

Study of different operative modalities used for treatment of supracondylar fracture and its outcome

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Abstract

Background: Supracondylar fracture femur cases present a complex problem to all surgeons. Soft tissue injury, intra-articular extension and quadriceps mechanism injury cause great morbidity in this fracture. Treatment of these fractures has been a controversial subject over the past two decades. There has been a changing philosophy towards surgical treatment of supracondylar fractures of femur. **Objective:** To study the outcome and results of operative modalities of treatment for supracondylar fracture femur with locking compression plates, dynamic condylar screw with side plate and retrograde supracondylar nail. **Methods:** The present clinical study was carried out over a period of January 2010 to August 2011. 50 Patients between the age groups 21-70 years were operated for supracondylar fracture femur. 20 patients operated with Locking Compression Plate, 17 operated with Dynamic Condylar Screw with side plate, and remaining 13 were operated with Retrograde Supracondylar Nail. The results were evaluated using Schatzker and Lambert's Criteria and patients were categorised into excellent, good, fair and poor at the final follow up. **Results:** Average duration of surgery for Locking Plate, Dynamic Condylar Screw with side plate and Retrograde Supracondylar Nail was 125.9 minutes, 134.41 minutes and 113 minutes respectively. Average blood loss was 305ml, 282.35 ml and 142.3 ml respectively. According to Schatzker and Lambert Criteria, Locking Plate had 35% excellent results, 50% good results, 10% moderate results, whereas only 5% poor results. Dynamic Condylar Screw with side plate had 47.07% excellent results, 17.65% good results, 23.53% moderate results and 11.77% poor results. Retrograde Supracondylar Nail had 38.46% excellent results, 30.77% good results, 7.7% moderate results and 23.07% poor results. **Conclusion:** Supracondylar nailing was superior to locking plate and dynamic condylar screw with respect to Average blood loss and Average duration of surgery. However, as per Schatzker and Lambert Criteria the outcome was dependent on type of fracture.

Keywords: Locking Plate, Dynamic Condylar Screw with side plate, Retrograde Supracondylar Nail

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INTRODUCTION

Supracondylar fracture femur cases present a complex problem to all surgeons. Soft tissue injury, intra-articular extension and quadriceps mechanism injury cause great morbidity in this fracture. Several treatment options are

available for fractures of the distal femur which require internal fixation using various plates such as 95 degree angled blade plate, condylar buttress plate, dynamic condylar screw with 95 degree side plate, locking compression plate, LISS (less invasive stabilisation system) and intramedullary nails (ante/ retrograde).¹ Conservative management may result in serious complications such as knee stiffness (reduced range of movement), inadequate alignment, delayed union or non-union, prolonged hospitalisation, and related morbidity² Thus, there has been a changing philosophy towards surgical treatment of supracondylar fractures of femur.³ Operative treatment involves using different implants with variable reported results. Fixation of the distal femur fractures with a lateral condylar blade plate or its modifications are popular because it allows fixation of intra-articular fracture and early mobilisation of the knee

joint. In cases with severe metaphyseal comminution, supracondylar nailing offers a more biological method of fixation with less devitalisation of soft tissue. Considering the widely accepted principles of anatomical articular reduction, minimal soft tissue dissection, stable reduction and early mobilisation, the locking plate also delivers a good outcome but at a significantly higher monetary cost than more traditional fixation devices. The present study was done to evaluate the outcome and results of operative modalities of treatment for Supracondylar fracture femur with locking compression plates, dynamic condylar screw with side plate and retrograde Supracondylar nail.

METHODS

The present clinical study was carried out over a period of January 2010 to August 2011. 50 Patients between the age groups 21-70 years were operated for Supracondylar fracture femur. 20 patients operated with Locking Compression Plate, 17 operated with Dynamic Condylar Screw with side plate, and remaining 13 were operated with Retrograde Supracondylar Nail. The results were evaluated using Schatzker and Lambert’s Criteria and patients were categorised into excellent, good, fair and poor at the final follow up. Every patient was evaluated after history, clinical examination and radiological investigation and fracture pattern was classified according to AO classification. All fractures were classified according to the comprehensive classification of supracondylar fractures of femur given by AO / OTA. [4] All patients operated according to standard AO-technique.

Inclusion Criteria: The fractures of the distal femoral metaphyseal, metaphyseal diaphyseal with or without intraarticular extension, Closed fractures and Fractures with Open Grade I and II wounds.

Exclusion Criteria: Fracture due to malignancy, Non-ambulatory previous fracture, Severe dementia, Medical contra-indication to surgery, AO type B fracture pattern, Open grade III fractures.

