

RETROGRADE INTRAMEDULLARY SUPRACONDYLAR NAILING AND DISTAL FEMORAL LOCKING COMPRESSION PLATE IN THE MANAGEMENT OF DISTAL FEMUR FRACTURES – A COMPARATIVE STUDY

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ABSTRACT

Objectives: The objective of the study is to assess the efficacy of retrograde intramedullary interlocking supracondylar nailing and distal femoral locking compression plate in the management of distal femur fractures.

Methods: The present prospective study consists of a total of 36 cases with extra-articular supracondylar fractures of the femur between the age group of 21–70 years. Participants were randomly allocated to group 1 treated with distal femoral locking compression plate fixation and group 2 treated with retrograde intramedullary interlocking supracondylar nailing technique. Post-operatively, all the cases were followed up in regular intervals to assess the functional outcome using the American Knee Society score.

Results: Road traffic accidents (80.56%) were the most common cause of injury. The average surgical duration (108 min and 90.14 min), duration of fracture union (12.48 weeks and 11.08 weeks), and blood loss (339.8 ml and 236.6 ml) was better in the nailing group than the plating group, respectively. The overall outcome was comparable between the two study groups.

Conclusion: The supracondylar nailing technique has better functional outcomes in terms of less fracture union time, less operative duration, and minimal operative blood loss. Supracondylar nailing technique was effective and better in soft tissue damage control.

Keywords: American Knee Society score distal femoral locking compression plate, Retrograde intramedullary supracondylar nailing, Functional outcome.

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INTRODUCTION

Distal femur fractures are complex injuries accounts of 6–7% of all femoral fractures and are more common in elderly people due to osteoporosis and less in the younger age group, which occurs usually due to high energy trauma [1-3]. The management of distal femur fractures is difficult due to the involvement of neurovascular structure, extensive soft tissue injury, and fracture extension into the nearby joints [4].

The ideal management method for distal femur fractures remains debatable [5]. Minimally invasive approaches and the concept of biological osteosynthesis have reported minimal complication rates. The biological approach like retrograde intramedullary interlocking supracondylar nailing technique has good control of the distal fragment. The distal femoral locking compression plate is an alternate method that has the advantage of soft tissue protection using a restricted approach [6]. Several studies reported that internal fixation devices provide better stability, early mobilization, less surgical duration, and minimal operative blood loss. In this regard, the present study was designed to assess the efficacy of retrograde intramedullary interlocking supracondylar nailing and distal femoral locking compression plate in the management of distal femur fractures.

METHODS

The present prospective study was conducted in the Department of Orthopaedics, SVS Medical College, Mahabubnagar and MNR Medical College and Hospital, Sangareddy from August 2020 to August 2021. A total of 36 cases with extra-articular supracondylar fractures of femur between the age group 21–70 years were considered. Informed consent

was obtained from all the study participants and a study protocol was approved by the institutional ethics committee (No. IEC: MNRMC/EC/1542).

Inclusion criteria

Cases of both genders with simple supracondylar femur fractures fit for surgery and grade I, grade II and grade IIIA compound fractures, with Muller classification A1, A2, and A3 fractures and willingness to participate were included in the study.

Exclusion criteria

Supracondylar femur fractures of grade IIIB and grade IIIC, type B and C Muller classification, and cases with osteoarthritis were excluded.

All the study participants underwent detailed clinical and radiological examination and the fractures were classified according to Muller classification. All the study cases were randomly allotted to two study groups. Group 1 subjects were treated with distal femoral locking compression plate fixation and group 2 were subjects treated with retrograde intramedullary interlocking supracondylar nailing technique. Pre-operatively, all the study cases underwent complete hemogram and cases were administered with test doses of antibiotics and xylocaine. In the supracondylar nailing technique, the patient was placed in a supine position with draped free leg and 45°–55° flexed knee. An infrapatellar incision of 4–5 cm was made either medial margin or directly over the patellar tendon. A lateral approach was used for the locking compression plate technique.

Post-operatively, all the cases were followed up in regular intervals to assess the functional outcome using the American Knee Society score

(KSS) [7]. Initially, all the cases were evaluated every 2 weeks till the initial 6 weeks, later every month for the initial 3 months then for every 3 months till 2 years.

