



UNION IN METAPHYSEAL LOCKING PLATE AROUND KNEE

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ABSTRACT

Introduction: The knee joint is superficial joint of lower extremity and complex movements of bones takes place during the motion at knee joint. Operative techniques and implants have dramatically improved, and internal fixation is recommended for most distal femoral fractures in adults. Fractures of the tibial plateau involve the articular surface of the proximal tibia. Adequate fixation and early achievement of postoperative range of motion are important for a good prognosis and adequate postoperative functioning. A lateral locking plate can provide adequate stability for comminuted or osteoporotic plateau fractures. Internal fixation with plate and screw remain treatment of choice for most periarticular fractures and other complex fractures inadequately stabilized by new locking plate designs. **Material & Methods:** Hospital Based Prospective Observational Study, All cases of distal femur and proximal tibia fractures coming to our hospital, Consecutive type of non-probability sampling was used for selection of study subjects. A total of 50 consecutive patients who are scheduled to undergo surgery for fractures around knee i.e. distal femur and proximal tibia fractures were taken in the study after informed consent. The results were analyzed according to the Oxford knee score criteria. **Results:** Most common mode of Injury was road traffic accident (54%) followed by fall (46%). Distal femur fracture were seen in 42% cases while proximal tibia fractures were seen in 58% cases. Delayed, mal and non-union was seen in 4 (8%), 3 (6%) and 1 (2%) cases respectively. Knee stiffness, surgical wound infection and osteomyelitis was seen in 3 (6%), 3 (6%) and 1 (2%) cases respectively. As per the oxford knee score, excellent outcome was seen in 84% cases while good and fair outcome was seen in 10% and 6% cases respectively. **Conclusions:** Metaphyseal locking plates is a good implant for the fractures around knee i.e. distal femur and proximal tibia with an excellent functional outcome. The locking plates preserve the periosteal blood supply and hence the union is early as compared to other methods.

KEYWORDS : Internal Fixation, Knee Joint, Metaphyseal Locking Plates**INTRODUCTION**

The knee joint is superficial joint of lower extremity and complex movements of bones takes place during the motion at knee joint. In the last few decades, rapid industrialisation and the fast pace of life have brought both comforts and catastrophe like road traffic accidents and crippling many young lives. These fractures are often difficult to treat and they are associated with many complications^{1,2}. Methods of treatment vary according to type, level of fracture and age of patient and are based on assessment of advantages and disadvantages associated with each. The goal of fracture treatment is to obtain union of the fracture in the most compatible anatomical position which allows maximal and full restoration of the extremity³. Distal femur fractures have been reported to account for 7% of all femoral fractures^{3,4}. Distal femur fractures can result from either high-energy trauma or low-energy trauma. High-energy trauma such as road traffic accidents and sports accidents are more likely in men ages 15–50, whereas low-energy trauma such as falls from standing height at home are more likely to lead to distal femur fractures in women aged 50 and above⁴. They present considerable challenges in management. Prior to 1970, most supracondylar fractures were treated nonoperatively; however, angulatory deformities, knee joint incongruity, loss of knee motion, as well as the complications of recumbency led to better methods of treatment. During the past 40 years, operative techniques and implants have dramatically improved, and internal fixation is recommended for most distal femoral fractures in adults. Nonetheless, internal fixation of the distal femur can be difficult for several reasons: thin cortices, a wide medullary canal, compromised bone stock, and fracture comminution that make stable internal fixation often difficult to achieve.

Fractures of the tibial plateau involve the articular surface of the proximal tibia. Tibial plateau fractures constitute 1% of all fractures and 8% of fractures in the elderly⁵. Isolated injuries to the lateral plateau account for 55% to 70% of tibial plateau fractures, as compared with 10% to 25% isolated medial plateau fractures and 10% to 30% complex bicondylar lesions. Due to increase in motor vehicle accidents we are faced with more number of complex tibial condyle fractures. Potential complications vary with the degree of trauma energy and include soft tissue injuries requiring coverage procedures. Treatment goals include preservation of soft tissues, restoration of

articular congruity, and correction of anatomic alignment in the lower extremities, ensure joint stability, and achieve full range of motion. Adequate fixation and early achievement of postoperative range of motion are important for a good prognosis and adequate postoperative functioning. A lateral locking plate can provide adequate stability for comminuted or osteoporotic plateau fractures.

