

The 18th Annual Cutting Edge Wound Care Symposium

November 14, 2025

7:30 AM - 8:30 AM

To Save a Limb: Diagnostics, Decisions, and Determination

Megan Oltmann, DPM, FACFAS, D.ABFAS

Dr. Megan L. Oltmann is a board-certified foot surgeon and managing partner of Foot and Ankle Associates of Cleveland. She earned her biology degree with a dance minor from The Ohio State University and her Doctorate of Podiatric Medicine from Kent State University College of Podiatric Medicine, completing her surgical residency at the Cleveland Clinic Foundation and Mercy Health.

Dr. Oltmann serves as Assistant Professor of Orthopedics at Case Western Reserve University, core faculty for the University Hospitals Podiatric Surgery Residency Program, and adjunct faculty for Kent State College of Podiatric Medicine. She is the Medical Director of UH Twinsburg Wound Care Center and part of the Bill and Lorraine Doderio Limb Preservation Center at UH Cleveland Medical Center, where she also serves on the Medical Executive Committee.

She co-authored the bestseller Chronicles of Women in White Coats 3 and was named one of Cleveland Magazine's Best Doctors (2023-2025). In 2025, she received Kent State's Young Professional Achievement Award. A diplomate of the American Board of Foot and Ankle Surgeons and fellow of the American College of Foot and Ankle Surgeons, Dr. Oltmann lives in Avon Lake with her husband Joshua, their three children, and three golden retrievers.

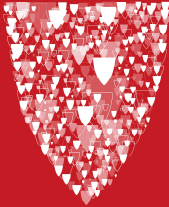


**Northeast Surgical
Wound Care**

To Save a Limb: Diagnostics, Decisions and Determination

Megan L. Oltmann DPM, FACFAS, D. ABFAS
Assistant Professor of Orthopedics, Case Western Reserve University
Owner, Foot and Ankle Associates of Cleveland
Medical Director, University Hospitals Twinsburg Wound Center

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Disclosures

Consulting: MiMedx, Solventum
Advisory Board: Asceplii



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Teamwork, Saves Limbs and Lives



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Limb Salvage Advisory Council (LSAC)

- Conceptualized in 2019
- Real-time multidisciplinary team discussion for patients at the brink of major amputation for CLTI
 - 19 patients between 1/19-9/19
 - Mean age 63, 47% female; 84% with prior intervention

[Circulation: Cardiovascular Interventions](#)

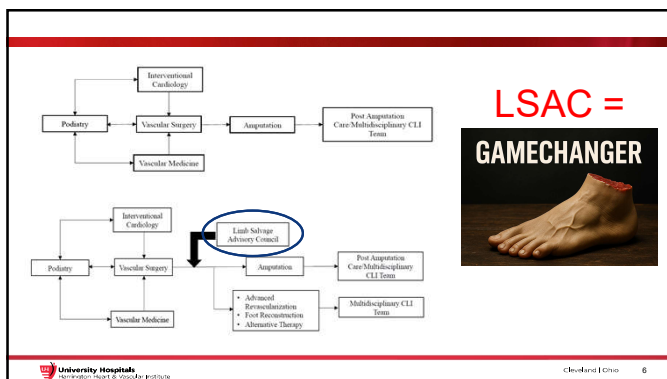
RESEARCH LETTER

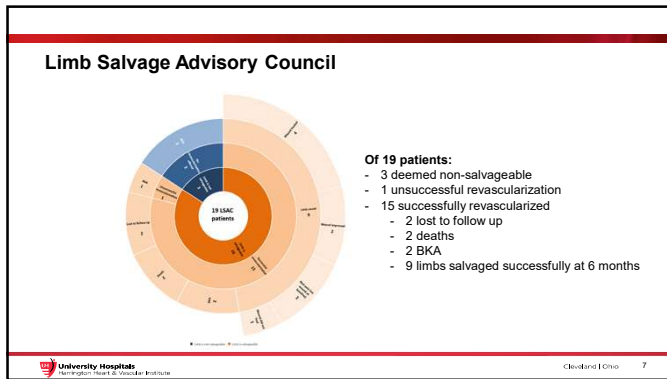
Impact of Interdisciplinary System-Wide Limb Salvage Advisory Council on Lower Extremity Major Amputation

