

FUNCTIONAL OUTCOME OF RETROGRADE INTRAMEDULLARY NAILING VERSUS LOCKED COMPRESSION PLATING IN THE TREATMENT OF SUPRACONDYLAR FRACTURE FEMUR

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Abstract

Background: The aim is to determine the functional outcome of Distal femoral locked compression plating versus retrograde intramedullary nailing in the treatment of supracondylar fracture femur. **Materials and Methods:** The study was planned to conducted among 120 patients with supracondylar femur fractures, but due to the covid 19 pandemic, sample size of 80 only could be obtained. Patients with supracondylar fractures who underwent retrograde intramedullary nailing and locked compression plating were followed up for 6 months and functional outcome was determined by knee society score. **Result:** 82.5% of patients treated with DFLCP had good functional outcome, 7.5% had good functional outcome, 2.5% had fair functional outcome and 7.5% had poor functional outcome. 82.5% of patients treated with MRFN had excellent functional outcome, 2.5% had good functional outcome, 2.5% had fair functional outcome and 12.5% had poor functional outcome. Radiological union was better at 3 months in the MRFN group than DFLCP group. At 6 months, there was no statistically significant difference in radiological union between the two groups. **Conclusion:** In our study, we can conclude that functional outcome of Retrograde intramedullary nailing is similar to locked compression plating in supracondylar fracture femur without intraarticular extensions. Time for union is significantly faster in cases which have undergone nailing. The mean KSS score at 6 months was higher in the retrograde nailing group and the mean functional score was better at 3 months in the retrograde nailing group when compared to the plating group. This shows that a person with supracondylar fracture femur who has undergone retrograde nailing can return to his normal daily activities earlier than a person who has been treated with locked compression plating.

INTRODUCTION

Incidence: Supracondylar femur fractures are commonly seen in both young age as well as old age due to high velocity trauma and trivial trauma respectively. Incidence has increased due to increased incidence of high velocity trauma and increased lifespan of the patients.^[1]

Sex Incidence: These fractures are more commonly seen in females than Males.

Treatment: Supracondylar femur fractures can be managed by conservative methods (traction or POP immobilisation) or surgical methods. Conservative methods were the treatment choice till the introduction of internal fixation devices. Complications of conservative management included

muscle wasting, bed sores, UTI, chest infections and venous thromboembolism.^[2]

So, conservative management is indicated only for elderly patients with high medical risk for anaesthesia and surgery.

Rigid internal fixation and early mobilisation is now recommended. Factors determining the quality of fixation include bone quality, fracture pattern. Reduction, choice of implant, open or closed reduction.^[3]

Nowadays we use distal femoral locked compression plates and retrograde intramedullary nail for the treatment of supracondylar femur fractures. Plates are load bearing devices and nails are load sharing devices.^[4]

The advantage of the retrograde nailing is that patient can be mobilised early, Range of motion exercises can be started early and reduction can be achieved in closed manner so that the fracture union will be faster than open reduction as done with plates and the blood loss will also be less when closed nailing.^[5] In view of these factors, we are conducting this study to compare the functional outcome of retrograde intramedullary nailing versus locked compression plating in the treatment of supracondylar fracture femur.

MATERIALS AND METHODS

Study design: Observational study

Duration of study: 18 months

Period of study: 18 months from the date of IRB approval

Study Setting: Department of Orthopaedics, Govt. Medical College, Kottayam

Sample Size: According to a study done by Gill et al,^[1] Extra Articular Supracondylar Femur Fractures Managed with Locked Distal Femoral Plate or Supracondylar Nailing, a total of 42 patients with supracondylar fracture femur were studied. 20 patients were treated by retrograde nailing and 22 were treated by plating.

Functional results in two groups.

