

Functional and Radiological Outcome of Retrograde Interlocking Nailing in Distal Femur Extra Articular Fracture

Ali Raza¹, Shujauddin², Abdul Waqas³, Sohaib Ilyas⁴, Sharjeel Hassan⁵, Muhammad Rashid⁶, Adeel Hamid⁷

¹⁻⁷Department of Orthopaedic Surgery, PGMI/ Lahore General Hospital, Lahore

Corresponding Author: Dr Shujauddin, Senior Registrar of Orthopedic Surgery,
Lahore General Hospital, Lahore **Email:** Drshujauddin111@gmail.com

Received:	28-03-2024
Revision :	18-06-2024
Accepted:	12-09-2024

ABSTRACT

Background: Among the several joints that bear the body's weight, the knee is particularly difficult to understand due to its anatomical peculiarities. Damage to the knee can change its stability, alignment, and mobility, which can hinder function. Fractures of the distal femur make up 4-6% of all femoral fractures, yet they only account for less than 1% of all fractures. For these fractures, antegrade nailing is seen to be the preferred course of action. Nonetheless, difficulties in maintaining good central location of the nail in a very wide medullary canal at this level led to the creation of the retrograde process.

Objective: The objective of this study was to evaluate the functional and radiological outcome in distal femur fractures fixed with retrograde nailing technique.

Methods: A prospective descriptive case series conducted in Department of Orthopedic Surgery, Lahore General Hospital Lahore of 47 patients with closed, isolated distal femur fractures, aged 18-60. Records were maintained for the side of the fractured bone, infection, radiological union time, start of weight bearing, and function outcome. Retrograde nailing (RN) was done in all patients after spinal anesthesia. Following the procedure, patients were followed up in the outpatient department (OPD) in the 2nd, 6th, 12th, 16th, 20th, 24th, 36th & 48th weeks. second, sixth, twelve, sixteen, twenty, twenty-four, thirty-six, and forty-eight. Clinical observations recorded local infection. The radiological union scale (RUST) was used to observe union, and a modified American knee society score was used to measure functional result.

Results: Thirty (63.8%) of the 47 patients were men, and seventeen (36.2%) were women. The patients' mean age was 38.8±6.19 years. There were 02 cases of infections (4.24%). The union rate with the retrograde nailing technique was 42 (91.5%). Of the 47 patients, 25 (53.2%) had good functional outcomes, 09 (19.2%) had good , 10 (21.3%) had average , and 03 (6.3%) had poor scores according to AKSS.

Conclusion: Retrograde nails provide a dependable alternative for managing complex distal femur shaft fractures, with a low infection incidence, satisfactory functional and radiological outcome.

Keywords: Distal shaft of the femur, closed fracture, retrograde nail

INTRODUCTION

Knee is one of the primary weight-bearing joints in the body. Handling its problems is challenging due to peculiar anatomical facts.¹ Function may be hampered by damage to this joint, which can alter knee stability, alignment, and movement.^{2,3} Less than 1% of all fractures are distal femur fractures, which account for 4-6% of all femoral fractures.^{6,7} Young individuals who have been in high-energy accidents like motorcycle and car crashes and those who have had trauma connected to sports are the two main categories affected by distal femur fractures. Osteoporosis-related distal femur fractures in the elderly are another consequence of low-energy falls.

Antegrade nailing is regarded as the optimal course of care for these fractures.¹⁻³ Retrograde procedures, however, was created as an alternative method of fixation.⁵ Retrograde nail has grown in popularity over the last 20 years or more, especially in North America.^{5,6} The nail is inserted as a minimally invasive procedure that preserves

blood supply and fracture hematoma while preventing significant soft tissue damage through the distal femur's intercondylar notch.^{8,9,10}

The fundamental objective of the retrograde method to treating distal femur fractures is to preserve distal femur alignment like other methods including locking plates and DCS, in order to preserve extremity function.⁹ The retrograde method provides multiple advantages, such as easier patient placement and nail insertion, a shorter operating time, and less blood loss, in addition to eliminating the requirement for a traction table.^{7,8} They are highly advised in cases of obesity, pregnancy, and concurrent hip fractures.^{11,12} However, they are generally not recommended in situations when there is patella baja, or extensive soft tissue damage around the knee. The purpose of this study was to determine the functional and radiological outcomes of different treatment regimens for distal femur fractures in our local population. The results though based on a single surgical unit and its practices

need to be studied on larger scale in order to develop guidelines.

