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Comparative Study Of Functional Outcome Of Retrograde Nailing Versus Locking Compression Plate In Distal End Femur Fracture

Dr. Pramod V Patil[1], Dr. Vishwanath C[1*], Dr. Vineeth K S[1], Dr. Mihira K L[1]
[1]Department of Orthopaedics, Adichunchanagiri Institute of Medical Sciences, Adichunchanagiri University, B G Nagara, Mandya, Karnataka, India

Abstract

Background and Objectives: *Distal femoral fractures reportedly account for less than 1% of all fractures and comprise between 4%–6% of all femoral fractures. The presentation in younger patients is primarily due to high energy injuries and can present in the elderly age group due to trivial trauma due to pre-existing osteoporosis. There are various methods for treating distal femur fractures and the present study compares the treatment of extraarticular distal femoral fractures using retrograde nailing versus use of locking compression plate.*

Materials and Methods: *It is a prospective study conducted from February 2023 to February 2025 in Adichunchanagiri Institute of Medical Sciences, B.G. Nagara, Mandya. 30 cases of extraarticular distal femoral fractures using retrograde nailing and locking compression plate. Outcomes were assessed based on operative parameters, functional score (Neer score), time to union and complications.*

Results: *Around 60% cases were female, with most cases falling in the 51-60 age group, The mean age of IMN group was 49.67±9.53 years and LCP group was 58.6 ± 12.98 years. Right femur was affected more (63%) than left, with majority injuries (57%) occurring as a result of accidental self-fall. Functional outcome was assessed using Neer's Scoring System which showed IMN group, total 6(40%) cases are excellent,6(40%) cases are good, 2(13 %) case are fair and 1(7%) case was poor result. In LCP group total 5(33%) cases are excellent,6(40%) cases are good, 1(7%) was fair and 2(13%) was poor. Complications like infection (1 case), anterior knee pain (2 cases), knee stiffness (1 case), limb shortening (1 case), non-union (1 case) were seen in patients managed by retrograde nailing, whereas knee pain (1 case), knee stiffness (2 cases), infection (3 cases) and non-union (2 cases) for plating cases. Mean Neer score in the group IMN was 82.2±17.77 and in the group LCP was 80.27±20.93.*

Conclusion: *Both retrograde intramedullary nailing and the use of locking compression plates may be considered as adequate treatment options. Early healing, increase range of movement, less average surgical time, less complications are seen in nailing compared to plating but are statistically insignificant with similar functional outcomes. Thus, it can be concluded that both techniques may be used for the treatment of distal femoral fractures if correct operative methods and postoperative protocols are followed.*

Keywords: *Distal femur fracture, locking compression plate, retrograde femur nailing, range of motion, Neer scoring system, extraarticular fractures*

INTRODUCTION:

Fractures within 15cm from articular surface of distal femur i.e., between articular surface and junction of metaphysis to femoral diaphysis are defined as distal femoral fractures which constitute around 6% of femoral fractures [1]. They exhibit a bimodal age distribution, with a peak incidence in males under 40 years of age due to high-energy trauma. A second peak is observed in females over 50 years of age, often with osteoporosis, where fractures typically result from low-energy trauma. The most common mechanism of injury involves an axial load on the femur, while rotational forces are a less frequent cause [2]. In 1967, Neer et al [3]. reported favorable outcomes in 84% of patients treated conservatively for distal femur fractures, compared to only 52% in those treated with internal fixation.

Retrograde IMN offers both mechanical and biological advantages. Mechanically, it acts as an intramedullary device positioned close to the femoral axis, providing superior load-sharing capabilities. Biologically, it minimizes disruption to the blood supply and promotes vascular stimulation through the reaming process. However, antegrade intramedullary nail has been associated with angular deformities because of the inability of distal interlock to achieve control of the small distal fracture fragment [4]. LCP offers precise anatomical fixation and has been a well-established method for managing distal femur fractures. However, the open reduction required for its placement may disrupt the natural fracture healing process and is associated with an increased risk of infection and non-union [5].

