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COMPARATIVE STUDY OF RETROGRADE DISTAL FEMORAL NAILING AND DISTAL FEMORAL PLATING IN EXTRA ARTICULAR DISTAL FEMUR FRACTURES

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Abstract

Background: Distal femoral fractures are among challenging orthopedic injuries. Anatomical Distal Femoral locked plating and retrograde nailing are now method of choices of fracture fixation in such patients. Purpose of present study was to compare anatomical distal femur locked plating and retrograde intramedullary nailing for treatment of extra articular distal femur fractures.

Materials and Methods: A prospective randomized study including 38 patients of extra articular distal femur fractures was conducted in the Department of Orthopedic surgery. Patients were divided in two groups by random allocation. Patients of group I (20 patients) were treated by distal femoral locked plating and group II (18 patients) by retrograde distal femoral nailing using standard technique.

Results: The mean age of group I and group II were 52.5±16.8Years & 48.7±12.4 years respectively. The female – male ratio for both groups was matched (p=.075). The time of full weight bearing was significantly (p=0.004) less in nailing group. Bone union was seen earlier in group II (DFN) and it came to be statistically significant (p value-0.0006). Knee pain was present in 42.86% of patients in group II and it came out to be statistically significant (p<0.001). At the end of 1-year, Functional outcome assessed by Neer scoring system was statistically insignificant between the two groups, (group I 87.86%, group II 82.5%).

Conclusion: In our study functional results trended toward better outcomes in distal femoral nails than plates in terms of knee flexion, early weight bearing, less union time but incidence of knee pain is significantly higher in nailing group as compare to plating group.

Keywords: distal femur fractures, internal fixation, retrograde nailing, distal femoral locking plates

Introduction

Distal femoral fractures make up around 7% of all femur fractures. They have two distinct patterns of occurrence: high-energy forces typically cause them in younger individuals, while low-energy trauma is the main cause in the elderly.

Traditionally, the primary treatment for distal femoral fractures was non-operative, following Neer's recommendation in 1967. However, over time, operative fixation became the standard of care with

the introduction of angled blade plates, dynamic condylar screws, anatomical locking plates, and pre-contoured distal femoral nails. These methods allow for open reduction and internal fixation, providing the advantages of early mobility and reduced risk of knee stiffness.

Locked plating has revolutionized fracture stabilization by minimizing soft tissue damage and preserving blood supply. It is less reliant on the screw-bone interface, making it more resistant to failure, especially in osteoporotic bone and comminuted fractures. Retrograde intramedullary nailing, particularly for extra-articular fractures, has shown promising results with fewer complications and minimal soft tissue disruption.

There is growing evidence supporting the use of retrograde nailing even in intra-articular fractures. Studies have demonstrated favorable outcomes when nailing is performed for type C1 fractures. Some researchers have also found reliable results for type C1 fractures using retrograde nailing. Comparative studies between nailing and plating for distal femoral fractures, specifically in type C1-C3 intra-articular fractures, have shown promising results with retrograde nailing.

Retrograde nailing is also considered a viable option for femur peri-prosthetic fractures, although not all prosthetic designs are suitable. One limitation of retrograde nailing is the potential for extension deformity of the fracture due to the posterior entry point.

Despite the extensive use of both locked plating and retrograde intramedullary nailing for distal femoral fractures, it remains uncertain which implant is superior. Existing studies comparing these implants have yielded inconsistent conclusions regarding their respective advantages. Therefore, a prospective study was conducted at our center to directly compare the outcomes of locked plating and retrograde intramedullary nailing in distal femoral fractures.

Material and Methods

This study was conducted in patients aged > 18 years having Extra Articular distal femoral fractures admitted through Emergency Department or Out Patient Department in Orthopaedics Unit during the study period from August 2021 to February 2023. It is prospective randomized study. Prior to start of study permission was obtained from institutional ethics committee (IEC). All the data collected as a part of this study was kept confidential.

Inclusion criteria: for the study included all patients who gave informed consent to be included in study and who were more than 18 years of age, had Extra Articular Distal femur fractures which was Closed or Gustilo type I and II open fractures and patients were able to walk without assistance before injury.

Exclusion criteria: included patients with Pathological fractures, Gustilo type III open fractures, accompanying vascular injury or floating knee and patients who did not consent to be included in the study.

