Ipsilateral Femoral Neck and Shaft Fractures with a Floating Knee Injury: A Case Report

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ABSTRACT

Isolated ipsilateral fractures of the femoral neck and shaft are rare injuries. Similarly, a floating knee (ie, ipsilateral fractures of the femur and tibia) is uncommon. We describe a 34-year-old man with ipsilateral fractures of the femoral neck and shaft with an ipsilateral floating knee after a motorcycle collision. He was treated with operative fixation, and was walking without assistive devices at his most recent follow-up appointment in February 2019. We believe this to be a unique combination of injuries not yet described in studies.

Keywords: Ipsilateral Neck Shaft, Floating Knee, Femoral Neck, Femoral Shaft, Tibial Shaft

INTRODUCTION

Ipsilateral femoral neck and shaft fractures are typically associated with high-energy polytrauma. The ipsilateral femoral neck and shaft fracture combination was originally described by Delaney and Street. Femoral neck fractures accompany femoral shaft fractures 6% of the time and are most commonly vertically-oriented basicervical, whereas femoral shaft fractures are most commonly transverse and butterfly fractures. To decrease the frequency of misdiagnosis, various protocols such as pre- and postoperative computed tomography scans and intraoperative stress examinations have been recommended. Although these injuries are typically treated surgically, no consensus exists on the order of fixation techniques or most effective fixation strategy.

Ipsilateral tibia fractures, also called floating knee injuries, are similarly difficult to treat. They were originally classified by Blake and McBryde in 1975 as Type I (extraarticular) or Type II (articular). Subsequently, Fraser et al added subclassifications to Type II fractures to indicate tibial plateau injury (IIa), distal femur (IIb), or articular involvement of both sides of the knee (IIc). Floating knee injuries are associated with open injuries with soft-tissue damage, occurring in 54% to 62% of patients. Amputation is performed 1% to 3% of patients.

In isolation, both ipsilateral femoral neck and shaft fractures and floating knee injuries present various treatment considerations that surgeons must take into account; yet, reports of patients presenting with both injuries are rare. We describe a patient who underwent surgical fixation for treating ipsilateral femoral neck and shaft fractures as well as a floating knee injury.

CASE REPORT

A 34-year-old man was transported directly to the emergency department after a motorcycle collision. On admission, he was given cefazolin and gentamycin and Advanced Trauma Life Support protocol was initiated. At that time, the patient had a Glasgow Coma Scale of 15. Subsequent imaging revealed a displaced fracture about the right vertical basicervical femoral neck (Figure 1), a right femoral shaft fracture (Figure 2), and a right tibial shaft fracture (Figure 3). The patient sustained a comminuted right patella fracture, right tibial shaft and fibula fractures, left distal radius fracture, left patella fracture, and a grade IIIA open left tibial plateau fracture. A thoracostomy tube was placed to treat his right-sided hemopneumothorax and intraventricular and subarachnoid hemorrhages.

About 12 hours after presentation, the patient was cleared by the neurosurgical team and taken back to the operating room by the orthopaedic trauma team. The patient was placed in supine position on a radiolucent table. First, the open left tibial plateau fracture was irrigated and debrided. The wound was then closed, and a knee spanning external fixator was placed. The right femoral neck fracture was treated with open reduction using a lateral approach to the proximal femur. A capsulotomy was performed along the anterior neck, and the fracture was then reduced.
with use of a Cobb and Schanz pin in the lateral femur. Reduction was verified by digital palpation and fluoroscopy findings, which was held provisionally with multiple K-wires. Next, a sliding screw was placed at a 130° angle into a four-hole side plate, with use of 4-mm antirotation screws placed proximal to the side plate. In a transpatellar manner, a retrograde intramedullary nail was placed in the femur. The distal two holes of the dynamic hip screw with a plate were placed around the femoral nail. Reduction was confirmed with findings of fluoroscopic images (Figures 4 and 5). To treat the tibia fracture, a suprapatellar intramedullary nail was placed normally. After fixation, fluoroscopic views were obtained to verify reduction and hardware placement (Figures 6 through 8). At the conclusion of the procedure, no instability or laxity was noted after examining the full ligamentous knee.

After being admitted to the hospital, the patient subsequently returned to the operating room on days 5 and 7 for definitive treatment of his other injuries. These included operative fixation of the left tibial plateau, operative fixation of the left distal radius, and partial patellectomies of both patellas. The patient was positioned to avoid weight bearing on the right and left

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**Figure 1.** Anteroposterior view of initial radiograph of the right hip showing a displaced vertical femoral neck fracture.

