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Research Article

**FUNCTIONAL OUTCOME OF DISTAL FEMORAL SHAFT
FRACTURES MANAGED WITH RETROGRADE INTRAMEDULLARY
NAIL IN TERM OF KNEE RANGE OF MOTION AND KNEE PAIN**

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Abstract:

Objective: To determine early post-operative functional outcome in patients with fracture of distal femoral shaft managed with retrograde intra-medullary nail.

Material and methods:

Study Design: Descriptive Case Series.

Setting: Department of Orthopedic Surgery Sheikh Zayed Medical College/ Hospital Rahim Yar Khan from April 2018 to December 2018. **Methodology:** Patients having isolated closed fracture of distal femur selected by non-probability consecutive sampling were included in the study. Fracture reduction & internal fixation was done with retrograde intramedullary nailing. They were followed till the evidence of radiological union and functional outcome was assessed in terms of knee pain & knee range of motion. Data entry and analysis was done using SPSS version 24.

Results: Out of 106 cases there were 74 males and 32 females with mean age of 35.67 ± 10.341 years. The mean duration of fracture was 3.63 ± 1.382 days. Post-surgical knee joint pain was present in 28 (26%) cases with comparable results in both males and females. Satisfactory range of motion with flexion at knee joint greater than or equal to 110 degrees was seen in 89 (84%) cases. **Conclusion:** Knee complaints were experienced commonly in our series of retrograde nailing of femoral shaft fractures. However, the majority of the patients had an acceptable knee range of motion.

Key words: Retrograde intramedullary nailing, functional outcome, knee pain, range of motion

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INTRODUCTION:

Despite evolution in treatment options over the years, distal femoral fractures still remain challenging injuries for orthopedic surgeons, due to their high complication rate and compromise of the lower limb function due to these complications.⁽¹⁾ Distal femoral fractures reportedly account for less than 1% of all fractures and comprise between 4%–6% of all femoral fractures.⁽²⁾ Typically, distal femur fractures are caused by two different mechanisms. In the older population with osteoporotic bone and vulnerable soft-tissue envelope, distal femoral fractures occur predominately after low-energy trauma, e.g., falls and sprain injuries while younger patients have complex injuries with comminuted and open fractures caused by high-velocity trauma. 30% of polytrauma patients have distal femur fractures.⁽³⁾ Various treatment options for supracondylar femoral fractures are Buttress condylar plate, angled blade plate, locked plate, dynamic condylar screw, and retrograde locked intramedullary nail.⁽⁴⁾ The management of femoral diaphysis fractures was revolutionized by the development of the interlocking intramedullary nail, with antegrade insertion being the gold standard.⁽⁵⁾ Femoral nailing has advantages of predictable realignment of bone, rapid healing and early functional use of the limb compared to other treatments for femoral shaft fractures.⁽⁶⁾ Certain limitations of this technique have led to the development of retrograde nailing (RN) for distal femoral shaft fractures. Interference with knee function and fractures in the lower third of the femoral shaft (which take longer to unite) are the major challenges which need to be addressed with this technique.⁽⁷⁾

In a study, 52 out of 57 patients (91%) being treated with retrograde nailing attained bone union.⁽⁸⁾

The incidence of persistent postoperative knee pain following retrograde nailing has been reported to be as 23%.⁽⁹⁾

While in another study, complaints of pain in the knee during follow-up were identified in 17 patients (23%). Knee flexion > 120° was seen in 73 knees (89%) and flexion < 120° in 9.⁽¹⁰⁾

There are different treatment modalities being used for fracture of distal shaft of femur but debate continues around choice of implant for fixation of distal femoral shaft fractures. This study was planned to analyze the outcome of operated distal femoral fractures with retrograde intra-medullary nail, as to establish valid recommendations in order to reduce the rate of complications and to improve the quality of life of the patients.

