

A Study of Surgical Management of Floating Knee in Adults

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Abstract

Background: Floating knee injury is a term used to denote ipsilateral femoral and tibial metaphyseal injuries. But recent literature has however expanded this term to include most ipsilateral fractures of the femur and tibia. These are extremely heterogeneous groups of injuries. They usually occur due to very high energy trauma. These are relatively uncommon injuries. These are always associated with high morbidity. Most of these injuries result in some permanent disability. There are no specific guidelines for the management. The implant choice needs to be determined depending on nature of fracture and soft tissue injuries.

Material and Methods: This study is about the Functional Outcome of Surgical Managements of Floating Knee For this study 17 consecutive patients with ipsilateral femur and tibia fractures, All cases of ipsilateral tibia and femur fractures were included. Study duration of two years. Detailed history will be obtained using Performa with special attention to mechanism of injury. Evaluations including base line clinical features. Examination of other associated symptoms will be based on history and physical examination. The plan of management for the given patient was made depending on the nature of fracture, location of fracture, associated soft tissue injuries.

Conclusion: Patients who undergo primary nailing will have Excellent or Good results. The most important factors which determine the functional outcomes were the type of fractures (open or closed), nature of comminution including intraarticular extensions, timing of fixations and post operative infections.

Keywords: Floating knee; primary nailing, intraarticular extension, comminution, metaphysic.

Introduction

Floating knee injury is a term used to denote ipsilateral femoral and tibial metaphyseal injuries. But recent literature has however expanded this term to include most ipsilateral fractures of the femur and tibia. These are extremely heterogeneous groups of injuries. They usually occur due to very high energy trauma. These are relatively uncommon injuries. These are always associated with high morbidity. Most of these injuries result in some

permanent disability. There are no specific guidelines for the management. The implant choice needs to be determined depending on nature of fracture and soft tissue injuries. A specific pattern of management can often not be determined. The incidence of floating knee injuries was reported as 2.6 % of all fractures by Letts et al in 1986.¹ These injuries were associated with life threatening injuries such as head injury, chest injury and abdominal injuries

as shown by Veith.² Other skeletal injuries were also seen in these patients. Injuries were often a combination of different fracture patterns. There was extensive soft tissue damage of the limb as well. The soft tissue injuries can also be variable from minor abrasions to grade III open injuries. Injuries to the neurovascular structures add a treacherous component to the whole picture. This often perplexes even the most experienced clinicians in the choice of management. The principals of treatments are: Early and thorough debridement of the wound in case of open fractures, Accurate reduction of intraarticular fractures and reduction of dislocations, Stabilization of fractures with appropriate implants, Concurrent management of neurovascular injury, Primary or delayed primary closure of wounds and appropriate soft tissue cover. Early mobilization of the knee joint and introduction of the functional activities of the lower limb as a whole, For this study 17 patients with ipsilateral femur and tibia fractures who presented to NRS medical college and Hospital, Kolkata. duration of two years, and who were managed surgically, were included. This study is a Prospective study with a minimum of 1 year follow up.

Objectives

To study the new cases, patterns and morphology of ipsilateral femur and tibia fractures, their management modalities and results, To identify any modifiable factor affecting the eventual functional result.

Review of Literature

For floating knee injuries in the 1970s and 80s, conservative management was favoured and surgical intervention with implant fixation was criticized. Complications such as non union, delayed union, osteomyelitis, knee stiffness and deformities were common. In 2015, M.L. Bertrand, P. Andrés-Cano and F.J. Pascual-López found that Ipsilateral fracture of the femur and tibia, or floating knee, is a rare injury that is

found almost exclusively in polytrauma or high-energy trauma patients.³ It presents a combination of diaphyseal, metaphyseal and intra-articular fractures of the femur and tibia, with a high incidence of neurovascular, ligamentous and soft-tissue injuries. The functional outcome and, in some cases, the life, of such polytrauma patients depends largely on a correct therapeutic approach being taken. In general, the treatment decided upon will depend on the individual characteristics present, regarding aspects such as the patient's general condition, the fracture line and the state of the soft

