



ORIGINAL ARTICLE

Assessment of knee pain and knee range of motion (ROM) in distal third femur shaft fractures managed with retrograde (RG) intramedullary locking nail: A Retrospective study.

Jemal Girma¹, Hannan Akbar², M. Muazzam³, Hazrat Akbar⁴, M. Ali Ayub⁵, Anum Hafeez⁶

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ABSTRACT... Objective: To assess knee pain and ROM in distal third femoral Fracture managed with RG intramedullary nailing technique. **Study Design:** Retrospective study. **Setting:** Ghurki Trust Teaching Hospital, Lahore. **Period:** November 2020 to March 2021. **Material & Methods:** 38 patients with extra-articular distal femoral Fracture were surgically treated in our center with an RG IM nail. The functional Outcome of the knee for knee pain and knee ROM was assessed using a modified Hospital for Special Surgery (HSS) Knee Score. **Results:** In this study, a total of 38 patients were diagnosed with distal third femur shaft fractures managed with retrograde (RG) intramedullary locking nail; among these, 31 (81.6%) were males, and 7 (18.4%) were females. The mean age of patients was 29.76 ± 11.87 , ranging from 16-50 years. In more than half of the cases, 30 (78.9%) had a history of injury as road traffic accident and 8 (21.1%) sustained fall. The right side affected 65.8% of cases compared to the left side. 60.53% of cases had excellent functional Outcomes due to HSS score between 85-100, 7.89% had good outcomes because of scores ranging from 70-84, 26.32 had fair, and 5.285 had poor outcomes, respectively. There was no case with extension lag. **Conclusion:** Based on this study, RG IM nail fixation of distal extra-articular femur fracture can be safely performed, and improved knee function score can be anticipated with meticulous patient selection and adherence to proper postoperative physical therapy protocol.

Key words: HSS Scoring System, Knee Pain, Knee ROM, Retrograde Intramedullary Nail.

INTRODUCTION

Approximately 37 per 100,000 people get a distal third femur fracture every year. Young males tend to have high-energy damage mechanisms, while old ladies often experience low-energy mechanisms. It might be difficult to treat these fractures. Most surgeons consider that distal femur fractures must be surgically repaired to get the best patient results.¹ There is an ongoing debate on the most effective technique for treating extra-articular distal third femoral fractures.¹⁻⁵ The natural environment for healing a fracture is disrupted by open fixation, which is frequently linked to a higher likelihood of infection and non-union.⁶

Low-invasive procedures and the idea of

“biological” fixation have reduced the risk of complications. Some surgeons like the ‘biological’ technique of retrograde intramedullary (RG) femoral nailing because it has good control over the distal section.^{7,8} On the other hand, a locking plate (LP) continues to be a well-liked and successful alternative to treating these difficult injuries. Anatomically pre-contoured locking plates provide the major benefit of protecting soft tissue with a minimally invasive procedure.⁹⁻¹¹ Retrograde IM nailing can produce a longer working length, and the distal portion may be fixed with numerous interlocking screws. Retrograde nailing is recognized to provide a higher benefit to antegrade IM nailing for infra-isthmus femoral shaft fractures regarding implant location, control of the short distal fragment, and

1. MBBS, Resident Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore.
2. MBBS, Resident Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore.
3. MBBS, Resident Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore.
4. MBBS, Resident Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore.
5. MBBS, Resident Orthopaedic & Spine Surgery, Ghurki Trust Teaching Hospital, Lahore.
6. MBBS, M.Phil (Anatomy), Assistant Professor Anatomy, Lahore Medical and Dental Colleges, Lahore.

Correspondence Address:
Dr. Jemal Girma
Department of Orthopaedic & Spine Surgery,
Ghurki Trust Teaching Hospital, Lahore.
jem6399@gmail.com

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fixation stability despite articular cartilage injury and postoperative knee discomfort.¹²

Despite the widespread use of retrograde nailing for fixation of distal femoral Fracture, few studies have been done to analyze the functional outcome of the knee concerning knee pain and stiffness. This study is conducted retrospectively to assess knee pain and stiffness in distal femoral fractures managed with the retrograde nailing technique.

