Original Research Article

Journal of College of Medical Sciences-Nepal, Vol-19, No 3, Jul-Sep 2023
ISSN: 2091-0657 (Print); 2091-0673 (Online) Open Access
DOI: 10.3126/jcmsn.v19i3.58380

Outcome of Surgical Management of Ipsilateral Femur and Tibia Fracture: The Floating Knee Injury

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ABSTRACT

Introduction

Floating knee injuries are one of the rare injuries of the lower limb involving fracture of ipsilateral femur and tibia. These injuries are often associated with other systemic injuries and have higher incidence of morbidity and mortality. Often times these fractures can pose difficulty in achieving union and might have residual stiffness around the knee. This study was carried out to assess the functional and radiological outcome of surgical management of floating knee injuries and the associated complications.

Methods

A hospital based prospective study including 34 cases of surgically managed floating knee injuries over a period between January, 2017 and December, 2019 with the mean follow-up duration of 15 months was performed. The final outcome was evaluated on the basis of Karlstorm and Orelud criteria.

Results

Final analysis was done based on the Karlstorm and Orelud criteria after the bony union was achieved. Based on the Karlstorm and Orelud criteria, 44.11% cases had excellent outcome, 29.41% cases had good outcome, 14.7% cases had a fair outcome and 11.76% cases had a poor outcome.

Conclusions

Floating knee injuries are severe injuries often associated with polytrauma. Operative management in these complex injuries can yield favorable functional outcome with fewer complications.

Keywords: damage control; floating knee; knee injuries.

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INTRODUCTION

The term floating knee was first introduced by McBride and Blake and it denotes ipsilateral fractures of the femur and the tibia. The spectrum of these fractures ranges from simple diaphyseal fractures to complex intra-articular fractures involving the combinations of diaphyseal and metaphyseal fractures.[1] These fractures results from a high energy trauma such as high speed motor vehicle accidents and often associated with multisystem injuries, therefore they carry high rate of morbidity and mortality. These fracture are often associated with soft tissues damage, meniscal, ligamentous and vascular injuries and their complications.[2] With the study of floating knee injuries in children, Letts et al in 1986 found the incidence to be 2.6%.[3] With the increase in the number of motor vehicles related injuries the incidence of this complex fracture is increasing.[4] Different classification systems have been proposed, while the most commonly practiced is the one devised by Fraser et al. This classification system distinguishes two different patterns of injuries; one with diaphyseal fractures in both bones, and the other with associated intra-articular fractures in the femur, tibia or both.[5]

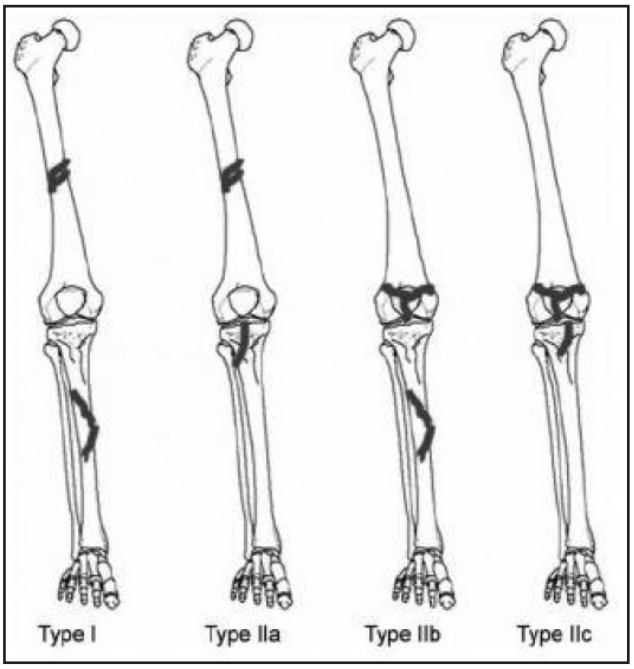

Figure 1. Fraser's classification of floating knee.

