

ORIGINAL ARTICLE

Comparison of Results of Distal Femoral Fractures Treated by Internal Fixation with Locking Compression Plate and Retrograde Femoral Nail

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Abstract

Background: The femur (thigh bone) is the longest, strongest, largest and heaviest tubular bone in the human body. Rapid industrialization and the fast pace of life have brought both comforts and catastrophe like road traffic accidents which are crippling many young lives. Supracondylar and intercondylar femoral fractures are often difficult to treat and they are notorious for many complications. **Methods:** In this study 40 patients with supracondylar fracture of femur with or without inter condylar extension were studied. The method used for fracture fixation was closed or open reduction and internal fixation with retrograde intramedullary supracondylar nail (Group-A) and locking compression plates (Group-B). All the fractures in this series were post-traumatic. No pathological fracture was included in the study. The study was restricted to fractures occurring at the region 9 cm proximal to lower end of the femur. **Results:** 75% of Group A patients underwent closed reduction remaining 25 % undergone open reduction due to partial articular extension (AO type B) 80% of group B patients underwent open reduction in order to fix the plate properly and due to complex nature of fracture (AO type B and C). Average radiological union time was weeks in group A was 10.95 weeks in group-B it was 14.0 weeks. Long-term final results were rated using the Neer's rating system, Mean Group-A 79.25 points Group-B 74.15 points which is in good category for both groups. **Conclusions:** Retrograde intramedullary supracondylar nail is a good fixation system for distal third femoral fractures, particularly extra-articular type and partially articular type. Locking plates are very good fixation types in all types of supracondylar fractures including severely comminuted type C fractures. The mean operative-time is equal in both types of fixations, only difference is we need to open the fracture site in plating and fracture hematoma is disturbed, and need to open the knee joint in supracondylar nailing. Risk of infection is almost same in both groups.

Keywords: Fracture, Closed reduction and internal fixation [CRIF], Open reduction and internal fixation [ORIF]

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Introduction

Distal femoral fractures accounts for 7% of all femoral fractures are complex injuries with the potential to cause long term disabilities. If fractures of the hip are excluded, 31% of femoral fractures involve the distal portion.^[1] Supracondylar and intercondylar femoral fractures are often difficult to treat. The traditional management of displaced fracture

supracondylar of femur was along the principle of Watson Jones^[2] and John Charnley.^[3] This comprised of skeletal traction, manipulation of fracture and external immobilization in the form of casts and cast bracings.^[4] These methods however, met with problems like deformity, shortening, prolonged bed rest, knee stiffness, angulation, joint incongruity, malunion, quadriceps wasting, knee instability and post-traumatic osteoarthritis.^[5,6]

The trend of open reduction and internal fixation has become evident in the recent years with good results being obtained with the AO blade plate, dynamic condylar screw and other implant systems like intramedullary supracondylar nails and locking compression plates. Supracondylar fractures tend to collapse into varus. During application of AO blade plate or dynamic condylar screw, the shaft of femur is often pulled laterally displacing the line of weight bearing, lateral to the anatomic axis of condyle.^[7] This creates rotational movements at the fracture site that causes pulling off the blade plate or condylar screws leading to fatigue fracture of the plates. Also, the presence of osteoporetic bone leads to fixation failures with screws and plates cutting of the soft bone.^[8] The obvious advantage of an intramedullary device is that it aligns the femoral shaft with condyles reducing the tendency to place varus movement at the fracture site. And because the bending movement of an intramedullary device is substantially reduced failure of fixation in osteoporetic bone should be less. In addition, a retrograde intramedullary supracondylar nail has got distinct advantages of preservation of fracture hematoma, decreased blood loss, minimal soft tissue dissection, less operative time and reduced rate of infection. Locking Compression Plate (LCP) implants offer multiple points of fixed-angle contact between the plate and screws, theoretically reducing the tendency for varus collapse that is seen with traditional lateral plates. Clinical studies of locking compression plates have demonstrated a high frequency of fracture union with lower incidence of mal-alignment.^[9, 10] Locking plates are with threaded screw holes, which allow screws to thread to the plate and function as a fixed-angle device. These plates may have a mixture of holes that allow placement of both locking and traditional non-locking screws (so called combi holes). Any plate that allows the insertion of fixed-angle / angular stable screws or pegs can be used as a locking plate. The purpose of this study is to evaluate the results of supracondylar and intercondylar fracture of femur, treated by close/ open reduction and internal fixation using retrograde intramedullary supracondylar nail and locking compression plate and compare the results of both types of fixation.

