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Research Article

Supracondylar Nailing In Floating Knee Injuries - A Case Series and Review of Literature

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ABSTRACT

Background: Floating knee injuries are defined as ipsilateral fractures of the femur and tibia and are frequently the result of high-energy trauma. These injuries pose substantial challenges in treatment and rehabilitation due to the complexity of associated fractures and high morbidity. This study aimed to evaluate the efficacy of supracondylar nailing for femoral shaft fractures in floating knee injuries, focusing on operative duration, intraoperative blood loss, and the benefits of a single surgical exposure.

Methods: We reviewed three cases of floating knee injuries treated with femoral supracondylar nailing and tibial intramedullary interlocking (imil) nailing. Postoperative assessments included the knee society score (kss), knee range of motion (rom), average surgical time, mean drop in hemoglobin, and fracture union.

Results: All patients underwent surgery in a single operative session. Fracture union was achieved in each case without postoperative infection. Functional outcomes were favorable, with excellent kss scores at six-month follow-up.

Conclusion: While multiple surgical techniques exist for floating knee injuries, supracondylar nailing offers a promising approach for femoral fracture management, reducing operative time, minimizing blood loss, and facilitating early mobilization through single-incision surgery.

Keywords: Floating Knee,Supracondylar Nailing ,Knee Society Score (Kss).

INTRODUCTION

Floating knee injuries involve ipsilateral fractures of both the femur and tibia. Although fractures of these long bones individually are common, simultaneous injuries to both on the same limb are less frequent. These complex injuries, often resulting from high-energy trauma such as road traffic accidents or falls, were first described by Blake and McBryde in 1975. While earlier treatment approaches included non-operative methods, these often resulted in complications such as nonunion and malalignment. Consequently, early surgical stabilization has become the standard, especially in polytrauma scenarios, to avoid systemic complications[1].

Retrograde femoral nailing provides a reliable technique for achieving early stabilization. This study investigates the outcomes of treating ipsilateral femoral and tibial fractures with retrograde femoral nailing and antegrade tibial nailing through a single knee incision[2].

Anatomy Relevant to Supracondylar Nailing in Floating Knee Injuries

Anatomy Relevant to Supracondylar Nailing

1. Distal Femur: The supracondylar region is located just above the condyles and is a common fracture site in floating knee injuries.
2. Intercondylar Notch: The entry point for supracondylar nailing lies anterior to the origin of the posterior cruciate ligament and can be accessed through a transpatellar or parapatellar approach.
3. Knee Joint Structures: The patella, patellar tendon, articular cartilage, menisci, and cruciate ligaments must be protected during surgery.

4. Neurovascular Structures: The popliteal artery and vein lie posterior to the femur, and nerves like the tibial and common peroneal are at risk during surgical procedures.
5. Femoral Canal: The medullary canal must be accurately aligned with the nail to prevent malalignment.
6. Tibial Anatomy: Proximal tibial fractures in floating knee injuries are typically fixed via antegrade IM nailing.
7. Soft Tissue Considerations: Preservation of the quadriceps mechanism, IT band, and gastrocnemius muscle is essential for optimal outcomes.
8. Radiographic Landmarks: Blumensaat's line and true AP/lateral views aid in accurate placement.

Classification

Fraser Classification of Floating Knee Injuries[8]

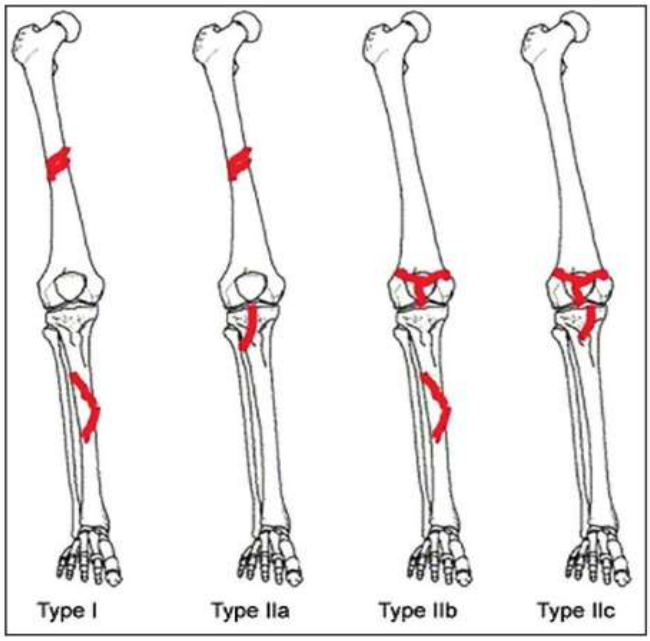
It is used to categorize the types of fractures in ipsilateral femoral and tibial shaft fractures:

Type I (Diaphyseal fractures only)

- Both femoral and tibial fractures are limited to the shaft (diaphysis).
- These are usually extra-articular fractures and represent a simpler injury pattern.

Type II (Articular involvement)

- Involves intra-articular extension of either the femur or tibia.
- Subtypes:
  - Type IIa: Intra-articular fracture of the femur.
  - Type IIb: Intra-articular fracture of the tibia.
  - Type IIc: Intra-articular fractures of both femur and tibia.



Fraser's classification

Objective

To evaluate the use of Supracondylar nails in management of floating knee injuries in terms of

1. Blood loss
2. Single Surgical exposure
3. Operative time

To evaluate the functional outcome and complications while the ipsilateral Femur and Tibial shaft fracture is treated using IMIL Nailing.

METHODS AND METHODOLOGY

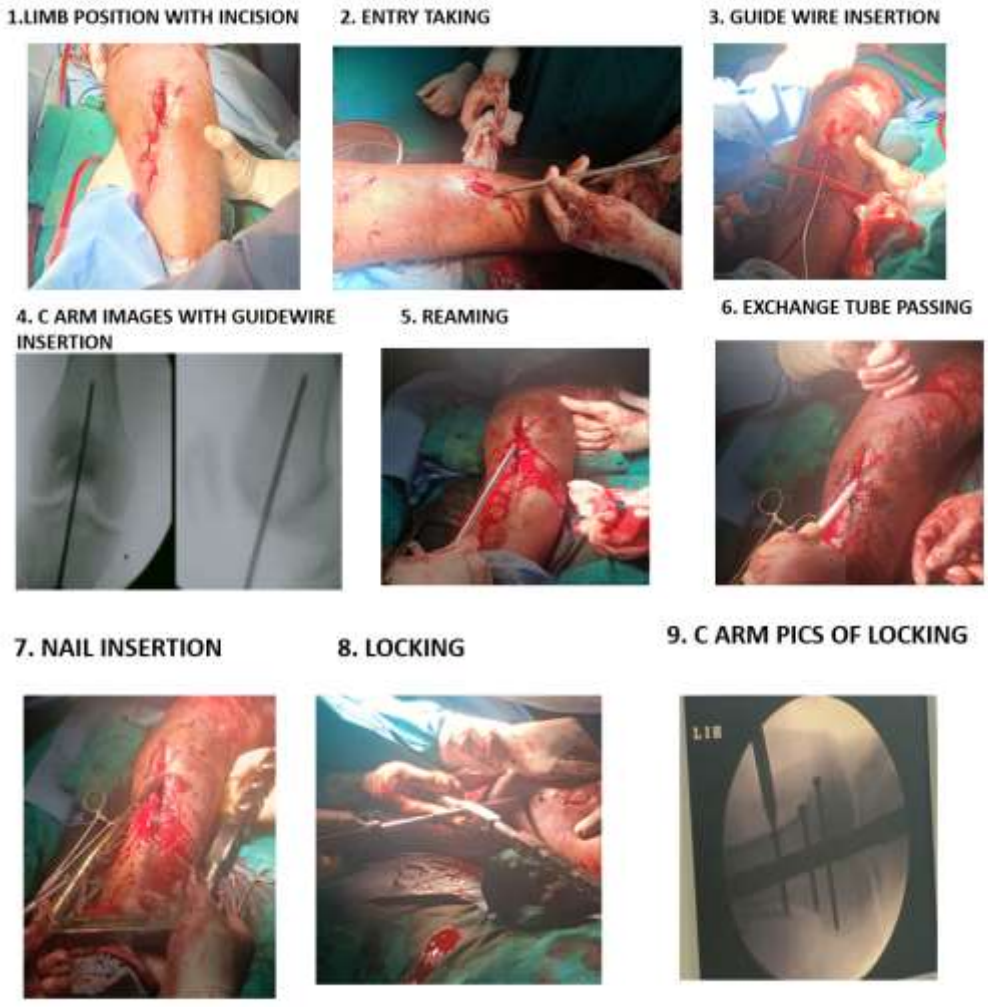
A total of 3 cases with Floating Knee injuries treated with Supracondylar nailing belonging to fraser type 1 or 2ba were included in this study. postoperatively Knee Society Score(KSS); Knee ROM; Average Surgical time; Mean drop in Hb; Average time for union were assessed and analysed.

