



Outcome of Fracture Distal Femur Treated with Intramedullary Interlocking Nailing

**Ajmal Khan Silro¹, Niaz Hussain Keerio^{2*}, Mohsin Aijaz Soomro³,
Muhammad Faraz Jokhio⁴, Raheel Akbar Baloch⁵, Najeeb Ur Rehman⁶
and Syed Shahid Noor⁷**

¹Dibba Hospital Fujairah, Al-Fujairah, United Arab Emirates.

²Muhammad Medical College and Hospital Mirpurkhas, Mirpur Khas, Pakistan.

³Suleman Roshan Medical Collage, Tando Adam, Pakistan.

⁴Liaquat University of Medical and Health Science, Jamshoro, Pakistan.

⁵Liaquat University Hospital Hyderabad. Pakistan.

⁶Peoples University of health and Sciences for Women, Nawabshah, Pakistan.

⁷Liaquat National Hospital and Medical College, Karachi, Pakistan.

Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

DOI: 10.9734/JPRI/2021/v33i40B32289

Editor(s):

(1) Dr. Jongwha Chang, University of Texas, College of Pharmacy, USA.

Reviewers:

(1) Zaid Abid-Ali AL-Shemmari, Al-Nahrain University, Iraq.

(2) Neeta Gade, All India Institute of Medical Sciences, India.

Complete Peer review History: <https://www.sdiarticle4.com/review-history/72214>

Original Research Article

Received 03 June 2021

Accepted 09 August 2021

Published 13 August 2021

ABSTRACT

Objective: To evaluate the functional and radiological outcome of the distal femur fracture treated with a retrograde locking nail.

Methods: This is a descriptive study conducted at the Orthopedic department Dibba Hospital Fujairah, United Arab Emirates for one-year duration from March 2019 to March 2020. All patients who met the inclusion criteria were treated with femoral retrograde nailing technique. The postoperative functional score was assessed according to Schatzker and Lambert criteria, which were rated excellent, good, and poor. Radiological union was assessed by X-rays.

Results: There were 103 patients with a mean age of 35.20 ± 10.66 (range, 20 to 50 years). There were 78 men (75.72%) and 25 women (24.27%). Most of the fractures (68.9%, $n = 71$) were

caused by car accidents. Fracture of the right side occurred in 70 (67.96%) patients, and the left side fracture in 33 (32.03%) patients. Excellent results were obtained in 75 (72.81%) patients and good results were obtained in 28 patients (28.20%). The nonunion has been documented in one patient.

Conclusion: Excellent and good functional and radiological results were obtained in patients with distal femur treated with retrograde locking nails. For some distal femoral fractures, we recommend the use of a retrograde locking nail.

Keywords: Distal femur fracture, schatzker and lambert criteria, interlocking nail.

1. INTRODUCTION

Fractures of the distal femur are often the result of high-energy injuries, such as car accidents in young patients, and low-energy injuries, such as a simple fall in older osteoporotic patients and women [1,2]. Although it accounts for 6% of common femoral fractures, inappropriate treatment can result in knee stiffness and osteoarthritis [3,4]. Distal femur fractures are usually treated surgically, and there are several treatment options for these fractures, but the ultimate goal is operative knee internal structure including alignment, fusion, weight bearing and early range of motion [5]. Closed intramedullary implants not only take into account the soft tissue sheath and the periosteum, but can achieve this goal without increasing the risk of infection and prolonged immobilization [6]. A retrograde-locking nail is associated with rapid healing, early union and fewer complications. This implant is preferred over plates and screws due to the load distribution during application, minimal soft tissue dissection and periosteal stripping, greater likelihood of union and earlier mobilization of the patient [7,8]. Treatment options for distal femur fractures in our department include traction treatment, locking plate, interlocking nails and Ilizarov [9]. We performed this descriptive study to determine the functional and radiological outcome of a distal femur fracture treated with a retrograde locking nail. The results of this study will help us establish standard guidelines for the management of distal femur fractures.

