

Comparison of outcomes of supracondylar femur fractures treated with locking compression plate vs supracondylar nail

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Abstract

Objective: To compare the outcomes of supracondylar femur (SC) fractures treated with locking compression plate (LCP) with supracondylar nail (SCN). **Methods:** Analysis of 90 cases was done out of which 45 were treated with supracondylar nail and 45 with LCP. **Results:** Results were graded according to Schatzker and Lambert criteria. In LCP group 28 (62.22%) had excellent, 12 (26.66%) had good, 2 (4.44%) had Fair and 3 (6.66%) had poor results while in SCN group 22 had excellent (48.88%), 9 had good (20%), 6 had fair (13.33%) and 8 had poor (17.77%) results. **Conclusion:** Locking condylar plate group had the best functional result followed by SCN group according to Schatzker and Lambert criteria.

Keywords: Supracondylar femur fractures, LCP, SCN, Schatzker and Lambert criteria

Introduction

Supracondylar femur fracture is one of the most common injuries of the lower extremity which many times involves damage to the articular cartilage of the knee joint. Fractures of the distal femur comprise 4-6% of all femoral fractures [1,2]. One end of spectrum includes patients < 40 years of age, with high male preponderance due to high energy trauma like road traffic accidents or fall from height. The other end of spectrum includes patients > 50 years of age with female preponderance due to low energy trauma with predisposing factors like osteoporosis [3,4]. Supracondylar femur fracture is challenging even when treated with new fixation techniques and implants. Currently treatment of choice for supracondylar femoral fractures is usually operative, while nonsurgical treatments are seldom used and reserved for morbid

patients. The operative methods include the use of either fixed angle blade plate (FABP), compression screw systems (Locking compression plate; LCP), condylar buttress plates, intramedullary nailing systems (Supracondylar nailing; SCN), external fixation or modular distal femoral replacement prosthesis [5].

Widely used classification of supracondylar fractures is the one described by Müller which was further updated by the AO group [6].

Aims and Objectives

To compare the outcomes of supracondylar femur fractures treated with locking compression plate (LCP) with supracondylar nail (SCN).

Material and Methods

Study design

It was a prospective study.

Computer generated random numbers were used for Randomization.

Total number of cases studied were 99 out of which 90 were included for final analysis.

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Duration of study- April 2015 to January 2017

Inclusion criteria

1. All types of S.C fractures included in AO classification.
2. Gustilo Anderson classification 1., 2., and 3A
3. Age-18 to 85 years
4. Patients of both gender were included.

Exclusion criteria

1. Open fractures type III B, III C and neurologically compromised patients
2. Paediatric age group
3. Pathological fractures
4. Previous surgery in and around knee joint

Implants:

Retrograde Locked Intramedullary Nail, Locking Compression Plate, Cortical and Cancellous Screws of all sizes and range.

Instruments:

Reamer, Bone Awl, Schatz Screw, Tunneler/Bristo, Drill Bit of 3.2mm, 4.0 mm and 4.3 mm, Drill Sleeve, Trocar, Depth Gauge, Tap 4.5mm, Tap Sleeve, Screw Driver, Plate Bender, C-Arm Image Intensifier. The common indications for the use of LCP plate are as follows: short distal fragment, C2 and C3 fracture patterns, failed closed reduction with retrograde IM nailing, salvage implant for revision surgery, severe osteoporosis and severe degenerative changes of the knee [8,9,10,11,12].

The common indications for the use of retrograde IM nailing for the treatment of distal femur fractures are[21,24,26,27]; Distal femur fracture AO type A, C1 and C2, open wound around fracture, bilateral femur fractures, unilateral segmental fracture with morbid obesity.

Treatment protocol:

1. Neurovascular status was monitored.
2. Standard Antero posterior and lateral plain X-ray including knee joint.
3. Upper tibial skeletal traction or above knee back slab whenever indicated.
4. CT scan for pre-operative planning if indicated.
5. Debridement for Open wounds was done within 6 hours.
6. Routine Pre-operative investigations were done along with physician fitness for surgery in all cases.
7. Patients were managed by closed reduction or open reduction using C-arm (Image Intensifier).
8. CPM (Continuous passive movement) started after 3 weeks after surgery, once the pain was tolerable.
9. Clinical follow up was done at 2 weeks, 6 weeks, 3 months, 6 months and 1 year.
10. X-rays were ordered post operatively and at 6 weeks, 2 months, 6 months and 1 year.
11. Partial weight bearing was started after 3-6weeks.
12. Result graded according to Schatzker and Lambert Criteria[7]

Table-1: Schatzker and Lambert criteria [7].

