

Acute Septic Arthritis Following Supra-Patellar Nailing of an Open Diaphyseal Tibia Fracture in an Immune Compromised Patient

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Abstract

The supra-patellar approach represents one approach to intramedullary nailing (IMN) of diaphyseal tibia fractures. Violation of the knee joint utilizing an intra-articular start point represents a risk for septic arthritis of the knee in the post-operative period. Previous retrospective studies of open tibia and femur fractures demonstrated that post-operative knee sepsis is rare, occurs in the chronic phase after injury, and due to extent of soft tissue injury rather than immune compromise. Here, we review current literature on post-operative knee sepsis, and present a case of acute septic arthritis of the knee following supra-patellar nailing of an open tibia fracture in a patient on chronic immune suppression. In this unique case, co-morbid patient factors likely led to this manifestation of a rare complication.

Keywords: *Septic arthritis; Semi-extended; Supra-patellar; Tibia; Intramedullary nail; Knee sepsis*

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Introduction

Intramedullary nailing (IMN) of tibia fractures via a semi-extended, supra-patellar approach was initially described for proximal tibia fractures [1], and indications have further broadened to include nearly any morphology diaphyseal tibia fracture given easy fluoroscopy and reduction, and even improved radiologic outcomes [2]. Moreover, the proposed risks of violating the knee joint, which include damage to articular cartilage or meniscus, have been invalidated in published studies. Septic arthritis of the knee represents a potentially devastating complication associated with a trans-articular start point which is rare [3-10]. The few published instances of knee sepsis after retrograde femoral nailing or antegrade tibial nailing occurred in the setting of exceptional soft tissue compromise (Table 1). However, patient factors such as smoking and diabetes are risk factors for deep infection after open tibia fractures [11]. We present here a case of acute septic arthritis of a knee following intramedullary nailing of an open tibia shaft fracture via a supra-patellar approach in a patient on chronic immunosuppression.

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Case History

The patient is a 49-year-old male with a history of rheumatoid arthritis on prednisone (5 mg daily) and methotrexate, type II diabetes mellitus (HbA1c 5.9), and a former smoker, who presented to our hospital after a low energy fall stepping out of his truck, with a Type II open left distal diaphyseal tibia fracture (Figure 1). He had a 5 cm traumatic wound over the medial aspect of his distal left tibia. After receiving antibiotics in the emergency department, he underwent irrigation and debridement of his open tibia fracture, and intramedullary nailing via a semi-extended supra-patellar approach (Figure 2).



Figure 1: Plain AP (A) and lateral injury radiographs (B).

Intraoperative and post-operative course were unremarkable. On post-operative day 13, he presented to an outside hospital with acute knee pain, erythema, swelling, febrile to 38.3°C, tachycardic, with a white blood cell count of 14.8. His erythrocyte sedimentation rate was 95, and C-Reactive protein was 37 mg/dl, and he received intravenous antibiotics (vancomycin). He was transferred to our emergency department, where aspiration of his knee yielded purulent fluid with 83,622 nucleated cells and 94.5% neutrophil predominance. He was taken emergently for irrigation and debridement of his left knee in the operating room. Intra-operative findings were remarkable for gross purulence in the knee joint. Notably, his traumatic tibia lacerations were without evidence of infection. No attempt was made to aspirate the nail tract or fracture site. His arthrocentesis and intra-operative cultures yielded no growth with a negative gram stain, and his bacterial sequencing results were negative (bacterial 16S rRNA sequencing [12]), although he had received antibiotics at an outside hospital prior to transfer.

His post-operative course was complicated by acute kidney injury, fever, and rash after ceftriaxone/vancomycin/rifampin therapy. He was discharged on intravenous daptomycin and rifampin. He completed 6 weeks of parenteral daptomycin, and was transitioned to a course of oral doxycycline to be completed at 6 months from surgery. At last follow up he was healing well 6 months from initial injury without evidence of recurrent infection (Figure 3).

