A STUDY OF FUNCTIONAL OUTCOME OF RETROGRADE INTRAMEDULLARY INTERLOCKING NAILING IN TREATMENT OF SUPRACONDYLAR FEMORAL FRACTURE

Prakriti Raj Kandel,[1] Bipan Shrestha,[1] Kishor Man Shrestha,[1] Pritam Chaudhary[1]

ABSTRACT

INTRODUCTION

Fractures of the distal femur are usually sustained from high velocity trauma in adults and trivial fall in elderly. These fractures are usually associated with severe degree of comminution and intra-articular involvement. Therefore, anatomical reduction of fracture fragments, restoration of limb length, and early mobilization are key factors for optimal outcomes of involved limb. This longitudinal study was intended to evaluate the functional outcome of distal femoral fracture in adults managed surgically by retrograde nail.

MATERIAL AND METHODS

This prospective and observational hospital based study was carried out in Orthopedics Department, Universal College of medical Sciences-Teaching Hospital (UCMS-TH) from July 2020 to June 2021. All patients with traumatic distal femoral fractures (AO/OTA type A) who fulfilled the inclusion criteria were enrolled in the study and were treated surgically by retrograde nail. Fracture was classified according to AO/OTA classification and functional outcome was assessed according to Neer's scoring system. Post-operatively patients were regularly followed at 6 weeks, 3 months and 6 months.

RESULTS

In this study of 30 cases, male to female ratio was 3:2 with mean age of 39.47 years. Road Traffic Accident (RTA) was most common mode of injury. The functional outcome evaluated according to Neer's scoring system was found good result in 43.3%, excellent in 36.7%, fair in 16.7% and poor in 3.3%. The mean Neer's score was 78.9.

CONCLUSION

Distal femoral fractures (AO/OTA type A) when treated with retrograde nailing has good to excellent functional outcome in majority of cases with minimal manageable complication.

KEYWORDS

Distal femoral fracture, Functional outcome, Retrograde nailing.

1. Department of Orthopaedics and Trauma Surgery, Universal College of Medical Sciences, Bhairahawa, Nepal

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For Correspondence
Dr. Prakriti Raj Kandel
Department of Orthopaedics & Trauma Surgery
Universal College of Medical Sciences
Bhairahawa, Nepal
E-mail: pratul22@gmail.com

INTRODUCTION

Distal femoral fractures are one of the most complex injuries to manage with potential to cause long term disabilities. These are fractures involving the distal 15 cm of femur including metaphysis and/or the articular surface.[1] They currently account for <1% of all fractures and about 3 to 6% of all femoral fractures.[2]

The fractures of distal femur show bimodal distribution where one group of patients belong to age below 40 years, predominantly males, sustaining high-energy trauma such as traffic accident or a fall from heights, whereas the other group consists of patients >50 years, predominantly females, with osteoporosis following relatively low energy trauma.[3,4] Distal femur fractures either extra-articular or intra-articular are challenging to treat because of their unstable nature and association with severe degree of comminution. Anatomical reduction, restoration of limb alignment and early mobilization has shown to be an effective way of managing most distal femoral fractures.[5]

In the early 1960s, most distal femur fractures were managed conservatively with fracture bracing and traction, achieving acceptable results in 67% to 90% of patients. The problems associated with conservative management were limitation of reduction and difficulty of maintaining reduction. It was also associated with complications of prolonged immobilization, increased hospital stay, bed sores, angular deformity, loss of knee range of motion and economic burden.[6] However, with the advent of new surgical techniques and implants, the pendulum shifted from conservative management to surgical stabilization of these injuries.[7] In the present scenario of improved techniques and implants fractures of distal femur are best treated by surgical stabilization which opens the way for anatomic reduction of articular surface, restoration of limb alignment and early mobilization thereby achieving early union and good knee function.[1]

Locking compression plate and retrograde nailing are two most commonly used surgical treatment modalities for distal femur fracture at present. Each of these modalities has their own pros and cons and is used based on the fracture pattern or according to AO/OTA classification.[8]

Retrograde nailing has evolved as one of the acceptable treatment modalities of distal femoral fracture. It is usually indicated for extra-articular or AO/OTA type A distal femur fracture. Intramedullary nailing through a retrograde approach was a commonly used technique in the late 1990s. Advantages of retrograde intramedullary nailing included minimally invasive insertion techniques, decreased blood loss and operative times as well as a mechanical advantage of central implant position.[9]

Hence, this study was conducted to evaluate the functional and clinical outcome of distal femur fracture treated operatively by retrograde nail.

