



Orthopaedics

COMPARISON OF CLINICAL AND RADIOLOGICAL RESULTS BETWEEN DUAL PLATING AND SINGLE LATERAL PLATING WITH MEDIAL TENS NAILING FOR COMPLEX BICONDYLAR PROXIMAL TIBIA EXTRA ARTICULAR FRACTURE

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ABSTRACT **Background:** in this study our aim was to compare results of dual locking plate fixation technique and lateral locking plate fixation with tens nailing from medial side for complex bicondylar proximal tibia fracture without posterior column involvement. **Aim:** To compare functional clinical and radiological results of patients treated with dual plating and single lateral locking plate fixation with tens nailing from medial side for complex bicondylar proximal tibia fracture without posterior column involvement. **Method:** We evaluated 70 patients who underwent surgical intervention for complex proximal tibial fracture between May 2020 to May 2024. 35 patients were included in group A and Treated to dual locking plate and 35 patients were included in group B and treated to lateral locking plate with tens nailing from medial side. In both groups functional clinical and radiological outcomes were observed according to knee society scoring system, Rasmussen functional and radiological score ,knee range of motion. **Results:** Mean follow up time was **16.6** months for Group A and **14.3** months for Group B patients. There were no significant differences between the two groups in term of functional clinical and radiological outcomes at final follow up. **Conclusion:** -In complex proximal tibial extraarticular fracture without posterior column involvement lateral plating with tens nailing from medial side showed similar functional clinical and radiological outcomes as dual plating at final follow up with reduced operating time and skin necrosis ,wound dehiscence and infection in single lateral plating with tens nailing from medial side.

KEYWORDS : Rasmussen's Criteria, Dual Locking Plate, Radiological Outcome, Oxford Knee Score, Schatzker, Unstable Bicondylar Tibial Plateau Fracture.

INTRODUCTION:

Tibial condyle with articular surface forms major part of knee joint and plays major role in weight transmission and mobility. incidence of proximal tibial fracture is 1% of all fractures in adults and 8% in elderly due to osteoporosis^[1-2]. Treatment of complex proximal tibial fractures is technically difficult and controversial. Proximal tibia fracture occurs due to axial loading, varus, valgus applied forces, while treatment goal is to obtain anatomical alignment and joint stability, early Range of motion^[1-2,3]. Inappropriate treatment can lead to complications such as infection, wound dehiscence, instability, nonunion, deformity, osteoarthritis in complex proximal tibial fracture^[4]. Many different treatment techniques are used for fracture fixation to treat these fractures. Open reduction and internal fixation with dual plating technique have been favored by association for osteosynthesis, Association for study of internal fixation, and is considered as gold standard for bicondylar fracture^[5]. However dual plating may require extensive Tissue dissection, more surgical time and more blood loss and may lead to wound complications and compromised fracture healing and wound healing. To reduce soft tissue trauma less invasive approach is needed^[6]. To avoid soft tissue damage instead of dual plating we used lateral simple plate and tens nail from medial side, this reduces complications which was associated with dual plating. Single lateral plating may lead to loss of fracture reduction as varus collapse, malunion, osteoarthritis, Reduced Range of motion^[7] which is prevented by tens nailing from medial side, tens from medial side supports medial column.

We hypothesized in this study that in selected complex proximal tibia fracture without posterior column involvement lateral locking plate fixation technique with tens nailing from medial side would provide functional clinical and radiological outcomes comparable to those of dual locking plate fixation technique while simultaneously reducing time for surgery, chance of infection, wound dehiscence, skin necrosis, blood loss, economic burden on patients, improving fracture healing.

AIMS AND OBJECTIVES:

Our aim in this study was to compare functional clinical and radiological results of patients treated with dual plating and single lateral locking plate fixation with tens nailing from medial side for complex proximal tibial fracture without posterior column involvement.