Internal fixation with plate and screw remain treatment of choice for most periarticular fractures and other complex fractures inadequately stabilized by new locking plate designs have been developed in an attempt to preserve the blood supply of injured bone, improve the rate of fracture healing, decrease need for bone grafting, and incidence of infections and complications¹. Locking compression plates with its in numerous advantage is of great use in metaphyseal fractures. Locking compression plate has the advantage of combination of conventional compression plating and locked plating techniques which enhances the plate osteosynthesis. Locking plates acts as internal external fixator. Anatomically pre-contoured plates eliminates needs of contouring and match on femur or tibia metaphysis. In addition, a locking compression plate has got distinct advantages of unicortical fixation and least chance of plate back out as the screw gets locked to the plate. Further, Minimal soft tissue injury occurs when closed reduction is done and MIPPO technique is used.

The present study was thus conducted to evaluate the average clinical and radiological union time and functional outcome in fractures of distal femur and proximal tibia managed by metaphyseal locking plates and also to study the complications associated with it.

METHODOLOGY

Study Area: The present study was conducted at Department of Orthopaedics, Sri Siddhartha Medical College & Hospital Agalakote, Tumkur, which is a tertiary level centre. for a duration of one years from July 2016 to June 2018

Study Design: Hospital Based Prospective Observational Study

Study Participants: All cases of distal femur and proximal tibia fractures coming to our hospital.

Sampling Technique and Sample Size: Consecutive type of non-probability sampling was used for selection of study subjects. A total of 50 consecutive patients who are scheduled to undergo surgery for fractures around knee i.e. distal femur and proximal tibia fractures were taken in the study after informed consent.

Inclusion criteria:

Age 18 years and above of either sex, Closed and open fractures, Fresh fractures, Distal Femur AO type A1,A2, A3, B1,B2,C1,C2, C3, Tibial plateau Schatzker type 1,2,3,4,5,6 and patients ready to participate in the study.

Exclusion Criteria:

Age less than 18 years, Pathological fracture, Middle shaft or segmental fractures, Non-consenting patients, Severe systemic illness (active cancer, chemotherapy, haemophilia, or medical contraindication for surgery)

Surgical Technique

All surgeries were done under C-arm image intensifier control. For tibia antero-lateral approach for the lateral plate and medial or posteromedial approach for the second plate was done. And for femur lateral approach was used. Adequate visualisation of fragments was done to aid in anatomical reduction. When the medial tibial plateau fracture contained a sagittal split involving the articular surface, the fracture site was entered and the coronary ligaments were elevated to expose the medial meniscus and the depressed joint surface. All the patients were managed by Locking plates. Temporary fixation done with 2 mm K-wires, it also convert intra-articular split to single condylar block. Length of plate was determined intraoperatively after fracture reduction. Usually we prefer minimum length of the plate which is three times the fracture comminution² segment Plate fixation was done with locking screws with bicortical purchase. After reduction joint surface congruity was assessed under C-arm. All patients had a similar postoperative regimen. The bone grafting done if needed for filling voids after reduction. The source of bone graft was ipsilateral iliac crest or Allograft. Suction drain was used as per requirement. Deep wound closer was done with the help of Vicryl and superficial with the help of ethilon or stapler.

Outcome Analysis

Patient's functional outcome was also assessed at each follow-up. The results were analyzed according to the Oxford knee score criteria. The scores were graded as poor (0-19), fair (20-29), good (30-39), and excellent (40-48)⁶.

Statistical Analysis

All the collected data was entered in Microsoft Excel Sheet 2007. The data was then transferred and analyzed using SPSS ver. 21. Qualitative data was represented in the form of frequency and percentage while quantitative data was represented using Mean +/- S.D. The treatment effect on outcome parameters was assessed by the calculation of relative risks. Appropriate statistical evaluation was carried out as per the type and distribution of data. A p-value of < 0.05 was taken as level of significance.

RESULTS

Mean age of the study subjects was 43.4 years with almost half of the subjects were between 41-60 years of age. Male predominance was observed in the study with 72% males to 28% females. Most common mode of Injury was road traffic accident (54%) followed by fall (46%). Distal femur fracture were seen in 42% cases while proximal tibia fractures were seen in 58% cases. Open plating was done in most (90%) cases while MIPO plating was done in 4 cases (10%). Delayed, mal and non-union was seen in 4 (8%), 3 (6%) and 1 (2%) cases respectively. Knee stiffness, surgical wound infection and osteomyelitis was seen in 3 (6%), 3 (6%) and 1 (2%) cases respectively. As per the oxford knee score, excellent outcome was seen in 84% cases while good and fair outcome was seen in 10% and 6% cases respectively.

