Peripheral Arterial Disease

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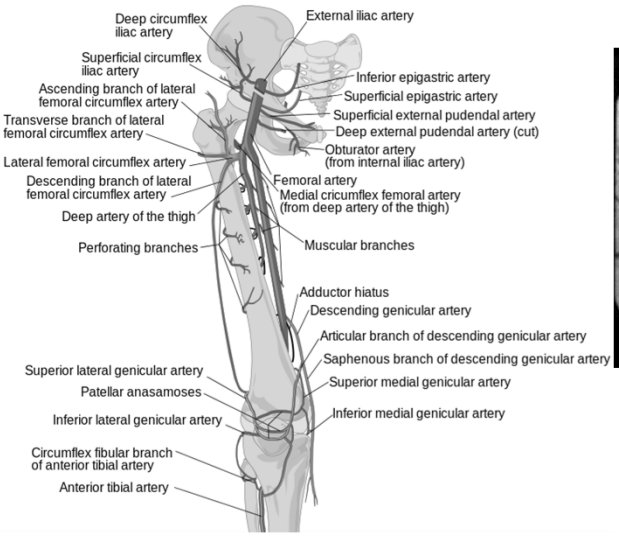
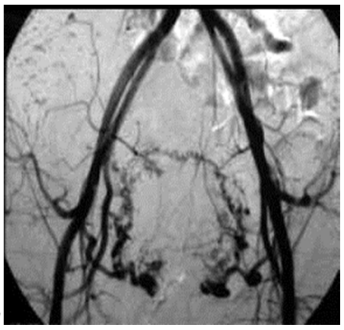
Disclosures

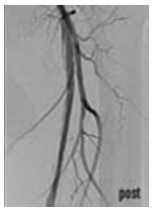
- **None**

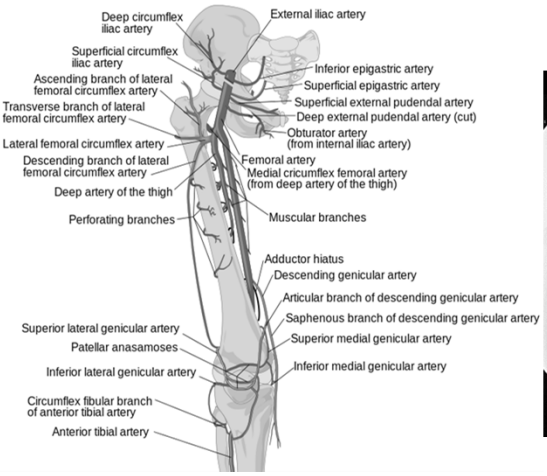
Objectives

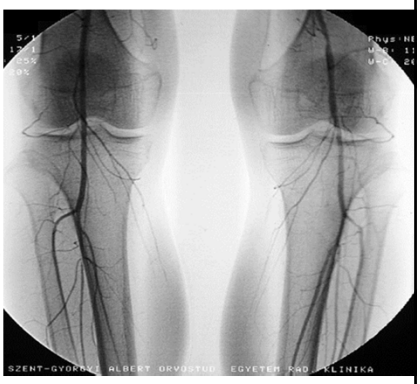
- Anatomy
- Pathophysiology
- Demographics
- Diagnosis
- Treatment







