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Functional outcome and duration of union in proximal tibial fractures treated with locking compression plate

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Abstract

Introduction: Proximal tibial fractures are one of the commonest intra-articular fractures. The various clinical studies established that bone beneath a rigid conventional plate is thin and atrophic which are prone for secondary displacement due to insufficient buttressing and secondary fractures after removal of plate, fracture site take longer period to osteosynthesis due to interruption of vascular supply to bone due to soft tissue and periosteal stripping.

Aims and objectives: To treat proximal tibial fractures with locking compression plate in adults. To evaluate the functional outcome and radiological union time in proximal tibial fractures treated with locking compression plate.

Method and Materials: 26 patients were selected of age group 18-70 yrs presenting with fracture of proximal tibia on the basis of OPD and emergency admissions in M.B. Govt Hospital Udaipur. Fractures were classified as per schatzker classification. All patients were treated operatively with locking compression plating and its outcomes were assessed using Rasmussens scoring and complications were observed with follow up to 6 months clinically and radiological imaging.

Result: Out of 26 cases 21 patients were treated by ORIF and 5 patients were treated by MIPPO, 84, 6% cases were male and 15.4% cases were female. Mean duration of union was 18.46 weeks. Most patients had good range of motion of 130°. Most patients had no complications, joint stiffness and infection found in some cases. The final outcome of the fracture most patients had excellent results (13 patients).

Conclusion: In our study we found that proximal tibial locking plate provides complete union and early mobilisation to attain better functional outcome. Even in osteoporotic bone, bone graft is not essential for defect in metaphyseal region as LCP internal fixator system act as single implant and prevent collapse of fracture intraoperatively and postoperatively subsequently bone deficient will heal by callus formation.

Keywords: ORIF-open reduction and internal fixation, MIPPO-minimal invasive percutaneous plate osteosynthesis, LCP-locking compression plate

Introduction

The knee joint is one of the major weight bearing joints in the lower extremity. Proximal tibial fractures are one of the commonest intra-articular fractures. Generally these injuries fall into two broad categories, high energy fractures and low energy fractures. Fractures of the proximal tibia are the results of high-energy injuries, and because of the lack of soft tissue coverage in this region, it is vulnerable and open fractures are commonly encountered. In such cases, the treatment of damaged soft tissues is of primary concern [1].

The majority of tibial plateau fractures are secondary to high speed velocity accidents and fall from height [2]. Fractures result from direct axial compression, usually with a valgus or varus moment and indirect shear forces [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 [4].

The various clinical studies established that bone beneath a rigid conventional plate is thin and atrophic which are prone for secondary displacement due to insufficient buttressing and secondary fractures after removal of plate, fracture site take longer period to osteosynthesis due to interruption of vascular supply to bone due to soft tissue and periosteal stripping.

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So there was the birth of a new concept of biological fixation using the plates, otherwise called minimally invasive percutaneous plate osteosynthesis (MIPPO).

But this was difficult as conventional plates needed to be accurately contoured to achieve good fixation, osteoporosis also posed the same problem of poor fixation with conventional plates this lead to the development of the internal fixators [5]. Point contact-fix I later Point contact fix-II.

As more and more concepts about biological fixation become clearer the innovation of plates progressed and lead to the development of less invasive stabilizing system. Research to combine these two methods has lead to the development of the anatomically contoured locking compression plate [6].

This new system is technically mature as it offers numerous fixation possibilities and has proven to worth in complex fracture situations and in osteoporotic bones.

Material and Method: Hospital based prospective interventional study conducted in Orthopaedics department of Rabindranath Tagore (RNT) Medical College & Maharana Bhupal Hospital Udaipur (Rajasthan), on the basis of OPD and emergency admissions 26 patients who met the inclusion criterias were selected and treated surgically with locking compression plating during the period of October 2017 to October 2018. Patients were informed about the study, written consent was taken, and then they were evaluated.

Inclusion Criteria: All Schatzker's classification type 1 to 6 proximal tibial fractures in adults.

- Fracture less than 3 week of duration.
- Aged 18 years and above of either sex.

