



EVALUATION OF RESULTS OF OPERATIVE MANAGEMENT OF CLOSE FRACTURE SUPRACONDYLAR FEMUR USING SUPRACONDYLAR FEMUR NAIL

Orthopedics

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ABSTRACT

Introduction: The study was conducted to evaluate the functional outcome of operative treatment of distal femur fractures treated with supracondylar femur nail.

Material and Methods: This study was conducted at tertiary care hospital from July 2015 to July 2017 in 25 patients. Patients with close fracture distal femur were classified according to Muller's classification and operated with supracondylar femur nail either close or open, and followed up for at least 6 months. The results were evaluated based on Mehrotra's criteria.

Results : Most common mode of injury was RTA which is in slightly younger age group (35 years). Most common fracture type was A-1. Closed reduction was achieved in 88% of cases. Final results were excellent in 84% cases.

Conclusion: Intramedullary supracondylar should be treatment of choice in closed fracture distal femur, particularly for types A, C-1, C-2. But for long follow up and large sample size needed.

KEYWORDS

Supracondylar fractures, Muller classification, Supracondylar nail, RTA.

INTRODUCTION

Fracture distal third femur has always been a challenge to orthopaedics surgeons, as the management of these fractures is difficult and controversial. It comprises only 4% of all femoral fractures. The incidence of stiffness, malunion, nonunion and infections are relatively higher in these fractures as also comminution. Closed management such as traction and cast bracing were the treatment of choice^{1,2}. Many times conservative treatment produced better results. But conservative management had the disadvantage of prolonged protected immobilization leading to many complications. Rigid plates were also used, These plates can provide compression at the site of fracture, may also produce local osteopenia. As a result of stress shielding or disturbance of blood supply^{3,4}. Thin distal cortex limits the grip of screws, these are technically difficult to use and may fail when early weight bearing is allowed.

Blade plate by the AO gained wide acceptance for treatment of the fracture of distal third femur. Although it provided stable fixation of most fractures, it was technically demanding. In the earlier period complications of blade plate fixation included infection, inadequate fixation in osteoporotic bones and refracture after plate removal⁵⁻⁷. A less technically demanding alternative was introduced in form of Dynamic Condylar Screw (DCS). The main disadvantage of DCS is that insertion of condylar lag screw requires removal of a large amount of bone which makes revision surgery difficult if required. External fixators⁸ are used as temporary/definitive fixation device in open distal femoral fracture, especially those associated with vascular injury. Because of increased risk of nonunion, pin tract infection and knee stiffness, they are now a days reserved for temporary fixation device in potentially infected open fractures.

Intramedullary fixation obtain more biological fixation than plates because they are load sharing devices. They offer greater soft tissue preservation and bone grafting is required less often. Though these provide less rigid stabilization than the side plate in distal femoral fractures yet they have all the advantages of closed nailing like preserving fracture hematoma, minimal soft tissue stripping, less blood loss and early union. Intra-Medullary supracondylar nail⁹ combines the biomechanical advantages of intra-medullary fixation with the stability of rigid internal fixation. Intramedullary fixation provides improved fracture stabilization in both elderly patients with osteoporotic metaphyseal bone and in younger patients with extensively comminuted fractures.

The present study has been undertaken to evaluate the overall functional outcome of management of patients with supracondylar femur fractures treated by supracondylar nail.

MATERIAL AND METHODS

This study was conducted on 25 patients with distal femur fractures and treated with supracondylar nail at Department of Orthopaedics, Dr. S.N. Medical College, Jodhpur from July 2015 to July 2017. The aims and objectives of this study were:- 1) To review the available literature on the management of fracture distal third of femur. 2) To evaluate for results and complications of operative fixation of fracture distal third of femur using retrograde Intra Medullary Supra Condylar Nail. 3) To discuss indications and contra indications of Intra Medullary Supra Condylar Nail.

All the patients were subjected to history with emphasis on mode of injury, time of injury, interval between injury and reporting and nature of treatment taken before admission. Clinical examination included examination of the injured part, other associated injuries and any neurovascular involvement. Depending upon the nature of injury relevant radiological examination was done.

Inclusion criteria:

Who presented within three weeks of injury, Had closed fracture of lower one third of femur, Had fracture distal third femur Type-A, Type-C1, Type-C2 as per AO classification, Highly comminuted supracondylar fractures, Fractures that require opening the knee joint to stabilize the femoral condylar segment, Distal fracture in osteoporotic bone.