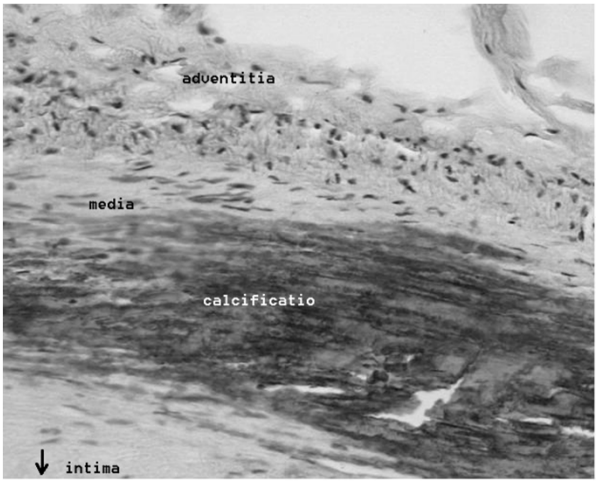




Author: Mcstrother CC BY 3.0

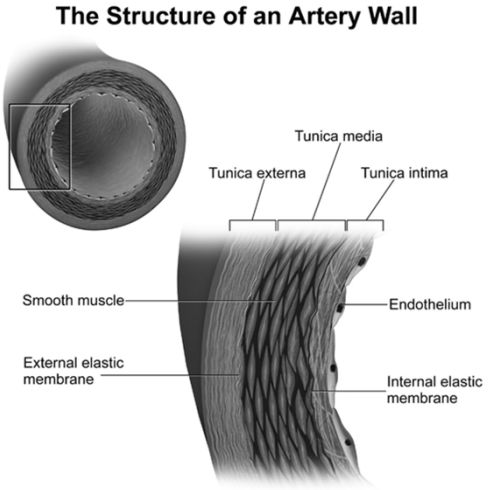
Intima

- **Luminal surface to IEL**
- **Endothelial cells**
- **Few leukocytes, connective tissue fibers, smooth muscle cells**



Media

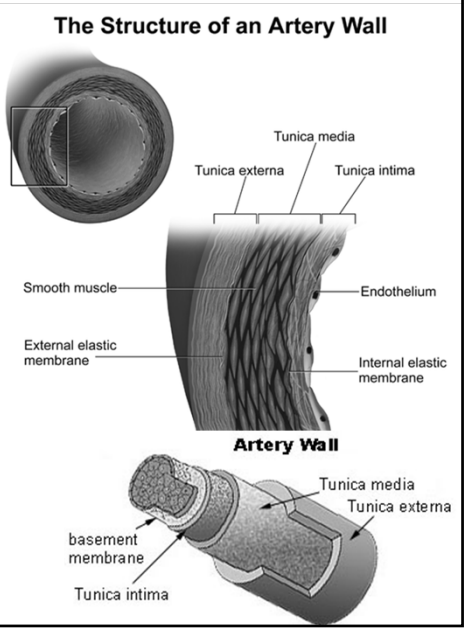
- IEL to EEL and adventitia
- Smooth muscle cells
- Elastin
- Collagen – type III



Blausen.com staff. "Blausen gallery 2014". Wikiversity Journal of Medicine. DOI:10.15347/wjm/2014.010. ISSN 20018762.

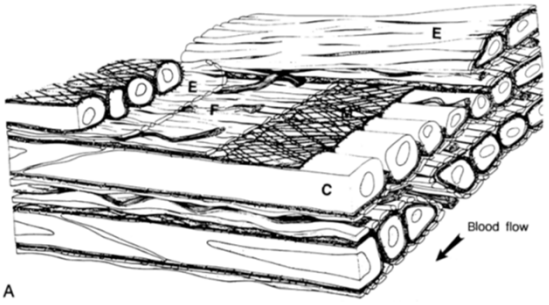
Adventitia

- Fibrocellular connective tissue
- Vasa vasorum
- Some collagen and elastin
- Normally does not contribute to tensile strength
- In atherosclerosis, a diseased media relies on adventitia for tensile strength



Elastic Arteries

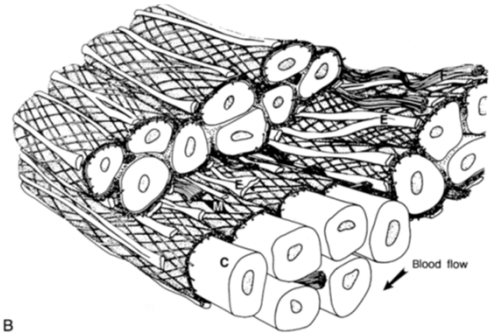
- Prominent elastic fibers in proximal vessels
- High compliance
- Recoil
- Interspersed with type I collagen bundles



