

A Study of Supracondylar Femur Fractures and Various Methods of Fixation

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Abstract

Original Research Article

The aim of the study was to determine the types of supracondylar fractures in male and female of age >18 years. To study the advantage of fixation with distal femoral locking compression plates, dynamic condylar screw and retrograde nailing along with the outcome of treatment. Methods: The present study was conducted between August 2016 to December 2018 in Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, and Warangal. 30 patients presenting with supracondylar fractures of the femur were selected according to the inclusion and exclusion criteria treated by distal femoral locking compression plates, dynamic condylar screws and retrograde supra condylar nailing. The patients were then assessed clinically to evaluate their general condition and the vital signs were recorded. The involved extremity was examined for swelling, deformity, abnormal mobility, crepitus, shortening, discoloration, skin integrity, neurological and vascular compromise, and signs or symptoms of compartment syndrome. A standard operating procedure was followed for the surgical treatment Antibiotics was started 1 hour pre-operatively and continued postoperatively [intravenous cephalosporins and aminoglycoside] for 7 days. Follow up after 3 weeks and later 3 months, 6 months, 18 months and 24 months. At each follow-up, X-rays were taken and ROM was assessed and Neer's scoring was done. Result: Out of n=30 patients n=9 cases were between 21-30 years (30%), n=5 cases (16.65%) between 31-40 years, n=4 cases (13.3 %) between 41-50 years, n=5 cases (16.6 %) between 51-60 years, n=7 cases (23.3 %) were aged more than 60 years. N=4 cases with DCS fixation had a radiological union between 12-14 weeks, n=5 cases between 14-16 weeks, the n=1 case between 16 -18nweeks n=5 cases of SCN fixation had a radiological union between 12-14 weeks, n=5 cases between 14-16 weeks. n=3 cases of LCP fixation had a radiological union between 12-14 weeks, n=2 cases between 14-16 weeks, n=5 cases between 16-18 weeks. Neer's scoring was excellent in n=2 case of DCS, n=2 cases of SCN and n=2 case s of LCP. Good in 7 cases of DCS, 7 cases of SCN and 8 cases of LCP., Fair in 1 case of DCS, and the n=1 case of LCP. Conclusion: Treatment of supracondylar fractures still remains a challenge to the orthopedic surgeon. The reason because of significant forces applied in this area even in restricted activities. Severe comminution after requires fixation of multiple independent fragments with the devices to minimize soft tissue damage. For distal fractures, the locking compression plate which fits the distal femur and is strong enough to allow early motion is often recommended. Supracondylar Nail is a load sharing device which can be inserted with minimal soft tissue stripping. There is a debate regarding the optimal treatment of distal femur fixation. No single implant is suitable for all fractures.

Keywords: supracondylar Femur Fractures, methods of fixation.

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INTRODUCTION

Supracondylar fractures of the femur by definition involve distal 15 cm of the femur including the distal femoral metaphysis (supracondylar) and the articular surface of the distal femur (intercondylar) [1]. They have been historically very difficult to treat. These fractures often are unstable, comminuted and tend to occur in elderly or multiple injured patients. Since these kinds of fractures are close to the knee joint, regaining full knee motion and function may be difficult. The

incidences of malunion, non-union and infection are relatively high. These serious injuries have the potential to produce significant long-term disability [2]. Distal femoral fractures are much less common as compared to that of the hip fractures and account for 7 % of all femoral fractures. Excluding the fractures of the hip, 31% of femoral fractures involve the distal portion. The incidence of distal femur fractures is around 37/100,000 patients per year [3] In the older population with osteoporotic bone and vulnerable soft-tissue envelope, distal femoral fractures occur predominantly after low

energy trauma, e.g., falls and sprain injuries complicated by a high rate of comorbidity (60% female, older than 60 years) [4]. In young patients (60% male, younger than 40 years), high-energy trauma causes complex injury with comminuted and open fractures. Severely comminuted fractures often require fixation of multiple independent fragments with one device to minimize soft-tissue damage. The consequential forces applied to this area, even during limited activities, these fractures require a strong implant; however, fixation is difficult because of the wide canal, the thin cortex, and the relatively poor bone quality of the distal femoral bones. They remain a significant challenge to the orthopedic surgeon. Many factors come into play while planning treatment of these fractures, including fracture type, associated injuries, age, pre-morbid functional and medical status and soft tissue injury.

