

Surgical Management of Ipsilateral Fracture of the Femur and Tibia in Adults (The Floating Knee): Postoperative Clinical, Radiological and Functional Outcomes

¹Dr. R. L. Dayma, Sr. Professor & Unit Head, Department of Orthopaedics, Sawai Man Singh Medical College & Attached Group of Hospitals, Jaipur, Raj.

²Dr. Pradeep Singh, Resident Doctor, Department of Orthopaedics, Sawai Man Singh Medical College & Attached Group of Hospitals, Jaipur, Raj.

³Dr. Rakesh Silaych, Assistant Professor, Department of Orthopaedics, Sawai Man Singh Medical College & Attached Group of Hospitals, Jaipur, Raj.

⁴Dr. Shankar, Resident Doctor, Department of Orthopaedics, Sawai Man Singh Medical College & Attached Group of Hospitals, Jaipur, Raj.

Corresponding Author: Dr. Pradeep Singh, Resident Doctor, Department of Orthopaedics, Sawai Man Singh Medical College & Attached Group of Hospitals, Jaipur, Raj.

Citation this Article: Dr. R. L. Dayma, Dr. Pradeep Singh, Dr. Rakesh Silaych, Dr. Shankar, “Surgical Management of Ipsilateral Fracture of The Femur And Tibia In Adults (The Floating Knee) : Postoperative Clinical, Radiological, And Functional Outcomes”, IJMSIR- May - 2020, Vol – 5, Issue -3, P. No. 224 – 230.

Type of Publication: Original Research Article

Conflicts of Interest: Nil

Abstract

Background: Ipsilateral fractures of the femur and tibia are called floating knee injuries and may include a combination of diaphyseal, metaphyseal and intra-articular fractures.

Methods: The prospective study was done in the department of Orthopaedics at SMS medical college and hospital, Jaipur from April 2018 to November 2019 which includes 25 patients with Close floating knee injuries.

Results: Males are affected in 23 out of 25 patients (92%). Right lower limb was involved in 19 out of 25 patients (76%). Majority of the patients were of young age group between 30-50 years (68%). Four out of 25 patients (16%) had type I floating knee injury and 21 out of 25 (84%) had type II floating knee injury.

Conclusion: Extra-articular (shaft) fractures, surgically stabilize by intramedullary interlocking nail. If fracture intra-articular then treatment of choice was screw and plating. Early stabilization provide good functional outcome in treatment of floating knee injury. Internal fixation of fractures permits early mobilization of the knee joint with good functional outcome.

Keywords: Extra-articular (shaft) fractures, Nails, Screw.

Introduction

Ipsilateral fractures of the femur and tibia are called floating knee injuries and may include a combination of diaphyseal, metaphyseal and intra-articular fractures. Floating knee injuries were first described by McBryde in 1974¹ as fractures of ipsilateral femur and tibia. The incidence of floating knee injuries was reported as 2.6

% of all fractures by Letts et al in 1986.² The most common mode of injury was due to a high velocity motor vehicle accident.

Floating Knee Injuries are becoming more and more common as a result of increasing industrialization and increase in number of vehicles as these injuries are caused by high energy trauma primarily involving high velocity motor vehicle accidents.

The combined femoral and tibial fractures are frequently accompanied by life threatening head injury, injuries to spinal cord, thoracic and abdominal (Visceral) injuries.

Surgical stabilization of both the femur and tibia fractures, early rehabilitation of the patient produces best clinical outcome. Although treatment planning for each fracture in the extremity should be considered individually to achieve the optimal results, the effect of that decision must be considered in the light of overall injury status of the entire extremity and general condition of the patient.³

The results will be better and the complications will be less if the fractures are diaphyseal or extra articular than compared to intra-articular fractures. The main aim of the early internal fixation of both femur & tibia in floating knee injuries is to obtain union of the fractures in the anatomical position compatible with maximal functional return of the extremity and to reduce the complications such as delayed union, non-union and knee stiffness.

Materials and Methods

The study was done in the department of Orthopaedics at SMS medical college and hospital, Jaipur from April 2018 to November 2019 which includes 25 patients with Close floating knee injuries. This was a prospective study.

Inclusion criteria

Patients having ipsilateral fracture Shaft of femur and tibia i.e.

