

# Foot & Ankle

VOLUME 5



Dear Colleagues,

Jefferson Health's Department of Orthopaedic Surgery is happy to share with you the latest in our series of Orthopaedic Outcomes & Research reports. This volume focuses on the innovative clinical and research work being conducted by our Foot and Ankle Program.

As a major referral center for orthopaedic care, Jefferson Health treats patients with the most complex injuries and disorders of the foot and ankle, as well as patients with common conditions who seek out our experienced team for evaluation, treatment planning and rehabilitation.

The foot and ankle service is headed by Steven M. Raikin, MD, who likes to make the point that "the foot and ankle is the foundation on which all your functionality depends." If something goes wrong, the "rest of the body isn't going to be able to get where it needs to be."

Very often patients with foot and ankle injuries or other conditions do not require surgery, but they do need a thoughtful, evidence-based approach to treatment so that they recover as quickly and fully as possible. No problem is seen as too small. As Dr. Raikin notes, "minor things with the foot and ankle often grow into major things."

When it comes to total ankle replacement, an especially complex procedure, Jefferson Health is a high-volume center, with nearly 200 procedures completed annually. As you well know, healthcare quality studies have repeatedly associated higher volume with better outcomes.

Our foot and ankle team's clinical skill is enhanced by a research agenda that strives to identify best surgical techniques and optimal paths to recovery. This past year the foot and ankle team published studies on a variety of topics including outcomes for acquired flatfoot deformity correction, ankle arthrodesis using a fibular-sparing anterior approach, and microfracture for treatment of osteochondral lesions of the talus.

The pages ahead offer a look at some of that research. I also invite you to learn more about our foot and ankle services by visiting our website, [JeffersonHealth.org/Ortho](http://JeffersonHealth.org/Ortho). To refer a patient, please call 215-503-8888.

Thank you for your interest.

Sincerely,



Alexander R. Vaccaro, MD, PhD, MBA

*Richard H. Rothman Professor and Chair  
Department of Orthopaedic Surgery, Jefferson Health  
Sidney Kimmel Medical College, Thomas Jefferson University*



### COMPLEX SERVICES

- Total ankle replacement surgery
- Complex deformity reconstruction
- Achilles tendon rupture and tendonitis treatment
- Treatment of ankle sprains and fractures
- Treatment of foot and ankle arthritis
- Talus and lisfranc fracture/dislocation repair
- Posterior tibial tendonitis treatment
- Treatment of tarsal tunnel syndrome
- Hallux valgus surgery
- Hallux rigidus surgery
- Flat foot reconstruction
- Treatment of various foot conditions

## Ankle Arthrodesis Through a Fibular-Sparing Anterior Approach

Arthritic degeneration of the tibiotalar joint is a debilitating condition afflicting patients with pain, deformity, impaired mobility of the lower extremity, and overall decreased quality of life. Following conservative treatment efforts, ankle arthrodesis has long been considered the gold standard for surgical management of ankle osteoarthritis.

The open anterior approach to ankle arthrodesis is a newer technique that provides several advantages for surgeons, such as better visualization of the joint for deformity correction, preservation of the malleoli for potential future conversion to total ankle arthroplasty and improved peroneal tendon function. However, compared with transfibular approaches, this method does bring additional risks. No consensus on which surgical approach for ankle arthrodesis is best has emerged.

Jefferson Health researchers led by Steven M. Raikin, MD, conducted a study to evaluate clinical, radiographic, and functional outcomes in a large series of patients undergoing open ankle arthrodesis via a fibular-sparing anterior approach.

A retrospective review was performed of 81 patients (31 women and 50 men, mean age of 51.5 years) undergoing primary ankle arthrodesis with a single fellowship-trained foot and ankle orthopedic surgeon between 2009 and 2017. Patient-reported outcome measures, including Foot and Ankle Ability Measure – Activities of Daily Living (FAAM-ADL), Short-Form 12 (SF-12), and visual analog scale (VAS) for pain, were subsequently

collected at a minimum of 24 months following index surgery along with patient outcome satisfaction and likelihood to repeat surgery. Fusion of the tibiotalar joint at the time of the last radiographic follow-up was also assessed.