Materials and Methods

In this study 40 patients with supracondylar fracture of femur with or without inter condylar extension were studied. All the cases were treated in Kamineni Hospitals LB Nagar between the periods between Aug-2010 To Dec 2011. The method used for fracture fixation was closed or open reduction and internal fixation with retrograde intramedullary supracondylar nail (Group-A) and locking compression plates (Group-B). The duration of follow up ranged from 6 weeks to 12 months. All the fractures in this series were post-traumatic. No pathological fracture was included in the study. Also supracondylar fractures in children were not considered. The study was restricted to fractures occurring at the region 9 cm proximal to lower end of the femur. The following protocol was observed for patients with supracondylar fractures of femur on arrival. General and systemic examination as well as local examination of the patient was done as per protocol. Thorough assessment of patient was done to rule out head/ chest/ abdominal/spinal or pelvic injury. Musculo-skeletal examination of patient to rule out associated fractures. Stabilization of patient with intravenous fluids, oxygen and blood transfusion as and when required. Careful assessment of injured limb as regards to neurovascular status. Primary immobilization of involved limb was done in Thomas splint with a cotton pad below the distal fragment and transport of patient to the Department of Radiodiagnosis. Radiological assessment Antero posterior and true lateral views of injured limb including complete knee joint and distal femur. Occasionally oblique views are also taken to coronal plane fractures. Irrigation and lavage of compound wounds was done with normal saline followed by padded dressings. Compound injuries were taken for cleaning and debridement under anesthesia at the earliest with meticulous debridement. Fixation was done. Injection Tetanus Toxoid and broad spectrum inject able antibiotics and analgesics were administered for compound injuries as and when required.

Implant Used:

- The implant used was locking plates by MATRIX or S.N system and supracondylar nail system with instrumentation set.

- The nails are available with outer diameter of 10, 11 and 12 mm
- The distal end is expanded to outer diameter of 13 mm.
- The nails are available in lengths of 150, 200 and 250 mm.
- There is 5 degree anterior bend and an anterior bow for anatomic fit.

Fractures were classified with the help of radiographs according to the AO-ASIF classification.^[12] Preoperative calculation was done on radiographs to ascertain the length of supracondylar nail, maximum possible diameter and lengths of interlocking bolts after subtraction of the magnification factor. The length of nail was selected so that the distal locking hole of two proximal holes was at least 2.5 cm proximal to fracture site. Similarly length of locking plate needed number of locking screws required in intercondylar area were evaluated. The limb to be operated was shaved and prepared on the operation table on the day of surgery. One gram of second or third generation intravenous cephalosporin was injected 30 mins before surgery. In all patients, static quadriceps and active or active assisted Bed side knee mobilization was started from second postoperative day. Suture removal was done on 14th postoperative day. In patients with open reduction, active assisted knee mobilization was instituted. Patients were discharged on 3rd or 5th postoperative and were advised to follow-up for dressing and for suture removal on day 14.

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. For each fracture type, the long-term results were evaluated using Neer's rating system and Sanders functional evaluation scale, which assigns points for pain, working and walking capacity, range of movement, radiological appearance, etc. The clinical data of each and every patient was collected in the proforma.

Results

70% of fractures of Group A and 65 % of fractures of Group B were closed however remaining 30% of fractures of Group A and 35% of Group B were of open types divided into

different grades by Gustilo-Anderson Classification of open fractures^[11] 75% of Group A patients went closed reduction remaining 25% underwent open reduction due to partial articular extension (AO Type B). 80% of Group B patients underwent open reduction in order to fix the plate properly and due to complex nature of fracture (AO Type B and C)^[12]

Average radiological union time was 16.42 weeks in group A. Of 20 patients, one patient went into deep infection after 2 months. Nail was removed and managed with antibiotic bead placements done finally fracture went into delayed union. The Average Radiological union in Group B was 17.7 weeks.

Table 1: Degree of Knee Flexion achieved after surgery

Knee flexion Degrees	Group A	%	Group B	%	Total
<90	3	15	4	20	7
90-110	5	25	14	70	19
>110	11	55	2	10	13
Total	19	95	20	100	39
p values	< 0.1*				

* Significant

Normal knee flexion is 140 degree. Laubethal^[13] has demonstrated that average motion required for:

- Normal sitting 93 degree
- Stair climbing 100 degree
- Squatting 117 degree

Thus, acceptable knee flexion compatible with daily activity would be 110 degree.

