

Functional analysis of distal one-third extra-articular femoral fracture managed with retrograde femur nailing system

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Abstract

Management of fractures has changed very much over the time. It has advanced from bamboo stick, POP to modern minimally invasive surgeries, to Robotic and distant operative techniques. In the modern world with the increase in speed and number of fast moving vehicles there is a great increase in number of RTA and number of polytrauma patients in causalities.

The purpose of study is to achieve complete union with full functional ability of Limb as compared to earlier fixation method. New method of fixation of extra-articular distal one-third femur fracture i.e.: 1: 95° angled blade plate; 2: DCS; 3: Retrograde Nailing; 4: Distal Femur LCP Plating.

Keywords: Extra-articular, Distal one-third, Femur fracture fixation using, Retrograde femur nailing system.

Introduction

Extra-Articular distal one-third femur fracture using angulate laterally after fixation using 95° angle blade plate or dcs both the implants tends to move the shaft away from normal anatomical axis so abnormal axis weight bearing cause implant into failure state or eventually into malunion or non union.

In elderly patient bone is very osteoporotic so using angle blade plate or dcs there is increase in chance of peri-implant fracture. Because of stress shielding and weakening of bone using multiple screw in above implants.

As compare to above implants retrograde femur nailing hold the fracture more in anatomical position so less chance to move shaft away from anatomical axis's i.e. less chance of fracture to angulate laterally or medially. As implant is intramedullary so better acceptability in elderly patient and in Osteoporotic bone.

1. In addition to other implants Retrograde femur nailing
2. Preserve hematoma at fracture site
3. Less damage to blood supply of bone and at fracture site
4. Less stripping of soft tissue
5. Decrease OT time and rate of infection

Aims and Objectives

1. Evaluation of result of the Retrograde femur nailing in distal one-third femur fracture in comparison to knee range of motion, early mobilisation, early weight bearing, reduce complication.
2. Evaluation of maximum possible rehabilitation after fracture fixation using retrograde femur nailing

Materials and Methods

In our study 30 patients were studied using retrograde femur nailing in distal one-third extra-articular femur fracture. All cases were operated in KCGMC Karnal in period of May 2018 to May 2019.

Inclusion criteria

1. Only Distal one-third extra-articular fracture (Type A-AO classification)

2. PAC and medically fit patient
3. Both male and female patient
4. Patients in the age group of 20-75 years
5. Gustilio-Anderson Grade I/ II/ IIIA compound fractures

Exclusion criteria

1. Patients with Partial articular and complete articular.
2. 3B and 3C fractures (Gustilio classification)
3. PAC unfit patients
4. Patients above 75 years and below 20 years
5. Pathological distal femoral fracture

Implant used

1. Retrograde femur nailing system.
2. Sizes:-
 - a. length of nail vary from 150 mm-250 mm
 - b. Diameter vary from 10 mm-12 mm
 - c. 5° anterior bow of nail for anatomical fit
 - d. Proximal curve of nail begins at 50 mm and distal curve at length of 120 mm
 - e. Proximal and distal holes for locking bolts

Surgical technique

Operative Procedure:

a) Prepping and Draping.

1. Limb was scrubbed using beta scrub and painted with povidone iodine or betadine.
2. Site clean with alcohol or spirit
3. Drapped with sterile drapes from mid thigh to 5 cm-10 cm distal to knee joint line.

b) Incision

Using transpatellar approach 3 cm-5 cm incision made longitudinally from inferior pole of patella to tibial tuberosity.



Fig. 1: Incision and entry point



Fig. 3: Guide wire insertion

c) Arthrotomy

Patellar tendon retracted laterally and capsule in sized vertically. Fat pad pushed aside with retractors. Exposing distal intercondylar area of femur.

d) Entry point

Entry portal made by using tissue protection sleeve and with 6.00 mm drill bit at the inter condylar area.approx 1cm anterior to PCL femoral attachment. Guide wire passed to desired level and should be centric.

e) Canal preparation

Canal is opened and prepared using entry reamer. After this serial reaming done proximal 2 cm-2.5cm is over reamed approx 13mm-13.5mm reamer.

f) Nail insertion

Appropriate size of nail chosen and mounted on a zig and inserted and lastly locking done proximally and distally.

g) closer

Soft tissue and skin closed in layer.