Procedure

1. The patient was placed in the supine position on a radiolucent table, with a large triangular support positioned beneath the knee to maintain the knee in approximately

30 degrees of flexion, ensuring optimal access to the distal femur.

2. A 3-cm longitudinal incision was made approximately 1 cm medial to the medial border of the patella, beginning about 2 cm proximal to the distal pole of the patella. the incision was deepened through the subcutaneous tissue in line with the skin incision.
3. The joint capsule was identified and incised longitudinally. the underlying synovium was divided to access the intra-articular space. two hohmann retractors were placed to visualize the intercondylar notch and the posterior cruciate ligament (pcl) insertion on the lateral aspect of the medial femoral condyle.
4. Under direct visualization, a guidewire was inserted into the intercondylar notch, ensuring the entry point was just anterior to the origin of the pcl and in line with the medullary canal of the femur.
5. The guidewire position was confirmed using fluoroscopy in both anteroposterior (ap) and lateral views. once confirmed, the entry point was enlarged using an entry reamer or entry reamer system as per the nail manufacturer's protocol.
6. Sequential reaming of the femoral canal was then performed to the appropriate diameter, followed by insertion of the retrograde femoral nail over the guidewire. the nail was advanced under fluoroscopic guidance until the proximal and distal holes were aligned.
7. Distal interlocking screws were inserted through the nail using a freehand technique or targeting jig, followed by proximal interlocking screw fixation as required.
8. Final fluoroscopic images were obtained to confirm proper nail position, alignment, and fixation. the wound was irrigated, hemostasis achieved, and the capsule, subcutaneous tissue, and skin were closed in layers.



Post-Operative out Come Measurement Score
Knee Society Score

Part 1. Knee score (point)			Part 2. Function score (point)
Pain			Walking
None (50)			Unlimited (50)
Mild/occasional (45)			>10 blocks (40)
Mild (stairs only) (40)			5–10 blocks (30)
Mild (walking and stairs) (30)			<5 blocks (20)
Moderate (occasional) (20)			Housebound (10)
Moderate (continual) (10)			Unable (0)
Severe (0)			Stairs
Total range of flexion (°)			Normal up and down (50)
0–5 (1)	46–50 (10)	91–95 (19)	Normal up down with rail (40)
6–10 (2)	51–55 (11)	96–100 (20)	Up and down with rail (30)
11–15 (3)	56–60 (12)	101–105 (21)	Up with rail, down unable (15)
16–20 (4)	61–65 (13)	106–110 (22)	Unable (0)
21–25 (5)	66–70 (14)	111–115 (23)	Walking aids used
26–30 (6)	71–75 (15)	116–120 (24)	None used (0)
31–35 (7)	76–80 (16)	121–125 (25)	Use of cane/walking stick deduct (–5)
36–40 (8)	81–85 (17)		Two canes/sticks (–10)
41–45 (9)	86–90 (18)		Crutches or frame (–20)
Flexion contracture (if present) (°)			Final knee score is:
5–10 (–2)			Grading for the KSS
10–15 (–5)			Excellent (80–100)
16–20 (–10)			Good (70–79)
>20 (–15)			Fair (60–69)
Alignment (varus & valgus) (°)			Poor (<60)
0 (–15)	11 (–3)		
1 (–12)	12 (–6)		
2 (–9)	13 (–9)		
3 (–6)	14 (–12)		
4 (–3)	15 (–15)		
5–10 (0)	Over 15 (–20)		
Stability (maximum movement in any position)			
Anteroposterior (mm)			
<5 (10)			
5–10 (5)			
10+ (0)			
Mediolateral (°)			
<5 (15)			
6–9 (10)			
10–14 (5)			
15 (0)			

