European Journal of Molecular & Clinical Medicine

ISSN 2515-8260 Volume 08, Issue 03, 2021

Distal Femoral Fracture Fixation with Retrograde Nailing versus Plating: Femoral Alignment Outcome

Tarek AbdElsamad ElHewala, Alaa Ahmed Elngehy,Mohamed Khaled Engim , and Osam Mohamed Metwally

Department of Orthopedic surgery, Faculty of Medicine - Zagazig University

Abstract:

Background:Distal femur fractures occur following high-energy impact in young patients or low-energy injury in elderly patients with osteopenic or osteoporotic bone.This study is aimed to compare the results of retrograde Nailing versus plating technique in distal femoral fractures regarding both clinical and radiological alignment. Patients and methods:This study was conducted on 18 patients with distal femoral fractureswho divided into two groups; Group A treated by retrograde femoral nail (RGN) and group B treated by Plating technique. All patients were subjected to clinical and radiological measurements to assess the outcomes after surgery. Results:Clinical measurements in normal limb was 4.66±1.32 in retrograde nail group while it was 4.88±1.58 in plating group, the MAD in fractured limp clinically was 5.38±1.89 in retrograde nail group while it was 6.48±2.31 in plating group. The radiological MAD showed significant difference between the normal and operated side. Mechanical Lateral Distal Femoral Angle (mLFDA) in fractured limb was 88.66±2.54 in retrograde nail group while it was 89.33±3.67 in plating group (P=0.663). Medial Proximal Tibial Angle (MPTA) in fractured limb was 87.77±1.85 in retrograde nail group while it was 87.88±3.48 in plating group. In spite of the excellent results in RGN group compared with group (B), the overall results showed no significant difference statistically between the two groups. Conclusions: Retrograde nailing is a good fixation system for fractures of distal femur with better outcome in terms of range of movements, less infection rate and early mobilization.

Keywords: MDA; Retrograde Nailing;MPTA; Plating

INTRODUCTION

Distal femur fractures representabout 6% of all fractures in femur. It's noticed that there is a bimodal distribution of fractures based on age and gender.[(1)] Injury caused through high-energy mechanisms was more common in men whilst in women sustained injuries are mainly from low-energy mechanisms.[(2)]

There are many factors make the final results of treatment of these fractures unsatisfactory in many cases as Fracture type, associated injuries, patient age, pre-morbid medical status, soft tissue injury, and the possible neurovascular injuries. This

reflects the challenges that face the orthopedic surgeons during the course of treatment, whether by conservative or surgical methods [3].Long-term disability can still occur in patients with extensive articular cartilage damage, marked bone comminuting, and severe soft tissue injury[4,5].

Treatment of distal femur fractures has not produced a high percentage of excellent clinical results. Thin cortices, osteoporosis, a wide intramedullary canal, and fracture comminution have made stable fixation of these injuries difficult to achieve and maintain with traditional operative methods.[6]Problems with conventional open reduction and internal plate fixation of distal femoral fractures are well established. These problems have been linked to extensile exposures of the fracture site.[7]Because anatomical reduction and immediate motion of the limb was sought by surgeons, the merits of stabilization techniques were based additionally on mechanical factors than biological considerations. Precise, direct reduction and rigid stabilization had their biological consequences; a loss of bone perfusion, a decreased rate of fracture vascularization, and an increased susceptibility to infection.[8]

Many options for treatment of this fracture which is non-surgical treatmentlike skeletal traction or Casting and bracing and Surgical treatment like External fixation, intramedullary nail and Plate and screws.[9]The mechanical axis for each bone is always a straight line connecting two joint center points, whether in the frontal or sagittal plane. The anatomic axis line may be straight in the frontal plane but curved in the sagittal plane, as in the femur.[9]

The aim of the current study is to compare the results of retrograde Nailing versus plating technique in distal femoral fractures regarding both clinical and radiological alignment.

PATIENTS AND METHODS

This study was conducted to detect by clinical and radiological assessment, abnormalities in the lower limp alignment after treatment of distal femoral fracture in eighteen patients, the patients were either treated by retrograde femoral nail or plating technique of distal femur and they were collected from registry of Zagazig University Hospital from March 2020 till March 2021.

The work has been carried out in accordance World Medical Association (Declaration of Helsinki) for studies involving humans before prospective collection of patient's data and after informed consent was obtained from patients.