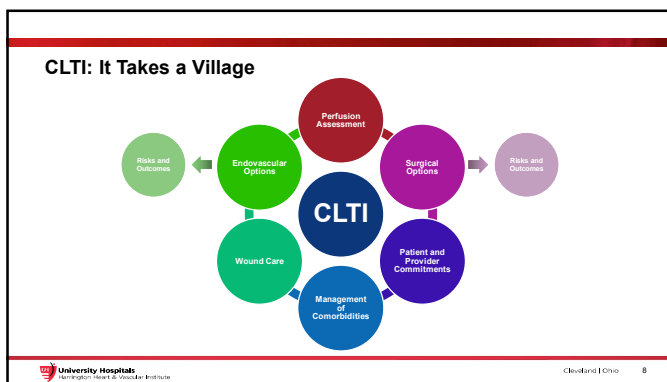
Ullrich M, Shrivastava R, GLL, Spivey P, Zeng A, Hernandez MD, Soria J, Phipps MD, Ahmad R, Kumar MD, Norman Kumar MD, Abdulkarim A, Jaber MD, Jun L, MD, Karen Hoff MD, Tims L, Ganes MD, Heather L, Ginn MD, Nee J, Pirooz MD, Piroz MD, Veen S, Hanley MD

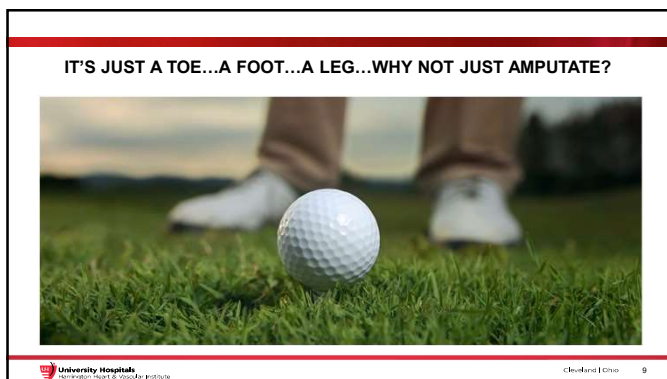
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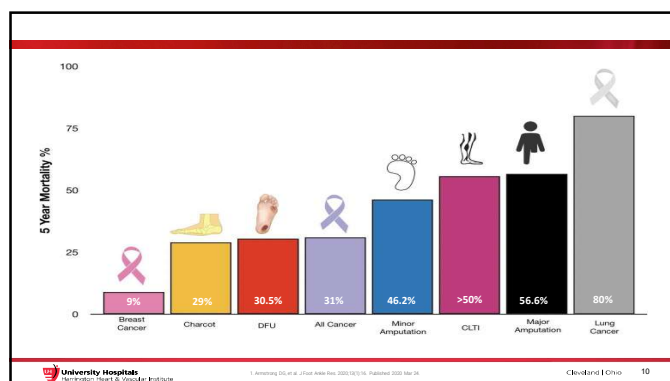
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Causes of Amputations

Infection	Vascular	Trauma
Diabetic Foot Infection	Acute Critical Limb Ischemia	Deaglving Injury
Osteomyelitis	Chronic Critical Limb Ischemia	GSW
Necrotizing Fasciitis	Inflow Disease	Penetrating wound
Sepsis	Infected necrosis aka wet gangrene	MVAs
Prosthetic Joint Infection	Ischemic necrosis aka dry gangrene	Industrial accidents
Endocarditis	Vascular Trauma	Explosions
	Frost Bite	