Grading	Description
Excellent	All of the following: loss of flexion, <10°; full extension; no varus, valgus, or rotatory deformity; no pain; perfect joint congruency
Good	No more than any 1 of the following: loss of flexion, >20°; loss of extension, >10°; varus deformity, >5°; valgus deformity, >10°; minimum pain
Fair	Any 2 of the criteria listed in the previous category
Failure	Any of the following: flexion, ≤90°; varus deformity, >10°; valgus deformity, >15°; joint in congruency; disabling pain, irrespective of radiographic appearance

Results

Out of Ninety-nine cases 48 were treated by distal femur locking plate and were designated as LCP group. Rest 51 were treated by supracondylar nail and were included in SCN group. Total five patients were lost to follow up. 2 from LCP group and 3 from SCN group. Hence, we randomly selected 45 patients from each group for the study.

Results were graded according to Schatzker and Lambert criteria [7]. In LCP group 28 (62.22%) showed excellent, 12 (26.66%) had good, 2 (4.44%) had Fair and 3 (6.66%) had poor results while in SCN group 22 achieved excellent (48.88%), 9 good (20%), 6 fair (13.33%) and 8 achieved poor (17.77%) results.

Table- 2: Distribution of LCP treated group and SCN treated group according to age, sex, mode of trauma, types and complications.

Type	Subtype	LCP GROUP (Number/Percentage)	SCN GROUP(Number/Percentage)
Age group	20-40	12(26.66%)	11(24.44%)
	40-60	19(31.11%)	19(31.11%)
	60-80	14(26.67%)	15(33.33%)
Sex	Male	29(64.44%)	31(68.88%)
	Female	16(35.55%)	15(33.33%)
Mechanism of injury	High energy	28(62.22%)	27(60%)
	Low energy	17(37.77%)	18(40%)
Type of fracture	Close	26(57.77%)	26(57.77%)
	Open	19(42.22%)	19(42.22%)
Infection rate	Superficial	3(6.66%)	2(4.44%)
	Deep	1(2.22%)	Nil
Non-union		1(2.22%)	2(4.44%)
Knee pain		4(8.88%)	10(22.22%)
Average knee flexion after 6 months	-	118.93 ± 17.30	109.03 ± 18.78

The youngest patient was a 20 year old female and the oldest one was 78 year old female patient. Maximum patients were between 40 years and 60 years age group. Sex and age distribution was very similar in both-groups.

High energy trauma (Road Traffic accidents, railway injuries, fall from heights etc) was noted in 55 patients (61.11%) [LCP group 62.22% (28 patients), SCN group 60% (27 patients)] and low energy impact in 35patients (38.88%) [LCP group 37.77% (17 patients), SCN group 40% (18 patients)].

Out of 90 patients, 38 were open and 52 were close type fractures. The nature of such fractures was about same in LCP (open-42.22%) and SCN group (open-42.22%) groups.



PREOP



POSTOP



Figure 1: Fracture treated with supra condylar nailing

In the LCP group 1 out of 45 patients (2.22%) developed non-union at 9 months after osteosynthesis. In the SCN group 2 out of 45 patients (4.44%) developed non-union requiring surgery with bone grafting.

In our study majority of patients were males. Sex distribution was quite similar in both groups with 64.44% males in LCP group and 68.88% males in SCN group. Male predominance may be due to their being more prone to high velocity trauma than females.

In our study, 5 patients (3 in LCP group and 2 in SCN group) developed superficial infection and 1 patient developed deep infection (LCP group), while post op pain was much more common in the nailing group after supracondylar nailing (10 cases) (22.22%) than plating (4 cases) (8.88%).