Inclusion Criteria:

Patients with extra-articular distal femoral fracture with intra-articular extension (open fractures grade I& II). Patients who are medically fit for surgery with age between (20-50) years.

Exclusion criteria:

Patients with intra-articular distal femoral fracture only, pathological fracture, fracture in children (immature skeleton), and open fracture grade III and patients who are medically unfit for surgery.

A. Clinical measurements:

Patients of both groups were subjected to the following clinical measurements of the coronal plane measurement used to identify the hip, knee and ankle centers: (1)Hip center fromthe midpoint between the anterior superior iliac spine and the pubic tubercle. (2)Knee center from the point between the medial and lateral border of the knee. (3) Ankle center fromthe point in the anterior ankle between the medial and lateral malleolus. A long arm goniometer was used to measure the coronal lower limb alignment either varus/valgus deviation using these surface landmarks[10].For Mechanical axis deviation expressed as distance between mechanical axis and midpoint of tibial plateau which normally 10 mm ± 7 mm [11].

B. Clinicsl assessment and Final total score:

Each patient in our study underwent for distal femur alignment, all data and complications that happened to the patients including (pain and its relationship to walking, joint stiffness, swelling, stair climbing, running, jumping, use of walking aids and ability to return to work) were recorded using (Modified Olerud Scale) score to assess the final outcome [12].

C. Radiological evaluation:

Standing long film x-ray with the patella facing forward from the hip to the ankle. The mechanical axis of the lower limb is determined on the full-length AP standing radiograph as the following: (a) The lateral or medial mechanical axis deviation (MAD) from the center of the joint is measured in millimeters (mm).(b)The mechanical Lateral Distal Femoral Angle (mLFDA) formed between the mechanical axis line of the femur and the knee joint line of the femur in the frontal plane (85°-90°). (c) Medial Proximal Tibial Angle (MPTA) formed between the anatomic or mechanical axis of the tibia and the knee joint line of the femur or tibia in frontal plane (85°-90°). (d)Posterior Distal Femoral Angle(PDFA) between the anatomic axis and the sagittal distal femoral joint orientation line, The PDFA is measured from the lateral view of the femur (83.1° ± 3,6°).[11]

Statistical Analysis

Data analyzed using Microsoft Excel software. Data were then imported into Statistical Package for the Social Sciences (SPSS version 20.0). Difference and association of qualitative variable were analyzed by Chi square test (X2). Differences between quantitative independent groups by unpaired t. P value was set at <0.05 for significant results &<0.001 for high significant result.

RESULTS

The current study showed that clinical measurements in normal limb was 4.66±1.32 in retrograde nail group while it was 4.88±1.58 in plating group (P = 0.812), the MAD in

fractured limp clinically was 5.38±1.89 in retrograde nail group while it was 6.48±2.31 in plating group (P = 0.277) with no significant difference between studied groups **(Table 1)**. The radiological MAD showed significant difference between the normal and operated side. However, there was no significant difference between the two groups **(Figure1)**.

Mechanical Lateral Distal Femoral Angle (mLFDA) in normal limp radiologically was 88.0±2.17 in retrograde nail group while it was 88.77±2.53 in plating group (P =0.498), the mLFDA in fractured limb radiologically was 88.66±2.54 in retrograde nail group while it was 89.33±3.67 in plating group (P=0.663) with no significant difference between studied groups **(Table 2).**

Medial Proximal Tibial Angle (MPTA) in normal limb radiologically was 88.00±2.12 in retrograde nail group while it was 87.11±2.97 in plating group (P=0.498), the MPTA in fractured limb radiologically was 87.77±1.85 in retrograde nail group while it was 87.88±3.48 in plating group (P =0.663) with no significant difference between groups and no significant between fracture and normal in both groups **(Table 3)**.

Posterior Distal Femoral Angle (PDFA) in fractured limp radiologically was 84.33±2.95 in retrograde nail group while it was 84.33±6.0 in plating group (P =0.922) with no significant difference between studied groups **(Figure 2)**.

A female case (40 years) sustained AO type A2 fracture of the distal Rt femur after a road traffic accident (RTA). The fracture limb measurements MAD, mLDFA, MPTA and PDFA were 0mm, 90°, 90° and 92°, respectively. Surgery was done with ORIF by locking plate **(Figure 3)**.

The studied cases were evaluated finally by Modified Oleured Scale and excellent results were found in 44.4% in group (A) and in 11.1% in group (B), while good results were found in 33.3% in group (A) and 55.6% in group (B), and fair results were in 11.1% in group (A) and 22.2% in group (B), and one case in both groups was poor 11.1%. In spite of the excellent results in group (A) compared with group (B), the overall results showed no significant difference statistically between the two groups **(Table 4)**.

