Section: Orthopaedics

Original Research Article

ASSESSMENT OF FUNCTIONAL OUTCOME OF FLOATING KNEE INJURIES WITH SURGICAL MANAGEMENT

Hitesh Ranasaria[1], Arjun Jain[2], Neeraj Jain[3], Chayan Jain[4]

[1]*Post-graduate resident, Department of Orthopaedics, Sri Aurobindo Institute of Medical Sciences, Indore, M.P., India.*
[2]*Professor, Department of Orthopaedics, Sri Aurobindo Institute of Medical Sciences, Indore, M.P., India.*
[3]*Associate Professor, Department of Orthopaedics, Sri Aurobindo Institute of Medical Sciences, Indore, M.P., India.*
[4]*Post-graduate resident, Department of Orthopaedics, Sri Aurobindo Institute of Medical Sciences, Indore, M.P., India.*

Received *: 19/05/2025*
Received in revised form *: 04/07/2025*
Accepted *: 27/07/2025*

Corresponding Author:
Dr. Hitesh Ranasaria,
Post-graduate resident, Department of Orthopaedics, Sri Aurobindo Institute of Medical Sciences, Indore, M.P., India.
Email: hitesh02031996@gmail.com

DOI: 10.70034/ijmedph.2025.3.210

Source of Support: Nil,
Conflict of Interest: None declared

Int J Med Pub Health
2025; 15 (3); 1135-1139

ABSTRACT

Background: Floating knee injuries—ipsilateral fractures of the femur and tibia—are complex, high-energy trauma events with significant morbidity. This study aims to evaluate the functional outcome of surgically managed floating knee injuries using Karlstrom and Olerud scoring.

Materials and Methods: A prospective study of 30 patients with floating knee injuries treated surgically at a tertiary centre was conducted. Patients were classified based on Fraser's system. Functional outcome was assessed at follow-up at 4 weeks/3 months and 6 months using the Karlstrom and Olerud criteria.

Results: Of the 30 patients studied, 60% had excellent to good functional outcomes based on the Karlstrom and Olerud scoring system. The most common cause of injury was road traffic accidents (86.6%), with Type I Fraser fractures being most frequent (46.6%). Post-operative complications were seen in 53.4% of patients, with infection (20%) and joint stiffness (16.6%) being the most common.

Conclusion: Surgical management of floating knee injuries, particularly early fixation using intramedullary nails, yields favourable outcomes. Complication rates are lower when treatment is tailored to fracture type and soft tissue condition.

Keywords: Floating knee, femur fracture, tibia fracture, surgical fixation, functional outcome, Karlstrom and Olerud score.

INTRODUCTION

Floating knee injuries represent a severe form of musculoskeletal trauma characterized by ipsilateral fractures of the femur and tibia, often resulting from high-energy mechanisms such as road traffic accidents (RTAs) or falls from height. These injuries were first described by Blake and McBryde in 1975, who emphasized the complexity involved in diagnosis, stabilization, and definitive treatment.

The clinical significance of floating knee injuries lies in their association with multiple systemic injuries, open fractures, soft tissue trauma, and potential complications such as fat embolism, compartment syndrome, deep vein thrombosis, and infection. The injury compromises limb alignment, disrupts vascular and neurological structures, and has a significant impact on mobility and quality of life.

Fraser's classification divides floating knee injuries into four types

- Type I: Diaphyseal fractures of both femur and tibia
- Type II a: Tibial intra-articular + femoral diaphyseal
- Type II b: Femoral intra-articular fracture + tibial diaphyseal
- Type II c: Both intra-articular fractures

This classification guides management and helps predict prognosis.

Treatment has evolved from conservative traction-based approaches to surgical stabilization, which allows early mobilization, reduces hospital stay, and improves long-term function. However, the functional outcome depends on multiple factors—fracture type, fixation method, timing of surgery, associated injuries, and post-operative rehabilitation.