A

Muscular Arteries

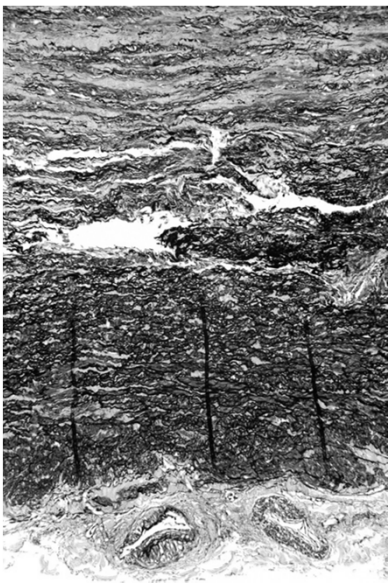
- Smaller distal vessels
- Less collagen and elastin, more smooth muscle cells
- Constrict and dilate more effectively



B

Vasa Vasorum

- Diffusion supports 0.5 mm or 30 musculoelastic bundles
- Vasa vasorum supply the rest



Atherosclerosis

- Most common cause of peripheral arterial disease
- Preferentially involves the internal carotid, infrarenal aorta, and superficial femoral arteries
- Typically occurs at bifurcations

Pathology

- Intimal thickening
- Fatty streaks
- Fibrous plaques
- Plaque complication

Intimal Thickening

- Increased wall tensile stress
- Increased wall thickness
- Occurs at bifurcations and areas of redistribution of wall stress in fetuses
- No lipid accumulation
- Occurs in same places as plaque, but not necessarily a precursor

Fatty Streaks

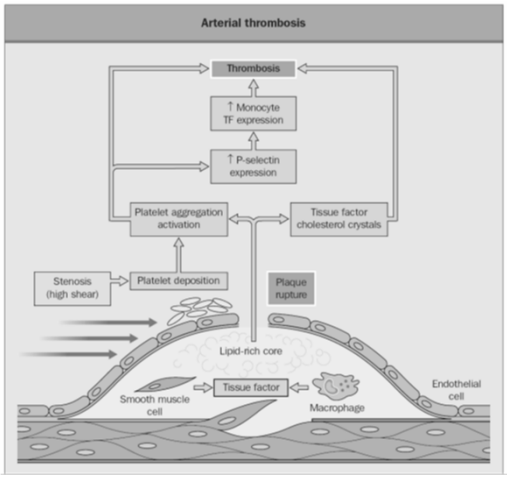
- Intimal accumulation of foam cells
- Affect all ages
- Do not compromise lumen
- Abnormal overlying endothelial cells
- Occurs throughout vascular tree
- Not necessarily a precursor of plaque

Fibrous Plaques

- Earliest definitive atherosclerotic lesion
- Appear by second decade
- Subendothelial smooth muscle
- Fibrous cap of connective tissue
- Intact but fragile endothelium
- Attenuated media

Plaque Complications

- Necrotic core of lipid, macrophages, and smooth muscle cells
- Calcification
- Endothelial disruption
- Ulceration
- Hemorrhage
- Embolism



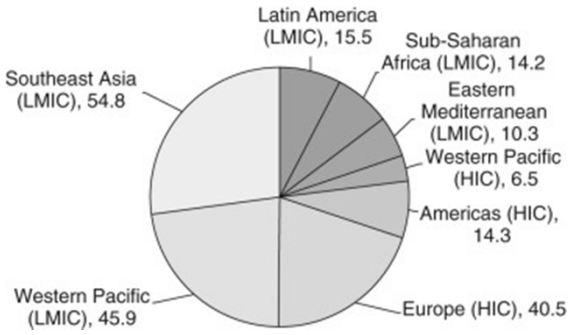
Pathophysiology

- Atherosclerosis may cause symptoms via stenosis or occlusion of axial vessels
- Inadequate tissue perfusion

Risk Factors

- Tobbaco use
- Diabetes
- Hyperlipidemia
- Genetics
- Hypertension

Peripheral Arterial Disease



- 200,000,000 people affected
- 2/3 live in low income countries

Rutherford: Vascular Surgery, 6th ed.