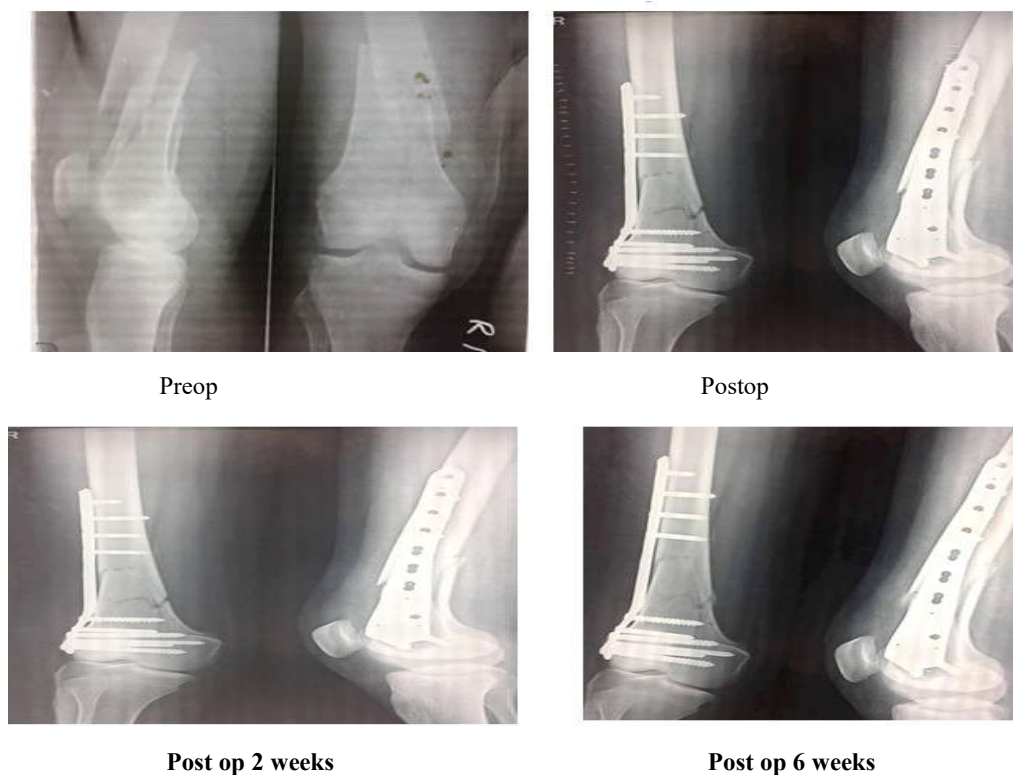


Figure 2: Fracture treated with LCP

Knee pain was more common (22.22% vs 8.88%) after nailing as compared to plating. This may be most likely because the nailing might have affected the knee and its flexion postoperatively.

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Average range of movement was $96.33^{\circ} \pm 8.03^{\circ}$ in the LCP group and $90.83^{\circ} \pm 8.84^{\circ}$ in the SCN group at the end of 8 weeks ($t = 2.5225$, $df = 58$, $p = 0.0144$). The range of movement improved to $118.93^{\circ} \pm 17.30^{\circ}$ in the LCP group and $109.03^{\circ} \pm 18.78^{\circ}$ in the SCN group by 6 months follow up after vigorous physiotherapy ($t = 2.1236$, $df = 58$, $p = 0.0380$). So flexion at knee was better in LCP group than SCN group.

Table-3: Outcomes of supracondylar femur fractures treated with LCP and SCN.

Grade	LCP group		SCN group		Overall	
	No. of cases	%	No. of cases	%	No. of cases	%
Excellent	28	62.22	22	48.88	50	55.55
Good	12	26.66	9	20.00	21	23.33
Fair	2	4.44	6	13.33	8	8.88
Poor	3	6.66	8	17.77	11	12.22

Other Contributing factors which affected the results:

- Better results in simple fracture than compound fracture.
- Better results in type A fractures than type C fractures.
- Intramedullary nailing may be better suited procedure in bilateral extremities fractures.
- Main limiting factors of supracondylar nail are persistent knee pain and inability to use in complex type C fractures.
- Inferior result in comminuted fractures.
- Locking plate can be utilized for all supracondylar femur fractures including periprosthetic and osteoporotic fractures.
- Good quality of operative technique is important for better clinical results.

Discussion

In the current study on supracondylar femur fractures, average age group was 51 years with male predominance. Our study was carried in a semi-rural area and majority of the sample had men who were working as labourers.

