Tibial Fracture After Total Knee Arthroplasty Treated With Retrograde Intramedullary Fixation

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Total knee arthroplasty is a common procedure performed by orthopedic surgeons, with approximately 250,000 procedures done annually in the United States. The long-term results of knee replacements have been steadily improving, with the majority of patients reporting good to excellent levels of satisfaction. With increasing longevity of both patients and implants, the incidence of postarthroplasty complications is also rising. The various complications following knee replacements have been well documented in the literature. Of these, periprosthetic fractures, although uncommon, pose a challenging issue to orthopedic surgeons.[1] We are reporting a case of a tibial fracture below a total knee arthroplasty treated with a retrograde intramedullary nail.

Case Report

A man in his early 60's was the unrestrained driver of a car that struck a large stationary object at high speed. The patient sustained multiple injuries, including a traumatic brain injury, bilateral pneumothoraces, a left scapular fracture, a left transverse and posterior wall acetabular fracture with hip dislocation, left superior and inferior pubic rami fractures, a displaced pubic symphysis, and a left segmental tibia fracture (Figures 1 and 2). The patient's surgical history was significant for previous right-sided total hip and left-sided total knee arthroplasties performed secondary to severe osteoarthritis years previously.

Because of the patient's severe medical condition, operative treatment of the hip fracture dislocation was delayed, and in the presence of a stable total knee arthroplasty, the plan of treatment for the tibial fracture was closed reduction and casting. This was performed in the operating room under fluoroscopy following the pelvic fixation. The patient remained in the intensive care unit, breathing by a ventilator, for several weeks. The patient's cast was well padded, his heel was unloaded with pillows under the calf, and attempts were made to logroll the patient every 2 hours.

Figure 1. Initial anteroposterior plain film of the tibia.

Figure 2. Initial lateral plain film of the tibia.

Three weeks after placement, the cast was removed to inspect the soft tissues. At that time, a small area of full-thickness skin loss resulting from pressure was noted on the patient's heel. To address the heel pressure sore, the long leg cast was discontinued and other options for stabilization were considered. Because of the segmental nature of the fracture, it was felt that a cylinder cast would not provide adequate stability, and that internal plating would require significant dissection. We also wished to avoid the possible problems associated with an external fixator and felt that a locked intramedullary nail would provide optimal stability with minimal soft tissue damage. Although the use of a standard tibial intramedullary nail placed in a retrograde manner had not been reported in the literature, the senior author (RAW) believed that this could be done. Therefore, the patient was brought to the operating room with this plan and with an external fixation system available if the nail could not be placed.

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Figure 3. Postoperative AP plain film of the tibia.

Figure 4. Postoperative lateral plain film of the tibia.

Figure 5. Anteroposterior plain film of the tibia at 2 years after surgery.

Figure 6. Lateral plain film of the tibia at 2 years after surgery.

The entry point for an intramedullary nail was made through the proximal portion of the medial malleolus. The canal was then reamed to 10 mm, and an 8 × 27-cm Richards Delta tibial nail (Smith and Nephew, Inc., Memphis Tenessee) was placed in a retrograde fashion. The fracture displaced as the nail was placed but could again be reduced with the nail in position. This nail was locked with 1 screw both proximally and distally, and this construct was observed to be stable under fluoroscopy. The pressure sore was then treated with local wound care (Figures 3 and 4).

At 3 months, the patient was doing well and was undergoing rehabilitation. The pressure sore had healed completely, and the leg had no residual swelling. Radiographic studies revealed healing of both the tibial and acetabular fractures. The patient was recently seen 2 years out from his injury, and he continues to do well (Figures 5 and 6).

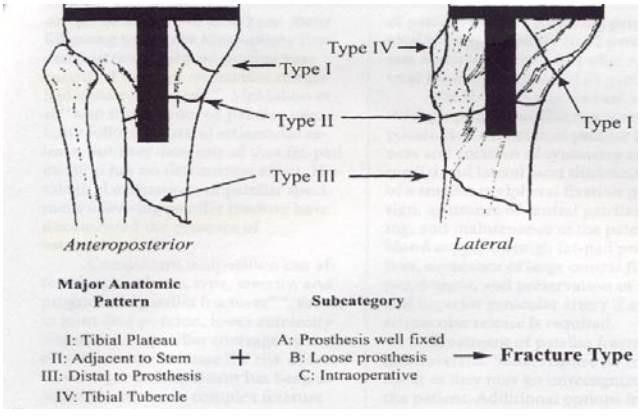

Figure 7. Mayo classification of periprosthetic tibial fractures Reprinted from *Orthopedic Clinics of North America*, vol. 30, Stuart MJ et al, Total Knee Arthroplasty: periprosthetic tibial fractures, p 280, Copyright 1999, with permission from Elsevier.

Discussion

Total knee arthroplasty is a common procedure, with infrequent complications. Of these complications, periprosthetic fractures of the femur range from 0.3% to 2.5%,[2-9] and tibial fractures range from 0.40% to 1.7%.[10-12] The majority of postoperative fractures can be attributed to trauma, although some are complications secondary to the surgical procedure, such as malalignment, instability, and loosening.[11-19]

Periprosthetic tibial fractures can be classified based first on their anatomical location and then by their prosthetic fixation status[12,14] (Figure 7). *Type I* fractures involve the tibial plateau and the tibial component interface. *Type II* fractures lie adjacent to the tibial stem. *Type III* fractures occur distal to the stem. *Type IV* fractures are of the tibial tubercle. Further classification is based on the involved component stability as being *A*, stable prosthesis; *B,* loose prosthesis; or *C,* intraoperative fractures. Fractures that cause instability of the components (category B) are best treated with revision surgery involving longer-stem components and fixation of any associated fragments. Fractures that leave the prosthesis stable (category A) are treated with standard techniques of fracture management.

In a patient without a prior knee prosthesis, the nature of the tibial fracture in our patient would have led most orthopedic surgeons to use intramedullary fixation devices to achieve fracture stability. Given the preexisting knee arthroplasty, some treatment options are less feasible, and closed treatment becomes a more attractive plan of care. Had our patient not required prolonged ventilation and immobilization because of his brain injury, it is possible that the pressure sore would not have developed and the closed treatment plan would have remained unchanged. With compromise of the skin, the need for fixation, either internal or external, became more of an issue.

An external fixator would have been a reasonable option, but in a polytrauma patient, it can be cumbersome and prone to pin tract infection. The incision required for placement of a standard plate and screws would have been extensive, with compromise of the vascular supply and an increased risk of infection. The long segmental nature of this fracture also made internal fixation using plates and screws a less attractive option. Intramedullary fixation would provide stability and allow early mobilization while minimizing complications.

Although intramedullary fixation of tibia fractures is common, its use in a retrograde fashion is not. A subsequent search of the English-language literature returned no prior reports of this technique. This unusual application of a common tool is another weapon in the armamentarium of an orthopedic surgeon when faced with a difficult periprosthetic fracture below stable arthroplasty components.

Authors' Disclosure Statement

The authors report no actual or potential conflict of interest in relation to this article.

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This paper will be judged for the Resident Writer's Award.