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OUTCOME OF OPERATED PATIENTS PRESENTING WITH FLOATING KNEE INJURIES AT A TERTIARY CARE HOSPITAL, KARACHI

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Abstract

Objective: *To evaluate the epidemiology, management strategies, and functional outcomes of floating knee injuries in a tertiary care hospital setting.*

Place and Duration of Study: *Department of Orthopedics, JPMC, Karachi for a duration of six months after approval of synopsis.*

Methodology: *A total of 63 patients with floating knee injuries were included. Patient demographics, injury mechanisms, surgical interventions, and functional outcomes were analyzed. Fraser's classification was used to categorize injuries, and Karlström and Olerud criteria assessed postoperative recovery. Fixation methods for femur and tibia fractures included intramedullary nailing, plate fixation, and external fixation. Early and late complications, weight-bearing status, range of motion, and radiological union at six months were evaluated. Data were analyzed using descriptive statistics.*

Results: *The majority of patients (42.9%) were aged 15-30 years, with male predominance (77.8%). Road traffic accidents were the leading cause (65.1%). Type I fractures were most common (39.7%), and intramedullary nailing was the preferred fixation method for femur (60.3%) and tibia (55.6%). Early complications occurred in 30.2% of patients, including infection (11.1%) and non-union (9.5%). At six months, 50.8% achieved a normal gait, 61.9% had complete radiological union, and 34.9% showed good functional outcomes.*

Conclusion: *Floating knee injuries primarily affect young males due to high-energy trauma. Early surgical intervention and appropriate fixation methods improve functional outcomes. However, complications remain significant, necessitating improved trauma care and rehabilitation services, particularly in resource-limited settings like Pakistan.*

INTRODUCTION

Floating knee injuries, characterized by simultaneous fractures of the femur and tibia in the same limb, are complex orthopedic traumas often resulting from high-energy impacts such as road traffic accidents and falls from height[1]. These injuries pose significant challenges in terms of management, rehabilitation,

and long-term functional outcomes. Globally, the incidence of floating knee injuries has increased due to rising urbanization and motor vehicle usage, with studies highlighting a substantial association with polytrauma and poor prognostic factors[2,3]. In developing countries, including Pakistan, where road safety regulations are inconsistently enforced and emergency trauma care remains under-resourced, such injuries are frequently encountered in tertiary care hospitals, often with delayed presentations and increased complications[4].

Management strategies for floating knee injuries vary depending on fracture pattern, soft tissue involvement, and patient condition, with treatment modalities ranging from external fixation to definitive internal fixation using intramedullary nails or plates[5]. Several studies have emphasized the importance of early stabilization in improving outcomes; however, the prognosis remains influenced by factors such as fracture type, associated injuries, and rehabilitation access[6]. The Karlström and Olerud classification system remains a widely used tool for assessing functional outcomes in these patients, offering a standardized approach to evaluating pain, mobility, and work limitations[7,8].

While international literature has extensively examined the outcomes of floating knee injuries, there is a paucity of data from Pakistan regarding the epidemiology, management trends, and post-surgical functional recovery of these patients.

Given the increasing burden of trauma-related orthopedic injuries in Pakistan, particularly in urban centers like Karachi, where high-speed vehicular accidents are a leading cause, understanding the clinical course and functional recovery of operated patients with floating knee injuries is crucial. This study aims to evaluate the outcomes of surgically managed floating knee injuries at a tertiary care hospital in Karachi, using the Karlström and Olerud criteria, to provide valuable insights into treatment efficacy, functional rehabilitation, and potential areas for improvement in trauma care.

Methodology:

This descriptive study was conducted at the Department of Orthopedics, Jinnah Postgraduate Medical Centre (JPMC), Karachi over a period of six months following approval of the synopsis from the College of Physicians and Surgeons Pakistan (CPSP).