MATERIAL AND METHODS:

Ethical:

Ethical committee's approval was duly taken. Data was collected in the department of Orthopaedic surgery from the bed side tickets of the patients after taking a short history and informed consent from the patient.

Source Of Data:

All patients admitted in the Orthopaedic wards in all the units of Maharani Laxmi Bai Medical College, Jhansi diagnosed to have bicondylar proximal tibia fracture were included in the study without bias on a serial basis.

Study Design:

This is a prospective study consisting of 70 patients who underwent surgical intervention for complex proximal tibial fracture between May 2022 to May 2024. 35 patients were grouped as group A 35 patients grouped as group B. Group A Patients got treatment with dual locking plate fixation and group B patients got treatment with lateral locking plate fixation with tens nailing from medial side.

Inclusion Criteria:

- Age >18 years to 60 years.
- Skeletally mature patients.
- Complex bicondylar proximal tibia fracture (Schatzker type V, VI) without involvement of posterior column.
- Patients willing to participate in study.
- Gustilo Anderson type I and type II compound proximal tibia fracture.
- No depression of medial articular surface.

Exclusion Criteria:

- <18 or >60 years age
- Proximal tibia fracture with posterior column involvement
- Patients with Gustilo - Anderson Type 3 compound proximal tibial fractures.
- Skeletally immature patients
- Pathological fracture

Statistical Analysis:

The data was summarized as mean values with standard deviations

(SD). The statistical analysis was performed using unpaired T-test. The statistical package for social science 21.0 for Windows computer software (SPSS Inc., Chicago, IL) was used for statistical analysis. P value less than 0.05 was considered significant.

METHOD:

Operative Procedure -

All patients were operated under spinal anaesthesia, pneumatic tourniquet was applied. In group A patients for dual plating anteromedial and anterolateral incision was made. After soft tissue dissection under longitudinal traction anatomical alignment and fracture reduction was achieved and checked under C arm fluoroscopy. By using lateral locking plate and locking screws definitive fixation was achieved. In Group B patients for single lateral locking plate and tens nailing from medial side we made an anterolateral incision after soft tissue dissection fracture was fixed with plate and screws. For medial tens nailing 1 cm incision made over medial side of proximal tibia 2 cm below joint line at middle of anteroposterior girth of tibia. Tens was introduced from proximal fracture fragment to distal fracture fragment, to avoid difficulty in advancing tens nail, it was introduced 2-3 screws fixation of plate proximally and distally. Tens of 2.5 to 4 cm diameter was introduced according to available intramedullary space. In this group subchondral screws as long as possible was used to secure medial part of tibia. Choice of fixation technique was based on surgeons preferences. Third generation cephalosporin antibiotic prophylaxis and low molecular weight heparin for preventing venous thromboembolism was used. All patient were encouraged to perform active and passive Range of motion exercises on third post operative days under supervision of physiotherapist. After 2 weeks suture was removed.

Functional, Clinical, Radiological Evaluation -

Patients were followed up at 6 weeks, 12 weeks, 6 months and 12 months. In both group of patients functional clinical and radiological outcomes after treatment were rated according to knee society scoring system, Rasmussen functional score and Rasmussen radiological score [Figure 1].

Radiological healing was defined as callus bridging of three of four cortices on anteroposterior and lateral view radiograph as well as painless weight bearing on affected limb [11]. Radiological assessment were carried out from immediately postoperative to last visit at outpatient clinic with 3 months interval. Last clinical and radiological outcomes were performed at final follow up.



Figure 1: Outcome of lateral plating with tens nailing from medial side

RESULTS:

Patients characteristics are shown in Table 1,2,3,4. There was no significant differences between group A group B in terms of patients age, gender, fracture type, side of limb involvement.