Cases that were excluded from the study:

Who presented more than three weeks after the injury, Compound fractures of distal third femur, Active infection, Fixed deformity at knee joint, Obliterated medullary canal due to previous fracture or infection, Supracondylar fractures extending up to the isthmus and AO type C3 fractures

Pre-operative Planning

Good preoperative radiographs were taken, Severely displaced fractures were stabilized by skeletal traction to maintain length and minimize complications like fat embolism, deep venous thrombosis etc. The choice of approach (open or percutaneous) was based on the extent of articular comminution and the quality of reduction that could be obtained with traction and external manipulation of the fracture at

the time of surgery. The largest implant suitable for the patient and the fracture was used.

Patient Positioning

Patient was placed in supine position on a radio lucent table, knee was flexed to 30 to 40 degrees with a leg roll to provide adequate access for reduction and fixation of the intercondylar fractures.

Operative Procedure: Open Technique:

In this technique, knee joint was entered through the standard midline incision and medial parapatellar capsular incision. Intra-articular fractures were anatomically reduced and fixed with screws in anterior and posterior segments of condyles, allowing adequate space to place the nail centrally in the intramedullary canal. Entry point was made in intercondylar notch just anterior to the origin of the posterior cruciate ligament. Entry into the intercondylar notch was made with a curve awl. Entry point was centralized with the condyles in anatomic alignment to ensure that the alignment could not deviate into a varus or valgus position.

Percutaneous Technique:

Was used in fractures without intraarticular involvement or with minimal intraarticular comminution. If intra articular fracture reduction was acceptable two guide wires were placed transversely across the inter condylar fractures lines anterior and posterior to entry point, and two cannulated screws were placed in standard fashion. Upon stabilization of condylar fracture 5.0cm midline skin incision was made over the patellar tendon. Following the skin incision patellar tendon was incised vertically in a midline fashion and with longitudinal fibers. Small retractors were used to minimize trauma as the curved awl positioned into the intra condylar portal. The entry portal was approximately 2.0 to 5.0 mm anterior to the posterior cruciate ligament. Once the awl was properly positioned, it was advanced deep into the metaphysis. The awl was removed and guide wire was advanced through the portal passing through the reduced fracture and proximally into the shaft. The entry portal and medullary canal were enlarged with intramedullary sequential reamers. Nail guide assembly was advanced over the guide wire into the distal condyles. Traction was applied at this time with gentle pull behind the gastrocnemius with knee in 45° to 60° of flexion. Once the nail was in the distal condylar fragment, it was advanced with a pressure over the guide wire until distal end of nail is countersunk 1-2mm below the articular surface. 2 distal interlocking screws were placed via jig and two screws were then placed proximally by free hand technique. The knee was then taken through the full range of motion after removing the jig to ensure articular function.

Post Operative Treatment:

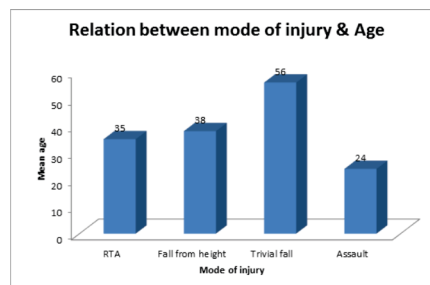
Limb was kept elevated on a pillow and active toe movements encouraged. Patients with stable fixation were started on a continuous passive motion programme after 48 hrs of surgery after removing compression bandage. Hinged knee braces were used to protect fractures with stable fixation. Fractures with less secure fixation are given temporary slab. Stitch removal were done at 2 week. Weight bearing was not allowed prior to proper callus formation.

Follow Up:

Patients were called for follow up at regular interval at two weeks, at one month then at two, four and six months after surgery. At every follow-up a detailed clinical and radiological assessment of the patients was done. A minimum of six month follow-up was done before assessment of final result. Final assessment of results according to modified Mehrotra's criteria also taking into consideration, the complications if there were any.

Results:

Age of the patients ranged from 19-71 years with mean age of 38.6 years. Maximum no. of patients were in the age group of 25-35 years. There were 20 male and 5 female patients. Maximum number of females belongs to 20-35 years while majority of males were in either 25-35 or 15-25 years of age group. Right side was involved in 14 patients i.e. 1.27 times more than left side. Road traffic accident was the most common mode of injury accounting for 64% of the cases. Assault was encountered in 16% of the cases, rest were fall from height or trivial fall. Most common type of fracture was type-A, accounting for 48% of the cases. Fractures occurred with trivial fall in elderly age group (mean age 56yrs) while road traffic Accidents occurred in relatively younger age group (mean 35 years).