Exclusion Criteria: Age group of less than 18 years.

- All open fractures of proximal tibia.
- Extraarticular fractures of proximal tibia.
- Patients with pathological proximal tibial fractures other than osteoporosis.
- Patients not fit for surgery, managed conservatively for other medical reasons.

Surgical Technique: The proximal tibia fracture was temporarily immobilized above knee joint. Once the patient selected for surgery, pre-operative planning and investigations were done and the patients were posted for surgical intervention. Two techniques were used for fixation of # proximal tibial fractures.

(A) Open reduction and internal fixation (ORIF) of tibial fractures by locking compression plate- Incision made using anterolateral approach. Curve the incision anteriorly over gerdy's tubercle and extend it distally, staying about 1 cm lateral to the anterior border of the tibia. After that Proximal Tibial LCP attached with bone. Once satisfactory plate positioning was achieved one proximal and distal screw was inserted. Additional screws were then applied using the same technique. The capsular incisions were closed with interrupted sutures and the skin, and subcutaneous tissue was closed over a Number 10 or 12 suction drain.



Fig 1: (a) Incision and (b) ORIF



Fig 2: (a) Closure with drain (b) Image intensifier view

B) Mipoo (Minimal Invasive Percutaneous Plate Osteosynthesis): Patients taken on Operation Table after informed risk and consent. A 3–4-cm skin incision was made proximal and distal to the fracture. Plate was applied on the anterolateral aspect of the tibia. An extra periosteal,

subcutaneous tunnel was created with a periosteal elevator. Proximal Tibial LCP passed along this tunnel, Once satisfactory plate positioning was achieved One proximal and distal screw was inserted. Additional screws were then applied using the same technique.



Fig 3: (a) Two separate incisions (b) fixation with plate (c) final view after treatment

Post-operative care

Parenteral antibiotics continued for first five days and then shifted to oral.

Posterior splint given if protection of fixation was desired. Quadriceps exercises and ankle mobilization started within 48 hours of surgery. Progressive weight bearing allowed as

tolerated by patient.

Full weight bearing was permitted only after clinico-radiological evidence of union.

In each follow up evaluation was done as per Rasmussen's Scoring:

Table 1: Rasmussen's scoring

Rasmussen's Scoring	points	Outcome evaluation			
		Satisfactory		Unsatisfactory	
		Excellent	Good	Fair	Poor
Subjective complaints					
Pain					
No pain	6	5	4	2	1
Occasional ache, bad weather	5				
Stabbing pain in certain positions	4				
Noon pain, intense, constant pain around knee after activity	2				
Night pain at rest	0				
Walking capacity					
Normal walking capacity	6	6	4	2	1
Walking outdoors atleast 1 hr	4				
Short walks outdoors 15 min	2				
Walking indoors only	1				
Wheel chair or bedridden	0				
Clinical signs					
Extension					
Normal	6	6	4	2	1
Lack of extension (0-10°)	4				
Lack of extension (>10°)	2				
Total range of motion					
At least 140°	6	5	5	2	1
At least 120°	5				
At least 90°	4				
At least 60°	2				
At least 30°	1				
0°	0				
Stability					
Normal stability in extension and 20° flexion	6	5	4	2	2
Abnormal instability 20° of flexion	5				
Instability in extension (<10°)	4				
Instability in extension (>10°)	2				
Sum (minimum)		27	20	10	6

Results

In this study of 26 cases of fracture of proximal tibia were treated and outcomes were studied. Patients were of age ranges between 18 to 70 yrs. Mean age for plating was 39.01 yrs. 84.61% cases were male and 15.38% cases were female. In this study of 26 cases time taken for union of fracture was less for MIPPO technique. Mean time of union in plating was 18.46 weeks. Patients who were treated with ORIF had more blood loss than MIPPO. In this study KNEE joint stiffness

and pain were the main morbidity.

Table 2: Functional Outcome.