Peripheral Arterial Disease

- 8,500,000 people in the US
- Affects 20% of people over age 80
- Asymptomatic
- Claudication
- Critical limb ischemia
  - Rest pain
  - Ulceration

Rutherford: Vascular Surgery, 9th ed.

Claudication

- Pain in the large muscle groups distal to an arterial lesion after exercise
- Cramping, heaviness, fatigue
- Occurs consistently after a certain distance of walking
- Reliably abates when patient stops
- The patient is asymptomatic at rest because there are adequate collaterals for perfusion without increased metabolic demand

Bloor K. Natural history of arteriosclerosis of the lower extremities.
***Ann R Coll Surg Engl* 1961; 28: 36-51**

- **Affects 5% of the population over 50**
- **75% of claudicants will remain stable**
- **25% will deteriorate**
  - **7 - 9% in first year**
  - **2 - 3% per year after first year**
- **5% will progress to critical limb ischemia**
- **2% will progress to major amputation**

Claudication

- **90% have concomitant CAD**
- **5 year overall amputation 5%**
- **5 year incidence of symptomatic coronary artery disease 23%**
- **5 year incidence of stroke 13%**
- **5 year mortality 20%**
- **10 year mortality 50%**
- **15 year mortality 70%**

Critical Limb Ischemia

- Ischemic rest pain
  - intense pain across distal foot and arch
  - burning, stabbing, constant
  - worsened with elevation
  - dependent rubor
- Ulceration
- Gangrene
  - dry
  - wet

Critical Limb Ischemia

- 500 – 1000 / 1 million new cases annually
- 1 – 3% of PAD population

Outcomes of CLI

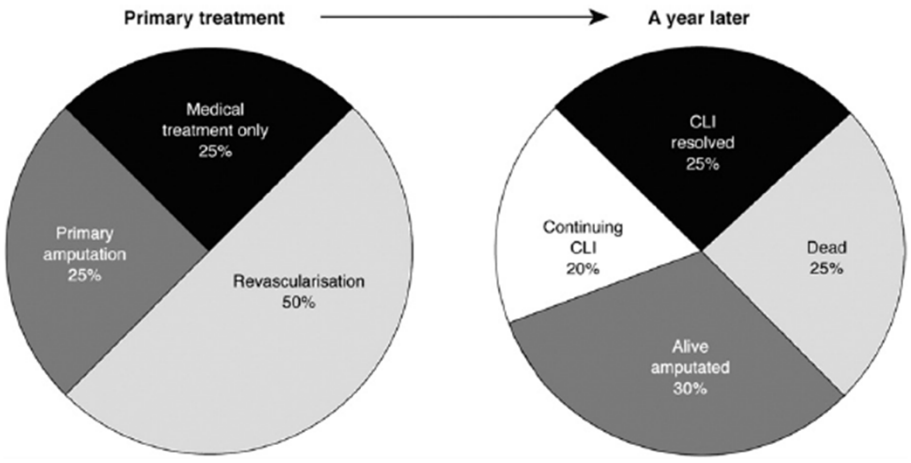
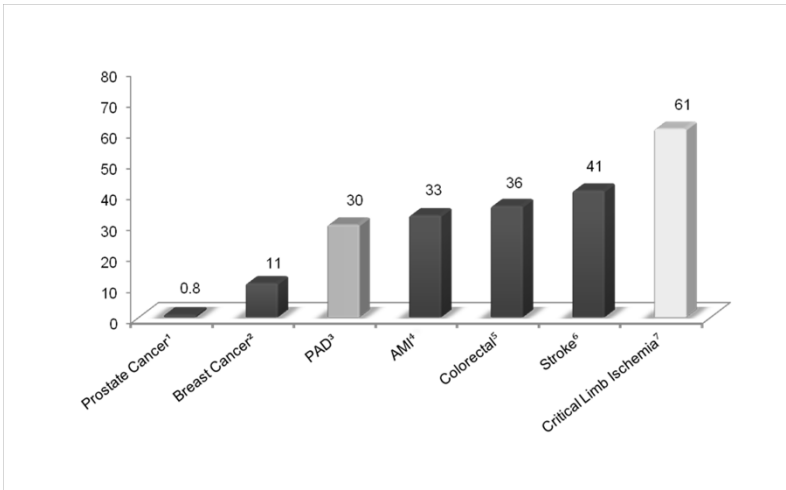


Fig. A5. Fate of the patients presenting with chronic critical leg ischemia. CLI – critical limb ischemia.