Associated injury:

Most common associated injury in our series was fracture shaft tibia in 6 cases followed by fracture tibial condyle (5 cases). Fracture shaft of tibia was treated by closed interlocking nail using same incision in same sitting.

S. No.	Injury	No. of patients
1	Fracture shaft tibia	6
2	Fracture femur	2
3	Fracture tibial condyle	5
4	Fracture dislocation ankle	1
5	Chest injury	1
6	Fracture Forearm	3

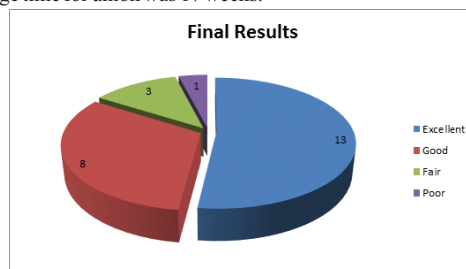
Duration between injury and surgery:

Patients were operated as early as within two days to as late as 15 days. The average duration between injury and surgery was 5.5 days. Closed reduction was achieved in majority 88% of cases. 12% cases required open reduction. Average duration of surgery was 55 minutes.

Complications: Most common complication observed was knee stiffness in 4 cases and patellar impingement in 3 cases. Infection and delayed union in one case each.

Range of movement at knee: Average range of movement at knee was 107°, none of the patients had extension lag and 12 cases were having full range of movement at knee. Three patients had knee flexion <90degrees. In 88% of cases there was no shortening while 8% cases had shortening more than 2.5cm causing a visible limp.

Final results: Results was analysed according to Mehrotra's criteria considering pain, ability to walk, muscle wasting, shortening, infection, range of movement of knee, ability to squat, sitting cross leg and visible limp. 84% cases in the present study had either excellent or good results. Fair and poor results were seen in only 16% cases. Average time for union was 17 weeks.



DISCUSSION

In our study age distribution showed that the maximum number of patients was in the age group of 25-35 years, with the mean age of 38.6 years. Males had an average age of 36.2 years and females had an average age of 42.3 years. Lauri Handolin et al¹⁰ in his study found males had an average age of 52.3 years and women with 66.5 years. This may be because females are more prone to fractures in the post menopausal period. Gellman RE. et al¹¹ who studied 22 patients had an average age of 50 years ranging from 26 to 84 in their study. Also men involved were younger at 39 years as compared to women at 60 years of age. The incidence of fracture distal third femur was higher in males than females (M: F: 4:1) in our series. Sex ratio in our series was similar to that of Rong Sen Yang et al¹² who showed male/female ratio to be 3:1. But in other studies Gellman RE et al¹¹ (M: F = 10:12), Lauri Handolin et al¹⁰ (M: F = 4:7) females outnumber males. This may be because in our country males are more involved in outdoor activities so more prone to trauma which was the major causative factor in our series, as compared to western world where males and females share

equal outdoor responsibility. Road traffic accident was the most common mode of injury in our series accounting for 64% of the cases, was followed by trivial falls in 12% cases. Ron-Sen Yang et al¹² reported 71% of the fracture distal third femur caused by RTA and Gellman R. E. et al¹¹ who reported RTA-59%, Fall-36%, and Assault-10%.

In our study right side was involved relatively more (56%) than the left (44%) with none of the case having bilateral fractures. Lauri Handolin¹⁰ In his study also found similar results with right femur was involved in 29 (63%) and left in 17 (37%) of cases.

We have classified fracture distal third femur as described by Muller et al¹³ and expended in AO/OTA classification. Only type A, C1 and C2 were included in the present study. In our series we found 12-type A1 (48%), 7-type A2 (28%), 4-type A3 (16%) and 2-type C1 (8%). Similar observations were noted by Watanabe Y, Takai S¹⁴ who reviewed 24 fracture distal third femur managed by intramedullary supracondylar nail with type A1 (56%), type A2 (3%), type C1 (6%), type C2 (3%), type C3 (6%). Kumar et al¹⁵ in their in elderly people included only Type-A fractures, thereby excluding the cases with intraarticular extension. In their series of 16 cases there were 4-TA Type-A (25%), 11-Type A2 (69%), 1-Type-A3 (6%) fractures.