This study evaluates the functional outcomes of floating knee injuries managed surgically, using the Karlstrom and Olerud score, and analyzes associations between fracture patterns, treatment methods, and complications.

MATERIALS AND METHODS

Study Design and Duration

This prospective observational study was conducted at Sri Aurobindo Medical College and PG Institute, Indore, MP, within the Department of Orthopaedics over 18 months from June 2023 to November 2024.

Inclusion Criteria

- Patients aged ≥18 years
- Radiologically confirmed ipsilateral fractures of femur and tibia
- Underwent definitive surgical fixation

Exclusion Criteria

- Polytrauma with head/spinal injuries requiring prolonged intensive care
- Pathological fractures
- Non-surgical management
- Lost to follow-up

Pre-operative Management

On admission, each patient underwent initial trauma assessment and resuscitation following ATLS guidelines. In cases of open fractures, immediate management included thorough debridement, administration of antibiotics, and application of temporary external fixation when necessary. Definitive surgical fixation was carried out once the patient achieved hemodynamic stability and the soft tissue condition was deemed suitable for operative intervention.

Surgical Procedures

The majority of patients with diaphyseal fractures underwent intramedullary nailing, utilizing antegrade interlocking nails for both the femur and tibia. For fractures involving the joint surfaces, fixation was achieved using distal femur locking plates or tibial plateau buttress plates. In cases with severe contamination or hemodynamic instability, temporary stabilization was provided with external fixators.

Post-operative Protocol

Early mobilization was encouraged, with knee range of motion exercises beginning within 1–2 weeks post-op in stable cases. Weight-bearing was delayed until radiographic evidence of callus formation appeared.

Outcome Assessment

Patients were followed up at 4 weeks, 3 months, and 6 months. Functional outcomes were assessed using the **Karlstrom and Olerud score**, which considers:

- Pain
- Gait
- Range of movement at the knee and hip
- Muscle wasting
- Return to previous activity level

Scores were classified as:

- Excellent
- Good
- Acceptable
- Poor

Data Analysis

The findings were entered into an MS Excel spreadsheet, and statistical analysis was carried out using Epi Info ™. Mean, mode and median were obtained and p-value less than 0.05 was deemed significant.

RESULTS

The present prospective interventional study titled "ASSESSMENT OF FUNCTIONAL OUTCOME OF FLOATING KNEE INJURIES WITH SURGICAL MANAGEMENT" was conducted in Department of Orthopaedics, at Sri Aurobindo Medical College and PG Institute, Indore, (M.P) on 30 patients who attended the emergency or OPD at Sri Aurobindo Hospital and qualified the inclusion criterion were enrolled for the study. All the patients were operated under suitable anaesthesia. Fractures were classified using, Gustilo Anderson and Fraser classification system.

Definitive fixation was done using nail-nail or nail-plate combination. Intra-articular fractures were fixed using open reduction and plating whereas, Extra articular fractures were fixed using intramedullary nailing and if needed plating. Patients were followed at 4 weeks/ 3 months /6 months and at final follow up functional score was evaluated by the Karlstrom and Olerud grading system.

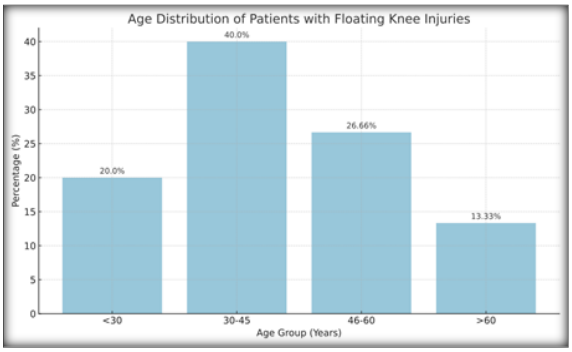

Figure 1: Distribution on basis of Age groups

Table 1 shows that the majority of patients in the study were between 30 and 45 years of age, accounting for 40% (n=12) of the total 30 cases. This was followed by patients in the 46–60year age group, who constituted 26.66% (n=8), while 20% (n=6) were under 30 years of age. Only 13.33% (n=4) of patients were above 60 years. [Table 1]