Five Year Mortality



Diabetic Foot Problems

- **Diabetic foot ulcers and amputations cost US health care providers over 10 billion dollars per year**

Diabetic Foot Problems

- **24,000,000 diabetic patients in the US**
- **3,500,000 people with DM and PAD in the US**

Diabetes and PAD

References	Country	Years	Population	Diagnostic criterion	Number of patients	Prevalence	Incidence
5	USA, Minnesota	1945–1969	Type 1 and Type 2 diabetes mellitus	Pulse deficit	1073	8.0%	21.3/1000 for men 17.6/1000 for women
6	Hoorn study	1995	Type 1 and Type 2 diabetes mellitus	ABI < 0.9	173	17.3%	NA
8	Australia	1984	Type 1 and Type 2 diabetes mellitus	IC or pulse deficit	1084	38.0%	NA
9	UK	1992	Type 2 diabetes mellitus	ABI < 0.9	864	23.5%	NA
9	UK	1992	Type 1 diabetes mellitus	ABI < 0.9	213	8.7%	NA
7	UK	1999	Type 1 and Type 2 diabetes mellitus	ABI < 0.9	48	33.0%	NA
10	North America	1985	General population	IC, pulse deficit, non-invasive testing	642	3% in age < 60 years 20% in age ≥ 75 years	2/1000 at 30 years of age 6/1000 at 60 years of age 7/1000 at 70 years of age
4	Framingham	1985	General population (26% with diabetes mellitus)	IC	5209	NA	12.6/1000 for men 8.4/1000 for women
11	UK	2002	Type 1 diabetes mellitus	IC, foot ulcer, lower extremity amputation	586	NA	13/1000

ABI, ankle-brachial pressure index; IC, intermittent claudication; NA, not available.

Diabetic Foot Problems

- **Lifetime risk of ulcers or gangrene is 15 - 25%**
- **> 15% of patients with ulcers will end up with an amputation**
- **Every 30 seconds a leg is amputated somewhere in the world as a consequence of diabetes**

Diabetic Foot Problems

- Highest incidence in ethnic minority groups
  - 2 – 4X higher rate of amputation compared to non-minority groups
  - Native Americans, Hispanics, African Americans
- A problem requiring intensive follow up and management is compounded by difficult access to care

Diabetic Foot Problems

- Neuropathy
- Deformity
- Trauma
- Ischemia
- Infection

Neuropathy

- Sensory nerves affected first
- Small diameter pain and temperature fibers are initially damaged
- Predisposes to pressure related trauma and minor skin Injuries

Neuropathy

- Motor neuropathy is late
- Affects both long fibers innervating both intrinsic muscles of the foot and leg muscles

Neuropathy

- Atrophy of intrinsic foot muscles
- Preserved flexor muscle strength results in "clawed position"
- Abnormal pressure points emerge at tips of toes
- Metatarsal heads relax

Neuropathy

- Calluses form which later may ulcerate
- Small muscles of the foot atrophy

Autonomic Neuropathy

- Dry skin
- Loss of sweat and oil gland function
- Dry skin predisposes to fissures
- Calluses and fissures breakdown
- Portals of entry for bacteria

Ischemia

- Neuropathy causes shunting of blood through AV connections in the microcirculation
- Results in decreased tissue perfusion even with normal axial vessels
- Cutaneous oxygen saturation is decreased
- Compounded with neuropathy, ulceration results

Ischemia

- Diabetes causes structural and functional changes in the capillary bed
- Thickened basement membrane
- Impaired migration of leukocytes
- Impaired vasodilation response to injury
- Blunted inflammatory response to injury