Statistics of Amputations

- 150k LE amputations in the US/year
 - 71% BKA's
 - 30-day mortality rate 6.2%-51.4%
 - 1 year mortality rate- 20-33%
- 82% of all vascular related amputations also have DM2
- DM have 30x great risk of amputation vs. Non-DM
- CLI = significant morbidity and mortality
- Gooden et al.- 20,464 patients 54% had no angio in year proceeding
- Teinecke et al- 4298 patients – 37% had no angio 24 months proceeding
- 20% of trauma patients with severe wound contamination and significant tissue loss
- MC- Males, >50 y/o, African Americans

Considerations for Level of Amputation

- Condition of patient
- Condition of soft tissue
- Adequate blood flow
 - After revasc attempts
- Neuropathy
- Pain
- Functional Status
- Primary Amputation= Non-ambulatory, CLTI, limb contraction
- Infection



Clinical Significance

- Reduces mobility
- Reduces quality of life
- Increase energy expenditures w/ higher levels of amputation
- Mean oxygen consumption can increase by 9%- BKA
- 49% with AKA, 280% with double AKA

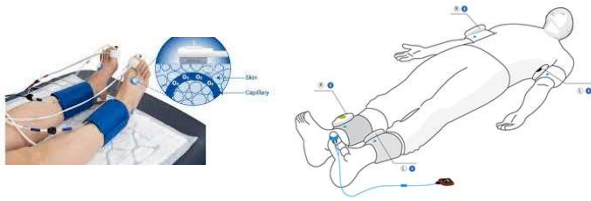


Complications

- Significant morbidity and mortality
- Mortality rates in DM LE limb amp can as high as 77% at 5 years
- A review of 2879 patients
 - Pneumonia 22%
 - AKI- 15%
 - DVT 15%
 - ARDS 13%
 - OM 3%
 - Flap Failure 6%
- Wound Complications
- Phantom Limb Pain
- Psychological Trauma
 - Depression- 3x higher than general population



Non-Invasive Diagnostics



Transcutaneous Oxygen Pressure

Measure of O₂ tension in the skin from local capillary blood perfusion

- Can be utilized to determine level of amputation in ischemic limbs
- Higher levels correlate to increase healing potential
- Useful in patients with non compressible vessels
- >40 mmHg

TcPO ₂ Value (mmHg) ^①	Interpretation	Clinical Significance
> 50-60	Normal	Indicates healthy tissue oxygenation and normal microcirculation.
40 - 50	Borderline	May suggest mild ischemia or a potential for delayed wound healing.
30 - 40	Impaired Healing	Associated with impaired wound healing and increased risk of complications.
< 30	Critical ischemia	Indicates severe PAD/CLTI. Suggests a high risk of non-healing wounds or the need for amputation.
≤ 10-20	Severe/Failed Healing	Almost always associated with failure of wound healing and a very high risk for major amputation.

Ankle Brachial Index w/ PVR

TABLE 1. ANKLE-BRACHIAL INDEX

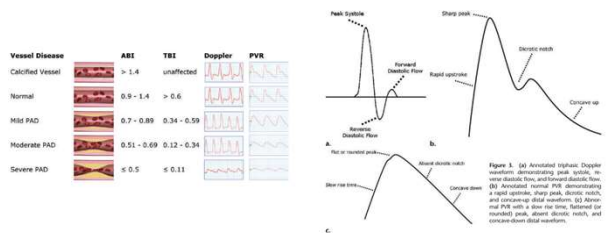
ABI	PAD Severity
>1.4	Noncompressible
1.00-1.4	Normal
0.91-0.99	Borderline (equivocal)
0.41-0.90	Mild or Moderate PAD
0.00-0.40	Severe PAD (CLTI)

ABI, ankle-brachial index; PAD, peripheral artery disease; CLTI, chronic limb-threatening ischemia.

