International Journal of Science and Research (IJSR)
ISSN: 2319-7064
SJIF (2022): 7.942

A Comparative Study between Lateral Plate Fixation Versus Dual Plate Fixation for Bicondylar Tibial Plateau Fractures

Dr. Ravi Yadav[1], Dr. Ratan Lal Dayma[2], Dr. Rajendera Soni[3], Dr. Bhanwar Lal[4], Dr. Ankit Jaipal[5], Dr. Prashant Modi[6], Dr. H. L. Dhawan[7]

[1, 2, 3, 4, 5, 6, 7]Department of Orthopaedics, Sawai Man Singh Medical College, Jaipur, Rajasthan, India

Abstract: ***Twenty-eight patients with fracture proximal tibia at S.M.S. medical college were assigned to assess the functional outcome results between lateral plate fixation versus dual plate fixation for bicondylar tibial plateau fractures treated with either single lateral locking plate or dual locking plate and compare pre-operative characteristics, complications during operative procedure and post operative period. Follow-up for minimum 6 months duration to asses clinical outcome and radiological union. When medial tibial condyle is relative intact, a lateral locking plate can provide the same stability as dual plates with shorter operation time and shorter hospital stay and less soft tissue complications, which can facilitate fracture healing but when medial tibial condyle is displaced, dual plate fixation group had better outcome result than lateral plate group to prevent malalignment/ medial collapse.***

Keywords: dual plate, bicondylar tibial plateau fracture, lateral locking plate

1. Introduction

The knee joint is one of three major weight bearing joints in the lower extremity. The proximal tibial fractures are one of the commonest intra articular fractures. The majority of tibial plateau fractures are secondary to high speed velocity accidents and fall from height.(1)Tibial plateau fractures can be categorized according to the Schatzker or AO/OTA classifications, and they constitute approximately 30% of all tibial fractures Bicondylar tibial plateau fractures (BTPFs), as per the Schatzker classification Bicondylar Fracture fall under type V and VI or type 41-C, respectively.(3)The aim of surgical treatment of proximal tibia fracture is to restore congruent articular surfaces of the tibial condyles maintaining the mechanical axis and restoring ligamentous stability eventually can achieve functional painless and good range of motion in the knee joint.(2)To achieve these goals open reduction and internal fixation is mandatory. For open reduction and internal fixation of bicondylar tibial plateau fractures ,several methods can be used like unilateral fixation with single plate, dual plating or bicolumnar plating, hybrid external fixator or a less invasive stablisation system(LISS). The advent of locked plates and angle stable constructs specifically designed for the proximal tibia made it possible to achieve fixation of many displaced bicondylar injuries through unilateral plating only. However there may be change in alignment and articular reduction on long follow-up. The bilateral open reduction and internal fixation technique have been fauvored by the Association for Osteosynthesis/ Association for the Study of Internal Fixation. However, bilateral plating may require excessive dissection through the injured soft tissue, leading to wound complications or compromised osteosynthesis.(4) A minimally invasive surgical approach is desirable for reducing the additional soft tissue trauma. Some authors claimed bicondylar tibial plateau fractures can be stabilized with unilateral locked plating technique while avoiding medial soft tissue dissection.(5,6)This reduces complications associated with bilateral plate fixation, but it is unclear whether it will maintain the acquired articular reduction compared to bilateral plate fixation.(7,8) Dual plating via two incision technique has received recent support because it allows for direct visualization of the articular reduction while minimizing the need for stripping off the soft tissue in the fracture area. With multitude of surgical procedures available, there still remains ambiguity regarding the ideal approach for bicondylar tibial plateau fractures.

2. Material and Methods

The study was conducted in orthopaedics department of S.M.S. medical college from July 2021 to December 2022 with minimum 6 month follow up. 28 cases(14 cases in each lateral plate and bicolumner plate group) were studied for pre-operative characteristics, surgical procedure, hospital stay, complication during operative and post-operative period and radiological union and functional outcome on basis KSS, RFS score on regular follow-up between lateral plate fixation versus dual plate fixation for bicondylar tibial plateau fracture.

3. Follow Up Plans

- Clinical follow up was at 2 weeks, 6 weeks (Clinical and radiological), 3 months, 6 months and regarding healing of the fracture based on Clinical examination and radiographs.
- Functional outcome analysis was done by Rasmussen functional score and Knee society score.
- Radiograph were used to assess medial collapse/malalignment or degree of joint depression and any angulation in both coronal and frontal plane.

4. Observations and Results

Out of 28 patients, 18 patients (64.3%) belonged to male gender and 10 patients (35.7%) belonged to female gender.

Mean age group of lateral plate group was 33.86±11.18 and in dual plate group was 32.21±10.24.

According to mode of injury maximum 22 patient reported with road traffic accident in both group.

According to fracture pattern maximum number of patients belonged to Schatzker type V.

Mean operation time in LP group was 72.57±12.03 minutes and the operation time in DP group was103.36± 12.77 minutes and the application of t-test showed that this difference was statistically significant.