MATERIAL AND METHODS:

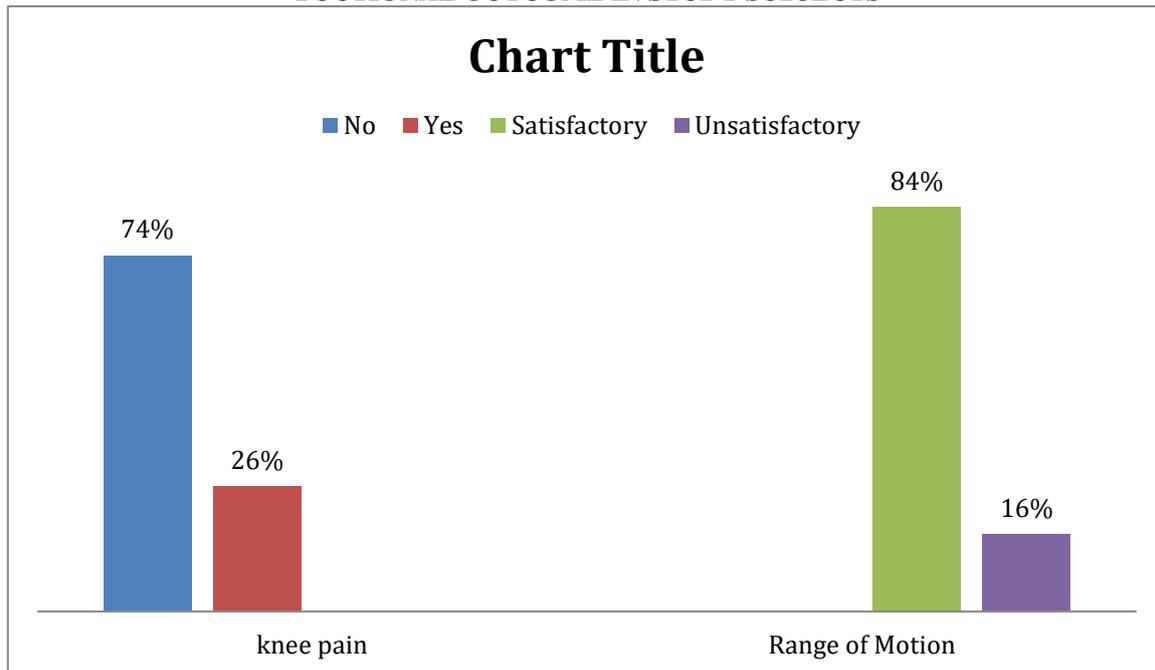
The descriptive case series was conducted in the Department of Orthopaedic Surgery Sheikh Zayed Medical College/ Hospital Rahim Yar Khan, from April 2018 to December 2018. Total of 106 patients were included in the study. Patients of either sex aged 18-60 years, with post traumatic fracture distal femur presenting at SZH, RYK selected by non-probability consecutive sampling were included in the study. Patients having previous surgery or intervention for knee of same side, infection, Osteoarthritis of knee joint, multiple fractures of other bones of same side were excluded. The informed consent was taken for this particular procedure and using their data for research. They were assured regarding confidentiality and expertise. Questionnaire (attached as appendix I) containing background information i.e. age, sex, date of operation and contact along with outcome i.e. knee range of motion in degrees measured with Goniometer, knee pain (presence/absence assessed by VAS for pain), is used as research instrument and data is recorded by researcher himself. A uniform protocol of surgery is adopted for retrograde nailing for fracture of distal shaft of femur by one team of orthopedic surgeons and patients is followed up to 6th week to determine the functional outcome. Data analysed by SPSS version 24. Quantitative variables including age, duration of fracture are analysed by using mean and standard deviation. Frequency and percentage are calculated for qualitative variables like gender, knee pain and range of motion. Effect modifiers will be controlled by stratification of data in term of age, gender, and duration of fracture. Chi square test will be applied to see the effect of these on outcome variables. P value <0.05 was taken as significant.

