

Outcomes of Surgical Management of Floating Knee Injuries

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ABSTRACT

Introduction: Floating knee, referred to as ipsilateral fractures of the femur and tibia, is usually associated with several complications and mortality. This study was designed to present our experience with treatment of this injury. Demographic parameters like age, sex, mechanism of injury, associated injuries, method and results of treatment, and complications of floating knee are discussed

Material and Methods: This Prospective study was performed between January 2014-July 2016. All patients with floating knee injuries who were admitted to the PMCH fulfilling the inclusion and exclusion criteria were included. The information about the 20 cases of floating knee injuries were gathered, particularly the demographic parameters, mode of injury, bones involved, condition of skin, other associated injuries and their neurovascular status. The patients were followed for a minimum of one year duration and functional outcome was assessed.

Result: Most of the patients were between 21-30 years of age (45%). The floating knee injuries were more common in males (85%). Fraser Type I fracture was observed in 70% of cases. Road traffic accidents (RTA) was the most common cause of such injuries. 18 out of 20 (90%) cases were having associated injuries while only 10% were cases of isolated floating knee. The most common early and late complications were infection and knee stiffness respectively. The final outcome as per Karlstrom criteria was excellent and good in 11 out of 14 cases of Fraser type I fracture and in 3 out of 6 cases of Fraser type II fracture, and this was statistically significant ($P=0.05$).

Conclusion: This study revealed that the complication rate associated with floating knee injuries remain high and the prognosis mostly depends on type of injury and associated injuries. This study also advocates early aggressive approach for management of these injuries.

Keywords: Floating Knee, Road Traffic Accidents (RTA), Karlstrom Criteria, Fraser Classification.

injuries of other bones and soft tissues of head, chest and abdomen.⁴ Hence patients suffering from floating knees are usually haemodynamically unstable. Floating knee injuries must be included in assessment and treatment protocols for patients with polytrauma. Damage to the vessels (mainly the popliteal and posterior tibial arteries) and lesions of the nerves (eg, peroneal nerve) are common. Vascular injury is common and may be limb threatening if not recognized and addressed.

The injuries of the floating knee can be classified according to Fraser classification or Blake and McBryde classification in adults and by Letts and Vincent classification in children. The floating knee is a complex injury and the prognostic indicators are injuries and the type of fracture (open, intraarticular, comminution).⁵ Complications attributed to floating knee injuries include infection, excessive blood loss, fat embolism, prolonged hospitalization, inability to bear weight, malunion, delayed or nonunion, hemarthrosis and knee stiffness.⁶ The aim of the study was to determine the outcome of patients after surgical management of the Floating Knee and identify prognostic factors for this injury.

MATERIAL AND METHODS

This prospective study was conducted between January 2014 to July 2016 at a tertiary care teaching hospital, Patna Medical College, Bihar, India. All patients with floating knee injuries who were admitted under the department of Orthopedics during the time period were enrolled in the study. Total 20 cases of floating knee injuries satisfying the inclusion criteria were enrolled in the study and followed up for minimum one year duration. All cases of conservatively managed floating knees along with those cases with bone loss were excluded from the study. Paediatric patients with floating knee injuries were also excluded.

INTRODUCTION

The term 'floating knee' is described as concomitant fractures of the ipsilateral femur and tibia. Blake and McBride were first to describe floating knee in 1974 which may include combinations of intra-articular, diaphyseal and metaphyseal fractures.¹ Floating knees may be associated with collateral ligament and meniscal injuries. The exact incidence of a floating knee is unknown; it is not a very common injury.² Road traffic accident (RTA) is the major cause for these cases followed by fall from height.³ Recent increase in incidence is due to better road connectivity, surge of high speed vehicles and a general sense of urgency and hurriedness prevailing in the society. As this injury is usually caused by high-energy trauma it is associated with potentially life threatening

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Detailed history of patient was taken particularly the demographic parameters and the mode of injury, along with clinical examination. The information gathered was noted on a proforma. The patients were carefully evaluated to detect and manage the life-threatening conditions. Initial management involved resuscitation and haemodynamic stabilization of the patient followed by splinting of the affected limb. Radiological evaluation of the pelvis, affected lower limb including all its joints, chest and other suspected bony injuries were carried out. The floating knee injuries were classified according to Fraser classification⁷(Table1). Tetanus immunization, antibiotic treatment and wound toileting was done initially for open fractures. Surgeries were performed for floating knees once the patients were fit for surgery. External fixators were applied in compound fractures. For femur fractures the surgical management included interlocking nail or distal femoral nailing and plating while tibial fractures were managed by either interlocking nailing or plating.