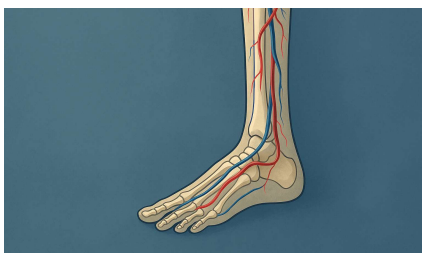
Toe Brachial Index

TBI Value ^②	Clinical Interpretation	Clinical Significance
> 0.7 or 0.8	Normal	Suggests no significant peripheral arterial disease (PAD).
0.61 – 0.8	Borderline	May indicate mild or early PAD.
< 0.6 or 0.65	Abnormal	Suggests the presence of PAD, often associated with claudication (pain during exercise).
≤ 0.2	Severe PAD/Critical Ischemia	Indicates severe limb ischemia, rest pain, or poor wound healing potential; often requires urgent vascular intervention.

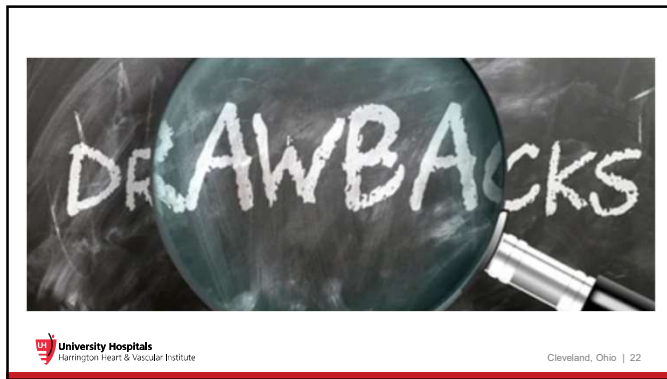
ABI/TBI/Doppler/PVR

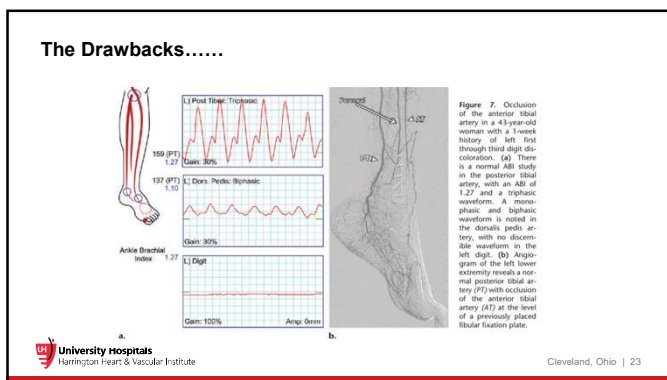


Arterial Ultrasound



- Calcified vessels may obstruct US beam
- Accuracy dependent on skill of tech
- Body habitus
- Difficult to detect significant stenosis distal to a severe or complete occlusion





An analysis of IN.PACT DEEP randomized trial on the limitations of the societal guidelines-recommended hemodynamic parameters to diagnose critical limb ischemia

Methods

- 315 of 358 had ABI testing w/ angiogram
- All had Rutherford 4,5,6 at time of testing
- Inflow disease was excluded- 78 patients
- 237 patients in study
- Multicenter, multinational, RCT

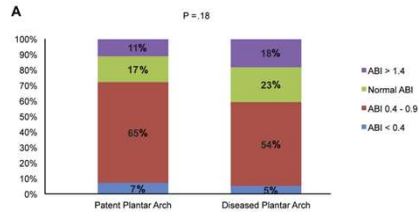
Results

- 29 patients- 12%- had one vessel disease
- 76 patients- 32%- had two vessel disease
- 132 patients- 56%- had three vessel disease