- Above age of 18 (skeletal mature)
- Recent history of trauma
- Patient consenting to be included in study
- Close Fracture

Exclusion criteria

- Pathological fractures or metastatic disease
- Ipsilateral hip and ankle fracture
- Neurovascular injury
- Open fracture

Study Design

The study will be time bound, hospital based, and prospective study. Cases satisfying the inclusion criteria admitted in SMS Hospital during the study period of April 2018 to May 2019 will be included. Patients will be followed up for a period of 6 months to 1.8 year and evaluated clinically with Karlstorm Olerud criteria.

Sample Size

Cases satisfying the inclusion criteria admitted in orthopedic department in SMS hospital, Jaipur during the study period of April 2018 to May 2019 was included. As per the previous records around 25 cases could taken under this study in the stipulated study period.

Period of Follow UP

The patients are followed up for a period of minimum 6 month and maximum 18 month at regular intervals.

Parameters For Evaluation

Functional and clinical outcome was evaluated by Karlstorm Olerud criteria.

Statistical Analysis

Data collected were entered into MS Excel spread sheet were summarized in form of tables and graphs.

Statistical analysis of results was carried out by using epi info version 7.2.1.0. Quantitative variables were summarized as mean and standard deviation and were analysed using unpaired t test, level of significance in each case was found by Levine's test for equity of variances and p value <0.05 was considered as significance difference between the two groups.

Results

The present study include 25 cases of ipsilateral fracture femur and tibia, treated in the Department of Orthopaedics at SMS Medical College and Hospital, Jaipur. The patient were followed up for a minimum period of 6 month and a maximum of 18 month. The following observations were made in the present study.

Table 1: Socio-demographic variable

Age (Mean ± SD)	40.56 ± 10.73 years
Male : Female	23:2
Side of injury (Left : Right)	7:18

The youngest patient was 22 years old and oldest was 64 years. Mean age of 25 patients who undergo floating knee surgery was 40.56 years. Floating knee injuries were more common in young age group. Maximum patient age was in third and fourth decade (68%). Majority of the patients were males 92% (23 patients) and 8% (2 patients) patients were females. Because Males are more involved in to outdoor activity compared to female.

Table 2: Distribution of study subjects according type of Fracture (Fraser classification)

Type of fracture	N	Percentage
I	4	16
II a	4	16
II b	4	16
II c	13	56
Total	25	100

In our study type II (intra articular) fractures were 21 and type I (extra articular) fractures were 4 so in our study intra articular fractures were more then extra articular factures.

Type – 1	-	4
Type – 2 a	-	4
Type – 2 b	-	4
Type – 2 c	-	13

Table 3: Distribution of study subjects according method of treatment of tibia

Tibia treatment	N	Percentage
Nail	2	8
Plate	23	92
Total	25	100

Table 4: Distribution of study subjects according method of treatment of femur

Femur treatment	N	Percentage
Nail	3	12
Plate	22	88
Total	25	100

Three femoral fractures were treated with intra medullary nail and 22 femoral fractures were treated with plating. Two tibial fracture were treated with intra medullary nail and 23 tibial fractures were treated with plating. Because intra articular fractures more in our study so maximum cases were treated with plating.

Table 5: Method used in treatment of tibia and femur

Treatment	N	Percentage
Tibia Nail & Femur Plate	2	8
Tibia Plate & Femur Nail	3	12
Tibia Plate & Femur plate	20	80
Total	25	100

Table: 6 Distribution of study subjects according to range of motion

Range of motion	N	Percentage
60-74°	4	16
75-89°	1	4
90-104°	13	52
105-119°	7	28
Total	25	100
Mean ± SD	94.9± 15.97°	

In our study Mean range of motion was 94.9

Table 7: Incidence of complications among study groups

Complications	N	Percentage
Improper fixation	2	8
Infection	3	12
Non union	2	8
Mal union	2	8
Osteomyelitis	3	12
Limb shortening	3	12
Knee stiffness	6	24
Pain	10	40
Total	25	100

Osteomyelitis develop in three cases and six patients developed knee stiffness. In two patients infection was developed. Two floating knee injuries under nonunion which was further treated with revision plating and bone graft. Limb shortening was developed in two patients. Mal union was developed in two patients.