2. METHODS

This is a descriptive study conducted at the Orthopedic department Dibba Hospital Fujairah, United Arab Emirates for one-year duration from March 2019 to March 2020. All adult patients of both sexes with distal femoral fractures were admitted to an emergency department or OPD within a week were included in this study. Open fractures, pathological fractures and multiple injuries requiring surgical intervention in other

parts of the body were excluded from the study. All patients were initially assessed and treated for any life-threatening conditions. A complete interview and physical examination were performed in all patients. Skin traction or a long slab was used upon delivery. The limb was x-rayed in both views and the fracture was classified according to the AO classification system (A1 in 38, A2 in 30 A3 in 21, and C1 in 14). In the case of fragmented fractures, 3D computed tomography scanning was recommended. All operations were performed on radiolucent operating table with scope controls under general or spinal anesthesia. All patients were administered a second-generation cephalosporin (cefuroxime) during preoperative induction. The operation was carried out by a senior consultant with at least 5 years of experience after a postgraduation. All procedures were performed in a uniform and standard manner. The femoral condyles were opened through a central incision with a bent knee. An appropriate entry point was made with an image intensifier, 5-6 cm incision was made between the lower pole of the patella and the tuberositas tibia, and the arthrotomy was performed by longitudinally splitting the tendon, and a guide wire was passed, keeping reduction and alignment. Sufficient nail length (Short nails (25 cm) were used in all patients except 1 patient having mid distal shaft fracture 32 cm tibia nail was inserted retrogradely) and maximum diameter nail was seated firmly and locked (In 62 fractures, 1 screw was used for proximal locking, whereas in 41 fractures two screws were used for proximal locking) at both ends.

Physiotherapy was started on the first day after surgery to induce an early range of motion in the knee. Patients were initially called for follow-up at 2, 4, and 6 weeks, then monthly for a year. At each visit, patients were clinically assessed for range of motion and weight tolerance. X-rays were taken to view the bone union.

Radiological recovery was assessed using AP and lateral view x-rays. Categorical variables

(such as gender, fracture side, fracture type) were presented as frequency and percentage, while quantitative variables (such as age) were presented as mean and standard deviation.

Important variables such as age were stratified to control effect modifiers, and a Chi-square test was used to see statistical significance. A p value of <0.05 was considered significant.



Fig. 1(a). anterior-posterior and **1(b).** lateral radiographs of a patient with a supracondylar femur fracture that occurred 1 year after amputation **1(c).** postoperative anterior-posterior and **1(d).** lateral radiographs

Excellent-full extension	Flexion loss less than 10°
	No varus, valgus or rotary deformity
	No pain
	Perfect joint congruency
Good-not more than one of the following	Loss of length not more than 1.2 cm
	Less than 10° varus or valgus
	Flexion loss not more than 20°
Fair—any 2 of the criteria in Good category	
Failure—any of the following:	Flexion to 90° or less
	Varus or valgus deformity, exceeding 15° joint incongruency
	Disabling pain no matter how perfect the x-ray

Chart 1. Functional outcomes were assessed at 36 weeks using the Schatzker and Lambert criteria;

Type 1	Simple fracture
Type 2	Comminution, but no joint involvement
Type 3	Involvement of articulating surface

Schatzker Lambert Score (femur fracture classification)

Chart 2. Femur fracture classification

3. RESULTS

There were 103 patients with a mean age of 35.20 ± 10.66 (range, 20 to 50 years).

The majority of patients (47.57%, n = 49) were in the 21-30 age group, compared to 31-40 years (29.12%, n = 30) and 41-50 years (23.3%, n = 24).

Most of the fractures (68.9%, n = 71) were caused by car accidents. Fractures among car accident victims are bilateral or multiple sites, followed by the right or left side [10]. Fracture of the right side occurred in 70 (67.96%) patients,

and the left side fracture in 33 (32.03%) patients. Excellent results were obtained in 76 (72.81%) patients and good results were obtained in 27 patients (28.20%) including one patient having delayed union. The fracture type was AO type A1 in 38 (36.8%) patients, A2 in 30 (29.12%) patients, A3 in 21 (20.3%) patients and C1 in 14 (13.59%) patients. Age stratification (Table I), younger patients (21-30 years) they achieved excellent results compared to other age groups (p-value <0.05). The delayed union has been documented in one patient. Superficial skin infection was reported in 10 (9.7%) patients who recovered from extensive care and antibiotics.

Table 1. (a) Total Num of Patients

Total Num of Patients	103
Male	78(75.72%)
Females	25(24.27%)

There were 78 men (75.72%) and 25 women (24.27%).

