

FUNCTIONAL OUTCOME OF SURGICAL MANAGEMENT OF DISTAL THIRD FEMORAL FRACTURES USING RETROGRADE SUPRACONDYLAR NAIL

M.E. Lakshmikanth¹, M. Antony Vimal Raj², G. Nagarajan¹, G.Karthik¹, M.Seran¹, P. Aravindh¹

¹Assistant Professor, Institute of Orthopaedics and Traumatology, MMC, Chennai, Tamil Nadu, India

²Professor, Institute of Orthopaedics and Traumatology, MMC, Chennai, Tamil Nadu, India

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Corresponding Author:
Dr. G.Karthik,
Email: dr.mathiseran@gmail.com

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Abstract

Background: Supra condylar fractures of femur, comprising 1% of all fractures, are on the rise due to industrialisation and the increasing high-speed transport, conventional operative methods of plating supra condylar femur fractures are fraught with complications such as varus collapse, weight bearing axis being pulled to the lateral side of anatomic axis of condyle, fixation failures and poorer functional outcomes. **Materials and Methods:** This study is a prospective study with a sample of 10 patients with extra articular supracondylar femur fractures treated with Supracondylar retrograde nailing at Rajiv Gandhi Government General Hospital, Chennai. Patients were selected from among the admissions to the trauma ward in the Institute of Orthopaedics & Traumatology and recruited into the study based on the inclusion criteria. **Result:** The functional outcomes were analysed using Scoring systems of NEER'S RATING SCORE. Patients were followed up every 4 weeks till fracture union and every 3 months thereafter. **Conclusion:** Retrograde intramedullary supracondylar nail is a good fixation system for distal third femoral fractures, particularly extra-articular type. It provides rigid fixation in a region of femur, where a widening canal, thin cortices and frequently poor bone stock make fixation difficult. The added benefits are less periosteal stripping and minimal soft tissue dissection.

INTRODUCTION

Supra condylar fractures of femur, comprising 1% of all fractures, are on the rise due to industrialization and the increasing high-speed transport conventional operative methods of plating supra condylar femur fractures are fraught with complications such as varus collapse, weight bearing axis being pulled to the lateral side of anatomic axis of condyle, fixation failures and poorer functional outcomes.^[1]

AO blade plate or dynamic condylar screw application pulls the shaft of the femur laterally, displacing the line of weight-bearing lateral to the anatomic axis of condyle. This creates rotational movement at the fracture site that leads to fatigue fracture of the plates.^[2]

The obvious advantage of an intramedullary device is that it aligns the femoral shaft with condyles reducing the tendency to place of varus movement at the fracture sight. And because the bending movement of an intramedullary device is substantially reduced failure of fixation in osteoporotic bones should be less.^[3]

The purpose of this study is to evaluate the results of distal third fracture of femur treated by closed/open reduction and internal fixation using retrograde intramedullary supracondylar nail.^[4]

MATERIALS AND METHODS

The aim of this prospective study is to assess the union rates and functional outcome of distal third femur fractures treated by supracondylar retrograde nailing. The objectives were to assess the clinical and radiological outcome and to look into the technical difficulties and complications.

Methodology

A total of 10 patients with extra articular supracondylar femur fractures were chosen based on the above criteria to the study. The fractures are classified according to Muller classification. Informed & written consent obtained from all patients.

Supracondylar nailing technique:

Under spinal anaesthesia the patient is placed supine on a radiolucent table. The leg should be draped free and knee should flexed 45 degrees to 55 degrees with

a leg roll. Knee flexion allows proper access to the entry portal, as well as reduction and fixation of intercondylar fractures. A tourniquet is not necessary. Fracture can be reduced either with a tibial traction pin or with manual traction applied by gripping the gastrocnemius muscle at the level of proximal tibial border. Occasionally, a femoral distractor is useful to maintain length and rotation.



