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A COMPARATIVE STUDY IN MANAGEMENT OF DISTAL FEMUR FRACTURES BY DISTAL FEMUR LOCKED COMPRESSION PLATE VERSUS RETROGRADE NAILING

Orthopaedics

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ABSTRACT

Background : Distal femoral fractures comprise approximately 3%–6% of all femoral fractures. The associated mechanism of injury can be of high or low energy. Surgery is the standard mode of treatment aiding for early weight bearing and mobilization is required in order to prevent long-term complications due to prolonged bed rest. Open reduction and internal fixation using extra-medullary implants have been the standard treatment for supracondylar fractures, irrespective of age group with high complication rates including delayed union; implant failure, and infection. Transmedullary nail offers a potential biomechanical advantage over side plates and screws because of intramedullary location; resulting in less stress over the implant and better stress distribution than with eccentric side plate and screws.6 While both techniques are considered standard , the merits and demerits of each technique may be different; leading to better results or alignment using one over the other. This study aims at comparing the two fixation methods. **Materials and methods:** A total of 70 patients who met the inclusion criteria were included in the study and were divided into 2 groups- Group A comprised those patients treated with Retrograde Nailing (n=35) while Group B patients were treated with Distal Femur Locking Compression Plate(n=35). All post-operative patients were evaluated at 2weeks, 4weeks, 3 months and 6months. **Results** and conclusion: It was found out that the mean Range of Motion (ROM) evaluated at 6 months was 119.85 (-+21.11) degrees for the RN group while it was 110.0(-+18.85) degrees in the DFLCP group and was statistically significant with p=0.044 , also the functional outcome assessed by AKSS was statistically significant (p=0.03) favoring the RN group over the DFLCP group. Similar significant outcomes were obtained in terms of duration of surgery and amount of blood loss favoring RN group . The radiological union time for RN group was 12 weeks compared to 13.21 weeks in case of DFLCP group , but was not statistically significant (p=0.100). Hence , distal femur fractures especially the extra articular type had good outcome when treated with RN compared to DFLCP , when intervened early and coupled with adequate post operative physiotherapy.

KEYWORDS

Distal femur fractures , Retrograde nailing , Distal Femur Locked Compression Plate , AKSS (American Knee Society Score).

INTRODUCTION

Distal femoral fractures are fractures within the distal 15 cms of the femur , which includes the metaphysis , epiphysis and the articular surface. They comprise approximately 3%–6% of all femoral fractures. Modernization has resulted in an increase in the number of road traffic accidents resulting in higher frequency and severity of fracture. The associated mechanism of injury can be of high or low energy; high-energy mechanisms such as motor vehicle accidents are more common in the younger population as compared with low-energy mechanisms such as fall from a stand in the elderly and osteoporotic patients.[2]

Surgery is the standard mode of treatment and hence enables for early weight bearing and mobilization so as to prevent complications due to prolonged bed rest.1Open reduction and internal fixation using extra-medullary implants have been the standard treatment for supracondylar fractures, irrespective of age group with high complication rates including delayed union; implant failure, and infection. Iatrogenic soft tissue trauma and devascularization of the periosteum needed to place the traditional extra-medullary fixation might play a major role in the development of infection and delayed union. Supplemental bone grafting is therefore frequently needed.[5]

Trans medullary nail offers a potential biomechanical advantage over side plates and screws because the intramedullary location results in less stress over the implant and better stress distribution than with eccentric side plate and screws. They also have the potential for load shearing.6 Their use involves minimal soft tissue injury; short operative time; limited perioperative blood loss and the ability to mobilize patients early 4. However the antegrade nail which was used earlier to fix these distal femoral fractures were associated with angular deformities due to inadequate distal interlocking leading to less control over the small distal fracture fragments. Therefore in order to extend the merits of intramedullary nailing in distal femoral fractures , supracondylar Nail was designed by Green , Seligson and Henry in 1988.

While both techniques are considered standard; very few clinical studies have directly compared locked plates to nails. The advantages and disadvantages of each technique may be different; leading to better results or alignment using one versus the other. This study aims to elucidate the respective advantages and disadvantages of each technique in a randomized clinical trial. Radiologic and functional outcomes will be collected and compared. This will help orthopedic surgeons to decide the ultimate treatment for patients with this injury.