Prior to the early 1970s most fractures of the distal femur were treated non-surgically [5, 6]. Advancements in internal fixation design and improvements in surgical techniques especially by AO group with studies on internal fixation gave better results, Retrograde intramedullary nailing, GSH [7], developed in 1988 offered potential biomechanical advantages over plates and screws because of the potential for load sharing, minimal soft tissue stripping, the ability to manipulate and reduce the distal fracture fragments directly [8]. The most predictable results are attained with operative fixation with the ability to obtain an anatomical reduction of the joint surface, restoring axial alignment and beginning early range of motion presented a clear advantage over closed means of treatment. Muller's classification is probably the most widely accepted classification system [2] and the same has been used in the present series. The dispute still remains regarding the optimum device for distal femur fixation. No one implant is suited for all fractures. The type of fixation device selected depends on patient variables, fractured personality, and soft tissue quality. Regardless of the device chosen, the ultimate goal is the same - restoration of articular congruity, stable fixation, limited surgical morbidity, and early mobilization and knee motion. The feasibility and the functional outcome of 30 cases of supracondylar fractures of the femur, by fixation with locking compression plates, retrograde nailing and dynamic condylar screw were studied in this series and the results are reported.

MATERIALS AND METHODS

The present study was conducted between August 2016 to December 2018 in Mahatma Gandhi Memorial Hospital, Kakatiya Medical College, and Warangal. 30 patients presenting with supracondylar fractures of the femur were treated by distal femoral locking compression plates, dynamic condylar screws and retrograde supra condylar nailing. Institutional Ethical committee permission was obtained for the

study. Institutional Ethical committee permission was obtained for the study; written consent was obtained from all the patients of the study.

Inclusion criteria

- Supracondylar fractures of the femur in both male and female patients.
- Supracondylar fractures of the femur that is both simple and comminuted.
- Supracondylar fractures of the femur in patients older than 18 years.
- Supracondylar fractures of the femur with intraarticular extension.
- All supracondylar fractures of femur treated by the dynamic condylar screw, locking compression plates and retrograde supracondylar nail.

Exclusion criteria

- Compound supracondylar fractures of the femur
- Supracondylar fractures of femur associated with an ipsilateral femoral neck fracture
- Supracondylar fractures of femur associated with ipsilateral leg fractures
- Pathological supracondylar femur fractures
- Supracondylar fractures in less than 18-year-old patients
- Supracondylar fractures in patients with congenital deformities of the femur
- Patients managed conservatively for other medical reasons
- Supracondylar fractures of the femur with neurovascular compromise
- Periprosthetic fractures of supracondylar area

All patients were admitted and a careful history was elicited from the patient or attendants to reveal the mechanism of the injury and the severity of the trauma, site of the incident, circumstances about which the injury occurred, pre-morbid medical history and preinjury functional status. The patients were then assessed clinically to evaluate their general condition and the vital signs were recorded. The involved extremity was examined for swelling, deformity, abnormal mobility, crepitus, shortening, discoloration, skin integrity, neurological and vascular compromise, and signs or symptoms of compartment syndrome. Medical consultation was sought expeditiously for geriatric patients. General surgeon consultation was sought to evaluate all high-energy accident victims to rule out polytrauma. Patients with severe blood loss were treated by blood transfusions and volume expanders. Routine investigations done were: hemoglobin percentage, bleeding time, clotting time, random blood sugar, blood urea, serum creatinine, serum electrolytes, HIV and HBs Ag, Blood grouping and cross matching, ECG, Chest X-Ray, Urine for sugar, albumin, and microscopy. Other investigations like 2D Echo. Radiographic evaluation included anteroposterior and lateral radiographs of the distal

femur, including the knee joint and proximal tibia and ipsilateral hip joint. If hemarthrosis was present the knee joint was aspirated and the limb was placed in Bohler Braun splint. The patient was then taken up for surgery after investigations and as soon as the patient was medically fit for surgery. The interval between the injury and the definitive operation ranged from several hours to ten days (mean 3 days). Any delay in the surgery was usually attributable to multiple trauma or poor medical condition of the patient. All fractures were treated with IV antibiotics. A standard operating procedure was followed for the surgical treatment. Antibiotics was started 1 hour pre-operatively and continued postoperatively [intravenous cephalosporins and aminoglycoside] for 7 days. Follow up after 3 weeks and later 3 months, 6 months, 18 months and 24

months. At each follow-up, X-rays were taken and ROM was assessed and Neer's scoring was done. By 6 weeks if x-ray showed signs of union progression, increased weight bearing can be allowed. By 12 weeks, with further evidence of radiological consolidation, full weight bearing can be allowed