Table 1. (b) Total Num of Patients

Age Groups	N	Excellent n=76	Good n=27
21 to 30 Years	49	44(89.8%)	6(12.2%)
31 to 40 Years	30	19(63.3%)	11(36.7%)
41 to 50 Years	24	13(54.2%)	10(41.7%)

1 delayed union was observed n=1

Table 2. Etiology of Fractures

AO type A1	38 (36.8%)
A2	30 (29.12%)
A3	21 (20.3%)
C1	14 (13.59%)

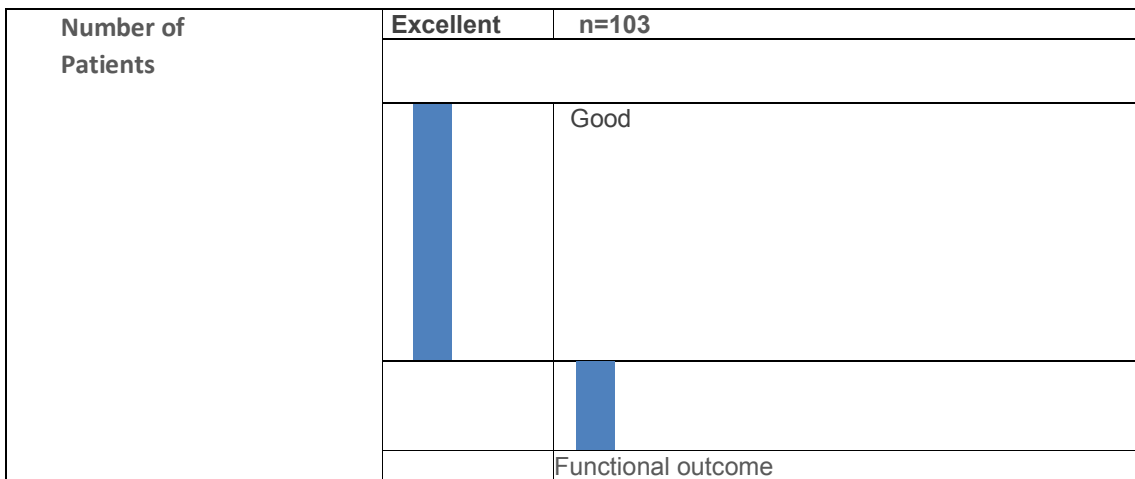


Fig. 2. Functional outcome assessed with Schatzker and Lambert criteria

4. DISCUSSION

The patterns of distal femur fractures are so diverse that no single treatment option can be recommended for all of these fractures. However, closed intramedullary nailing has fewer advantages in terms of complications compared to early mobilization and other treatment options [11]. The demographic profile of our study participants was almost the same as that reported in previous studies. In our study, excellent results were obtained in 75 (72.81%) patients according to Schatzker and Lambert criteria, and good results in 28 (28.20%) patients. Kim et al [12-16] had excellent or good results in 84% (26 of 31 patients), but the sample size was 31 [13,14]. They also reported 3 non-consolidated femurs in their series. They consider a retrograde nail to be a good option. In the treatment of distal femoral fractures, care should be taken only in overly comminuted fractures and fractures around the knee joints. 20 patients were treated with retrograde nailing and had excellent results in 50% of patients, good results in 20% and moderate results in 5%. However, the performance evaluation tool used was the Neer scoring system. The youngest patients in their series, like ours, achieved good results [13]. However, they reported multiple complications such as pulmonary embolism in 2 patients, shortening of the femur in 3 patients, knee stiffness in 2 patients, and delayed union in 3 patients. No connection in their series were also reported. A study also stated that 9% are not united in their work. In our study, we obtained a higher rate of union with minimal complications, and similar results were obtained in previous studies [14-15]. Retrograde nailing is a closed treatment option without breaking the fracture hematoma and leads to early callus formation. This observation was confirmed by Henderson in his comparative study with nailing [16]. He found excessive early periosteal callus formation in the nail group compared to the plating group. Recommendation of titanium nails was also made for the treatment of distal femoral fractures in elderly patients, especially distal femoral fractures. Comparison was made between retrograde intramedullary nailing with traditional open reduction and found a much greater need for posterior bone grafting and the incidence of defective union in the ORIF group than in the nailing group. There was also a higher rate of infection and non-union in the ORIF group, but this was not statistically significant [17-18]. A study presented the results in contrast to previous studies when comparing the constant

