant along with 6.5 mm cancellous screws or single T buttress plate on lateral side in the management of bicondylar tibial plateau fracture. In Pakistan such studies has never been conducted for local population. Thorough this study we were able to generate evidence regarding functional and clinical outcome of this additional antiglide plate using Oxford Knee Score and maximal joint depression respectively. We were expecting similar results in our study as compared to the study mentioned in introduction and we found high frequency of excellent results, so this proposed fixation technique can be used in future to gain more patients' satisfactory

MATERIALS AND METHODS

This was a descriptive case series done at Orthopedic department in Mayo Hospital Lahore using Non probability consecutive sampling technique from January 2015 to July 2015. Total 170 cases were taken, the sample size was calculated using expected post-operative poor results (in terms of fracture reduction) achieved in 5.6% patients.[7] A total of 170 patients were taken after meeting inclusion criteria from out-patient department and accident and emergency unit, Mayo hospital Lahore. After taking informed consent their basic demographical history (name, age, gender) and contact details were taken. Every patient was explained about surgical procedure. We used conventional T-buttress plate or 6.5mm cancellous screws and added 3.5mm 1/3rd tubular plate to address posteromedial cortex and saw postoperative articular surface congruency/ depression, and functional outcome

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on post-op follow-up visits. Surgery was done by single operating team. Post-operatively limb was kept elevated, antibiotics and analgesics were administered and regular assessment of the distal neurovascular status was done. Stitches were removed at 2 weeks post-operatively. The patients were followed up for the clinical and functional outcome (as per operational definition) on 1st, 7th, 14th & 28th postoperative days and finally after 3 months post-operatively. Functional outcome was assessed using Oxford knee score (OKS). The OKS ranges from 0-48 and the scores was graded as poor (0-19), moderate (20-29), good (30-39) and excellent (40-48) on the final follow-up visit after 3 months.

RESULTS

The mean age of patients was 36.62±9.67 years ranged from 18.0 years to 50.0 years. Out of total 170 patients included in this study, 71(41.8%) were in age group of 18-35 years whereas, 99(58.2%) were in 36-50 years age group. Majority of patients were male 128(75.3%) while only 42(24.7%) were females.

The Body Mass Index (BMI) of 29(17.1%) patients was obese and for rest of 82.9% was non-obese. On first post op day, the articular surface depression was excellent in 142(83.5%) patients, satisfactory in 20(11.7%) patients and poor in 8(4.7%) patients. On 7th post op day, the articular surface depression remained excellent in 142(83.5%) patients, satisfactory in 20(11.7%) patients and poor in 8(4.7%) patients.

On 14th post op day, the articular surface depression was excellent in 140(82.3%) patients, satisfactory in 21(12.3%) patients and poor in 9 (5.3%) patients. On 28th post op day, the articular surface depression was excellent in 138(81.1%) patients, satisfactory in 22(13%) patients and poor in 10(5.9%) patients. After three months, the articular surface depression remained excellent in majority of the patients 137(80.6%) patients, satisfactory in 22(12.9%) patients and poor in only 11(6.5%) patients.

When the Oxford Knee Score was assessed at 3 months, it was found that to be excellent in majority of the patients 141(82.9%) patients, good in 15(8.8%) patients, moderate in 6(3.5%) and poor in 8(4.7%) patients. In 18-35 years age group, at 3rd month follow up, the articular surface depression was excellent in 61(85.9%) patients, satisfactory in 4(5.6%) patients and poor in 6(8.5%) patients. In 36-50 years age group, the articular surface depression was excellent in 76(76.8%) patients, satisfactory in 18(18.1%) patients and poor in 5(5.1%) patients. Statistically, there was significant association between age groups and articular surface depression (p-value= 0.045).

In males, at 3rd month follow up, the articular surface depression was excellent in 111(86.7%) patients, satisfactory in 9(7%) patients and poor in 8(6.3%) patients. In females, the articular surface depression was excellent in 26 (61.9%) patients, satisfactory in 13(31%) patients and poor in 3(7.1%) patients. There was highly significant association between gender and articular surface depression (p-value<001).In obese patients, at 3rd month follow up, the articular surface depression was excellent in 29(100%) patients, and none had satisfactory and poor level. In non-obese patients, the articular surface depression was excellent in 108(76.6%) patients, satisfactory in 22(15.6%) patients and poor in 11(7.8%) patients. There was significant association between obesity and articular surface depression (p-value= 0.015).

The Oxford Knee Score at 3rd month follow up, with respect to 18-35 years age group, was excellent in 54(76.0%) patients, good in 6(8.5%) patients, moderate in 5(7%) and poor in 6(8.5%) patients. In 36-50 years age group, the Oxford Knee Score was excellent in 87(87.9%) patients, good in 9(9.1%) patients, moderate in 1(1%) and poor in 2(2%) patients. Statistically, there was a strong association between age groups and Oxford knee score (p-value= 0.035).