Statistical analysis

The unpaired student “t”-test was used to compare the two study groups. The statistical analysis was performed using Statistical Package for the Social Sciences V16.0.

RESULTS

Among the 36 study participants, majority of cases were in between the 4th and 6th decade (88.89%) with more male participants (86.11%). Road traffic accidents (80.56%) were the most common cause of injury followed by falling injuries (13.88%) and injury by assaults (5.56%). Fractures on the right leg (55.55%) were more common than the left side (44.45%) (Table 1).

A-I type (50%) of Muller subtype fractures were more common followed by type A-II (36.11%) and type A-III (13.88%). The majority of cases had closed-type fractures (80.56%) than open fractures (19.44%). The average duration for the reunion of fracture in group 1 was 12.48 weeks and in group 2 was 11.08 weeks. The average duration of surgery in group 1 was 108 minutes while in group 2 it was 90.14 min.

Table 1: Demographic and clinical characteristics of study participants

Demographic data	Total no of cases (n=36)	
	Frequency	Percentage
Age (In years)		
21-30	1	2.78
31-40	9	25
41-50	12	33.33
51-60	11	30.56
61-70	3	8.33
Gender		
Male	31	86.11
Female	5	13.8
Mode of injury		
Falling from height	5	13.88
Road traffic accidents	29	80.56
Physical assaults	2	5.56
Side of injury		
Right	20	55.55
Left	16	44.45
Muller subtype fracture		
Type A-I	18	50
Type A-II	13	36.11
Type A-III	5	13.88
Nature of fractures		
Closed	29	80.56
Open	7	19.44

Table 2: Operative findings

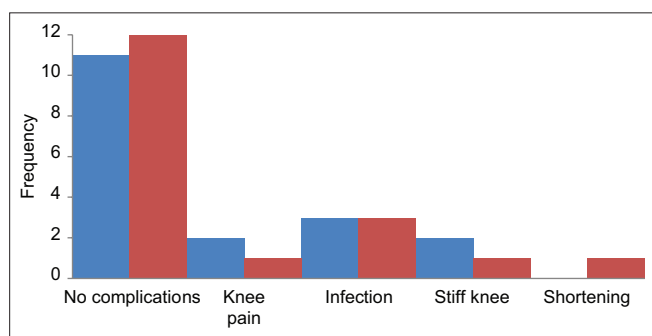
Operative findings	Duration
Duration of the surgery (In minutes)	
Group 1	108
Group 2	90.14
Intraoperative blood loss (In ml)	
Group 1	339.8
Group 2	236.6
Duration for fracture reunion (In weeks)	
Group 1	12.48
Group 2	11.08
American Knee Society score	
Group 1	66.98
Group 2	71.15

The intraoperative blood loss was more in group 1 (339.8 ml) than group 2 (236.6 ml) (Table 2).

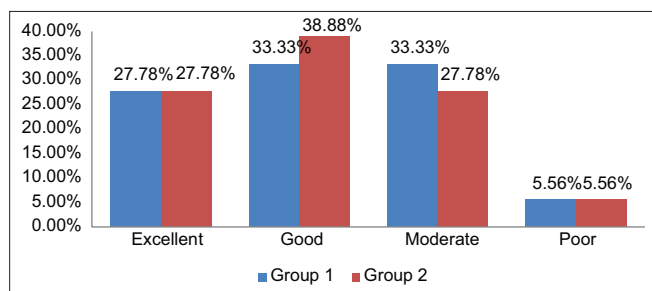
The majority of cases were not developed any postoperative complications in both the study groups. Infection was a common postoperative complication followed by knee pain and stiff knee. One case treated with supracondylar nailing technique showed shortening of the knee (Graph 1). The overall outcome was comparable between the two study groups. However, cases treated with supracondylar nailing technique had reported comparatively better outcomes (Graph 2). The p-value for duration of the surgery, intraoperative blood loss and duration for fracture reunion was statistically significant (p<0.05) Whereas, the p-value for American knee society score was not statistically significant (p>0.05) (Table 3).

