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ORIGINAL RESEARCH

A comparative study of results of fracture distalone-third femur treated with DFLCP vs nail

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ABSTRACT

Background: Majority of these fractures are situated in close proximity to neurovascular structures, treating distal femur fractures is often complicated.Surgical methods available for treating distal femoral fractures reflects the difficulties these injuries present. The study compared the functional outcomes of the retrograde supracondylar interlocking nail with the distal femoral locking compression plate for the treatment of extra articular distal femur fractures. **Methods:** A prospective observational study of 70 Patients with fracture distal femur presenting to the outpatient department and emergency of Mahatma Gandhi Hospital, satisfying the following inclusion & exclusion criteria were included in this study. Initially patient was well educated about the significance of each of the procedure surgery and the detailed surgical procedure. All patients were enrolled in this study and allocated into two groups. **Results**: Patients who underwent DFLCP in Group A and Patients who underwent Retrograde Nailing in Group B. The mean age is 49.87±12.09. 82% of all the patients affected were males while 12% of the patients affected were females. The right limb was affected more commonly than the left limb. Mostly 49 patients were due to a Road Traffic Accident (RTA).While comparing the outcomes, 29 patients out of 35 had excellent and good outcomes. **Conclusion:** We therefore draw the conclusion that DLFP and Retrograde intramedullary nail fixation are both successful methods for treating distal femur fractures based on the aforementioned findings. Retrograde nailing, however, resulted in a significantly quicker period for fracture union.

Keywords: Femur fractures, Retrograde nailing, DLFP, etc.

INTRODUCTION

Every orthopaedic surgeon is confronted with a challenge while treating distal femur fractures given the complexity and the grave nature of the injuries. Approximately 1% of all fractures and 6-7% of femur fractures are distal femur fractures. Supracondylar femur fractures incidence in a general population is 37/100,000 people annually. It often results due to involvement of two distinct mechanisms. It is caused by high-velocity trauma in younger individuals and is linked to severe soft tissue damage & open fractures. Even after a simple accident fall, isolated distal femur fractures from low energy trauma will occur in older people who already have osteopenia.Because the majority of these fractures are situated in close proximity to neurovascular structures, treating distal femur fractures is often complicated. As a result, they are more vulnerable to vascular injuries. These fractures are proximal to the knee joint's articular site, which affects the joint's movement relatively quickly and necessitates comprehensive rehabilitation for a favourable functional outcome.

The variety of surgical methods available for treating distal femoral fractures reflects the difficulties these injuries present. These fractures usually involve osteoporotic bone, are intra-articular, frequently comminuted, and are challenging to decrease and hold while preserving joint function and total limb alignment.Regardless of the fixation method used, the principles of internal fixation must be followed, which include early active mobilization, minimal soft tissue damage, stable internal fixation, and anatomical reduction of the articular surface. Since fractures involving the knee joint's juxtaarticular position impact this joint's movement fairly quickly, recovery of the lost knee movement is delayed unless excellent physical therapy and gradual mobilization exercises are performed.

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Significant advances have been made in treatment of these fractures in the past three decades. Neer et. al.[1] in 1967 concluded that these fractures were not suitable for internal fixation and treated with traction & cast bracing. It is recognized that operative fixation with the ability to maintain anatomical reduction of the joint surface, restoring axial alignment and early range of motion presents clear advantages over closed means of treatment. Numerous devices have been proposed for the treatment of these fractures.Similar to those with a proximal femur fracture, the goal of surgical therapy in these frail patients should be considered, which allows early weight bearing and mobilisation to prevent the risks of prolonged bed rest.[2] This study compared the functional outcomes of the retrograde supracondylar interlocking nail with the distal femoral locking compression plate for the treatment of extra articular distal femur fractures.

OBJECTIVES

We assessed the functional outcome of treatment by use of DFLCP and the treatment by use of Nail for distal one third femur fractures.Lastly we assessed the mean fracture union time between the use of DFLCP vs for distal one third femur fractures.