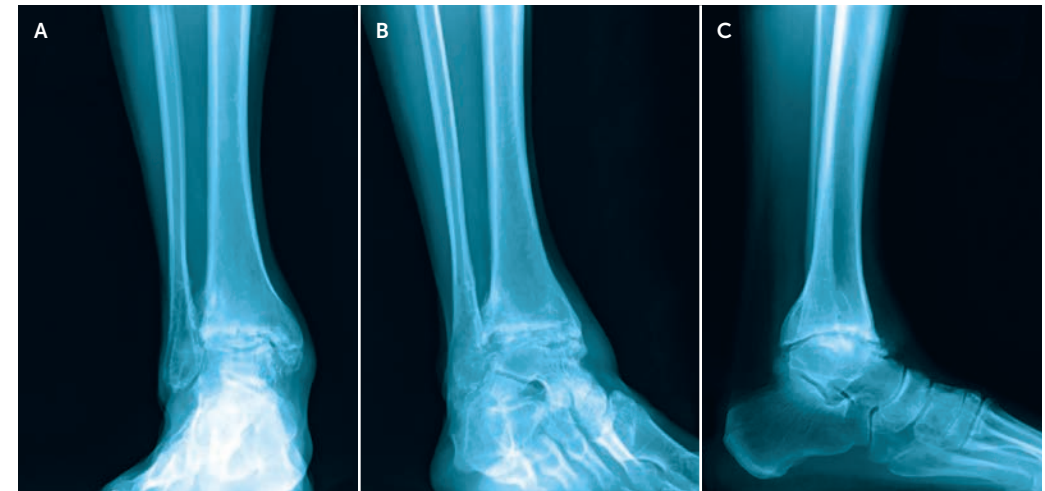
Paired t-tests were performed to assess change in pre- to postoperative outcomes, while linear regression analysis was performed to identify any patient factors associated with outcomes. The patients had a mean follow-up of 58.9 months.

Sixty-two patients reported significant improvement in mean FAAM-ADL, Physical Component Scale and VAS pain. Better improvement in pain was associated with younger age. The SF-12 Mental Composite Scale also improved, though not significantly.

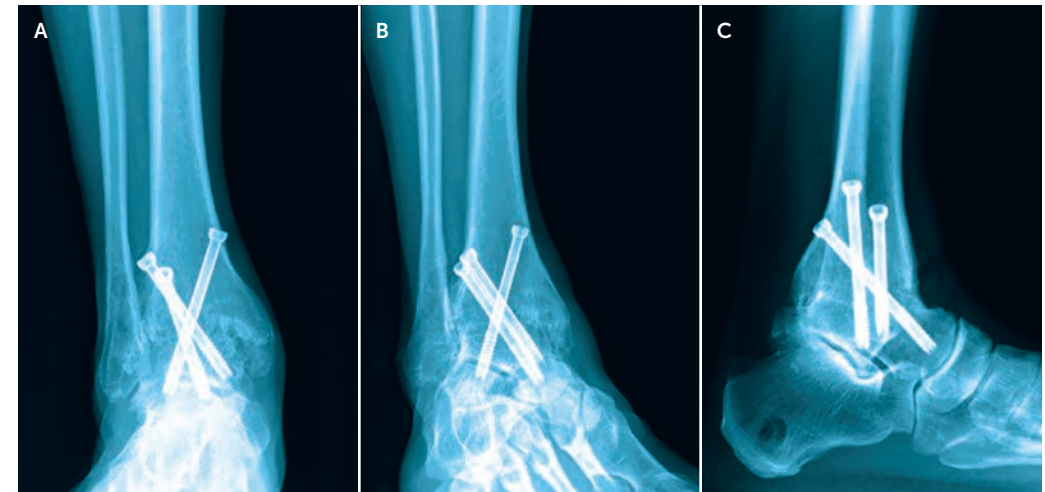
Twelve patients (14.8%) experienced complications following their ankle arthrodesis procedure. At their last radiographic follow-up, 79 patients (97.5%) achieved fusion. As part of the postoperative survey, 70.6% of patients said they were satisfied or very satisfied with the outcome of surgery and 72% said there was a high or very high likelihood they would repeat the procedure if given the same preoperative conditions.

“Ankle arthrodesis utilizing a fibular-sparing anterior approach combined with the transarticular fixation technique offers surgeons several advantages, along with a low postoperative complication rate, high rate of radiographic evidence of joint fusion, and substantially large improvement in pain

### Ankle Arthrodesis Through a Fibular-Sparing Anterior Approach



(A) Anteroposterior, (B) mortise, and (C) lateral preoperative radiographs of a 41-year-old man with posttraumatic arthritis.