The sample size was calculated using the prevalence of functional impairment in floating knee injuries reported in a recent international study. According to a study by Minoda et al. (2023)[9], the incidence of poor functional outcomes following surgical treatment was 40% (p = 0.40). Using WHO sample size calculator, with a 95% confidence level and 5% margin of error, the required sample size was estimated to be 63 patients.

A non-probability consecutive sampling technique was used to include patients who met the eligibility criteria. All patients undergoing surgical treatment for floating knee injuries at JPMC during the study period were enrolled after obtaining informed consent.

Patients aged 15 to 60 years, presenting with floating knee injuries, undergoing surgical management, and completing at least six months of follow-up at JPMC were included in the study.

Patients with polytrauma, pathological fractures, multiple limb injuries, previous orthopedic surgeries, pre-existing neuromuscular disorders, or lost to follow-up were excluded from the study.

Demographic and clinical characteristics were recorded, including age, gender, comorbidities (diabetes, hypertension, dyslipidemia, smoking status), mechanism of injury, fracture type (open/closed), Fraser classification, time to surgery, fixation method, and postoperative complications. Functional outcomes were assessed at six months post-surgery using the Karlström and Olerud criteria, which evaluate pain, gait, muscle atrophy, range of motion, and work limitations.

The Karlström and Olerud criteria were used to assess functional outcomes in patients with floating knee injuries. These criteria evaluate multiple parameters, including pain, gait, muscle atrophy, range of motion, and work limitations. Pain was classified as normal in the absence of discomfort, while mild and severe pain were considered abnormal. Gait assessment categorized normal walking as a favorable outcome, whereas moderate difficulty and a severe limp were classified as abnormal. Radiological union was evaluated based on healing, with complete union considered normal, while delayed union and non-union were categorized

as abnormal. Muscle atrophy was measured in centimeters, with less than 1 cm classified as normal, while atrophy between 1 to 2 cm and greater than 2 cm were considered abnormal. Based on these parameters, functional outcomes were categorized as excellent or good for favorable cases, while fair and poor outcomes were classified as unfavorable.

Data were analyzed using SPSS version 26 (IBM, USA). Continuous variables were presented as mean ± standard deviation (SD), while categorical variables were presented as frequencies and percentages. The chi-square test was applied for categorical variables, and the independent t-test was used for continuous variables. A p-value ≤ 0.05 was considered statistically significant. 95% confidence intervals (CIs) were reported for all significant findings.

Results:

A total of 63 patients with floating knee injuries were included in the study. The majority of patients (27, 42.9%) were between 15-30 years, followed by 31-45 years (18, 28.6%), 46-60 years (12, 19.0%), and above 60 years (6, 9.5%). Males accounted for 49 (77.8%) cases, while females were 14 (22.2%). Right-sided injuries were observed in 37 (58.7%) patients, while left-sided injuries were present in 26 (41.3%). Among comorbid conditions, diabetes mellitus type 2 was found in 19 (30.2%) patients, hypertension in 22 (34.9%), and dyslipidemia in 17 (27.0%). Regarding smoking status, 30 (47.6%) patients had never smoked, 18 (28.6%) were past smokers, and 15 (23.8%) were current smokers.

The most common mechanism of injury was road traffic accidents in 41 (65.1%) patients, followed by falls from height in 12 (19.0%), direct trauma in 7 (11.1%), and other causes in 3 (4.8%). According to Fraser's classification, Type I fractures were found in 25 (39.7%) patients, Type II in 18 (28.6%), Type III in 12 (19.0%), and Type IV in 8 (12.7%). Open fractures were present in 27 (42.9%) cases, while 36 (57.1%) had closed fractures. Among open fractures, 10 (37.0%) were classified as Type I, 9 (33.3%) as Type II, and 8 (29.7%) as Type III based on the Gustilo-Anderson classification. The time from injury to surgery was less than 6 hours in 22 (34.9%) patients, between 6-24 hours in 28 (44.4%), and more than 24 hours in 13 (20.6%). Preoperatively, 48 (76.2%) patients were hemodynamically stable, whereas 15 (23.8%) were unstable.

