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A Comparative Study of Locking Versus Nonlocking Plate in Distal Femur Fractures

Orthopaedic

KEYWORDS : Nonunion, Malunion, Fractures of the distal femur, Locking plate, Nonlocking plate

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ABSTRACT

The management of distal femoral fractures has presented significant challenge to Orthopaedic surgeons. A wide medullary canal, thin cortex and poor bone stock make stable internal fixation in these fractures difficult This type of fracture is more common in young people with major trauma like motor vehicle accidents. In old patients with osteoporosis the fractures are often closed and occur following a minor trauma. The aim of our study was to compare the outcomes and complications of treatment of intra-articular distal femur fractures using locking and nonlocking condylar buttress plates. Methods: In this prospective study, 32 patients undergoing surgery due to type C distal femur fractures (T or Y condylar fracture) from 2012-2014 were included. Exclusion criteria like open fracture, comorbidities such as diabetes or end stage diseases and patients with other lower extremity fractures on the same side. For each patient demographic data including age, sex, mechanism of injury, and type of injury was collected. All patients were followed for at least one year postoperatively for functional outcome ,complications such as infection, non-union, and malunion. Results: In this study 19 patients (73%) were male and 13 (23%) female. The mean age of the locking group was 35.9 ± 18.2 years and the nonlocking group 30.8 ± 17.3 years. There were no significant differences between the two groups in age and sex. In both groups 4 patients had infections (11.1% in the locking group and 14.7% in the nonlocking group) and 2 patients in locking group and 1 patient in nonlocking group had nonunion. In the locking group 1 patients (8.9%)had implant failure.There was no implant failure in the nonlocking group. Conclusions: In our study the effects of treatment with both locking and nonlocking condylar buttress plates regarding infection and nonunion were similar but malunion and plate failure were higher in the locking group. Nonetheless, this difference was not statistically significant.

INTRODUCTION:

Distal femur fractures are very rare and considered as severe injuries. They account upto 0.4%-0.5% of all fractures and 3% of all femoral fractures. They have an equal male and female distribution. This type of fracture in younger patients is primarily due to high energy injuries like road traffic accident and can present in the elderly age group due to trivial trauma due to pre-existing osteoporosis. Sufficient surgical stabilization is essential in this type of fracture to withstand the static loading and dynamic muscular forces. There have been many advancements of fracture fixation techniques and improvement in surgical implants. But, long term disability in these patients can occur due to a variety of factors like bony comminution, severe soft tissue injuries, articular cartilage damage etc. Despite so many advances in this field the ideal management still is an unanswered question.

AIM:

To compare the radiological fracture union and functional outcome of knee after fixation with distal femur nonlocking and locking plate using the minimally invasive technique in AO type C distal femur fractures.

MATERIALS AND METHODS:

A prospective study was conducted in MGM Medical college &LSK hospital Kisanganj,Bihar from March 2012 to august 2014. The AO/OTA classification was used in classifying the fractures which presented to us. All fractures of AO type C(C1,C2,C3) were included in the study. Any fractures with associated fractures such as proximal tibia fractures or patella fractures were excluded from the study. Even cases with associated ligament or meniscal injuries were also excluded from the study. Pathological fractures were excluded from the study. Age group included in the study was 17 to 56 years. Consent for participating in the study was first obtained from all the patients. All the patients were operated by same surgical team. A total of 32 patients formed the sample size. 17 of the 32 patients had undergone locking condylar plate fixation with minimally invasive technique and remaining 15 had undergone nonlocking condylar buttress plates . weight bearing mobilization was started at 6-8 weeks postoperative depending on the status of the fracture union noted in the x-rays .We reviewed all patients who underwent locking & unlocked plate fixation at 3 month, 6 months and 12 month post operativly. They were assessed for knee function and x-rays were taken to assess the fracture union. The radiological union of the fracture was evaluated as per the Hammer. The knee function was assessed as per the American knee society score(AKSS). Complications such as Delayed union,nonunion, knee pain, swelling, deep and superficial infection, implant failure osteoarthritis etc, were noted down. The results were tabulated and compared using the chi square test.