(A) Anteroposterior, (B) mortise, and (C) lateral postoperative 7.1-year radiographs of the same patient in Figure 1 undergoing anterior ankle arthrodesis with a transarticular screw technique demonstrating successful fusion at the ankle joint.

Source: Steven M. Raikin, MD

and functional levels,” the researchers reported in *Foot & Ankle International*.

They said future prospective studies should be conducted to compare this technique

with alternative arthrodesis methods and with total ankle arthroplasty in order to identify the best indications for treatment of end-stage ankle arthritis.

## High Prevalence of Degenerative Changes at the Metatarsal Head Sesamoid Articulation Found During Hallux Valgus Correction Surgery

Despite the absence of complications and a restoration of normal hallux alignment, some patients have suboptimal outcomes from hallux correction surgery. One risk factor for persistent pain may be the presence of arthritic changes at the metatarsal head articulation with the sesamoids, an area not easily assessed with standard radiographs unless dedicated sesamoid views are obtained.

Jefferson Health researchers headed by Justin Tsai, MD, and Steven M. Raikin, MD, did a prospective study to evaluate the metatarsal head for degenerative changes during hallux valgus correction surgery and identify preoperative risk factors associated with these changes.

The study enrolled 200 feet in 196 patients who underwent hallux valgus surgery. Most of the patients were female (184) and the average age was 52.5 years.

The patients were assessed preoperatively using the Foot and Ankle Ability measure (FAAM) Activities of Daily Living (ADL) and Sports subscale and the Visual Analog Scale (VAS) for pain. Their feet were assessed radiographically to determine the severity of the hallux valgus deformity. Radiographs were then obtained intraoperatively of the first metatarsal and sesamoid joint to assess for arthritic changes.

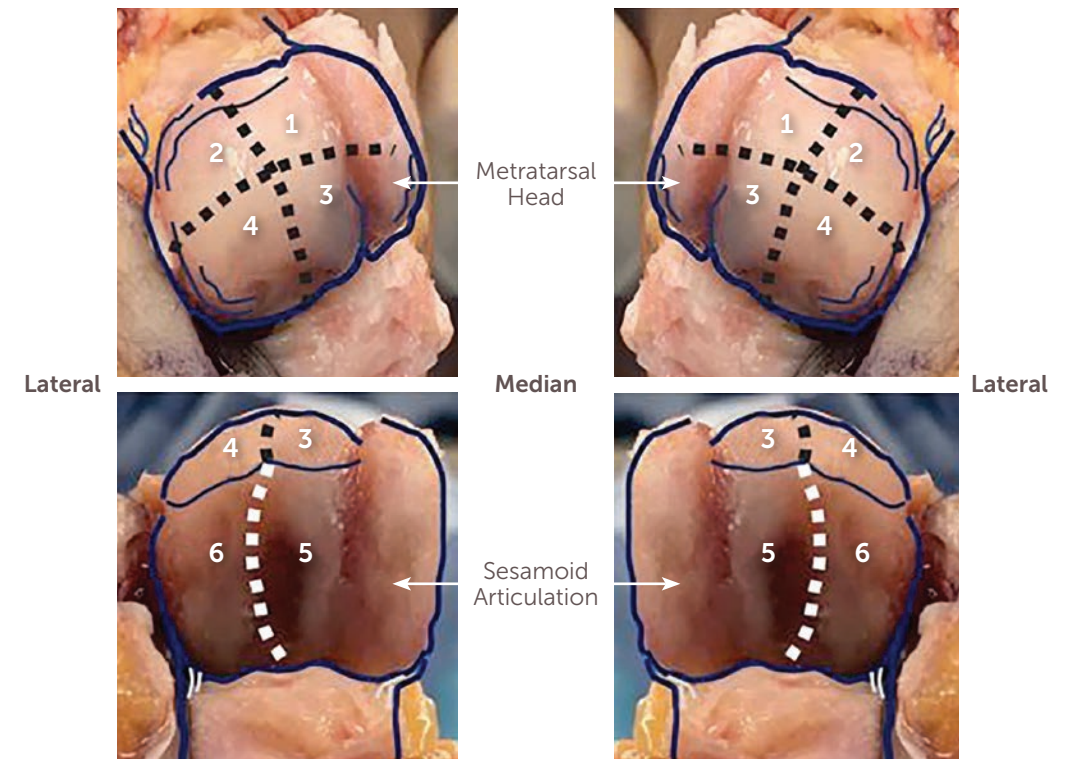
Mann-Whitney U testing was implemented to compare differences in arthritic scores between preoperative deformity groups. The Spearman correlation test was used to determine the association between age and preoperative deformity with the severity of degeneration changes.

