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Evaluation of management and outcome by various treatment methods in 35 patients of floating knee Inuries

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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. The aim of our study to evaluate the type of fracture in floating knee injury and associated injuries along with the injury and the best treatment method along with basic protocol for its management.
Materials and Methods: Study included 35 patients with floating knee injuries, 32 males and 3 females, belonging to 30 to 60 years of age group. The modified Fraser's classification was used to classify fracture, open fractures were classified according to Gustilo & Anderson's classification. Most of the floating knee injuries were treated with intramedullary (IM) nailing for both the femur and tibia fractures. Other modes of treatment included dynamic hip screw fixation, tibia and femur plate fixation and external fixation for open fractures, followed by secondary procedure. No patient required amputation and patients were followed for 12 months after surgery. Patients were assessed for clinical and radiological union of the fractures. The result was assessed by the Karlstrom criteria.
Results: Out of 35 patients, 21 patients had Fraser type 1 fracture and 14 had Fraser Type 2 fractures (2A Type= 5, 2BType =4 and 2C Type = 5). Fraser type-1 have shown good results while Fraser type 2 showed acceptable results with somepoor results due to joint involvement. Closed fractures showed good results.
Conclusion: Floating knee injuries should be surgically stabilized with appropriate fixation methods. IM nailing in closed extra articular fractures produced good results and early functional recovery.

Keywords: floating knee injury, fraser 's classification, Gustilo & and erson 's classification, karlstrom criteria

Introduction

With the modernization & advances in motor vehicle technology, the way of pattern of problems associated with trauma is also changing. The 'floating knee' is one of such injury, its incidence is increasing day by day.This injury is defined as the simultaneous ipsilateral disturbance of skeletal integrity above and below the knee, which is usually associated with high-energy impact and can be a part of polytrauma. Floating knee injuries or ipsilateral fractures of the tibia & femur in the adult are serious injuries from the concern point of view with a high rate of complications. Besides being caused by high-energy trauma with extensive bone and soft tissue damage, they are also associated with many life-threatening injuries like head injury, chest trauma, and abdomen injury [1, 2, 3].

Some other complications of floating knee injuries include infection, excessive blood loss, fat embolism, malunion, delayed or nonunion, knee stiffness, prolonged hospitalization, and inability to bear weight.

The purpose of this study was to review the long-term outcomes of treatments for floating knee injuries performed at our institutions, and also to calculate the distribution of fracture types, mechanism of injury, associated injuries, method and results of treatment.

Materials and Methods

The study was conducted over a 2-year period (2014-2016) in Department of Orthopedics, SAMC and PGI, Indore. All adult (age > 18 years) patients with floating knee injuries that were managed surgically during the study period in the centre were included. Patients with age<18 years, floating knee injuries with associated neurovascular insult, patients with other fractures of ipsilateral limb or other extremity, and floating knee injuries managed conservatively were excluded from the study. We conducted this study in compliance with the principles of the Declaration of Helsinki. All the standard protocols were followed as per institute's ethical committee policy. Written and informed consents were obtained from all the participants.

Study includes 35 patients with floating knee injuries. Demographic variables like age, sex, mode of injury, and associated injuries were taken into account. Modified Fraser's classification was used to classify the fracture type [4]. Initial management involved resuscitation and haemodynamic stabilization of the patient, splinting of the affected limb in a Thomas splint, Open fractures were classified according to Gustilo & Anderson's (GA) classification [5]. Initial wound toilet, tetanus immunisation and antibiotic therapy was initiated for open fractures.

Routine hematological investigations and standard roentgenograms of the involved region were obtained in all patients.

All fractures were surgically operated within a period of three days. Thorough wound debridement was done for open fractures before definitive skeletal stabilization. The choice of implants included intramedullary (IM) nails, various plates/screw constructs (e.g., 4.5 mm dynamic compression plates, anatomical locking plates), and external fixators. Factors determining the choice of implants were the clinical state of the patients, presence of fat embolism, type of fractures, degree of comminution, presence of segmental fractures, and presence of metaphyseal or intra- articular fractures. Extra-articular fractures were usually treated with IM nailing. Fractures with intra-articular extension were treated with open reduction and internal fixation (ORIF) with plating, and open fractures were treated depending upon the Gustilo& Anderson's (GA) type. GA type I were treated as above, and GA type II and III were treated with external fixation (including trans articular external fixation (TAEF)).

Patients were assessed for clinical and radiological union of the fractures. The clinical results were assessed according to Karlstrom and Olerud score [6].