Despite the widespread use of both techniques, there are a few clinical studies which compare locking plates to nails. The aim of the study was to compare the clinical, functional, and radiological outcomes of distal femur fractures treated with Locking Compression Plates (LCP) versus those treated with Retrograde Intramedullary Nails (IMN).

MATERIALS AND METHODS:

The study was done at Department of orthopaedics, Adichunchanagiri Institute of Medical Sciences, B G Nagara from February 2023 to February 2025 with sample size of 30. Patients who had extraarticular distal femur fractures were evaluated clinically and radiologically using X-rays and AO/OTA classification [6]. Those meeting inclusion criteria underwent surgery using either retrograde intramedullary nail or distal femoral locking compression plates. The patients were followed up for 12 months and functional outcome was evaluated by using Neer scoring system [7].

Inclusion criteria:

1. Open type 1 and 2 fractures (Gustillo-Anderson classification)
2. Medically fit patients
3. Patients in age of 18 years and above
4. Osteoporotic fractures
5. Muller classification A1, A2
6. Extra articular fractures

Exclusion criteria:

1. Open type 3 fractures (Gustillo-Anderson classification)
2. Muller classification A3, B, C types
3. Communited fractures
4. Intra-articular fractures
5. Patients <18 years of age
6. Pathological fractures
7. Patient not medically fit for surgery or not willing for surgery
8. Distal femoral fractures with neurovascular compromise.

Operative procedure:

Retrograde Nailing:

A 4 cm longitudinal midline skin incision is made, extending from the inferior pole of patella to the tibial tuberosity. The entry point is identified either by palpation or radiographically, positioned a few millimetres anterior and lateral to femoral attachment of posterior cruciate ligament, and aligned with the femoral canal. Radiologically, the entry point should coincide with the apex of Blumensaat's line on the lateral view. On the anteroposterior (AP) view, it is centred in the middle of the intercondylar notch. The bone awl was then removed and guide wire passed through the entry point. The fracture was reduced under image intensifier control and guide wire passed in proximal fragment. The nail was then inserted over the guide wire through the entry point made previously through distal and then proximal fragment. Either single or both holes were locked proximally. Similarly, the distal holes were locked in one, two or three numbers.

Figure 1: Retrograde nailing technique

Locking compression plating:

A triangular bolster kept under the operating knee to allow 30° of flexion helps in relaxing gastrocnemius muscle. 10-15cm long skin incision was made, sub cutaneous tissue, tensor fascia lata and vastus lateralis muscle were incised till the lateral condyle, reduction of the condyles done using point reduction clamp and image intensifier. Reduction held temporarily using two K wires plate re-positioning. LCP along with jig assembly is then slid along the shaft. The jig plate assembly is fixed to distal condylar portion with a temporary K wire. The condylar fragment is then aligned with metaphyseal fragment by appropriate traction and rotation under image control. The reduction is held temporarily with k wires, to align the plate along the shaft. After reduction and plate position parallel to the condyle is confirmed, the second K wire passed into jig, plate and condyle. The condyles are fixed to the plate using 6.5mm cannulated locking head cancellous screws without disturbing the reduction. The reduction and the position of the plate were controlled clinically and by image intensifier. The locking head screws inserted using jig sleeve assembly with image intensifier. The insertion guide is removed and wound is closed over a suction drain.

Static quadriceps exercise on 1st post-operative day and active bedside knee mobilization was started from second postoperative day. Suture removal was done on 11th postoperative day. Assisted walking following which patients were discharged was advised. Toe touch walking was allowed by the 6th week. Further, weight bearing was allowed depending on the clinical and radiological picture.