Infection

- Because of this blunted inflammatory response, diabetic patients lack a crucial component of the body's first line defense against pathogens and thus are more susceptible to foot infection

Peripheral Arterial Disease Differential

- Neurogenic claudication
  - spinal stenosis or nerve root compression
  - history of back pain
  - burning or shooting pain radiating down posterior leg
  - numbness or paresthesias
- Neuropathy
- Arthritis
- Neuropathic ulceration

History

- Coronary artery disease
  - MI
  - CHF
  - arrhythmia
  - recent cardiac evaluation
- DM
- Smoking
- Hypertension
- Hypercholesterolemia
- Family history of atherosclerotic disease
- Cerebrovascular disease
  - stroke
  - TIA
  - amaurosis

Physical Exam

- Complete heart and lung exam
- Neurologic exam
  - carotid bruits
  - superficial temporal pulses
  - cranial nerves
  - motor
  - sensory

Vascular Exam

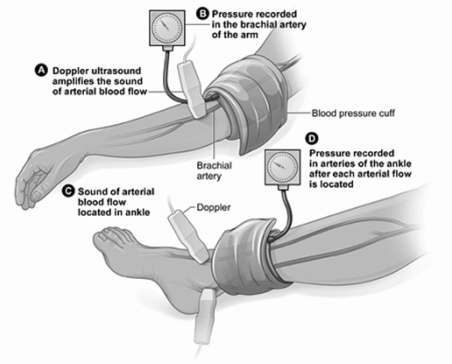
- Complete bilateral pulse exam
  - Doppler
    - monophasic
    - multiphasic
  - 0, 1+, 2+, 3+, widened pulses
  - Bruits and thrills

Vascular Exam

- Dependent rubor
- Shiny skin
- Loss of hair
- Diminished nail growth
- Ulceration and gangrene

Vascular Lab Testing

- ABI
- Can be affected by vascular calcification or edema



ABI

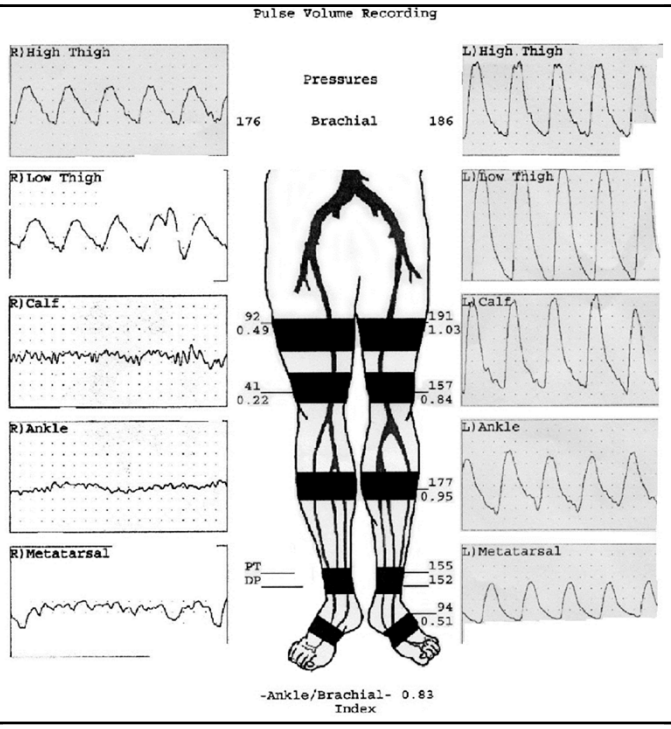
- Claudication 0.6
- Rest pain 0.3
- Tissue loss 0.2

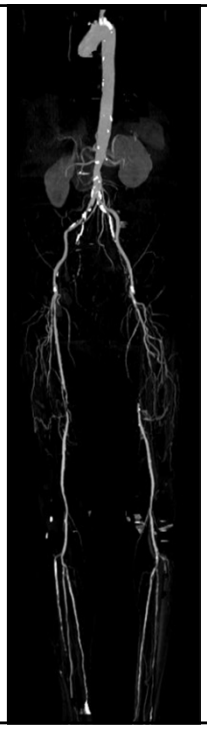
Exercise Testing

- Treadmill or calf raises decrease peripheral resistance
- Flow increases based on Ohm's law
- If there is a proximal stenosis, flow increase is limited and pressure will drop