METHODOLOGY

A prospective observational study carried out thefunctional outcome of treatment by use of DFLCPvs Nail for distal one third femur fractures among 70 patients to the outpatient department and emergency department of Mahatma Gandhi Hospital, after obtaining ethical clearance permission vide reference number MGMCH/IEC/JPR/2021/384 during the study period of 18 months(February 2021 to August 2022) with satisfying the following inclusion & exclusion criteria were included in this study.

Initially patient was well educated about the significance of each of the procedure surgery and the detailed surgical procedure.All patients were enrolled in this study and allocated into two groups.Patients who underwent DFLCP in Group Aand Patients who underwent Retrograde Nailing in Group B.

A total of 70 patients with distal femoral fractures were chosen and sampling based on the inclusion and exclusion criteria and included to the study. Inclusion Criteria was all patients with closed fracture or non union.Fractures with AO type 33A,33B,33C fractures,Mullers type A,B,C fractures. Gustilo Anderson Grade 1 and grade 2.Excluded patients were those who refused to give consent,patients,with deformities prior to fracture and compound fractures with Gustilo Anderson Grade iii. All patients enrolled in this study were randomized and allocated into two groups. On admission detailed examination of the patients was carried out after hemodynamic stabilization. Then standard Antero-Posterior and Lateral view X-Rays were taken and the fracture configuration noted. Patients were initially managed with either Mid-tibial pin traction or upper and lower tibial pin traction to immobilize and maintain the length to prevent from shortening Computerized Tomography is also taken when needed to assess the exact alignment of the fragments. The fracture is classified using the Muller classification.

Pre-Operative Assessment: All basic investigations include complete hemogram, Blood Grouping and Viral markers were carried out. If patients aged more than 50 years, both, cardiologist and pulmonologist' opinion was obtained to know cardiac and pulmonary reserve of the patient to withstand surgical procedure. Informed written consent was obtained from all patients. Preoperative haemoglobin levels and also amount of blood loss during surgery was recorded. Preoperative test dose of antibiotics and test dose of xylocaine was done. Preparation of both lower limbs up to hip level will be done. All patients electively posted after getting anaesthetic fitness for surgery.

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 centre 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. (figure1) A 1⁄4 - inch twist drill or Steinman pain 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 manoeuvre 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.

Figure1: infrapatellar incisions extended to a formal medial para patellar arthrotomy

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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. If difficulty is encountered, a femoral distraction can be applied to achieve reduction but it must be positioned where it will not interfere with either the nail or its lateral targeting device. 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 bi-cortical 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. 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.

Locking Compression Plate Technique

Position of the patient:For Locking compression plating patients were positioned in supine positions with both lower limbs extended and a small triangular bolster placed below the thigh in operative limb to make hip in neutral rotation and also make knee flex to aid in posterior vessels falls away from operative area.

Incision and surgical approach:Lateral approach for distal femur

Procedure: Under spinal/General Anaesthesia patient positioned supine on the radiolucent table. A triangular bolster kept under the operating knee to allow 30 - 600 of flexion to relax Gastrocnemius muscle. A 10-15cm long skin incision is made, Sub cutaneous tissue, , tensor fascia lata, vastuslateralis is incised till the lateral condyle is reached, reduction of the condyles done using point reduction clamp and image intensifier. Reduction held temporarily using two K wires by avoiding disturbance to plate positioning. The plate along with jig assembly is slid along the shaft using the bevel. The jig plate assembly is held with distal condylar portion with a temporary K wire. The condylar fragment is aligned with metaphyseal fragment by appropriate manipulation (traction and rotation) under image control.

The reduction is held temporarily with k-wire, after aligning the plate along the shaft. After confirming the reduction and plate position parallel to the condyles the second K wire passed into the jig, plate and condyle. In this position the anatomically pre bent implant matches the distal femur. The condyles were fixed to the plate using 6.5mmcannulated locking head cancellous screws without disturbing the reduction. The reduction and the position of the plate were controlled clinically and by image intensifier help (axis, length, and rotation).The locking head screws inserted using jig sleeve assembly with image intensifier in accordance with pre op planning. The insertion guide is removed and wound is closed over a suction drain. Sterile non bulky dressing applied.