Table 1: Age Wise Distribution

Age (in years)	Group A [Dual plating]		Group B [Single Lateral Plating]	
	N	%	N	%
18-30 years	8	22.86%	9	25.71%
31-40 years	8	22.86%	9	25.71%
41-50 years	12	34.29%	8	22.86%
51-60 years	7	20.00%	9	25.71%
Total	35	100%	35	100%

Table 2: Sex Wise Distribution

Age (in years)	Group A [Dual plating]		Group B [Single Lateral Plating]	
	N	%	N	%
Male	24	68.57%	19	54.29%
Female	11	31.43%	16	45.71%
Total	35	100%	35	100%

Table 3: Fracture Type Distribution

Fracture type	Group A [Dual plating]		Group B [Single Lateral Plating]	
	N	%	N	%
Schatzker type V	12	34.29%	23	65.71%
Schatzker type VI	23	65.71%	12	34.29%
Total	35	100%	35	100%

Table 4: Side Involvement Distribution

Side involvement	Group A [Dual plating]		Group B [Single Lateral Plating]	
	N	%	N	%
Right	17	48.57%	12	34.29%
Left	18	51.43%	23	65.71%
Total	35	100%	35	100%

Table 5: Post Operative Complications

Complication	Group A [Dual plating]		Group B [Single Lateral Plating]	
	N	%	N	%
Immediate complication	3	8.57%	1	2.86%
Late complication	5	14.29%	3	8.57%

Table 6: Mean Age, Mean Surgical Time, Mean Union Time, Mean Follow Up Time

	Group A [Dual plating]	Group B [Single Lateral Plating]	p-value
Mean age (in years)	40.66±11.593	40.37±12.166	0.91
Mean surgical time (in minutes)	139.71±10.428	89.29±5.165	0.001
Mean union time (in weeks)	15.03±2.242	14.40±1.802	0.19
Mean follow up (in month)	16.67±6.306	14.34±5.688	0.10

Table 7: Mean Functional Outcome At 12 Month

Functional outcome	Group A [Dual plating]	Group B [Single Lateral Plating]	p-value
KSS	80.34±3.048	79.23±4.386	0.22
ROM	121.43±7.334	120.57±6.835	0.61
RFS	26.83±2.051	26.82±1.336	0.98
RRS	14.80±1.952	15.14±1.630	0.43

There were no significant difference between the groups with regard to knee society scoring system (KSS), Rasmussen functional score (RFS), Rasmussen radiological score (RRS), Knee range of Motion (ROM).

DISCUSSION:

In this study we compared clinical, functional, radiological results between dual plating and single lateral locking plate with tens nailing from medial side for complex Bicondylar proximal tibia fracture without posterior column involvement.

Aim of operative treatment for complex proximal tibial include

anatomical alignment and restoration of articular congruity, rigid fixation for recovery of previous range of motion^[3]. There are many different surgical technique that have been advocated for the management of complex proximal tibial plateau fracture such as Dual buttress plate, locking plate, external fixation (ring or unipolar), Minimally invasive techniques (LISS system), Medial fixator and lateral plating (combination of internal and external fixation)^[5,6].

Advantage of dual plating technique are visual reduction and maintenance of proximal tibia alignment but there is risk of soft tissue damage, damage to periosteal blood supply.

Some authors claimed single lateral locking plate fixation can decrease risk of soft tissue damage, infection but it can not provide adequate stability to fracture for complex proximal tibial fractures^[5,7].

There is posteromedial fragment present in frequency of 33 % in bicondylar tibial plateau fracture^[6] so single lateral plating can not provide adequate stability in all bicondylar tibial plateau fracture. Lateral locking plate with medial tens nailing can provide adequate fracture fixation in complex bicondylar proximal tibial plateau fractures with reduced risk of malalignment and varus collapse^[8,9]. TENS from medial side maintains medial column and prevents varus collapse.

Biomechanical and cadaveric studies have shown dual locking plate fixation technique in bicondylar tibial plateau fracture allows less collapse when compared to lateral locking plate fixation technique^[10-11]. But dual plate fixation technique has very risk of infection, increased surgical time, skin necrosis wound dehiscence, more blood loss, which is reduced in single lateral plating with tens nailing from medial side.

