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Original Research Article

Evaluation of Functional Outcome of Floating Knee Injuries in a Tertiary Care Hospital

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Abstract

Background: The simultaneous ipsilateral fracture of the femur and tibia that isolates the knee from the rest of the limb is known as a floating knee. The intricacy of the injury and related consequences, including meniscal, collateral, vascular, and compartment syndrome injuries, continue to present a significant challenge to the treating orthopedic surgeon.

Methods: The present study was conducted in the Department of Orthopedics, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. All the patients who were victims of high-velocity road traffic accidents were brought to our institute of treatment. Patients were revived as per the ATLS procedure (maintenance of airway with cervical spine control, breathing, and circulation) as soon as they arrived. Standard protocols were followed for treatment and complications. Functional outcome was assessed by using KarlstromOlerud's criteria.

Results: The grading of fractures was done in the study as described in table 2. The most common fractures were IIIB and II followed by IIIA. Out of n=20 cases, n=11(55%) cases were having an extension of either femoral or tibial or both fractures into the knee joint (Type I floating knee fracture), and the rest 9(45%) cases were purely diaphyseal fractures (Type II) floating knee fractures. Treatment Modality:Intramedullary nail fixation was done in a greater number of patients in the femur and external fixator in fracture tibia as compared to other modalities.

Conclusion: The floating knee fracture is a complicated condition brought on by high-energy trauma. Each floating knee fracture is distinct, and the best course of action should be determined by the patient's overall health, the specifics of the fracture, and the degree of soft tissue damage. Better outcomes are achieved with vigorous wound cleaning and stabilization in compound fractures and early internal fixation and mobilization in closed fractures.

Keywords: Floating knee fractures, tibial fractures, femur fractures, functional outcome

Introduction

Due to the high-energy trauma brought on by high-velocity motor vehicle collisions, floating knee injuries are becoming more and more prevalent because of increased industrialization and the number of automobiles. [1] The care of these kinds of fractures is a difficult therapeutic challenge because of the complexity of the injury and accompanying consequences such as compartment syndrome, vascular injuries, collateral ligament injuries, and meniscal injuries. These ipsilateral

complex fractures most frequently result in serious soft tissue injury and compound fractures. It is common for a life-threatening head, spinal cord, thoracic, and abdominal (Visceral) injuries to occur alongside combined femoral and tibial fractures. [2] The classification system for floating knee injuries in adults first proposed by Blake and McBryde in 1975 is still in use today. Fraser14 proposed a different grading scheme for floating knee injuries in adults in 1978. [3] Similar to M Letts et al., [4] proposed a categorization scheme for the ipsilateral femur and tibia fractures in young patients. In a study of thirty-two cases from 1977, Karlstorm G et al., [5] emphasized the significance of tight fixation of both fractures. A universal system was also proposed by them to evaluate the functional outcomes following floating knee injuries. A study on n=57 cases with floating knees was published in 1984 by Veith RG et al., patients had complex fractures, while 21 patients suffered life-threatening injuries. All but one of the femur fractures and around half of the tibia fractures were internally repaired. The typical hospital stay was five weeks. One below-knee amputation, three deep infections, four ununited fractures, and fat embolism syndrome in 13% of the patients were among the consequences. The mean range of knee motion was 129o at the most recent follow-up assessment, which was performed an average of 40.5 months after the incident. 80% of the patients had satisfactory or outstanding outcomes. The greatest outcomes came from surgically treating both fractures. The best clinical result is obtained when both the femur and tibia fractures are surgically stabilized, and when the patient receives early rehabilitation. Although each fracture in the limb should be treated separately to get the best results, the impact of that choice must be taken into account in light of the patient's overall health and the overall damaged state of the entire extremity. [7] In contrast to intra-articular fractures, the outcomes and consequences will be better if the fractures are diaphyseal or extra-articular. In floating knee injuries, the primary goals of early internal fixation of the femur and tibia are to achieve union of the fractures in anatomical positions consistent with the maximum functional recovery of the extremity and to minimize sequelae. [7] The present study aimed to analyze the functional outcome of floating knee injury in a Tertiary Care Teaching hospital in south India.

Material and Methods

This cross-sectional study was conducted in the Department of Orthopedics, Prathima Institute of Medical Sciences, Naganoor, Karimnagar. Institutional Ethical approval was taken for the study. Written permission was obtained from all the participants of the study.