Table 2 presents the distribution of cases based on Fraser's classification of floating knee injuries. Among the total cases, Type I and Type II b were the most common, each accounting for 30% of the cases (9 patients each). Type II a was observed in 26.66% of cases (8 patients), while Type II c was the least frequent, seen in 5 cases, comprising 16.66% of the total. [Table 2]

Table 3 shows the distribution of patients based on the time of surgical fixation. A majority of the patients (60%, n=18) underwent fixation after 7 days of injury, while 40% (n=12) received surgical fixation within 7 days. [Table 3]

Table 4 shows the outcomes of patients according to the Karlstrom and Olerud scoring system. Out of a total of 30 patients, 6 patients (20%) had an excellent outcome, out of which 4 were operated within 7 days of injury. 12 patients (40%) had a good result, out of which 7 were operated within 7 days of injury. 8 patients (26.66%) had an acceptable outcome, out of which 1 was operated within 7 days of injury, and 4 patients (13.33%) had a poor outcome. Overall, the majority of patients (60%) had either excellent or good results, indicating a generally favourable response to the treatment. [Table 4]

Table 5 shows the distribution of post-operative complications among the study participants. Out of the 30 patients evaluated, 6 (20%) experienced infection, making it the most common complication. Joint stiffness was the next most frequent issue, observed in 5 patients (16.66%). Less common complications included malunion of the femur in 2 patients (6.66%), and limb length discrepancy, neurovascular injury, and malunion of the tibia, each occurring in 1 patient (3.33%). Notably, 14 patients (46.6%) did not report any complications, indicating a favourable post-operative outcome in nearly half of the cases. [Table 5]

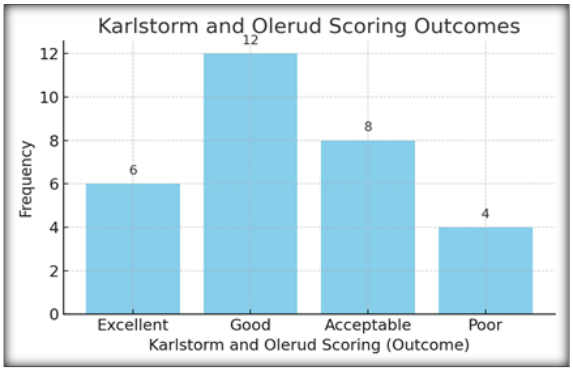

Figure 2: Distribution on Basis of Karlstrom and Olerud Scoring

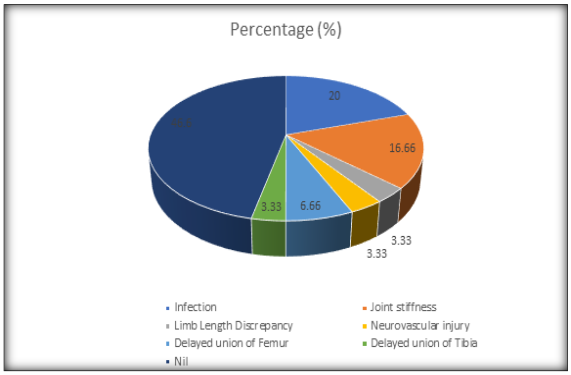

Figure 3: Distribution based on Complications

Table 1: Distribution on basis of Age groups

Age (in years)	Frequency	Percentage (%)
<30	6	20
30-45	12	40
46-60	8	26.66
>60	4	13.33
Total	30	100

Table 2: Distribution on Basis of Fraser's Classification

Fraser's Type	Frequency	Percentage (%)
Type I	9	30
Type II a	8	26.66
Type II b	9	30
Type II c	5	16.66