MATERIAL & METHODS

The extra-articular distal femoral fractures examined in this retrospective analysis conducted at the Department of Orthopaedics & Spine Centre, Ghurki Trust Teaching Hospital, Lahore from Nov 2020 to March 2021, included those treated at our center using retrograde intramedullary interlocking nails. The following were the requirements for inclusion in this study: (a) acute, unilateral fractures; (b) patients who could walk unassisted before the accident; and (c) femoral supracondylar fractures and supracondylar fractures with fracture line extension into distal third femoral shaft. Patients having pre-injury knee discomfort, pre-injury knee stiffness, fractures involving an articular surface, Open fractures classified as Gustilo III, fractures connected to neurovascular injuries, fractures connected to cruciate ligament tears, patients requiring intensive care or transfer to other departments for treatment and periprosthetic supracondylar femoral fractures following total knee arthroplasty were excluded from this investigation. According to the Orthopaedic Trauma Association classification, the fractures were categorized.¹³

From November 2020 to March 2021, a retrospective study design was performed on 38 patients after approval from ethical committee (2023/01/R-06) with an extra-articular distal femoral fracture who were surgically treated in our center with RG IM nail were matched for inclusion criteria for analysis as age ranged from 16-50 years and Classification (AO/OTA) 33A2 23 and 33A3 9.

Operative Management

A skilled group of orthopaedic surgeons who did not favor any particular fixation technique conducted all operations. Every patient was lying flat on a radiolucent table. The knee was positioned in a mild flexion over a bolster by reducing the deforming stress of the gastrocnemius and improving the sagittal plane reduction of the Fracture. Thru 3-5cm skin incision, patellar splitting approach used to identify intercondylar notch. The center guide pin was determined to be precisely located using anterior-posterior and lateral Intra operative imaging. Entry to the medullary canal was made at the exact location, and reaming was done. An appropriate-sized nail is inserted, and the two distal locking screws are first placed. After confirmation of correct alignment, rotation, and reduction, proximal two lockings are also done. The Ortho nail system was used in 30 patients, and the SIGN nail system was utilized in 2 patients. No pneumatic tourniquet was used in any patient.

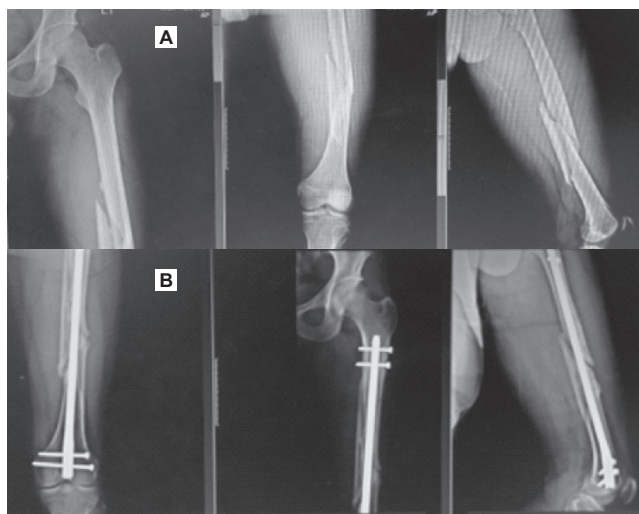


Image-1 (a). Xray showing Fracture of left shaft of femur with distal 3rd extension b. 6mo postop x-ray of same Fracture managed with RG nail with the good healing progress.

Postoperative Management

The patients began to perform an active knee range of motion after surgery. In collaboration with the physical therapy department in our center, active and assisted range of motion exercises started on 1st POD. Weight-bearing as tolerated started on most patients with stable patterns of Fracture, and delayed weight-bearing protocol

was instituted in those patients with unstable fracture patterns. All patients were educated on how to proceed with their physical therapy protocol and provided with a manual for further reference throughout their recovery.



Image-2. clinical picture of a patient with full ROM, weight-bearing, and squatting comfortably three months after RG IMN fixation for distal 3rd left femoral Fracture. Healed infrapatellar and lower lateral thigh incision sites for nail entry and locking, respectively, can be seen.