Different scoring system have been recommended to evaluate functional results of complex proximal tibial fracture, we used knee society scoring system, Rasmussen functional scoring system in this study. With regard to these systems there was no significant differences between both groups of patients **Table 7**. Our results are comparable with those of other published studies with 82% satisfaction rates. Jiang et al.^[12] reported high incidence of malalignment, loss of reduction of complex proximal tibial fracture in Less invasive stabilization system. Dual plating is standard treatment for complex proximal tibial fracture so single lateral plating cannot replace it^[13].

Similarly another biomechanical study using cadaveric model of bicondylar proximal tibial plateau fracture reported less collapse in load bearing than isolated lateral locking plate. This suggested single lateral locking plate is not sufficient for bicondylar tibial plateau fracture^[11].

In our study single lateral plating with tens nailing from medial side was used for complex proximal tibial fracture without posteromedial fragment which showed no loss of reduction and malalignment post operatively and results were comparable with dual plating as standard treatment.

In another mechanical study by Mueller et al^[13] stability was compared between unilateral locking plate fixation and double plating fixation. Result was similar to study of Yao et al^[7] who suggested shape of medial condyle plays a key role in post operative loss of reduction and malalignment for proximal tibia fracture. They reported that there was no significant difference in post operative malalignment and malreduction between dual plating and single lateral plating for proximal tibial fracture in patients with relatively intact media condyle. Similarly in our study Radiological outcomes assessed by Rasmussen radiological score (RRS) showed no significant difference between both groups **Table 7**.

Soft tissue complications are major concern in treatment of bicondylar tibial plateau fracture with plates and incidence is reported to range from 5 % to 88%^[3].

Optimal timing of surgery, surgical time, soft tissue protection and prevention of infection are important factors^[8]. With use of single incision and less soft tissue damage, less surgical time, less blood loss fracture healing may be improved in single lateral plating. Deep infection with plates has been reported to occur up to 22 % in proximal tibial fractures^[14] in our study there was one deep infection and 2 superficial infection in group A (6%) which was cured with antibiotics

and wound care. In Group B one patient had one superficial infection **Table 5**.

Articular incongruity and join instability can lead to early post traumatic joint degeneration and arthritis. Incidence of in proximal tibia fracture is 17-83 %^[5]. Since follow up period in our study was relatively short incidence of arthritis was not as high as seen in other studies. In total 8 patients (5 in group A and 3 in group B) has developed arthritis **Table 5**.(Kellgren Laurence grade 1-3) when compared to uninjured side. So our results are comparable to those in other published studies.

Nonunion of bicondylar tibial plateau fracture had an incidence of approximately 4%^[6]. Nutrient vascular injury, lack of adequate fixation can cause these complications^[6]. There was no nonunion in both groups of study which is attributed to less damage to periosteal blood supply and less extensive soft tissue dissection. Mean union time 15.03 weeks for group A and 14.04 weeks for group B was observed and there was significant less surgical time for group B patients in comparison of group A **Table 6**.

Spongious bone defect can occur in complex proximal tibial fractures which can be filled with bone graft, bone graft provides mechanical support and prevents collapse. In our study Bone graft was used in 2 patients one in group A and one in group B.

One of limitation of this study is relatively small number of patients for which post hoc analysis could not be performed. In addition there was also short duration of follow up. Studies with large number of patients with long follow up periods in Randomized controlled manner can provide better results and accurate assessment. Dual locking plate fixation and lateral locking plate fixation technique are effective method in treatment of complex proximal tibial fractures when used properly.

CONCLUSION:

Lateral locking plate fixation with tens nailing from medial side can provide comparable clinical, functional, radiological outcomes with dual locking plate fixation technique for treatment of complex proximal bicondylar tibial fracture without posterior column involvement.

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