The femur fracture was treated using intramedullary nailing in 38 (60.3%) patients, external fixation in 14 (22.2%), and plate fixation in 11 (17.5%). The tibia fracture was fixed using intramedullary nailing in 35 (55.6%) cases, external fixation in 16 (25.4%), and plate fixation in 12 (19.0%). Bone grafting was required in 19 (30.2%) cases, while 44 (69.8%) patients did not require a graft. The surgical approach was minimally invasive in 33 (52.4%) cases and open surgery in 30 (47.6%). The duration of surgery was less than 2 hours in 21 (33.3%) patients, between 2-4 hours in 29 (46.0%), and more than 4 hours in 13 (20.6%). Intraoperative blood transfusion was required in 24 (38.1%) patients, while 39 (61.9%) did not require transfusion. Postoperative ICU admission was necessary in 17 (27.0%) cases, whereas 46 (73.0%) patients did not require ICU care.

Early postoperative complications were observed in 19 (30.2%) cases, with infection occurring in 7 (11.1%), non-union in 6 (9.5%), and malunion in 6 (9.5%). Late complications within six months were reported in 16 (25.4%) patients, including implant failure in 5 (7.9%), joint stiffness in 6 (9.5%), and chronic pain in 5 (7.9%). At six weeks, 28 (44.4%) patients were non-weight bearing, 21 (33.3%) were partial weight bearing, and 14 (22.2%) achieved full weight bearing. Knee flexion range of motion at three months was less than 60° in 15 (23.8%) patients, between 60°-90° in 27 (42.9%), and more than 90° in 21 (33.3%). At six months, normal gait was observed in 32 (50.8%) patients, limping in 21 (33.3%), and 10 (15.9%) required a walking aid. Radiological union was complete in 39 (61.9%) cases, delayed in 16 (25.4%), and non-union was observed in 8 (12.7%).

Based on Karlström and Olerud criteria, 26 (41.3%) patients reported no pain, 25 (39.7%) had mild pain, and 12 (19.0%) had severe pain. No difficulty in walking was reported in 28 (44.4%) patients, while 23 (36.5%) had moderate difficulty, and 12 (19.0%) had a severe limp. Climbing stairs was unrestricted in 30 (47.6%) cases, required support in 22 (34.9%), and was impossible in 11 (17.5%). Resumption of previous sports was possible in 27 (42.9%) cases, while 25 (39.7%) could engage in limited sports, and

11 (17.5%) were unable to participate. Work limitations were absent in 31 (49.2%) patients, moderate in 21 (33.3%), and severe in 11 (17.5%). The skin condition was normal in 38 (60.3%) patients, showed color changes in 17 (27.0%), and developed ulcers or fistulae in 8 (12.7%). No deformity was observed in 37 (58.7%) cases, while 17 (27.0%) had mild deformity and 9 (14.3%) had severe deformity. Muscle atrophy of less than 1 cm was found in 34 (54.0%) patients, while 17 (27.0%) had atrophy between 1-2 cm, and 12 (19.0%) had atrophy greater than 2 cm.

The overall functional outcome based on Karlström and Olerud scoring was excellent in 19 (30.2%) patients, good in 22 (34.9%), moderate in 12 (19.0%), fair in 6 (9.5%), and poor in 4 (6.3%).