Table (1): Clinical measurements of MAD distribution between studied groups at normal and operated sides:

	Group A	Group B	Unpaired t	P
Normal clinical	**4.66±1.32**	**4.88±1.58**	**0.242**	**0.812**
Fracture clinical	**5.38±1.89**	**6.48±2.31**	**0.925**	**0.277**
Paired t	**2.568**	**4.28**		
P	**0.029***	**0.00****		

ISSN 2515-8260 Volume 08, Issue 03, 2021

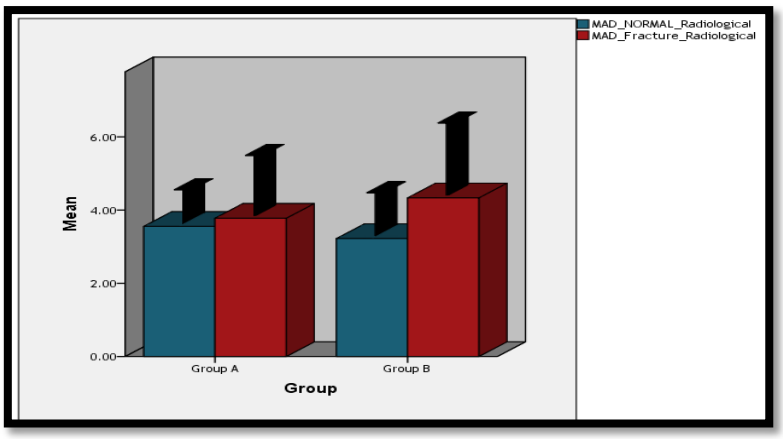

Figure (1): Radiological MAD assessment bar chart between the two groups, normal and operated sides

Table (2): Radiological mLDFA distribution between studied groups at normal and fracture sides

	Group A	Group B	Unpaired t	P
mLDFA normal	88.0±2.17	88.77±2.53	0.695	0.498
mLDFA Fracture	88.66±2.54	89.33±3.67	0.441	0.663
Paired t	0.686	0.612		
P	0.412	0.471		

Table (3): Radiological MPTA distribution between studied groups at normal and fracture sides

	Group A	Group B	Unpaired t	P
MPTA normal	88.00±2.12	87.11±2.97	0.695	0.498
MPTA Fracture	87.77±1.85	87.88±3.48	0.441	0.663
Paired t	0.654	0.632		
P	0.432	0.441		

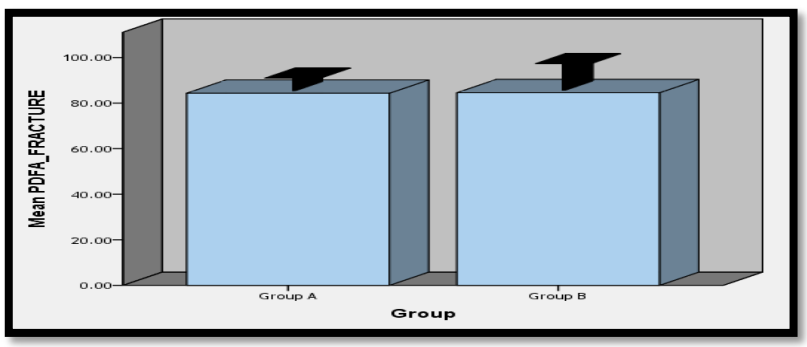

Figure (2): Radiological PDFA assessment bar chart at operated side

ISSN 2515-8260 Volume 08, Issue 03, 2021

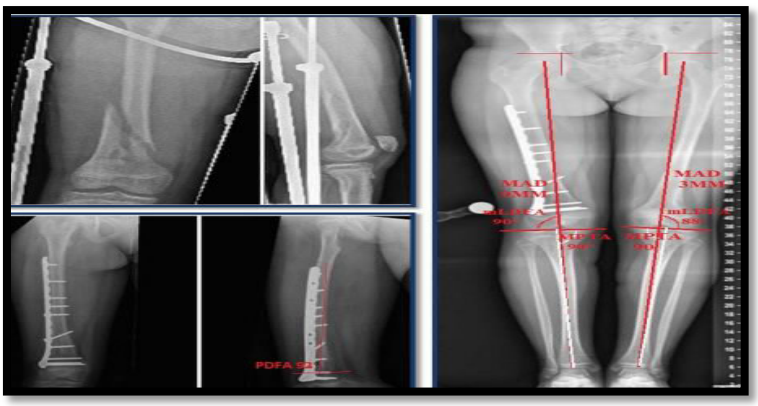

Figure (3): A40 yearsfemale patient sustained AO type A2 fracture of the distal Rt femur after a road traffic accident (RTA). Surgery was done with ORIF by locking plate.