Fig. 4: Insertion of nail

Operative Photographs



Fig. 2: Incision and entry point



Fig. 5: Locking



Fig. 6: Skin closure

Observations and Result

Total 30 patients were studied and evaluated with Type A extraarticular fracture. All cases were operated in Kalpna Chawla medical college, Karnal between the period of May 2018– May 2019 using reverse femur nailing technique.

The duration of follow up ranged from 3 weeks to 12 months. 70% good to excellent result were obtained using Neer's and Sander's evaluation scoring system.

Table 1: Functional rating as per Neer's rating score

Long term final results were rated using Neer's rating system, which allots points for pain, function, working ability, joint movements, gross and radiological appearance. Neer's score was assigned for each patients after 24 to 36 weeks. Using this scale there were 21(70) excellent results, 5(15%) good results, 3(10%) fair results and 1(0.5%) poor result.	5	15
Neer's rating		
Rating	No. Of cases	Percentage
Excellent >85	21	70
Good 70-84 points		
Fair 51-69 points		3 10
Poor <50points		1 0.5

Discussion

Radiological union

Danziger MB44 (1995) noted average radio graphical union period of 87 days. Gellmann GE48 (1996) noted average radio graphical union period of 84 days. Kumar A60 (2000) noted average radio graphical union period of 98 days.

In our study average union period was of 119 days. The fractures which takes long time for union were more complex fracture.

Table 2: Comparison of average union, knee flexion and extension lag

Studies	Average union in (Days)	Knee flexion in degrees	Extension lag in Degrees
Lucas SE40 (1993)	-	104	4
Gellmanna GE48 (1996)	84	106	2
Kumar A60 (2000)	98	100	6.9
Watanabe Y62 (2002)		102	5
Ingman AM63 (2002)	84	101	-
In our study	119	110	2.80

In our study, shows ROM at knee joint was 110 degrees. Lucas SE40 (1993) noted, no variation in the knee flexion.

In our study, 5 patients with A1-type had ≥ 110 degree knee flexion (100%), 7 of 9 patients that is 77.78 % has knee flexion ≥ 110 with both A1 and A2 type had ≥ 110 degrees flexion (85.71%). Fractures in which close reduction and fixation was done were having better flexion than fractures which had to be open reduced. This could be explained on the basis of surgical trauma to quadriceps mechanism with open reduction and subsequent soft tissue healing with fibrosis as mentioned earlier.

Also, it was found that, injury surgery interval was inversely proportional to knee flexion. Also it was found that longer the nail better the knee flexion.

Lucas SE40 (1993) noted that, "the patients consistently showed a continued increasing range of motion for 12 months and frequently for 15 months post-operative.

Knee extension lag

Lucas SE40 (1993) documented extensor lag of 4 degrees. Gellmann GE48 (1996)

Documented extensor lag of 2 degrees.

Kumar A60 (2000) documented extensor lag of 6.9 degree.

Watanabe Y62 (2002) documented extensor lag of 5 degrees.

The average extensor lag in our study series was 3.2 degrees.

Shortening

In Lucas SE40 (1993) observed one patient had reduction of >3 cm limb length.

Gellmann GE48 (1996) observed six patient out of 24 patients having 2 cm reduction in limb length and Kumar A60 (2000) observed as average reduction is 1.4 cm

In our study, 3 patients had reduction of limb length with an average 22.33 cm that has to be managed by heel raise.

Complications

Impingement

In our method one patient was having slight protrusion of the nail in the sulcus intercondylaris because of faulty insertion.

Neer's rating

Neer's et al 15 (1967) reported 52% satisfied results with operative method. Janzing et al 53 (1998) treated 26 patient of extrarticular femur fracture with reverse femur nailing and got Neer's rating of 75% and score of >85 Point.

In our study, 21 patient has excellent score of 70%, 5 patient has good result of 15% and 3 patient has fair result of with 10% score and only 1 patient has poor result of .5%.