Parameters	Group LP	Group RN	p-value
Union rate	90.9%	90%	1.00
Average time to union (weeks)	26.5± 12.9	22.6± 13.1	0.312
Range of motion	112.0± 9.8	107.0 ±9.9	0.106
Mean KSS score	74.4± 10.9	77.6± 8.6	0.288

$$N = 2 \times (Z_{\alpha} + Z_{\beta})^2 \times \left\{ \frac{(SD_1^2 + SD_2^2)}{2} \right\} / (x_1 - x_2)^2$$

$$N = (2 \times 7.84 \times 97) / 25$$

$$N = 60$$

So, sample size of group 1 is 60 and group 2 is 60

Total sample size is 120.

(Sample size calculated from the parent study by taking the range of motion into consideration)

Z = mean deviate

$$Z_{\alpha} = 1.96 \text{ (value of Z at 5\% } \alpha \text{ error)}$$

$$Z_{\beta} = 0.84 \text{ (value of Z at 20\% } \beta \text{ error)}$$

SD₁ = standard deviation of group 1 is 9.8

SD₂ = standard deviation of group 2 is 9.9

X₁ = mean of group 1 is 112

X₂ = mean of group 2 is 107

Study Procedure: After getting approval for the thesis from the Institutional Review Board, Comparative study is conducted on a group of 80 patients (sample size of 120 could not be achieved due to the covid-19 pandemic) with supracondylar femur fractures who were treated with distal femoral plating and intramedullary nailing at Department of Orthopaedics at Government Medical College Kottayam after getting permission from IRB. Patients with supracondylar femur fractures are evaluated at the time of presentation with AP and Lateral views of

affected femur with knee and the normal limb. All patients are given immediate limb elevation with an above knee POP slab in functional position or skeletal traction. A uniform standard operative procedure and a uniform standard postoperative management and follow up are followed for all patients included in the study.

Injectable antibiotics are administered for three to five days after surgery followed by oral, till suture removal. Patients were discharged on 5th-10th day after surgery. Active toe movements and limb elevation is started on first postoperative day. Post-operative x-ray taken on the third postoperative day. Patients are called for follow-up at 10 days, 3 months and then at 6 months. Full weight bearing is approved after ascertaining radiological union in both the groups.

At each follow up, AP and lateral views of fracture were obtained. Pain is assessed on Visual Analogue Scale (VAS). Clinical examination comprised checking for wound healing, knee stability, alignment, range of motion and any other complication. Osseous healing is assessed radiologically by the presence of at least three of the four cortices with bridging callus formation and crossing trabeculae in AP and lateral radiographs. Absence of pain and tenderness at fracture site is also an evidence of clinical healing of the fracture. Groups are compared in terms of time to union and functional results.

Functional results are determined using Knee Society Score (KSS)⁶ at 3 months and 6 months follow up that include knee ROM, pain, deformity, walking, stair climbing capacity and knee stability. Results are allocated as excellent, good, intermediate or poor.

Knee Society Score

Finding		Description	Knee score	Score
Pain			50 (maximum)	
Walking	None			35
	Mild or occasional			30
	Moderate			15
Stairs	Severe			0
	None			15
	Mild or occasional			10
Range of motion	Moderate			5
	Severe			0
	8 degree = 1point			25 (maximum)
Stability			25 (maximum)	
Medial/Lateral	0 – 5 mm			15
	5 – 10mm			10
	> 10mm			5
Anterior/Posterior	0 – 5			10
	5 – 10			5
	> 10			0
Deductions				
Extensor lag	None			0
	< 4 degrees			-2
	5 – 10 degrees			-5
	> 11 degrees			-10
Flexion contracture	< 5 degrees			0
	6 – 10 degrees			-3
	11 – 20 degrees			-5
	> 20 degrees			-10
Malalignment	5 – 10 degrees			0
	(5 degrees)			(- 2)
Pain at rest	Mild			-5
	Moderate			-10
	Severe			-15
Symptomatic plus objective			0	
Knee score			100 (maximum)	
Functional score				
Finding	Description		Score	
	Walking	Unlimited		50
> 10 blocks		40		
5 – 10 blocks		30		
< 5 blocks		10		
Stairs	Housebound		0	
	Normal up and down		50	
	Normal up and down with rail		40	
	Up and down with rail		30	
	Up with rail; unable down		15	
Functional deductions	Unable		0	
	Cane		- 5	
	Two canes		- 10	
Crutches or walker			- 20	
Functional score			100 (Maximum)	

Inclusion Criteria

All extra articular supracondylar femur fractures attending the orthopaedic casualty of Government medical college Kottayam during the study period.