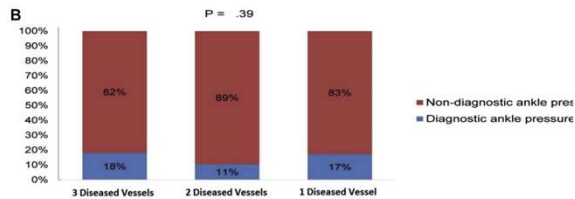
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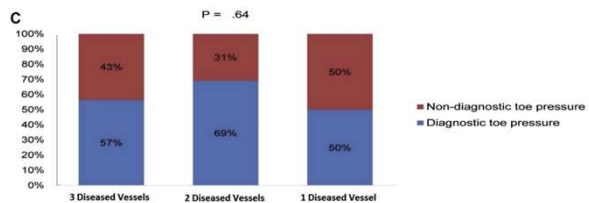
An analysis of IN.PACT DEEP randomized trial on the limitations of the societal guidelines-recommended hemodynamic parameters to diagnose critical limb ischemia



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An analysis of IN.PACT DEEP randomized trial on the limitations of the societal guidelines-recommended hemodynamic parameters to diagnose critical limb ischemia

Consensus

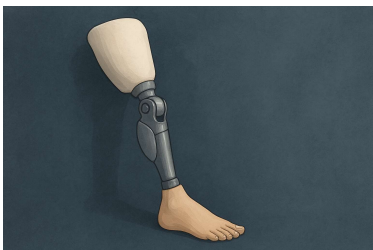
- A significant proportion of patients with advanced PAD had normal ABI and ankle pressure readings
- There was no significant correlation between the ABI, ankle, and toe pressure readings and the extent of arterial occlusion or the severity of ischemic symptoms.
- Patients w/ severe ischemic symptoms presented with higher ABI and ankle pressure values compared to those with less severe disease manifestations.
- Toe pressure measurements demonstrated slightly higher sensitivity compared to ABI and ankle pressure but still failed to accurately identify a substantial # of CLI cases.
- Toe pressure should be done on all patients with CLI
- Current guidelines only recommend for non compressible vessels

An analysis of IN.PACT DEEP randomized trial on the limitations of the societal guidelines-recommended hemodynamic parameters to diagnose critical limb ischemia

Consensus

- The cause of falsely elevated ABI's in isolated infrapopliteal disease is unknown
- Use lower # in ABI reading
- ABI and Ankle pressure may better represent- inflow disease, SFA, or multi level involvement and less sensitive to infrapopliteal disease
- The findings suggest a need for the development and integration of more sensitive and specific diagnostic methods to improve the identification and management of CLI.
- This evidence challenges the current diagnostic protocols and calls for a reevaluation of standard practices to ensure that patients with severe PAD receive appropriate and timely medical intervention

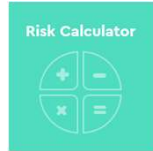
Classifications to Aid in Assessment for Amputation



AMPREDICT- Decision Support Tool

<https://ampdecide.org/ampredict/>

- Criteria
 - >40 yrs/old
 - Undergoing 1st amputation of LE (TMA or higher)
 - Amputation due to CLTI
 - Minimally ambulatory- no para or quadriplegia, CNS tumor, or cancer with mets
- Risk Calculator
 - Demographics
 - Co-morbidities
 - Lab Values
 - Medications
 - Other Health Factors



Informs patient and amputation level-specific 1-year risks of:
Mortality
Reamputation
Mobility

AMPREDICT- Decision Support Tool

Mortality

Risk of death within the first year after amputation



Rutherford Classification

		Symptom complex	Rutherford Classification
		Asymptomatic	Stage 0
Intermittent claudication	Mild claudication		Stage 1
	Moderate claudication		Stage 2
	Severe claudication		Stage 3
	Rest pain		Stage 4
Critical limb ischemia	Ischemia ulceration		Stage 5
	Severe ulceration or gangrene		Stage 6



Estimation of Risk of Amputation at 1 Year According to Wifl Classification Clinical Stages

Wifl Classification System:

W: Wound/Clinical Category

- Classifies wounds by size, depth, severity, and procedural complexity needed for healing
- Includes gangrene, stratified by extent of involvement