Results

The mean age of patients was 39.6±12.2 years. Of the 35 patients, 21 had age <= 50 years, and 14 had age >50 years. Floating knee injuries were more common in males (90%). This study showed that 30% of frequent mechanism of injury was by fall from height or fall of heavy object over limb, 70% had the history of road traffic accidents (RTA). It has been seen that, of all the patients middle third fracture of shaft tibia and femur is more common than other fractures. Of the 35 patients 60% had extra-articular fractures of femur and tibia (Fraser type-1), 15% of patient had intra-articular fracture of tibia with extra-articular femur fracture (Fraser type-2A), 10% of patient had intra-articular fracture of femur with extra-articular tibia fracture (Fraser type-2B) and 15% of patient had intra-articular fracture of both, femur and tibia (Fraser type-2C). Eighteen patients had associated injuries with more than one association in 11 patients. Open femur and tibia fractures were observed in 18 patients each. 11 patients had open fractures of both tibia and femur. Amid the open femur fracture, Gustilo& Anderson's type 1 fracture was present in 7 patients, type 2 in 9 patients whereas type 3A was observed in 2 patients. In open tibia fractures, GA type 1 fracture was present in 2 patient, type 2 in 7, type 3A in 5 and type 3B in 4 patients. Table I shows the demographic and clinical spectrum of patients.

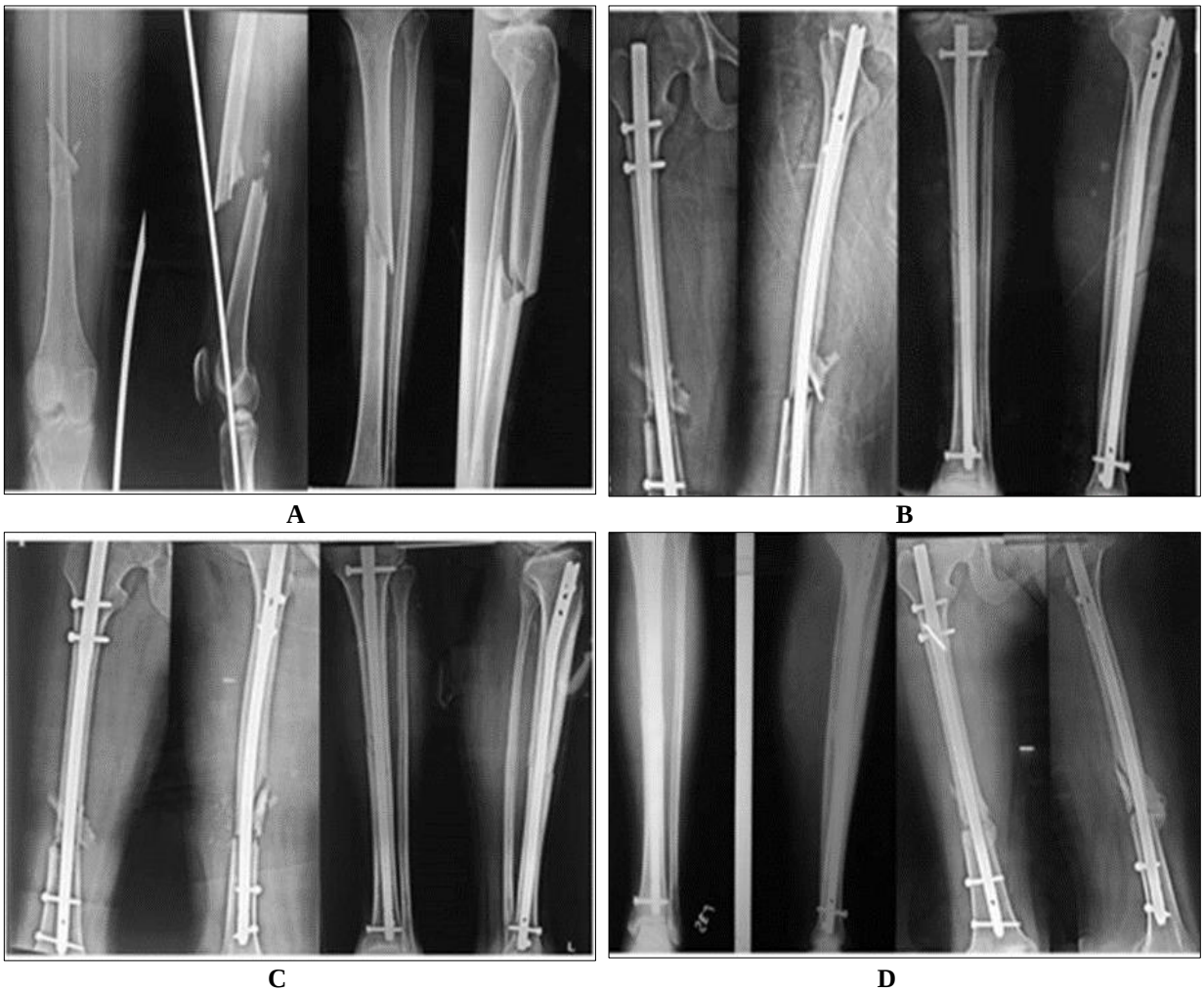

Fig 1: Roentgenograms of a patient at pre-operative(A), immediate post-operative(B), at 6 months follow up(C) and at 1 year follow up period(D)

Shows the roentgenograms of a patient at pre-operative, immediate post-operative, 6 months follow up and at 1 year follow up period managed by IM nails.