Statistical Analysis

All the data were entered and analyzed using SPSS software version 22. Frequency and percentages were constructed for demographic features like gender, injury mechanism, side effect, and HSS scoring system (Excellent/ good/ fair/poor) outcome. Mean, standard deviation, minimum, and maximum values were calculated for age and HSS score. Stratification of functional outcome and demographic profile was done using the Chi-square test of independence. All $p \leq .05$ was considered to be significant.

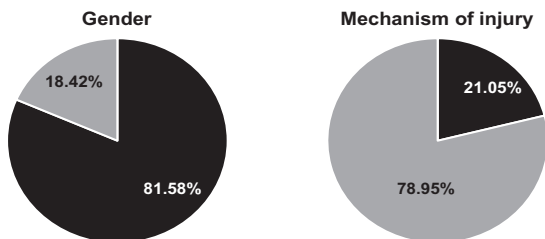


Figure-1. Demographic profile of distal third femur shaft fracture patients (n=38)

Title	Points
1. Pain-30 points	15
A. 1. No pain on walking	10
2. Mild pain on walking	5
3. Moderate pain on walking	0
4. Severe pain on walking	15
B. 1. No pain at rest	10
2. Mild pain at rest	5
3. Moderate pain at rest	0
4. Severe pain at rest	
2. Function-22 points	12
A. 1. Walking and standing unlimited	10
2. Walking distance of 750 meters outdoors and standing >30 min.	8
3. Walking up 350 meters outdoors and standing <30 min.	4
4. Walking inside and brief standing	0
5. Can't walk	5
B. 1. Climb stairs	2
2. Climb stairs with support	5
C. 1. Transfer activity without support	2
2. Transfer activity with support	
3. ROM-18 points	
1. 1 point for each 8° of arc of motion maximum of 18 points	
4. Muscle strength -10 points	10
1. Can't break quadriceps power	8
2. Can break quadriceps pwr	4
3. Moves through arc of motion	0
4. Can't move through arc of motion	
5. Flexion deformity -10 points	10
1. No deformity	8
2. Less than 5°	5
3. 5-10°	
4. 11° or more	0

* **Remarks:** Subtract 1 point for using cane, 2 points for 1 crutch and 3 points for 2 crutches. 2 points for 5° of extension lag, 3 points for 10° and 5 points for 15° or more.

Table-I. Modified HSS knee score

		Statistics	
		Age	HSS_SCORE
N	Valid	38	38
	Missing	0	0
Mean		29.7632	79.3421
Std. Deviation		11.66754	13.53130
Minimum		16.00	45.00
Maximum		50.00	90.00

Table-II. Descriptive statistics of clinical profile of distal third femur shaft fractures patients (n=38)

