

Research Article
Orthopaedics

**MANAGEMENT
OF DIAPHYSEAL
FRACTURE OF FEMUR
WITH ANTEGRADE
AND RETROGRADE
NAILING
(COMPARATIVE
STUDY)**

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Abstract:

Diaphyseal femoral fractures are commonly encountered in routine orthopaedics emergency. They occur commonly due to high velocity trauma and therefore are mostly associated with injuries such as head injury, chest injury as well as other fractures. Operative treatment is the treatment of choice in the management of diaphyseal fractures of femur. There are extramedullary and intramedullary methods of fixation of fracture shaft femur. This can be treated with plating and nailing methods. Nailing method is superior to plating in decreasing blood loss during operation, in achieving better union rates and decreasing incidences of postoperative infections. There are two methods of femoral nailing - Antegrade and Retrograde methods. A study was conducted in tertiary care hospital of Punjab where Antegrade and Retrograde methods of femoral nailing were compared. It was concluded that both the methods are good in achieving union of bone and retrograde nailing more favourable in obese, pregnant and patients with ipsilateral spine and pelvic trauma.

Key words: Femur, Interlocking Nail, Antegrade, Retrograde.

Introduction

Diaphyseal femoral fractures are commonly encountered in routine orthopaedics emergency. They occur commonly due to high velocity trauma and therefore are mostly associated with injuries such as head injury, chest injury as well as other fractures. Operative treatment is the treatment of choice in the management of diaphyseal fractures of femur. There are extramedullary and intramedullary methods of fixation of fracture shaft femur. Extramedullary fixation is in form of plating and intramedullary is with interlocking intramedullary nails. Barring a few indications, intramedullary nailing is the treatment of choice for fracture shaft femur.

Intramedullary nailing of femoral fractures was introduced by Gerhard Kuntscher during the years of World War II who introduced Kuntscher nail for femur fractures.¹ Since then considerable improvement have occurred leading to the development of currently used interlocking nails. Nailing done by closed method does not damage extra periosteal soft tissues and biological environment around fracture is disturbed minimally, thus results in high rates of fracture healing and very less incidences of non union and malunion. With nailing early weight bearing can be started which aids in healing process and side effects of prolonged recumbency are minimized. With early nailing of fracture shaft femur, problems like fat embolism are minimized. As intramedullary nail is inserted into the centre of femoral medullary canal axially, thus can tolerate bending and torsional loads better than plate. Intramedullary interlocking nail is a load sharing device compared to plates which are load bearing devices, hence

causing less cortical osteopenia due to stress shielding which is a feature with plates.²

There are two methods of femoral nailing. First is antegrade nailing which is done by passing nail from proximal end of femur to distal end. It is associated with high rates of fracture union and low rates of infection, malunion and non union. It requires more operative time due to prolonged set up time and in obese patients where finding piriformis fossa is quite difficult and more radiation exposure than retrograde nailing. It is commonly associated with heterotopic ossification around hip, hip pain, abductor weakness, lurch and associated pudendal nerve palsy with excessive traction on fracture table. It is not method of choice in presence of other associated injuries like patients with ipsilateral fracture neck of femur, pelvic injury, and spine injury when antegrade nailing cannot be done. It can cause avascular necrosis of femoral head and iatrogenic fractures neck of femur.³⁻⁷

Retrograde nailing is done by passing nail from distal to proximal end. In this nail is passed from intercondylar notch of femur to proximal end. In patients with polytrauma, bilateral femur fractures, in obese patients, fractures in distal parts of femur, pregnancy, patients with vascular injury, associated spine fracture, patients with ipsilateral femoral neck fracture, ipsilateral acetabular or pelvic ring and shaft fractures, ipsilateral patella fracture, ipsilateral shaft femur and tibia fractures can be very well managed by retrograde nail.⁸⁻¹¹ It requires less operative and less fluoroscopy time than antegradenailing. There is difficulty in rotational control of femur during procedure and there is risk of

synovial metallosis. So surgeon should be well conversant to retrograde technique.⁹⁻¹²

Material and methods

A prospective study was done on 40 cases of fracture shaft femur admitted in orthopaedics department of Govt. Medical college Amritsar. Where 20 cases were treated by antegrade and 20 cases were treated by retrograde method. Cases for either method were randomly selected. Main aim was to compare management of femoral shaft femur by these 2 methods with special reference to fracture union, clinical and functional outcome, operative time, fluoroscopy exposure and other complications. All patients of > 18 years age with fracture shaft femur 5 cm below inferior margin of lesser trochanter and a line transecting the shaft 8 cm proximal to articular surface of femoral condyles, grade I fracture according to Gustillo Anderson classification, ASIF Type A & B fractures were included in study. Patients with age < 18 yrs, open grade II and III fractures according to Gustillo Anderson classification and pathological fractures because of infection were excluded from study.