Follow – up Regime: All patients were followed up at 1.5, 3 and 6 months for assessment of fracture union and to note any complications. At time of follow up a thorough clinical evaluation was done for any complaints, limb length discrepancy and deformity. Implant status and signs of union were also assessed on X-rays. Accordingly weight bearing was allowed. At final follow up all the cases were evaluated clinically and radiographically and the results were rated on the basis of ‘Schatzker and Lambert criteria’ as – excellent, good, fair and failure results.⁵

Data Analysis: Data entry was done in Microsoft Excel 2007 and statistical analysis was done using percentage, proportions, Chi-square test and Unpaired t-test for difference between two means.

RESULTS

Table 1: Distribution of Cases according to Intra-Operative Average Blood Loss

Blood loss in ml	Locking plate	Dynamic compression screw with plate	Supracondylar nail
<300 ml	8 (40%)	10 (58.82%)	13 (100%)
>300ml	12 (60%)	7 (41.18%)	0
Average blood loss	305 ml	282.35 ml	142.30 ml
Total cases	20 (100%)	17 (100%)	13 (100%)

The average blood loss was least (142.30 ml) with Supracondylar nail and when compared with Locking compression plate and Dynamic compression screw with plate, it was found to be statistically significant (p<0.05).

Table 2: Distribution of Cases according to Duration of Surgery

Duration of surgery (minutes)	Locking plate	Dynamic compression screw with plate	Supracondylar nail	Total
<120	11 (55%)	6 (35.29%)	12 (92.30%)	29
120-150	7 (35%)	10 (58.82%)	1 (7.70%)	18
>150	2 (10%)	1 (5.89%)	0	3
Average duration	125.9	134.41	113	--
Total	20 (100%)	17 (100%)	13 (100%)	50

For Chi-square analysis plating (Locking compression plate and Dynamic compression screw with plate) was compared with Supracondylar nail. The difference in proportion observed between the groups in regard to operative modality of treatment (plating and nailing) and duration of surgery was found to be statistically significant with p<0.05. The mean duration of surgery was compared for Locking compression plate and Supracondylar nail and it was found to be statistically significant with Supracondylar nail requiring less mean duration for surgery (113min) compared to locking compression plate (126min) (p<0.05). The mean duration of surgery was also compared for Dynamic compression screw (DCS) with plate and Supracondylar nail and it was also found to be statistically significant with Supracondylar nail requiring less mean duration for surgery (113min) as compared to Dynamic compression screw with plate (134.41min). (p<0.05).

Table 3: Implant Used in Various Fracture Patterns and Results

Type of fracture	Implant	Number of patients	Results			
			Excellent	Good	Fair	Poor
A1	Locking plate	2	1	1	-	-
	DCS with plate	2	2	-	-	-
	Supracondylar nail	3	2	1	-	-
A2	Locking plate	3	3	-	-	-
	DCS with plate	5	4	1	-	-
	Supracondylar nail	2	2	-	-	-
A3	Locking plate	4	2	2	-	-
	DCS with plate	5	2	1	1	1
	Supracondylar nail	3	1	2	-	-
C1	Locking plate	2	1	1	-	-
	DCS with plate	2	0	1	1	-
	Supracondylar nail	5	0	1	1	3
C2	Locking plate	5	0	4	1	-
	DCS with plate	3	-	-	2	1
	Supracondylar nail	-	-	-	-	-
C3	Locking plate	4	-	2	1	1
	DCS with plate	0	-	-	-	-
	Supracondylar nail	0	-	-	-	-
Total		50	20	17	7	6

Type A fracture pattern: In this study, all 9 patients having AO type A fracture pattern operated with locking plates had excellent to good results. Whereas, 10 out of 12 patients operated with DCS with plate had excellent to good results. On the other hand, all 8 patients operated with Supracondylar nail had excellent to good results. **Type C1 fracture pattern:** Both the patients operated with locking plate for above fracture pattern had excellent to good results. Whereas out of 2 patients operated with DCS with plate 1 had good result and 1 had fair result. On the other hand, out of 5 patients operated with Supracondylar nail, 1 had good result, 1 had fair result and 3 had poor results. **Type C2 fracture pattern:** Out of 5 patients operated with locking plates, 4 had good results and 1 had fair result. Out of 3 patients operated with DCS with plate, 2 had fair results and 1 had poor result. **Type C3 fracture pattern:** Out of 4 patients operated with locking plates, 2 had good results, 1 had fair result and 1 had poor result. This fracture pattern is unsuitable for DCS and Supracondylar nail. So, DCS and Supracondylar nail are not included in AO type C3.