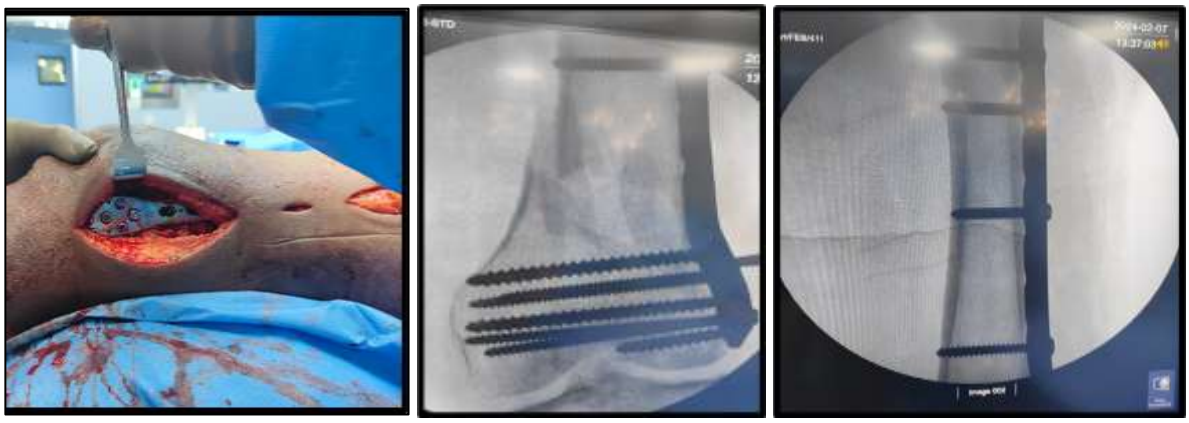


Figure 2: Locking compression plating: technique

Follow up was done at 6 weeks, 12 weeks and 6 months and 1 year interval regarding fracture healing, x-ray evaluation for union, pain and functional evaluation. Neer's Scoring System was used for evaluation at 6 months. The data was analysed using Epi Info software. Descriptive analysis was done for various demographic variables like age, gender, mechanism of injury and associated injuries. To compare conservative and operative management, we used chi square test and p value less than 0.05 was taken to be statistically significant.

RESULTS:

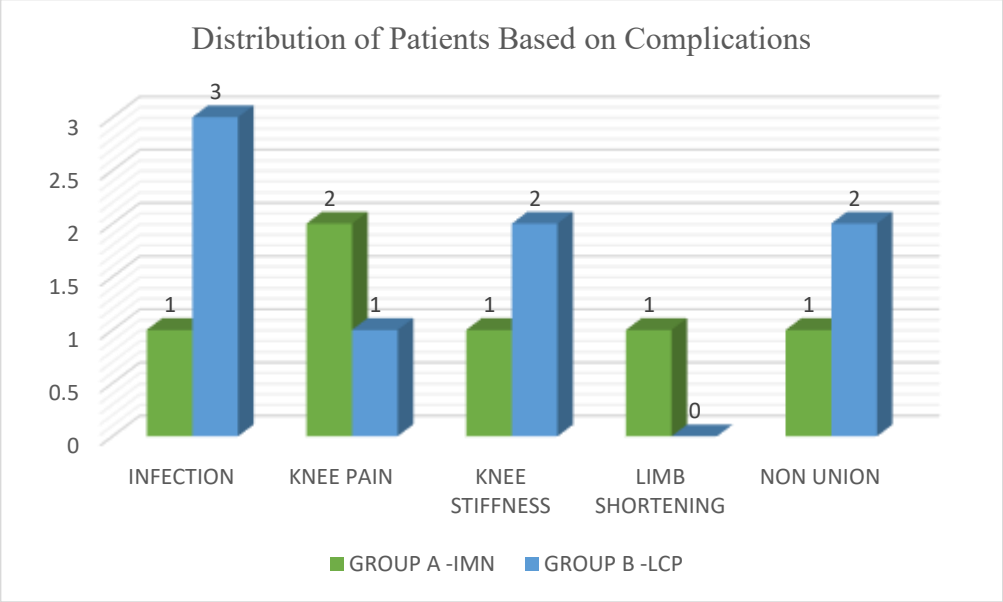
Around 60% cases were female, with most cases falling in the 51-60 age group, The mean age of IMN group was 49.67±9.53 years and LCP group was 58.6 ± 12.98 years. Right femur was affected more (63%) than left, with majority injuries (57%) occurring as a result of accidental self-fall. Average time taken for performing surgery with IMN technique being 79.1±9.74 mins (range: 65–120) and LCP technique which is average of 98 .67±14.61 mins (range: 75–150). Average blood loss from surgery was significantly less in IMN patients was 224.29±8 ml and for LCP was found to be 357.50±10 ml. Average time to union with IMN was 15.43±3.57 weeks which is earlier than the LCP group which was 18.05±4.0 weeks. The average duration of hospital stay in the present study was significantly shorter in IMN group, average of 7.56±3.61 days than 10.62±3.88 days in LCP group.