Both dual plate and lateral plate surgery performed after tourniquet application so there is minimal loss of blood during both surgical procedure but we found that the mean blood loss in DP group was little bit higher than blood loss in LP group.

Mean hospitalization period in LP group was lower than DP group (7.79 ± 0.70 days in LP group versus 9.79 ± 1.19 days in DP group) but the application of t test showed that this difference was statistically significant.

Different scoring systems have been defined and preferred in order to evaluate the functional results of tibial plateau fractures. We used Rasmussen functional score (RFS Scoring system), Knee Society Score (KSS) and range of motion to compare results of DP versus LP. The mean KSS in LP group was 71.93 ± 4.51 and the mean KSS in DP group was79.21 ± 3.31 and the application of t test showed that this difference was statistically significant. The mean RFS in LP group was 20.71 ± 1.64 and the mean RFS in DP group was 24.21 ± 2.15 and the application of t test showed that this difference was statistically significant. ROM is one of the most frequently used parameters to evaluate the functional status of patients after BTPFs. Mean ROM was higher in DP group than LP group (119.71±2.61in LP group versus 122±2.42 in DP group) and the application of t test showed that this difference was statistically significant.

Patients information and surgical details:

Parameter	Lateral plate		Dual plate	
Mean Age (years)	33.86±11.18		32.21±10.24	
Sex	Female	5	Female	5
	Male	9	Male	9
Mode of Injury	FALL	3	FALL	3
	RTA	11	RTA	11
Schatzker Classification	TypeV	12	TypeV	12
	TypeVI	2	TypeVI	2
Operation Time(minutes)	72.57±12.03		103.36±12.77	
Hospitalization Period (days)	7.79±0.70		9.79±1.19	
KSS Score	71.93±4.51		79.21±3.31	
RFS Score	20.71±1.64		24.21±2.15	
ROM	119.71±2.61		122±2.42	

Non-unions are seldom reported complications after proximal tibia fracture, probably because of the good healing potential of the metaphyseal bone (presence of cancellous bone at metaphyseal end) compared with the diaphysis, none of the patients either in LP group or inDP group developed non-union. Radiographically an atomic joint reduction and proper alignment of the tibial condyle are critical for early mobilization and creation of a functional knee joint, Causes such as injury to the nutrient vessels, bone defects, and the lack of stable fixation have been reported as the cause of non union. Soft tissue injury after BTPFs is an issue that should be considered for orthopedic surgeons. In some cases, treatment modalities may change according to the soft tissue injury. Proper care during preoperative period like limb elevation reduce the swelling and decrease soft tissue injury during operation and proper tissue and skin closure decrease the chances of skin necrosis.

Preoperative and postoperative use of antibiotics And proper suture line care and dressing during postoperstive period reduce the chance of infection. Only one case in dp group present with superficial infection during follow up which was controlled after antibiotic coverage. No case reported with deep infection in either group.

5. Complications

Parameter	Lateral plate	Dual plate
Inection	0	1
DVT	0	0
Non-union	0	0
Delayed-union	0	0
Malalignment/ Medial collapse	2	0

6. Discussion

Relatively few studies have been performed in past to formally compare between lateral plate fixation versus dual plate fixation for bicondylar tibial fracture. Single lateral plate fixation of bicondylar tibial plateau fracture using Single lateral incision improves soft tissue preservation, reduces surgical time, and favours the outcomes. However studies demonstrate that tibial fixation using lateral locked plate causes the highest rates of loss of reduction, vicious consolidation and complains related to the decrease range of motion. When we use dual platting for bicondylar tibial plateau fractures two incision increase more soft tissue dissection, increase chance of infection, increase surgical time and hospital stay, but favours outcome in less rates of loss of reduction or medial collapse and increase range of motion. So there is dilemma among clinicians regarding selection of single plate versus dual plate for Bicondylar tibial plateau fractures. Georgiadis et al concluded that dual plate fixation is the gold standard method in Schatzker typeV/VIBTKFs[9].

Yoo et al. found that the single lateral locked plate technique was insufficient in fixing the posteromedial fragment, so medial plate should be added to the BTPF treatment [10]. Higgins et al. and Egol et al., intheir biomechanical analyses, showed that patients treated with DP had less collapse in the medial plateau than patients who were treated with LP [11]. Yao et al. and Weaver et al. stated that LP treatment is sufficient and safe if the BTPFs meet the criteria of tibial condyles in bone contact, simple fractures in the sagittal plane, and large, non-marginal medial fragments [5, 12]. Meng-Hsuan Lee et al. in their

study found that mean Operation time in LP was 76.6 ± 14.73 minutes and mean operation time in DP was 101.4 ± 18.23and there was statistically significant differences which is consistent with our study.

Menghi et al. followed up 38 patients operated on for BTPFs for a minimum of one year, and evaluated the patients who were treated using single and double plates, in terms of functionality, with the KOOS and 36-Item Short Form Health Survey, and reported that satisfactory results were achieved in both groups.They could not find a significant difference between the groups [13].