Operative technique: Extra articular fractures can be approached through a limited incision using a variety of techniques. An infrapatellar incision 4 to 5 cm long is made either directly over the patellar tendon or at its medial edge. The patellar tendon is correspondingly then either split longitudinally or retracted laterally (as for tibial nailing, hence the ability to fix a floating knee with minimal dissection). The entry point is 5mm anterior to the attachment of posterior cruciate ligament and it lies slightly medial to the center of the distal femoral condyles. Direct visualization of the entry site in the intercondylar notch can be accomplished by excision of the fat pad. C-arm guidance confirms that the entry site is along the axis of the distal fragment in both the AP and lateral planes. Either of the two infrapatellar incisions can easily be extended to a formal medial para patellar arthrotomy if necessary. A ¼ - inch twist drill or Steinman pin is used to perforate the subchondral cortex. The subsequent path created in the distal fragment by passage of hand-held reamers is the most crucial reduction maneuver of the entire procedure. C-arm must confirm that the reduction is in perfect alignment along the longitudinal axis of the distal fragment, because the varus/valgus and sagittal alignment of the fracture will be determined by this. A guide wire is then passed into the distal fragment, the fracture is reduced by manual traction and , the guide wire will be passed into the proximal canal. Length and alignment are maintained manually or

with a femoral distractor while the canal is reamed incrementally to at least 1 mm greater than the anticipated nail diameter. Over reaming by up to 2 mm may be necessary when the 250 mm length nail is used to minimize the distortion within the canal, which can complicate proximal interlocking. The reamers must be passed far enough proximally to accommodate the length of the nail being used. The distal end of the nail should be at least 1 mm deep to the subchondral bone. Length and alignment are confirmed on the image intensifier prior to interlocking. The nail should be statically locked in all cases. At least two screws should achieve secure bicortical purchase in the distal fragment. The same is true proximally unless using a nail long enough to gain at least approximately 10 mm of secure circumferential intramedullary purchase in which case a single proximal interlocking screw may suffice.



Reduction: Proper alignment and reduction must be completed using traction or manual manipulation to reduce the fracture. If closed reduction cannot be achieved then mini open reduction can be done. The primary intent is to restore anatomic alignment between the condyles and the structural integrity of the shaft. Both A-P and lateral radiographs should be taken intraoperatively for the confirmation of proper reduction and alignment.



Nail insertion: After removal of the alignment rod from the nail/drill guide assembly, the nail is advanced by hand through the intercondylar notch into the medullary canal. Usually the apex of the angle is directed anteriorly. The distal nail tip should be counter sunk 1-2 mm below the surface of the intercondylar notch. There is a notch on the drill guide to aid in visualizing the connection with the nail on the image intensifier.



Post op protocol: Depending on presence of concomitant ipsilateral other injuries, the patient was given a posterior above knee slab of plaster of paris bandage, with knee in extension. If intraoperative

open reduction was required, knee brace was given. In the wards, limb elevation was done with injectable analgesics and antibiotics for 5 days. Patients in whom closed nailing was achieved were shifted on second post-operative day on continuous passive mobilization machine and knee was flexed passively till 90 degree.

In closed nailed patients, static quadriceps and active or active assisted bedside knee mobilization was started from second postoperative day. Suture removal was done on 12th postoperative day.

In patients with open reduction, the brace was discarded if wound was found to be healthy and active/ active assisted knee mobilization was instituted.

Patients were discharged on day 12 or 13th postoperative and were advised to follow-up after 4 post-operative weeks. In the mean time, between suture removal and discharge, patients were given crutch training and were made ambulatory on bilateral axillary crutches without weight bearing.

As the patient gained confidence on crutches, toe touch walking was allowed by the 6th week.

Further, weight bearing was allowed depending on the clinical and radiological picture. The initial fracture geometry, intraarticular comminution, stability of fixation were the major factors considered while advising progressive weight bearing.

At each follow-up patient was assessed as regards clinico-radiological union in the form of pain at fracture site, thickening at fracture site, warmth at fractures site, radiographic alignment, evidence of callus seen, knee range of motion, extensor lag and shortening.

