Functional and Radiological Outcome Following Imil Nailing for Floating Knee

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KEYWORDS

Floating Knee, Karlstorm And Oleruds Criteria

ABSTRACT

Introduction: The term "Floating Knee" denoted fractures that occur simultaneously on the same side of the tibia and femur, resulting in the knee joint flailing. Typically caused by high-energy traumas, like motor vehicle accidents or falls from height, these injuries present challenges due to related consequences like vascular injuries, compartment syndrome, and ligament damage. The study aimed to evaluate various surgical treatments for floating knee injuries, considering factors influencing prognosis and complications.

Patients and Methods: A prospective survey of 15 patients with Frazer type 1 floating knee injuries, conducted from April 2022-2023, involved clinical and radiographic assessments. Exclusions encompass skeletally immature patients, those unfit for surgery, extensive soft tissue injuries, knee ligament involvement, intraarticular fractures, and pathological fractures. All patients underwent thorough preoperative evaluations, with treatment including intramedullary nailing. Postoperative rehabilitation and follow-up were integral components of the study.

Results: The study involved 15 patients (mean age 30.9 years) with floating knee injuries, predominantly because of RTAs (Road Traffic Accidents). Intramedullary nailing for the femur, as well as tibia fractures, exhibited an average surgery duration of 2 hours 32 minutes and an average blood loss of 270 ml. Complications, including knee stiffness and infections, were managed effectively. Follow-up assessments according to Karlstrom's criteria revealed excellent results in 20%, good in 60%, and acceptable in 20% of cases.

Conclusion: The floating knee injury involves complexities impacting prognosis beyond simultaneous fractures of the femur and tibia. A meticulous initial assessment, prioritizing the identification of life-threatening related injuries, is crucial. Surgical fixation, preferably through intramedullary nailing, along with early and intensive postoperative rehabilitation, is recommended for improved functional and radiological outcomes.

1. Introduction

The term "floating knee" describes a condition where fractures occur simultaneously in the femur and tibia on one side, leading to instability in the knee joint. These fractures can manifest in different forms, such as metaphyseal, diaphyseal, as well as intra-articular fractures of the tibia and femur.[1,2] Coined by McBryde and Blake in 1974, this term highlights injuries resulting from high-energy traumas, notably from RTAs or high-speed motor vehicle accidents, which are increasingly common.[3] Three types of floating knees have been identified using the modified Fraser classification: type I, which involves fractures outside the joint; type II, which involves fractures in the joint surface; as well as type III, which involves the patella. Simple articular (Type IIA) and complex articular (type IIB) injuries are subtypes of type II injuries.[4] Because of the complicated nature of the injury and its correlation with various consequences such as vascular injuries, compartment syndrome, infection, difficulty in attaining union, meniscal and ligament injuries, etc., managing floating knee injuries is a difficult task.[5,6] These wounds frequently involve substantial damage to the surrounding soft tissues, making them compound injuries. There could also be potentially spinal cord injuries, fatal head injuries, thoracic as well as abdominal (visceral) traumas. It is vital to perform timely surgical stabilization of tibia and femur fractures, succeeded by prompt rehabilitation to attain optimal clinical and functional results.[7] Planning a course of treatment should carefully weigh the implications of each choice, with the goal of achieving good to exceptional functional outcomes as determined by the Karlstorm and Olerud criteria.[8] Achieving anatomical reduction and fracture union is the main goal of early internal fixation of the tibia and femur in cases of floating knee injuries. This reduces the risk of delayed union, nonunion, infection, and sequelae such as arthritis and stiffness in the knee.[1-3,14] This study aimed to identify prognostic factors and consequences related to floating knee injuries as well as compare and evaluate the results of various surgical treatments.