Table (4): Final outcomes of studied cases between studied groups

			Group		X^2	P
			Group A	Group B		
Outcome	Poor	N	1	1	2.65	0.45
		%	11.1%	11.1%		
	Fair	N	1	2		
		%	11.1%	22.2%		
	Good	N	3	5		
		%	33.3%	55.6%		
	Excellent	N	4	1		
		%	44.4%	11.1%		
Total		N	9	9		
		%	100.0%	100.0%		

DISCUSSION

The current study showed that clinical measurements of limp alignment in fractured limp was 5.38±1.89mm varus in retrograde nail group while it was 6.48±2.31mm varus in plating group with no significant difference between studied groups, while the difference between normal and operated sides was significant statistically in both groups.

It was obvious that there was significant change in alignment between the normal and fractured limb. This can be due to the widening of the canal in distal femur with thin cortex and relatively poor bone quality.

This was the same results with finding in **Choudhary et al.**[13] study who mentioned that was a significant correlation between the AO classification and malalignment of the fracture.

Mechanical Lateral Distal Femoral Angle (mLFDA) in fractured limb was 88.66±2.54 degrees in retrograde nail group while it was 89.33±3.67degrees in plating

group (P =0.663) with no significant difference between studied. Medial Proximal Tibial Angle (MPTA) in fractured limb was 87.77±1.85 degrees in retrograde nail group while it was 87.88±3.48degreesin plating group (P =0.663) with no significant difference between studied groups. Posterior Distal Femoral Angle (PDFA) in fractured limb was 84.33±2.95degreesin retrograde nail group while it was 84.33±6.0degreesin plating group (P =0.922) with no significant difference between studied groups.

These results are in agreement with the study of **Choudhary et al.**[13] who concluded that there was no significant difference between studied groups regarding mLDFA and MPTA. Also, the study of **Markmilleret al.**[14] who concluded that there was no significant difference between studied groups regarding mal-alignments.

Gao et al.,[15] who reported that one (5.3%) patient in the plating group developed a late onset deep infection 5 months after surgery. There was no statistically significant difference in postoperative malreduction (p= 0.593) and hardware failure (p = 0.487). Knee pain was more common after nailing but there was no significant difference between the two groups (p = 0.326).

The current study showed that in retrograde nail outcomes were four patients (44.4%) excellent,three patients (33.3%) good, one patient (11.1%) fair and one patient (11.1%) poor, while in plate group there was one patient (11.1%) excellent, five patients (55.5%) good, two patients (22.2%) fair and 1 patient (11.1%) poor, with no significant difference between groups regard outcome although outcome was better among retrograde nail Group than plating group.

These is in agreement with the study of **Agarwal et al.**[16] where were fourteen patients (70%) were excellent, five patients (25%) were good and one patient (11.1%) was fair in Retrograde nailing group, while in plate group there were thirteen patients (65%) excellent, five patients (25%) good, one patient (5%) fair and one patient (5%) with no significant difference between groups regard outcome.

Similarly, **Hefny et al.** [17] who found that in retrograde nail group, the results were excellent in two patients (20.0%), good in three (30.0%), fair in three (30.0%) and poor in two patients (20.0%). In plate group B, the result was excellent in one patient (10.0%), good in four patients (40.0%), fair in three patients (30.0%) and poor in two patients (20.0%). There was no significant statistical difference regarding final score in the two studied groups (P > 0.05)

Also**, Ajith et al.**[18]who reported that in Retrograde nailing groupseven patients (46.67 %) were excellent, four patients (26.67%) were satisfactory, three patients (20%) unsatisfactory and one patient (6.67%) failure, while in plate group there were eight patients (53.33 %) excellent, three patients (20%) were satisfactory, three patients (20%) unsatisfactory and one patient (6.67%) failure with no significant difference between groups regard outcome.