Inclusion Criteria

1. Ipsilateraltibial and shaft of femur fractures
2. McBryde & Black Type I Type II A
3. Males and females
4. Those voluntarily participating in the study

Exclusion criteria

1. Ipsilateral fracture of femur and tibia with extension into the hip and
2. ankle joints.
3. Patients who were lost in follow-up or follow-up of fewer than 4 months were also excluded from the study

All the patients who were victims of high-velocity road traffic accidents were brought to our institute of treatment. Patients were revived as per the ATLS procedure (maintenance of airway with cervical spine control, breathing, and circulation) as soon as they arrived. The patient's general health was evaluated in light of any hypovolemia, related orthopedic, or other systemic ailments. Any systemic injury if the present was given priority in treatment. The Thomas Splint was used to immobilize the

fractured femur and tibia. All patients got intravenous antibiotics and I.M. injections of analgesics. Compound fractures required rapid debridement and the use of an external fixator while sedated. Primary closure was carried out following appropriate debridement when the wound was uncontaminated and clean cut. Skin grafting, local flaps, or secondary closure were used when a wound's size was substantial and there was skin loss. All patients had routine examinations. X-rays were obtained in the lateral view and anteroposterior planes. Pre-operative preparation of the cases: Patients were kept NPO for 6-8 hours before surgery, and I.V. Fluids were given as per the need. I.V. Antibiotics were given to all the patients' pre and perioperatively. An adequate amount of compatible blood if needed was arranged. Preparation of the whole extremity, private parts, and back was done. Intramedullary interlocking nailing was done wherever possible. The anatomical reduction was achieved for intra-articular fractures and fixed with plates and screws. Patients were operated on under Spinal / General Anesthesia.

Intramuscular injections of analgesics were administered following surgery. All closed fractures received intravenous antibiotics for 3 days after surgery. On the fourth post-operative day, when the check dressing and drain were removed, oral antibiotics were started. If the fracture was complex, antibiotics were administered based on the condition of the wound. On the twelfth postoperative day, skin sutures were removed. Following fixation, early range of motion exercises was started based on the patient's consciousness, hemodynamic state, pain level, and any accompanying injuries. Passive range-of-motion exercises were performed on the ankle, toe, and calf muscles for patients with low Glasgow coma scores to avoid deep vein thrombosis. The respiratory difficulties were avoided with the help of chest physical therapy. On the first post-operative day, active range of motion exercises for the ankle and toe were begun for patients who were aware and hemodynamically stable. Exercises for isometric quadriceps and gluteal contraction were provided. With the use of a walker, the patient was made mobile through non-weight-bearing walking. When the fracture site had developed enough callus on the x-rays after six weeks, partial weight bearing was initiated. According to the radiographic evidence of unions, more weight-bearing was put into place. All patients were followed up for clinical and radiographic evaluations of union status, knee range of motion, and other problems monthly for the first four months, then every three months. After a minimum of 4 months, the patient's functional recovery was evaluated using the Karlstrom G et al., [5] criteria.

Results

A total of n=20 cases of ipsilateral fracture of the femur and tibia were included in the study. They were followed up for a period of 12 months. The most common age group involved was 21 – 40 years with n=13(65%) of all the cases. The other groups had a 10% distribution of the cases and the least was in age 61 and above with 5% cases. The age range of this group was 19 years to 64 years and the mean age was 27.5 years. The details has been depicted in table 1. In the study majority of cases, n=18(90%) were males and n=2(10%) were females.

Table 1: Age-wise distribution of cases included in the study

Age in Years	Frequency	Percentage
18 – 20	2	10
21 – 30	8	40
31 – 40	5	25
41 – 50	2	10

51 – 60	2	10
> 61	1	05
Total	20	100

The right side was involved in n=14(70%) of cases of patients and the left side was involved in n=6(30%) of the cases in this study depicted in figure 1. Out of the n=20 cases, n=19(95%) cases were due to Road Traffic Accidents and n=1(5%) were due to falls from height. Femur fractures were closed in 80% of patients and open in 20% of patients whereas tibia fractures were closed in 60% of patients and open in 40% of patients. The fractures were closed in 60% open in 20% of patients' details have been depicted in Figure 2.