Functional outcome was assessed using Neer's Scoring System which showed IMN group, total 6(40%) cases are excellent,6(40%) cases are good, 2(13 %) case are fair and 1(7%) case was poor result. In LCP group total 5(33%) cases are excellent,6(40%) cases are good, 1(7%) was fair and 2(13%) was poor. Mean Neer score in group IMN was 82.2±17.77 and in group LCP was 80.27±20.93. Complications like infection (1 case), anterior knee pain (2 cases), knee stiffness (1 case), limb shortening (1 case), non-union (1 case) were seen in patients managed by retrograde nailing, whereas knee pain (1 case), knee stiffness (2 cases), infection (3 cases) and non-union (2 cases) for plating cases.

Parameters	IMN	LCP	p-value

Mean age ± SD, years	49.67±9.53	58.6 ± 12.98	0.157
Sex			
Male	7	8	0.709
Female	5	10	
Side			
Right	10	5	1
Left	9	6	
Mode of injury			
RTA	5	8	0.461
Self-fall	10	7	
Classification			
33A1	9	6	0.714
33A2	6	8	
Duration of surgery	79.1±9.74	98 .67±14.61	0.086
Blood Loss	224.60 ± 8 ml	310.50 ± 10 ml	0.01
Duration of hospital stay	7.56±3.61	10.62±3.88	0.04
Time to union	15.43±3.57	18.05±4.0	0.075
Neer score	82.2±17.77	80.27±20.93	0.342

Table 1: Demographic and postoperative parameters in the two groups



Graph 1: Distribution of Patients Based on Complications

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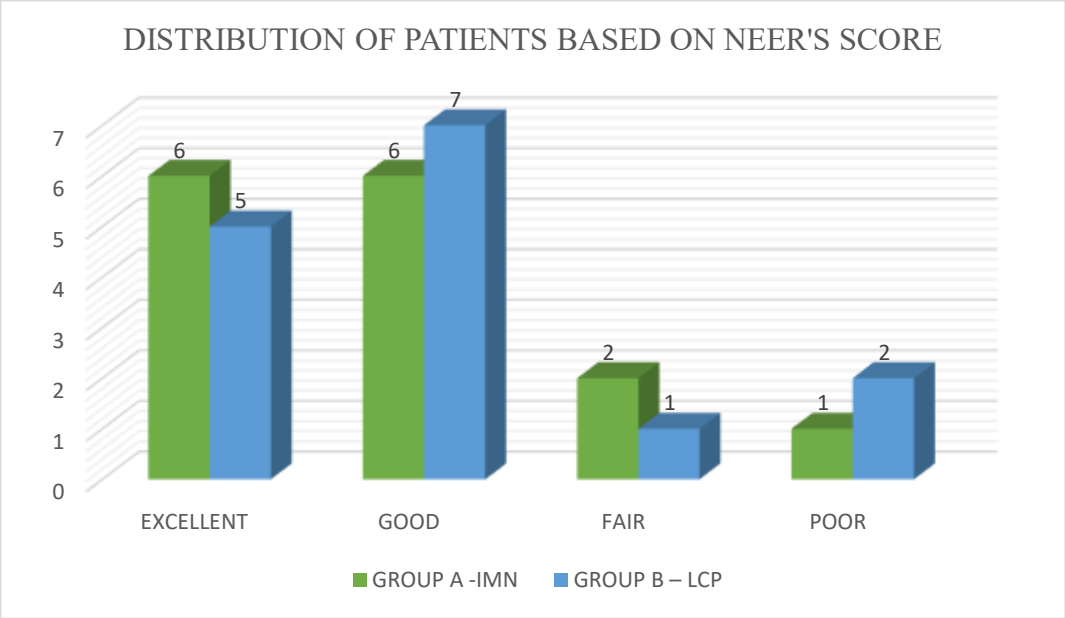