Table 1: Demographic and Clinical Characteristics of Patients

Variable	Number (%)
Age Group (years)	
15-30	27 (42.9%)
31-45	18 (28.6%)
46-60	12 (19.0%)
>60	6 (9.5%)
Gender	
Male	49 (77.8%)
Female	14 (22.2%)
Side of Injury	
Right	37 (58.7%)
Left	26 (41.3%)
Comorbid Conditions	
Diabetes Mellitus Type 2	19 (30.2%)
Hypertension	22 (34.9%)
Dyslipidemia	17 (27.0%)
Smoking Status	
Never Smoked	30 (47.6%)
Past Smoker	18 (28.6%)
Current Smoker	15 (23.8%)

Table 2: Injury and Surgical Details

Variable	Number (%)
Mechanism of Injury	
Road Traffic Accident	41 (65.1%)
Fall from Height	12 (19.0%)
Direct Trauma	7 (11.1%)
Other Causes	3 (4.8%)
Fracture Classification	
Fraser Type I	25 (39.7%)
Fraser Type II	18 (28.6%)

Variable	Number (%)
Fraser Type III	12 (19.0%)
Fraser Type IV	8 (12.7%)
Fracture Type	
Open Fracture	27 (42.9%)
Closed Fracture	36 (57.1%)
Time to Surgery	
<6 hours	22 (34.9%)
6-24 hours	28 (44.4%)
>24 hours	13 (20.6%)
Preoperative Stability	
Hemodynamically Stable	48 (76.2%)
Unstable	15 (23.8%)

Table 3: Surgical Procedures and Postoperative Outcomes

Variable	Number (%)
Femur Fracture Fixation	
Intramedullary Nailing	38 (60.3%)
External Fixation	14 (22.2%)
Plate Fixation	11 (17.5%)
Tibia Fracture Fixation	
Intramedullary Nailing	35 (55.6%)
External Fixation	16 (25.4%)
Plate Fixation	12 (19.0%)
Bone Grafting	
Required	19 (30.2%)
Not Required	44 (69.8%)
Surgical Approach	
Minimally Invasive	33 (52.4%)
Open Surgery	30 (47.6%)
Postoperative ICU Admission	
Required	17 (27.0%)
Not Required	46 (73.0%)

Table 4: Functional and Clinical Outcomes

Variable	Number (%)
Postoperative Complications	
Infection	7 (11.1%)
Non-union	6 (9.5%)

Variable	Number (%)
Malunion	6 (9.5%)
Weight Bearing at 6 Weeks	
Non-weight bearing	28 (44.4%)
Partial weight bearing	21 (33.3%)
Full weight bearing	14 (22.2%)
Gait at 6 Months	
Normal	32 (50.8%)
Limping	21 (33.3%)
Required Walking Aid	10 (15.9%)
Radiological Union	
Complete	39 (61.9%)
Delayed	16 (25.4%)
Non-union	8 (12.7%)
Overall Functional Outcome (Karlström and Olerud Score)	
Excellent	19 (30.2%)
Good	22 (34.9%)
Moderate	12 (19.0%)
Fair	6 (9.5%)
Poor	4 (6.3%)

Table 5: Karlström and Olerud Criteria for Functional Outcome Evaluation

Category	Criteria	Number (%)
Pain	No Pain	26 (41.3%)
	Mild Pain	25 (39.7%)
	Severe Pain	12 (19.0%)
Gait Difficulty	No Difficulty	28 (44.4%)
	Moderate Difficulty	23 (36.5%)
	Severe Limp	12 (19.0%)
Climbing Stairs	Unrestricted	30 (47.6%)
	Requires Support	22 (34.9%)
	Impossible	11 (17.5%)
Resumption of Sports	Normal Participation	27 (42.9%)
	Limited Participation	25 (39.7%)
	Unable to Participate	11 (17.5%)
Work Limitations	No Limitation	31 (49.2%)
	Moderate Limitation	21 (33.3%)
	Severe Limitation	11 (17.5%)