For each patient a detailed history was taken, relating to the age, sex and occupation, mode of injury, past medical illness and other co morbid conditions. The patients were kept on skeletal pin traction or below knee skin traction application till the time of surgery.

Total 40 patients of extra Articular distal femoral fracture were included in the study according to inclusion criteria and were randomized in two groups.

Group I patients were treated by distal femoral locking plate while Group II patients were treated by distal femoral nailing. All patients were operated as elective surgeries in the operation theatres by the same set of surgeons who had no preference for nailing or plating. Routinely Regional anaesthesia was administered to the patients.

For the patients undergoing Open Reduction and femoral plate fixation a standard surgical protocol was followed. Patient was placed supine on a radiolucent table with a pillow below the knee, the entire injured extremity and ipsilateral iliac crest are prepared and draped. Tourniquet applied. Lateral incision was made parallel to the shaft of the femur, beginning at the Gerdy tubercle and extending proximally far enough to permit application of plate. Longitudinal incision is made through the fascia

lata, and extended distally into the iliotibial band. The distal part of the incision was extended through the lateral joint capsule and synovium, avoiding injury to the meniscus. More proximally, the fascia overlying the vastus lateralis muscle was incised and the muscle reflected anteriorly off the intermuscular septum and perforating vessels were identified and ligated or coagulated. Minimal Stripping of soft tissue necessary for application of the plate and reduction of the articular surface was done. To preserve their vascularity, attempt was not made to expose and anatomically reduce comminuted anterior and metaphyseal fragments. Then the proper sized plate was selected and the fracture was fixed. We inserted minimum 5 screws including lag screws and locking head screws in distal expanded part and minimum 4 screws in proximal femoral diaphysis [11]
In group II patients (Retrograde nailing), patients were kept supine on radiolucent table with knee in slight flexion. A 5- cm incision was made starting from lower pole of patella and just medial to the patellar tendon. The inter condylar notch was palpated and guide pin was placed just above and medial to the femoral attachment of posterior cruciate ligament and confirmed by means of anterior-posterior and lateral fluoroscopy. The medullary canal was reamed and the nail of appropriate size was reinserted. All the cases were statically locked with at least two distal locking screws and nail was buried deep into the distal articular cartilage of femur.
Operative timing and intraoperative blood loss were recorded for comparison in the study. Post-operatively, patients were kept under observation for 5 days. Wound inspection was done on second-day post-op. Patients were taught active knee ROM exercises and assisted walking following which patients were discharged on the fifth day. Suture removal was done on fourteenth post operative day. Patient were advised partial weight bearing at 3 weeks and encouraged to do full weight bearing at 6 wks. Subsequently, patients were followed up at 10,14 and 18 weeks and then at 6 months and 1 year. At each follow-up, patients were evaluated for signs of post-op infection at the surgical site, radiological signs of union, knee ROM, ability to bear weight, pain as assessed by VAS, and functional outcome at 1 year using Neer scoring**. (12)** Lower limb full length scanogram to assess alignment was done at 1 year follow-up. Deviation of more than 10 degrees from anatomical axis of femur in antero-posterior full limb scanograms or more than 10 degrees of angulation in lateral radiograph was considered as mal-alignment. Delayed union was defined as a fracture that didn't show any sign of healing after 6 months. Non-union was defined as a fracture which didn't heal by 9 months and didn't show any radiographic progression for 3 months.
The data analysis was done using SPSS-20. Student t-test was applied as a test of significance. A probability value of<0.05 was considered significant.

Results:
Of the 40 patients initially enrolled in the study, 2 patients were lost to follow-up. So, 38 patients were finally included in the study. 20 patients were operated with LCP (group I) and 18 patients were operated with Retrograde femoral nailing (group II).
There was no significant difference in mean follow-up duration in both groups (10.5±0.4 months in group I and 11.2±0.6 in group II).
The age, sex distribution of the patients, mean follow-up and side of fracture were recorded as follows: Group I (LCP) had mean age of 52.5±16.8Years while mean age of patients in Group II was 48.7±12.4 . The distribution of involved limb was Left side in 16 patients while 22 patients had involvement of right side. The sex ratio shows slight preponderance for male patients who were 24 (11 in group I and 13 in Group II) in number while female patients were 14 in number(8 in Group I and 6 in Group II. Follow-up time (month) 10.5±0 11.2±0.6 The mechanism of injury was found to be fall from standing height in 76.6% cases followed by RTA in 19% cases followed by others in 4.4% cases.