The study found that more than half of all feet assessed had severe arthritic changes at the sesamoid articulation with the plantar medial aspect of the metatarsal head and 40% of the feet at the plantar lateral aspect. Age and intermetatarsal angle were found to be positively correlated with arthritis in this area.

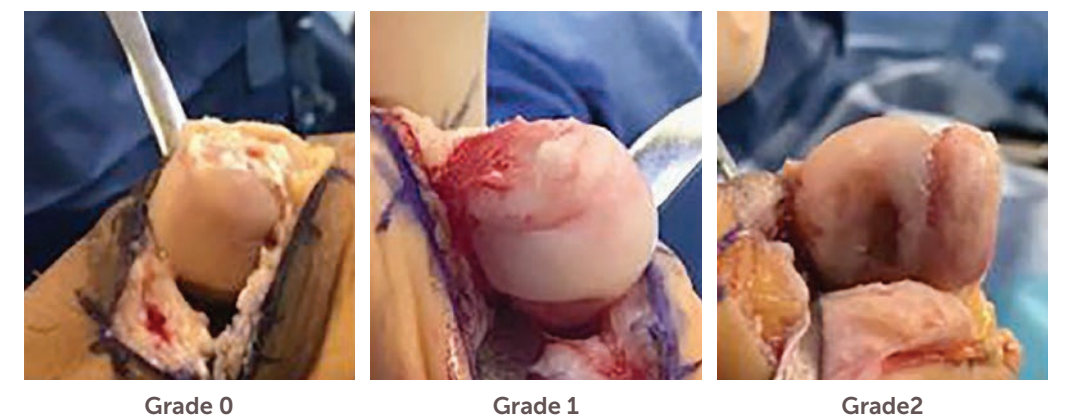
The researchers reported in *Foot & Ankle Specialist* that the study “demonstrates an unexpectedly high level of severe arthritic changes seen in the sesamoid metatarsal head articulation in a population undergoing elective hallux valgus correction surgery.” They said the high prevalence of such arthritic changes “may be particularly responsible for suboptimal outcome following hallux valgus correction surgery, but this requires further investigation.”

A follow-up study is being done.

Schematic of designated zones for assessing the metatarsal head intraoperatively for degenerative changes.



Clinical examples of grade 0, 1 and 2 arthritis using a novel arthritis grading scheme.



Source: Justin Tsai, MD and Steven M. Raikin, MD



## Outcomes of 2B Adult Acquired Flatfoot Deformity Correction in Patients With and Without Spring Ligament Tear

It is unclear how injury to the spring ligament (SL) affects the preoperative presentation of adult acquired flatfoot deformity (AAFD) or the outcome of operative reconstruction. Jefferson Health foot and ankle specialists led by Steven M. Raikin, MD, conducted a retrospective study to assess the preoperative features and pre- or postoperative function of patients who underwent direct operative repair of an SL tear compared to patients without a tear.

