

Suprapatellar Nailing in Open Tibia Fractures

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ORIGINAL ARTICLE

Risk of Knee Sepsis After Treatment of Open Tibia Fractures: A Multicenter Comparison of Suprapatellar and Infrapatellar Approaches

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Marecek et al *JOT Feb 2018*

- Retrospective, multicenter study (3 level 1 trauma centers)
- 2009-2015 all open tibia fxs >18y/o and minimum 12 wk f/u
- 289 fxs / 282 patients

Marecek et al *JOT Feb 2018*

- 142 cases IP group
- 147 cases SP group
- PRIMARY OUTCOME =KNEE SEPSIS
- *KNEE SEPSIS defined as “presence of a positive culture from knee aspiration or arthrotomy”*

Results

- 142 patients in IP group: mean f/u = 46.8 wks (12-231)
- 147 patients in SP group: mean f/u = 40.4 wks (12-171)

Results

TABLE 1. Demographic Information

	IP (n = 142)	SP (n = 147)	<i>P</i>
Age (median, range)	29 (18–70)	39 (18–84)	
Mean \pm SD	32.7 \pm 10.5	39.7 \pm 13.9	0.00006
Male	114 (80.3%)	131 (89.1%)	0.049
Gustilo–Anderson Classification			
Type I	35 (25%)	35 (24%)	
Type II	51 (36%)	40 (27%)	
Type III	55 (39%)	66 (45%)	
IIIA	32 (23%)	48 (33%)	
IIIB	22 (15%)	16 (11%)	
IIIC	1 (<1%)	2 (1%)	0.0977
Unknown	1 (<1%)	6 (4%)	
Tobacco use	45 (31.7%)	44 (29.9%)	0.80

TABLE 2. Treatment Information

	IP (n = 142)	SP (n = 147)	<i>P</i>
Time to surgery, d	1.22	1.21	0.97
Operations to definitive treatment	1.26	1.27	0.89
Reamed nailing	102 (72%)	144 (98%)	0.001
Local antibiotic administration	27 (19%)	15 (10.2%)	0.044
Follow-up, wk	46.9 (12–231)	40.4 (12–171)	0.80

Local antibiotic administration included antibiotic-impregnated polymethylmethacrylate (PMMA) beads or spacers.

TABLE 3. Outcomes After Medullary Nailing of Open Tibia Fractures

	IP (n = 142)	SP (n = 147)	<i>P</i>
Total infections	20 (14.1%)	24 (16.3%)	0.63
Deep infections	14 (9.9%)	16 (10.9%)	0.85
Reoperation	29 (20.4%)	31 (21.1%)	1
Septic arthritis	0	2 (1.4%)	0.5

Conclusion

CONCLUSIONS

In this large series of patients from 3 urban level I trauma centers, we found that the risk of knee sepsis after medullary nailing of open tibia fractures is low. There was no significant difference in the rate of knee sepsis with SP or IP entry. However, when an infection develops at the open fracture site or within the medullary canal, the risk of knee sepsis is tangible for patients treated with a SP nail. Based on the information presented, we believe that the SP approach can be used safely for treatment of most open tibia fractures after a thorough debridement and irrigation of the open fracture site. In the setting of grossly contaminated open fractures, consideration should be given to the small, but present, risk of septic arthritis.

Analysis

- 2/147 cases of septic arthritis in SP group
- 0/142 cases of septic arthritis in IP group

was not classified at the time of debridement. Approximately 1 month after treatment, the patient complained of knee pain and was diagnosed with septic arthritis of the knee. He was treated with knee arthrotomy, debridement, and retention of the implant. He ultimately developed an infection over an interlocking screw site and given that the fracture was united, the implant was removed during debridement without further sequelae.

Two patients with superficial infections in the SP group merit discussion. These patients presented to outside institutions with knee pain, swelling, and erythema. One man had a type I injury and the other man had a type IIIB injury with circumferential soft tissue loss. Both were treated with 6 weeks of intravenous antibiotics for presumed septic arthritis according to outside records. However, no aspiration was obtained in either case, and both were treated nonsurgically and, therefore, defined as superficial infections. If these cases were included as septic arthritis, the rate would be 2.7% ($P = 0.12$, 2-tailed t test). Our overall infection rate of 15.2% is in line with other studies,^{19–22} suggesting that our patient sam-

Analysis

- 2/147 vs 0/142: $p=0.50$
- 4/147 vs 0/142: $p=0.12$
- 5/147 vs 0/147: $p=0.06$
- ***but IP group may also acquire cases of knee sepsis***

There are several weaknesses of our study, notably the retrospective nature of the investigation, which introduces selection and recall bias. Some of the surgeons may have avoided the use of SP nails in severe open fractures due to the theoretical risk of knee sepsis. In addition, we had loss to follow-up of 29.7%, although this is in line with accepted norms for retrospective trauma studies. As tertiary referral centers, we anticipate that our patients will return when complications develop, but this is not always the case. We were able to identify some complications in patients that presented to outside institutions. The cutoff of 12 weeks was arbitrarily selected to give adequate time for the development of adverse events. It is possible that we may have missed some patients who developed postoperative infections and were treated elsewhere. However, no patient who was excluded had known knee sepsis. Despite a large cohort, this study remains underpowered. Based on the event rates in our series (1.4% vs. 0%), it would take 1102 patients to identify a difference in the risk of postoperative knee sepsis with appropriate power ($\beta = 0.8$) after SP or IP nailing. With the worst-case scenario of 2.7% septic arthritis, this drops to 546 patients. These large numbers would likely preclude an adequately powered study to specifically address this question, although reporting knee sepsis rates in large prospective studies may facilitate later systematic review.

fracture in a golf cart crash. He developed deep infection approximately 2.5 months from injury. During debridement, his nail was removed through an IP approach, and debridement of the medullary canal was performed with the reamer-irrigator-aspirator before exchange nailing. A septic knee was identified a month later and subsequently required multiple surgical debridements over several months. He ultimately progressed to union and elimination of infection. In the other, a 27-year-old man had a saw fall on his leg. He presented 1 week out from injury and required serial debridement before complex wound closure. The wound was not classified at the time of debridement. Approximately 1 month after treatment, the patient complained of knee pain and was diagnosed with septic arthritis of the knee. He was treated with knee arthrotomy, debridement, and retention of the implant. He ultimately developed an infection over an interlocking screw site and given that the fracture was united, the implant was removed during debridement without further sequelae.

