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Functional outcome of surgical management of floating knee injuries in adults (Ipsilateral femoral and tibia fractures) and its prognostic indicators

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Abstract

Background: Ipsilateral femoral and tibial fractures are termed as floating knee injuries^[1,2]. They range from simple diaphyseal fractures to complex intraarticular fractures. Combinations of diaphyseal, metaphyseal and intra-articular fractures can be seen in different patients. Our study evaluates functional outcome of surgical management of these injuries and the prognostic indicators.

Materials and methods: This is a prospective study where 20 adult patients of floating knee injuries were treated surgically using locked intramedullary nail or locking plate and screws for femoral fracture and locked intramedullary nail or locking plate and screws for tibial fracture depending on individual fracture types. Patients were classified using Fraser's classification (Assessment at the end was done using Karlstorm –Olerund criteria after union of fractures. Follow up period was 1 year.

Results: Functional outcome after bony unions according to Karlstorm – Olerund criteria were excellent-9, good -8, acceptable -2, poor -1.

Conclusions: The associated injuries, age of the patient, type of fracture, modality of fracture fixation, post-op rehabilitation are the factors that determine good final functional outcome in floating knee injuries.

Keywords: Floating knee, femur, tibia, Karlstorm-Olerund criteria, surgical management

Introduction

Floating knee injury is a term used to denote ipsilateral femoral and tibial fractures and the word was first introduced first by McBride and Blake^[1,2]. It ranges from simple diaphyseal fractures to complex intraarticular fractures. Combinations of diaphyseal, metaphyseal and intra articular femoral and tibial fractures can be seen in different patients. These injuries are known to occur due to high energy trauma^[2]. Though they are relatively rare injuries they carry high morbidity and high mortality when associated with other injuries. Incidence of floating knee injuries is 2.6% as reported by Lettes *et al* in 1986 and is increasing^[3]. They are often associated with other injuries such as head injury, chest injury, abdominal and pelvic injuries, and other skeletal injuries as shown by Veith^[3]. There can be extensive soft tissue injury as well which varies from minor abrasions to grade III open injuries and also can have associated injuries to the surrounding neuro -vascular structures.

Treatment planning for each fracture in the extremity should be individually considered so as to achieve the optimal result. Fewer complications and better results are observed when both fractures are diaphyseal than when either of the fractures are intra-articular. The purpose of our study is to determine the functional outcome of surgical management of floating knee injuries and to identify the prognostic indicators for this injury.

Materials and methods

This is a prospective study where 20 adult patients who had ipsilateral femoral and tibial fractures were studied from jan 2014 to june 2016 with a minimum follow up of 1 year.16 patients were from 20-40 years of age and 4 patients were 40-60 years of age. The patients were Classified using fraser's classification of floating knee injuries^[4] and gustilo-anderson classification used for open fractures^[5]. In our study 15 Patients had fraser type I, 2 patients had fraser type IIA and 3 patients had fraser type IIB fractures.

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Fraser type IIC(both intra articular fractures) were excluded from the study. Pathological fractures, periprosthetic fractures, previous femoral fractures, previous knee injuries, previous knee surgeries and Gustilo-Anderson type 3 open fracture of femur or tibia were excluded. Patients with associated chest injury, head injury were managed appropriately

before surgical stabilization of the fractures and for patients with open fractures thorough wound irrigation was done [6, 7]. Patients who were victims of polytrauma were closely monitored for fat embolism and temporarily limb immobilized in Thomas splint until surgery.



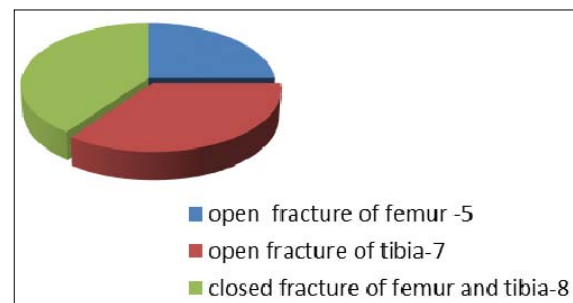
All the patients were treated by internal fixation and were operated within 5 days of injury. Depending on the type of floating knee fracture pattern fixation was planned. Locked intramedullary nailing was done for both femur and tibia in case of Fraser type I, locked intramedullary nailing for femur and plate and screw for tibia in case of Fraser type IIA, and plate and screw for femur and locked intramedullary nailing for tibia in case of Fraser type IIB [6]. Intramedullary nail for femur and tibia was inserted in antegrade manner. Both fractures were addressed at the same time and considering order of operation, femoral fracture was addressed before tibia as per surgeon's preference.

In the Postoperative period Thromboprophylaxis was initiated in all patients and given for 5 days. Physiotherapy in the form of isometric quadriceps strengthening exercises & isotonic exercises for hamstrings were started as tolerated one week after surgery. Non weight bearing walking using crutches was permitted for one and half months, followed by partial weight bearing using walker [11]. Full weight bearing was allowed only after clinical and radiological union had been confirmed [11]. Clinical union was defined as the ability to perform single-leg standing on the injured limb without pain or instability. Radiological union was defined as three bridging cortices seen on the combined anteroposterior (AP) and lateral views. In the post operative period radiological and functional evaluation were performed and patients were followed-up once in three weeks for first 2 months, every 6 weeks for next six months, every 2 months thereafter for 1 year. Final outcome and functional assessment was done using the Karlstrom-olerund criteria [7] after the bony union had been confirmed radiologically.