Table 3: Comparison of results between various studies

	Neer's rating (excellent)
Neer et al 15 (1967)	52
Janzing et al 53 (1998)	72
Our study	70

Summary

The study was done for the evaluation function after treatment of supracondylar one-third distal femur fracture with reverse interlocking femur nailing.

1. The commonest mechanism of injury was due to road traffic accident (70%), males were more affected (70%) than females probably due travelling, outdoor working and involved in high velocity injuries.
2. The commonest age group of presentation was 30 to 50 years.
3. Right leg was more commonly affected.
4. Mean operative time was 99.5 min.
5. The injury-surgery interval was 6.3 days
6. The average time to start weight bearing from surgery was 14.10 weeks. Its more in type A3 kind of fractures.
7. The average time of radiological union is 17 weeks.
8. Complications encountered in supracondylar nailing were Local symptoms at distal
 - a. Screw (45%), impingement (5%), Superficial infection (5%), Shortening (15%), Deep infection (5%).
9. According to Neer's criteria results were excellent in 70% cases, good in 15% cases, fair in 5% cases and poor in 10% of cases.

Conclusions

Fractures of distal femur are complex as they are nearer to and may involve the knee joint which needs to be appropriately treated. Reverse femur nailing is excellent technique of treating Type A fractures.

Surgical advantages

1. The most important is that, it eliminates the need for extensive surgical dissection and so prevents the scarring around knee and hence the knee is less stiff.
2. The correct insertion point of nail is one cm dorsal to pcl femoral attachment in the sulcus intercondylaris.
3. The OT time is shorten.
4. Less soft tissue stripping, less blood loss, ultimately led to less fibrous tissue formation all in favour of reduced knee joint stiffness after operation.
5. Early recovery period, early start of post op rehabilitation and rapid mobilisation and weight bearing not advisable in other exrtramedullay implant.
6. No need of bone grafting
7. Help in satisfactory anatomical alignment, internal fixation.

Postoperative advantage

1. It helps in rapid mobilization and early fuctional rehabilitation. The significant advantage of retrograde nail is early weight bearing which cannot be advice with plates.
2. Distal screws related local symptoms is a common problem and is related to implant and technique and has definitive learning curve.
3. Upmost great care needed to avoid infection.
4. There is no non-union, less delayed unions and rates of angular or rotational malunions.
5. Early surgery, closed reduction, atleast two screws in each of the fragment and early postoperative knee mobilization are essential for good union and good knee range of motion.
6. Associated injuries increases the duration of hospital stay and delayed mobilization of patient.
7. It provides good fixation in osteoporotic bone.
8. Post operative range of motion is good in our study average was 110(80-140)
9. High union rate:- Most of the fractures united at an average of four months. This may be due to biomechanical advantages of the nail i.e. preservation of periosteal blood supply.
10. Less Incidence of implant failure.
11. Neer's knee rating system probably helps best in analyzing the functional
12. Outcome, since it includes both functional and anatomical criteria.
13. Retrograde nailing system is excellent implant for extra-articular lower one-third type A fracture sit provide anatomical alignment as it is inserted into the medullary canal it provide rotational stability because of proper anatomical contour and with proximal and distal locking scews.it is highly acceptable in elderly patient and patient with poor bone quality. As it is inserted through minimal invasive technique, soft tissue stripping is very less unlikely to angled blade plate or dcs The supracondylar nail is the optimal tool for many supracondylar and with distal femoral fractures with preoperative planning, adherence to ao principles, strict asepsis, proper post - operative rehabilitation and patients education. It gives rigid fixation in region femur, where canal is widened, thin cortex and frequently less bone stock that makes fixation difficult. thus, by our method we concluded and evaluated that retrograde femur nailing is very useful and excellent divide to treat extra-articular distal one-third femoral fracture.

Clinical example

Radiological Photos and Results

Case 1



Pre operative AP

Pre operative lateral

Immediate post-op AP & lateral

Standing full weight bearing



Sitting cross legged

Sitting in squatting position

Case 2



Pre-operative X ray view



Immediate Post-operative AP view



Immediate Post-operative Lateral view



Complete union AP view



Complete union Lateral view



Full weight bearing



Cross leg sitting



Knee Flexion

Source of funding

None.

Conflict of interest

None.

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