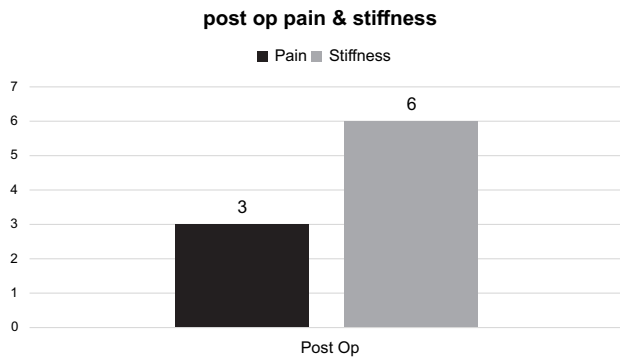


Figure-2. Distribution of post op pain & stiffness

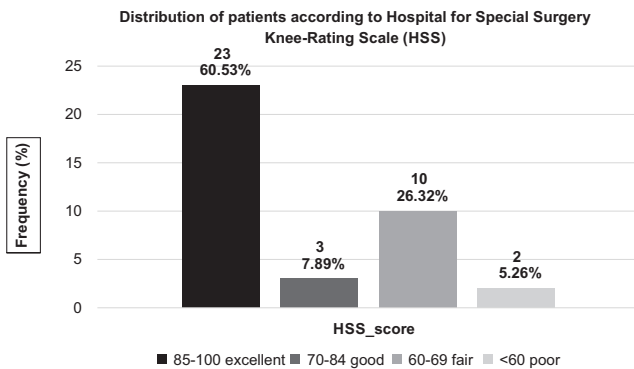


Figure-3. Distribution of cases according to the outcome using HSS

In this study, a total of 38 patients were diagnosed with distal third femur shaft fractures managed with retrograde (RG) intramedullary locking nails; among these, 31(81.6%) were male cases, and 7(18.4%) were female cases. The mean age of patients was 29.76 ± 11.87 , ranging from 16-50 years. In more than half of the cases, 30(78.9%) had a history of injury as RTA and 8(21.1%) sustained fall. The right side affected 65.8% of cases compared to the left. The postop knee pain was observed in only 3 cases. Postop knee stiffness was found in 6 cases. Physiotherapy

management was done in all cases. (Table-I) The average HSS score was 79.32 ± 13.53 ranging from 45 to 90. 60.53% of cases had excellent functional Outcomes due to HSS sore between 85-100, 7.89% had good outcomes because of scores ranging from 70-84, 26.32 were fair, and 5.285 had poor outcomes, respectively. (Figure-1) There is no significant association found between demographic profile (Age, gender, mechanism of injury, and side effects) and functional outcome as $p > .05$. (Table-II)

DISCUSSION

The closed antegrade intramedullary interlocking nail has been the gold standard therapy for femoral shaft fractures, with extensive series reporting union rates of more than 97%.¹⁴ The preferred care method for fractures in the supracondylar area of femur is now retrograde nailing. The two most important phases in femoral interlocking nailing techniques are achieving closed reduction and identifying the entry site for nail insertion.¹⁵ The entry point has significant consequences for the ease of insertion and strength of fixation.¹⁶ Retrograde nailing is a superior alternative for treating femoral shaft fractures in patients with multiple injuries than antegrade nailing because it is technically simpler, makes it easy to reach adjacent fractures, and does not need traction on a fracture table. Since the technique also makes it possible to treat ipsilateral femoral shaft and tibial shaft fractures, several surgeons have recommended using it to treat bilateral femoral shaft fractures and floating knee injuries. Some have increased its use to include patients with ipsilateral neck of femur ,pelvic or acetabular fractures.

Parameters	Categories	Excellent	Good	Fair	Poor	P-Value
Gender	Male	20(64.5)	2(6.5)	8(25.8)	1(3.2)	.526
	Female	3(42.9)	1(14.3)	2(28.6)	1(14.3)	
Age (years)	16-30	13(65)	1(5)	6(30)	-	.387
	31-50	10(55.6)	2(11.1)	4(22.2)	2(11.1)	
Mechanism of Injury	RTA	16(53.3)	3(10)	9(30)	2(6.7)	.350
	Fall	7(87.5)	-	1(12.5)	-	
Side	Right	14(58)	3(12)	6(24)	2(8)	.392
	Left	9(69.2)	-	4(30.4)	-	

Table-III. Stratification of functional outcome based on demographic characteristics of patients

As it is a RG intramedullary device, it protects hip abduction musculatures and also avoid incisions at the area of later acetabulum surgical sites. Retrograde nailing is a viable option for individuals who are obese and have skin lesions in the greater trochanter region.

For pregnant patients, femoral retrograde nailing is relatively safe since there is no direct radiation exposure to the pelvic area. Because the antegrade technique might result in considerable heterotopic ossification of the hip joint and retrograde nailing reduces the associated surgical time, patients with the head of femur fractures may also benefit. Retrograde nailing of the femur has developed during the past several decades to alleviate some of these shortcomings of antegrade nailing.¹⁷ It achieves union rates for femoral shaft fractures that range from 88 to 98% and are equivalent to those of antegrade nailing. Surgery continues to be challenging for fractures of the distal part of the femoral shaft. Because of its volume, nail may move within the cavity in stress. This causes difficulty in maintaining reduction. Even when the Fracture has been successfully reduced with an antegrade or supracondylar nail, loading the femur may cause a loss of reduction. Because of its longer functional length in the fracture fragments and higher adhesion at both ends, the retrograde nail offers a more robust fixation. The retrograde nailing treatment may cause knee discomfort, stiffness, quadriceps atrophy, articular cartilage degradation, and synovial metallosis, which limits its widespread use.