In the study conducted by Lee et al., 38 patients who were operated on for BTPFs were divided into three groups, as patients who received a single-plate, a classical double-plate, or hybrid double-plate treatment, and no significant difference was found between the three groups in terms of ROM.

Yu Z et al. in their study on 54 patients who were treated using a double buttress plate due to BTPFs were followed up for a minimum of one year, and an average of 107.6° flexion was achieved in the knee joint.

Meng-Hsuan Lee et al. in their study found that mean hospitalization period in LP was lower than DP(9.3 ± 4.27 days in LP group versus15.6 ± 8.71 days in DP group)and there was statistically significant differences which is consistent with our study.

Ceyhun Çağlaretal. In their study found that union was achieved in all of the patients and non union was not observed. The stable fixation that was applied and filling the bone defects with an allograft minimized the non union rate.

Ceyhun Çağlar et al. in their study found that superficial infection was detected in two patients in the DP group, and deep tissue infection was detected in one patient in the LP group, and all were treated without complications.

During follow up not a single patient reported with complication in form of DVT in both groups because maximum of our patients belong to younger age group without any co-morbidities like obesity.

So which ever technique is used in the surgical treatment of BTPFs, soft tissue should be care fully evaluated before surgery and minimal dissection should be performed during surgery in order to minimize soft tissue injury.

7. Summary and Conclusion

1) ThebloodlossandhospitalizationperiodinDualplategroup waslittlebithigherthanlateralplategroup.
2) On functional outcome dual plate fixation had been proved to be superior than lateral plate fixation.
3) The mal alignment and Medial collapse were little bit higher in lateral plate fixation thandualplate.
4) The soft tissue infection were more seen in dual plate fixation than lateral plate fixation.
5) When medial tibial condyle is relative intact, a lateral locking plate can provide the same stability as dual plates with shorter operation time and fewer soft-tissue complications, which can facilitate fracture healing and shorten the patient's hospital stay but when medial tibial condyle is displaced, dual plate fixation had an advantage over lateral plate fixation in maintaining the anatomic alignment of knee during follow-up examination.

References

[1] Gosling T, Schandelmaier P, Marti A, Hufner T, Partenheimer A, Krettek C. Less invasive stabilization of complex tibial plateau fractures: a biomechanical evaluation of a unilateral locked screw plate and double plating. J Orthop Trauma 2004; 18: 546-51
[2] Messmer P, Regazzoni P, Gross T. New stabilization techniques for fixation of proximal tibial fractures (LISS/LCP). Ther Umsch 2007; 60: 762-67
[3] Schatzker JO, MCBROOM R, BRUCE D. The Tibial Plateau Fracture: The Toronto Experience 1968-1975. Clinical orthopaedics and related research. 1979;138:94-104
[4] Moore TM, Patzakis MJ, Harvey JP. Tibial plateau fractures: definition, demographics, treatment rationale, and longterm results of closed traction management or operative reduction. J Orthop Trauma. 1987;1(2):97-119
[5] Weaver MJ, Harris MB, Strom AC, et al. Fracture pattern and fixation type related to loss of reduction in bicondylar tibial plateau fractures. Injury. 2012; 43(6):864-9.
[6] Mueller KL, Karunakar MA, Frankenburg EP, Scott DS. Bicondylar tibial plateau fractures: a biomechanical study. Clin Orthop Relat Res. 2003;(412):189-95.
[7] Chang H, Zhu Y, Zheng Z, et al. Meta-analysis shows that highly comminuted bicondylar tibial plateau fractures treated by single lateral locking plate give similar outcomes as dual plate fixation. Int Orthop. 2016;40(10):2129-41
[8] Watson JT. Tibia: proximal. In: Ruedi TP, Murphy WM, eds. AO principles of fracture management. Stuttgart: Thieme; 2000. 499-517
[9] Mubarak S J, Owen C A. Double-incision fasciotomy of the leg for decompression in compartment syndromes. JBone Joint Surg Am 1977; 59:184-7.
[10] Parekh A A, Smith WR, SilvaS, Agudelo JF, Williams AE, HakD, et al. Treatment of distal femur and proximal tibia fractures with external fixation followed by planned conversion to internal fixation. J Trauma 2008;6(3):736-Q
[11] Moore TM, Harvey JPJ. Roent genographic measurement of tibial- plateau depression due to fracture. J Bone Joint SurgAm 1974; 56:155-60
[12] Wicky S, Blaser PF, Blanc C H, Leyvraz P F, Schnyder P, Meuli RA. Comparison between standard radiography and spiral CT with 3D reconstruction in the evaluation, classification and management of tibial plateau fractures. EurRadiol 2000;10:1227-32
[13] MuiL W, Engelsohn E, Umans H. Comparison of CT and MRI in patients with tibial plateau fracture: can CT findings predict ligament tear or meniscal injury? Skeletal Radiol 2007;36:145-51