METHODS

A prospective cohort study was conducted in the Department of Orthopedic Surgery, Lahore General Hospital Lahore, from March 2021 to January 2023 after approval of ethical review approval. The sample consisted of 47 people, aged 18 to 60, who had closed, isolated distal femur extra articular fractures. Patients with open epiphyseal plates, pathological fractures, grade 3 open fractures, intercondylar extension, ischemic heart disease, chronic liver illness, chronic renal disease, head injuries with a Glasgow coma score of less than 14, and cancer were excluded from the study. After informed consent, Every patient received follow-up in the second, sixth, twelve, sixteen, twenty, twenty-four, thirty-six, and forty-eight weeks in the outpatient department (OPD). The American Knee Society Score (AKSS) 15 was used to quantify functional outcome, and the radiological union scale (RUST) 14 was utilized to measure union.

SPSS version 23.0 was used to analyze the data. A quantitative variable, like age, was represented by the mean and standard deviation. Frequencies and percentages were used to display qualitative characteristics like fracture side and gender. When it comes to qualitative variables (gender, presence or absence of infection, and union), chi-square analysis or the Fisher exact was used with <0.05 p-value was taken as significant.

RESULTS

Thirty (63.8%) of the forty-seven patients were men, and seventeen (36.2%) were women. The patients' average age was 38.8 ± 6.19 years. Table1 shows that out of 47 patients, 26 (55.3%) had a right femur and 21 (44.7%) had a left femur. The infection rate was 02 (4.2%). The union rate using the retrograde technique was 45 (95.8%), with 28 (59.5%) having an excellent functional outcome, 08 (17.1%) good, 09 (19.2%) having an average, and 02 (4.2%) having a poor functional outcome.

The rate of nonunion till last follow-up was 4.2%. The AKSS score was excellent in 59.5%, good in 17.1%, average in 19.2% and poor in 4.2% at last follow-up.

Table-1: Gender, Age, Side, Infection, Union and Functional Outcome

Variables	Retrograde Nail (n=47) (%)
Gender of the Patient	
• Male	30 (63.8%)
• Female	17 (36.2%)
Age of the patient in years (Mean$\pm$SD)	38.8 $\pm$ 6.19
Laterality	
• Right	26 (55.3%)
• Left	21 (44.7%)
Infection	
• Yes	02 (4.2%)
• No	45 (95.8%)
Union of the bone	
• Yes	45 (95.8%)
• No	02 (4.2%)
American Knee Society Score	
• Excellent	28 (59.5%)
• Good	08 (17.1%)
• Average	09 (19.2%)
• Poor	02 (4.2%)

Table-2: Rate of Union of Fracture with Chi-Square Tests

Groups	Union of the bone		N=94 (%)	P-value
	Yes (n=45) (%)	No (n=2) (%)		
Total patients 47	45 (96%)	02 (4.0%)	47 (100%)	0.001

DISCUSSION

Fractures of the distal femur are common, mainly the consequence of low-energy trauma in the younger as well as older populations.¹³⁻¹⁶ Complications and associated injuries are common.^{17,18} A study of the literature revealed that only a small number of research had been done on femur fractures in this patient group, compared to the large number of studies that have been published on management of distal femur fractures.²⁰⁻²³ An intramedullary antegrade nail is the gold standard method for fixing fractures of the femur shaft.^{19,22} Antegrade technique reports a union rate of above 97% in such cases.^{2,3} For fractures, especially those that happen in the distal section of the shaft of femur, retrograde intramedullary nailing is a more suitable course of action. In certain situations, retrograde operations have proven to be more effective than antegrade approaches. These circumstances include pregnancy, obesity, bilateral femoral shaft fractures, floating knee-type injuries, and

ipsilateral acetabular or femoral neck fractures. The retrograde approach is better than the antegrade one since it is simpler technically, facilitates access to fractures, and doesn't require traction or a fracture table. Not only does it not raise the risk of heterotopic ossification of the hip joint, but compared to antegrade nailing, it drastically shortens the surgical time. Additionally, the risk of abductor damage is eliminated in comparison to the antegrade approach.¹⁹ The retrograde nail provides a more stable fixation because it achieves better purchase and adherence at both ends and a longer functional length in cases of distal shaft fracture.^{20,24}