Table 8: Outcome among study subjects (Karlstorm Olerud classification)

Outcome	N	Percentage
Favourable	Excellent	6 24
	Good	8 32
Unfavourable	Fair	7 28
	Poor	4 16
Total	25	100

In our study Excellent – Good outcome in 56% patients and 44% results were fair – poor. In our study little increase in no. of poor patients. One of the causative factors that intra articular fractures were more in our study.

Discussion

Ipsilateral fractures of femur and tibia which include fractures from the subtrochanteric level to the distal femoral condyles and tibial condyles and shaft fractures. Floating Knee Injuries are becoming more and more common as a result of increasing industrialization and increase in number of vehicles as these injuries are caused by high energy trauma primarily involving high velocity motor vehicle accidents.

The study was done prospectively over a period of 1.5 years from April 2018 to November 2019. The last patient included in the study was treated in May, 2019. The minimum follow up after surgical treatment was 6 month and maximum was 17 months.

In our study maximum patients were in age group 30-50 years. Floating knee injuries was more common in young population. In our study Mean age was 40.56 years. Male patients were more than female. In our study there was a male predominance (92% (23) males, 8% (2) female).

In our study most common mode of injury was high velocity motor vehicle accident (88%). Only two patients mode of injury was assault and one patient mode of injury was Fall from height. In our study 18 patients (72%) had right sided injury and 7 (28%) patients had left sided injury. Right side lower limb was more commonly involved.

Ulfin Rethnam et al⁴ 2007 studied 29 patients and reported that mean age was 28 (18-56) years. 27 patients were involved in motor vehicle accidents while

2 patients sustained the injury by fall from height. Right side was involved in 19 patients and left side in 10 patients. There was male predominance.

Alla M Hegazy, MD et al⁵ 2011 studied 15 patients and reported that mean age was 34.8 years (18-55). 13 patients were male and 2 patients were female. Fourteen patients were involved in motor vehicle accidents whereas one patient sustained the injury from a fall from height. The right and left sides were involved in 9 and 6 patients, respectively.

Hatem S.A ELohary et al⁶ 2018 studied 32 patients and reported that mean age of patients was 30.8(19-48) years. All patients were injured by road traffic accidents. Right side was involved in 13 patients and left side in 21 patients.

These studies and majority of the other studies in literature also describes the similar age, gender and mode of injury distribution.

Hayes et al⁴ 1978 suggested that automobile passengers with floating knees should have had their feet braced firmly against the sloping floor of the front seat just prior to the collision, their legs becoming crumpled under the massive decelerating forces produced by the impact. Pedestrians are frequently catapulted some distance from the point of impact and are further injured by striking the pavement.

In our study Fraser classification was used for fracture classification.

- Type 1 (both femur and tibia extra articular)
- Type 2a (femur extraarticular and tibia intraarticular)
- 4 (16%)
- Type 2b (femur intra-articular and tibia extra-articular)
- 4 (16%)
- Type 2c (both femur and tibia intra-articular)

Alla M Hegazy, MD et al⁶ 2011 studied 15 patients and also use Fraser classification. The type of fractures

were follows: type 1(5), type 2a(3), type 2b(4), type 2c(3).

Hatem S.A ELohary et al⁷ 2018 studied 32 patients and there were 17(50%) patients with Fraser type 1, six with type 2a, six with type 2b and five with type 2c floating knee injuries.

Muthukumar Kaliamoorthy et al⁸ 2018 studied 25 patients and there were type 1 71%, type 2a 8%, type 2b 12%, type 2c 9% extra articular fractures were more then intra-articulars.

In our study type 2 fractures (intra-articular) were more then type 1 fractures (Extra-articular). Type 2c fracture (Both femur and tibia intra-articular) was 56% (13) more then other type 2 fractures in comparison to other studies.

In our study three femoral fractures were stabilized using an intramedullary nail and 2 tibial extra-articular fractures were fixed with intramedullary nail. 23 (92%) tibial intra-articular fractures were treated with plating and 22 (88%) femoral intra-articular fractures were treated with plating. Because in our study intra-articular fractures were more then intra-articular fractures so plating was done in maximum cases.

Hatem S.A ELohary et al⁷2018 studied 32 patients and reported that 21 femoral extra-articular fractures were treated with intramedullary nail and 20 tibial extra-articular fractures were treated with intramedullary nail, 3 femoral intra-articular fractures were treated with locking and buttress plate and 10 tibial intra-articular fractures were treated with plating.