Antegrade nailing was done using fracture table with spica applied. Entry was made into medullary canal with the help of bone awl through piriformis fossa. After passing guide wire across fracture, sequential reaming was done. Universal femoral nail of appropriate size with diameter 1 mm less than last reamer used, was inserted with help of zig. Distal and proximal locking screws were put.

For retrograde nailing, patient was put supine on operation table. Knee was flexed to 30°-50° by placing bolsters under the knee. Incision was given on medial parapatellar region. Knee joint

was opened and intercondylar sulcus was identified. Entry was made 7 mm anterior to attachment of posterior cruciate ligament. Guide wire was passed across fracture and reaming was done. Universal femoral nail of appropriate size mounted on a zig was inserted through intercondylar sulcus and passed across fracture site. Distal and proximal locking screws were

inserted. Post operative quadriceps strengthening and active assisted range of motion were started on 2nd postoperative day. Drain was removed on 3rd postoperative day. Static quadriceps and hamstring exercises started. Stitches were removed on the 11th postoperative day. Toe touch weight bearing was started until there

was formation of callus. Follow-ups were done every month for six months and patient was assessed clinically and radiologically. Union was taken as a bridging callus on two orthogonal radiological views, with no tenderness to palpation or pain on standing.

Final results were evaluated using Thoresen et al.(1985) Criteria.¹³

Criteria For The Results Of Treatment (Thoresen Et Al)¹³

Result	Excellent	Good	Fair	Poor
Malalignment of femur (degrees)				
Varus or valgus	5°	5°	10°	> 10°
Antecurvatum or recurvatum	5°	10°	15°	> 15°
Internal rotation	5°	10°	15°	> 15°
External rotation	10°	15°	20°	> 20°
Shortening of femur (cm)	1 cm	2 cm	3 cm	> 3 cm
Range of motion of knee (degrees)				
Flexion	> 120°	120°	90°	< 90°
Extension deficit	5°	10°	15°	> 15°
Pain or swelling	None	Sporadic, minor	Significant	Severe

Patients were divided in group I and group II. Group I patients were treated by antegrade method and group II were treated by retrograde method. Following comparisons were noted.

Sr.No	Parameter	Group I Antegrade group	Group II Retrograde group
1	Mean Age	33.3 years	33.3 years
2	Mode of injury Road side accident Falls	No. of cases 17 3	No. of cases 19 1
3	AO type of fracture 3.2.A 3.2.B. 3.2.C	No. of cases 15(73% being A.3) 5 0	No. of cases 13(66% being A.3) 7 0
4	Operative time 50-70 minutes 70-90 minutes >90 minutes	No of cases 5 14 1	No of cases 16 4 0
5	Flouroscopy time in no. of shots <50 shots 50-75 76-100 >100 shots	No. of cases 0 5 13 2	No. of cases 15 5 0 0
6	Time to union <16 weeks 16-20 weeks 20-24 weeks >24 weeks	No. of cases 1 15 3 1	No. of cases 2 12 5 1

7	Range of motion of knee Excellent >120° Good upto 120° Fair upto 90° Poor <90°	No. of cases 16 2 1 1	No. of cases 15 4 1 0
8	Knee pain Excellent; None Good; Sporadic Fair; Significant Poor; Severe	No. of cases 17 3 0 0	No. of cases 15 5 0 0
9	Shortening of femur Excellent upto 1 cm Good upto 2cm Fair upto 3cm Poor >3cm	No. of cases 1 1 0 0	No. of cases 3 0 0 0
10	Malunion Varus/Valgus Upto 5° Antecurvatum/ Recurvatum External/Internal Rotation	2 0 0	2 0 0
11	Extension Deficit Upto 5° Upto 10°	2 0	0 2
12	Hip pain Present	7	0
13	Other complications Infections	2	3

In this study, we found that fracture of femur was most common in 20-40 years of life with mean age of 33.03 years ranging from 18 to 65 years with males are predominantly more prone to fracture diaphysis of femur .86.6% (26 out of 30) of patients in our study were males. 93.3% cases were due to vehicular accidents and 6.66% were due to falls. As per AO classification, in this study, 21 patients had simple fractures 3.2.A (70%) with majority being transverse type 3.2.A.3 in 16 patients and 9 had wedge fractures (44%) with predominant spiral wedge type 3.2.B.1 in 5 patients.