MATERIAL AND METHODS

A hospital-based observational, longitudinal study was designed and approved by IRC of UCMS-TH, Bhairahawa, Nepal (UCMS/IRC/046/20). The sample size was calculated using Cochran's formula, $n=z^2 pq/d^2$.

n=required sample size p=prevalence of disease q=100-p z=1.96 taken at 95% confidence interval d=allowable error taken as 3.5%

$P= 1\%^2$, q=100-1=99% $n= \{1.962 \times 1 \times 99\}/3.52 = 30$

The sample size calculated by the above formula was found to be approximately 30. So, we included a total of 30 patients with distal femur fracture in our study. Data were collected from patients with extra-articular distal femur fractures who reported to Department of Orthopaedics, UCMS-TH, Bhairahawa, Nepal, from July 2020 to June 2021.

Inclusion criteria

Age ≥18 years
Extra-articular distal femur fracture (AO/OTA type A1, A2, A3)
Both sexes

Exclusion criteria

Age <18 years
Pathological fracture
Periprosthetic fracture
Congenital anomaly of the affected limb
Previous fracture of the affected limb
Patients unfit for surgery

Distal femur fractures are traumatic injuries involving the region extending from the distal metaphyseal-diaphyseal junction to the articular surface of the femoral condyles. The fracture was classified according to AO/OTA classification (Fig 1). Among various surgical techniques described for distal femur fracture we used retrograde nailing for AO/OTA type A1, A2 and A3.

Demographic data such as age, gender and address were recorded along with information regarding mode of injury, side of injury and other associated injuries. The patients with extra-articular distal femur fracture were initially assessed for any life threatening injuries according to Advanced Trauma Life Support protocol (ATLS) and were managed accordingly. The fractures were immobilized with above knee posterior slab or knee immobilizer in emergency or OPD for maintaining alignment of limb.

All preoperative investigations including radiographs were sent along with CT scan if needed. Then the patient was planned for surgery after getting clearance on pre-anesthetic check-up. All cases were operated by a single surgeon.

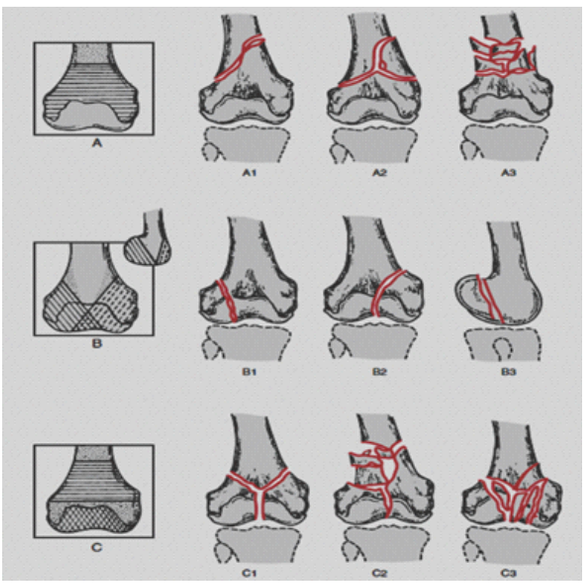

Fig.1 AO Classification system

Surgical technique

Patients were positioned supine on operating table with knee flexed to 30 degree using a bolster under distal thigh. This knee flexion helps to relax the gastrocnemius which aids in reduction of fracture. Closed reduction of the fracture was done using fluoroscopy guidance. A longitudinal midline skin incision of 4-5 cm was made extending from the inferior pole of patella till the tibial tuberosity. In this study, patellar tendon spitting approach was used for all cases. The entry point was located either with palpation or radiographically. It was few mm anterior and lateral to the femoral attachment of posterior cruciate ligament and in line with the canal of the femur. Radiographically, the entry point was at the apex of the Blumensaat's intercondylar roof line on lateral view. On Anterior-Posterior (AP) view, it was in the middle of the intercondylar notch. Guide wire was inserted and its position was checked under C-arm control. Guide wire was maintained in central position. It was in line with femoral canal in the AP view and anterior to the Blumensaat's line in lateral as there is no safe zone posterior to it.

Serial reaming of the femoral medullary canal was done using either flexible or manual reamers. The canal was over reamed by at least 1 mm greater than the desired nail diameter. The fracture reduction was maintained during reaming. The nail was driven gently into the canal. It required gentle hammer taps to ensure proper advancement of the nail. During the insertion process, the assistant applied traction to the limb in order to prevent shortening and angulation. The nail was countersunk into the intercondylar notch below the subchondral bone in order to avoid damage to the patellar articulation surface. Distal locking was done prior to the proximal locking. It was performed using the appropriate targeting device attached to the insertion handle. At least two locking screws were applied for all the distal femoral fractures. Proximal locking screw was done by two lateral to medial locking screws, applied using the free hand perfect circle technique or with the use of the targeting device itself.