I: Ischemia

- Assessed using Ankle-Brachial Index (ABI)
- Grade 0: ABI ≥ 0.80
- For ABI > 1.3 (incompressible), measure Toe Pressure (TP) or Transcutaneous Oxygen Pressure (TcPO₂)
- TP measurement is crucial for diabetic patients due to potential ABI inaccuracies
- If ABI and TP differ, TP determines the ischemia grade

fi: Foot Infection

- Evaluates infection presence and severity
- Considers PEDIS and IDSA diabetic foot classification systems
- Grade 3 indicates systemic infection signs

WIFI Classification

Component	Grade	Description
Wound (W)	0	No ulcer or gangrene (ischemic pain at rest)
	1	Small or superficial ulcer on leg or foot, without gangrene (SDA or SC)
	2	Deep ulcer with exposed bone, joint, or tendon $\pm$ gangrene limited to digits (MDA or standard TMA $\pm$ SC)
Ischemia (I)	3	Deep, extensive ulcer involving heel/foot and/or midfoot $\pm$ calcaneal involvement $\pm$ extensive gangrene (CR of the foot or nontraditional TMA)
	ABI	SBP of the ankle
	0	≥ 0.80 > 100 mmHg ≥ 60 mmHg
Foot Infection (fi)	1	0.6-0.79 70-100 mmHg 40-59 mmHg
	2	0.4-0.59 50-70 mmHg 30-39 mmHg
	3	≤ 0.39 < 50 mmHg < 30 mmHg
Foot Infection (fi)	0	Undetected
	1	Mild local infection, involving only the skin and subcutaneous tissue, erythema > 0.5 to ≤ 2 cm
	2	Moderate local infection, with erythema > 2 cm or involving deeper structures
	3	Severe local infection with signs of SIRS

Wifl = Wound, Ischemia, and foot Infection

SDA = simple digital amputation

SC = skin coverage

MDA = multiple digital amputations

CR = complex reconstruction

ABI = ankle-brachial index

SBP = systolic blood pressure

TP = toe pressure

SIRS = systemic inflammatory response syndrome

Estimation of Risk of Amputation at 1 Year According to Wifl Classification Clinical Stages

	Ischemia 0				Ischemia 1				Ischemia 2				Ischemia 3			
Wound 0	VL	VL	L	M	VL	L	M	H	L	L	M	H	L	M	M	H
Wound 1	VL	VL	L	M	VL	L	M	H	L	M	H	H	M	M	H	H
Wound 2	L	L	M	H	M	H	H	H	M	H	H	H	H	H	H	H
Wound 3	M	M	H	H	H	H	H	H	H	H	H	H	H	H	H	H
	0.0	0.1	0.2	0.3	0.0	0.1	0.2	0.3	0.0	0.1	0.2	0.3	0.0	0.1	0.2	0.3

VL = very low; L = low; M = moderate; H = high; fi = foot infection; Wifl = Wound, Ischemia, and foot Infection.

Complications of Amputations

- Significant morbidity and mortality
- Mortality rates in DM LE limb amp can be as high as 77% at 5 years
- A review of 2879 patients
 - Pneumonia 22%
 - AKI- 15%
 - DVT 15%
 - ARDS 13%
 - OM 3%
 - Flap Failure 6%
- Wound Complications
- Phantom Limb Pain
- Psychological Trauma
 - Depression- 3x higher than general population

Clinical Significance of Amputations

- Reduces mobility
- Reduces quality of life
- Increase energy expenditures w/ higher levels of amputation
- Mean oxygen consumption can increase by 9%- BKA
- 49% with AKA, 280% with double AKA
- CLI = significant morbidity and mortality
- Gooden et al.- 20,464 patients 54% had no vascular procedures or diagnostic angio in year proceeding
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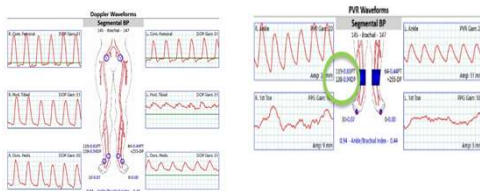
To Amputate or Not?