Unprotected weight bearing was not allowed till there was good clinical and radiological evidence of progressive fracture healing. Clinically, fracture was considered to be united when there was no pain on palpation and no discomfort on weight bearing. Radiologically evidence of callus and consolidation were analysed. For each fracture type, the long-term results were evaluated using Neer's rating system which assigns points for pain, working and walking capacity, range of movement, radiological appearance, etc.

This study is a prospective study with a sample of 10 patients with extra articular supracondylar femur fractures treated with Supracondylar retrograde nailing at Rajiv Gandhi Government General Hospital, Chennai. Patients were selected from among the admissions to the trauma ward in the Institute of Orthopaedics & Traumatology and recruited into the study prospectively based on the following criteria.

Inclusion Criteria

1. Age > 20 years
2. Patient with distal third femur fracture closed and Grade I and II compound fractures
3. AO classification type A(Extra articular)
4. Segmental shaft fractures
5. Associated tibial shaft fractures

Exclusion Criteria

1. Patient not willing for surgery
2. AO type B and C
3. Grade III compound fractures
4. Associated intertrochanteric femur fractures
5. Associated tibial plateau fractures
6. Severe osteoarthritis knee patient

RESULTS

In this study, 10 cases of distal femur fractures were included and treated with supracondylar femur nailing. Patients were followed up every 4 weeks till fracture union and every 3 months thereafter. Clinically, tenderness at fracture site, knee pain, limb length discrepancy, range of movements, alignment in varus/valgus deformity were assessed at each follow up. The results were analysed with standard AP and Lateral radiographs. The fracture was said to be radiologically united if callus was seen in at least three cortices. The functional outcomes were analysed using Scoring systems of NEER'S RATING SCORE.

Many of the injured patients were male indicates that makes more involved in outdoor activities and highest number of patients were in their third decade (50%), Road traffic accidents was the most common mode of injury (70%), 2 patients had accidental fall fracture and 1 patient had bull gore injury. Most of the patients, reported within 5 days of injury to the hospital.

8 out of 10 patients had closed injury. Type A2 is more common among the 10 patients 5 out of 10 (50%). The average range of Knee flexion was about 0-89 degree. The maximum gain in knee flexion was 110degree and minimum was 40 degrees. The amount of average blood loss intraoperatively was 226ml with maximum loss of 250ml in 2 patients and minimum loss of 200ml in 2 patients.

The average operative time for surgery is 110mins with maximum time of 120mins in 4 patients and minimum of 90mins in 1 patient. The average time for union in our study was 11.1 weeks with minimum of 8 weeks in 1 patient and maximum of 14 weeks in 2 patients.

The patients are followed an average of 8.4 months and the Final outcome measured by NEER's scoring was excellent in 5 patients (50%), good in 4 patients (40%) and fair in 1 patient (10%).

The associated injuries were ipsilateral both bone fracture leg in 4 patients, Quadriceps rupture in 1 patient, Medial malleoli fracture in 1 patient, Ipsilateral segmental femur fracture in 1 patient and Ipsilateral segmental femur fracture in 1 patient.



DISCUSSION

Treatment of the distal femoral fractures is a cumbersome subject over the decade. There have been changing principles towards surgical treatment of supra condylar fractures of femur. Conservative methods at any age may be complicated by knee stiffness, mal union and nonunion.^[5]

Early surgical stabilization can facilitate soft tissue care, permit early mobility and reduces the complexity of nursing care. Open reduction and internal fixation have been advocated, using implants, including angled blade plate, fickle devices, Rush rods, Ender nails, Dynamic condylar screw, condylar buttress plate and interlocking nails, locking compression plate. A locking plate decreases the screw-plate toggle and motion at the bone- screw interface and provides more rigid fixation. Rigid fixation is felt to be one key to the successful treatment of these fractures.^[6,7]