A modification of above classification has been proposed by Ran et al. taking consideration to the impact on the patella and the complexity of the articular fracture. According to the modified classification, the floating knees were classified as three types: type I as extra-articular fracture, type II when articular surface involved and type III with patellar involvement. Type II and type III injuries were sub-divided into type IIA injury articular simple and type IIB injury articular complex and type IIIA patella simple and type IIIB patella multi-fragmentary injury, respectively.[6] This classification does not take into account of the diaphyseal fractures associated with patella fractures. Soft-tissue injury and ligament injuries are not considered in both of the abovementioned classification system. However, these aspects of injuries should be considered prior to the management because they may produce a variable post operative result and complications.Surgical stabilization of both fractures and early mobilization of the patient and extremity produces the best clinical outcomes. Since the spectrum of these injuries result from isolated limb involvement to polytrauma, open or closed injuries, with or without vascular injuries therefore the treatment planning for each of these fractures should be considered individually so as to achieve the optimal result.[4] The purpose of this study is to determine the functional and radiological outcome of surgical management of floating knee injuries and the associated complications.

METHODS

Thirty-four patients with ipsilateral fractures of the femur and the tibia were treated using various surgical modalities at the Department of Orthopedics, College of Medical Sciences, Bharatpur, Nepal, over a period of January, 2017 and December, 2019. Operative interventions were made only after proper patient counselling. Written informed consent was obtained in

all cases. Approval to conduct the study was obtained from the Institutional review committee of committee of College of Medical Sciences. Patient's demographics were collected using a proforma. Patients above the age group of 18 years who has sustained floating knee injury were included in the study. Fractures were classified using Fraser classification system of floating knee injuries.[5] Pathological fractures were not included in the study. Age distribution, gender distribution, mechanism of injury, fracture types, radiological union, requirement of repeat surgery and complications were noted. The data were entered refined and analyzed using Microsoft Excel, and SPSS version 18. Final outcome evaluation was done on the basis of Karlstorm and Orelud criteria. The data were tabulated and presented using appropriate tables, graphs and pictures. Patients with age more than 18 with associated injuries to other body parts were included in this study. While patients with, pathological fractures, previous knee/ femoral/ tibial injury or surgery, penetrating, periprosthetic injury, previous deformity of involved lower limb, Neurological disability before or after trauma were excluded from this study. All patients in our study were managed in the emergency department as per the standard ATLS protocol. Patients were assessed for spinal injuries, chest and pelvic injuries and resuscitated. Radiological investigations were sent as per requirement. Standard anteroposterior and lateral radiographs of the affected limbs were obtained. Computed Tomography (CT) scan was obtained for complex types of Fraser II A, IIB and IIC injuries as when required. Open fractures were classified according to the Gustilo and Anderson (GA) classification system for open fractures.[7] Thorough wound irrigation and splinting of the affected part was done in the emergency department, tetanus prophylaxis and intravenous antibiotics were started for all open fractures. Patients with polytrauma were managed appropriately before surgical stabilization of the fractures and in these patients the principle of damage control orthopedics was followed, i.e. immobilization of fracture by means of external fixation.[8] Patients were observed closely for any signs of fat embolism syndrome. Open fractures were debrided thoroughly in the operating room and primary closure of the wound was performed if soft tissue coverage was adequate and external fixators were applied in GA-II and GA-III fractures. Definitive fixation was performed once the patient were hemodynamically stable and fit for surgery. In GA-II and GA-III fractures definitive fixation was delayed until 7-14th day of initial debridement depending on the soft tissue status. Spinal anaesthesia and epidural analgesia will be given, preoperative antibiotics were given. Diaphyseal fractures of the femur were addressed either closed through the standard antegrade approach or opening the fracture site whenever closed nailing failed. Distal femoral fractures were fixed using the standard Swashbuckler approach to the distal femur. Diaphysel tibial fractures were fixed with antegrade intramedullary nail using standard approach. Intraarticular fractures were fixed with proximal tibial locking plates using MIPPO technique. Open fractures were fixed temporarily using tubular rod external fixators which were later converted to definitive fixation or using hybrid Ilizaov external fixator system. In postoperative care intravenous antibiotic were given for 3 days and will be continued with oral antibiotics depending upon the condition of wound. Thromboprophylaxis was started only in cases of polytrauma patients whereas in others early limb range of motion was started from 1st post-operative day. Epidural analgesia was given to all except to those with head injury. Early passive motion with some active motion will be started as tolerated. Isometric quadriceps hamstrings and hip abductors were started soon