Crepe bandage application and limb elevation for first few postoperative days was advised to reduce swelling in the operated limb and to minimize wound complications. Mobilization was started on the first postoperative day with strict non weight bearing on the operated limb. Passive mobilization was also started for other joints. Intravenous antibiotics were given as per the protocol. Drain removal was done after 72 hours. Wound inspection was done on second-third Postoperative day and thereafter for every two days. Suture removal was done on 12-14th postoperative day.

Patients were followed up at 6th week, 12th week and then at 6th month. During each visit clinical and radiological union were assessed. The fracture was considered united only when there was formation of callus in any three of the four cortices assessed using the standard AP and lateral radiographs and when the patient was able to bear weight without any discomfort. Weight bearing was started depending upon the radiological union and consolidation at the fracture site. The functional outcome of fracture fixation was evaluated using Neer's scoring system.

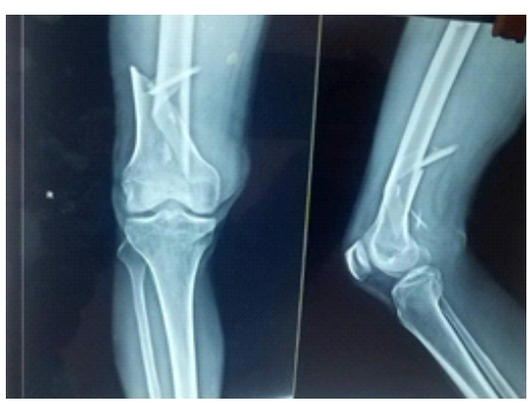

Fig 2. Preoperative X-ray

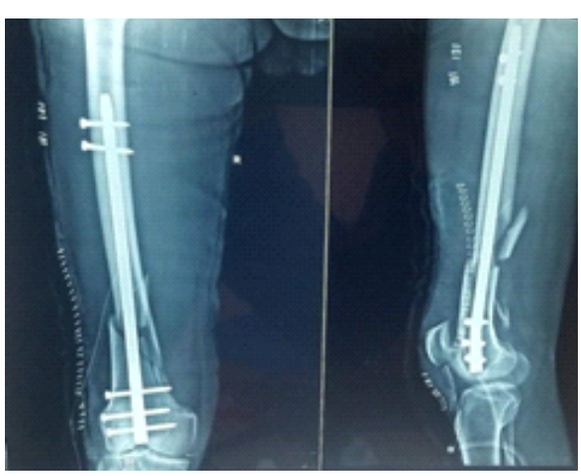

Fig 3. Postoperative X-ray

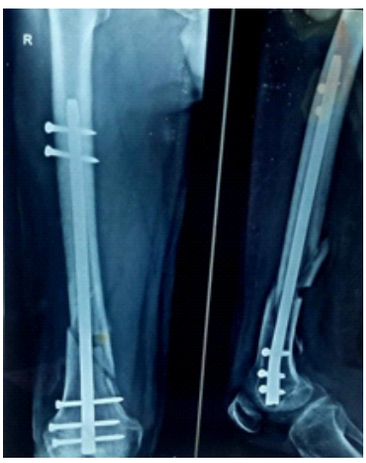

Fig 4. Six weeks follow-up

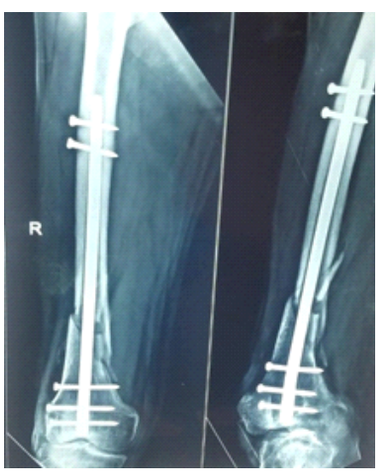

Fig 5. Three months follow-up

Fig 6. Six months follow-up

Statistical analysis

All the data were collected as patient's demographic profile, general history, clinical and radiological findings, its management and regular follow up. Data were entered and analyzed by SPSS 21. Descriptive Statistics like frequency, percentage, mean and standard deviation were used to analyze the data.