The Oxford Knee Score at 3rd month follow up, with respect to male gender, was excellent in 102(79.7%) patients, good in 12(9.3%) patients, moderate in 6(4.7%) and poor in 8(6.3%) patients. In females, the Oxford Knee Score was excellent in 39(92.9%) patients, good in 3(7.1%) patients, and none had moderate and poor outcome. Statistically, there was no association between gender and Oxford knee score (p-value= 0.143).

The Oxford Knee Score at final follow up, for obese patients was, excellent in 23(79.3%) patients, good in 2 (6.9%) patients, moderate in 2(6.9%)and poor in 2 (6.9%) patients. In non-obese group, the Oxford Knee Score was excellent in 118(83.7%) patients, good in 13(9.2%) patients, moderate in 4(2.8%) and poor in 6(4.3%) patients. Statistically, there was no association between obesity and Oxford knee score.

Table 1: Comparison of articular depression at 3 month with respect to age groups

Age groups	Articular surface depression (at 3 months)			Total
	Excellent	Satisfactory	Poor	
18-35	61(85.9%)	45.6%)	6(8.5%)	71(100%)
36-50	76(76.8%)	18(18.1%)	5(5.1%)	99(100%)
Total	137(80.6%)	22(12.9%)	11(6.5%)	170(100%)

P value = 0.045

Table 2: Comparison of oxford knee score at 3 month with respect to age groups

Age group	Oxford Knee Score (OKS) [at 3 months]				Total
	Excellent	Good	Moderate	Poor	
18-35	54(76%)	6(8.5%)	5(7%)	6(8.5%)	71(100%)
36-50	87(87.9%)	9(9.1%)	1(1%)	2(2%)	99(100%)
Total	141(83%)	15(8.8%)	6(3.5%)	8(4.7%)	170(100%)

P value = 0.035

DISCUSSION

The treatment of bicondylar tibial plateau fracture is still debatable and the treatment totally relies on surgeon choice. The definitive surgical indications of such fractures include open fracture, compartment syndrome and vascular injury. Whereas the acceptable articular depression which is recommended in tibial plateau fracture is 02mm to 01cm. While in cases of non-displaced or minimally displaced fractures, there are evidences of successful non-operative treatments even in minimally displaced fractures while

other favors restoration of articular congruency by surgical intervention. The patients with greater than 10^0 of instability in extended knee as compared to contralateral side required surgical intervention[10,11].

Treatment of tibial plateau depends upon the type of fracture pattern like pure depression type injuries are more stable as compared to split type injuries because the cortical rim of the tibia is not distorted so varus and valgus and varus stress can be applied. Conservative management is only reserved for un-displaced and stable fractures. Conservative treatment involves early range of movement and protected weight bearing in hinged brace or cast. Full weight bearing is allowed after 8 to 12 weeks after appropriate clinical and radiological fracture healing[12].

Quadriceps strengthening exercises and range of motion should be started as soon as pain allows and should be progressed from passive to assisted active range of motion. In patients who are not medically fit and adherence to rehabilitation program is not possible and long cast with 45^0 flexion at knee joint is usually advisable as non- operative technique[10-11].

In our study we used 1/3rd tubular plate as antiglide plate along with 4.5mm T-butress plate or 6.5mm cancellous screw on the lateral side of proximal tibia in bicondylar tibial plateau fracture. 1/3rd tubular plate was used as antiglide plate because it is low profile plate over posteromedial cortex of tibia and required less soft tissue dissection. Due to this we hypothesized that we can get better functional outcome with few chances of complications. Our main focus of study was to assess functional and radiological outcome of1/3rd tubular plate.

One proposed option is to apply single locking plate on lateral aspect suggesting that the single plate provides support to medial plateau and prevent varus collapse of tibial plateau. However Gosling et. al conducted a cadaveric study concluding that dual plate using traditional plate and single lateral locking plate provides same outcome and similar resistance to permanent deformation of the construct under load. Surprisingly LISS promotes fracture healing on medial cortex because it allows more movement medially and enhance callus formation[8].

Patil S et.al in 2006 conducted a study comparing 3.5mm cortical screws with 6.5mm cancellous screws in depressed tibial plateau fractures. He concluded that the force required to produce a depression of 5mm of tibial plateau with 04 3.5mm cortical screws was much higher than with that of two 6.5mm cancellous screws in osteoporotic bone but is similar in non-osteoporotic bone.[13] Trenholm et al in 2005 completed a biomechanical study comparing a calcium phosphate cement, BSM and cancellous bone in treating split depression fracture of lateral tibial plateau. He concluded that in BSM group there is significant increase in knee stiffness[14].