as tolerated by the patient. Partial weight bearing was started in Fraser type-I fractures within 4-6 weeks. Weight bearing was avoided for 10 -12 weeks in intraarticular fractures. Active and passive range of motion will be encouraged during this time. The mean follow-up duration was 15 months.

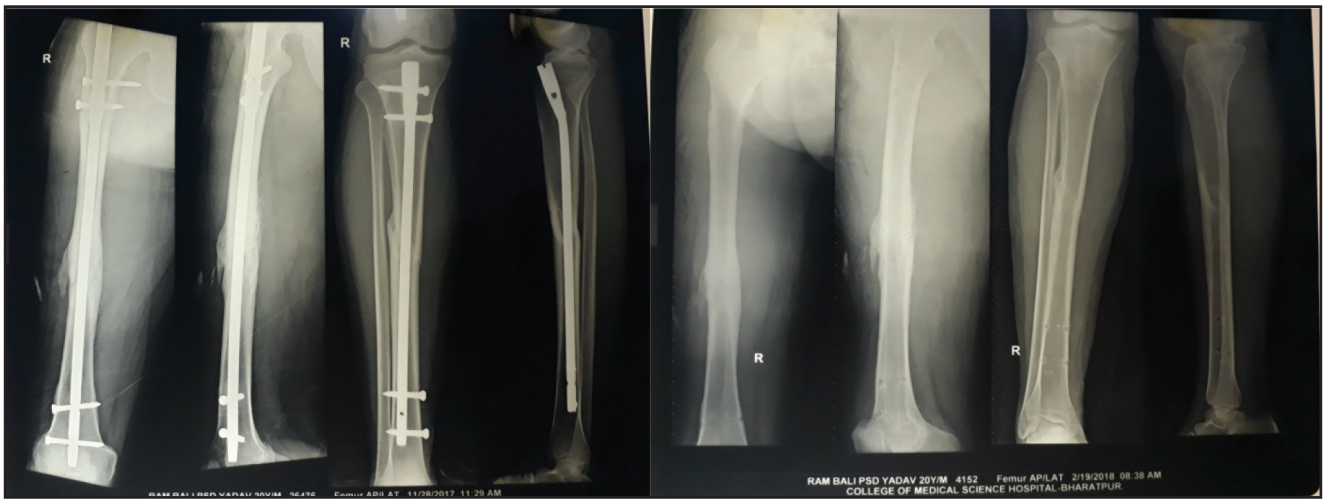

Figure 2. Fraser type-I injury managed with IMIL on both the femoral and the tibial side.