Case Discussion

Case 1: A 22 Year Male with History of Rta Hit By A 4wheeler Has Sustained Injury To Right Lowerlimb Diagnosed As Right Floating Knee

Preop x Rays

Postop X Rays

Followup X Rays and Clinical Pics at 6 Months

Kss Score: Excellent
Knee Rom: 0-120 Degrees
Surgery Time: 2hr 30 Mins
Drop In Hb%: 2mg/Dl
Duration Of Hospital Stay: 5 Days
Fracture Union:United
Complications:Nil

Case 2: A 36y/M with History of Rta Hit By 4 Wheeler Sustained Injury To Right Lowelimb Diagnosed As Right Floating Knee

Preop x ray

Postop x Rays

Followup at 6 Months
Kss Score: Excellent
Knee Rom: 0-110 Degrees
Surgery Time: 3hr 30 Mins
Drop In Hb%: 2.5 Mg/Dl
Duration of Hospital Stay: 8 Days

Fracture Union:United
Complications:Nil

Case 3: A 55y/M with H/O Rta Hit By 4 Wheeler Diagnosed As Left Floating Knee Preop X Rays

Postop X Rays

Followup at 6 Months
Kss Score: Excellent
Knee Rom: 0-115 Degrees
Surgery Time: 3hr
Drop In Hb%: 2.5 Mg/Dl
Duration Of Hospital Stay: 7 Days
Fracture Union:United
Complications:Nil

Observations and Results

Parameter	Case 1	Case 2	Case 3
KSS Score	Excellent	Excellent	Excellent
Knee ROM	0–120 degrees	0–110 degrees	0–115 degrees
Surgery Duration	2 hrs 30 mins	3 hrs 30 mins	3 hrs
Drop in Hemoglobin	2 mg/dL	2.5 mg/dL	2.5 mg/dL
Hospital Stay	5 days	8 days	7 days
Fracture Union	United	United	United
Complications	None	None	None

Parameter	Mean Value
Knee Society Score	Excellent (all cases)
Knee ROM	0–115 degrees
Surgery Duration	3 hours
Hemoglobin Drop	2.33 mg/dL
Hospital Stay Duration	6.67 days (~7 days)

Fracture Union	United (all cases)
Complications	None (in all cases)

Observations

1. **Functional Outcome**
   All three patients achieved an Excellent Knee Society Score, suggesting favorable early functional outcomes postoperatively**.**
2. **Knee Range of Motion (ROM)**
   ROM ranged from 0–110° to 0–120°, indicating good recovery of joint mobility, with Case 1 showing the highest ROM and Case 2 the lowest.
3. **Surgical Duration**
   Surgical time varied slightly, with Case 1 being the shortest (2.5 hrs) and Case 2 the longest (3.5 hrs), possibly reflecting intraoperative complexity.
4. **Hemoglobin Drop**
   Minor variation was observed in blood loss, with a slight increase in Cases 2 and 3 (2.5 mg/dL) compared to Case 1 (2 mg/dL), but still within acceptable perioperative limits**.**
5. **Hospital Stay**
   Duration of hospitalization ranged from 5 to 8 days, with Case 2 requiring the longest stay.
6. **Fracture Healing and Complications**
   All cases showed successful union without any postoperative complications, highlighting effective surgical and postoperative management.

DISCUSSION

Functional Outcome

In our study, all three patients achieved excellent postoperative Knee Society Scores (KSS), aligning with the findings of Rethnam et al. In their prospective study involving 29 patients with floating knee injuries, Rethnam et al[1]. reported outcomes assessed using the Karlström criteria: 15 patients had excellent results, 11 had good, 1 had acceptable, and 3 had poor outcomes. This indicates that approximately 52% of patients achieved excellent functional outcomes, which is consistent with our results.

Knee Range of Motion

In our study, all patients achieved a postoperative knee range of motion (ROM) between 0° to 110°–120°, indicating excellent functional recovery. These results are in line with previous literature.

Rethnam et al[1]. reported that patients treated operatively for floating knee injuries showed satisfactory knee function, with the majority regaining a knee ROM >90°, especially when early mobilization was initiated and joint surfaces were preserved . They emphasized that preservation of the articular surfaces, early physiotherapy, and stable fixation were critical to restoring joint function.