Research comparing union times²⁰⁻²¹ demonstrates that employing the retrograde nailing approach results in a slower union time than the antegrade nailing technique when a nail is passed retrogradely. However, our study demonstrated the equivalency of union time as compared to ante grade nailing technique. However, it is dependent on several factors, including mechanical parameters and fracture morphology. According to Ostrum et al²¹ the variation in union time was more likely to be caused by fracture morphology and geometry than by insertion technique. They noted when fractures occurred at the junction of the distal third and intermediate fractures, the union time was continuously delayed. Furthermore, Moed and Watson²⁶ reported that static locking was more likely to cause longer union times and that dynamization was necessary for 19% of their patients to achieve union. Early union can also result from early dynamization. Kregor et al showed nonsignificant trend for increased infection (25%) and nonunion (33%) in the ORIF group versus 0% infection and 9% nonunion in RN group, that similar to our study.²²

Although it is a very safe approach, there are still some dangers involved, including synovial metallosis, articular cartilage injury, quadriceps atrophy, and knee stiffness and soreness. Though concerning, knee stiffness did not lead to loss of knee range of motion because most patients were still able to achieve flexion of greater than 100 degrees during our experiment. In addition, these fracture patients also showed signs of ligamentous instability. Nevertheless, it was concluded that early trauma was most likely the origin of this instability, rather than the nailing procedure.²³

Other issues seen with the RN technique include heterotopic ossification, infections and malalignment of the knee joint, neurovascular injury during proximal screw insertion, and symptomatic distal screws. Two of the patients in our study showed limb length discrepancy, and four of the patients had angular malunion; however, neither patient required surgery to treat their conditions. However, in order to treat

symptomatic distal screws, either distal screw removal was necessary or analgesics were utilized.

In our survey, 28 people (59.5%) scored excellent, 08 people (17.1%) scored well, 09 people (19.2%) scored mediocrely, and 02 people (4.2%) scored poorly. Outstanding results were reported by Solanki et al.²⁴ in 18 (34.6%) instances. Patients rated 22 (42.3%) as satisfactory, 07 (13.5%) as fair, and 05 (9.6%) as poor. This discrepancy in functional outcome could be attributed to the older group in Solanki et al.,²⁴ with a mean age of 41.77 years and complex intraarticular fractures. This investigation's functional outcome is similar to Khajotia et al.²⁵

The technological obstacles related to the use of implants were disregarded. For better fracture access in the future, a different approach utilizing minimally invasive technologies might be considered.

CONCLUSION

The functional outcome and union rate of the retrograde nailing method are encouraging. Additionally, it shows greater dependability in certain complicated cases of distal femur fractures, when antegrade nailing can be successfully replaced with the retrograde approach.

CONFLICT OF INTEREST / DISCLOSURE: Nil.

FUNDING SOURCE: Nil.

AUTHORS' CONTRIBUTION:

AR: Acquisition of data, conception & design, analysis and interpretation, final approval of manuscript.

SD: Data acquisition and interpretation, manuscript writing, revision for important intellectual contents

AW: Data acquisition and interpretation

SI: Helped in data collection and manuscript writing.

SH: Interpretation and analysis

MR: Helped in data collection and manuscript writing.

AH: Helped in data collection and manuscript writing.

REFERENCES

1. Gwathmey WF, Jones-Quaidoo SM, Kahler D, Hurwitz S, Cui Q. Distal femoral fractures: current concepts. JAAOS- Journal of the American Academy of Orthopaedic Surgeons. 2010;18(10):597-607.
2. Martinet O, Cordey J, Harder Y, Maier A, Bühler M, Barraud GE. The epidemiology of fractures of the distal femur. Injury. 2000;31:62-94.
3. Santolini E, West R, Giannoudis PV. Risk factors for long bone fracture non-union: a stratification approach based on the level of the existing scientific evidence. Injury. 2015;46:S8-19.