We found 72% cases were suffering from other associated injuries. Fracture ipsilateral tibia was most common (6cases) associated injury followed by fracture opposite femur in 2 cases. Other associated injuries were fracture tibial condyle 5 case, compound fracture dislocation ipsilateral ankle 1 case; fracture forearm bones 3 case and chest injury 1 case. Ron-Sen Yang et al¹² observed 69% cases with multiple injuries whereas Gellman R.E. et al¹¹ observed 50% incidence of poly-trauma.

We could achieve satisfactory close reduction in majority (88%) of cases. Open reduction of fracture by additional lateral incision was done in only 3 cases (12%). This was most probably due to configuration of the fracture. In one case the spike fixed in soft tissue was not allowing closed reduction, in one case acutely flexed distal fragment repeatedly guided guide wire posterior, while in one case with spiral fracture closed reduction could not be achieved.

Lauri Handolin et al¹⁰ in his series reported open reduction by additional lateral incision in 30% of the cases, which was quite high as compared to our study.

The duration of surgery varied with the complexity of fracture and became less with experience. The average operative time in our series was 55 minutes (ranging from 35 minutes to 190 minutes). Henry S. L.¹⁵ in his study used percutaneous retrograde nail, reported mean operative time of 76 minutes. We had used percutaneous techniques in most of our cases so mean operative period of our series is almost comparable.

Stiffness of knee joint was the most common complication in our series i.e. 4cases (16%). Gellman R. E. et al¹⁰ also reported knee stiffness as one of the major complication in his series. He reported 8% cases with knee stiffness. Knee stiffness in our study was slightly higher due to presence of ipsilateral tibial condyle and tibial shaft fractures. Knee stiffness could also be attributed to the fact that most of the patients at our centre were from rural background where facilities of proper physiotherapy is not available.

Patellar impingement was the second most common complication in our series (3cases); 12%. Gellman R. E. et al¹¹ reported three cases (11%) with patellar impingement. Danziger MB¹⁷ reported 1 patient (4%) with impingement of nail in the intercondylar notch.

Delayed union was seen in one case while there was no case of nonunion in our series. Innacone WM¹⁸ has reported high incidence of nonunion in his series (10%). Henry SL¹⁶ has also reported that nonunion increases significantly in the cases treated by open reduction and internal fixation (39%) as compared to those who were treated by percutaneous technique (7%). Low incidence of delayed union in our series may be because of the fact that we have included only closed cases and closed reduction could be achieved in 91% of cases. No open fractures were included in our series whereas good numbers of open fractures were included in other series.

There was no implant failure in our study while Seligson & Henry¹⁶, Innacone et al¹⁸ had implant failure as they were using nails with 6.4 mm distal interlocking screw holes. In our series we have used Intra Medullary Supra Condylar Nail with distal locking screw 5 mm diameter.

Final results in our series were assessed according to Modified Mehrotra's Criteria, as this criteria is most suited to Indian Scenario because it takes into account activities like squatting and sitting cross legged which were very important for Indian patients.

In our study we observed excellent results in 52% of cases, good results in 32% of cases, fair in 12% of cases and poor in 4% of cases. Average range of flexion in our series was 107° and average time of union out to be 13.2 weeks.

Gellman R.E. et al¹¹ used functional evaluation scale developed by Sander's et al¹⁹ for evaluation of his results. He reported 4-excellent, 16-good, 2-fair and 2 poor results. Average range of movement in his series was 106° ± 22° and average union time was 3 months.

Janzing H.M. et al²⁰ reported 72% excellent, 20% good, 4% fair and 4% poor results. They evaluated their results as per relative Neer's score. Kumar et al¹⁵ reported that average time to union of 3.6 month and average range of movement at knee to be 116°. Denziger MB¹⁷ in his series reported 94% cases with excellent and good results with average union time of 3.3 months and average range of motion at knee of 109°.

SUMMARY AND CONCLUSION:

Intra Medullary Supra Condylar Nail should be the treatment of choice for closed fractures of lower third of femur. As it has all the advantages of closed treatment like minimal blood loss, less soft tissue stripping, preservation of fracture haematoma and minimal complications. This operation is particularly suited for Type A, C₁ & C₂ type of fractures as shown by the final functional results of this study. Though a larger sample size and long term follow up recommended.

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