Postoperative evaluation: Postoperative rehabilitation plays a major role in recovery of range of movement and improving the quadriceps mechanism and functions of joint. If fracture fixation is stable, early rehabilitation can be started.Increased and useful range of motion can be achieved, in the first few weeks of postoperative period.

Early Phase (1-3 Weeks):The primary goal is full range of motion, started on 2nd day, if fixation is stable. Static & dynamic Quadriceps strengthening and hamstring stretching exercises are encouraged. Hip and ankle mobilization exercises are continued.

Late Phase (After 3 weeks): Continue isometric quadriceps setting exercises, Active and passive Range motion exercises. Partial weight bearing is allowed after 3rd week. Full weight bearing is allowed after radiological evidence of healing.

Follow Up: All the patients were advised to review for regular follow up in regular interval. Initial 6 weeks they were advised to review every 2 weeks then every month for first 3 months and every 3 months for two years. In each visit their functional outcome analysed and also good quality digital x-ray of the knee with lower thigh taken to assess the union of fractures and see the signs of fracture union. Functional outcome of all patients analysed using AKSS American Knee Society Score. It has six variables positive points for three variables Pain, Range of movements, Stability (both antero-posterior &medio-lateral stability) subtraction points for three variables Flexion contracture, Extensor lag and varusvalgus alignment. All patients functional outcome analysed in each visit & the final 1 year follow up results were included for comparison.

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STATISTICAL ANALYSIS

All the demographic details, base line data and postoperative data were recorded in the case report form over the course of the study. The Categorical data was presented as numbers(percent) and were compared among groups using Chi square test. The quantitative data was presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if less than 0.05. The statistical analysis was done using SPSS (Statistical Package for Social Sciences) Version 22.0 statistical Analysis Software.

RESULTS

In this study, the minimum age of presentation was 22 years and maximum age was 84 years andmean age is 49.87±12.09.82% of all the patients affected were males while 12% of the patients affected were females.The right limb was affected more commonly than the left limb, with a ratio of 1.4:1. Although, there was a 1:1 ratio amongst the females with respect to the side involved. In the category of mode of injury, 49 were due to a Road Traffic Accident (RTA), 12 were due to a fall (domestic fall / fall from height) while 3 cases were due to assault.After clinical and radiographical examination, they were classified into Müllerian type A, B and C, and further, into A1, A2, A3, B1, B2, B3 and C1, C2, C3. Most patients presented within 7 days of injury (96%). The most common presentation was the A subtype, with 27 cases out of 70 (39%). This was followed by Type B (35%) and Type C (26%). However, the most common subtype was the B2 subtype, with an overall percentage of 12 cases (17%), followed by A1 (14%) and A3 (13%).

Table: Age Distribution

AGE	No. of cases	Percentage %
<30	3	4.5
31-40	11	15.5
41-50	17	24
51-60	15	21.5
61-70	13	18.5
71-80	10	14.5
>80	1	1.5%
Total	70	100
MEAN	49.87 years	
SD	12.09 years	

Distribution according to sex

Sex	No. of cases	Percentage
Male	58	82%
Female	12	18%
Total	07	100%

Table 1: AKSS score and outcome

AKSS Outcome(Score)	DFLCP	Retrograde Nailing
Excellent(>81)	8 (23%)	9 (25%)
Good(71-80)	21 (60%)	19 (55%)
Fair(61-70)	6 (17%)	7 (20%)
Poor (<60)	0 (0%)	0 (0%)

Table 2: Evaluation of AKSS score

	DFLCP	Retrograde Nailing	Total
Excellent and Good Outcome	29	28	57
Fair and Poor Outcome	6	7	13
Marginal Column total	35	35	70

The chi-square statistic is 0.0945. The p-value is 0.758. Not significant at p >0.05.