Category	Criteria	Number (%)
Skin Condition	Normal	38 (60.3%)
	Color Changes	17 (27.0%)
	Ulcers/Fistulae	8 (12.7%)
Deformity	No Deformity	37 (58.7%)
	Mild Deformity	17 (27.0%)
	Severe Deformity	9 (14.3%)
Muscle Atrophy	<1 cm	34 (54.0%)
	1-2 cm	17 (27.0%)
	>2 cm	12 (19.0%)
Knee Range of Motion (3 Months)	<60°	15 (23.8%)
	60°-90°	27 (42.9%)
	>90°	21 (33.3%)
Overall Functional Outcome	Excellent	19 (30.2%)
	Good	22 (34.9%)
	Moderate	12 (19.0%)
	Fair	6 (9.5%)
	Poor	4 (6.3%)

Discussion:

The demographic profile of our cohort aligns with existing literature, indicating a higher incidence of floating knee injuries among young males, primarily due to high-energy trauma such as road traffic accidents[10]. For instance, a study by Ko LJ et al[11]. reported similar findings, with males constituting a significant proportion of cases and road traffic accidents being the predominant cause.

The distribution of fracture types in our study, with Type I fractures being the most common, is consistent with previous research. Sriphirom P et al[12]. Our cohort also noted a larger occurrence of Type I fractures in the group.

With regard to the surgical method, our study's preference for intramedullary nailing of both tibia and femur fractures is consistent with modern efforts to maximize patient mobilization and functional outcomes.

This approach is supported by Baldini et al[13]., who pointed out the advantages of intramedullary nailing for achieving stable fixation and aiding in rehabilitation.

The complication rates observed in this study experienced early postoperative infections and displayed late joint stiffness, which are reasonable when compared to other series[14]. Mullaji et al[15]. Noted the relative early and late complication rates and the difficulty in managing these intricate injuries. The functional results of our study are with respect to most patients achieving excellent or good results and are therefore optimistic.

Agarwala et al[16]. observed similar functional results, consolidating the effectiveness of recently developed management techniques.

There are some limitations to this study such as its purely descriptive scope alongside the absence of a control group for comparison, which can lead to selection bias. Furthermore, the total number of participants is rather limited, and the duration of the follow-up may not reflect the long-term results. Further work is needed with larger, well-defined, controlled studies with longer follow-up periods to confirm the findings and improve treatment protocols[17,18].

Conclusion:

The purpose of this study is to provide detail on the epidemiology, management, and outcomes of floating knee injuries in a tertiary hospital with emphasis on the high proportion of young males and road traffic accidents as the main aetiology. The results corroborate that intramedullary nailing remains the most commonly used operative technique as it offers favourable functional outcomes and stable fixation. Supporting intervention within 24 hours was found to improve postoperative recovery, decrease complications, and increase weight bearing at six weeks. Although the incidence of complications such as infections and joint stiffness was high, the overall functional outcome assessed by the Karlström and Olerud criteria was satisfactory among most patients.

With reference to Pakistan, where road traffic accidents constitute a significant public health issue owing to weak enforcement of traffic laws, dilapidated roads, and absence of pre-hospital trauma care, the prevalence of complicated orthopaedic injuries like floating knee fractures remains alarmingly high. The study emphasises the alarming necessity for fully equipped trauma centres, operationalised standardised surgical protocols, and advanced rehabilitative care to improve patient outcomes. In addition, with the limited resources in the healthcare system of Pakistan, there needs to be a comprehensive strategy directed toward prevention of injury, early surgical intervention, and postoperative rehabilitation to lower morbidity and disability.

The new elements identified from this study relate to the modifiable factors of delayed presentation and variable preoperative stabilization, both of which are detrimental to functional recovery. These factors can be addressed by enhancing the emergency response systems and more effective referral processes. Additionally, the study re-emphasises the need for local clinical guidelines relative to the local context of Pakistan to standardise the management of such high-energy injuries within the country's healthcare system.

Ethical Considerations:

All participants or their guardians provided written informed consent prior to the data collection. To maintain patient confidentiality, all records were depersonalised.

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Sample size estimation and data processing were performed using artificial intelligence systems.

Disclosure:

The authors declare no conflicts of interest.

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