Missed Ipsilateral Femoral Neck Fracture in a Young Patient With a Femoral Shaft Fracture

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Summary: Ipsilateral femoral neck-shaft fractures are uncommon but significant injuries that can present a diagnostic difficulty with respect to recognition of femoral neck component. Although there are improved diagnostic methodologies, identification of a faction of these fractures will be delayed or missed even when the most sensitive protocols are used. As such, it is essential for treating surgeons to be attentive to the potential associated femoral neck fracture when managing femoral shaft fractures and consider its possibility even in the postoperative period. This case report describes the case of a young male who was initially managed for an isolated femoral shaft fracture after a high-energy injury and was postoperatively diagnosed and treated for an ipsilateral femoral neck fracture.

Key Words: femur shaft fracture, femoral neck fracture, ipsilateral femoral neck

INTRODUCTION
Femoral neck fractures are associated with up to 9% of ipsilateral femoral shaft fractures. Between 20% and 50% of these fractures are reported to be missed on initial presentation, and although there are improved diagnostic methodologies, identification of a faction of these fractures will be delayed or missed even when the most sensitive protocols are used.1 Although this associated pattern of fractures is not regularly encountered, it is common enough that orthopaedic surgeons should consider the possibility of its presence when evaluating femoral shaft fractures especially if the injury resulted from a high-energy mechanism in a young patient.2 Missing a femoral neck fracture has a high potential to lead to significant negative consequences requiring further surgical intervention such as more severe fracture displacement, healing complications, avascular necrosis, loss of function, and pain.3,4 This case report discusses the case of a missed femoral neck fracture in a young patient who was initially treated for a femoral shaft fracture.

CASE PRESENTATION
Patient Presentation
A 19-year-old white male was brought to the emergency department by ambulance in the evening after he lost control of his truck and hit a house while texting and driving. He was hemodynamically stable and alert on arrival and denied loss of consciousness during the accident. His primary complaint was deep right thigh pain. The patient’s previous medical and surgical histories were remarkable for appendicitis and appendectomy, respectively. His social habits included regular tobacco, marijuana, and social alcohol use. The remaining history was negative for any pertinent positive findings.

Clinical Findings and Diagnostic Assessment
On physical examination, the patient had an obvious right thigh deformity and tenderness in the same area. His hip and knee motion was restricted secondary to pain. There were no open wounds or...
neurologic deficits on examination. Vascular evaluation revealed a palpable dorsalis pedis and posterior tibial pulse.

Radiographic evaluation included an anteroposterior (AP) pelvis film and also AP and lateral views of the femur, which demonstrated a transverse femoral shaft fracture in the mid-diaphyseal region (Fig. 1). The femoral neck was evaluated on the same films, and there was no evidence of a concomitant ipsilateral neck fracture. No other injuries were identified during workup.

**Therapeutic Intervention**

Initial management of the femoral shaft fracture involved stabilizing the right lower extremity in Buck traction and

**FIGURE 1.** AP pelvis film and also AP and lateral views of the femur demonstrating a transverse femoral shaft fracture in the mid-diaphyseal region.

**FIGURE 2.** Intraoperative fluoroscopic evaluation of the femoral neck after IMN placement failing to demonstrate a femoral neck fracture.
pharmacologic pain management. The patient’s injury was described in detail to him, and also the necessary surgical management of his injury with operative reduction and intramedullary nailing (IMN). After this discussion and obtaining surgical consent, the patient was scheduled to undergo retrograde IMN of his femur in the morning.

The patient was brought to the operating suite the following morning, and radiographs were again reviewed to assess the femoral shaft fracture and closely inspect the femoral neck for any evidence of injury (Fig. 1). Surgery proceeded with induction of anesthesia and sterile preparation and draping of the extremity on a Jackson table. Before incision, the femoral neck was examined under intraoperative fluoroscopy to rule out an ipsilateral femoral neck fracture. This assessment was negative and surgery proceeded with successful reduction of the femoral shaft fracture and placement of a retrograde IMN. Before closing the operative sites, the femoral neck was examined again with fluoroscopy, and no femoral neck fracture was identified (Fig. 2). The operative sites were then closed, sterile dressings applied, and the patient was awakened from anesthesia without issue and taken to the postanesthesia care unit. Postoperative AP and lateral radiographs of the femur were obtained in the postanesthesia care unit per standard protocol and revealed an ipsilateral basicervical femoral neck fracture (Fig. 3).

Postoperatively, a standard course of postoperative antibiotics and venous thromboembolism prophylaxis was instituted. The patient was allowed to weight bear as tolerated on the right lower extremity and discharged from the hospital on postoperative day 2. At his most recent follow-up period of 2 months out from surgery, he has no complaints and subjectively states he feels he is doing well. Follow-up radiographs show maintained fracture reduction and stable fixation (Fig. 7).

**DISCUSSION**

Ipsilateral femoral neck-shaft fractures are uncommon but significant injury patterns that potentially lead to serious complications if missed. The femoral neck fracture in these cases is often subtle with minimal displacement and difficult to visualize on standard plain radiographs of the pelvis and hip. Improvements for effective diagnosis of these associated injuries using fine-cut computed tomography (CT) and dedicated internal rotation radiographs have been advocated to significantly reduce delays in diagnosis.
Tornetta et al\textsuperscript{1} described their experience with these diagnostic methods in 16 cases of ipsilateral femoral neck-shaft fractures and reported 1 missed femoral neck fracture diagnosed intraoperatively and 1 that was diagnosed postoperatively after fixation of the femoral shaft. As such, even with these recognized diagnostic improvements, there remain some ipsilateral femoral neck-shaft fractures that will still be missed on initial evaluation.\textsuperscript{5} Furthermore, it is also important to consider ipsilateral injury to the distal femur as there is evidence in the literature describing this even more complex although rare pattern of injury.\textsuperscript{6}

In this case, there was a recognized deficiency of sufficient quality imaging preoperatively during the workup phase. A standard intraoperative evaluation of the femoral neck using fluoroscopy was used as a diagnostic adjunct during the initial procedure (Fig. 2) but failed to reveal the presence of the femoral neck fracture. In comparison, the intraoperative fluoroscopic images obtained during the second operation (Fig. 4) clearly demonstrated the fracture and highlight how subtle these fractures may be. Ideally, preoperative images should at minimum include AP pelvis and also AP, lateral, and internal rotation hip views with no equipment obstructing the clear visualization. CT may also be used in cases with suggestive but no definite findings on preoperative plain films.

**CONCLUSIONS**

Patients presenting with femoral shaft fractures, especially if the injury resulted from a high-energy mechanism, should always be evaluated for an associated femoral neck fracture. Appropriate preoperative, intraoperative, and postoperative imaging of the femoral neck can be effectively used to rule out or identify a fracture of the femoral neck. Furthermore, consideration of advanced imaging modalities such as fine-cut CT may improve diagnostic efficiency and reduce the rate of missed femoral neck fractures.

**FIGURE 5.** Intraoperative fluoroscopic images demonstrating placement of the SHS.

**FIGURE 6.** Final intraoperative fluoroscopic images demonstrating completed placement of SHS.

**FIGURE 7.** Radiographs of 2-month follow-up show maintained fracture reduction and stable fixation.
REFERENCES


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