DISCUSSION

Among the 36 study participants, the majority of cases were in between the 4th and 6th decade (88.89%) with male dominance (86.11%). The most common cause of injury was road traffic accidents (80.56%), followed by falling injuries (13.88%) and injury by assaults (5.56%). Fractures on the right side (55.55%) were more common than the left side (44.45%) (Table 1). Several studies reported common cause of fractures was road traffic accidents (55%) [1]. According to Muller subtype fractures, A-I type (50%) of were more common than type A-II (36.11%) and type A-III (13.88%). The majority of cases had closed type fractures (80.56%) than open fractures (19.44%). The average duration for the reunion of fracture, duration surgery, and intraoperative blood loss was better in nailing group than plating group (Table 2). Mallik *et al.*, reported mean surgical duration (68 min and 81 min), duration of fracture union (15.2 weeks and 18 weeks) and blood loss (65 ml and 141 ml) was better in the nailing group than the plating group, respectively [1]. A study by Demirtas *et al.*, noticed mean duration for the fracture union was better in nail group (22.3 weeks) than plate group (25.7 weeks) [8]. Gill *et al.*, noticed mean duration of fracture union was 26.5 weeks in plate group and 22.6 weeks in nail group, while more cases showed delayed union in the plating group (five cases) than nail group (one case). The mean operative time was 88.4 min in plating group and 102.3 min in nail group. The intraoperative blood loss was 228.2 ml in plate group and 323 ml in nail group [9]. Gao *et al.*, observed significantly higher intraoperative blood loss and operating time in nail



Graph 1: Details of post-operative complications (Group 1 [n=18], Group 2 [n=18])



Graph 2: Overall surgical outcome

Table 3: Significance of intraoperative findings

Operative findings	“t”-test for equality means			Levene’s test for equality variances	
	t-value	df	Significance	F	Significance
Duration of the surgery					
Equal variance assumed	2.846	28	0.025	0.287	0.524
Not assumed	2.844	20.44	0.022		
Intraoperative blood loss					
Equal variance assumed	2.533	28	0.018	0.564	0.344
Not assumed	2.533	21.36	0.022		
Duration for fracture reunion					
Equal variance assumed	17.52	28	0.002	0.249	0.216
Not assumed	17.55	25.36	0.002		
American knee Society score					
Equal variance assumed	-0.552	28	0.234	1.635	0.352
Not assumed	-0.552	22.38	0.287		

group (298 ml and 87.4 min) than plate group (200 ml and 79.7 min) [10].

In this study, infection was the common postoperative complication followed by knee pain and stiff knee. One case treated with the nailing method showed shortening of the knee. However, the majority of cases did not develop any major postoperative complications in both the study groups (Graph 1). Mallik *et al.*, reported knee stiffness and infection were common postoperative complications encountered [1]. Superficial infection and hematoma formation were observed more in the plating group than the nail group [9]. A study by Meccariello *et al.*, did not find any significant postoperative complications in plating and nailing groups [10].

The overall outcome was comparable between the two study groups. However, cases treated with the supracondylar nailing technique had reported comparatively better functional outcomes (Graph 2). A study by Demirtas *et al.*, used sanders criteria to assess functional outcomes and found 12 cases in the plate group and ten cases in the nail group had excellent and good functional outcomes [8]. The functional outcome was comparable between nail and plating groups which were assessed by KSS [9].

Several studies concluded that retrograde nailing in the management of distal femoral fractures had better outcomes in regard to mobilization, less time to fracture union, soft tissue injury, range of movement, operative time, operative blood loss, and functional outcome [1,8,11,12,13]. Memon *et al.*, stated that retrograde intramedullary nail fixation is a better choice for distal femur fracture management and furnish a secured intramedullary fixation with mild soft tissue injury [14]. Gill *et al.*, stated that the nailing method has higher operative time and blood loss which are difficult intraoperative events [9]. Gao *et al.*, stated that the overall union disturbance rate was higher in the plate group than the nail group [10]. The outcome of the present study showed no significant difference in terms of fracture healing. This study has a limitation of minimal sample size with a smaller duration of postoperative follow-up; due to this long trend complications after implant removal could not be assessed.

CONCLUSION

The study results concluded that supracondylar nailing technique has better functional outcomes in terms of less fracture union time, less operative duration, and minimal operative blood loss. The supracondylar nailing technique was effective and better in soft tissue damage control. However, both techniques are better treatment options for distal femur fracture with proper preoperative planning and surgeon's experience.

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