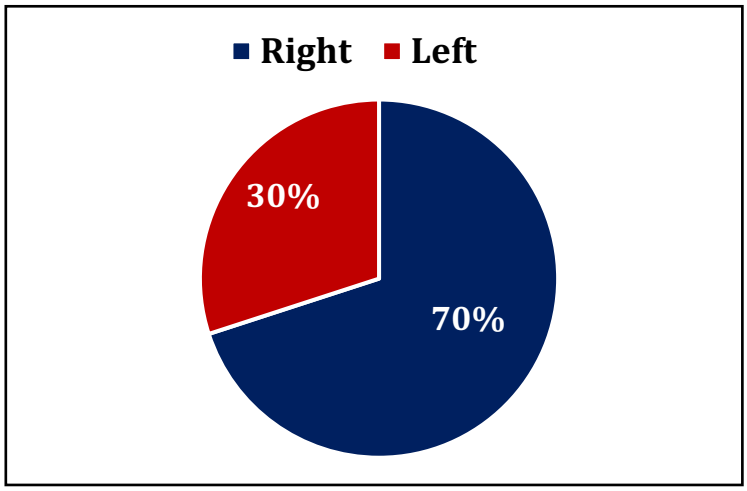

Figure 1: Showing the laterality of the injury

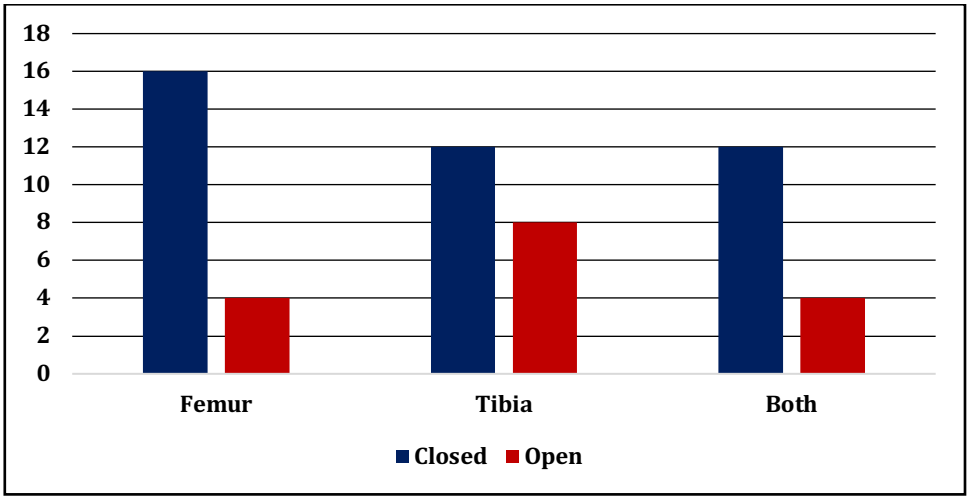

Figure 2: Distribution of fractures in the cases of the study

Table 2: Grading of fractures in the cases of the study

Grade	Femur	Tibia	Total
I	0	0	0
II	2	2	4
IIIA	1	2	3
IIIB	1	4	5
IIIC	0	0	0
Total	4	8	12

The grading of fractures was done in the study as described in table 2. The most common fractures were IIIB and II followed by IIIA. Out of n=20 cases, n=11(55%) cases were having an extension of either femoral or tibial or both fractures into the knee joint (Type I floating knee fracture), and the rest 9(45%) cases were purely diaphyseal fractures (Type II) floating knee fractures. Treatment Modality:Intramedullary nail fixation was done in a greater number of patients in the femur and external fixator in fracture tibia as compared to other modalities. Various modalities used have been depicted in table 3.

Table 3: Treatment modality of fractures in the cases of the study

Treatment	The femur (%)	Tibia (%)
Conservative	0 (0))	6 (30)
Intramedullary nailing	15 (75)	8 (40)
Plating	3 (15)	2 (10)
External fixator	2 (10)	4 (20)
Total	20 (100)	20 (100)

Table 4: Complications in the cases of the study

Complication	Frequency	Percentage
Shock	2	10
Mal union	0	00
Delayed union	3	15
Compartment syndrome	1	05
Knee stiffness	7	35
Non-union	1	05
Local infection	2	10

The incidence of knee stiffness was reported in n=7 cases out of which n=3/11 cases of type I floating knee fractures were involved and the average flexion angle was 0 – 120 degrees. N=4/9 cases of type II floating knee fractures were with knee stiffness and the average flexion angle was 0 – 70 degrees. In this study, n=3 cases out of 20 cases developed more than 3 cm shortening. All n=3 cases were due to severe comminution and soft tissue injury. These were managed with heel and sole-raised footwear. By using Karlstrom&Olerud criteria the functional outcome in our study was excellent in n=10 (50%) patients; good in n=5 (25%) patients acceptable in n=4 (20%) patients and poor in n=1 (5%) patients depicted in table 5.