Numerous investigations have demonstrated that the range of motion is not significantly impacted, despite knee stiffness following retrograde nailing being a prominent worry.¹⁷ In our series, 87.5% (28) of the operated knees flexed over 100 degrees (on average, 110 degrees). The retrograde nail may not be the sole cause of anterior knee discomfort, which several other things, including initial trauma-induced cartilage damage, quadriceps atrophy, or ligamentous instability, can cause. In our study, it was the second most frequent complaint (34.38%) and was noticed even a year after surgery. Most patients' discomfort did not

interfere with daily activities, and only 6 (18.75%) experienced moderate pain that slightly restricted daily activities and necessitated painkillers. It is uncertain how much this ligamentous instability contributes to knee discomfort, even though 5 to 48% of femoral shaft fractures result in ligamentous damage. Retrograde nailing does not affect the anterior cruciate or collateral ligaments. Hence the original damage is most likely to blame for this instability.¹⁷ Postop knee function has been assessed in terms of knee pain and/or ROM instead of a comprehensive function. Although the modified Hospital for Special Surgery (HSS) Knee Score (Table-I) was created in connection to total knee replacement surgery, the study's overall evaluation was well-suited to the system's first two components—the knee score and knee function score.

In our study, 60.53% of cases had excellent functional outcome due to HSS score between 85-100, 7.89% had good outcome because of score ranging from 70-84, 26.32 had fair and 5.285 had poor outcomes respectively. In research to evaluate the use of retrograde locked intramedullary nails in patients with distal femur fractures, Gurkan et al.⁷ conducted an investigation. According to his study, great results were obtained in five cases (29.4%), good results in six cases (35.3%), intermediate results in five more cases, and bad results in one case (5.9%). In comparison to earlier research, our results are rather excellent.

As seen by the lower knee score, retrograde nail appears to have a negative impact on knee functionality. Studies show up to 70% of people may experience postoperative knee discomfort following retrograde nailing.¹⁸ Another study found that individuals who had retrograde nailing suffered knee discomfort statistically more frequently than those who had antegrade nailing. As was previously indicated, the cause of this discomfort has been linked to incidents such as concurrent patellar or ligamentous damage from the original trauma, knee joint infection, distal locking screws, quadriceps atrophy, or projecting nails.¹⁴ However, none of the trials had adequate follow-up time to demonstrate a link between

retrograde nailing and an increased risk of knee osteoarthritis. In the absence of a prominent nail within the knee joint or septic arthritis, the risk of knee osteoarthritis is likely less; however, the long-term incidence of osteoarthritis following retrograde nailing remains unknown.¹⁴ Increased knee instability reduces the knee score, even though the cause is likely unrelated to the nail surgery. Therefore, it might not be acceptable to blame the retrograde nail treatment for the low overall knee ratings. Regardless of the source, the reality remains that at least 27% of patients have impaired knee function, defying the claims of numerous writers that knee function is not greatly impacted.⁸ Different knee joint assessment criteria may also cause this dispute, in addition, a different surgical approach or a different postoperative physical therapy regimen may contribute. The condition of the operated knees got better. But more research with a longer follow-up period should paint a clearer picture. With attention to the appropriate postoperative physical treatment and careful patient selection, this study shows that RG IM nail fixation of distal extra-articular femur fracture may be done safely. It also shows that an increased knee function score can be predicted. A knee ROM from full standing to squatting was attained in 40.6% of postoperative patients with an HSS score of 90.

CONCLUSION

This study demonstrates that RG IM nail fixation of distal extra-articular femur fracture can be safely performed, and it's a reliable alternative in such fractures. Improved knee function scores can be anticipated with meticulous patient selection and proper postoperative physical therapy protocol adherence. However, a more detailed study with longer follow-up is required to determine the different outcomes of such fixation.






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AUTHORSHIP AND CONTRIBUTION DECLARATION

No.	Author(s) Full Name	Contribution to the paper	Author(s) Signature
1	Jemal Girma	Article writing.	
2	Hannan Akbar	Data collection.	
3	M. Muazzam	Data collection.	
4	Hazrat Akbar	Results.	
5	M. Ali Ayub	Discussion writing.	
6	Anum Hafeez	Article review.	