Table 2: Neer's rating

Ratings	GroupA	%	GroupB	%
Excellent >85 points	10	50	9	45
Good 70-84 points	3	15	2	10
Fair 50-69 points	6	30	7	35
Poor <50 points	1	5	2	10
p values	0.38*			

Table 2 showing Long-term final results were rated using the Neer's rating system which allots points for pain, function, working ability, and joint movements, gross and radiological

appearance. It shows that the group B had 10% of outcome as poor where as Group A had only 5% as poor outcome which was significant.

Discussion

In the present study we tried to evaluate the results of treatment of distal third femur fractures with locking compression plates and intramedullary nail. Most of the fractures treated by us were supracondylar type with or without intercondylar extension. Supracondylar fractures of femur are notoriously difficult to treat because they are highly unstable and comminuted and tend to occur usually in elderly and multiply injured patients. Because of strong muscular attachment it is difficult to maintain it in proper alignment without fixation and also because of their proximity to knee, regaining full knee motion is usually more difficult. JB Giles et al^[14] treated 26 cases of supracondylar and intercondylar fractures with supracondylar plate and lag screw assembly. They reported that this device was very successful in restoring the normal alignment of femur and intra-articular anatomy of the knee joint. In a similar study 1989, JM Siliski^[15] reported the use of AO blade plate for the management of 52 supracondylar and intercondylar fractures. They followed the AO classification of fractures and used the Neer rating system for evaluation of results and obtained 92% excellent and good results in C1 type fractures, 72% good/excellent results in C2 type fractures and 85% good/excellent results in C3 type fractures. In 1995, in the comparative study conducted by Krickler and Butt MS et al^[16] 42 displaced fractures of supracondylar and intercondylar fractures of femur in elderly patients were studied. 20 patients received operative treatment with the AO DCS and side plate assembly and 22 received skeletal traction followed by cast bracing. Good to excellent results were obtained in 53% of the patients treated surgically while only 31% good results were obtained in conservative group. The author concluded that the use of DCS allowed good alignment, adequate joint congruity and early knee mobilization. In general, there were fewer incidences of complications in the operative group. In the present study it was found that Locking plates are very good fixation types in all types of supracondylar fractures including

severely comminuted fractures. The supracondylar Nail were used because they obtain more biological fixation than plates because they are load sharing, rather than load sparing implants. In addition, a retrograde intramedullary supracondylar nail has got distinct advantages of preservation of fracture hematoma, decreased blood loss, minimal soft tissue dissection, less operative time and reduced rate of infection. In 1996, Gellman RE et al^[17] reported 26 supracondylar femoral fractures treated with intramedullary supracondylar nail with 20 good to excellent results and average knee range of motion of 104 degrees. In our cases we treated 20 patients with Supracondylar nail. Out of the treated cases 11 55% had Excellent and good results and 7 (35%) had fair results Only 2 (10%) had poor result according to Neer's rating scale. In 2000, Kumar A et al^[18] reported the results of 18 distal femoral fractures (all Type-A, AO classification) in elderly patients treated with retrograde titanium supracondylar nail 15 fractures (93.7%) united in an average duration of 3.6 months. The average range of motion achieved at knee was 100.6 degrees. There were no implant failure, knee sepsis or wound healing problem. One non-union and two stress fractures of femur above the nail were the main complications in this series. In the present study we found that the Average knee flexion in Group A patients was 105 degrees and that of Group B was 95 degrees the knee extensor lag in our study was 5.9 degrees in Group A and in Group-B 5.5 degrees. Complication rates in both groups were similar with one case in each group showing deep infection but there was one non union case in Group A whereas no non union case reported in Group B. There is no difference in overall functional outcome at 6 months in both groups.

Conclusion

Within the limitations of the present study we concluded that retrograde intramedullary supracondylar nail was a good fixation system for distal third femoral fractures, particularly extra-articular type and partially articular type. Locking plates offers good fixation in all types of supracondylar fractures including severely comminuted fractures. Distal screw related problems are common in nailing, however no

such type of problems with plating. Since there is no requirement of bone graft in nailing it decreases the morbidity associated with donor site. With careful selection of cases and attention to prevent complications both implants can be used successfully in distal femoral fractures effectively with good to excellent outcome.

Conflict of Interest: None declared

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