MATERIALS AND METHODS

This was a prospective randomized comparative study carried out using either Retrograde femur nail or DFLCP for internal fixation of Distal femur fracture among 70 patients admitted to S.M.S Hospital, Jaipur. A total of 70 patients who met the inclusion criteria were included in the study and were divided into 2 groups- Group A comprised those patients treated with Retrograde nail (n=35) while Group B patients were treated with DFLCP (n=35). All post-operative patients were evaluated at 2weeks, 4weeks, 3 months and 6months. Sutures were removed on day-14, and subsequent follow-up patients were evaluated clinically and radiologically.

Patients with Compound fracture of distal femur of AO type B3 and C2.3 and C3 with extensive articular comminution, age less than 18years , those with pathological fractures and osteoarthritis were excluded , while those with AO type A , B 1, B 2 , C1.1 , C2.1 , those consenting for surgery and regular follow-up were included for surgery.

RESULTS

This study included patients of age over 18 years with mean age being 37.28 years for RN group and 37.88 years for DFLCP group respectively. Overall Males were predominant accounting for 72.85%(51) and females 27.15%(19). Right-sided fractures(43) were more than Left-sided(27). Most common mode of injury was road traffic accident in 52 cases(74.29%) followed by slip and fall in 15 cases(21.43%) and rest accounting due to Assault in 3 cases(4.28%).

Table 1: Demographic details at the time of admission

Parameter		Group A (RN) N=35	Group B (DFLCP) N=35
Age		37.28yrs	37.88yrs
Sex	Males	27	24
	Females	8	11
Side	Left	14	13
	Right	21	22
MOI	RTA	25	27
	Assault	1	2
	Slip &Fall	9	6

Size of incision was observed to be much larger in DFLCP group than in RN group. No significant difference was observed in terms of time taken for radiological union between two groups (p=0.100) though the ones treated with RN had a mean union time of 12.02 weeks compared to 13.21 weeks in DFLCP group.

The mean Range of Motion (ROM) assessed at 6 months was 119.85+-21.11 degrees in RN group and 110.05+-18.85 degrees in DFLCP group with a p-value of 0.044 (statistically significant). Two patient in group A (RN) developed complications like infection and Late union whereas ; Three patients in group B (DFLCP) had this complication and were subsequently managed with antibiotics & wound debridement and later showed signs of union .

In our study, the final functional outcome was compared by AKSS . 27 (77.15%) cases in group A and 25(71.43%) cases in group B had excellent results. The overall mean AKSS score for Group RN was 86.342+-10.35 while that of Group DFLCP was 81.171+-9.15 and was statistically significant with p=0.030. Thus, cases managed by Retrograde Nailing had better functional outcomes as compared to those fixed by DFLCP. Two patients in RN group had knee pain along medial aspect of knee due to locking screw protrusion and was managed subsequently with screw removal once fracture healed completely (10weeks) , similarly three patients had anterior knee pain in group B managed conservatively with physiotherapy and injection of local analgesics which improved subsequently after 3 months.

Table 2: Functional and Radiological outcomes in two groups

Parameters		Group A (RN) (N=35)		Group B(DFLCP) (N=35)		Significance(p)
American Knee Society Score (AKSS)		Number	Percentage	Number	Percentage	
	Excellent	27	77.15%	25	71.43%	
	Good	4	11.43%	5	14.29%	
	Fair Poor	2 2	5.71% 5.71%	3 2	8.57% 5.71%	p = 0.030
Total	35	100%	35	100%		
Time to radiological union(weeks)		12.028+-2.930		13.214+-3.034		p=0.100
Duration of surgery (minutes)		93.57±10.07		98.65±10.45		p=0.0420
ROM@ 6month (degrees)						
	Knee flexion	119.85-+21.11	110.05-+18.85	p=0.044		
Complications	nil	33	32			
	Infection	1	2			
	Late union	1	1			

STATISTICALANALYSIS

Statistical analysis was performed with the SPSS, version-21 for Windows statistical software package (SPSS inc., Chicago, IL, USA). The Categorical data were presented as numbers (percent) and were compared among groups using Chi-square test. The quantitative data were presented as mean and standard deviation and were compared by student's t-test. Probability was considered to be significant if <0.05.

CASE ILLUSTRATIONS

CASE 1: Representative case from the current study of a 36-year-old male patient Mr.Kishore with AO type A3.2 distal femur fracture acquired following a RTA: (a) x-ray showing distal femur fracture (b)post operative X-ray (c) lateral surgical approach (d-e) 6 month post operative range of motion showing knee flexion and extension.