blade angle with the retrograde nails. He found that while the nailing and coating worked just as well, the nailing group patient had more knee pain complaints and had more revision surgery to remove the nails [19-20]. Two local studies involving 31 and 140 patients, respectively, found that retrograde nailing for distal femur fracture gave excellent functional and radiological results with minimal complications. Our study design was descriptive [21-22]. Our study had a small sample size and short follow-up time. (53 weeks) We recommend randomized trials with larger sample sizes and longer follow-up times to verify our results [23].

5. CONCLUSION

Excellent and good functional and radiological results have been obtained in patients with the distal femur treated with retrograde locking nails one patient faced delayed union but later on he was healed completely. We recommend retrograde locking nails as the first choice for certain distal femur fractures. With this treatment option, patients walk and move earlier and return to work and social life faster than with other treatments for similar fractures.

CONSENT AND ETHICAL APPROVAL

The study was approved by the hospital's Ethics Committee (ERB). Informed consent was obtained from all participants.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

REFERENCES

1. Shah, Syed Ghulam Mujtaba, Adeel Ahmed, Saeed Ahmed Shaikh, Nadeem Ahmed, and Allah Rakhio Jamali. "Outcome of Fracture Distal Femur Treated with Retrograde Nailing." *Journal of Pakistan Orthopaedic Association*. 2019;31(4):149-152.
2. Noor SS, Hussain N, Javed I. Functional outcome of locked intramedullary interlocking nail in patients with diaphysial femur fracture.
3. Rollo, Giuseppe, Michele Bisaccia, Giuseppe Rinonapoli, Auro Caraffa, Valerio Pace, Javier Cervera Irimia, Enio de Cruto et al. "Radiographic, bone densitometry and clinic outcomes