In this study, 12 (80%) cases had union within 20 weeks, 2 (13.3%) cases had union at 24 weeks and 1 (6.66%) cases took more than 24 weeks to unite in group I. 10 (66.6%) cases had union within 20 weeks, 4 (26.6%) cases had union at 24 weeks and 1 (6.66%) cases took more than 24 weeks to unite.

There was no stastically significant difference of union times between both groups. Thus both techniques are having comparable results in achieving healing of fracture.

In this study in antegrade group 4 (26.6%) cases took 50- 70 minutes operative time while 12 cases (80%) took same time in retrograde group. In 10 (66.6%) cases in antegrade group operative time was 70-90 minutes and only 3 (20%) cases of retrograde group took 70-90 minutes. 1 case of antegrade group took more than 90 minutes who was obese patient. Difference in operative time was statistically significant ($p < 0.001$). Similar observations had been made by Tucker et al⁵ and Aneja et al.¹⁴

From the study it was observed that in antegrade group more fluoroscopy time (measured as number of shots required during procedure) was needed than in retrograde group. In the study

11 cases (73.3%) in retrograde group required <50 shots of fluoroscopy and 100% cases were finished at 75 shots of fluoroscopy. In antegrade group no case was done with <50 shots of fluoroscopy. Only 4 cases (26.6%) were done with 50-75 shots of fluoroscopy. 9 (60%) cases required 75-100 shots of fluoroscopy and 2 (13.33%) cases used >100 shots of fluoroscopy due to obesity. Difference in fluoroscopy time between both groups was stastically significant ($p < 0.001$). Similar results was made by Tucker et al⁵.

In this study it was observed that in antegrade group 12 (80%) cases had excellent results with flexion of knee more than 120° , 2 (13.3%) cases had good results (flexion of knee upto 120°) , 1 case (6.66%) had fair result (flexion of knee upto 90°) and 1 (6.66%) had poor results. In retrograde group 10 cases (66.6%) had excellent results, 4

cases (26.66%) had good results, 1 case (6.66%) had fair and no case had poor result. No statistically significant difference was noted between two techniques regarding range of knee flexion.

In this study, there were no knee pain (excellent results) in 13 cases (86.66%) in antegrade group. 2 cases (13.3%) complained of sporadic pain (good results) in antegrade group. 10 cases (66.6%) complained of no pain (excellent results). 3 cases (20%) complained of sporadic pain (good result) while 2 (13.3%) cases complained of significant pain (fair result) in retrograde group. There was no statistical difference of knee pain between the two groups.

In this study we had observed 1 case (6.66%) with 1.5 cm shortening of limb in antegrade group (good result). In retrograde group 3 cases (20%) were having 1 cm shortening which was excellent result. Hence there were 93.3% excellent results and 6.66% good results in antegrade group and 100% excellent result in retrograde group. No fair or poor result was seen in any group. There was no statistically significant difference between two groups regarding shortening of femur.

In this study in antegrade group we had observed no varus and valgus deformity in 86.6% cases and deformity of 5° in 2 (13.3%) cases which was excellent result and in retrograde group 5° valgus deformity in 1 case (6.66%) and 5° varus deformity in 1 case (6.66%) and no deformity in 86.6% cases was observed which were excellent results. Hence there were 100% excellent results in both groups. No case with antecurvatum or recurvatum deformity was reported. No statistically significant difference was noted between two techniques regarding postoperative deformity

of femur. We had not reported any rotational deformity in both groups of patients.

There was 5° extension deficit in 2 cases (13.3%) with excellent result in antegrade group and 10° extension deficit in 2 cases (13.3%) (good result) in retrograde group. Thus there were 100% excellent result in antegrade group and 86.6% excellent result in retrograde group with 13.3% good results. No statistical significant difference was present between the two techniques regarding this.