DISCUSSION

Fractures around knee are challenging injuries despite improvements of fixation techniques and plate designs. Some authors^{7,8} have demonstrated the ability of locked plates to absorb more energy before failure compared with conventional non-locking plates, angled blade plates, thereby having a lower incidence of loss of fixation. Mean age of the study subjects in present study was 43.4 years with almost half of the subjects were between 41-60 years of age. Male predominance was observed in the study with 72% males to 28% females.

Chang-Wug Oh et al.⁹ in 2006 reported results of MIPO in proximal tibial fractures in 23 patients and concluded that it was more common in males and the mean age was 54 yrs. In a study by Singh et al.^{9a}, for fractures around knee joint, mean age of the patients was 36 years and there were 20 males and 2 females. In present study, common mode of Injury were road traffic accident (52%) followed by fall (48%). P Kanabar et al.¹⁰ reported higher incidence of falls in their study. K. Kolb et al.^{10b} reported that most of the injuries were caused due to road traffic accidents. In present study, distal femur fractures were seen in 42% cases while proximal tibia fractures were seen in 58% cases. In a similar study by Singh et al.¹¹, out of the 22 fractures, 13 were proximal tibia fractures (59%) and 9 distal femur fractures (41%).

In present study, open plating was done in most (82%) cases. MIPO plating was used in 4 cases (8%) while bicondylar open plating was done in 5 cases (10%). Shrestha SK et al. used MIPPO technique in distal femur and found good results¹².

In our studies in the cases we have used MIPPO technique, union seen early and less wound related complications. In present study Out of the 21 cases of distal femur fractures, anatomical locking plate was used in 7 cases while non-anatomical distal femur locking plate was used in remaining 14 cases. Out of total 29 cases of proximal tibia, anatomical and non-anatomical plates were used in 6 and 16 cases respectively. Anatomical bicondylar locking plate was used in 5 cases while raft plat was used in 1 case. In femur, proximally 4 screws are used followed by 5 in most patients and distally 5screws are used followed by 4screws in most patients. In tibia proximally 4screws are used followed by 3 in most patients and distally 3screws are used followed by 4screws in most patients.

In a study by Singh K et al.¹³, out 30 patients of proximal tibia fracture, 6 patients were treated with Percutaneous cancellous cannulated screw fixation and 5 patients by ORIF with Buttress Plate, 4 patients by ORIF with Buttress Plate and Bone Grafting, 8 patients by ORIF with proximal tibial locking compression plate (LCP) and 7 patients by ORIF with LCP and Bone Grafting. In a similar study on 100 distal femoral fractures, Gupta VK et al.¹⁴, concluded that early surgery, at least two screws in each fragment and early post-operative knee mobilization are essential for good union and good knee range of motion. In a similar study Singh et al.¹⁵, used locking plates, condylar buttress plates, t-buttress, l-buttress, and hockey stick plates for fixing fractures around the knee. Kyle F et al.¹⁶ recommended locking plates in large aging population continuing active lifestyles. If used appropriately, locked plating can result in good patient outcomes with recreation of bony architecture and restoration of function. S.L. Ezekiel et al.¹⁷ stated that locked plating have evolved simultaneously with the minimally invasive techniques, which together provide an elegant safe option for restoring function in well trained, experienced hands.

Radiological union of the fracture i.e. characterized by cortical bridging of the fracture in both AP and lateral views of follow up x-rays, was considered as a landmark for union. In our study, in 46% cases, bridging of fracture site on x-ray was seen at 8-10 weeks while in 52% cases it is visible at 10-12 weeks. A total of 28.6% patients showed fracture union by 5months (20 weeks), 79.6% showed union by 6months (24 weeks). Median fracture union time was 22 weeks. 1 case was non-union of distal femur. Chr. Krettek et al.¹⁸ evaluated a minimally invasive approach for proximal tibial fractures in six patients. The average time to callus formation was between 10-12 weeks and that of radiological union was 18-20 weeks postoperatively. Union time in a study by Pascarella et al.¹⁹ was 8-10 weeks for callus formation and 18-28 weeks for complete union. Callus formation was seen at 10.2 weeks and mean union time was 18.9 weeks. Similar results were also observed by other authors^{12,20,21}.