Other studies also highlight similar outcomes. Fraser et al[8]. Found that achieving at least 90° of ROM was a reliable predictor of good to excellent long-term function in floating knee injuries .

Thus, the knee ROM achieved in our case series aligns well with these findings, suggesting that supracondylar nailing, along with early rehabilitation, effectively restores knee mobility in such complex injuries.

Surgical Duration

In our case series, the surgical duration ranged from 2 hours 30 minutes to 3 hours 30 minutes, which is consistent with findings from prior studies on floating knee management using intramedullary fixation techniques.

Rethnam et al[1]. Reported average surgical durations of approximately 3 to 4 hours depending on fracture complexity and whether both femoral and tibial fractures were addressed in a single-stage procedure. The time was longer in cases with intra-articular involvement or soft tissue complications.

Similarly, Singh et al[3]. noted a mean operative time of 3.2 hours for floating knee injuries treated with a combination of retrograde femoral and antegrade tibial nailing, highlighting that operative time was influenced by the approach, fracture type, and surgical experience .

Our surgical durations, being on the shorter end of this spectrum, may reflect prompt surgical intervention, the use of standardized protocols, and efficient intraoperative coordination.

Heamoglobin Drop

In our study, the postoperative hemoglobin drop ranged between 2.0 to 2.5 g/dL, which reflects a moderate level of intraoperative blood loss. This is consistent with findings from prior studies involving surgical management of floating knee injuries.

Rethnam et al[1]. Reported an average hemoglobin drop of approximately 2.8 g/dL, particularly in cases involving comminuted fractures or prolonged surgical times. Blood loss was attributed to the complexity of managing

both femoral and tibial fractures simultaneously and the extensive soft tissue handling required. In another study, Kaushik et al[4]. Observed hemoglobin reductions of 2–3.5 g/dL in patients undergoing intramedullary nailing for floating knee injuries, noting that retrograde nailing of the femur coupled with early fixation of the tibia helped reduce operative blood loss.

The relatively lower hemoglobin drop in our series may be attributed to efficient surgical technique, timely intervention, and the absence of major intraoperative complications.

Duration of Hospital Stay

In our study, the hospital stay ranged from 5 to 8 days, reflecting smooth postoperative recovery without complications. These findings are in line with previously published data on floating knee injuries managed surgically.

Rethnam et al[1]. Reported an average hospital stay of 10–14 days, with longer durations noted in patients with open fractures, associated injuries, or complications such as infections and delayed mobilization .Their findings emphasize that early definitive fixation and rehabilitation can significantly reduce hospital stay.

Bansal et al[5]. also observed that patients who underwent early surgical fixation and had no postoperative complications were typically discharged within 7–10 days, supporting our outcomes and suggesting that supracondylar nailing in isolated, uncomplicated floating knee injuries can lead to earlier discharge .

The shorter hospitalization in our patients can be attributed to timely surgical intervention, absence of complications, and adherence to early mobilization protocols.

Fracture Healing and Complications

In our case series, all fractures united successfully without any reported complications such as infection, non-union, or implant failure. This aligns well with existing literature emphasizing the effectiveness of supracondylar nailing in achieving stable fixation and promoting timely fracture healing in floating knee injuries.

Rethnam et al[1]. Reported a union rate of approximately 90%, with non-union and infection rates below 10% when stable fixation and early mobilization were ensured. They highlighted that complications were more common in open fractures and cases with delayed surgery.

Similarly, Haddad et al[6]. Observed complication rates around 15%, mostly related to surgical site infections and delayed union, which were minimized by meticulous surgical technique and postoperative care

Our complication-free outcomes may reflect careful patient selection, prompt surgical intervention, and adherence to aseptic and rehabilitation protocols.

CONCLUSION

In this case series, supracondylar nailing demonstrated excellent functional outcomes, as evidenced by high Knee Society Scores and satisfactory knee range of motion in all patients. The surgical duration and intraoperative blood loss were within acceptable limits, contributing to relatively short hospital stays and uncomplicated recoveries. All fractures united successfully without any complications, underscoring the effectiveness and safety of this fixation method in managing floating knee injuries. These findings align with existing literature, reinforcing the role of timely surgical intervention, stable fixation, and early rehabilitation in optimizing patient outcomes. Further studies with larger sample sizes are recommended to validate these results.

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