Graph 2: Distribution of Patients based on Neer's Score at 12 months

Figure 1: Pre operative and immediate, 4th and 1 year follow-up postoperative X-Ray (IMN)

Figure 2: Knee range of movements at 1 year (IMN)

Figure 3: Pre operative and immediate and 1 year follow-up postoperative X-ray (LCP)

Figure 4: Knee range of movements at 1 year (LCP)

DISCUSSION:

For several decades, there has been ongoing discussion about how to treat distal femoral fractures [8]. The methods used to treat distal femoral fractures surgically have changed over time. Because there were insufficient implants and ineffective surgical methods, conservative therapy was the recommended course of action until the 1970s. Conservative treatment, on the other hand, avoided surgery, but it frequently resulted in problems including non-union, malunion, and stiff knees, while also making it difficult to keep elderly patients bedridden. The LCP is a single beam construct where the strength of its fixation is equal to the sum of all screw-bone interfaces rather than a single screw's axial stiffness and pull-out resistance in unlocked plates Retrograde IMN, on the other hand, has the edge of being biological, not disturbing fracture hematoma because of indirect reduction, less soft tissue handling and no loss of blood supply to the bone as periosteum is left intact. Its disadvantages are lack of alignment control, posterior angulation, damaging the knee joint cartilage, risk of early OA knee and intra articular effect of reaming debris [9].

In the present study, average age of distal femur fracture was 49.67±9.53 years in Group A – IMN and 58.6 ± 12.98 years in Group B – LCP, c in this present study, total of 30 patients, among whom, 60% were females, remaining 40% were male indicating higher incidence in female patients, similar reports were noted in studies by Singh S et al [10], Yadav A et al [11] and Ahmed A et al [12] had male predominance. Present study reveals 56.67% of distal femur fractures are due to accidental self-fall, remaining 43.33% were due to road traffic accidents. The predilection of distal femur fractures was 63.33% to right femur and 36.67% to left femur.

The significant average time taken to perform the surgery with IMN technique being 79.1±9.74 mins (range: 65–120) which is less time consuming than LCP technique which is average of 98 .67±14.61 mins (range: 75–150). Average operative time in study by Ahmed A et al [12] was 105 minutes in retrograde nailing group and 110 minutes in plating group.

Regarding blood loss, IMN patients had less blood loss when compared with LCP operated patients in present study with no significant difference statistically. Average blood loss in IMN patients was 224.29±8 ml and for LCP it was 357.50±10 ml. In study by Gao K et al [13] the mean intraoperative blood loss was significantly higher in the IMN group (298 ± 65.2 ml, range 200–410) than in the LCP group (200 ± 48.9 ml, range 130–300). Regarding union of fracture, the fracture united well earlier among those who were operated with IMN at an average of about 15.07±3.71 weeks which is earlier than the LCP group which was 18.05±4.0 weeks. Mean duration until union was 26.5 weeks (SD=12.9; range 12 to 64 weeks) in the locked plating and 22.6 weeks (SD=13.1: range 12 to 60 weeks) in the retrograde nail group in the study by Gill S et al [14]. Whereas in study by Agarwal S et al [15], average duration of union in IMN was 14.69 weeks and in LCP was 16.25. Similar results were obtained by Krishna C et al [16] in their prospective study with 40 patients. The mean union time in group I (LCP) was 16.33± 8.77 weeks and in group II (IMN) was 11.00 ± 5.92 in study by Singh S et al [10].