Exclusion Criteria

1. Open fractures.
2. Fractures having intraarticular extensions.
3. Any other fracture in the same limb.
4. Previous history of any injuries around ipsilateral knee joint.
5. Previous history of any knee pathology.

Data Management and Statistical Analysis: All the data collected were coded and entered in Microsoft Excel sheet which was re-checked and analysed using SPSS statistical software version 22. Quantitative variables were summarised using mean and standard deviation (SD). Categorical variables were represented using frequency and percentage. Normality of distribution was checked using Shapiro-Wilk test. Pearson Chi-square test was used for comparing categorical variables between groups. Mann Whitney test was used to test statistical significance of difference between means of variables among two independent groups. A p value of <0.05 was considered statistically significant.



Figure 1: Patient Position for nailing



Figure 2: Midline Skin Incision



Figure 3: Guide pin Insertion

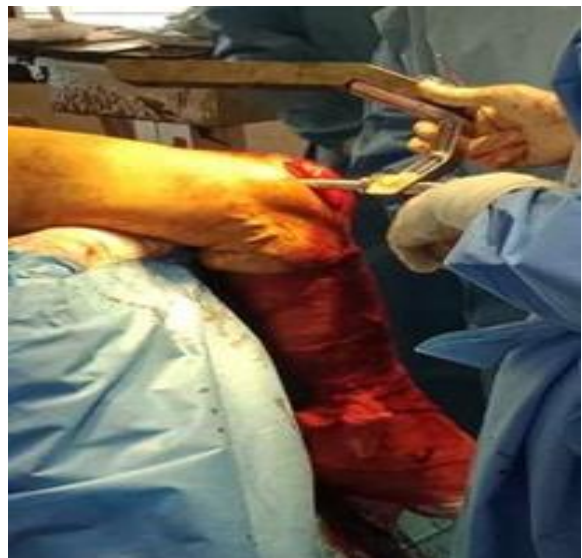


Figure 4: Guidewire Insertion and Reaming

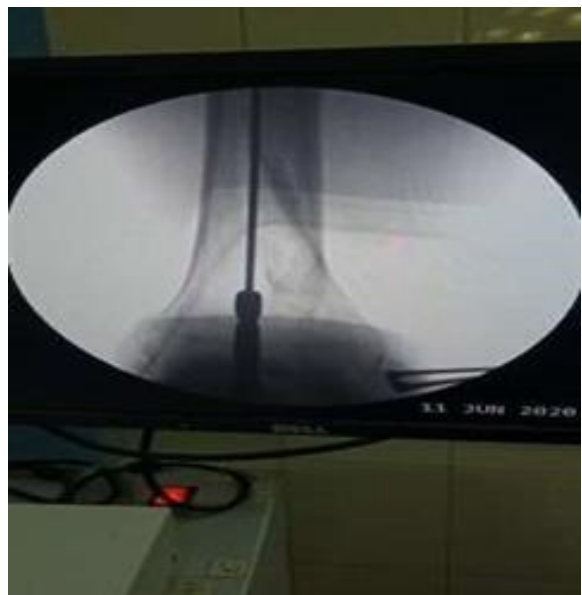


Figure 5: Nail Insertion



Figure 6: Locking of the Nail

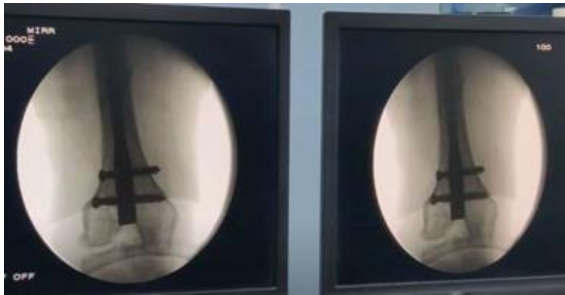