Vascular Lab Testing

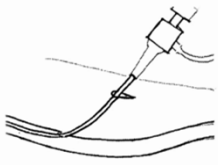
- Pulse volume recordings
  - normal
  - blunted
- Doppler waveforms
  - multiphasic
  - monophasic
- Digital pressures
- Not limited by vessel calcification
- Complements pressure testing

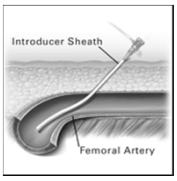




Angiography

- Diagnostic
- Therapeutic
- Complications
  - nephrotoxicity
  - contrast allergy
  - arterial injury
  - embolization
  - hematoma
  - pseudoaneurysm

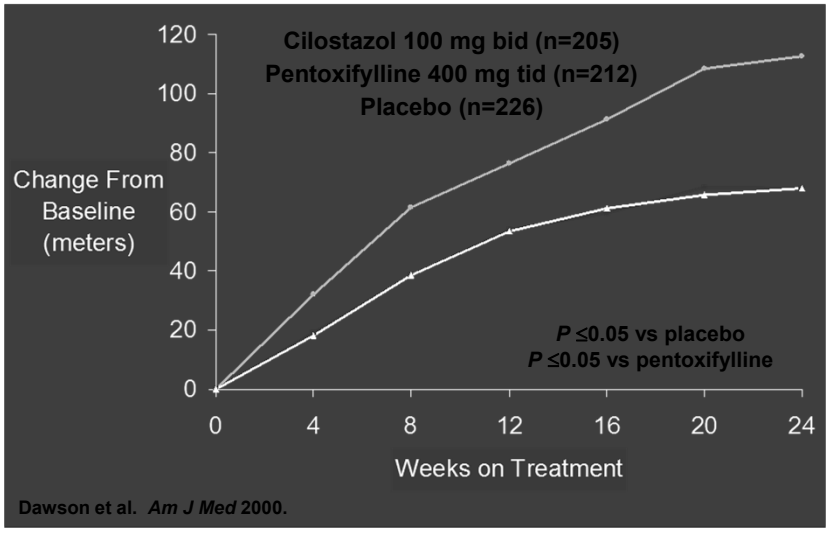




Treatment of Claudication

- Risk factor modification
  - smoking cessation
  - hypertension
  - hyperlipidemia
  - diabetes
- Supervised exercise program
  - 30 minutes of cardiovascular exercise daily
  - 5 days per week

Cilostazol



Cilostazol

- 2 to 4 weeks prior to response
- 12 weeks of treatment are recommended to assess effectiveness
- Improvement was noted throughout the trial period (up to 24 weeks) and did not plateau by study's end
- Treatment must be continued to maintain increases in walking distance