The complications rate there was not much significant difference between the two groups. Knee pain (13.3%) and shortening (6.67%), infection (6.67%), non-union (6.67%) and knee stiffness (6.67%) was more common among those operated with IMN technique. Infection rate (20%), knee pain (6.67%), stiff knee (13.33%) and non-union (13.33%) was more common among the LCP patients. Most common complication presented was infections (13.3%) in overall 4/30 patients, mostly settled with culture sensitivity-based antibiotics and 2 patients needed secondary wound wash and debridement. At 3 months, patients with knee stiffness were given physiotherapy with a continuous passive motion (CPM) machine. Anterior knee pain was present in 3 patients (10%) with nailing and had no significant changes in functional outcome. They were treated with analgesics a for longer period (2-3weeks) compared to other patients. Many studies had proved the higher incidence of knee pain in patients with nailing. 3 cases of non-union were a result of hardware failure (screw breakage) and loss of

reduction. Non-union cases were treated with exchange implants and autologous bone grafting and eventually healed adequately.

Functional outcome assessed by Neer scoring system at end of 1 year was statistically insignificant between two groups, IMN had 82.2±17.77 and LCP had 80.27±20.93) on average. The final outcome based on Neer scoring system was not significantly different among these two groups (p-value: 0.841). In Group A – IMN,40%- 6 cases showed excellent results, 40% -6 cases showed good results, 13.37% - 2 cases had fair results and 6.67%-1 case had poor result. Among15 patients in Group B – LCP, 33.33% - 5 cases showed excellent results, 46.67% - 7 cases showed good results ,6.67% - 1 cases had fair results and 13.3% - 2 cases had poor results.

In a study by Ahmed A et al [12], the distal femoral locking plate group, 55% had an excellent NEER score, 35% had a satisfactory NEER score, while in the distal femoral nail group, 55% had an excellent NEER score, and 30% had a satisfactory NEER score. In a study by Jillala SR et al. [17], they obtained a satisfactory outcome in 46.4% of cases and 34.6% of cases for the nailing and plating groups, respectively, according to the NEER Score. In study by Krishna C et al [16], they had 11 excellent, 6 good, 1 fair, 2 poor cases in LCP group and 5 excellent, 7 good, 6 fair, 2 poor cases in IMN group. 70% excellent results were found in Retrograde nailing and 65% excellent results were found in Locked compression plating in the study by Agarwal S et al [15]. Functional outcome in study by Singh S et al [10], according to Neer's scoring system between two groups, group I (LCP) and group II(IMN) was statistically insignificant (p value- 0.134). Past studies have discovered similar functional outcome despite using different scoring system. Demirtas A. et al. [18], in their study, using Sanders's criteria, announced equivalent patients with excellent to good and fair to bad results. Concordant findings were also narrated by Markmiller M. et al. [19], with Lysholm Gillquist Scoring System, Gao K. et al [13] employing the Hospital for Special Surgery Score (HSS).

CONCLUSION:

Both retrograde nailing and LCP plating are best treatment options for distal femur fractures. Early healing, increase range of movement, less average surgical time, less complications are seen in nailing compared to plating but are statistically insignificant, the reason being mostly due to simple fractures treated by nailing and complex ones by plating. No significant differences were noted in the outcome between implants regarding radiological fracture union, complications rates like infection and non-union were higher in LCP plating cases.

Both procedures need correct preoperative planning and adequate surgical experience so as to avoid revision surgery. However, large study sample and long term follow up needed for accurate analysis of functional outcome.

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