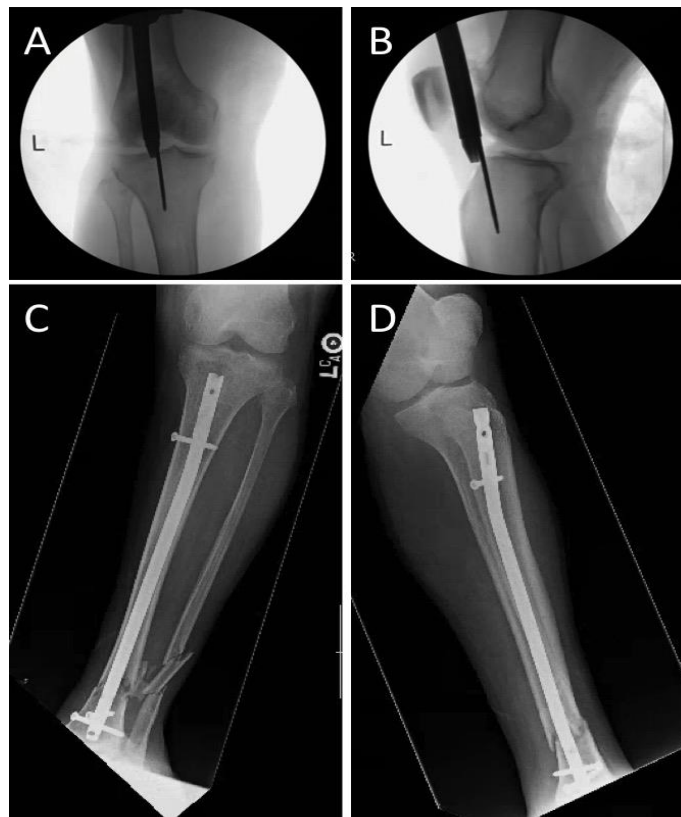


Figure 2: Intraoperative fluoroscopy with AP (A) and lateral (B) views of knee demonstrating starting point for intramedullary nail achieved using suprapatellar approach. AP (C) and lateral (D) X-rays of tibia after intramedullary nailing.



Figure 3: AP (A) and lateral (B) X-rays demonstrating callus formation and interval healing six months after initial surgery.

Discussion

We present here an instance of acute septic arthritis of the knee following index supra-patellar IMN of a Type II open tibia fracture in a patient with rheumatoid arthritis on chronic immune suppression, history of tobacco use, as well as diabetes. In our review of current literature, three instances of knee sepsis following medullary nailing of femur or tibia fractures have been reported (Table 1). The contributing factor in each case was extensive soft tissue compromise about the knee with need for multiple debridements, and each instance presented in either subacute to chronic temporal fashion one to four months after injury.

Study	Fractures (n)	Open (n; %)	Septic Arthritis (n; %)	Deep Infection (n; %)	Patient Risk Factors for infection (n; %)	Case Notes
Suprapatellar Tibia						
Mitchell [3]	139	139 (100%)	0 (0%)	25 (18%)	60 (45%; tobacco, diabetes)	Delayed sepsis 4 months post op with necrotizing infection
Chan	11	15/37 (41%)	0 (0%)	0 (0%)	N/R	
Marecek [6]	147	147 (100%)	2 (1%)	16 (11%)	44 (30%; tobacco)	-3.5 months after injury, setting of deep infection and exchange nail at 2.5 months
						- 5 weeks after injury, history delayed presentation, wound required serial debridements and complex wound closure
Retrograde Femur						
Halvorson [4]	185	38 (21%)	0	9 (5%)	N/A	
O'Toole [5]	93	100%	1 (1%)	4 (4%)	30 (33%; diabetes/ smoker)	Concomitant massive degloving injury with serial debridements
Becher [8]	35	100%	0 (0%)	2 (6%)	N/A	
Dougherty [9]	53	0%	0 (0)	1 (0.2%)	N/A	Ballistic injuries
Papadokostakis[10]	573	55 (10%)	1 (0.2%)	1%	N/A	

Table 1: Review of previous studies examining rates of knee sepsis after suprapatellar nailing of tibia fractures or retrograde nailing of femur fractures. Number of fractures studied, number of open fractures, cases of septic arthritis and deep infection are reported, as well as number of cases with immune compromise. N/A, not applicable: authors did not report smoking/diabetes rates. Case notes for reported instances of knee sepsis demonstrating extensive soft tissue compromise.

In addition to the risk of infection conferred by open fracture, co-morbid risk factors could also increase patient susceptibility to infection [11]. Indeed, our patient not only had poorly controlled diabetes, but was also on long time chronic immune suppression (prednisone) for rheumatoid arthritis and had a history of tobacco use. In our review of previous studies, several series evaluated the presence of smoking and diabetes to infection but did not establish a connection with knee sepsis post-operatively. While previous cases occurred in the chronic phase after injury and multiple surgical debridements, the immune compromise status of this patient likely led to the rapid progression of symptoms one week from injury in this instance.

We present here a case of acute septic arthritis following suprapatellar nailing of an open tibia fracture in an immune compromised patient. Compared to rare instances of delayed knee sepsis after extensive surrounding soft tissue injury, this represents a unique case. It is likely that an immune compromised host with an open fracture is more susceptible to post-operative sepsis. We recommend considering an extra-articular start point, if possible, when multiple immune suppressive factors are present. Finally, as the suprapatellar approach for intramedullary nailing is increasingly utilized for its benefits, potential complications should be monitored as well.

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