The patients were closely observed in the postoperative period for development of any complications and were followed up regularly thereafter by clinical examination and radiographs till bony union. Functional assessment and final outcome was measured using the Karlstrom's criteria⁸ (Table2).

RESULTS

Total 20 patients were enrolled in the study. The mean age of the patients in the study was 34.2years. Most of the patients were between 21-30years of age (45%). 85% patients in the study group were male. All 20 patients had sustained their injuries in motor vehicle accidents. The right side injury was present in 15 cases while left side was involved in 5 cases

only. 70% of the cases were having type I injury according to Fraser classification. Out of 20 patients 18 were having associated injuries while only 2 were cases of isolated floating knee. Among the associated injuries patellar fracture and knee ligament injury were most common seen in 12% cases. 2 cases each were of head injury, fat embolism, forearm bone fracture and rib fracture. Abdominal injury, opposite femur fracture, clavicle fracture and haemo-pneumothorax were seen in rest of the cases. Interlocking nailing of femur was done in 85% cases and that of tibia in 55% patients. While plating of femur and tibia were done in 15% and 45% patients respectively. (Figure 1).

Post-operative complications were present in 35% cases. Early complications were seen in 3 cases out of 7. Infection was the commonest early post-operative complication. 4



Figure-1: (a,b,c) A preoperative, postoperative and one year follow up radiograph of a 28-year-old male patient with floating knee.

TYPE I	Both fractures involve the shaft without articular involvement of the knee
Type II	Articular involvement of knee
Type II A	Femoral shaft and tibial plateau fracture
Type II B	Distal femur fracture and shaft of tibia fracture
Type II C	Fracture of distal femur and tibial plateau

Table-1: Fraser classification for Floating Knee injuries

Criteria	Excellent	Good	Acceptable	Poor
Symptoms from thigh or leg	None	Intermittent slight symptoms	More severe symptoms impairing function	Considerable functional impairment; pain at rest
Symptoms from knee or ankle joint	None	Same as above	Same as above	Same as above
Walking ability	Unimpaired	Same as above	Walking distance restricted	Uses cane, crutches or other support
Work and sports	Same as before	Given up sports; work same as before	Change to less strenuous work	Permanent disability
Angulation, rotational deformity or both	0	<10 degrees	10-20 degrees	>20 degrees
Shortening	0	<1 centimeters	1-3 centimeters	>3 centimeter
Restricted joint mobility	0	<10 degrees at ankle; <20 degrees at hip, knee or both	10-20 degrees at ankle; 20-40 degrees at hip, knee or both	>20 degrees at ankle; >40 degrees at hip, knee or both

Table-2: Karlstrom criteria for functional assessment after management of floating knee injuries

patients had late complications. Knee stiffness preceded the list of late complications (50%) followed by malunion and delayed union.

The average follow-up was for 14.6 months (range, 12–18 months). In the assessment of end results at last follow-up according to the Karlstrom criteria, 20% were having excellent outcome while 15% were having poor outcome. (Table3)

The final outcome as per Karlstrom criteria was excellent and good in 11 out of 14 cases of Fraser type I fracture and in 3 out of 6 cases of Fraser type II fracture, and this was statistically significant (P=0.05). Only 1 case out of 6 with associated knee injury had good outcome in comparison to 12 out of 14 cases without associated knee injury which

had excellent to good outcome (p=0.001). 13 out of 16 cases with closed wound had good outcome whereas only 1 with open wound had good outcome, and this was statistically significant (p=0.01).(Table 4)

DISCUSSION

Due to rising population and therefore increase in the number of motor vehicles in most cities of the developing countries like India, rate of road traffic accidents are higher. Men aged 21-30 years are most commonly involved in RTAs because of their rash driving habits. High impact injuries results in floating knees. Floating knee are important because of the high mortality with associated injuries. Floating knee injuries have higher incidence of associated injuries compared with patients with isolated femoral or tibial fractures.¹