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No Incidence of Postoperative Knee Sepsis With Suprapatellar Nailing of Open Tibia Fractures

Phillip M. Mitchell, MD, Benjamin M. Weisenthal, MD, and Cory A. Collinge, MD

Objective: To evaluate the incidence of knee sepsis after suprapatellar (SP) nailing of open tibia fractures.

Design: Retrospective; Setting: ACS level 1 trauma center.

Patients/Participants: We reviewed 139 open tibia fractures that underwent SP nailing as definitive treatment over a 5-year period (January 1, 2011 to January 1, 2016). Most patients (90%, n = 126) underwent intramedullary nailing at the time of their initial surgery. We defined knee sepsis as intra-articular infection requiring operative debridement, either open or arthroscopically, within 1 month's time.

Intervention: Open tibia fractures treated with an SP tibial nail.

Main Outcome Measurements: Demographic data, fracture characteristics, Gustilo and Anderson classification of open fractures, and occurrence of knee sepsis.

Results: In 139 open tibia fractures, there were no cases of knee sepsis in the 30 days after treatment with an SP intramedullary nail. Eighty-seven percent of our cohort had Gustilo and Anderson type II (41%) or type III (46%) open fractures. Most open fractures (83%) underwent primary wound closure during the index procedures. Twenty-five limbs (18%) had evidence of infection at the open fracture site of their open fracture necessitating operative intervention and/or antibiotics: none, however, developed knee sepsis.

Conclusions: Although the SP approach carries intra-articular risks, we found a low risk of knee sepsis using this technique in the

Intra-articular infection is a semiextreme frequency of open tibia fractures. Intraoperative suprapatellar nailing in open tibia fractures moved over the joint's patella. Surgeons have and distal femoral fractures improve the increase in comprehensive critical.

The use of the patellar arthroscopy most recent patellofemoral arthroscopy. Risk with the patellar arthroscopy most likely risk factor was

INTRODUCTION

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No Incidence of Postoperative Knee Sepsis

TABLE 2. Fracture Characteristics (n = 139)

Gustilo and Anderson type, n (%)	
I	18 (13)
II	57 (41)
IIIA	46 (33)
IIIB	17 (12)
IIIC	1 (1)
Location of fracture, n (%)	
Proximal	21 (15)
Middle	45 (32)
Distal	73 (53)
OTA fracture type, n (%)	
A	43 (31)
B	51 (37)
C	45 (32)
Average number of fractures	2.0 (range, 1–7)

plating was conducted with 3.5 millimeter limited contact dynamic compression plate (Synthes, Paoli, PA) ranging from 8 to 14 holes, with only 1 plate remaining after definitive nail placement. An average of 6.8 L of irrigation was used. Twenty-eight patients (20%) required multiple debridements before definitive closure or soft tissue coverage.

We found 25 cases (18%) of infection at the site of the open fracture that were treated with operative debridement and/or antibiotics. Details of these infected cases are in Table 4. Over half (n = 13, 52%) of the infections were acute (<30 days postoperative) and diagnosed at an average of 16.4 days postoperatively (range, 6–29 days). Nine patients (36%) were treated successfully with antibiotics and 16 (64%) required reoperation. Seventy-five percent (12/16) of the deep infections requiring reoperation were in patients with grade 3 open fractures. Multiple debridements before definitive closure or coverage was an indicator for a more significant soft tissue injury and was risk factor for infection with 43% (12/28) of

TABLE 4. Details of Infections (n = 25)

Acute infections (<30 days postoperatively), n (%)	13 (52)
Mean time between nailing and acute infection	16.4 d
Superficial infections treated with antibiotics, n (%)	9 (36)
Deep infections requiring reoperation, n (%)	16 (64)
Gustilo type of cases with deep infection (n = 16), n (%)	
II	4 (25)
IIIA	4 (25)
IIIB	8 (50)

No episodes of knee sepsis were found within 30 days of nailing open tibia fractures using an SP technique (0/139). There was only 1 intra-articular knee infection in our cohort at any period, occurring in a patient who developed local infection (at the site of graft placement) and subsequent rapidly ascending methicillin-resistant staphylococcus aureus necrotizing fasciitis involving the knee joint. This occurred after being treated with BMP-2 at the site of a segmental defect 4 months out from his index IMN. Notably, during this reoperation, the initial IMN remained in place, and the operation was limited to local BMP-2 placement at the site of the segmental defect.

DISCUSSION

We reviewed the treatment and early clinical results of 139 open tibia fractures treated with modern open fracture care and fixation using an SP nail and found no cases of acute knee sepsis. This finding was present in a cohort with severe soft tissue injuries, the majority (87%) being Gustilo and Anderson type II and III fractures. Notably, 18% of

Discussion...

- Recommend SP Nailing in Diaphyseal open tibia fractures...?
- ...in proximal 1/3 open tibia fractures?