

Short vs. Long Leg Splints for Initial Stabilization of Tibial Shaft Fractures: A Non-Inferiority Comparative Analysis

Andrew J Burcke, Ashley Gall, Joshua Ungar, Achraf Hani Jardaly, Matthew Wagoner, Ryan Evan Bruner, Jasmine Lee, Dalton J Ennis, Rashini Jayawardena, Thomas Revak

INTRODUCTION:

Long leg posterior splints (LLS) have historically been used to stabilize tibial shaft fractures in order to eliminate the deforming forces of the lower extremity, including the gastrocnemius. Although still in use for provisional stabilization, the relevance of LLS has come under scrutiny with the widespread adoption of intramedullary nailing (IMN) for definitive fixation. Limitations associated with LLS include technically demanding application, patient discomfort during manipulation, suboptimal knee immobilization, and posterior thigh impingement. In the setting of these limitations, the use of short leg splints (SLS) for middle and distal third tibia shaft fractures was considered as an alternative to facilitate ease of application and adequately stabilize patients in the brief period prior to fixation. As such, a transition from primarily LLS to SLS of tibia shaft fractures occurred at this institution in the year 2022. The primary outcomes of this study are patient reported pain scores and radiographic fracture alignment comparing patients placed into LLS and SLS. Secondary outcomes include complications such as skin breakdown, compartment syndrome, superficial and deep surgical site infection, and nonunion surgery. We hypothesized that SLS would be non-inferior to LLS regarding patient reported pain and would provide comparable radiographic fracture alignment.

METHODS:

After IRB approval, patients that underwent intramedullary nailing (IMN) for tibia shaft fractures at a single Level I trauma center between 2016 and 2024 were identified from the hospital's medical record database using CPT code 27759 for surgical treatment of a fracture of the tibia. All tibia fractures that underwent short or long leg splinting prior to fixation were identified via chart review. Inclusion criteria were patients aged 18-90 years with isolated tibia fractures and associated ipsilateral fibula fractures classified as AO/OTA 42A/B/C and 43A. Exclusion criteria included polytrauma patients defined as having a concomitant injury to the head, neck, chest, abdomen, pelvis, additional extremity fracture except minor hand, foot or ipsilateral ankle injuries, lack of perioperative documentation, lack of adequate post-splint application radiographs, lack of patient reported pain scores, fractures proximal to the tibia metaphysis, fractures with Gustilo-Anderson grade IIIB and C, and proximal or distal intra-articular tibia fractures classified as AO/OTA subtype 41A/B/C and 43B/C. Patient pain scores are regularly collected in the emergency department by the nursing staff and reported in the electronic medical record. The visual analogue scale (VAS) pain scores were collected from time of splint application to time of surgery and averaged for each patient. Fracture angulation was measured in the coronal and sagittal plane after fracture reduction and splint application using anterior-posterior (AP) and lateral radiographs (Figure 1). A power analysis for non-inferiority was calculated at a sample size of 45 patients per group.

RESULTS:

286 patients met inclusion criteria with 134 in SLS group and 152 in LLS group. The average age of the SLS group was 45.3 years with BMI of 28.0 while the LLS group was 46.6 years and BMI of 28.2. There were no significant differences between groups in regard to demographics, high energy mechanism of injury or open fracture incidence (Table 1). There was a greater fracture angulation in the coronal plane of the LLS group of 4.5 degrees compared to the SLS group of 3.6 degrees, $p=0.04$. There was no significant difference in sagittal fracture angulation with 4.5 degrees in the SLS group compared to 4.9 degrees in the LLS, $p=0.41$. The LLS group had a significantly higher VAS pain score of 6.9 compared to the SLS group score of 6.4, $p=0.049$ (Table 2). The average follow-up was 6.6 months with no significant difference between groups regarding skin breakdown in splint, superficial and deep surgical site infections, and nonunion surgery. The SLS group had 2 (1.5%) patients that developed compartment syndrome while there were none in the LLS group (Table 3).

DISCUSSION AND CONCLUSION:

Patients treated with SLS demonstrated significantly lower VAS pain scores and reduced coronal fracture angulation compared to those treated with LLS. While these differences reached statistical significance, their clinical relevance may be limited. Nonetheless, the findings support the use of SLS as a non-inferior alternative to LLS for temporary immobilization of tibial shaft fractures managed with intramedullary nailing. Given its ease of application and comparable efficacy in pain control and fracture alignment, SLS offers a practical, efficient, and effective option for preoperative stabilization.



	Short Leg	Long leg	P Value
N	134	152	
Demographics			
Age (SD)	45.3 (16.1)	46.6 (16.6)	0.503
BMI (SD)	28.0 (6.9)	28.2 (7.3)	0.863
Male	87 (65%)	103 (68%)	0.612
Diabetes	13 (11%)	18 (12%)	0.864
Smoker	56 (42%)	76 (50%)	0.155
Comorbidities (%)			
0	45	43	0.818
1	21	16	0.334
2	7.5	14	0.085
≥3	27	26	0.916
Mechanism of Injury			
Ground level fall	50 (37%)	48 (32%)	0.308
Motor vehicle collision	21 (16%)	28 (18%)	0.536
Pedestrian vs MVC	20 (15%)	8 (5%)	0.006
Gunshot wound	16 (12%)	25 (16%)	0.278
Crush injury	8 (6%)	5 (3%)	0.278
Other	19 (14%)	38 (25%)	0.022
Gustilo-Anderson Grade (%)			
Open fracture	47 (35%)	57 (38%)	0.671
Grade 1	17	26	0.256
Grade 2	49	44	0.605
Grade 3A	34	30	0.645
Laterality			
Right/Left	62/72	76/76	0.529

Table 1: Demographics and Injury Data

	Short Leg	Long Leg	P Value
Fracture Location (%)			
Proximal 1/3	2 (1.5%)	3 (2%)	0.757
Middle 1/3	36 (27%)	52 (34%)	0.179
Distal 1/3	96 (72%)	97 (64%)	0.159
AO/OTA Classification (%)			
42A	71 (53%)	86 (57%)	0.542
42B	20 (15%)	24 (16%)	0.840
42C	15 (11%)	17 (11%)	0.998
43A	28 (21%)	25 (16%)	0.334
43B	9.8	0.7	0.645
Time in Splint (days)			
Fracture Angulation in Splint			
Coronal (degrees)	3.6	4.5	0.04
Sagittal (degrees)	4.5	4.9	0.41
Fracture Apex in Splint			
Volar/Sagittal/Neutral (%)	48/46/7	46/45/9	0.634
Procurvatum/Recurvatum/Neutral (%)	43/54/3	47/49/5	0.788
Mean VAS Pain Scores	6.4	6.9	0.049

Table 2: Fracture Classification, Fracture Alignment, and Pain Scores

	Short Leg	Long Leg	P Value
Hospital Stay (days)			
	3.9	3.8	0.656
Complications			
Skin breakdown in splint	3 (2%)	1 (0.7%)	0.259
Compartment syndrome	2 (1.5%)	0 (0%)	
Superficial SSI	9 (8%)	4 (3%)	0.098
Deep SSI	11 (9%)	7 (5%)	0.211
Nonunion surgery	8 (7%)	4 (3%)	0.160
Average Follow-Up (days)			
Mean	185	217	0.261
Median	136	133	

Table 3: Length of Hospital Stay, Complications, and Follow Up Data