RESULTS

In this study, the patient's average age was 39.47±16.73 (range 18-70) years. Out of 30 patients, there were 19 males (63%) and 11 females (37%) with male to female ratio of 3:2. The major cause of fracture was road traffic accidents (60%) followed by fall injury (40 %) and right side was commonly affected than left side. AO/OTA type A2 was most common fracture type followed by A3 type. Seventeen cases (56.6%) were operated within 5 days of trauma and 9 cases (30%) were operated between 6 to 10 days while the remaining 4 cases (13.3%) were operated between 11-15 days. The average day between trauma and surgery was 5.90±3.623 days. The average duration of surgery was118.83 ±18.037 minutes (range of 90-160 minutes). The mean duration of hospital stay was 17.07 ± 4.177 days (range 8-26 days).

The mean duration for fracture union was 18.40±2.044 weeks (range 15-24 weeks). Ten out of 30 patients developed complications following the surgery. Majority of cases (20%) had knee stiffness followed by infection (3.33%), pain (3.33%), delayed union (3.33%) and malunion (3.33%).

Postoperatively, functional outcome was evaluated according to Neer's Scoring System at the end of 6 months. We found excellent results in 11 (36.7%) cases, good result in 13(43.3%) cases, fair result in 5 (16.7%) cases and poor result in just 1 (3.3%) case. The mean Neer's score was 78.9.

Table 1. Distribution according to AO/OTA classification

AO/OTA classification	Frequency	Percentage
Type A1	4	13.33%
Type A2	17	56.67%
Type A3	9	30%

Table 2. Functional outcome distribution according to Neer's scoring system

Neer's Scoring System (at 6 months)	Frequency	Percentage
Excellent (>85)	11	36.7%
Good (70 - 85)	13	43.3%
Fair (55 - 69)	5	16.7%
Poor (<55)	1	3.3%
Total	30	100%

DISCUSSION

In this study, the mean age was 39.47 ±16.73 years. It is similar to study done by Rajaiah et al[10] and Virk et al[11] where mean age was 44 years and 36.64 years respectively. There were 19 males (63%) and 11 females (37%) in this study which is similar to study published by Yeap and Deepak[6] and Kregor et all2 where 63% and 50% were male patients respectively. The major cause of fracture was road traffic accidents (60%) followed by fall injury (40%) which is reported similarly by Memon et al[13] in his study. Right side (56.66%) was affected more than left (43.33%), which is similar to study done by Krishna et al[14] where out of 40 patients, 70% involved right side and 30% involved left.

The most common type of fracture in our study was AO type A2 (56.67%) which is similar to Kumar A et al[15] where AO type A2 accounted for majority of cases (68.75%). In this study, the mean duration between trauma and surgery was 5.90 days which is similar to Gupta, SV16 study where mean duration between trauma and surgery was 4.25 days. This delay in surgery was due to associated injuries and comorbid conditions of the patient that needed some time to prepare the patients for surgical intervention. The delay was also due to need for initial temporary fixation with external fixator in some cases due to open injuries and severe comminution.

The average duration of surgery was 118.83 ±18.037 minutes (range of 90-160 minutes) which is similar to study done by Gupta et al[16] where mean duration of surgery was 100 minutes (range 75-150 minutes). The mean duration of hospital stay was 17.07 ±4.177 days (range 8-26 days). This result is similar to study done by Rajaiah et al[10] and Yeap and Deepak[6] where mean duration of hospital stay was 19 days and 17.2 days respectively.

Successful fracture union was defined as complete bridging callus in three cortices, together with painless full weight-bearing. The mean duration for fracture union was 18.40 ±2.044 weeks (range 15-24 weeks) which is similar to Gupta et al[16] (18 weeks), Yeap and Deepak6 (18 weeks) and Kregor et al[17] (12 weeks).

Ten out of 30 patients developed complications following the surgery. Majority of cases (20%) had knee stiffness followed by infection (3.33%), pain (3.33%), delayed union (3.33%) and malunion (3.33%) which is near similar to Vishwanath et al[18] study where knee stiffness (30%) was the most common complication followed by knee pain (14%), infection (10%) and delayed union (8%). In our study the mean Neer's score was 78.9 which is similar to study done by Rajaiah et al[10], Kim et al[19] and Saini et all which showed a mean Neer's score of 82, 74 and 87 respectively.

CONCLUSION

Distal femoral fractures (AO/OTA type A) when treated with retrograde nailing has good to excellent functional outcome in majority of cases with minimal manageable complications.

LIMITATIONS

There were certain limitations to our study.

Small sample size

It is a single center study. Hence the generalisation of the conclusion of this study might not be externally valid

The duration of follow-up was only 6 months, so the long-term outcome could not be evaluated. For a better evaluation of the outcome a long-term follow up with larger sample size is recommended

No blinding techniques were used.

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None

CONFLICT OF INTEREST

There is no conflict of interest.

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