Figure 7: Locking Carm Picture



Figure 11: Fracture Reduction Carm Picture



Figure 8: Patient Position for plating

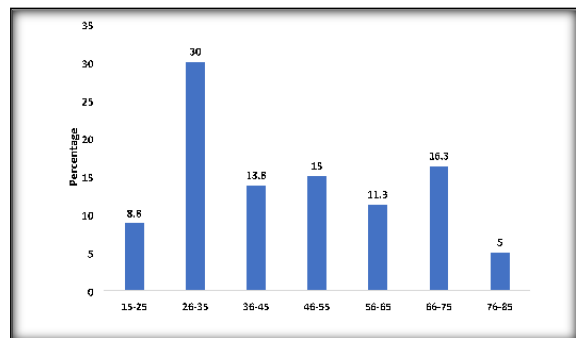


Figure 9: Fracture Exposed by Elevating Vastus Lateralis



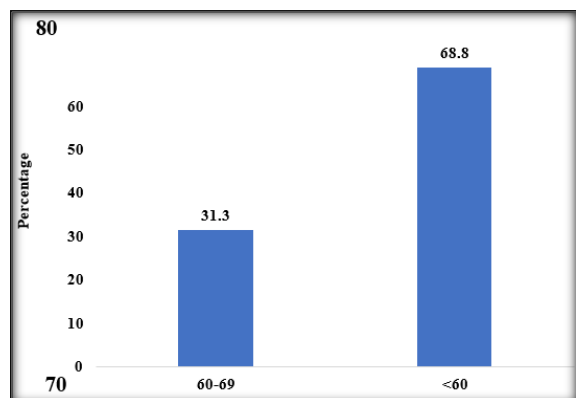
Figure 10: Locking

RESULTS



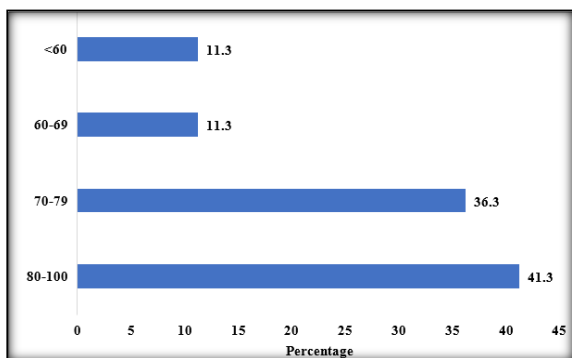
Graph 1: Age Distribution

30% of the patients fall in the age group 26-35 probably due to the high incidence of road traffic accidents in the age group.



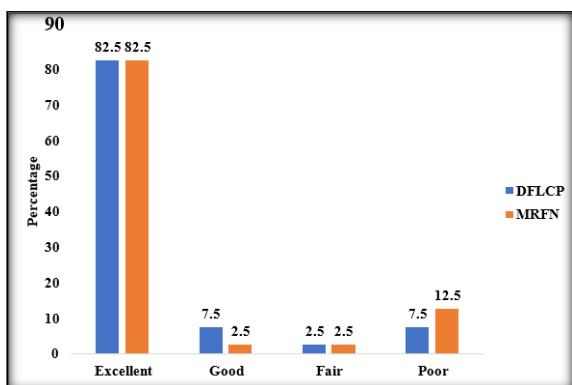
Graph 2: KSS at 3 Months

68.8% of the patients have KSS less than 60 at 3 months post op.



Graph 3: KSS at 6 Months

77.6% of the patients have KSS more than 70 at 6 months post op.



Graph: Functional Outcome between DFLCP and MRFN

There is no statistically significant difference in the functional outcome between DFLCP and MRFN. The functional score at 3 months post op is better for the MRFN group than the DFLCP group and the result is statistically significant. A 6 months post op, the results are not statistically significant.

MRFN – POST OPERATIVE FOLLOW UP



DFLCP – POST OPERATIVE FOLLOW UP



6-month post op showing union of the fracture

Table 1: Age Distribution.

