

## Original Research Article

# Surgical management of supracondylar fracture femur by retrograde intramedullary Green Seligson Henry nail: a clinical study

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## ABSTRACT

**Background:** Femoral shaft fractures in young people are frequently due to some type of high-energy collision. The most common cause of femoral fracture is a motor vehicle crash. Treatment for the femoral shaft is at most priority. Hence, the study is aimed to evaluate the results of the retrograde femoral nailing in supracondylar femoral fractures concerning knee flexion, mobilization of patients, and early weight-bearing.

**Methods:** The study is conducted from October 2019 to October 2021 with 25 patients having supracondylar fractures of the femur. The age group of patients was 15-70 years. Patients with midshaft femur fractures, nonunion, malunion, and pathological fractures were excluded. Chest X-ray post anterior view electrocardiography was performed in patients. Operative procedure was followed and postoperative management was done for all the patients. Radiological evidence of callus and consolidation was analyzed. Neer's rating system and Sander's functional evaluation scale were used to find the points for pain, working and walking capacity, range of motion and radiological appearance, etc.

**Results:** In the study, 25 patients are admitted with supracondylar fractures of the femur. The closed or open reduction method and the retrograde intramedullary supracondylar Green Seligson Henry (GSH) nail were used for internal fixation. The patients were followed for a period of 3 to 24 months. The results of Neers and Sander's evaluation scoring system determined good to excellent results in 65% of cases.

**Conclusion:** To conclude from the study results, it was noted that retrograde intramedullary supracondylar nail is an ideal fixation system for distal third femoral fractures, especially the extraarticular type.

**Keywords:** Retrograde, Femoral nail, GSH nail, Supracondylar, Femur, Fracture

## INTRODUCTION

Road accidents are unfortunately prevalent in India, and the majority of these accidents are caused by human fault. Distracted driving, drunk driving, reckless driving, driving on wet roads, and breaking traffic rules are some of the common causes of road accidents in India. Among the various fractures that occur for an individual, femur fractures are most common in road accidents. The severity of a femur break may vary. The worst kind of fractures can

lead to blood loss and even death. Supracondylar and intercondylar femoral fractures are often difficult to treat, and prone to several complications.

In the early 1960s, there was a great reluctance to manage this fracture because of a high incidence of infection, nonunion, malunion of fracture, inadequate fixation techniques, and lack of proper instruments, implants, and antibiotics. The traditional management of displaced fracture of the supracondylar femur was based on Watson

Jones & John Charnley.<sup>1,2</sup> It comprises skeletal traction, fracture manipulation, and immobilization in casts and cast bracings. These methods had deformities, limb shortening, prolonged bed rest, knee stiffness, angulation at the fracture site, joint incongruity, malunion, quadriceps wasting, knee instability, and post-traumatic osteoarthritis. In recent years, the open reduction and internal fixation trend has become more evident. Good results are obtained with the AO blade plate, dynamic condylar screw, and other implant systems like intramedullary supracondylar nails. Supracondylar fractures tend to collapse into varus.<sup>3</sup> During AO blade plate or dynamic condylar screw application, the shaft of the femur is pulled laterally, displacing the line of weight-bearing, lateral to the anatomic axis of the condyle. It produces rotational movements at the fracture site, causing the blade plate or condylar screws to be pulled off, resulting in plate fatigue fracture. Furthermore, the presence of osteoporotic bone causes screw and plate fixation failures by cutting the soft bone. The apparent advantage of an intramedullary device is that it aligns the femoral shaft with condyles and reduces the tendency to place varus movement at the fracture site. And because the bending mobility of an intramedullary device is decreased substantially, failure of fixation in the osteoporotic bone will be less.<sup>4</sup>

In addition, a retrograde intramedullary supracondylar GSH nail has distinct advantages like preservation of fracture hematoma, decreased blood loss, minimal soft tissue dissection, less operative time, and reduced infection rate. The primary purpose of this study is to evaluate the results of supracondylar fracture of the femur, treated by closed/open reduction and internal fixation using retrograde intramedullary GSH interlocking nails.