2. Methodology

This prospective study, conducted at the Department of Orthopedic "Saveetha Medical College and Hospital" in Thandalam between April 2022 and April 2023, involved 30 patients with floating knee injuries. Our study included patients with developed fractures of the femur and tibia categorized as Frazer type 1 floating knee injuries, who were willing to undergo treatment and follow-up. Skeletal immature patients, those who were hemodynamically unstable or unsuitable for surgery, fractures involving extensive local soft tissue injuries (including open injury grades IIIB and IIIC), injuries to the knee ligaments, intraarticular fractures, and pathological fractures were all excluded from the study. Every patient had a radiographic and clinical evaluation. Based on the X-ray scans, the fractures were categorized using the Modified Fraser classification system. The Gustilo-Anderson classification was applied to open fractures. Patients with injuries to their floating knees were brought into the ward. Every patient had a thorough medical history taken, which was kept on file in the hospital. Every patient underwent a clinical evaluation. Every patient underwent a preoperative medical evaluation to guard against potentially fatal or severely disfiguring consequences. Every patient had either a fall from height or an RTA. Upon arrival, patients underwent resuscitation in accordance with the ATLS ("Advanced Trauma Life Support" protocol, which involves breathing, circulation, and airway management with cervical spine control. The patient's overall health was evaluated in relation to any systemic injuries, related orthopedic conditions, or hypovolemia. Treatment for any systemic injury was prioritized if it existed. A Thomas splint was used to immobilize the tibia and femur fractures. Analgesics and intravenous (IV) antibiotics were administered to every patient. When there were open fractures, spinal anaesthesia was used to apply an external fixator and rapid debridement. For patients with medical conditions like asthma, chronic obstructive pulmonary disease, hypertension, ischemic heart disease, diabetes, and anaemia, necessary and sufficient care was provided before they underwent surgery. Strict preoperative procedures were adhered to, including part preparation, getting RTAs, anaesthetic checkups, and other necessary approvals. Appropriate blood arrangements were made. Keeping the patient under surgery for six hours before the procedure. Consent is obtained in writing and with full knowledge. Additional consents that were needed, including high-risk consent, were acquired. Once the patient was well enough to have surgery and the local conditions were favorable, both fractures were permanently managed surgically. All surgeries were carried out under general or spinal anaesthesia with antibiotic cover. Injection. During the induction of anaesthesia, 500 milligrams of sulbactam and 1 gram of cefoperazone were administered. These dosages were continued for three days following the procedure. The patient was placed in a supine position during the procedures. After sterile preparation, the patient was draped from the thighs to the toes. The level of soft tissue injury, the fracture pattern, and the patient's characteristics all influence the kind of fixation (nailing). There was intramedullary interlocking nailing. Using the same 4 cm medial parapatellar incision, femur nails were introduced retrogradely, and tibial nails antegrade. Femoral nailing is performed after the tibia has been stabilized with an external fixator (or a splint in situations of severe comminution). A higher risk to the patient's overall health, including a higher risk of fat embolism, would result from the femur's movement and deformation during surgery if the tibia were stabilized first. For intra-articular fractures, the anatomic reduction was accomplished and the damage was secured with plates and screws. When the distal femur and distal tibia are intra-articularly involved, plating should be utilized. Regardless of the tibial fracture, the most common implants for the lower part of the femur are retrograde nails or locking plates, and the course of therapy for these injuries should likely not be different from that for a comparable isolated femur fracture. The most common treatments for upper-extremity tibia fractures are antegrade nails and locking plates. Certain straightforward articular fractures can be treated using nails that have sophisticated locking features. Every patient received thromboprophylaxis following their admission, and it continued into the postoperative phase. As soon as feasible following surgery, patients' rehabilitation was started based on active-assisted mobilization of the hips and ankles, with the limbs in full extension while the patient was seated in a wheelchair. Knee range of motion (ROM) was gradually raised based on the patient's ability to tolerate pain and the integrity of the fracture-implant complex. Together with the lumbopelvic and ankle muscles, the strengthening of the quadriceps and hamstrings began early. The patient's regimen continued until she was able to resume her regular daily activities. Patients had monthly follow-ups until their bony union (clinical and

radiological), after which they had quarterly follow-ups till their final follow-up. Karlstrom's criteria were used to measure the final result at the most recent follow-up. IBM SPSS Version 22.0 was utilized for the analysis of the gathered data. P-values below 0.05 are regarded as statistically significant.