Table 3: Complications

	DFLCP	Retrograde Nailing	Total
Infection	01	00	01
Limb Shortening	00	02	02
StiffKnee	03	02	05
Knee Pain	04	06	10
Total	**8**	**10**	**18**

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The majority of patients were males, in their fourth decade of life and road traffic accidents were the most prevalent cause of injury. 30 patients had linked fractures, including 10 patients with associated distal radius fracture, 7 patients with ipsilateral clavicle fracture, 6 patients with pubic rami fracture, 4 patients with ipsilateraltibial shaft fracture, and 3 patients with contralateral femur fracture.

Of the 70 patients, 60 had closed wounds. When the mode of definitive management was by DFLCP, the patients typically attained between 100 to 110 degrees of knee flexion. Similarly, patients who underwent retrograde nailing, they attained a flexion between 100 and 110 degrees.

The quantity of intraoperative blood loss that was compared between the two groups revealed that the average blood loss among patients who underwent DFLCP was 136 ml, with a maximum blood loss of 150 mL on three instances and a minimum blood loss of around 90 ml in two cases. The retrograde intramedullary interlocking nailing patients experienced blood loss of about 84 mL, with a maximum of 50 ml in two patients and a minimum of 100 ml in three patients.

In the 35 cases with retrograde nailing, the average time was 40 minutes; the longest case took 70 minutes, while the shortest case was done in 31 minutes. The median operative time for 35 patients who underwent DFLCP was 61 minutes, ranging from 45 to 82 minutes.

Retrograde intramedullary nailing required 9.76 weeks for union, compared to12.88 weeks for DFLCP patients.

By 18 weeks, all of the patients had functionally stopped using their walking aids. Those patients who had limb shortening were advised using a heel or a sole rise.

While comparing the outcomes, 29 patients out of 35 had excellent and good outcomes, while 6 patients had a fair outcome for those operated for DFLCP. Those who underwent Retrograde nailing, 28 patients out of 35 had an excellent and good outcome, while 7 patients had a fair outcome (Table 2).

With respect to complications, a total of 18 patients had experienced complications, ranging from early knee pain to late complications like limb shortening. 8 DFLCP patients while 10 Retrograde nailing patients had experienced complications. Patients who underwent nailing experienced late problems, including two patients who experienced a 2 cm shortening, six patients who continued to experience knee pain, and two patients who experienced stiff knees. No patients experienced infection. Similar late problems, including infections in one individual, knee pain in four patients, and stiff knees in three patients, totaled eleven, amongst the patients that underwent DFLCP (Table 3).

DISCUSSION

Over the past several years, treating distal femoral fractures has been a vital challenge. Due to its close proximity to the knee joint, distal femur fractures frequently present difficulties for trauma surgeons. Principles governing the surgical management of femur supracondylar fractures have changed. Up until 1970, closed management was the preferred treatment for these fractures. This was brought on by a lack of acceptable procedures and a dearth of suitable implants. Knee stiffness, malunion, and nonunion can all complicate conservative procedures at any age. Injury occurs more frequently in the younger age group as a result of high-speed vehicle collisions. It is frequently the result of low energy accidents, mainly falls, in elderly people with osteoporotic bone. The fracture is typically comminuted in both scenarios. For a successful treatment, skill and careful technique are required. Supracondylar femoral fractures have been treated using a number of devices. In order to establish union, the locking plate uses the principles of open reduction, absolute stability, and inter-fragmentary compression. Indirect reduction of the metaphyseal fracture component is used in the retrograde nailing procedure, which provides relative stability and a less invasive method. The majority of the time, internal fixation of supracondylar femoral fractures with a distal femoral locking plate yields positive outcomes.

Early surgical stabilization can ease the management of the soft tissue, allow for early mobility, and simplify nursing care. The use of implants such as angled blade plates, fickle devices, Rush rods, Ender nails, Dynamic condylar screws, condylar buttress plates, interlocking nails, and locking compression plates has been recommended for open reduction and internal fixation. A locking plate reduces screw-plate toggle and motion at the bone-screw interface and offers a more rigid fixation. One factor in the successful management of these fractures is rigid fixation. Conventional plates have drawbacks such as screw withdrawal, implant failure, and unstable fixation requiring postoperative immobilization.