DISCUSSION

A lot of studies have been conducted for the management of distal femur fractures but few compare the two fixation methods mainly due to a lack of uniformity of fractures or criteria to assess the results. This study aims at comparing two different internal fixation methods in distal femur fracture i.e. RN versus DFLCP.

Distal femoral fractures are often complex, intra-articular, and comminuted, irrespective of etiology, and thus make achieving and maintaining an adequate reduction challenging. Due to the location of these fractures in close proximity to neurovascular structures , there may be associated neural or vascular compromise necessitating urgent intervention. Joint function may get affected as these fractures are located close to the articular surface and thereby requires adequate physiotherapy for better functional outcome. Special care must be taken to avoid disrupting the soft tissue envelope to reduce the risk of nonunion.[3]

Though distal femur fractures are managed recently by Locking Compression Plates , in some fractures especially the extra articular ones Retrograde Nailing can be a good option. As intramedullary nailing is a load sharing device and by applying via closed means without disturbing fracture hematoma , biological fixation is a main advantage.

Operative time : The significant mean time taken for RN was 93.57 mins as compared to 98 mins for DFLCP (p=0.042) ,similar outcome was seen in Markmiller et al[11] with mean time of 142 min in RN compared to 155 min in DFLCP. This relatively long operative time in DFLCP was attributable to open reduction rather than closed reduction used in RN.

Intra-operative blood loss : patients operated with RN had relatively less blood loss of an average of 252.62 ml compared to 313.57 ml in DFLCP group, also the need for blood transfusions were reduced significantly in nailing groups , this observation was opposite to the one studied by Gao et al[10] , in which the mean blood loss was 298 cc for RN as compared to 200cc in DFLCP which was attributable to the LISS technique employed in his study. But all other studies had comparable results to the one obtained in this study ,with increase blood loss attributing to the open reduction technique.

ROM: nailing group had better range of flexion of average of 119.8 degrees while those with LCP had about 110 degrees which turned out to be significant outcome(P=0.044) . Gao et al[10] ; there was no significant difference seen regarding two groups (p=0.346) , but still better ROM was obtained in nailing group. This can probably be attributed to opening up of capsule in DFLCP as part of open reduction technique.

AKSS : scores assessed at 6 months showed significantly better results in nailing group as compared to plated ones (p=0.03) . Excellent to good results were seen in roughly 89% in RN group as compared to 84 % in plating, although 2 (5.71%) showed fair and 2(5.71%) had poor results in RN Group , while the other had 3 (8.57%) fair and 2 (5.71%)

poor results. Gao et al[10] : showed no statistically significant difference in HSS score (p=0.406). Markmiller et al[11] : used Lysholm-Gillquist score to assess the lower extremity function but wasn't significant. Significant result in our study was attributable for early intervention , methodical approach to the case and regular follow-ups with early physiotherapy coupled with keen assessment with AKSS system. **Union time**: Infact the nailing group had earlier union with duration averaging to 12 weeks compared to the plated ones at 13.2 weeks , but the differences were not that significant enough statistically p=0.100. Henderson et al[9] : significantly less periosteal callus was formed in fractures stabilized with LCP than with plates. Gao et al[10] and Hierholzer et al[8] had no significant difference between the two groups. Earlier union time in our study for RN group was due to open reduction in LCP group with periosteal stripping at fracture site , also in the study conducted by Henderson et al[9] , most of LCP group operated by open technique had had longer union time than those with RN. In other studies , the plate group operated with LISS technique had comparable results with those of nailing group.

Post-operative Complications: just as seen in most other studies including ours there was no significant difference in complication rate between two methods.

CONCLUSION

In this study, we can conclude that distal femur fractures when intervened early especially the extra articular ones with retrograde nailing had good outcomes in comparison with DFLCP with less soft tissue damage , early union , reduced operative time and reduced blood loss during surgery. Although both RN and DFLCP both are adequate treatment options for managing these fractures RN was technically more advantageous than DFLCP. However to generalize the results a large study sample and long term follow-up is needed.

CASE 2: Representative case from the current study of a 23-year-old female patient Ms.Shilpa with AO type A 3.2 , acquired following an RTA: (a-b) AP / Lateral radiographs showing obvious fracture line; (c-d) post-op X-ray showing RN after 3 month follow-up; (e-f) figure depicting knee flexion and extension of the patient at 3 month follow-up.

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