Case #1
Initial Clinical Presentation - 9/19/23



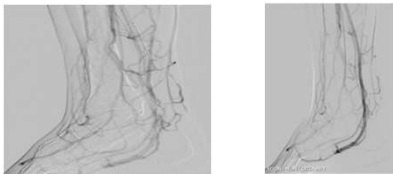
PVR/ABI/TBI- 9/19/23



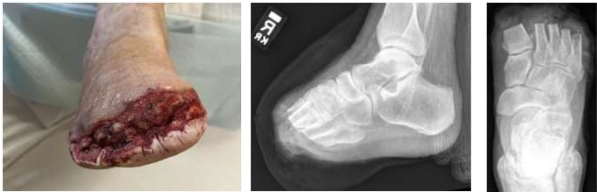
****NC Vessels, Biphasic Flow in DP and PT****

DVA found to be occluded
01/15/25

S/p successful aspiration thrombectomy and PTA of 'PT Artery-PT Vein' DVA graft



Open TMA
11/30/23



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S/p 2.5 weeks Open TMA
12/17/23



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DVA found to be occluded
01/15/25

S/p successful aspiration thrombectomy and PTA of 'PT Artery-PT Vein' DVA graft



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Revisional TMA with graft
01/16/24



Planning for further surgery



Septic Shock due to infection
04/20/24



Planning for further surgery



04/02/24



04/09/24

Lisfranc amputation + grafting + wound vac
04/22/24



Lisfranc amputation + grafting + weekly debridement + wound vac



05/14/24



06/18/24

Lisfranc amputation + grafting + weekly debridement + wound vac



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Lisfranc amputation + grafting + weekly debridement + wound vac



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Case #2

- 63-year-old female with PMHx of IDDM x 48 years, s/p kidney transplant, PAD, CAD
Baseline intermittent claudication
- Non-healing arterial wounds to bilateral feet for a 2nd opinion
- Never smoker; married w/ children

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04/24/24



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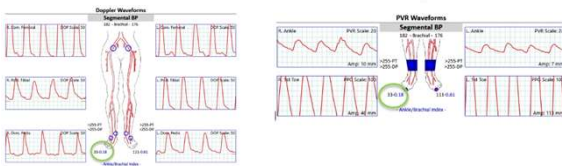
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PVR/ABI/TBI
04/24/24

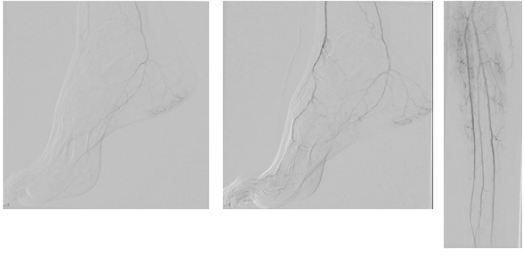


NC vessels, mild disease LT, moderate RT, called off waveforms

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Angiogram- RT side
4/29/24

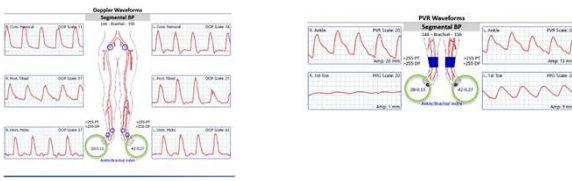


CFA: significant disease
TP trunk: no significant disease
AT: distal AT-CP CTO with reconstitution at distal DP with collaterals.
PT: Diffuse severe PT disease (>90%)
PA: no significant disease

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PVR/ABI/TBI
05/16/24

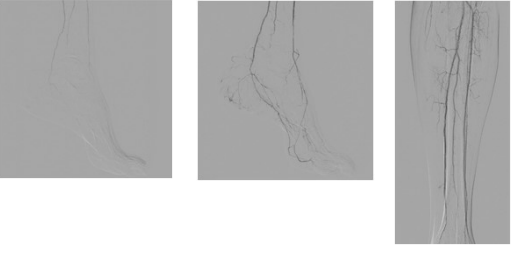


NC vessels, mild disease LT, moderate RT, called off waveforms

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Angiogram- LT side
06/3/24



CFA: significant disease
TP trunk: No significant disease
AT: Severe disease
PT: Severe disease
PA: no significant disease