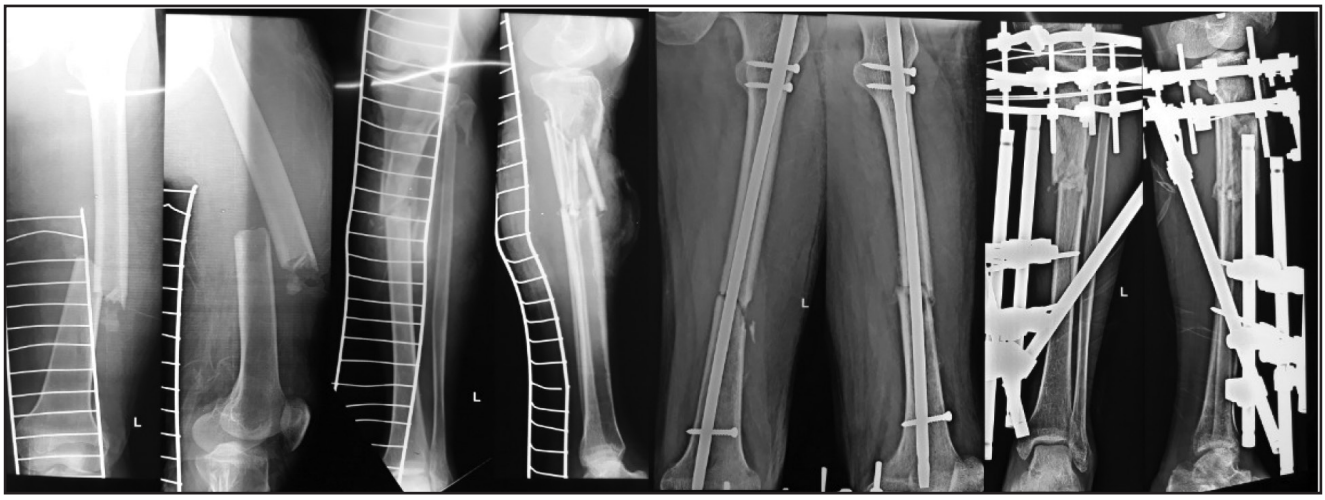

Figure 3. Fraser type-I injury managed with IMIL on the femoral side and Hybrid fixator on the tibial.

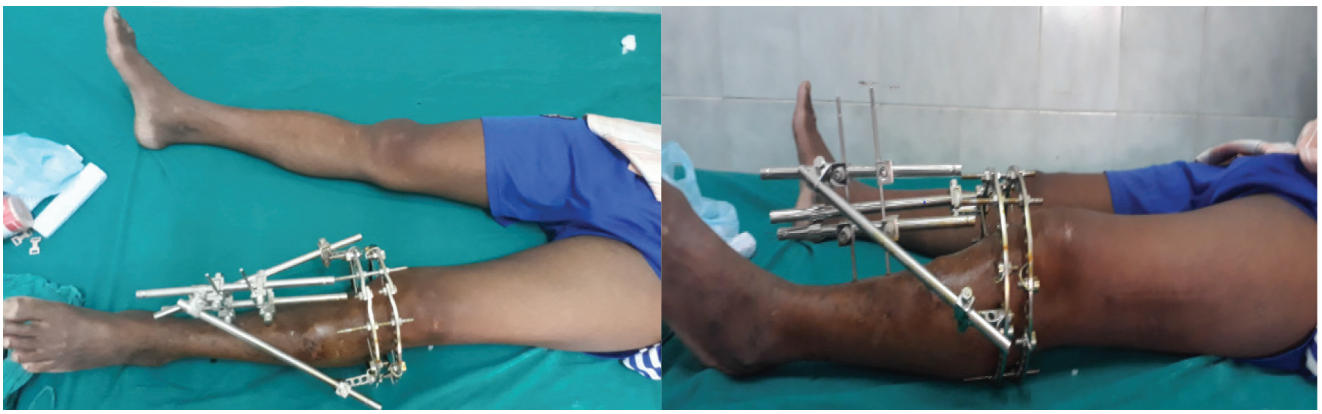

Figure 4. IMIL on the femoral side and Hybrid fixator on the tibial.

Figure 5. Patients managed with plates and screws in both the femoral and the tibial side in a Fraser type-II C injury.