In the management of extra articular distal femur fractures, as the articular congruity is maintained and there is no involvement of articular cartilage damage fixation and early mobilization and rehabilitation can lead to excellent outcome for the patients. Though distal femur fracture is managed recently by locking compression plate, as far as extra articular distal femur fracture is concerned retrograde intramedullary nailing can also be an option. In intra medullary nailing as it is load sharing device and by applying closed means without disturbing the fracture hematoma biological fixation is a main advantage.^[8-11]

The average time taken for the surgery and intra operative blood loss was less comparative to conventional plate fixations. Regarding union there was 100% union rate without any adjuvant techniques like Bone Grafting, Dynamization etc. There was no implant failure in any of the cases. The average union was 11.1 weeks and the average knee flexion was 89 degrees. The functional outcome score was excellent in 5 cases and good in 4 cases and fair in 1 case which is due to associated quadriceps

rupture and both bone fracture of leg of same side which resulted in knee stiffness and shortening.^[12]

The complications mainly associated with our study was knee stiffness in 1 case (10%), shortening of 0.5cm in 2 cases (20%) which is not significant in routine activity of the patients, 3 patients had anterior knee pain which was mainly due to the exposure by medial parapatellar approach. There was varus malalignment in 3 cases with angulation of 5 -10 degree (30%). No valgus malalignment in any of these cases. There was no superficial or deep infection of the skin incision site and no complications like septic arthritis of knee seen. There was no nail protrusion into the joint.^[13,14]

Open reduction and fixation of fracture was technically easier compared to closed reduction and fixation and the fracture reduction & alignment was perfectly anatomical in openly reduced fractures than closed fractures. The entry point decides the fracture reduction and alignment. Therefore, it is the key step for good fixation. The supracondylar nail fixation for extraarticular distal femur fractures is a good choice with good outcome but the technique has a high learning curve and practical difficulties has been encountered during this procedure.^[15,16]

Comparison of our study with other studies was done, but the functional outcome measurement was different in different studies and no score is superior to another scoring system. Thus, according to study of Seifert et al⁵⁹, total patients were 48 and average age in years was 44 with 77% extra-articular type with mean union time of 12.6 weeks with average follow up of 33 weeks and all fractures were healed well with complications of shortening in 2, DVT-1, retropatellar lesion in 2 and the outcome result was measured with Leungs score.^[17]

According to study of Janzing HMJ et al, total patients were 24 with extra-articular type of 83% with average follow up of 19 months with all healed fractures with complications of shortening in 4, malunion in 5 and distal locking bolt loosening in 5.^[18]

According to study of Gellman RE et al, total patients were 24 with average age of 50 years with average follow up of 18 months with average operative time of 154 mins with average union rate of 12 weeks and with no failures with shortening in 6 patients and malunion in 1 patient and the outcome was measured by Sanders score.^[19]

According to study of Lucas et al, total patients were 25 with average age of 39 years and minimum follow up of 5 months with average operative time of 156 mins with average knee flexion of 104 degrees and all fractures were healed with complications of knee pain, shortening, infection and malunion.^[20]

At present in our study, total patients were 10 with average age of 43 years with all extra articular type with average follow up of 8.4 months with average union rate of 11.1 weeks with average operative time of 110 mins with all fractures healed with complications of knee pain in 3, stiffness in 1 and

shortening in 2 and the outcome were measured with Neers rating score.

Recently, though distal femur LCP is the implant of choice for distal femoral fractures for extra articular type fracture Intramedullary supracondylar nailing is better with advantage of load sharing device with less operative time without disturbing the fracture site which aids in faster healing and reduces the complications of infections which is more with plating. But, functional outcomes in both distal femur LCP and SCN had no significant differences according to study of Christain Hierholzer et al.

The limitations of our study were smaller study group, no comparative study group and shorter duration of follow up.

CONCLUSION

Thus, supracondylar nail is the optimal tool for many supracondylar fractures of femur. It provides rigid fixation in a region of femur, where a widening canal, thin cortices and frequently poor bone stock make fixation difficult. Surgical exposure for nail placement requires significantly less periosteal stripping and soft tissue exposure than that of lateral fixation devices.

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