tissues. In 1975, Blake and McBryde reported a series of forty seven patients.⁴ Most of them were young men who had multiple injuries with high velocity trauma and complications of these fractures were frequent. Delayed union or non union occurred in 44.6% of the total number of bones involved. 60% to 70% of the adult patients showed significant permanent functional disability. In 1977 Karlstrom and Olerud reported thirty two patients with floating knee injuries, fourteen patients were treated by rigid internal fixation or external fixation for both fractures.⁵ Three patients had internal or external fixation of one fracture and conservative treatment of other fracture. Fifteen patients underwent non operative management for both fractures. The patients who were treated operatively for both fractures had a lower incidence of complications, shorter duration of hospitalization and shorter time to healing. An active surgical approach produced considerably better functional end results. Twelve of fourteen patients treated surgically, resumed their former occupations compared with four of thirteen patients treated non-operatively. Katada reported fourteen patients with floating knee injuries.¹⁰ He found that intramedullary nailing of both femur and tibia gave good results. As communitation is often severe in patients with floating knee injuries intramedullary nailing with Kuntscher nail may

be difficult. He introduced a closed Enders nailing for femoral and tibial shaft fractures. Its advantages were that it was technically simple, has wide indications and results in rapid bone union without knee stiffness. In 1984, Veith et al reported about fifty seven patients, fifty six of those femoral fractures and half of the tibial fractures were treated with internal fixation.² These included open fractures also. He reported that overall a good or excellent functional result was achieved in about 80 % of those patients. The best results were achieved when both fractures were stabilized surgically. Szalay MJ, Hosking OR, Annear P did a study on the injury of the knee ligaments associated with ipsilateral femoral shaft fractures and with ipsilateral femoral and tibial shaft fractures. The anterior cruciate ligament was more commonly injured with/without other ligaments injury. Della Rocca GJ et al did a study on conversion of external fixation to intramedullary nailing for closed fractures of the femoral and tibial shaft. They had analyzed the time interval between the conversion of the fixations. They had concluded that the management of closed femoral and tibial diaphyseal fractures with external fixation then conversion to intramedullary nailing should be based on the condition of the given limb. They also mentioned that external fixation can be a definitive treatment for floating knee in paediatric population. Mark P et al did a study on the long term follow up of patients with ipsilateral femur and tibia diaphyseal fractures. This included the patients admitted between 1966 to 1981 in university of Iowa hospitals. There were forty five patients with forty six injured limbs.

Material and methods

This is a prospective study conducted in Department Of Orthopedic Surgery, Nil Ratan medical college, Kolkata. This study is about the Surgical Management of Ipsilateral Femur & Tibia Fractures [Floating Knee] in adults. For this study 17 consecutive patients with ipsilateral

femur and tibia Study duration of two years. who fulfilled the criteria were included. The patients were classified according to Blake and McBryde's Classification for floating knee injuries.

Inclusion Criteria

All ipsilateral femur and tibia fractures in adults, Both closed and open fractures.

Exclusion Criteria

Children with ipsilateral femur and tibia fractures – skeletally immature patients.

Associated neurological injuries such as paraplegia or quadriplegia resulting from spinal injuries. When the patients presented in casualty primary survey of airway breathing and circulation was done. The patients were resuscitated accordingly. Once the patient was hemodynamically stable necessary primary investigations were done. All fractures were splinted in Thomas splint or plaster of paris slab. Open fractures and wounds were documented properly. Cultures were sent. Adequate wound wash and irrigation was done with minimum of 5L of sterile normal saline. Appropriate antibiotics and prophylactic tetanus toxoid were started. The subject was included into the study once a diagnosis of floating knee injury was made in the Emergency room. Floating knee was classified according to Blake and McBryde's Classification. Open fractures were classified according to Gustilo and Anderson classification. The plan of management for the given patient was made depending on the nature of fracture, location of fracture, associated soft tissue injuries. A primary survey was made and x-rays were taken to image the entire femur and tibia with the adjacent articulations of the knee hip and ankle. Primary care was given to all these patients and then they were operated. The patient was subjected to mobilization schedule according to associated injuries and general condition.