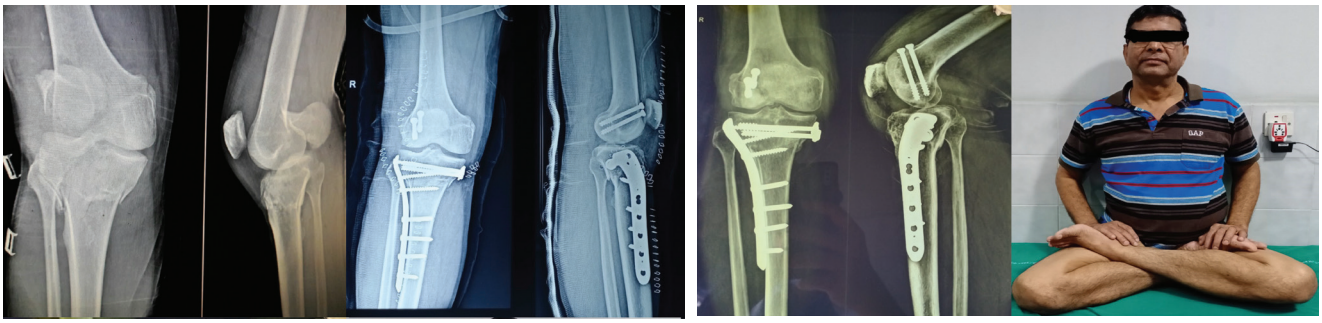

Figure 6. Patient managed with CCS on the femoral side and MIPO plate and CCscrews in the Tibial side in a Fraser type-II C injury.

RESULTS

In this study the age distribution of the patients ranged from 18 to 59 years and the mean age was 29.65± 10.95 yrs. There were 23.5% female and 76.5% male patients. In this study 5.9% patients sustained fall from height while 94.1% road traffic incidents. Right side was frequently involved in 67.6% while left side in 32.4% patients. All 34 cases were classified using the Fraser Classification system (Table 1).

Table 1. Fracture classification (n = 35).

Fraser Type	n (%)
I	19 (55.9)
II-A	9 (26.5)
II-B	3 (8.8)
II-C	3 (8.8)

There was associated polytrauma in 41.17% patients. All cases of polytrauma were managed accordingly (Figure 7).

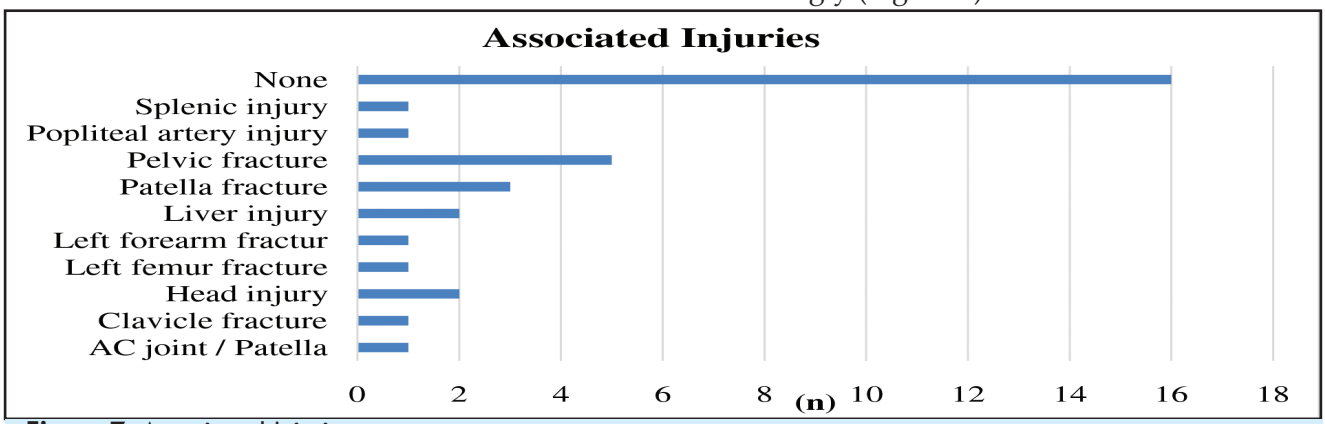

Figure 7. Associated Injuries.

Out of the 34 cases 35.3% cases were closed injuries and 64.7% were open injuries, of which 17.64% were femoral open fractures, 44.11% were tibial open fractures and 2.94% had both femoral and tibial open fractures (Table 2).

Table 2. Closed/ Compound: GA-type (n = 35).