Results	No. of Patients	%
Excellent	13	50
Good	8	30.76
Fair	4	15.38
Poor	1	3.85

Table 3: Fracture Union in Weeks

Fracture union in weeks	No. of patients	%	Mean
14	2	7.69	18.46
16	8	30.77	
17	4	15.38	
18	10	38.46	
20	2	7.69	

Table 4: Range of Motion

Range of Motion	No. of Patients	%	Mean
60	1	3.85	106.92
70	1	3.85	
80	2	7.69	
90	4	15.38	
100	5	19.23	
120	6	23.07	
130	7	26.92	

Table 5: Comparison of different study series in functional outcome.

Study by	Year	No. of cases	Result-final outcome of the fracture in most cases
G Thiruvengita Prasad <i>et al.</i> [8]	2013	40	Excellent (30 patients)
Tang Xin <i>et al.</i> [7]	2012	42	Excellent
Our study	2017	26	Excellent (13 patients)



Radiological outcome after plate osteosynthesis

Table 6: Complications in this study

Complications	No. of Patients	%
Superficial Wound Infection	1	3.85
Deep Wound Infection	1	3.85
Varus Collapse	1	3.85
Non Union	1	3.85
Knee Stiffness	2	7.69
Nil	20	76.92



Deep wound infection

Discussion

Tibial plateau fractures are one of the most common intra articular fractures and involve the most important weight bearing joint of the body. Tibial plateau fractures are increasing everyday due to ever increasing accident rates. There is change in the treatment plans for the tibial plateau fractures with the evolution of newer treatment plans and newer implants. Being a major weight bearing fracture of the body, management of these tibial plateau fractures is of prime importance, since it results in significant disability and alters quality of life. To overcome this difficulties and to early restoration of strength of bone and function of knee joint with minimal injury to soft tissue the innovators developed new technologies of minimally invasive techniques and development of locking plates.

We studied the functional outcome in a total of 26 patients treated surgically with locking compression plates. Patients were analyzed in parameters of age and sex, side of the fracture, Schatzker type of fracture, type of surgery, approach for surgery and complications following surgery. Most of the fractures occurred between the age group of 18 to 70 years. 34 % of the cases involved 31-40 years of age group. In a case series studied by tan xin *et al.* [7] majority of the patients belonged to the age group of 20 to 65 years. A study by G thiruvengita Prasad *et al.* [8] also correlated well with our study with majority of the patients belonging to age group of 22 to 61 years. In this series we studied 26 cases. Out of them most of the patients fall into type V, VI Schatzker's classification.

Different authors use different criteria for the surgical management of these fractures. Seppo E. Honkonen⁹ conducted 130 tibial plateau fractures taking into consideration of -

1. Condylar widening of > 5mm
2. Lateral condyle step off > 3mm
3. All medial condylar fracture

In our series the indications for the surgery were the same standard indications as for the tibial plateau fractures. 3mm depression was considered as an indications for surgery in our series.

In our series we used minimally invasive technique for reduction and fixation in 5 patients (19%), in which both duration of procedure and soft tissue injuries are less compare to open reduction technique, wound healing also better and faster compare to open reduction technique but it demands more surgical techniques.

In our series we approached with antero medial incision in 6 patients this approach need less soft tissue stripping from bone can contour plate to bone appropriately and we preferred antero lateral approach in 20 patients with lateral condylar displacement fracture and soft tissue injury on medial side of proximal tibia.

The period of immobilization was again individualized depending on the security of stable fixation. The benefits of early knee motion include reduce of knee stiffness and improved cartilage healing (regeneration) and promote good callus formation and remodeling. We are able to achieve 50 % excellent result and 30.76% good result. In addition we have 4% fair and 3.85 % poor results in term of functional outcome. These results are comparable and on par with other documented standard studies.

Conclusion

In this study of fracture of proximal tibia, in osteoporotic bone, bone graft not necessary for metaphyseal defects

because LCP acts as single implant and prevent collapse. Fractures treated with mippo healed rapidly hence achieve stron bone union across the fracture at much earlier compared to ORIF.

The rate of complications like joint stiffness, postoperative pain, delayed union, nonunion were low in patients treated with locking compression plating. In our we found that proximal tibial locking plate provides complete union and early mobilization to attain better functional outcome.

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