RESULTS

A total of n=30 cases were treated during the study period, n=10 cases (33 %) were fixed with DCS, n=10 cases (33 %) were fixed with SCN and n=10 cases (33 %) were fixed with LCP shown in table 1. Out of the n=30 22(73.3%) were male and n=8 (26.66%) were female.

Table-1: Number of cases and type of fixation done

Method of fixation	Number of cases	Percentage
Dynamic Condylar Screw	10	33.33
Supra Condylar Nail	10	33.33
Locking Compression Plate	10	33.33
Total	30	100

Out of n=30 patients n=9 cases were between 21-30 years (30%), n=5 cases (16.65%) between 31-40 years, n=4 cases (13.3 %) between 41-50 years, n=5 cases (16.6 %) between 51-60 years, n= 7 cases (23.3 %) were aged more than 60 years given in table 2. The

mode of fractures in the study was recorded with 17 fractures (57 %) were due to road traffic accidents and 13 cases (43%) were due to accidental fall out of which 8 fractures (60 %) were on the right side and 12 fractures (40 %) were on the left side.

Table-2: Age wise distribution of the cases involved in the study

Age group years)/ number of cases	Number of cases	Percentage
21 to 30	9	30
31 to 40	5	16.6
41 to 50	4	13.3
51 to 60	5	16.6
>60	7	23.3

Out of 30 fractures, 5 (16.6 %) were Mullers Type A1; 8 (26.6 %) were Mullers Type A2; n=4 (13.3 %) were Mullers Type A3; n=5 (16.6 %) were Mullers Type C1; n=5(16.6%) were Mullers Type C2; 3 (10 %) were Mullers Type C3. The treatment was done in which 2 cases of type A1; 3 cases of type A2; 1 case of type A3; n=2 cases of Type C1, the n=1 case of type C2; and the n=1 case of type C3 were fixed by DCS.

n=2 cases of type A1; n=2 cases of type A2, the n=1 case of type A3, n=2 cases of type C1, n=2 cases of type C2, the n=1 case of type C3 were fixed by SCN. The n=1 case of type A1, n=3 cases of type A2, the n=1 case of type A3, n=2 cases of type C1, n=2 cases of type C2, the n=1 case of type C3 were fixed by LCP shown in table 3.

Table-3: Type of fractures as per Muller's classification and mode of fixation

type of fracture/ Mode of fixation	Total Number of cases (n)	DCS (n)	%	SCN (n)	%	LCP (n)	%
Type A1	5	2	40	2	40	1	20
Type A2	8	3	37.5	2	25	3	37.5
Type A3	4	1	25	2	50	1	25
Type B1	0	0	0	0	0	0	0
Type B2	0	0	0	0	0	0	0
Type B3	0	0	0	0	0	0	0
Type C1	5	2	40	1	20	2	40
Type C2	5	1	20	2	40	2	40
Type C3	3	1	33.3	1	33.3	1	33.3

N=5 fractures which were fixed by DCS had the blood loss of fewer than 500 ml, n=5 cases had blood loss between 500-1000. N=9 cases of supracondylar nailing had less than 500 ml blood loss,

the n=1 case had 500-1000 ml, blood loss. N=4 cases of fixation by LCP had blood loss less than 500 ml, n=5 cases had blood loss between 500 -1000 ml and the n=1 case had blood loss more than 1000 ml.