- assessments in femoral shaft fractures fixed by plating or locking retrograde nail." *Medical Archives*. 2019;73(3):195.
4. Hake Mark E, Max E, Davis Aaron M, Perdue, and James A. Goulet. "Modern implant options for the treatment of distal femur fractures." *JAAOS-Journal of the American Academy of Orthopaedic Surgeons*. 2019;27(19):e867-e875.
 5. Yuan Yi, Bing Luo, Qi Hao, Jun Yuan, Gang-bo Qu, Pan-deng Hao, Zhi-jiang Zeng, Jia-fu Yang, and Zu-jian Xu. "Clinical outcomes of revision with retrograde intermedullary nailing for failed plating of distal femoral fractures: a retrospective study." *International Orthopaedics*. 2020:1-6.
 6. Herrera, A., J. Albareda, S. Gabarre, E. Ibarz, S. Puértolas, J. Mateo, and L. Gracia. "Comparative analysis of the biomechanical behavior of antero/retrograde nailing in supracondylar femoral fractures." *Injury*; 2020.
 7. D'sa, Prashanth, and Saravana Vail Karuppiyah. "Extra articular distal femoral fractures in the elderly treated with retrograde nailing using a spiral-locking blade system." *Indian Journal of Orthopaedics*. 2019;53(2):232.
 8. Schumaier Adam P, Brendan R, Southam Frank R, Avilucea Ryan P, Finnan John D, Wyrick Michael T, Archdeacon, and Theodore T. Le. "Factors Predictive of Blocking Screw Placement in Retrograde Nailing of Distal Femur Fractures." *Journal of Orthopaedic Trauma*. 2019;33(6):e229-e233.
 9. Aloudah AA, Almesned FA, Alkanan AA, Alharbi T. Pattern of Fractures Among Road Traffic Accident Victims Requiring Hospitalization: Single-institution Experience in Saudi Arabia. *Cureus*. 2020;12(1):e6550. Published 2020 Jan 3. DOI:10.7759/cureus.6550
 10. Lee, Jae-Ho, Ki-Chul Park, Seung-Jae Lim, Kyeu-Back Kwon, and Ji Wan Kim. "Surgical outcomes of simple distal femur fractures in elderly patients treated with the minimally invasive plate osteosynthesis technique: can percutaneous cerclage wiring reduce the fracture healing time?." *Archives of Orthopaedic and Trauma Surgery*. 2020:1-10.
 11. Richard Raveesh D, Roman M, Natoli Anthony T, Sorkin Walter W, Virkus, Greg E, Gaski. "Retrograde intramedullary nailing below a hip arthroplasty prosthesis: a viable fixation option for periprosthetic and interprosthetic femur fractures." *International Orthopaedics*. 2020:1-7.
 12. Kim JW, Oh CW, Kyung HS, Min WK, Yoon SH. Factors Affecting the Results of Distal Femoral Fractures Treated by Retrograde Intramedullary Nailing. *Chinese Journal of Reparative and Reconstructive Surgery*. 2009;23(11):1311-1315.
 13. Yoon, Byung-Ho, In Keun Park, Youngwoo Kim, Hyoung-Keun Oh, Suk Kyu Choo, and Yerl-Bo Sung. "Incidence of nonunion after surgery of distal femoral fractures using contemporary fixation device: a meta-analysis." *Archives of Orthopaedic and Trauma Surgery*; 2020.
 14. Bisaccia, Michele, Auro Caraffa, Giuseppe Rinonapoli, Giovanni Battista Mancini, Giuseppe Rollo, Miguel Carrato-Gomez, David Gomez-Garrido et al. "Feasibility and value of non-locking retrograde nail vs. locking retrograde nail in fixation of distal third femoral shaft fractures: radiographic, bone densitometry and clinical outcome assessments." *Medicinski Glasnik*. 2020;17(1).
 15. Memon, Rohan, Drashtant Patel, and Nirav Patel. "Functional outcomes of retrograde femoral nailing in extra articular distal third femoral fractures." *International Journal of Orthopaedics*. 2020;6(1):143-146.
 16. Shah Jay K, Patrick Szukics, Arianna L, Gianakos Frank A, Liporace, Richard S. Yoon. "Equivalent union rates between intramedullary nail and locked plate fixation for distal femur periprosthetic fractures—a systematic review." *Injury*; 2020.
 17. Hefny, Abdelsalam Mohammed, Yuosuf Mohammed Khira, Ashraf AbdEldayem Mohamed, and Mohammed Nasr Mahmoud Mousa. "Treatment of Distal Femoral Fractures by Retrograde Nail Versus Minimally Invasive Percutaneous Plate Osteosynthesis: A Comparative Study." *The Egyptian Journal of Hospital Medicine*. 2020;78(1):28-33.
 18. Tandon T, Tadros BJ, Avasthi A, Hill R, Rao M. Management of periprosthetic distal femur fractures using distal femoral arthroplasty and fixation-Comparative study of outcomes and costs. *Journal of Clinical Orthopaedics and Trauma*. 2020;11(1):160-4.

19. Griffin XL, Costa ML, Phelps E, Parsons N, Dritsaki M, Achten J, Tutton E, Lerner RG, McGibbon A, Baird J. Intramedullary nails versus distal locking plates for fracture of the distal femur: results from the Trial of Acute Femoral Fracture Fixation (TrAFFix) randomised feasibility study and process evaluation. *BMJ open*. 2019;9(5):e026810.
20. Kumar A. Clinical assessment of supracondylar femur fracture with retrograde nailing in patients from bihar region. *International Journal of Medical and Biomedical Studies*. 2019; 3(11).
21. Griffin XL, Costa ML, Phelps E, Parsons N, Dritsaki M, Png ME, Achten J, Tutton E, Lerner R, McGibbon A, Baird J. Retrograde intramedullary nail fixation compared with fixed-angle plate fixation for fracture of the distal femur: the TrAFFix feasibility RCT. *Health Technology Assessment (Winchester, England)*. 2019;23(51):1.
22. Dhanda S, Munde S. Functional analysis of distal one-third extra-articular femoral fracture managed with retrograde femur nailing system. *Indian Journal of Orthopaedics*. 2019;5(3):182-8.
23. Muralidharan R. A Comparative study on the Functional Outcome in the Management of Extra Articular Distal Femur Fractures by Retrograde Intramedullary Interlocking Nailing Vs Distal Femoral Locking Plate (Doctoral dissertation, Madurai Medical College, Madurai).

© 2021 Silro et al.; This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/4.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Peer-review history:
The peer review history for this paper can be accessed here:
<https://www.sdiarticle4.com/review-history/72214>