RESULTS:

In this study there were total 106 cases out of which 70% were males and 30% females. The mean age was 35.67±10.341 years. Mean duration of fracture was 3.63±1.382 days, while mean hospital stay post operatively was 3.63±1.166 days. 38 cases had age 18-29 years, 33 were aged 30-39 years, 21 cases were 40-49 years and rest were 50 years or above. 20.8% cases had fracture duration of 1-2 days, 68.9% had fracture duration of 3-5 days while 10.4% cases had fracture duration of 6 or more days. Eighty five per cent of injuries were caused by road traffic accidents while 11% of patients had fracture after history of fall while other causes of injury were 4%. Younger patients with age groups 16-29 and 30-39 had fracture distal femur caused by high energy trauma after RTA, while 78.6% of cases occurred after history of fall among age group of 50 and above with p value 0.000. There are two peaks regarding the frequency of these fractures in the study group; high energy

fractures were more frequent in young males, and due to osteoporosis.
low energy (fragility) fractures in older females,

FUNCTIONAL OUTCOME IN STUDY SUBJECTS



Post-surgical pain in knee joint was present in 28 (26%) cases with comparable results in both males and females with absent pain in 73% of male patients and 75 % of females with p value of 0.828. Half number of patients presented after 1-2 days of injury had knee pain. Results were good in cases presented within 3-5 days of injury with no knee discomfort in 81% of patients. Out of 11 cases presented after 6 days or more of injury knee pain was seen in 3 cases (27.3%). The p value is 0.016 in these differences and is statistically significant. 27 (28.4%) out of 28 cases having knee pain had distal femur fracture after road traffic accidents with p value 0.169. This may be due to the fact that

high energy trauma usually causes associated soft tissue and joint injuries.

Satisfactory range of motion with flexion at knee joint greater than or equal to 110 degrees was seen in 89 (84%) cases with comparable results in both males and females. Results were excellent in cases presented within 1-2 days & 3-5 days of injury with satisfactory knee mobility in 91% and 84% of patients respectively. Out of 11 cases presented after 6 days or more of injury restricted knee movements were seen in 3 cases (27.3%). The p value is 0.401 in these differences and is statistically insignificant.

TABLE NO. 01
KNEE RANGE OF MOTION WITH RESPECT TO AGE GROUPS

AGE GROUPS (YEARS)	KNEE PAIN		Total
	NO	YES	
18-29	26 (68.4%)	12 (31.6%)	38 (100%)
30-39	22 (66.7%)	11 (33.3%)	33 (100%)
40-49	17 (81%)	4 (19%)	21 (100%)
50 or Above	13(92.9%)	1(7.1%)	14(100%)
Total	78 (73.6%)	28 (26.4%)	106 (100%)

Chi square= 4.595, p= 0.204

TABLE NO. 2
KNEE RANGE OF MOTION WITH RESPECT TO AGE GROUPS

AGE GROUPS (YEARS)	KNEE RANGE OF MOTION		Total
	Satisfactory	Unsatisfactory	
16-29	37 (97.4%)	1 (2.6%)	38 (100%)
30-39	31 (93.9%)	2 (6.1%)	33 (100%)
40-49	15 (71.3%)	6 (28.6%)	21 (100%)
50 or Above	6(42.9%)	8(57.1%)	14(100%)
Total	89 (84%)	17 (16%)	106 (100%)

Chi square= 27.528, p= 0.000

DISCUSSION:

Although their treatment evolved during the last years, distal femoral fractures still remain challenging injuries for orthopaedic surgeons, due to their high complication rate and negative impact of those complications upon the function of the lower limb. The incidence of these fractures is around 37/ 100,000, representing 4-6 % of all femoral fractures ^(2, 11). Regarding the epidemiology, two spikes characterize these fractures, also differentiated by age, traumatic energy and, thus, fracture aspect: distal femoral fractures in young patients appear after high energy trauma, usually produced by a frontal collision mechanism, frequently within polytrauma, with comminuted aspect, whilst elderly sustain fragility fractures on osteoporotic bone, usually spiroid, due to low energy trauma, mainly falls ⁽¹²⁾. In both these categories, fixation is usually difficult in distal femoral fractures due to either involvement of the articular surface and comminution (in the first group), either poor bone stock in the second group, thus surgery has to be properly indicated and performed.