Table 4: Distribution of Patients according to Schatzker and Lambert Criteria

Schatzker and Lambert Criteria	Locking plate	Dynamic compression screw with plate	Supracondylar nail	Total
Excellent	7 (35%)	8 (47.05%)	5 (38.46%)	20
Good	10 (50%)	3 (17.65%)	4 (30.77%)	17
Moderate	2 (10%)	4 (23.53%)	1 (7.7%)	7
Poor	1 (5%)	2 (11.77%)	3 (23.07%)	6
Total	20 (100%)	17 (100%)	13 (100%)	50

Table 5: Distribution of Patients according to Period of Radiological Union

Period (wks)	Locking plate	Dynamic compression screw with plate	Supracondylar nail	No. Of cases
10- 15	14 (70%)	14 (82.35%)	10 (76.92%)	38
15-20	6 (30%)	3 (17.65%)	2 (15.38%)	11
>20	0 (0%)	0 (0%)	1 (7.70%)	1
Average period of radiological union	12.85 weeks	12.29 weeks	14.15 weeks	
Total	20 (100%)	17 (100%)	13 (100%)	50

Table 6: Distribution of Patients according to Complications

Complications	Lockin g plate	Dynamic compression screw with plate	Supracon dylar nail	Total
Superficial infection	1	2	0	3 (6%)
Deep infection	1	1	0	2 (4%)
Delayed union	0	0	2	2 (4%)
Non-union	0	0	0	0
Fat embolism	0	0	0	0
Knee impingement	0	0	1	1 (2%)
Significant Shortening >1.5cm	0	1	2	3 (6%)
Extension lag	-	1	1	2 (4%)
Pulmonary complication	1	0	0	1 (2%)
Knee stiffness	1	1	1	3 (6%)

Table 7: Distribution of Patients according to Limb Length Discrepancy

Shortening (centimetres)	Locking plate	Dynamic compression screw with plate	Supracondylar nail	Patients
None	15 (75%)	12 (70.59%)	9 (69.23%)	36
<1.5	4 (20%)	4 (23.53%)	2 (15.38%)	10
1.5-2.5	1 (5%)	0 (0%)	1 (7.69%)	2
>2.5	0 (0%)	1 (5.88%)	1 (7.70%)	2
Total	20 (100%)	17 (100%)	13 (100%)	50

DISCUSSION

In our study, Average duration of surgery for Locking Plate, Dynamic Condylar Screw with side plate and Retrograde Supracondylar Nail was 125.9 minutes, 134.41 minutes and 113 minutes respectively. EJ Yeap *et al.*¹ have reported average duration of 119.2 minutes for locking plate surgery which is in line with our results. Also, similar to our results, Christodoulou A *et al.*⁶ have reported average duration of 145 minutes for Dynamic condylar screw with plate and 92 minutes for Supracondylar Nail implant. Sameh El-Kawy *et al.*⁷ have also reported results which are similar to our study results. Average blood loss was 305ml, 282.35 ml and 142.3 ml respectively for Locking Plate, Dynamic Condylar Screw with side plate and Retrograde Supracondylar Nail. Bolhofner *et al.*⁸ have reported average blood loss of 425 ml for locking plate surgery. Christodoulou A *et al.*⁶ have reported average blood loss of 310 ml for Dynamic Condylar Screw with side plate and 118 ml for Supracondylar Nail. However, Sameh El-Kawy *et al.*⁷ have reported average blood loss of 350 ml for Supracondylar Nail. In this study, Average period of radiological union for locking plate was 12.85 weeks. Similar observations were also found in the studies of Bae SH *et al.*⁹, and Khan *et al.*¹⁰ with 14.3 weeks and 14 weeks as average period of radiological union. Similarly, in our study, Average period of radiological union for dynamic condylar screw was 12.29 weeks. Muhammad AK *et al.*³ have also reported 12 weeks as average period of radiological union. Average period of radiological union with Supracondylar nail was 15.69 weeks. Similarly, Ceilisk *et al.*¹¹ have also reported 16 weeks as average period of radiological union for nailing. However, A Saw *et al.*¹² have reported 24 weeks as average period of radiological union for nailing. According to Schatzker and Lambert Criteria, Locking Plate had 35% excellent results, 50% good results, 10% moderate results, whereas only 5% poor results. EJ Yeap *et al.*¹ have reported similar results with 36% excellent, 36% good, 19%

moderate and 9% poor. Dynamic Condylar Screw with side plate had 47.07% excellent results, 17.65% good results, 23.53% moderate results and 11.77% poor results. Muhammad AK *et al.*³ have reported 60% excellent, 20% good, 17% moderate and 3% poor. Retrograde Supracondylar Nail had 38.46% excellent results, 30.77% good results, 7.7% moderate results and 23.07% poor results. Christodoulou A *et al.*⁸ have reported 51% excellent, 31% good, 9% moderate and 9% poor results.

CONCLUSION

In AO type A fracture pattern, Supracondylar nail was superior to plating group (Locking Compression Plate And Dynamic Condylar Screw With Plate) with respect to less average duration of surgery, blood loss (statistically significant finding), and infection rate (apparently significant). Plating group has more infection rate in our study but mean period of union and results were more favourable than in nailing group. In addition, locking plate and dynamic condylar screw were found superior to supracondylar nail for obtaining better results in AO type C1 fracture pattern. Locking plate was found to be best implant for osteoporotic and severely comminuted intra articular fracture pattern (AO type C2 and C3) in obtaining better results than dynamic condylar screw with side plate and Supracondylar nail.

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