Gender predilection: The study done by Lucas et al. showed similar results to our study which showed preponderance of younger patients [15]. This was in contrast to the studies conducted by Gellman et al and Watanabe et al which showed higher number of older patients [13,14]. High female preponderance was seen in older age group, while high male preponderance was seen in the younger age group. This may be attributed to the higher incidence of road traffic accidents seen in young males.

Mode of injury: In the present study, road traffic accident accounted for 56% of cases. These findings matched with those observed by Gellman et al and Schatzker et al who also observed trauma as the most common cause [13,16] of such fractures.

Average time to union with plating:

Radiological union was defined as bridging callus across three cortices. In the present study average time to union for plating was around 15 weeks, which was comparable to the findings of the studies done by Henderson et al and Mark Miller et al who observed 12 and 14 weeks respectively [17,18]. Similar duration of 11-14 weeks was observed by other authors [18-22].

Average time to union with nailing:

In the present study, average time to union for nailing was 13 weeks, this was similar to the results noted in the study done by Gellman et al, Kumar et al and Ingman et al who recorded these as average durations of 12 weeks, 14 weeks and 12 weeks respectively [23,13,24].

Comparison of average union in weeks for Nailing and Plating:

Average healing time / time to Union for Nailing was better than plating. The time to union for nailing was 13.4 weeks and that for Plating was 15.6 weeks. The management of more complex, comminuted fractures (Muller type C) with Plating may have contributed to delayed healing time with use of plates.

Comparison of knee flexion in plating and nailing:

In this study, the range of motion was better in the nailing group (112 degrees) compared to that seen in the plating group (107 degrees). The reason for this difference may be due to the fact that knee mobilization was started early in the nailing group than the plating group. Complex and comminuted fractures usually need more stable fixation hence are mostly treated by plating. In the plating group there may have been a delay in mobilization which may have contributed to relatively poor knee ROM as compared to Nailing group. Our results matched those of Lucas et al, Gellman et al, [15] Kumar et al [23], Ingman et al who reported 104, 106, 100, 102 degrees of average knee flexion respectively with the use of nailing procedures. For

plating procedures our study reported similar results to the ones noted by Kregoret al [14,25] Schutzet al [20], Mark Milleretal who reported average knee flexion of 103,107 and 110 degrees respectively [17,22].

Average time of surgery:

In the present study the average time taken for nailing procedure or surgery was 104.8minutes and that for Plating procedure was 117.5minutes.

Rate of Non-unions in Nailing and Plating:

In our study the rate of non-union for cases treated by nailing was 2.22% which is comparable to the observations made by Kumaretal which were 2% [23].

However, in the Plating group we observed a non-union rate of 4.44% which is quite less as compared to those reported by Kregoretal (7%) and by Schutzet al (5%) [22,20]. The difference in the non-union rates between nailing and plating groups was found to be almost double.

Implant failure rate in Nailing and Plating:

Obgemudia et al observed a rate of 3.4% of failure of implants in the nailing group, these are almost similar to 2.7% seen in our study [25]. Kregoretal and Schutzet al observed rates of 1.5% and 6% respectively [22, 20] of failure of implants in the plating group. We found a 3.6% failure rate in the Plating series. In the current study we observed almost similar implant failure rates between the nailing and plating group.

Previous studies showed that failure rate was predominantly seen in plating series when compared to nailing series. Now with improved plating procedures and implants these failure rates have substantially reduced.

There are certain disadvantages of the nailing like difficulty in achieving the alignment, difficulty in control of angulations, accidental perforation of joint and decreased stability with small diameter nails.

The management of Supracondylar fracture is challenging with high potential risk of morbidity. Most failures are because of inadequate fixation of the fracture.

The prognostic factors include age, intraarticular involvement, treatment methods used and time when the range of motion is initiated. It is difficult to compare the results of different reported series because of different demographic distribution, different patient characteristics, different classification-systems and variable functional rating-systems used in different studies.

Conclusion

To summarize LCP had better results than SCN in all parameters especially when used for intra articular fractures. Thus, we conclude that locking plates are the better implants in almost all ways than SCN in managing supracondylar fracture of femur.

Limitations- The sample size of this study was small and also study period. We are continuing this study further and will report results at the end of five years follow up. We need studies with big sample size and with a long duration of follow-up.

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