

Incidence of Preoperative Deep Vein Thrombosis in Isolated Calcaneal Fractures*Joan Williams, MD¹; Milton Little, MD²; Patricia Kramer, PhD³; Stephen Benirschke, MD⁴;**¹University of California-Los Angeles, Santa Monica, California, USA;**²Cedars Sinai Medical Center, Los Angeles, California, USA;**³University of Washington, Seattle, Washington, USA;**⁴University of Washington-Harborview Medical Center, Seattle, Washington, USA*

Background/Purpose: Calcaneal fractures are a complex injury that can lead to significant morbidity despite surgical treatment. The most common cause of postoperative morbidity is early operative intervention through a damaged soft-tissue envelope. To limit those risks, calcaneal fracture surgical intervention is often delayed 7-10 days until the soft-tissue envelope is deemed safe. This prolonged period of extremity elevation and limited mobility may place patients at increased risk for the development of deep vein thrombosis (DVT) both pre- and postoperatively. This study examines the incidence and risk factors of preoperative DVT in patients presenting to an outpatient setting with an isolated calcaneal fracture who have all undergone preoperative duplex ultrasonography.

Methods: This is an IRB-approved retrospective review of all isolated calcaneal fractures treated as an outpatient at a regional Level I trauma center from 2005-2013. All patients included were over the age of 18 years, had a preoperative duplex ultrasonography of bilateral lower extremities per the treating surgeon's protocol, and had at minimum 6 weeks follow-up. Patients were excluded if they were polytrauma patients, had a documented hypercoagulable state, or were on baseline pharmacologic anticoagulation for another condition. We compared the rate of DVT in our study to that of the three similar prospective DVT diagnostic studies, using the binomial probability for small sample size test. Multiple logistic regression was also performed with the presence or absence of a DVT as the outcome variable, and the patient or injury characteristics as the predictor variables. All analyses were performed with Stata software (StataCorp) and statistical significance was established using $P < 0.05$.

Results: 160 (114 male, 46 female) isolated calcaneus fracture patients qualified for our study (Table 1). The mean age was 46.4 years (range, 18-77). The mean BMI (body mass index) was 26.2 kg/m² (range, 17.9-42.1) and the mean time to surgery was 19.5 days (range, 1-105). 19 patients (16 males and 3 females; 12%) had a DVT preoperatively. All of the DVTs were in the operative extremity with the exception of one patient who had bilateral DVTs. The average time to surgery for the patients who had a DVT was 23.6 days (range, 11-105). There were 10 peroneal vein DVTs, followed by 6 soleal, 2 posterior tibial, and 1 intramuscular calf veins (Table 2). Seven patients had DVTs in multiple veins in the leg. One patient required inferior vena cava filter placement (IVC), while the remainder were treated with Lovenox or Coumadin. The proportion of calcaneal patients with DVT in our study (12%) is significantly different from the rates reported in the literature (5% to 6.5%) for foot and ankle trauma ($P < 0.01$). Older age was found to be the only risk factor for DVT ($P = 0.009$, odds ratio = 1.06).

Conclusion: The incidence of preoperative DVT found here is almost 2 times as high as any previously published examination of lower extremity injuries. Both physicians and their patients should be aware of the risk of preoperative DVT with isolated calcaneal fractures.

See pages 47 - 108 for financial disclosure information.

	Patients without DVT	Patients with DVT
Male:Female	98:43	16:3
Age	45.4 (18-77)yrs	53.4 (25-74)yrs
BMI	26.5 (18.7-41.6)kg/m ²	23.4 (18.5-33.3)kg/m ²
Time to Surgery	18.9 (1-102)days	23.6 (11-105)days
Fracture Classification		
73A	1	1
73B	15	0
73C	94	12
73NFS	8	0

Table 1. Demographic data of patients with isolated calcaneal fractures with and without preoperative DVT.

Distribution of DVTs	
Peroneal vein	10
Soleal vein	6
Intramuscular calf veins	5
Posterior tibial vein	4
Gastroc vein	2
Popliteal vein	1
Femoral vein	1

Table 2. Location of the DVTs found in patients prior to surgical fixation of isolated calcaneal fractures.