Almost all distal femur fractures need operative treatment and fixation. Non-operative methods are indicated in non displaced fractures, non ambulatory patients, and patients with significant co morbidities . selection of implant is determined by the fracture pattern, patient age, bone density, and other injuries to the patient. Usually Implants which can be used to treat distal femoral fractures are retrograde intramedullary (IM) nail, blade plate, dynamic condylar screw (DCS), condylar buttress plate (locked or nonlocked). Retrograde IM nail is suitable for supra-condylar fractures without significant comminution (there must be enough intact distal femur to allow distal locking screw fixation). The main indication for IM nail is AO/OTA type 33 A fractures. Blade plates are not commonly used, they are technically difficult and contraindicated in C3 fractures (T condylar with intraarticular comminution). Dynamic condylar screw (DCS) is identical to 95-degree angled blade plate except that technically it is easier because sagittal plane alignment is not necessary. A large amount of bone can be removed with DCS. Condylar buttress plates (anatomical plate) provide improved fixation in short distal femoral block. These anatomical plates are useful for intercondylar fractures and help to obtain anatomic reduction of the joint. In the lock-

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ing plate the screw head has threads which lock into the plate, and the combination of screws and plate create a stable construct for comminuted and osteoporotic fractures. Biomechanical studies have demonstrated the advantage of locking plate in osteoporotic bone but in young bone there was no difference between locking or nonlocking plates. Our objective for this study was to compare clinical results of locked and nonlocked condylar buttress plate in the intercondylar fractures (Type 33C) of distal femur.

Results:
All 32 patients were included for final follow up for statistical analysis. A comparison of the two groups showed that they were similar with regard to the age and sex (Table 1). A comparison of the two groups according to mechanism of injury and type of fracture showed no significant difference (Table 1). According to the chi-square statistical test, there were no statistically significant differences between the two groups such as infection, nonunion, malunion and device failure (Table 2).

Malunion and device failure were more frequent in the locking group but this difference was not statistically significant.

Discussion:
Since intraarticular distal femoral fracture is a complex injury and no single surgical implant can be used for all distal femur fractures. Several biomechanical studies have compared anatomical condylar buttress plate and DCS with locking condylar buttress plate with minimal invasive surgical approach. Locking plate had more reversible deformation when compared to the other two constructs. Zlowdzki et al compared the locking plate with unicortical locking screws to 95 degree blade plate in axial, torsional and cyclic axial loading in a cadaveric model with 1cm gap. They concluded that the LISS provided improved distal fixation in osteoporotic bone. In a 4cm fracture gap model in a high bone density cadaveric specimen no significant differences was found between the locking plate with unicortical locking screws and the angled blade plate for axial load to failure, but the locking plate had significantly less axial stiffness . The complications related to open reduction techniques led to the development of closed fracture reduction technique as reported by Mast et al.The concept of closed reduction technique is preservation of soft tissue attachments and bone circulation and restoration of limb alignment, length and rotation, without direct exposure of the fracture. Minimally invasive plate osteosynthesis (MIPO) includes closed fracture reduction techniques for metaphyseal and diaphyseal fractures, limited lateral dissection, passage of the plate sub-muscularly under vastus lateralis and proximal screw insertion through small incisions. There were no significant differences between implants for nonunion, fixation failure, infection and revision surgery. Subgroup analysis showed that submuscular plating may reduce the rate of infection when compared to compression plating (55% relative risk reduction, p=0.056) but at the increased risk of fixation failure and revision surgery. Krettek et al used condylar buttress plate or dynamic condylar screw, and transarticular approach with subcutaneous plate osteosynthesis technique in 8 distal femur fractures (2 open). No nonunion, secondary bone grafting procedure, infection or implant failure was reported.In this study absence of complication is related to preservation of soft tissue and bone circulation. In our study we compared locking and nonlocking condylar buttress plates in type C (intra-articular fracture of distal femur). We evaluated clinical results of these two groups 12 months after surgery. In our locking group infection rate 17.64% superficial and 5.86% deep, nonunion 11.76%, delayed union17.60%%, and plate failure 5.88%. In nonlocking group these complications were 20.00%,6.66% 6.66%,13.3% and 0% respectively. Between the two groups there was no statistically significant difference. In Moradi et al (26) which used only locking plate, infection rate was 19.1% (in our study 5.88%% and 6.66% in locking and non-locking groups, respectively), nonunion rate was 19.1% (in our study 11.76 and 6.6). In this study complications were more than our patients' and probably were related to inclusion of open fractures in the study. In Shahhoseini et al (27) a lower infection rate (7.9%) was related to a lower percentage of open fractures.