Complaint of pain at 3 month was given by 11 (22%) cases while at the end of 6 months pain was experienced in only 3 (6%) cases. Pain at the end of follow up period was seen in 6.9% cases in a study by Parikh M et al.^{10c}. No patient complaint of pain in a study by Shrestha et al.¹² and Gupta et al.²¹.

Range of motion (ROM) less than 90 degrees at 3rd month was seen in 14% cases while 42.5% had ROM over 110 degrees. Range of motion (ROM) less than 90 degrees at 6th month was seen in 10% cases while 82% had ROM over 110 degrees. In a study by Singh et al.¹⁵ average range of motion achieved was 0-110 degrees. K. Kolb et al.²² in their series of patients with distal femoral fractures reported average range

of motion of 120 degrees. P Kanabar¹⁰ in their series of 17 patients operated with MIPO or LISS of distal femur reported average range of motion of 0-100 degrees.

Delayed, mal and non-union was seen in 5 (10%), 2 (4%) and 1 (2%) cases respectively. Knee stiffness, surgical wound infection and osteomyelitis was seen in 3 (6%), 3 (6%) and 1 (2%) cases respectively. Singh et al.¹³ had a 9% rate of malunion in their study with no cases of delayed or non-union. K. Kolb²² reported 12.1% cases of malunion in their study.

P Kanabar et al.¹⁰ reported malunion in 1 case out of 17 cases i.e. in 5.8% of cases. Also, 5.8% had delayed union and 5.8% had non-union. Jackson et al.¹⁰⁶ in their study of MIPO of proximal tibial fractures in 35 patients reported 2 cases of delayed-union and no cases of non-union. They had 8% of delayed unions among 25 patients that completed study.

Functional Outcome

As per the oxford knee score (OKS), excellent outcome was seen in 86% cases while good and fair outcome was seen in 8% and 6% cases respectively.

In a study by Rohra N et al.²³, 24 patients (70.59%) had excellent, 8 patients (23.53%) had good and 1 patient (2.94%) each has poor and fair outcome as per according to the Oxford knee score criteria. In a similar study by Khatri K et al.⁶ the functional outcome was assessed using Oxford knee score. Fifty-four cases (83%) had excellent outcome, 10.7% had good outcome 4.6% had fair and 1.5% had poor outcome. In a similar evaluation score used in 15 cases of tibial plateau fracture by Lee TC et al.²⁴, 5 (33.3%) cases had excellent outcome while remaining 10 (66.7%) cases had good outcome.

CONCLUSION

Metaphyseal locking plates is a good implant for the fractures around knee i.e. distal femur and proximal tibia with an excellent functional outcome. The locking plates preserve the periosteal blood supply and hence the union is early as compared to other methods. In elderly patients with osteoporotic bones it is recommended because of less chances of screw cut-out and implant failure. The concerns in the literature about the incidence of healing difficulties have been supported by the findings in this study.

CONFLICT OF INTREST

Authors don't declare any conflict of Interest

TABLES

Table 1. Age distribution of the subjects

Age group (yrs)	N	%
21-30	12	24.0%
31-40	6	12.0%
41-50	18	36.0%
51-60	7	14.0%
61-70	7	14.0%
Total	50	100.0%
Mean age - 43.4 +/- 13.90 years		

Table 2. Distribution of study subjects based on Mode of Injury

Mode of Injury	N	%
Fall	23	46.0%
RTA	27	54.0%
Total	50	100.0%

Table 3. Distribution of study subjects based on Site of Fracture

Site of Fracture	N	%
Distal Femur	21	42.0%
Proximal Tibia	29	58.0%
Total	50	100.0%

Table 4. Distribution of study subjects based on type of plating

Plating	N	%
MIPO Plating	5	10%
Open Plating	45	90%
Total	50	100.0%

Table 5. Distribution of study subjects based on associated complications

Complications	N	%
Delayed Union	4	8 %
Mal Union	3	6 %
Non-Union	1	2.0%
Knee Stiffness	3	6.0%
Surgical Wound Infection	3	6.0%
Osteomyelitis	1	2.0%
No complications	42	84.0%

Table 6. Distribution of study subjects based on Functional Outcome

Functional Outcome (OKS)	N	%
Poor	0	0.0%
Fair	3	6.0%
Good	5	10%
Excellent	42	84.0%
Total	50	100.0%

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