CONCLUSION

In our study, both groups were significantly higher (Varus) at fracture side but still within normal. Also, the results of mLDFA, PDFA and MPTA tended to indicate that there is no significant difference between the two groups and between the normal limp and operated limb. Therefore,Retrograde nailing is a good fixation system for fractures of distal femur with better outcome in terms of range of movements, less infection rate and early mobilization.

REFERENCES

1. **Rafalla AAA; MD, Abdullah EA; MD. (2020).** Locked plate fixation of the distal femoral fractures by using the less invasive stabilization system (LISS). The Egyptian Orthopedic Journal; 2020 supplement (1), June, 55: 81-87.
2. **Khan AM, Tang QO, Spicer D.(2017).** The epidemiology of adult distal femoral shaft fractures in a central London major trauma centre over five years. The open orthopaedics journal 2017;11:1277.
3. **Zhao Z, Li Y, Ullah K, Sapkota B, Bi H, Wang Y.(2018).** The antegrade angle-stable locking intramedullary nail for type-C distal femoral fractures: a thirty four case experience. Int Orthop 2018;42(3):659-65.
4. **Sanders R, Swiontkowski M, Rosen H, Helfet D.(1991).**Double-plating of comminuted, unstable fractures of the distal part of the femur. JBJS 1991;73(3):341-6.
5. **Schatzker J.(1998).** Fractures of the distal femur revisited. Clinical orthopaedics and related research 1998(347):43-56.
6. **Du YR, Ma JX, Wang S, Sun L, Wang Y, Lu B, et al.(2019).** Comparison of Less Invasive Stabilization System Plate and Retrograde Intramedullary Nail in the Fixation of Femoral Supracondylar Fractures in the Elderly: A Biomechanical Study. Orthop Surg 2019;11(2):311-7.
7. **Krettek C, Müller M, Miclau T.(2019).** Evolution of minimally invasive plate osteosynthesis (MIPO) in the femur. Injury 2001;32:14-23.
8. **Massoud EI.(2015).** Fixation of distal femoral fractures**:** Restoration of the knee motion. Ulus Travma Acil Cerrahi Derg 2015;21(3):197-203.
9. **McKee M, Larsson S, Bucholz R, Heckman J, Torne P.(2006).** Rockwood and Green's fractures in adults. 2006;4:1915-67.
10. **Deep K, Nunag P, Willcox N, Deakin AH, Picard F (2016).**A Comparison of Three Different Methods of Measurement of Knee Deformity in Osteoarthritis. J Orth Rhe Sp Med 1(1): 107.
11. **Paley,Dror:Principles of Deformity Correction.(2002). /** Dror Paley. Springer-Verlag Berlin Heidelberg New York,2002
12. **Olerud S. (1972).** Operative treatment of supracondylar-condylar fractures of the femur: technique and results in fifteen cases. JBJS 1972;54(5):1015-32
13. **Choudhary S., Nishant K Gaonkar., Amit B Garud., Gaurav Sahu. (2019).** A study of the functional outcome of different operativemodalities of treatment for distal femur fractures. Int J Orthop Sci2019;5(2):911-922.

14. **Markmiller, Max MD; Konrad, Gerhard MD; Südkamp, Norbert MD. (2004).** Femur–LISS and Distal Femoral Nail for Fixation of Distal Femoral Fractures, Clinical Orthopaedics and Related Research: September 2004 - Volume 426 - Issue - p 252-257.
15. **Gao, K., Gao, W., Huang, J., Li, H., et al. (2013).** Retrograde nailing versus locked plating of extra-articular distal femoral fractures: comparison of 36 cases. Medical Principles and Practice, 22(2), 161-166.
16. **Agarwal, S., Udapudi, S., & Gupta, S. (2018).** To Assess Functional Outcome for Intra-Articular and Extra-Articular Distal Femur Fracture in Patients using Retrograde Nailing or Locked Compression Plating. Journal of Clinical & Diagnostic Research, 12(3).
17. **Hefny, A. M., Khira, Y. M., Mohamed, A. A., & Mousa, M. N. M. (2020).** Treatment of Distal Femoral Fractures by Retrograde Nail Versus Minimally Invasive Percutaneous Plate Osteosynthesis: A Comparative Study. The Egyptian Journal of Hospital Medicine, 78(1), 28-33.
18. **Ajith Kumar, K. S., Mohsin, S., &Sreeranga, N. (2020).** Comparative study of outcome of retrograde intramedullary nailing and locking compression plating of distal femoral fractures in adults. International Journal of Orthopaedics, 6(3), 765-768.