**Figure 2.** (Left) anteroposterior view and (right) lateral view of the right femur showing a displaced, shortened, transverse shaft fracture.

**Figure 3.** (Left) anteroposterior view and (right) lateral view of the right tibia and fibula showing comminuted fracture.
Figure 4. (Left) intraoperative anteroposterior view and (right) lateral fluoroscopic image of the right hip confirming reduction femoral neck fracture with appropriate placement of hip screw with side plate and antirotation screw.

Figure 5. Intraoperative fluoroscopic image of the right femoral shaft confirming adequate reduction and intramedullary placement of nail.

Figure 6. (Left) intraoperative anteroposterior view and (right) lateral fluoroscopic image of right knee confirming appropriate placement of femoral and tibial nails.

Figure 7. (Left) intraoperative anteroposterior view and (right) lateral fluoroscopic image of right tibia confirming adequate reduction and intramedullary placement of nail.
**Figure 8.** (Left) intraoperative anteroposterior view and (right) lateral fluoroscopic image of right ankle displaying appropriate placement of intramedullary nail and distal locking screws.

**Figure 9.** Radiographs at 5 months postoperatively. A) (Left) anteroposterior view and (right) lateral right hip. B) (Left) anteroposterior view and (right) lateral femur. C) (Left) anteroposterior view and (right) lateral tibia and fibula.
lower extremities, with the knees maintained in extension for the partial patellectomies. Additionally, he was positioned to avoid weight bearing on the left upper extremity, with weight bearing allowed through the elbow.

At 10 days postoperatively, the patient was given enoxaparin to treat venous thrombosis prophylaxis and was discharged to a skilled nursing facility. At 8 weeks postoperatively, knee range of motion was initiated and the patient was advised to bear weight as tolerated on the right lower and left upper extremities. At 12 weeks postoperatively, the patient could bear weight on the left lower extremity as tolerated.

At the most recent follow-up 5 months postoperatively, he could walk without assistive devices. The range of motion of both knees was 0° to 90°. The patient continued to undergo physical therapy to increase the range of motion and strength of his knees. At this time, radiographs showed healing of the femoral neck and shaft fractures as well as the tibia fracture. Additionally, no loss of reduction was observed in the femoral neck fracture (Figures 9A through 9C).

**DISCUSSION**

Ipsilateral femoral neck and shaft fractures, as well as floating knee injuries, are rare. In the current case, the femoral neck fracture was first approached using a sliding hip screw. We then used a retrograde intramedullary nail for the femoral shaft fracture followed by the use of a suprapatellar intramedullary nail for the tibia fracture. Initial stabilization of the femur allowed for easy manipulation of the tibia fracture. Additionally, no loss of reduction was observed in the femoral neck fracture.

Many authors have advocated to first fixate the femoral neck fracture with three cannulated screws or a sliding hip screw to avoid high risk of complications (eg, avascular necrosis of the femoral head, nonunion, and varus deformity).12-17 Some authors have suggested to first fixate the femoral shaft fracture, which allows for improved control of the distal fragment while addressing the more technically demanding femoral neck fracture. Further debate exists regarding use of a single cephalomedullary device versus two separate implants with treating each fracture.18-20 Bedi et al19 found a significantly higher rate of femoral malreduction after using a single cephalomedullary device to treat ipsilateral femoral neck and shaft fractures. Subsequently, the authors concluded that using two implants was preferable owing to improved fixation outcomes with a sliding hip screw or three cannulated screws. In the current case, we utilized two implants while first addressing the femoral neck: a sliding hip screw and a derotational screw. Shortly after, we used a retrograde intramedullary nail in the femoral shaft.

Regarding treatment of floating knee injuries, fixation strategies should be tailored to each individual patient’s fracture pattern because no standard method exists. Type I floating knee injuries have been treated using intramedullary nails in both femur and tibia fractures, with promising results.14 It is recommended that the femur undergo fixation before the tibia. This is because of a concern that further soft-tissue injury might happen in the unstable femur fracture when reducing and stabilizing the tibia fracture. Additionally, stabilization of the femur allows for a more stable position to approach the tibia fracture and allows access to the starting point.14-22

Femoral neck and shaft fractures as well as floating knee injuries result from high-energy trauma, and they often include various associated injuries that affect treatment outcomes. In the current case, we described treatment of a unique injury pattern that has not yet been reported. Ultimately, because no standard method exists, surgical management should be tailored to patients’ injury patterns and surgeons’ preference and experience.

**REFERENCES**