Various treatment options for supracondylar femoral fractures are Buttress condylar plate, angled blade plate, locked plate, dynamic condylar screw, and retrograde locked intramedullary nail.⁽⁴⁾ The management of femoral diaphysis fractures was revolutionized by the development of the interlocking intramedullary nail. Retrograde nailing is an established management option for distal femur fractures. Previous studies on the outcome of patients managed by retrograde nailing often included both young patients with high-energy fractures and elderly patients with osteoporotic fractures. ^(13, 14) The mechanism of intramedullary nailing is by way of splinting. Partial loads are transferred through the nail and cortex to enable the secondary fracture healing process. Callus formation is copious. Retrograde intramedullary nailing is a good surgical option for distal femur

fracture. We can avoid invasive soft tissue dissection and minimize secondary damage of the blood circulation at the fracture site. In a previous biomechanical study, intramedullary nails had significantly higher stiffness and significantly lower micro motion across the fracture gap with axial compression than with a dynamic condylar screw or a locked condylar plate. ⁽¹⁴⁾ The current study is conducted to evaluate functional outcome of distal femoral shaft fractures with retrograde intramedullary nail in terms of knee pain and range of motion.

Distal femoral fractures have bimodal age distribution; young patients as a result of high-energy injuries and elderly patients after simple falls. This study also showed that high energy fractures were more frequent in young males, and low energy (fragility) fractures in older females, due to osteoporosis. Despite affecting the same anatomical location as young patients, fractures in the elderly pose different challenges due to osteoporotic bone and the overall patients' medical condition.

In current study post-operative knee pain was present in 26% of the cases which is comparable to other studies reported in literature. The incidence of knee pain reported in several retrospective studies ranges from 30 to 68%. ^(15, 16) A review of the literature showed a mean incidence of knee pain of 25.6% (1.1%-55%) at the end of follow-up ⁽¹⁷⁾. It was found that age is the independent predictor of knee pain after retrograde femoral nailing. Possible explanations include higher physical demands in younger adults or higher pain tolerance in older patients.

Studies comparing antegrade versus retrograde nailing of femoral shaft fractures give conflicting results with respect to the occurrence of knee pain. In a prospective (pseudo)randomized study, Tornetta & Tiburzi reported that in the retrograde

group knee pain was common (81%) in the immediate postoperative period.⁽¹⁸⁾ However, these complaints of pain subsided by the time of union in all but 4 retrograde (13%) and 5 antegrade patients (13%). Yu et al found no difference in knee pain between the antegrade and retrograde nailing group.⁽¹⁹⁾ This is consistent with the prospective, (pseudo)randomized study of Ostrum et al. However, he found that hip and thigh pain predominated significantly in the antegrade group.⁽²⁰⁾

Postoperative knee soft tissue irritation is a common complication after retrograde nail fixation of distal femoral fractures. Although the exact etiology of this complication is unknown, distal locking screw prominence is one of the causes for soft tissue irritation.⁽²¹⁾ Several studies have reported distal locking screws as a possible cause of knee pain.^(14, 16, 18, 22) Other sources of knee pain include quadriceps dysfunction, intra-osseous hypertension and patellar tendon injury due to a trans-tendinous approach.^(17, 18, 23) Knee pain may also be caused by degenerative changes secondary to an alteration in the mechanical axis of the femur after union.^(24, 25)

We achieved a satisfactory outcome in term of range of motion greater than 110 degrees in 89 out of 106 of our patients. These results are comparable to other workers with similar or different methods of treatment.^(16, 26, 27) Papadokostakis et al in a meta-analysis reported a mean knee ROM of 127.6° after retrograde nailing of femoral fractures. Patients with type A compared to type C fractures regained a slightly but significantly better ROM.⁽²⁷⁾

CONCLUSION:

Knee complaints were experienced commonly in our series of retrograde nailing of femoral shaft fractures. However, symptoms improved in patients after removal of the distal locking screws or of the nail. Furthermore, the majority of the patients had an acceptable knee range of motion.

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