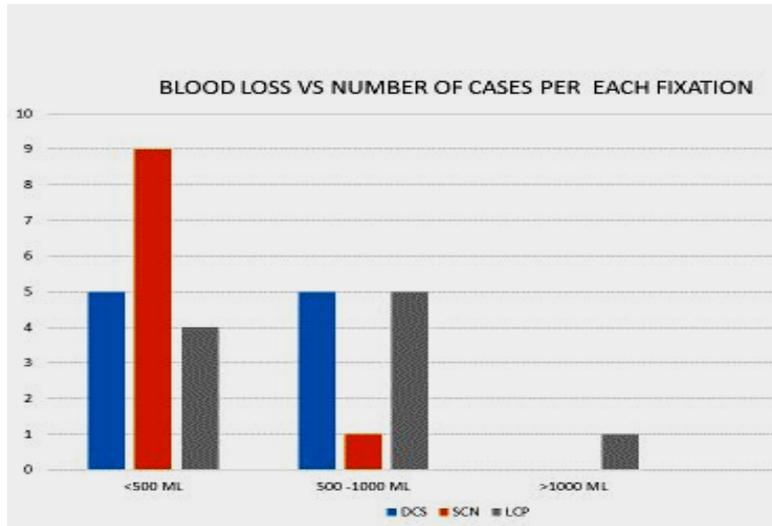


Fig-1: Blood loss during the surgical procedures

N= 5 cases of type A1 had 94 degrees of ROM at knee postoperatively, n=8 cases of type A2 had 83.7 degrees of ROM, n=4 cases of type A3 had 90 degrees of ROM, n=5 cases of type C1 had 82 degrees of ROM, 45 cases of type C2 had 90 degrees of ROM, n=3 cases of type C3 had 90 degrees of ROM. N =7cases of DCS fixation had ROM of 70 - 90 degrees, n=3 cases had more than 100 degrees. N=2 cases of SCN fixation had

ROM 50-70 degrees, n=5 cases had 70-90 degrees; N =2 cases had 90 -100 degrees, the n=1 case had more than 100 degrees. N=3 cases of LCP fixation had ROM OF 70 -90 degrees, the n=5 case had 90-100, n=2 cases had more than 100 degrees of ROM The Average ROM achieved with DCS fixation was 85 degrees, with SCN 88 degrees and with LCP ROM was 91 degrees.

Table-4: Type of fixation and average ROM at the knee

Number of cases vs ROM average	Number of Cases	Average ROM
DCS	10	85
SCN	10	88
LCP	10	91

N=4 cases with DCS fixation had a radiological union between 12-14 weeks, n=5 cases between 14-16 weeks, n=1 case between 16 -18weeks n=5 cases of SCN fixation had a radiological union between 12-14 weeks, n=5 cases between 14-16 weeks. n=3 cases of LCP fixation had a radiological union

between 12-14 weeks, n=2 cases between 14-16 weeks, n=5 cases between 16-18 weeks. Neer's scoring was excellent in n=2 case of DCS, n=2 cases of SCN and n=2 case s of LCP. Good in 7 cases of DCS, 7 cases of SCN and 8 cases of LCP., Fair in 1 case of DCS, and the n=1 case of LCP.

Table-5: Mode of Fixation and Functional Outcome [Neer's Score]

Type of surgery/functional Outcome	Excellent Neer's	Good Neer's	Fair Neer's	Poor Neer's
Dynamic condylar screw	2	7	1	0
Supracondylar Nailing	2	7	1	0
Locking compression screw	2	8	0	0

DISCUSSION

Rapid industrialization and urbanization have led to many road traffic accidents resulting from high energy trauma. The current supracondylar femur fracture pattern is towards complex comminuted fractures, especially in young individuals. All

contemporary treatment trends have shown that the best results are now achieved with operative methods. The goal of our treatment is the restoration of a stable limb for functional, pain-free ambulation. The demographic profile of our study was closely comparable with that of Seifert J et al. [3] and Gellman RE et al. [9] study where the age group involved in supracondylar