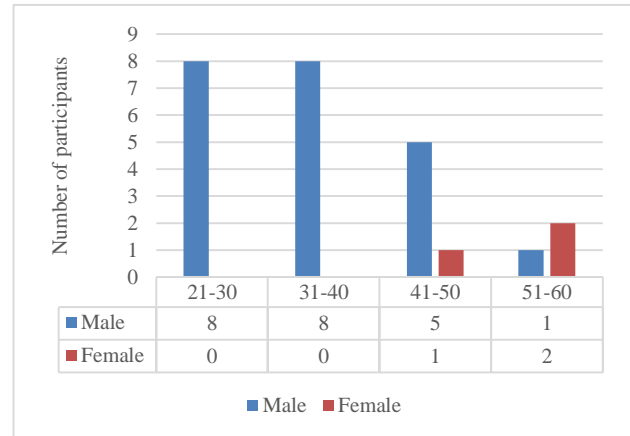
**METHODS**

This was an observational study, conducted from October 2019 to October 2021 in the department of orthopaedics, Kurnool Medical College, Kurnool. The study considers 25 patients with supracondylar fractures of the femur in the age group of 15-70 years and H/O trauma (RTA, fall from height). Patients with midshaft femur fractures, nonunion, malunion, and pathological fractures were excluded from the present study. Ethical clearance was obtained before the start of the study from the Institutional Ethical Committee. The earlier history of the patient and all demographic characteristics were noted. Surgical procedures were followed to fix the femur fracture and the implant used an orthocare retrograde supracondylar nail with an instrumentation set. Preoperative investigations such as hemogram, blood sugar, urea, and creatinine levels followed by liver function tests, blood group and Rh typing, bleeding and clotting time, and prothrombin time were noted. Chest X-ray post anterior view and electrocardiography were performed in patients. The operative procedure was followed and postoperative management was done for all the patients. Radiological evidence of callus and consolidation was analyzed. Neers rating system and Sanders functional evaluation scale were

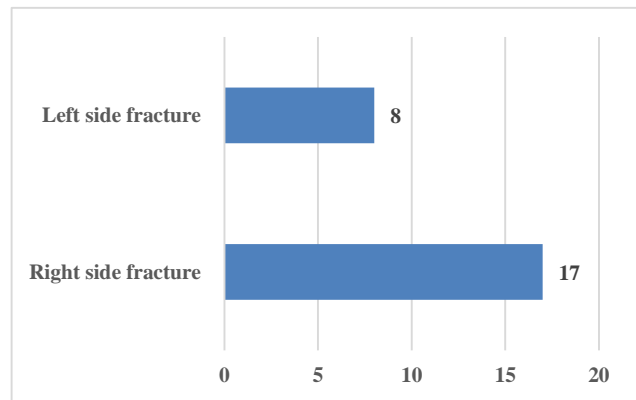
used to find the points for pain, working and walking capacity, range of motion radiological appearance, etc.<sup>5</sup> The obtained results were tabulated and analyzed using SPSS software 22.0 version.

**RESULTS**

In the study, 25 patients were admitted with supracondylar fractures of the femur.



**Figure 1: Age and sex distribution.**



**Figure 2: Side of fracture.**

The closed or open reduction method and the retrograde intramedullary supracondylar GSH nail were used for internal fixation. The patients were followed for a period of 3 to 24 months. The results of Neers and Sanders’s evaluation scoring system determined good to excellent results in 65% of cases. From the study results, the age of individuals ranges from 22 to 54 years with a mean age of 36.4 years. The mean age of males was 32.68 years and in the females was 47 years. The majority of patients who had fractures due to vehicular accidents were between 21 and 40 years with equal number of cases in the age categories. Most of the cases in the present study were encountered with right side fractures i.e., 17 (68%) and few were left side fractures i.e., 8 (32%). 76% of the cases encountered are from road traffic accidents and 24% are from fall from height.