Results

20 adult patients (Aged 20 -60 years) who had floating knee injury were included.16 patients were from 20-40 years of age and 4 patients were 40-60 years of age. 19 were male patients and 1 was female patient.12 patients had right lower limb

fractures and 8 had left lower limb fractures. All injuries occurring due to high energy trauma were due to RTA [3]. About 3 patients had associated head injury and 4 had chest injury and 1 had both head and chest injury. 5 had open fracture of the femur and 7 had open fracture of the tibia and rest were closed fractures. Only type 1 and type 2 Gustilo Anderson open fractures were included in the study.



18 patients had full range of movements and 2 patients had moderate limitation in knee movements at 1 year follow up. 4 patients had post-op complications of which 1 had delayed union of tibia. Dynamisation of tibial nail was done and fracture united in next 2 months.3 patients of open fracture of tibia had superficial infections who were treated successfully by intravenous antibiotics for 10 days after obtaining culture and sensitivity of discharge.

Mean follow up duration of all cases was 1 year and both fractures of femur and tibia united radiologically and clinically in 1 year. Radiological Union of femur was seen at 5 months and that of tibia was seen at 6 months in cases treated both by intramedullary nailing and little delayed in cases treated by plate and screw. Union of tibia little delayed than femur. The Final outcome and functional assessment was done using the Karlstrom-olerund criteria [7] and accordingly 9 patients had Excellent, 8 patients had Good, 2 patients had Acceptable and 1 patient had poor results.

Table-1: Karlstrom criteria.

Criterion	Excellent	Good	Acceptable	Poor
Subjective complaint From thigh or leg	0	Intermittent slight symptoms	More severe symptoms Impairing function	Considerable functional impairment; pain at rest
Subjective symptoms from knee or ankle joint	0	Same as above	Same as above	Same as above
Walking ability	Unimpaired	Same as above	Walking distance restricted	Use cane, crutch or other support
Work and sports	Same as before accident	Given up sport; work same as before accident	Changes to less strenuous work	Permanent disability
Angulation, rotational deformity or both	0	<10°	10-20°	>20°
Shortening	0	<1 cm	1-0 cm	>3 cm
Restricted joint mobility (hip, knee, ankle)	0	<10° at ankle ; <20° at hip, knee or both	10-20° at ankle; 20-40° at hip, knee or both	>20° at ankle; >40° at hip, knee or both

Excellent: No complaints or limitations secondary to the injury to the extremity.

Good: Occasional minor pain in the extremity or a decreased ability to participate in athletic activities.

Fair: Intermittent moderate pain in the extremity but the patient is able to perform all activities of daily living and most recreational activities.

Poor: Constant pain in the extremity and an inability to perform activities of daily living because of the injury to the extremity.



Case 1: pre-op xrays, post-op xrays at 7 months follow up showing union, clinical full range of knee movements



Case 2: pre-op xrays, post-op xrays at 6 months, clinical full range of knee movements and single leg standing on affected limb.

Discussion

The term "Floating Knee" involves ipsilateral fracture of femur and tibia. These fractures are majorly due to high energy trauma in Road traffic accidents. Survivors of these high-energy trauma carry high morbidity and are associated with other injuries such as head, chest, abdominal injuries making these injuries to be treated appropriately. A careful evaluation and resuscitation of the patient must precede the definitive management of specific fractures. The occurrence of open fractures shows that these fractures are more severe than just the bony injuries. There are plenty of studies in the literature detailing different management options for the Floating Knee.

Hayes opined that in a patient with ipsilateral fracture of femur and tibia, operative fixation of one or more of the fractures was valuable in the management of the entire limb^[8]. Ratcliff found that internal fixation of both the fractures should be done wherever possible as these patients were less likely to develop knee stiffness^[9]. Omer treated the Floating Knee injuries by both conservative and operative fixation found that where internal fixation was done for both femoral and tibial fractures, the healing time was about 8 weeks earlier than the group managed conservatively^[10]. The general consensus in recent studies is that the best management for the Floating knee is surgical fixation of both the fractures with intramedullary nails^[11].

Our study showed a male predominance comparable to other studies. Management consisted of treating both the femoral and tibial fractures surgically, intramedullary interlocking nail in case of diaphyseal fractures and plate and screw in case of intra articular femur or tibial fractures. With this management, we found the fracture union time to be 6 months on avg. and good functional recovery. Intra-articular involvement, comminuted fracture, open fracture, severity of soft tissue injuries, associated injuries, associated co-morbidities as diabetes mellitus, poor nutrition, smoking, have been found to be significant indicators of poor outcome results^[12, 13]. In our study a majority (17/20) of patients had favourable results.

Conclusion

Floating knee injuries are a group of complex injuries that needs careful assessment and appropriate treatment. Prognostic factors being age of patient, type of fracture (open/closed, intra-articular or extra-articular, comminuted/non-comminuted fractures) associated injuries of chest, head and abdomen, nutritional status of patient, immune status, associated co morbidities like diabetes mellitus, smoking, surgical fixation of fracture and post-op rehabilitation^[13, 14]. Combination of all these would determine the ultimate outcome of these patients.

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