Fixation, early mobilization, and rehabilitation can produce great results for patients with extra articular distal femur fractures if the articular congruity is preserved and there is no involvement of articular cartilage injury. Retrograde intramedullary nailing is another alternative for treating extra articular distal femur fractures, even though locking compression plates have been the standard treatment for distal femur fractures. The fundamental benefit of intra medullary nailing is biological fixation because it is a load-sharing device and is applied using closed techniques without disturbing the fracture hematoma. In our study, the length of the procedure for both techniques was compared. The DFLCP approach took an average of 117.94 minutes, whereas the significant average time for retrograde nailing was 93.38 minutes. In our study, retrograde nailing operated patients experienced significantly reduced blood loss compared to LCP operated patients. Patients with

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retrograde nailing lost an average of 287 mL of blood, whereas those with LCP lost an average of 387 mL. The frequency of blood transfusions decreased when nailing was used.

There is a tendency for patients having retrograde distal femoral nailing to experience increased pain and need revision surgery to have the implants removed. In fractures repaired with a distal femoral nail, arthritis seems to have a propensity to develop. In supracondylar femoral fractures, the surgical technique's quality is the key determinant and the only assurance of good radiological and clinical outcomes. Plates or other minimally intrusive procedures appear to produce superior outcomes. In their prospective comparison of the condylar blade plate and retrograde intramedullary nail, Markmiller et al.[3] at 12 months, non-union, fixation failure, infection, and secondary surgical procedure did not show any statistically significant differences.

In a retrospective analysis of 115 fractures comparing retrograde nailing (n = 59) with mini-invasive locking plate (n = 56), Hierholzer et al.[4] validated these findings.

The plate can be used to treat all fractures, but retrograde nailing is more suited for extra-articular fractures, according to the authors' descriptions of the indications for each approach. They stress that choosing the right implant is less important than using a surgical approach that produces high-quality results.

In a randomized study of the management of extra-articular fractures by retrograde intramedullary nailing and blade plate, Hartin et al.[5] found no differences in functional recovery. The sole difference was that the group receiving retrograde nailing experienced more frequent knee pain, resulting in a 25% removal rate of the fixation material.

According to Thompson et al., statistical outcomes for retrograde intramedullary nailing are better in terms of the rate of surgical revision and the rate of malunion. The open internal fixation group had greater rates of infection and nonunion. In extra-articularfractures, Zlowodzki et al.[6] compared LCP, blade plates, and retrograde nailing. Strength under axial compression was improved by 34 and 13%, respectively, with the LCP system over the blade plate or nailing, although strength under torsion was decreased.[7,8,9,10,11] The authors found that the LCP technique provided improved distal fixation, with just one LCP plate (6% loss), three blade plates (38%) and eight losses with retrograde intramedullary nailing (100% loss) experiencing distal fixation loss.[12,13]

CONCLUSION

Distal femur fractures are more frequent in high-velocity traumas and happen to people with any age group. When compared to DFLCP, which is currently in use, retrograde nailing also shown a positive outcome in extra articular fractures.Retrograde nailing has advantages over DFLCP in terms of soft tissue damage control, early union, shorter operating times, and less blood loss. LCP plating and retrograde IM nailing may be suitable treatments for distal femur fractures.For both procedures, there were no discernible differences in the outcomes of the implants in terms of fracture healing or non-union. To prevent the need for revision surgery, both procedures require proper preoperative planning and sufficient surgical skill.Limitations of our study was a sample size of 70 patients.To accurately analyse the functional outcome, however, a sizable study sampl and extensive follow-up are required.We therefore draw the conclusion that DLFP and Retrograde intramedullary nail fixation are both successful methods for treating distal femur fractures based on the aforementioned findings. Retrograde nailing, however, resulted in a significantly quicker period for fracture union.

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