Results

Mean and standard deviation of age, knee mobilization, weight bearing, bony union femur,

bony union tibia, duration of surgery and knee range of motion

Table 1:

Variables	Minimum	Maximum	Mean	Standard deviation
Age	20	67	36.76	15.39
Knee Mobilisation	3	14	7.24	3.07
Weight Bearing	6	20	13.88	3.84
Bony Union Femur	12	48	24.00	14.69
Bony Union Tibia	12	48	25.41	13.99
Duration of The Surgery	80	160	110.00	21.51
Knee-Range of Motion	60	120	99.41	17.49

As per the table in this study the mean age was 36.76 with standard deviation of 15.39. Mean duration for starting knee mobilization was 7.24 weeks. Mean duration for starting partial weight bearing was 13.88 weeks. Mean duration for radiological signs of bony union of Femur was 24 weeks, the earliest was 12 weeks and longest duration was 48 weeks. Mean duration for radiological signs of union for Tibia was 25.41 weeks the earliest and longest duration are same as those for femur. Mean duration of surgery was 110 minutes. Mean knee range of motion achieved at the end of follow up was 99.41 degree. There was only one female patient in this study out of 17 constituting 5.88%, the rest were males accounting 94.12%. In this study majority were right sided injuries constituting 58.12%. Major mechanism of injury was motorcycle accidents, 9 patients had motorcycle accident constituting 52.94%, 4 had motor

vehicle accident (four wheelers) constituting 23.53%, rest of them were pedestrians hit by vehicle (23.53%) Out of 17 femur fractures in this study classified according to Gustillo and Anderson classification 11 were closed fractures constituting 64.71 %, 2 were type 1 open (11.76%), 2 were type 2 open (11.76%) 1 was type 3 A open (5.88%) and 1 was type 3 B open (5.88%). Femur fractures were transverse, comminuted and segmental. In this study 6 patients had transverse fractures (35.29%), 11 had comminuted fractures (64.71%) and none had segmental fractures. Out of 17 tibia fractures 10 patients had fracture level at diaphysis accounting for 58.82%, 5 had fractures at diaphysiometaphyseal junction (29.41%), 2 had fracture extending to knee joint intraarticular (11.76%) and none had intraarticular ankle fractures.

Table 2: Blake and McBryde classification

Blake and McBryde classification		
Type 1	8	47.1
Type 2A	9	52.9
Type 2 B	0	0.0

In this study 47.1% of patients had Blake and McBryde class 1 fractures, that is 8 patients whereas 9 patients had Blake and McBryde class 2A fractures (52.9%) and none had type 2B fractures. The complications which might occur during fixation of ipsilateral Femur and Tibia fracture are disseminated intravascular coagulation, fat embolism, infection, implant failure, delayed union, malunion, nerve injury and amputation. In this study the complications encountered were, patient with type 3 B open tibia fracture developed infection accounting for 5.88% of total study population, 1 patient had implant failure with proximal tibia fracture who was fixed with intramedullary interlocking nail

developed breakage of implant which was then re-operated with implant removal and locking plate fixation (5.88%) and 3 patients, one with supracondylar fracture femur fixed with distal femur locking plate, one with subtrochanteric fracture fixed with long proximal femoral nail and one with distal tibia type 3B open fracture fixed with distal tibia locking plate developed delayed union. patients underwent implant removal, 1 patient had excellent outcome with intramedullary nailing for both tibia and femur had achieved bony union underwent implant removal at 40 weeks. Another patient who underwent plating of femur and nailing for tibia underwent implant removal at 42 weeks as the bone was united.