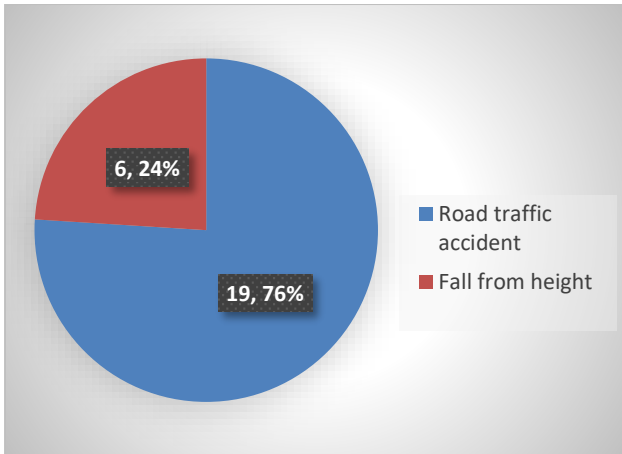


Figure 3: Mode of injury.

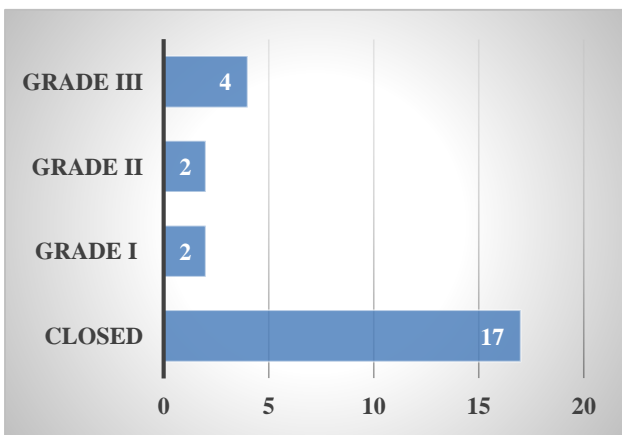


Figure 4: Nature of fracture.

Table 1: Distribution of fracture.

Nature of fracture	N	%
A1	9	36
A2	14	56
A3	2	8
Total	25	100

Table 2: Closed/open reduction.

Reduction	N	%
Closed	19	76
Open	6	24
Total	25	100

In the present study, there were 8 compound fractures, 2 being grade-I, 2 being grade II, and 4 being Grade-III, according to Gustilo-Anderson's classification. Out of these 4 grades- III compound cases, three were type-IIIA, and one was type-IIIB. Of the 8 cases, 5 were due to vehicular accidents, and 3 were falls. In a total of 25 fractures, 9 were of A1 type, 14 are of A2 type and 2 were of A3 type. 76% of cases underwent closed reduction and 24% of cases underwent open reduction.

Table 3: Radiological union.

Union (weeks)	N	%
<16	12	48
16-18	6	24
18-20	3	12
20-22	1	4
22-24	3	12

Table 4: Time of full weight-bearing achievement.

Achieved time (weeks)	N	%
8-10	12	48
>10-12	6	24
>12-14	4	16
>14-16	2	8
>16-18	1	4
>18-22	-	-
>22	-	-

Table 5: Neer's rating.

Rating	N	%
Excellent > 85 points	13	52
Good 70-85 points	4	16
Fair 50-69 points	7	28
Poor < 50 points	1	4

Table 6: Sander's rating.

Malalignment of >5 degree	Points	N	%
Excellent	36 to 40	13	52
Good	26 to 35	4	16
Fair	16 to 25	7	28
Poor	0 to 15	1	4

Table 7: Thoresen rating.