Table 3: Distribution on Basis of Fixation time

Fixation Time	Frequency	Percentage (%)
Within 7 days	12	40
After 7 days	18	60

Table 4: Distribution based on Karlstrom and Olerud Scoring

Karlstrom and Olerud Scoring (outcome).	Frequency	Percentage (%)
Excellent	6	20
Good	12	40
Acceptable	8	26.66
Poor	4	13.33
Total	30	100

Table 5: Distribution based on Complications

Complications	Frequency	Percentage (%)
Infection	6	20
Joint stiffness	5	16.66
Limb Length Discrepancy	1	3.33

Neurovascular injury	1	3.33
Delayed union of Femur	2	6.66
Delayed union of Tibia	1	3.33
Nil	14	46.6
Total	30	100

DISCUSSION

Floating knee injuries, defined as ipsilateral fractures of the femur and tibia, are complex and often associated with significant soft tissue damage, open wounds, and polytrauma. Our study observed that the majority of patients were young males involved in high-energy road traffic accidents, which is consistent with global trends reported in multiple studies. [1-3]

The Fraser classification continues to be an effective tool in predicting functional outcomes. We found that Type I injuries, which are limited to diaphyseal fractures, had significantly better outcomes compared to Type II injuries that involve the knee joint. This is in line with previous findings by Fraser et al. and Behr et al., who reported higher complication rates and poorer outcomes in intra-articular fractures. [4-6]

Surgical Management Strategies

Intramedullary (IM) nailing was the most commonly employed surgical modality in our study (70%) due to its biomechanical stability and minimal soft tissue disruption. Studies by Gregory et al. and Delee et al. have demonstrated that IM nailing for both bones leads to early mobilization, shorter hospital stays, and lower rates of infection compared to plating or external fixation. [7-9]

In cases involving articular surfaces (Type IIa, IIb, IIc), plating was necessary for anatomical reduction. While plating provides rigid fixation, it increases the surgical exposure and potential for soft tissue complications. These patients also had delayed mobilization, which contributed to a higher incidence of knee stiffness and functional limitation.

Our use of temporary external fixation in open and contaminated fractures aligns with protocols recommended by Gustilo and Anderson for managing open injuries and avoiding infection.10 Patients stabilized with external fixators were converted to definitive fixation after wound control, and this two-stage approach minimized the risk of deep infections.

Functional Outcome Analysis

The Karlstrom and Olerud score remains a comprehensive tool for evaluating post-operative function. In our study, 60% of patients achieved excellent or good outcomes, comparable to previous studies by Yadav et al. and Lahrach et al, who reported similar success rates when early definitive fixation was achieved.[11,12]

We observed a clear association between early surgical intervention and favourable outcomes. Patients who underwent fixation within 7 days of injury demonstrated faster union, less stiffness, and a quicker return to work. Delayed fixation, especially in open fractures or those requiring secondary procedures, was associated with complications like delayed union and reduced range of motion.

Our results align with Aher et al., who concluded that Fraser Type I injuries managed with IM nailing show superior functional recovery compared to articular types.[13] Similarly, Schiedt's et al. emphasized the importance of early rehabilitation in avoiding long-term stiffness, which our study supports.[14]

In contrast, a study by Nouraei et al. reported a higher infection rate in patients managed with open reduction and plating, which reinforces the need for careful surgical planning and soft tissue management.[15]

CONCLUSION

Floating knee injuries, typically resulting from high-energy trauma, are complex and demand individualized, timely surgical management. In this prospective study of 30 patients, early surgical intervention, particularly using intramedullary nailing for diaphyseal fractures, demonstrated favourable functional outcomes, with 60% of patients achieving excellent to good scores on the Karlstrom and Olerud scale. The most common complications observed were infection and joint stiffness, though nearly half of the patients (46.6%) had no postoperative complications, highlighting the benefits of proper surgical planning and early mobilization. Fraser Type I injuries, involving extra-articular fractures, had better outcomes compared to articular types.

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