In our study the mean age of patients was 36.62±9.67 year ranging from18 to 50 years. Out of total 170 patients included in this study, 71(41.8%) were in age group of 18-35 years whereas, 99(58.2%) were in 36-50 years age group. In this case series, age range was 39-69 years. Majority of patients were male 128(75.3%) while only 42 (24.7%) were females. In above mentioned study there were 50% males and females each[15]. In another study of type V and IV Schatzker fracture, a total of 46 patients were treated with dual plates thru anterolateral approach and MIPPO technique on medial side over a period of 08 years. The results of 40 final patients (6 lost to follow up) showed there were 33(83%) males and 7(17%) females, much similar to our study. The age of the patients varied from 22 to 61 years (mean 40 years close to our mean age)[16,17].

CONCLUSION

Hence due to of such favorable clinical and functional results we may suggest that tubular plating is excellent treatment option for bicondylar and complex tibial plateau fractures. Use of 1/3rd tubular plate as antiglide plate yields excellent results in terms of articular surface congruity and fewer soft tissue complications.

REFERENCES

1. Pelser P. Controversies in the management of tibial plateau fractures. SA Orthopaedic Journal. 2010;9(3):75-82.
2. Perren SM. Fracture healing. The evolution of our understanding. Acta chirurgiae orthopaedicae et traumatologiae Cechoslovaca. 2008;75(4):241.
3. Markhardt BK, Gross JM, Monu J. Schatzker Classification of Tibial Plateau Fractures: Use of CT and MR Imaging Improves Assessment1. Radiographics. 2009;29(2):585-97.
4. Cho K-Y, Oh H-S, Yoo J-H, Kim D-H, Cho Y-J, Kim K-I. Treatment of Schatzker Type V and VI Tibial Plateau Fractures Using a Midline Longitudinal Incision and Dual Plating. Knee Surg Relat Res. 2013;25(2):77-83.
5. Babis GC, Evangelopoulos DS, Kontovazenitis P, Nikolopoulos K, Soucacos PN. High energy tibial plateau fractures treated with hybrid external fixation. Journal of orthopaedic surgery and research. 2011;6(1):1-7.
6. Prasad GT, Kumar TS, Kumar RK, Murthy GK, Sundaram N. Functional outcome of Schatzker type V and VI tibial plateau fractures treated with dual plates. Indian J Orthop. 2013;47(2):188.
7. Yu Z, Zheng L, Zhang Y, Li J, Ma B. Functional and radiological evaluations of high-energy tibial plateau fractures treated with doublebuttress plate fixation. Eur J Med Res. 2009;14:200-5.
8. Mills WJ, Nork SE. Open reduction and internal fixation of high-energy tibial plateau fractures. Orthopedic Clinics of North America. 2002;33(1):177-98.
9. Wiss DA, Capers CM, Williams CB. Master techniques in orthopaedic surgery: fractures.: Lippincott Williams & Wilkins. 407–37; 2006.
10. Rasmussen PS. Tibial condylar fractures impairment of knee joint stability as an indication for surgical treatment. The Journal of Bone & Joint Surgery. 1973;55(7):1331-50.
11. Scolaro JA, Lee G-C. Tibial Plateau Fractures in the Elderly. Fractures in the Elderly: Springer; 2011. p. 269-82.
12. Koval KJ, Helfet DL. Tibial plateau fractures: evaluation and treatment. Journal of the American Academy of Orthopaedic Surgeons. 1995;3(2):86-94.
13. Patil S, Mahon A, Green S, McMurtry I, Port A. A biomechanical study comparing a raft of 3.5 mm cortical screws with 6.5 mm cancellous screws in depressed tibial plateau fractures. The Knee. 2006;13(3):231-5.
14. Trenholm A, Landry S, McLaughlin K, Deluzio KJ, Leighton J, Trask K, et al. Comparative fixation of tibial plateau fractures using α-BSM™, a calcium phosphate cement, versus cancellous bone graft. Journal of orthopaedic trauma. 2005;19(10):698-702.
15. Cho K-Y, Oh H-S, Yoo J-H, Kim D-H, Cho Y-J, Kim K-I. Treatment of schatzker type V and VI tibial plateau fractures using a midline longitudinal incision and dual plating. Knee surgery & related research. 2013;25(2):77-83.
16. Asik M, Sen C, Kilic B, Goksan SB, Ciftci F, Taser OF. High tibial osteotomy with Puddu plate for the treatment of varus gonarthrosis. Knee Surgery, Sports Traumatology, Arthroscopy. 2006;14(10):948.
17. Rana RE, Akhtar MS, Hanif M. Restoration of Posteromedial Cortex with Additional Antiglide Plate in Bicondylar Tibial Plateau Fracture Fixation: Radiographic and Clinical Outcome. PJMHS. 2014;8(3):606