Rating	N	%
Excellent	14	56
Good	4	16
Fair	5	20
Poor	2	8

The average radiological union time was 17.5 weeks. Average full weight bearing was achieved by 12.2 weeks. Long-term final results were rated using Neer's rating system, which allows points for pain at the operative site, function, working ability, joint movements, and gross and radiological appearance. It was noted that 52% of cases observed excellent ratings and 16% of the cases observed good ratings. As per the Thoresen rating, out of 25 patients, 18 patients (72%) achieved good to excellent results. In this study, at least two distal locks gave uniformly good final knee flexion. There is no correlation between fracture type and weight bearing in this study. Average weight bearing for A1 type fracture 11.03 weeks. Average weight bearing for A2 type fracture 11.03 weeks. Average weight bearing for A3 type fracture 13.00 weeks.

There is no correlation between the type of reduction and full weight bearing; 68.4% in closed reduction and 66.66% in open reduction had full weight bearing in 5- 12 weeks. Average weight bearing for closed reduction 11.5 weeks. Average weight bearing for open reduction 12 weeks. Local symptoms at distal screws were the most common complications like pain and loosening of screws.

**Table 8: Relationship between type of fracture and full weight-bearing.**

Type of fracture	Avg. weight bearing in weeks
<b>Type-A1</b>	
A1-1	-
A1-2 (N=2)	8
A1-3 (N=7)	10
<b>Type-A2</b>	
A2-1 (N=2)	10.30
A2-2 (N=10)	10.80
A2-3 (N=2)	12
<b>Type-A3</b>	
A3-1 (N=2)	12

**Table 9: Correlation between type of reduction and full weight bearing.**

Type of reduction	Full weight-bearing					
	8-12 weeks		13-16 weeks		>17 weeks	
	N	%	N	%	N	%
<b>Closed (N=19)</b>	13	68.4	4	21	2	10.5
<b>Open (N=6)</b>	4	66.66	2	33.33	-	-

**Table 10: Complications.**

Complications	N	%
<b>Local symptoms at the distal screw</b>	4	16
<b>Impingement</b>	1	4
<b>Superficial infection</b>	1	4
<b>Delayed union</b>	1	4
<b>Distal migration of nail</b>	1	4
<b>Deep infection</b>	1	4
<b>Non-union</b>	-	-
<b>Distal screw breakage</b>	1	4
<b>Stress fracture</b>	-	-
<b>Implant failure</b>	-	-

## DISCUSSION

The mean age of the study participants was 36.4 years, out of which 23 participants were below 50 years of age and 18 were below 40 years of age. These results are consistent with the study reports of Lucas and Gellman who stated that the mean age in the study was 39 years.<sup>5,6</sup> With respect to the mode of injury, among the total population, the majority of participants (19, 76%) were injured by road traffic accidents who fall under the age group below 40 years. This peaks the predominant cause of trauma in the

younger population enrolled in the study. From the present study, road traffic accidents accounted for 76% of cases, and the rest 24% resulted from falls. These were coordinated with the studies of Schatzker, Yang, and Leung et al who stated that road traffic accidents are the major causing factors for fractures.<sup>7-9</sup> Another study by Lucas et al also supports the present study where 78% of participants included were from road accidents and 17% from falls and 4% from gunshots. Lucas's study reports are also well coordinated with fracture type whereas in the present study, 8 compound fractures were noted, 2 being grade-I, 2 grade II, and 4 grade III according to Gustilo-Anderson classification. The average operative time in this study was 98.5 minutes (75-140 minutes). The majority of the fractures of A1 (7 of 9) and A2 (8 of 14) required an operative time of less than 90 minutes, while it was > 90 minutes in type-A3 fractures. It is attributed to better fracture reduction in comminuted fractures. The study reports were in coordination with the following reports. Lucas reported an average operative time of 156 minutes. Gellman reported an average operative time of 154 minutes. Gynning reported an average operative time of 112 minutes.<sup>10</sup> The average extensor lag in the present study was 5.68 degrees which is similar to the reports of Lucas who documented an extensor lag of 4 degrees. Gellmann documented an extensor lag of 2 degrees.