3. Result and Discussion

Between April 2022 and April 2023, a study was conducted on 15 patients with floating knee (fracture of the femur and ipsilateral tibia), whose mean age was 30.9 years (range, 23–45 years). In our study, six females and 9 males participated (FIG-1). Four patients (27 %) suffered injuries from falls from a height, while 11 patients (73 %) were involved in RTA(FIG-2). There were 8 knees involving the right side and 7 involving the left. The patients were all classified as having floating knee injuries (Frazer type 1, Modified Fraser's classification). Three open fractures were present. The mean duration from the start of treatment to the end of it was 13 days (interval, 0–18). The procedure took an average of 2 hours 32 minutes (with a range of 2 hrs 20 mins to 3 hrs 10 mins) and resulted in an average blood loss of 270 ml (with a range of 240 to 310 ml) for 15 knees requiring intramedullary nailing for both fractures. After nailing, the average time for tibia fracture union was 19 weeks and 4 days (range: 17 to 23 weeks). After nailing, the average time for femur fracture union was 22 weeks (range: 20 to 25 weeks). One patient in this trial experienced knee stiffness, which was resolved with physiotherapy, and two other patients experienced infections that resolved well with antibiotic treatment. The following results were obtained when the results at the last follow-up were assessed using the Karlstrom criteria: excellent − 3 (20%), good −9 (60%) and acceptable − 3 (20%)(FIG-3,TABLE-1). We weren't missing any patients to follow up.

DISCUSSION

The rise in motor vehicle accidents has led to a growing number of patients experiencing involvement across multiple bodily systems. Managing such patients presents two primary concerns: firstly, addressing systemic injuries complicated by the body's response to trauma, and secondly, tackling issues related to concurrent fractures. In 1977, Karlström and Olerud adopted an aggressive surgical approach to treating floating knee injuries. [8] Compared to non-surgical treatment, operative treatment has shown better functional outcomes, reduced hospitalization rates, and fewer systemic complications. [14] According to published research, the majority of surgical series had an average hospital stay of between 30 and 36 days. According to Karlstrom and Olerud, when both fractures were repaired surgically, the average length of hospital stay was 11.5 weeks. [2,4] The average length of stay in our study was lower. All 222 occurrences of floating knees in a study by Fraser etal. [10] involved collisions with moving vehicles. In addition to being involved in auto accidents, individuals in our study were also alleged to have fallen from a height in the past. For the best management of complex floating knee injuries with significant soft tissue damage, aggressive physical therapy, and early mobilization was required to obtain good functional results and reduce the rate of sequelae. Following internal fixation of the tibial and femoral fracture sites, many writers have reported positive outcomes. Recent research has generally concluded that surgically fixing both fractures with intramedullary nails is the best course of treatment for the floating knee. For early mobilization, Lundy and Johnson fyj[12] suggested surgical stabilization of the fractures, which yielded the greatest outcomes. Dwyer et al. [11] combined methods of treatment, treating one fracture surgically and the other conservatively. They concluded that the quadriceps muscle fixation caused by the external fixation of the fractured femur reduced the range of motion at the knee; however, in our study, the surgical treatment of the femur did not affect joint movement. Intramedullary nailing was suggested as the optimal course of treatment by Theodoratos et al. The treatments we implemented involved surgical treatment of both the femur and tibial fractures, with the majority being secured with an interlocking nail placed intramedullary. We discovered that this therapy improved both the functional recovery and fracture union time over the other surgical techniques. This was consistent with research by Ostrum[13], who used intramedullary nailing to treat both fractures and had great outcomes. Similar to our study, the author employed minimal blood loss throughout the surgical and anesthetic procedures, as well as a safe setup time for the retrograde nailing of the femur. We found no cases of deep infection in our investigation, although

Gregory and Mc Andrew et al. [15,16] reported deep infection in 11% of femur fractures and 22% of tibial fractures, respectively. According to our study, 4.5% of patients experienced problems of varied degrees after undergoing surgical treatment for floating knee injuries, compared to 80% of patients who had excellent and satisfactory outcomes. Our research revealed that floating knee injuries were intricate injuries requiring meticulous evaluation to identify poor prognostic variables and related injuries. To improve these patients' outcomes, this should be used in conjunction with meticulous surgical planning, adequate surgical repair of the fractures, and aggressive rehabilitation

4. Conclusion and future scope

The floating knee injury extends beyond mere ipsilateral fractures of the femur as well as the tibia, encompassing complexities. The ultimate prognosis hinges on factors such as related injuries and the nature of the fracture (open, comminution, intraarticular, as well as knee ligament injuries). We advocate for a comprehensive initial assessment, prioritizing the identification of life-threatening related injuries. Surgical fixation for both fractures, preferably through intramedullary nailing, is recommended. Additionally, an early and intensive postoperative rehabilitation program is advised to enhance the eventual outcome.

DECLARATIONS

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