Alla M Hegazy, MD et al⁶ studied 15 patients and reported that intramedullary nailing for both fractures was performed in 4 patients. A combination of a dynamic condylar (52%) fixation for a tibial fractures and buttress plating for tibia plateau fractures were performed in remaining 9 patients.

Kao et al.⁹ 2010 summarized the indications of surgical treatment and concluded that patients with closed fractures or open type I or II fractures were treated according to the fracture site. Femoral fractures in the intercondylar area were fixed by open reduction with condylar plates or dynamic compression screws. Tibial fractures around the tibial plateau, proximal tibia, or distal tibial areas were fixed by open reduction using buttress plates or dynamic compression plates. Some tibial shaft fractures were fixed with interlocking nails by open or closed reduction.

In our study pain and knee stiffness were most common complications. Pain was developed in 10 cases. Infection was developed in 3 cases, osteomyelitis in 3 cases, Mal union in 2 and non union developed in 2 cases. Improper fixation was done in 2 cases and 3 cases developed limb shortening. High complication rate was found in Fraser type 2c fractures.

All M Hegazy et al⁶ 2011 studied 15 patients there was knee stiffness in 2 patients, delayed union of tibia in 2 patients and superficial infection in one patients.

Cheng et al¹⁰ 2010 had done a detailed study on complications in over 419 patients that include infection 20.8%, non union 20.3%, knee stiffness 11%.

Ulfin Rethnam et al¹¹ 2007 had studied 29 patients. Complications encountered were knee stiffness in 4 patients, foot drop in 1 patient, delayed union in 2 patients and superficial infection in 2 patients.

Conclusion

From our study, we conclude:

- Extra-articular (shaft) fractures, surgically stabilize by intramedullary interlocking nail. If fracture intra-articular then treatment of choice was screw and plating.
- Early stabilization provide good functional outcome in treatment of floating knee injury.

- Internal fixation of fractures permits early mobilization of the knee joint with good functional outcome.

References

1. Blake R, McBryde A Jr . (1975) The floating knee: Ipsilateral fractures of the tibia and femur. South Med. J. Jan;68(1):13-6.
2. Letts M, Vincent N, Gouw G. (1986). The "floating knee" in children. J Bone Joint Surg Br. 1986 May;68(3):442-6
3. Veith RG, Winquist RA, Hansen ST Jr (1984). Ipsilateral fractures of the femur and tibia. A report of fifty-seven consecutive cases. J Bone Joint Surg Am. Sep;66(7):991-1002
4. Hayes 14. Fraser R.D., Hunter G.A Ipsilateral fractures of the femur and tibia, J.Bone& Joint Surg, 1978; Vol. 142 (B), pp. 115-122.
5. Alaa M Hegazy, MD, Surgical Management of Ipsilateral Fracture of the Femur and Tibia in Adults (the Floating Knee): Postoperative Clinical, Radiological, and Functional Outcomes, Clinics in Orthopedic Surgery 2011;3:133-139 , doi:10.4055/cios.2011.3.2.133
6. Alla M Hegazy, MD 2011 surgical management of ipsilateral fracture of the femur and tibia in adults: postoperative clinical, radiological, and functional outcome 2011;3:133-139
7. Hatem S.A. ELgohary, Mhmod A. Elghafar, Nabil A. Outcome and prognostic factors of surgical management of floating knee injuries December 2018, 53;210-218
8. Muthukumar kaliasmoorthy, Kosalraman Padmanabhan, Shreyas Doddihithlu June 2018;4(2):178-186
9. Kao FC, Tu YK, Hsu KY, Su JY, Yen CY, Chou MC, Floating knee injuries: a high complication rate,

2010 Jan;33(1):14. DOI: 10.3928/01477447-20091124-04

10. Anastopoulous G, Assimakolopoulos A, Exarchou E, Ipsilateral fractures of the femur and tibia; 1992; Vol. 23(7); pp. 439

11. Rethnam V, Study of epidemiology, prognostic indicators and outcome following surgical management of floating knee. Journal of Trauma Management and Outcomes, 2007; Vol I (1), pp. 2; PMID: 1827- 1992.