Mean operative time and intra-operative blood loss in both groups were recorded with IMN proving to be quicker procedure with smaller incision and better Scar healing. Group I(LCP) Operative time (min) 87.5±5 Blood loss (ml) 209±1 Group II (IMN)Operative time minutes 77±4 Blood loss 280± 9

mL 3 patients in group I developed surgical site infection noticed at the time of suture removal. All patients recovered as the wound healed with IV antibiotics as per culture sensitivity and dressing. No superficial or deep infection was documented in group II.

Wound infections and subsequent post-operative complication rate were significantly lower in group II. Comparison of post-operative outcome of the 2 groups. Variables I (LCP) Mean time till union (weeks) 16.24±7.4 Non Union 3 Delayed union 2 Mal-alignment 0 Infection 3(Superficial 2 - Deep 4) Knee ROM 100±15 degrees Group II (IMN) 11.85±3.4 Non-union 1 Delayed union 0 Mal-alignment 2 Infection 0 - Knee ROM 116±6 degrees

There was a statistical difference in time till radiological union among the 2 groups with group I having mean time of union of 16.24±7.4 weeks while in group II it was 11.85±3.4 weeks ($p<0.05$). Union disturbance was seen more frequently in group I where 2 patients showed delayed union and 3 cases had non-union.

Both cases of delayed union healed completely at 1 year follow-up with bone marrow aspiration from iliac spine and injection at fracture site. Their subsequent follow-up was uneventful. 2 cases of non-union were a result implant failure and other 1 was due to loss of reduction.

Nonunion cases were treated with exchange implants and autologous bone grafting and eventually healed adequately. 2 cases in group II showed malalignment with angulation deformity. Since the activities of daily living of these patients were not hampered because of this malalignment and patients were satisfied with the outcome, these patients were not further intervened. One nonunion in group II was operated with exchange nailing and healed satisfactorily. Non-union rates were found to be significantly high in group I.

Time till full weight bearing was significantly short in group II with 95% cases able to bear full weight by 12 weeks as compared to group I where 72% of cases could bear full weight by that time. Knee ROM at 1 year was 100±15 degrees for group I and 110±6 degrees in group II. Though statistically insignificant, knee ROM at 1 year follow-up was better in group II.

Knee pain at the end of 6 months as assessed by VAS, was present in 38.42% cases in group II against 12.5% in group I and was found to be statistically significant. Functional outcome assessed by Neer scoring system at the end of 1 year was statistically insignificant between the two groups, (group I 88.6%, group II 81.5%).

Discussion & Conclusion:

Internal fixation is considered superior to nonoperative treatment for distal femoral fractures, but these fractures pose challenges in terms of implant and technical decisions. One concern with plated constructs is their axial stiffness, which can contribute to delayed union or nonunion, especially when there is no medial cortical support.

Retrograde intramedullary (IM) nailing has been extensively studied for distal femoral fractures and has shown to be a reliable treatment method with fewer complications. It has been found to be effective even in cases of osteoporotic bone. Several studies have compared the biomechanical aspects of locked plating and intramedullary implants for distal femur fractures, but there have been limited comparative studies directly involving patients.

Both locked plating and retrograde intramedullary nailing allow fixation with minimal soft tissue disruption, adhering to the principles of biological osteosynthesis. A study by Gao et al. in extra-articular distal femur fractures found that while the plating group had less blood loss and shorter surgical time compared to the nailing group (due to the additional reaming procedure in nailing), there were no significant differences in long-term outcomes such as deep infection, implant failure, knee pain, or knee range of motion. However, the plating group did experience more union disturbances, including both nonunion and delayed union, compared to the nailing group.

Therefore, both locked plating and retrograde intramedullary nailing can be used to manage distal femur fractures, with similar outcomes in terms of malunion, nonunion, implant failure, infection, knee range of motion, anterior knee pain, and time to union. Plating has the advantage of reduced blood loss and shorter surgery duration, which were statistically significant. These findings can also

be applied to patients with intra-articular fractures of the distal femur, as the distribution of AO type C fractures was similar in both the nailing and plating groups. Retrograde nailing is a viable alternative, even in fractures with comminution, and allows for early weight-bearing and mobilization.

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