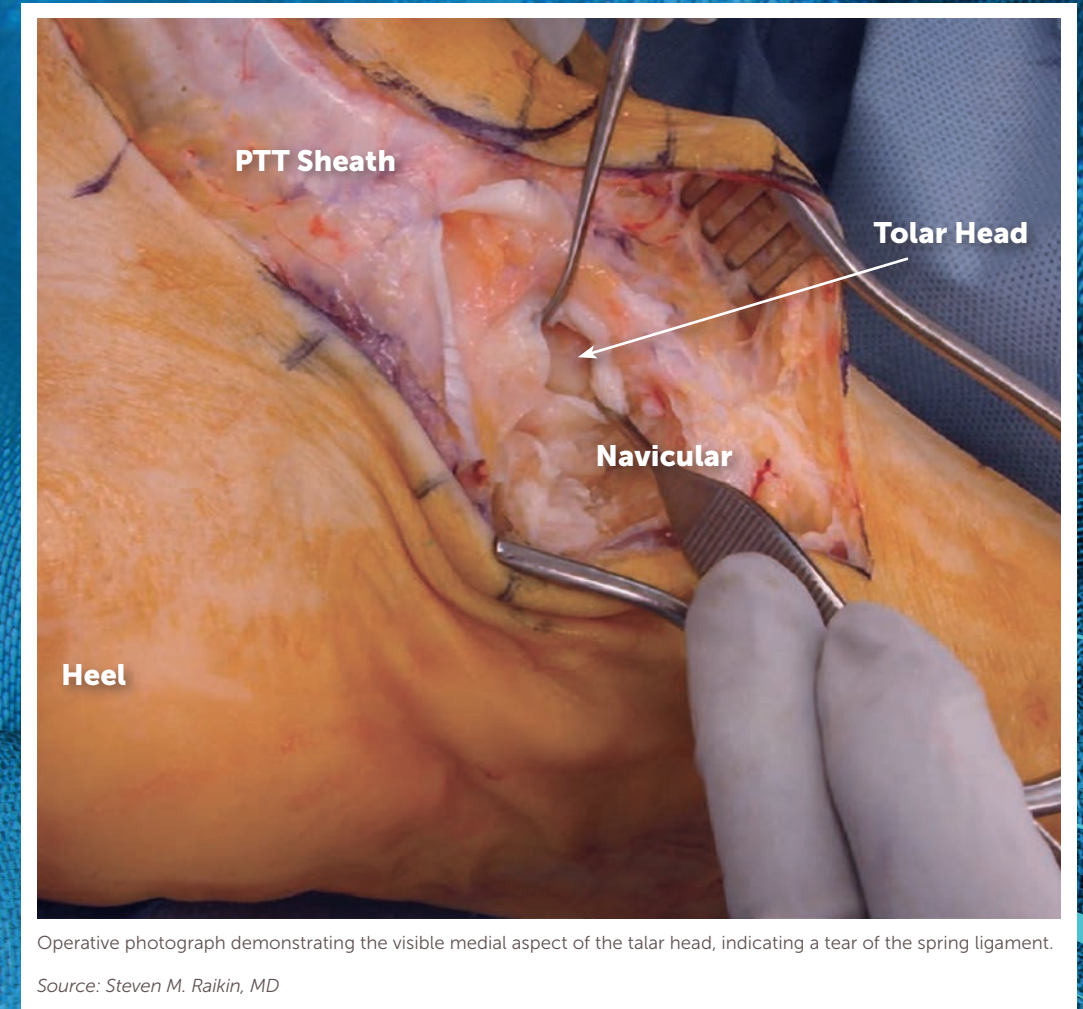
The research team reviewed the cases of 86 patients who underwent operative correction of grade 2B AAFD by a single fellowship-trained foot and ankle surgeon. Among that patient group, there were 35 feet with an SL tear that underwent concomitant debridement and direct repair.

Patient charts were reviewed for demographic information, preoperative visual analog scale (VAS) pain level, and Foot and Ankle Ability Measure (FAAM) activities of daily living (ADL) and sports subscales. Preoperative radiographic parameters also were assessed. Patient outcomes for VAS pain, FAAM-ADL, and FAAM-Sports were collected and compared between the two groups of patients, who had an average follow-up of 45.9 months.

Patients with an SL tear had significantly lower FAAM-ADL and sports scores, with higher VAS scores preoperatively. Patient age, talonavicular uncoverage percentage, and talonavicular angle were found to be associated with spring ligament degeneration.

At final follow-up, patients overall demonstrated a significant improvement in all outcome parameters. There was no statistical difference in patient satisfaction, final postoperative VAS pain, FAAM-ADL or FAAM-Sports in patients who required a repair of their SL compared to those who did not need the repair.

“Elliptically debriding the tear and direct repair of SL resulted in excellent improvement in outcomes, comparable with patients undergoing the same procedure who have an intact SL,” the researchers reported in *Foot & Ankle International*. “Close inspection of the SL is recommended intraoperatively to evaluate for any tears, as repair was shown to significantly improve outcomes as compared to preoperative function.”



Operative photograph demonstrating the visible medial aspect of the talar head, indicating a tear of the spring ligament.

Source: Steven M. Raikin, MD

## Long-term Outcomes of Microfracture for Treatment of Osteochondral Lesions of the Talus

Microfracture is the most common reparative surgery for osteochondral lesions of the talus (OLTs). While the procedure has been shown to be effective when it comes to short- to midterm outcomes, the fibrocartilage that microfracture produces is both biomechanically and biologically inferior to that of native hyaline cartilage and is susceptible to possible deterioration over time following repair.