Closed/Compound	n (%)
Closed	12 (35.3)
GA-I	2 (5.9)
GA-II	15 (44.1)
GA-IIIA	3 (8.8)
GA-IIIB	1 (2.9)
GA-IIIC	1 (2.9

Gustilo Anderson type-I injuries were managed definitively in the form of IMIL or plating or combined modality, after adequate wound debridement. Gustilo Anderson type-II fractures were managed either definitively or in an external fixator depending upon the level of contamination. All Gustilo Anderson type-III fractures were managed initially with external fixators after thorough wound debridement. Fifteen cases underwent external fixation either on the femoral or the tibial side. Half pin external fixators were used in thirteen cases which were later converted to definitive internal fixation. One case of open tibia fracture was managed inilizarov external fixator and one case was managed with hybrid ilizarov external fixator. Ring fixators were continued until union. Out of thirteen cases managed in half pin external fixator conversion to definitive internal fixation was done in twelve cases once the soft tissue condition improved. In one case half pin external fixator was continued until union and later converted to functional bracing. Final analysis was done based on the Karlstorm and Olerud criteria after the bony union was achieved. End results according to Karlstorm and Olerud Criteria (Table 3).

Table 3. Outcome of Surgical Management of Ipsilateral Femur and Tibia Fracture (n = 35).

Outcome	**n (%)**
Excellent	15 (44.11)
Good	10 (29.41)
Fair	5 (14.7)
Poor	4 (11.76)

In this study 64.7% fractures healed uneventfully, 14.7% cases underwent debridement due to infection over the femoral or the tibial side, 14.7% cases underwent bone grafting, 5.9% cases underwent bone marrow injection at the fracture site. Majority (70.6%) patients had no complications. However, 11.8% had infection over the femoral side, 2.9% had infection over the tibial side and 14.7% had pin tract infection.

DISCUSSION

The floating knee injuries are considered one of the rarities in lower limb orthopedic trauma. Majority of these injuries are attributed to high velocity mechanism of injury and most of these patients sustain concomitant polytrauma requiring a keen evaluation in the Emergency Department (ED). All patients are managed as per the ATLS guideline and should undergo adequate resuscitation and stabilization in the ED prior to the definitive surgery. Polytrauma patients with injuries to the head, chest, abdomen and spine should be managed operatively as when required. All open fracture patients require prompt IV antibiotics and wound debridement. Various literature suggests various surgical modalities in dealing with these complex injuries.[1] A high incidence among males (85.5%) was seen in a study by Nouraei et al[9], the results of which are similar to those of our study. The distribution of age ranged from 18-56 years with a mean age of 28 years in a study by Rethnam et al.[10] the findings of which are similar to those of our study (29.65±10.95

yrs). Similar to our results, road traffic incident was the major cause of injury in both the studies conducted by Nouraei et al. and Rethnam et al.[9,10] Right side was frequently involved (65.5%) in a study by Rethnam et al.[10] the findings are similar to our study. Literature suggest the incidence of open fractures upto 69% either in the femoral or the tibial side.[11] In our study 64.7% were open injuries, this finding is in line with the literature. Vives et al. reported associated fractures in 44% of patients.[11] our study showed an incidence of associated fractures in 35.29% patients. Fraser et al. in their series reported the incidence of type-I fractures to be 70.72% and type-II fractures to be 29.27%.[5] Our study also shows a higher incidence type-I fractures 55.9% and 44.1% type-II fractures. The incidence of vascular injury was low (2.9%) in our study, as similar findings were noted by Vives et al.,[11] The role of associated injuries can be related to the functional outcome with regards to delay in initial surgery, type of anesthesia used, duration of surgery and difficulty in rehabilitation. The most commonly used functional scoring system is the one described by Karlström and Olerud. Using this criteria, excellent or good outcome were reported form 24% to 81% in literature.[12] In our study, 44.11% patients had excellent and 29.41% had good functional outcome which are in line with the literature.In a study by Rethnam et al. 51.72% had excellent, 37.93% had good, 3.44% had fair and 10.34% had poor functional outcome.[10] Mohamadean et al. in their study had excellent results in 52.3%, good in 28.5%, fair in 14.3% and poor result in 4.7%.[13] The results of our study are comparable to the above studies, but in contrast to those by Demirtaset al., where 23.07% had excellent, 30.76% had good, 23.07% had fair and 23.07% had poor outcome.[13]Majority of cases in our study had excellent to good functional outcome which may be attributed to early physiotherapy and range of movement exercises. In our study 29.4% cases presented with complications, out of which 11.8% had infection over the femoral side, 2.9% had infection over the tibial side and 14.7% had pin tract infection. These results are comparable to those by Akue et al. where complications were noted in 33.33% cases.[14] Complications and infections may be attributed to associated polytrauma and open fractures either in the tibial or the femoral side.