4. Gangavalli AK, Nwachuku CO. Management of Distal Femur Fractures in Adults: An Overview of Options. *Orthop Clin North Am.* 2016;47(1):85–96.
5. Saka N, Watanabe Y, Sasaki G, Kawano H. Corrective Intra-Articular Osteotomy Using a 3D-Printed Model and Induced Membrane Technique for AO/OTA C3 Distal Femur Fracture with Articular Malunion and Metaphyseal Nonunion. *Case Rep Orthop.* 2020 ;2020:1250231.
6. Sain A, Sharma V, Farooque KVM, Pattabiraman K. Dual Plating of the Distal Femur: Indications and Surgical Techniques. *Cureus.* 2019;11(12):e6483.
7. Kiyono M, Noda T, Nagano H, et al. Clinical outcomes of treatment with locking compression plates for distal femoral fractures in a retrospective cohort. *J Orthop Surg Res.* 2019;14(1):384.
8. Ehlinger M, Ducrot G, Adam P, Bonnomet F. Distal femur fractures. Surgical techniques and a review of the literature. *Orthop Traumatol Surg Res.* 2013 ;99(3):353–60.
9. Smith WR, Ziran BH, Anglen JO, Stahel PF. Locking plates: tips and tricks. *J Bone Joint Surg Am.* 2007;89(10):2298–307.
10. Meneghini RM, Keyes BJ, Reddy KK, Maar DC. Modern retrograde intramedullary nails versus periarticular locked plates for supracondylar femur fractures after total knee arthroplasty. *J Arthroplasty.* 2014;29:1478–81
11. Ebraheim NA, Kelley LH, Liu X, Thomas IS, Steiner RB, Liu J. Periprosthetic distal femur fracture after total knee arthroplasty: a systematic review. *Orthop Surg.* 2015;7(4): 29–305.
12. Matlovich N.F, Lanting B.A, Vasarhelyi E.M, Naudie D.D, McCalden R.W, Howard J.L. Outcomes of surgical management of supracondylar periprosthetic femur fractures. *J. Arthroplasty.* 2017;32:189–92.
13. Ristevsk BI, Nauth A, Williams DS, Hall JA, Whelan D.B, Bhandari M, Schemitsch EH. Systematic review of the treatment of periprosthetic distal femur fractures. *J. Orthop Trauma.* 2014;28:307–12.
14. Neubauer T, Ritter E, Potschka T, Karlbauer A, Wagner M. Retrograde nailing of femoral fractures Acta Chir Orthop Traumatol Cech. 2008;75:158–66.
15. 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.
16. Christodoulou A, Terzidis I, Ploumis A, Metsovitis S, Koukoulidis A, Topsis C. Supracondylar femoral fractures in elderly patients treated with the dynamic condylar screw and the retrograde intramedullary nail: A comparative study of the two methods. *Arch Orthop Trauma Surg.* 2005; 125(2): 73–79.
17. Papadokostakis G, Papakostidis C, Dimitriou R, Giannoudis PV. The role and efficacy of retrograding nailing for the treatment of diaphyseal and distal femoral fractures: A systematic review of the literature. *Injury.* 2005;36(7):813–822.
18. El-Kawy S, Ansara S, Moftah A, Shalaby H, Varughese V. Retrograde femoral nailing in elderly patients with supracondylar fracture femur; is it the answer for a clinical problem? *Int Orthop.* 2007;31:83–6.
19. Ricci WM, Sanders R. Retrograde femoral nailing. In: Robinson CM, Alho A, Court-Brown CM, editors. *Musculoskeletal trauma series- femur.* London ; Arnold publishers; 2002:112–27
20. Henderson CE, Lujan T, Bottlang M, Fitzpatrick DC, Madey SM, Marsh JL. Stabilization of distal femur fractures with intramedullary nails and locking plates: Differences in callus formation. *Lowa Orthop J.* 2010;30:61–8.
21. Kumar A, Jasani V, Butt MS. Management of distal femoral fractures in elderly patients using retrograde titanium supracondylar nails. *Injury.* 2000;31(3):169–73.
22. Kregor PJ, Obremskey WT. Long-term functional outcomes after intra-articular distal femur fractures: ORIF versus retrograde intramedullary nailing. *Orthopedics.* 2008;31(8):748–50.
23. Hartin NL, Harris I, Hazratwala K. Retrograde nailing versus fixed-angle blade plating for supracondylar femoral fractures: a randomized controlled trial. *ANZ J Surg.* 2006;76(5):290–4.
24. Habib MK, Niazi A. Outcome of Retrograde Interlocking Nail in Supracondylar Femur Fracture. *J Pak Ortho Association.* 2018;30(1):5–8.
25. Shafiq M, Akram R, Ahmed A, Kaleem ullah, Ahmad I, Atiq uz Zaman et al. Retrograde femur nail; Outcome of retrograde femur nail, is it the implant of choice for the distal shaft of femur fracture? *Professional Med J.* 2018; 25(3):364–370.
26. Moed BR, Watson JT. Retrograde nailing of the femoral shaft. *J Am Acad Orthop Surg.* 1999;7(4):209–216.



This open-access article distributed under the terms of the Creative Commons Attribution License (CC BY 4.0). To view a copy of this license, visit <https://creativecommons.org/licenses/by/4.0/>