Age GP	Count	Percentage
15-25	7	8.8
26-35	24	30
36-45	11	13.8
46-55	12	15
56-65	9	11.3
66-75	13	16.3
76-85	4	5

Table 2: Sex Distribution

Sex	Count	Percentage
Male	45	56.3
Female	35	43.8

Table: Fracture Type

Fracture Type	Count	Percentage
Simple	49	61.3
Comminuted	31	38.8

Table : KSS at 3 Months

KSS	Count	Percentage
60-69	25	31.3
Less Than 60	55	68.8

Table: KSS at 6 Months

KSS	Count	Percentage
80-100	33	41.3
70-79	29	36.3
60-69	9	11.3
Less Than 60	9	11.3

Table: Union at 3 Months

Union	Count	Percentage
Union In Progress	66	82.5
United	14	17.5

Table: Union at 6 Months

Union	Count	Percentage
Union In Progress	16	20
United	64	80

Table: Outcome

Outcome	Count	Percentage
Excellent	33	41.3
Good	29	36.3
Fair	9	11.3
Poor	9	11.3

Table: Functional Outcome

Functional Outcome	Count	Percentage
Excellent	66	82.5
Good	4	5
Fair	2	2.5
Poor	8	10

Table: Age Distribution between DFLCP and MRFN

Age	DFLCP		MRFN		P Value
	Count	%	Count	%	
15-25	1	2.5	6	15	0.270
26-35	11	27.5	13	32.5	
36-45	7	17.5	4	10	
46-55	8	20	4	10	
56-65	3	7.5	6	15	
66-75	8	20	5	12.5	
76-85	2	5	2	5	
Mean ± Sd	47.55±17.26		43.13±18.28		0.163

Gender Distribution between DFLCP and MRFN

Sex	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Male	23	57.5	22	55	0.822
Female	17	42.5	18	45	

Fracture Type Distribution between DFLCP and MRFN

Fracture Type	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Simple	22	55	27	67.5	0.251
Comminuted	18	45	13	32.5	

KSS at 3 Months for DFLCP and MRFN

KSS	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
60-69	11	27.5	14	35	0.469
Less Than 60	29	72.5	26	65	0.193
Mean ± SD	52.45±9.25		55.28±10.23		

KSS At 6 Months For DFLCP And MRFN

KSS	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
80-100	11	27.5	22	55	0.056
70-79	19	47.5	10	25	
60-69	6	15	3	7.5	

Less Than 60	4	10	5	12.5	0.035*
Mean ± SD	74.75±8.88		78.13±9.65		

Union at 3 Months for DFLCP AND MRFN

Union	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Union in progress	37	92.5	29	72.5	0.019
United	3	7.5	11	27.5	

Union at 6 Months for DFLCP and MRFN

Union	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Union In Progress	9	22.5	7	17.5	0.576
United	31	77.5	33	27.5	

Outcome between DFLCP and MRFN

Outcome	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Excellent	11	27.5	22	55	0.056
Good	19	47.5	10	25	
Fair	6	15	3	7.5	
Poor	4	10	5	12.5	

Table 20: Functional Outcome between DFLCP AND MRFN

Functional Outcome	DFLCP		MRFN		P Value
	Count	Percentage	Count	Percentage	
Excellent	33	82.5	33	82.5	0.682
Good	3	7.5	1	2.5	
Fair	1	2.5	1	2.5	
Poor	3	7.5	5	12.5	

Table: Functional Score At 3 Months and 6 months

Functional score at 3 months		Functional score at 6 months		P Value
Mean ± SD	65.13±13.61	83.50±27.29	90.88±16.40	
Functional score at 3 months		Functional score at 6 months		<0.001
Mean ± SD	90.88±16.40	89.38±20.69	90.88±16.40	0.930

Table: Study conducted by gill, mittal1 on the functional outcome of distal femur plating VS retrograde nailing. Knee Society Score (KSS) in two groups.