In the present study, there was no case of nonunion and all fractures united radiologically at >3 month intervals from surgery. Iannacone reported four nonunion cases treated with bone grafting and revision fixation.<sup>11</sup> In the present study, there was a case of A2.3 supracondylar fracture, associated with ipsilateral comminuted fracture proximal tibia, immobilized the patient for 10 weeks and showed bridging callus and clinical signs of union at 24 weeks. There was no secondary procedure in that patient except for delayed full weight bearing.

Iannacone WM43 reported 5 delayed unions treated with screw removal and dynamization or revision internal fixation. Danziger MB45 also reported a case of delayed union.<sup>12</sup> In the present study, there was a case of type-A3-1 fracture in which, with weight bearing, the single distal screw cut through the femoral condyles and migrated into surrounding soft tissue. The patient had restricted knee flexion because of a mechanical block and painful knee flexion. The implant was removed after the fracture had completely healed. The distal screw in the lateral soft tissue was also removed. The patient's flexion increased from 60 degrees to 80 degrees after implant removal. Gellmann RE49 reported a case of distal migration of the nail, which was due to a technical error when the distal interlocking screws missed the nail, allowing it to migrate distally. Gynning JB57 also reported a case in which the distal locking screws broke at three months, and the nail protruded in the knee joint by 2cm.

## Limitations

The limitations of the study were less sample size and

single centered study.

## CONCLUSION

To conclude from the study results, it was noted that retrograde intramedullary supracondylar nail is an ideal fixation system for distal third femoral fractures, especially the extraarticular type. The duration of operative time is decreased with reduced blood loss. Closed reduction can be attained without distressing the fracture hematoma and soft tissue. Non-union, less delayed unions, and rotational malunions were absent. Early planned surgery, closed reduction, at least two screws to each fragment, and early postoperative knee mobilization are required for proper union and knee range of motion. Therefore, the supracondylar nail is considered the best optimal tool for fractures of the femur.

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## REFERENCES

1. Wilson JN. Fractures and joint injuries. 6th ed. USA: Churchill Livingstone; 1982:1003-70.
2. Charnley J. The closed treatment of common fractures. 3rd ed. UK: Cambridge University Press;1999:197-204.
3. Petsatodis G, Chatzisyneon A, Antonarakos P, Givissis P, Papadopoulos P, Christodoulou A. Condylar buttress plate versus fixed angle condylar blade plate versus dynamic condylar screw for supracondylar intra-articular distal femoral fractures. J Orthop Surg. 2010;18(1):35-8.
4. Shin WC, Jang JH, Jung SJ, Moon NH. Advantages and limitations of intramedullary nailing for the surgical treatment of ipsilateral intertrochanteric and femoral shaft fractures: a retrospective comparative study based on propensity score matching. Eur J Trauma Emerg Surg. 2022;48(3):1779-86.
5. Rockwood CA, Green DP. Fractures in adult. J Orthop Surg. 1996;11:1972-93.
6. Gellman RE, Paiement GD, Green HD. Treatment of supracondylar femoral fractures with a retrograde intramedullary nail. CORR. 1996;332:90-7.
7. Schatzker J, Home G, Waddell J. The Toronto experience with supracondylar fractures of the femur. Injury. 1975;6:113-28.
8. Sen YR, Liv HC. Supracondylar fractures of the femur. J Trauma. 1990;30:315-9.
9. Leung KS, Shen WY, Mui LT. Interlocking intramedullary nailing for supracondylar and intercondylar fractures of the distal part of the femur. JBJS. 1991;73:332-40.
10. Gynning JB, Hanson D. Treatment of distal femoral fractures with intramedullary supracondylar nails in elderly patients. Injury. 1999;30(1):43-6.
11. Iannaccone WM, Bennett FS, DeLong WG. Initial experience with the treatment of supracondylar femoral fractures using the supracondylar nail: A Preliminary Report. J Ortho Trauma. 1994;8(4):322-7.
12. Danziger MB, Louci D, Zecher SB. Treatment of intercondylar and supracondylar distal femur fractures using the GSH supracondylar nail. Am J Orthop. 1995; 24(9):684-90.

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