Pre- operative Radiograph



Union at 28 weeks follow up

Discussion

Floating knee injury occur usually due to high velocity trauma. There is an increase in the occurrence of floating knee injuries due to the increase in more number of road traffic accidents. These are always associated with high morbidity. Most of these injuries results in some permanent disability. In our study the most common mechanism of injury was road traffic accidents (100%). Among the road traffic accidents motor cycle accidents (Two wheeler accidents) (52.9%) accounted the most. Four wheeler accidents accounted to about 23.5% and 23.5% were pedestrians. The more number of road traffic accident cases were due to the fact that our hospital is a tertiary referral centre. There are many studies showing the association of other injuries like head injuries, chest injuries, abdominal injuries and contralateral limb injuries. Many of these injuries are often life threatening. Adamson *et al* in their study encountered 71% major associated injuries with 21% vascular injuries. Seventeen patients were included in this study, males predominated in our study (94.1% male, 5.1% female). Other similar studies in literature also describes the similar gender distribution. The age distribution was from 20 years to 67 years with mean of 36.76 years. Skeletally immature paediatric age group was not included in the study. Hee *et al* in their study described almost the same age group. Right sided injuries (58.8%) were more common than left sided injuries (41.2%). Hee *et al* described in their study that comminuted and segmental fractures were poor predictors of functional outcome. Of the 17 patients in this study 8 patients had Blake and McBryde class 1 of which 4 had excellent outcome accounting for 50% of patients with class 1 Blake and McBryde, 2 patients had good outcome (25%), 1 patient had acceptable outcome (12.5%) and 1 patient had poor outcome (12.5%). 9 patients had Blake and McBryde class 2 A of which none had excellent outcome 3 patients had good outcome which was 33.3% of

all class 2 A Blake and McBryde, 4 patients had acceptable outcome (44.4%) and 2 patients had poor outcome (22.2%). Blake and McBryde⁴ were one of the pioneers to classify floating knee injuries. After an extensive study, they had classified floating knee injuries as Type-I fractures involving both shafts, Type-2 A fractures involving the knee joint, Type- IIB fractures involving the hip or ankle joints. Fraser *et al*⁶ in 1978, studied 222 cases with ipsilateral fractures of the femur and tibia. They found that poor function outcome was seen in intraarticular fractures. Similar results were shown by Bansal *et al*⁹. Studies reveal associated injuries such as head injuries, chest injuries, abdominal injuries and injuries to other extremities. Most injuries to the head chest and abdomen are life threatening. A study done by Adamson *et al* encountered 71% major associated injuries with 21% being vascular injuries. A deliberate and careful examination of the patient must be carried out to determine major intracranial, abdominal and thoracic injury if present and should take precedence over extremity injury in the priority of treatment. There were 3 patients in this study who developed delayed union, 1 patient with distal femur fracture fixed with distal femur locking plate had delayed union and had poor functional outcome, 1 patient with subtrochanteric fracture femur fixed with long proximal femoral nail developed delayed union, same patient also had grade 3B open tibia fracture which was managed with external fixator had developed implant infection, he had poor outcome and 1 patient with distal tibia fracture, grade 3 B open for whom split skin grafting was done as a wound coverage procedure and fracture fixed with distal tibia locking plate developed delayed union and had acceptable functional outcome. There were 3 patients with poor outcome (17.6%), 1 patient had been fixed with plating for both tibia and femur fracture had 0-80° of knee motion complained of severe knee pain and bony union of femur occurred at 48 weeks this patient left the job which he used to

do before accident, another patient had subtrochanteric fracture femur fixed with long proximal femoral nail and grade 3 B open tibia fracture fixed with external fixator developed implant infection and complained of pain and could not walk without assistance and another patient with poor outcome had both his femur and tibia fracture fixed with plating also couldn't walk without assistance and could achieve 0-60° knee motion.

Conclusion

Floating knee injuries are due to high velocity trauma. Road traffic accidents particularly two wheeler accidents is the commonest cause. Males are affected more. There are many post operative complications like, infection, delayed union and implant failure. Poor outcomes are mainly due to open fractures, comminution and intraarticular extensions. Patients who undergo primary nailing will have Excellent or Good results. The most important factors which determine the functional outcomes were the type of fractures (open or closed), nature of comminution including intraarticular extensions, timing of fixations and post-operative infections.

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