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The Clinical Challenge



06/12/24



06/18/24

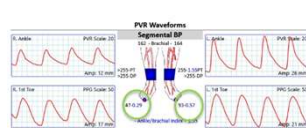
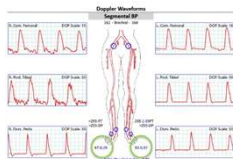
****Increased pain and mottling to digits 1-3 Rt****

Angiogram- Rt side 06/21/24



CFA: significant disease
TP trunk: No significant disease
AT: Occlusion at ankle
PT: Occlusion proximally
dissection of plantar artery

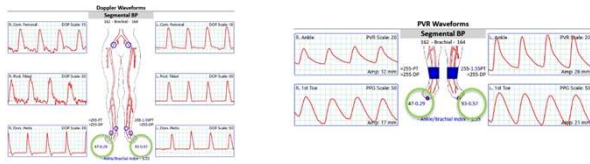
PVR/ABI/TBI 07/24/25



*****NC vessels, mild disease LT, moderate RT, called off waveforms, monophasic signals*****

PVR/ABI/TBI

07/24/25



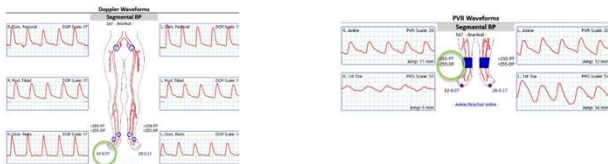
NC vessels, mild disease LT, moderate RT, called off waveforms, monophasic signals

The Clinical Challenge

- 9/19 Complication of fall
 - Epidural hematoma/thoracic compression fractures
 - OSH discontinued ASA and Plavix
 - Back brace x 3 months, can't lie flat
 - Pain is worsening bilaterally
 - Odor is worsening
- 10/03- DVA consultation
 - Await 3 months until out of brace

PVR/ABI/TBI

10/03/25



NC vessels, called off waveforms, monophasic signals

11/19/24



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TADV- Lt side

01/29/25- Left Peroneal A and V
TBA- TADV right side



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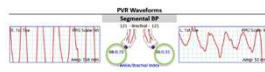
Resolution of the Challenge



03/05/25



04/09/25



05/13/25

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Resolution of the Challenge

07/22/25



Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail

- 68-year-old male
- Right ankle fracture
 - Ortho: ORIF and fusion
- Former smoker
 - 35 years, 1.5 packs per day
- BMI: 31.9 (obese)
- A1C: 7.0% (during course of treatment)
- Hypercholesterolemia
- Peripheral arterial disease
- Osteoarthritis
- GERD
- Right leg neuropathy
 - Secondary to several ortho surgeries



Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail



Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail



3rd APPLICATION



5th APPLICATION

Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail

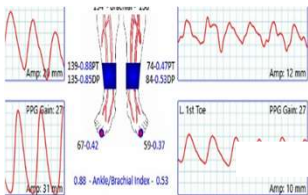


July of 2023 Osteomyelitis



Debridement, Bone Biopsy, Particulate, Wound Vac

Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail



12th APPLICATION



POST OR FOR HWR & PARTICULATE APPLICATION

Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail



1/18/2024: 0.4 cm x 0.2 cm



2/15/2024: Wound completely closed

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Tibiotalar Calcaneal Fusion with Intramedullary (IM) Nail



5/2023: No perfusion, open wound with bone, tendon, and muscle exposed...



2/15/2024: Wound completely closed

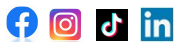
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Thank you!

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Contact with questions at
Megan.Oltmann@uhhospitals.org

Bibliography

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