The use of orthobiologics is being proposed as a way to augment repair. But there is a gap in research regarding the long-term clinical outcomes of microfracture and whether the expense of adding orthobiologics is justified.

To examine the issue, Jefferson Health researchers led by Steven M. Raikin, MD, conducted a retrospective review of patients who underwent microfracture of an OLT with a single fellowship-trained orthopedic surgeon from 2007 to 2009. Of 82 patients who met the inclusion criteria for the study, 45 were available for follow-up at a minimum of 10 years following their arthroscopic microfracture. They were asked to complete the Foot and Ankle Ability Measure (FAAM) Activities of Daily Living (ADL) and Sports subscales and visual analog scale (VAS) for pain.

Patients were also surveyed about their satisfaction with the outcomes of their procedure and their likelihood to recommend the procedure to a friend with the same problem. Patient demographics were reviewed and included for statistical analysis.

Of the 45 patients who responded in the follow-up, three required additional surgery on their ankle for the osteochondral defect, yielding a 10-year survival rate for the procedure of 93.3%. Of the surviving cases, 90.4% (38/42) of the patients reported being extremely satisfied or satisfied with the outcome of the procedure. The VAS score at follow-up averaged 14 out of a possible score of 100, while the FAAM-ADL and FAAM-Sports scores averaged 90.29 out of 100 and 82 out of 100, respectively. Of the 45 responders, 36 (85.7%) stated that their ankle did not prevent them from participating in sports of their choice.

The researchers reported in *Foot & Ankle International* that the results of their study were consistent with a couple of long-term studies of microfracture for OLT that demonstrated good functional results and return to sports participation, which were maintained over time.

“This is contrary to the opinion that fibrocartilage repair of OLTs will fail 5 to 7 years after surgery,” the Jefferson researchers said. They said that “while biological adjuvants may play a role in improving the long-term outcomes of microfracture procedures, large and longer-term follow-up studies are required for procedures using orthobiologics before their cost can be justified for routine use.”



Details of 3 Patients Who Underwent Revision Surgery

Age (y)	Sex	Zone	Surface area (mm <sup>2</sup> )	Previous Scope	Revision Procedure	Month to Revision	Scores at follow-up		
							VAS	FAAM-ADL	FAAM-Sports
51	M	6	24	Yes	OAT	31	64	35	3
57	F	4	42	No	TAA	52	94	19	0
60	F	4	49	No	OAT	38	25	90	61

Abbreviations: ADL, Activities of Daily Living; FAAM, Foot and Ankle Measure; OAT, Osteochondral Autologous Transplant; TAA, Total Ankle Arthroscopy; VAS, Visual Analog Scale.

Source: Steven M. Raikin, MD

## Opioid Consumption Patterns and Prolonged Opioid Use Among Opioid-Naive Ankle Fracture Patients

Orthopedic surgeons are the third highest prescribers of opioids in the United States. Previous studies in the orthopedic literature have documented that narcotics are overprescribed postoperatively, leaving a significant surplus of pills available for potential abuse by the patient or diversion to other people.

Jefferson Health researchers led by Joseph N. Daniel, DO, examined the issue by assessing immediate postoperative opioid consumption patterns and incidence of prolonged opioid use among opioid-naive patients who underwent ankle fracture surgery.

The study included 173 patients who had outpatient open reduction and internal fixation of an ankle or tibial plafond fracture over a one-year period. Patients were excluded from the analysis if they had been prescribed narcotics prior to surgery.

Patients were asked to bring their pill bottle with any remaining opioids to the first follow-up office visit, which typically occurred two weeks after surgery. Patients were asked how many pills they had taken and that number was confirmed with a pill count by a member of the research team. Leftover pills were safely discarded.

To account for the different opioids prescribed, all opioids were converted to a morphine-equivalent dose (MED). Prolonged use was defined as filling a prescription for a controlled substance more than 90 days after the index procedure.

The 173 patients seen at the first postoperative visit consumed a median of 24 out of 40 pills prescribed. The initial utilization rate was 60%, and 2,736 pills were left unused. In all, 32 patients (18.7%) received a narcotic prescription 90 days after the index procedure and 28 different physicians were involved in that prescribing. Many of the prescribers were primary care practitioners.

The analysis found no statistically significant difference between fracture type and prolonged opioid consumption. In general, men were more likely than women to use opioids immediately after surgery, and older patients tended toward less opioid use than younger patients. Patients with self-reported depression or diabetes were slightly more likely to have prolonged opioid use. The study design did not allow the researchers to identify the indication for which patients continued on opioids and noted that the reason may not have been related to the ankle surgery.