Parameters	Group LP	Group RN
Excellent (80-100)	8	9
Good (79-70)	9	7
Fair (69-60)	3	3
Poor (<60)	2	1

DISCUSSION

The age of patients in the present study ranged from 18 years to 83 years with mean age of 47.55 years in DFLCP group and 43.13 in the MRFN group. This shows that distal femur fractures occurred in the middle age group and most had road traffic accidents rather than slip and fall. This was seen similar to few studies by Chantara N, Assaris et al, Park J having nearly same range of age groups.^[6-8]

In our study, out of the total 80 patients, 49 had simple fracture pattern and 31 had comminuted fracture pattern. In DFLCP group, 22 patients had simple fracture and 18 had comminuted fracture. In MRFN group, 27 had simple fracture pattern and 13 had comminuted fracture pattern. The results were comparable to studies (Patel K, EL-kamy S) done.^[9,10]

In our study, the overall outcome and functional outcome of DFLCP and MRFN statistically do not

have any difference. The mean KSS score at 3 months for DFLCP and MRFN were 52.45 and 55.28 respectively. The functional score at 3 months for DFLCP and MRFN were 65.13 and 83.50 respectively.

The mean KSS at 6 months for DFLCP and MRFN were 74.75 and 78.13 respectively. The P value is 0.035 and the difference is statistically significant. The functional score for DFLCP and MRFN at 6 months were 90.88 and 89.38 respectively. These were comparable to the studies done by Saw A, Leung KS, and Pao JL were mean KSS were higher as compared to our study.^[11-13]

At 3 months post op, greater number of fractures united in the MRFN group than the DFLCP group (11 and 3 respectively). The P value is 0.019 and the difference is statistically significant. Which is similar to the study done by Steinberg EL.^[14]

At 6 months post op, there is no statistically significant difference in the union rate of fractures in

both the treatment groups which was contrasting to the results given by studies done by WN CC, papakostakis K.^[15,16]

Among the 40 patients who had undergone distal femoral plating, 27.5% had excellent outcome, 47.5% had good outcome, 15% had fair outcome and 10% had poor outcome. 82.5% had good functional outcome, 7.5% had good functional outcome, 2.5% had fair functional outcome and 7.5% had poor functional outcome.

The poor outcomes have been obtained in elderly patients. This was similar to study done by Beeres FJP and Wang T.^[17,18]

Among the 40 patients who had undergone MRFN nailing, 55% had excellent outcome. 25% had good outcome. 7.5% had fair outcome and 12.5% had poor outcome. 82.5% had excellent functional outcome, 2.5% had good functional outcome, 2.5% had fair functional outcome and 12.5% had poor functional outcome. The poor outcome had been obtained in elderly patients.

The mean functional score at 3 months post op was higher in MRFN group than DFLCP group. The P value is 0.001 and the result is statistically significant. At 6 months post op, there is no statistically significant difference in the functional score between the two treatment groups.

In this study too (our parent study), the functional outcome of the two groups was not statistically significant.

Radiological Union

Among the 40 patients who underwent DFLCP, 7.5% had fracture united at 3 months and in 92.5% fracture was uniting. In MRFN group, 27.5% showed fracture union at 3 months and in 72.5% patients fracture was still uniting. P value is 0.019. So, the rate of fracture union in the initial 3 months was statistically better in the MRFN group when compared to the DFLCP group.

These results coincides with the results of the study done by Ads T and Chandra VK.^[19,20]

At 6 months, in DFLCP group, 77.5% showed fracture union and 22.5% showed union in progress. In MRFN group, 82.5% showed fracture union and 17.5% showed union in progress. There is no statistical difference in radiological union among the two groups at 6 months in our study.

CONCLUSION

In our study, we can conclude that functional outcome of Retrograde intramedullary nailing is similar to locked compression plating in supracondylar fracture femur without intraarticular extensions. Time for union is significantly faster in cases which have undergone nailing. The mean KSS score at 6 months was higher in the retrograde nailing group and the mean functional score was better at 3 months in the retrograde nailing group when compared to the plating group.

This shows that a person with supracondylar fracture femur who has undergone retrograde nailing can return to his normal daily activities earlier than a person who was treated with locked compression plating.

Hence in our opinion, retrograde intramedullary nailing may be the better fixation device in most of the supracondylar femur fractures.

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