fractures of the femur was 17-92 years; and 24-84 years in male average age 34.3 years and 39 years, females. In the present study, overall age group was 20-75 years, average age 47.5 years and females 43 years. The Mullers fracture types of this series is comparable to those of In the present series Type A1 were 17%, Type A2 was 26%, Type A3 was 13%, Type C1 was 17%, Type C2 was 17% and Type C3 was 10% in agreement with study by Gellman *et al.* [9] and Lucas *et al.* [10]. In the present study we found the most common fracture type was Muller's Type A2 in n=8 (23.33%) of cases. A study by Prasad A in Maharashtra found the most common type of fracture was Muller's Type A2 with 40% of cases [11]. The extra-articular and intra-articular pattern of distribution in this series is comparable to Bel JC *et al.* [12] and Gellman *et al.* [9] series where type A were 45% and 11%, type C were 55% and 54%. In the present series type, A was 57% and type C was 43%. The blood loss, operative time and union rates are comparable to the other studies [4, 9, 10, 12] where average blood loss was ranging from 224ml to 373 ml, operative time was 154-156 min, and union rate was 12.6 weeks, and 12 weeks. In the present series blood loss was 443 ml, operative time was 89.5 min, and the union was at 15.6 weeks. Dr. Sven Olerud in their study of 16 cases with 10 males and 6 females found that 9 cases were Neer's group n=3 and n=5 were Neer's group 2, and n=2 was Neer's group 1 and there was an infection in n=4 cases [13]. Dr. Muller reported 3 infections in 72 cases and 4 deaths. In the present study, there were n=3 infections with no deaths [14]. Malik I Khan *et al.* Studied management of distal femoral fractures by dynamic condylar screw and distal femoral locking compression plate [15]. The average radiological union time was 14.25 weeks ranging from 10-24 weeks in the DCS group. Shewring *et al.* [16] showed that average union time was 11.3 weeks ranging from 6-16 wks whereas Iftikhar *et al.* 2007 showed average union time to be 15 wks [15]. In the present study all fractures treated by DCS healed by an average of 16.2 weeks, 85 degrees ROM, with LCP healed by the average of 15.6 weeks, 91degrees ROM, with SCN healed by an average of 15.2 weeks with ROM 88 degrees. Giles JB *et al.* [17] treated 26 patients with DCS and attained average ROM of 110 deg and the average time of healing 4.3 months Pritchett JM [18] treated 19 cases with DCS and achieved 90 degrees ROM with healing at 2.5 months. Healy and Brooker treated 47 cases with DCS and buttress plate and achieved 90 ROM. Average ROM in the present study was 99 degrees and for type A fractures ROM average was 89 degrees, for type C fractures ROM average was 87 degrees thus achieved better ROM in extraarticular fractures type A. Neer's *et al.* obtained 50% of excellent to good results in the present study 76 % of cases achieved good Neer's score, 20% excellent Neer's score and 4% achieved fair Neer's score [19]. The results of LCP in the present study were 80% of patients had good results and 20% had excellent results. The results with DCS are 20% excellent, 70% good and

10% fair. The results with SCN were 20% excellent and 80% good. The results of the present series were comparable with the study done by Schatzker's and Lambert in 1979 [20] where they had excellent or good results in 74% of the patients. In the present study with DCS, the average ROM was 85, with SCN was 88 and LCP was 91degrees in the present study the implant suitable for a particular fracture was not appropriate in all cases which did not yield good results. The younger age group patients attained better results compared to the older age group of patients. Presumably, this is because the younger patients adhere to strict and vigorous physiotherapy postoperatively than the elderly patients had knee discomfort with occasional pain. According to this study, this fracture was more common in young patients with high energy injuries and elderly osteoporotic bones with low energy injuries. These fractures were common with road traffic accidents. The high energy injuries were mostly comminuted with both metaphyseal and intra-articular extension.

CONCLUSION

Treatment of supracondylar fractures still remains a challenge to the orthopedic surgeon. The reason because of significant forces applied in this area even in restricted activities. Severe comminution after requires fixation of multiple independent fragments with the device to minimize soft tissue damage. The extra-articular distal femur fractures and those with condylar fragmentation the standard method of fixation is the dynamic condylar screw. This is to insert, provides more mal-alignment. For distal fractures, the locking compression plate which fits the distal femur and is strong enough to allow early motion is often recommended. Supracondylar Nail is a load sharing device which can be inserted with minimal soft tissue stripping. There is a debate regarding the optimal treatment of distal femur fixation. No single implant is suitable for all fractures. The type of fixation device selected depends on patient's variable fractures type and soft tissue quality and anatomical reduction of the distal femoral articular surface. Minimal soft tissue stripping internal fixation of displaced supracondylar fractures have gained widespread acceptance as operative technique and properly designed implants, a better understanding of soft tissue preoperative antibiotics, improved anesthetic measures have made internal fixation safe.

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