In the index study the mean age of the patient was 34.2 years which was similar to the study conducted by Mohamadean A et al in which the mean age was 30.6 years.⁹ Male preponderance was seen in the present study with 85% patients being male. Similar findings were observed in the study done by Mohamadean A et al and Rethnam U et al.^{9,10} In this study, all patients had sustained their injuries in motor vehicle accidents. Rethnam U et al stated that most of the studies showed road traffic accidents as the only mode of injury.¹⁰ In a study of 222 cases of floating knee by Fraser et al.¹⁰, all cases were involved in road traffic accidents.⁷ Right sided injury dominance was seen in the study (75%). Rethnam U et al also observed more injury (65.5%) on right side compared to left. However the study done by ELgohary HS et al right side was involved in 13 and left side in 21 knees.¹¹

In the present study 70% cases were of Fraser classification type I. ELgohary HS et al had 50% cases of type I and 50% of type II injury. 90% cases (18/20) had other associated injuries. 38 associated injuries were noted in 29 cases by Rethnam U et al.¹⁰ Many studies have mentioned associated injuries like head, chest, abdominal injuries and injuries to other extremities. These injuries can be life threatening.¹²

According to recent studies the best management for the floating knee is surgical fixation of both the fractures with intramedullary nails. Lundy and Johnson recommended surgical stabilization of the fractures for early mobilization, which produced the best results.¹³ Dwyer et al in its study concluded that the external fixation of the fractured femur resulted in a decreased range of movement at the knee due to quadriceps muscle fixation whereas the treatment method for

Variables	N=20	%
Mode of injury		
RTA	20	100
Fall from height	0	0
Side involved		
Right	15	75
Left	05	25
Fraser Type		
I	14	70
IIA	03	15
IIB	02	10
IIC	01	5
Associated injury		
Yes	18	90
No	02	10
Operation performed		
Femur		
Nailing	17	85
Plating	03	15
Tibia		
Nailing	11	55
Plating	09	45
Post-operative complications		
No	13	65
Yes	07	35
Karlstrom criteria for functional assessment		
Excellent	04	20
Good	10	50
Acceptable	03	15
Poor	03	15

Table-3: Distribution of patients according to mode of injury, type of injury, associated injuries, complications, treatment and outcome.

	Excellent	Good	Acceptable	Poor	p-value
Fraser type					0.005
I	4	7	1	2	
II	0	3	2	1	
Associated knee injury					0.001
Yes	0	1	3	2	
No	9	3	1	1	
Type of wound					0.01
Open wound	0	1	1	2	
Closed wound	8	5	2	1	

Table-4: Correlation between Karlsrom criteria outcome and type of injury

the tibia did not interfere with joint mobilization.¹⁴ Several studies have reported good results after internal fixation of both femur and tibia fracture.¹⁵ The management of floating knee in the index study consisted of treating both the femoral and tibial fractures surgically, most of them (85% of femur and 55% of tibial fractures) by using an interlocking nail and rest by plating. With this treatment, the functional recovery was better than the other surgical modalities. This was in accordance with study done by Ostrum RF who had good results with fixation of both fractures by intramedullary nailing.¹⁶

In the index study post-operative complications were observed in 35% cases which was less than the study done by ELgohary HS et al (50%). The less complication rate in the current study may be due to small number of patients. However knee joint stiffness was the commonest complication. Studies have reported excellent and good results after surgical treatment for floating knee injuries which ranged from 34.5 to 68.7%.¹⁰ In our study, the rate of excellent and good results according to Kalstrom criteria after surgical treatment of floating knee injuries was 70%.

Hee et al suggested a preoperative scoring system, which took into consideration the age, smoking status at time of injury, injury severity scores, open fractures, segmental fractures, and comminution to prognosticate the final outcome of these fractures.¹⁷ Hung SH et al have shown that indicators of poor outcome of floating knee injuries are intra-articular involvement of the fractures, severity of skeletal injury and soft tissue injuries.¹⁸ The presence of intra-articular fracture was a significant indicator of poor or accepted final outcome ($p=0.05$) in the current study. Three patients had poor outcomes in our study and these patients were having intra-articular fractures, associated knee injuries and open wounds. Thus the poor prognostic factors were related to the type of fracture (open or closed, intra-articular fractures and knee ligament injuries). The associated injuries had role in the initial outcome of patients in the study with regard to delay in initial surgery, prolonged duration of surgery and in rehabilitation.

The limitation of our study is the small sample size and the recommendations for treatment option and prognostic indicators are based on this small observation only.

CONCLUSION

Floating knee injury is an indicator of severe trauma. Damage to remote organs should be suspected and systematically sought for. Following standardized resuscitation protocols, surgical fixation of both fractures and aggressive postoperative rehabilitation offer the best chance of an optimum outcome. The prognostic indicators of the final outcome are associated injuries and type of fracture.

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