Table 5: Karlstrom and Olerud Criteria for functional recovery of a floating knee injury

Criteria	Excellent	Good	Acceptable	Poor
Subjective Symptoms of thigh or leg	10	5	4	1
Subjective symptoms from knee or ankle joints	11	4	3	2
Walking ability	13	3	2	2
Work & Sports	12	3	4	1
Angular or rotational deformity or both	11	6	2	1
Shortening	13	2	2	3
Restricted Joint movements				
Hip	15	3	2	0
Knee	12	2	2	4
Ankle	14	3	3	0

Discussion

An increase in automobile usage because of urbanization has led to an increase in auto accidents. Multiple fractures are common in such individuals. There are two main things to be concerned about when treating such people. The first is systemic damage that is complicated by the body's reaction to the injury, and the second is an issue brought on by concurrent fractures. Most of these fractures occur in younger male patients between the 20-40 years age group indicating that it is an injury occurring commonly in young adults. Since 1977 Karlstrom and Olerud [5] used surgical techniques to repair floating knee fractures. Several researchers have recommended aggressive surgical therapy for floating knee injuries. Compared to non-surgical treatment, surgical management has led to lower hospitalization rates, fewer systemic problems, and better functional outcomes. ME Winston [8] suggested conservative therapy as a safe way for treating floating knee injuries that produce satisfactory outcomes without the risks of infection associated with internal fixation. N=3 undisplacedtibial fractures in our research were conservatively treated with an above-knee cast. JJ Yue et al., [9] concluded that surgical stabilization was linked with decreased leg length disparity, angular malunion, and subsequent operations from conservative therapy. They compared the surgical and non-operative treatment of ipsilateral femur and tibia fractures. In patients receiving nonoperative treatment, 31% infection incidence was observed by Omer et al., [10] According to RD Fraser et al., [11] patients who had surgical stabilization of both fractures had a greater infection rate (20% Vs. 8%) than patients who underwent non-operative treatment. Veith RG et al., [6] observed that when any fracture was surgically stabilized, the infection rate was just 5%. According to Mc Andrew et al., [12] profound infection occurred in 11% and 22%, respectively, of the femur and tibial fractures. In the current study, we did not encounter any case of deep infection superficial infections were seen in 10% of cases. In the current study, we found the mean time taken for the healing of femur fractures was 24 weeks and similarly it was 25 weeks for tibial fractures. Karlstrom G et al., [5] reported a healing time of around 20 weeks whereas according to Adamson GJ et al., [13] it was 39 weeks for the femur and 37.5 weeks for the tibia. Based on Karlstrom&Olerud criteria [5] functional outcome in our study was excellent in n=12(60%) of cases good in n=4(20%) acceptable in n=2(10%) and poor in n=2(10%). Our study indicates 60% of overall excellent results compared to 86% in Karlstrom G et al., [5] analysis of 32 instances, which included excellent to good results in 86% of the cases. Veith RG et al., [6] found 72% excellent to good outcomes, whereas Anastopoulos G et al., [14] study found 81% excellent to good results overall. These outcomes far outperform the cautious series of Fraser et al., [11] which displays 29% excellent to good outcomes. The outcomes of fractures that involve the knee joint are often worse than those of fractures that do not. According to Rethnam U et al., [15] concomitant injuries and the kind of fracture whether it is open, intra-articular, or comminuted are included in the prognosis of fractures in floating knee injuries. Adamson et al., [16] study of type II floating knee injuries found results were excellent to good in 24% of cases. whereas Hung et al., [17] found results that were 23.8% excellent to good in 23.8% of cases. As a result of knee joint involvement and the severity level of soft tissue injury, Yokoyama et al., [18] concluded that floating knee injuries had a bad prognosis.

Conclusion

A floating knee fracture is a complicated condition brought on by high-energy trauma. Each floating knee fracture is

distinct, and the best course of action should be determined by the patient's overall health, the specifics of the fracture, and the degree of soft tissue damage. Better outcomes are achieved with vigorous wound cleaning and stabilization in compound fractures and early internal fixation and mobilization in closed fractures. Injury to the knee ligaments is significant, and thorough postoperative therapy will result in a favorable functional outcome.

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