Conclusion:
The locking condylar buttress plate is a valuable advancement in distal femoral fracture treatment. However clinical and biomechanical studies have not shown any advantage of locking compared to nonlocking plates in non-osteoporotic bone. In our study complications like infection non-union, were similar in the two groups with a higher incidence of delayed union and implant failure in the locking group, however this was not statistically significant. Further studies with greater number of patients and longer follow up are required to conclude on the long term outcome of type **c** distal femoral fractures.

Table 1. Demographical characteristics of the patients.

	LOCKINGI PLATE (n=17)	NON LOCK-ING PLATE (n=15)
Mean age(years)	35.90	30.80
Gender Male Female	 **10** **7**	 **9** **6**
Side Affected **Right** **Left**	 **12** **05**	 **8** **7**
Trauma Mechanism **Road traffic Accident** **Fall from height** **Trivial injury(Osteoporosis)** **Assault**	 7 8 1 1	 6 8 1 0
AO/OTA Type **33-C1** **33-C2** **33-C3**	 **4** **6** **7**	 **3** **6** 6

Table 2.Postoperative Complications

	Locking Plate group	Unlocking Plate group	P Value
Union Disturbance	5(29.41%)	3(20.00%)	0.675
Non Union	2(11.76%)	1(6.60%)	1.00
Delayed Union	3(17.60%)	2(13.30%)	1.00
Movement Restriction Of Knee Joint			
Flexion Restriction (ROM-100°-124°)	3(17.64%)	3(20.00%)	1.00
Extension Restriction			
6°-10 °	1(5.8%)	1(6.6%)	1.00
1°-5°	5(29.4%)	4(26.6%)	1.00
Knee Pain	3(17.64%)	3(20.00%)	1.00

Knee Swelling	2(11.7%)	1(6.66%)	1.00
Implant Failure	1(5.88%)	--	1.00
Infection			
Superficial	3(17.64%)	3(20.00%)	1.00
Deep	1(5.88%)	1(6.66%)	1.00

ROM-Range of movement

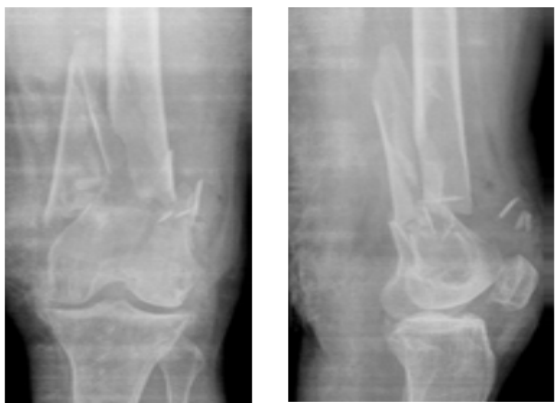

Figure 1(A) and 1(B) :Antero posterior and Lateral radiograph showing AO type C3 distal Femur fracture.

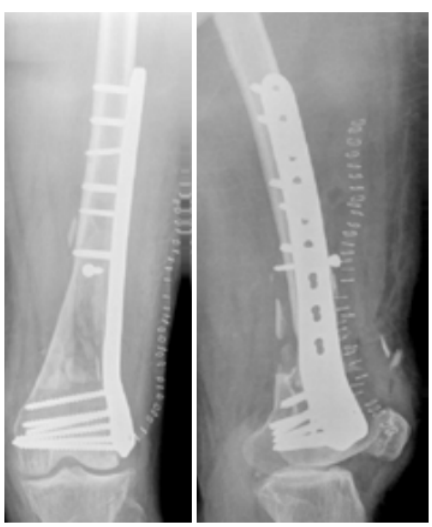

Figure2(A) and 2(B):Anteroposterior And Lateral radiograph After surgery.

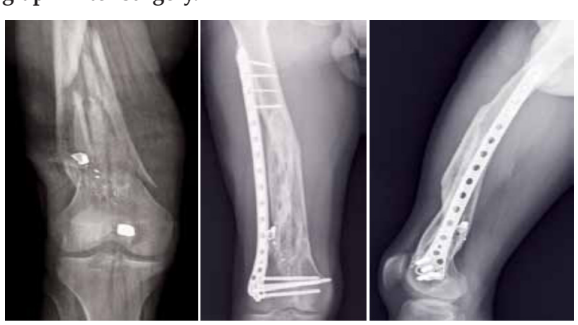

Figure 3: Radiological images of a 34-year-old male patient in which closed reduction with bridge
plating was applied. **(A)** Preoperative anteroposterior X ray. **(B)** anteroposterior and **(C)**lateral X ray 36 month after syrgery.

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Conflict of interest
The authors declare no conflict of interest.

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