7 patients (46.6%) complained of hip pain in antegrade group while no case complained of hip pain in retrograde group which is statistically significant (p=0.001). Similar observations was made by Ricci et al and Ostum et al.^{6,15}

Pertaining to late complications, 2 cases (13.3%) in antegrade group and 3 cases (20%) had wound infections which were superficial in nature. There was no statistically significant difference between both groups regarding late complications.

Based on thoresen scoring criteria and upon analysing all cases treated by antegrade and retrograde nailing methods following was observed.

In antegrade group there were 11 (73.3%) cases with excellent results, 2 cases (13.3%) with good results, 1 case (6.66%) with fair and 1 case (6.66%) with poor results.

In retrograde group there were 10 cases (66.6%) with excellent results, 4 cases (26.6%) with good results and 1 (6.66%) cases with fair result. No poor result was observed in retrograde group.

**CASE NO. 1
(Antegrade Nailing)**



Pre-operative photograph



Post-operative photograph



Showing union



Patient showing complete weight bearing and full range of flexion at hip and knee joints



**CASE 2
(Antegrade Nailing)**



Pre-operative photograph



Post-operative photograph



x ray showing union



Patient showing complete weight bearing and complete range of motion of knee and hip joints



**CASE 3
(Antegrade Nailing)**



Pre-operative



Pre-operative



X-ray showing union



Patient is bearing weight and showing complete range of motion at knee and hip joints after antegrade nailing.

**CASE 4
(Retrograde Nailing)**



Preoperative x ray



Preoperative x ray



X-ray showing union

**CASE 4
(Retrograde Nailing)**



Patient showing weight bearing and

complete range of motion at hip and knee joints.



**CASE 5
(Retrograde Nailing)**



Preoperative



Post-operative



Showing union

**CASE 5
(Retrograde Nailing)**



Patient showing weight bearing and good range of motion of hip and knee joints after retrograde nailing

**CASE 6
(Retrograde Nailing)**



Preoperative



Post-operative



Showing union

**CASE 6
(Retrograde Nailing)**



Patient showing good range of motion at hip and knee joints following retrograde nailing

Discussion

Surgical intervention is necessary for fracture shaft femur to give good near normal anatomical alignment. Out of both plating and nailing methods, closed intramedullary nailing of femoral shaft has revolutionised the treatment of fracture of shaft of femur. Intramedullary nailing as compared to other modes of fixation (like plates) has the advantage of being less invasive, maintains fracture biology, results in early weight bearing and union with minimal complications. Early mobilization of patient can be started with intramedullary

nailing, thus avoiding long term complications of bed ridden patients. Closed interlocking nail reduces the incidence of complication like infection, malunion, non-union. Both antegrade and retrograde methods are comparable as far as management of diaphyseal fracture of femur is concerned with certain advantages and disadvantages with both techniques.

Antegrade method is more time consuming during surgery especially in obese patients in whom getting entry into piriformis fossa is quite difficult. Antegrade method puts patient, surgeon and other staff to more radiation exposure during the procedure. There are problems of hip pain, abductor weakness and heterotopic ossification in patients treated with antegrade method and similar observation is made in this study. With retrograde approach it is difficult to control rotational alignment of femur and proximal locking is difficult in proximal part of femur. Retrograde method is helpful especially in cases with ipsilateral fracture neck of femur and pelvis, in polytrauma patient when it can be used for quick stabilization of femur as damage control measure, in obese patients when entry into piriformis fossa is difficult, in pregnant woman where we can protect baby by shielding abdomen from radiations, and in patients with associated head injury in whom heterotopic ossification is more. There are potential problems with retrograde nailing, specifically, the potential for patellofemoral arthritis, knee stiffness, quadriceps atrophy and intra-articular infection. But if due attention is given at the time of operation and end point of nail is recessed under cartilage, knee problems are not more in retrograde method than in antegrade one. The

literature has not shown an increased incidence of these complications in these patients and similar observations have also been made in our study.

Conclusion

We conclude that both techniques for management of shaft femur fractures with few distinct advantages and disadvantages associated with both techniques and as such the method chosen should be based on patient's physique, fracture geometry, associated injuries like head injury, ipsilateral pelvic injury (fracture acetabulum, fracture neck of femur), spinal injury and pregnancy.

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