“Our study demonstrated that, on average, patients utilize significantly fewer pills than prescribed and that many patient demographics are not significant predictors of continued long-term use following outpatient ankle surgery,” the researchers reported in *Foot & Ankle Specialist*. They said “large variations in consumption rates make it difficult for physicians to accurately prescribe and predict prolonged narcotic use.”



### Immediate Opioid Consumption Patterns Based on Fracture Type and Syndesmosis Integrity

Fracture Type	Syndesmotic Injury	Median Pills Taken (IQR <sup>a</sup> )
Medial Malleolus	No	32 (20, 51)
Medial Malleolus	Yes	24 (6,37)
Lateral Malleolus	No	21 (3, 36)
Lateral Malleolus	Yes	26 (16, 39)
Bimalleolar	No	24 (10, 39)
Bimalleolar	Yes	23 (11, 35)
Trimalleolar	No	23 (13, 32)
Trimalleolar	Yes	31 (22, 43)
Pilon	No	41 (26, 52)
Pilon <sup>b</sup>	Yes	32
Posterior Malleolus <sup>b</sup>	No	0
Posterior Malleolus <sup>b</sup>	Yes	60

Abbreviations: IQR, Interquartile Range.

<sup>a</sup>IQR is the range from the third quartile below which is opioid consumption for the lowest 25% and above which is opioid consumption for the highest 25%

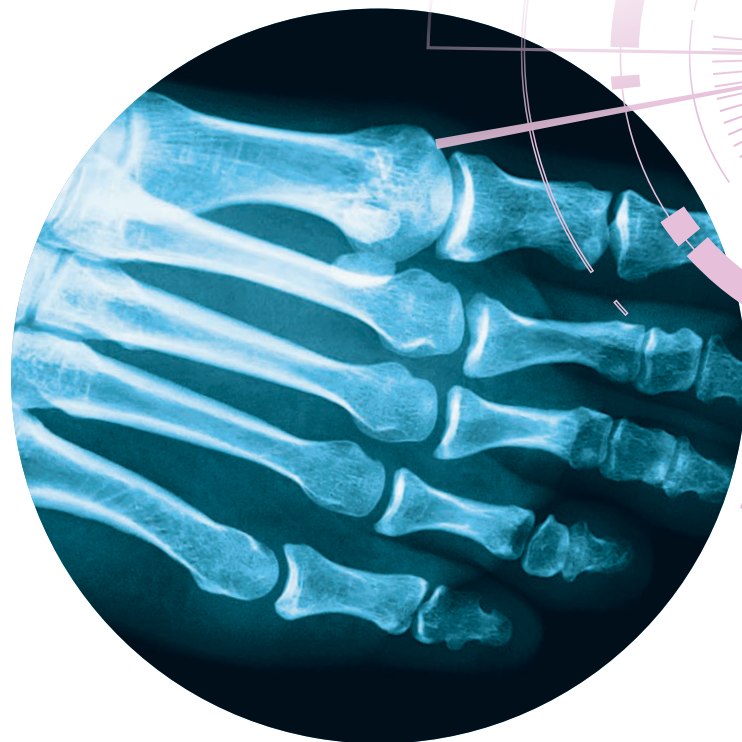
<sup>b</sup>One patient in each group: raw data are reported.

Source: Joseph N. Daniel, DO

FOOT & ANKLE SURGICAL VOLUME	
August 2020 - July 2021	
Jefferson Abington Hospital	265
Jefferson Cherry Hill Hospital	24
Jefferson Washington Township Hospital	159
PhyCare ASC	44
Physician Care Surgical Hospital	191
Jefferson Health – Navy Yard	654
Rothman Orthopaedic Specialty Hospital	246
Thomas Jefferson University Hospital	237
<b>GRAND TOTAL</b>	<b>1,820</b>

Surgical volumes include all procedures performed at Jefferson Health hospitals and ambulatory surgery centers.

Source: Jefferson internal data







Jefferson Health  
Department of Orthopaedic Surgery  
Philadelphia, PA 19107

Physician Referrals: **1-800-JEFF-NOW**  
Patient Transfers: **1-800-JEFF-121**

[JeffersonHealth.org/Ortho](https://www.jeffersonhealth.org/Ortho)