Stabilization of femur fracture was done by nailing in 25 patients, by plate in 4 patients and by trans- articular external fixator(TAEF) in 6 patients whereas in tibia fracture nailing was done in 18 patients, external fixation and plating in 5 patients each and TAEF in 7 patients. 12 patients required further surgery after a median period of 2 weeks which includes nailing in 8 patients for femur fracture and in 6 patients for tibia fracture and plating in rest of the patients. 2 patients of proximal tibia fracture managed by ORIF with plating developed superficial wound infection, which was managed with extended period of antibiotics. 2 patients developed Fat Embolism Syndrome (FES) which was managed accordingly. Joint stiffness was noticed in 5 patients. Results of Karlstrom scoring were good or excellent result in 14 patients, acceptable in 12 patients and poor in 9 patients. Fraser type 1 fractures showed more good to excellent results than Fraser type 2 fractures which was statistically significant. Closed fractures and those treated with IM nailing produced better results than open fractures. Table II represents the functional outcome of patients in two groups.

Table 1: Demographic and Clinical Spectrum of patients

Variables	Particulars
Mean Age (In years)	39.6±12.2
Sex(M/F)	32/3
Type of Injury	
Fraser Type 1	21
Fraser Type 2 A	5
Fraser Type 2 B	4
Fraser Type 2 C	5
Associated Injuries	
Pelvic fracture	5
Patella fracture	4
Metatarsal fracture	2
Wrist and Hand fractures	2
Vascular injuries	2
Head injury	4
Ligament Injury	7

Table 2: Functional Outcome

	Fraser Type 1	Fraser Type 2	Total	P Value
Karlstrom scoring				
Good or excellent	12(58.3)	2(12.5)	14(40)	0.022
Acceptable	5(25.0)	7(50.0)	12(34)	
Poor	4(16.7)	5(37.5)	9(26)	

Data of Karlstrom is presented as number (percentage).

Discussion

The floating knee injury is a complex injury and has more complications than a simple fracture of either femur or tibia. It occurs mainly in high velocity trauma like road side traffic accident and the numerous associated complications can be life threatening. Severe complications like early amputations are observed in 6% to 27% patients with floating knee injury [7-10].However, in present study no patients had amputation.

In 70 % of patients the mechanism of injury was a traffic accident which is similar to other previous studies [11, 12]. Associated injuries such as open fracture, vascular injuries, head injuries, ligament injury were observed in almost similar prevalence than other previous reported studies [8, 9, 13-16].

According to the Fraser classification, Piétu *et al* [17] reported that 71.5% of the cases were type I and subtype: II A in 8.2%, II B in 11.6%, and II C in 8.7% of cases which is quite similar to our study. Furthermore, in their study at least one of the fractures was open in 69.2% of the patients whereas in our study prevalence of at least one open fracture was 65%.

There was no case of nonunion in either tibia or femur fracture. However, the previous studies by Hung *et al* (2007) and many othersreported the nonunion rate of 4-20% for femur and 3-30% for tibia [10, 11, 15, 16, 18-21].

Elmrinietal [1] in their study concluded that fractures with the poorest prognosis are those in which many factors are involved, such as open fracture, infection, and fracture comminution. However, the best results were seen in cases of extra-articular fractures treated by locked intramedullary nailing. Fraser *et al* [22], Bansal *et al* [23], Hwan Tak *et al* [24] and Kazuhiko *et al* [25] also reported the same. In present study, also extra-articular fracture of femur and tibia operated with nailing has shown more excellent and good score and better ROM outcome than in patient treated with open intra-articular fracture of femur or tibia, operated with plating or external fixation.

Conclusion

The current recommendation for floating knee injuries is surgical stabilization of both the fractures. There are variable methods of fixation but not a single ideal technique. The chosen method depends on the fracture pattern, location, intra articular extension, comminution and the soft tissue injury status. Closed fracturesand open GA type I fractures produced better results and showed early return to daily activities,as compared to open GA type II and III fractures. Also, extra articular fractures showed better results than intra articular fractures. Younger patients showed better results than older patients (age> 50 years). A secondary procedure may be required for patients initially managed with external fixation. One should be aware of the

Impact of the osteosynthesis technique on the overall physiology of the patient.

There is a high incidence of associated injuries with the floating knee, which offers no hindrance in fracture union and functional recovery.

Conflict of Interest

None

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