CONCLUSIONS

Ipsilateral fractures of the femur and tibia are severe injuries often associated with polytrauma and has a male preponderance. Appropriate and timely operative management can yield favorable functional outcome with fewer complications.

Limitations

All patients of age 18 and above and both sexes were included in the study. Heterogeneous subgroups are the major limitations to this study. More accurate results may be obtained with studies comprising patients with homogeneous subgroup types.

REFERENCES

1. Shobha H, Kamran I, Lingaraju K, Bansal R. Functional outcome of surgical management of floating knee injuries in adults (Ipsilateral femoral and tibia fractures) and its prognostic indicators. International Journal of Orthopaedics. 2017;3(3):305-8.
2. Elmrini A, Elibrahimi A, Agoumi O, Boutayeb F, Mahfoud M, Elbardouni A, et al. Ipsilateral fractures of tibia and femur or floating knee. International

orthopaedics. 2006;30(5):325-8.

3. Letts M, Vincent N, Gouw G. The" floating knee" in children. Bone & Joint Journal. 1986;68(3):442-6.
4. Hegazy AM. Surgical management of ipsilateral fracture of the femur and tibia in adults (the floating knee): postoperative clinical, radiological, and functional outcomes. Clinics in orthopedic surgery. 2011;3(2):133-9.
5. Fraser RD, Hunter GA, Waddell JP. Ipsilateral fracture of the femur and tibia. Bone & Joint Journal. 1978;60(4):510-5.
6. Ran T, Hua X, Zhenyu Z, Yi C, Fan L. Floating knee: a modified Fraser's classification and the results of a series of 28 cases. Injury. 2013;44(8):1033-42.
7. Gustilo R, Anderson J. Prevention of infection in the treatment of one thousand and twenty-five open fractures of long bones: retrospective and prospective analyses. JBJS. 1976;58(4):453-8.
8. Bertrand M, Andrés-Cano P, Pascual-López F. Suppl 1: M9: Periarticular Fractures of the Knee in Polytrauma Patients. The open orthopaedics journal. 2015;9:332.
9. Nouraei MH, Hosseini A, Zarezadeh A, Zahiri M. Floating knee injuries: results of treatment and outcomes. Journal of research in medical sciences: the official journal of Isfahan University of Medical Sciences. 2013;18(12):1087.
10. Rethnam U, Yesupalan RS, Nair R. Impact of associated injuries in the floating knee: a retrospective study. BMC musculoskeletal disorders. 2009;10(1):7.
11. Vives JM, Bel J-C, Agundez AC, Rodríguez FC, Traver JP, Schultz-Larsen M, et al. The floating knee: a review on ipsilateral femoral and tibial fractures. EFORT open reviews. 2016;1(11):375-82.
12. Demirtas A, Azboy I, Alemdar C, Gem M, Ozkul E, Bulut M, et al. Functional outcomes and quality of life in adult ipsilateral femur and tibia fractures. Journal of orthopaedic translation. 2019;16:53-61.
13. Mohamadean A, Beeh HA. Floating knee injuries: treatment with a single approach. The Egyptian Orthopaedic Journal. 2017;52(1):6.
14. Akue AH-m, Lawson E, Goukodadja O, Ouedraogo A. Associated injuries and complications in floating knee management. East African Orthopaedic Journal. 2014;8(2):39-41.

Citation: Gupta HK, Lamichhane S. Outcome of Surgical Management of Ipsilateral Femur and Tibia Fracture: The Floating Knee Injury. 2023; 19(3); 337-44.