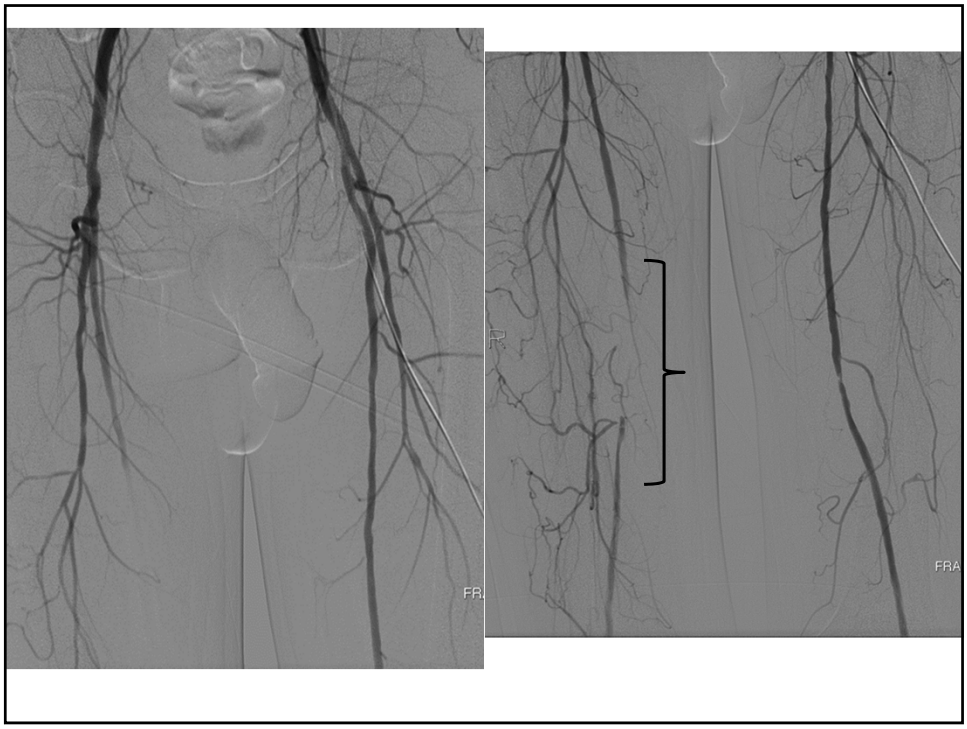
Procedural Intervention for Claudication

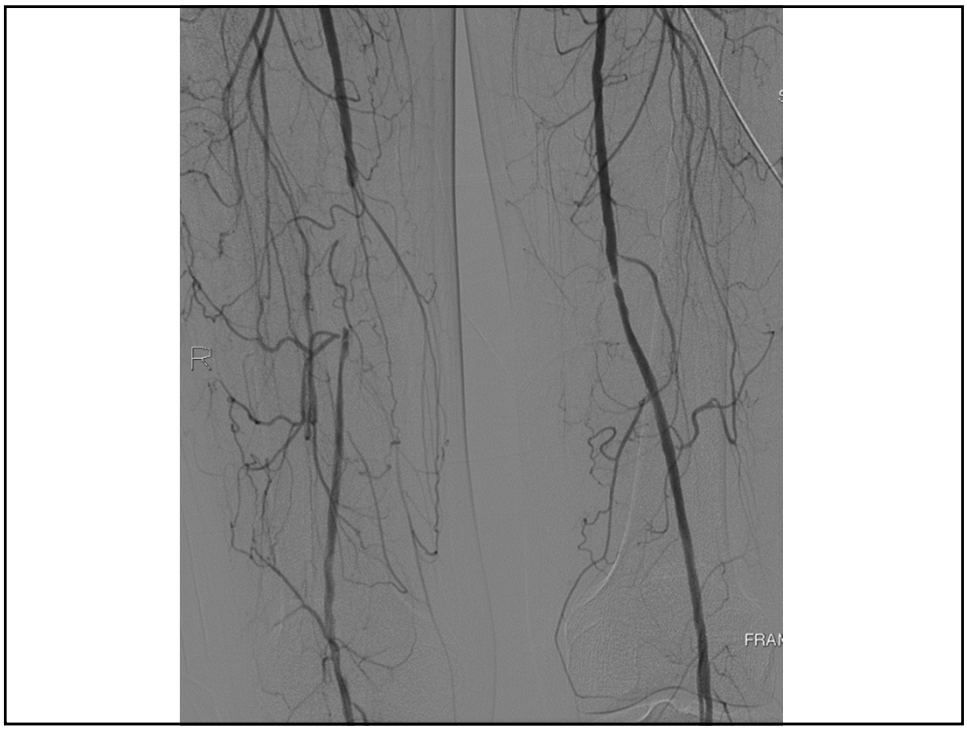
- Procedural intervention for claudication is reserved for patients with lifestyle-limiting claudication and failure of medical therapy
- Often, this is related to single level, proximal disease
  - aortoiliac
  - femoral
  - ABI 0.6

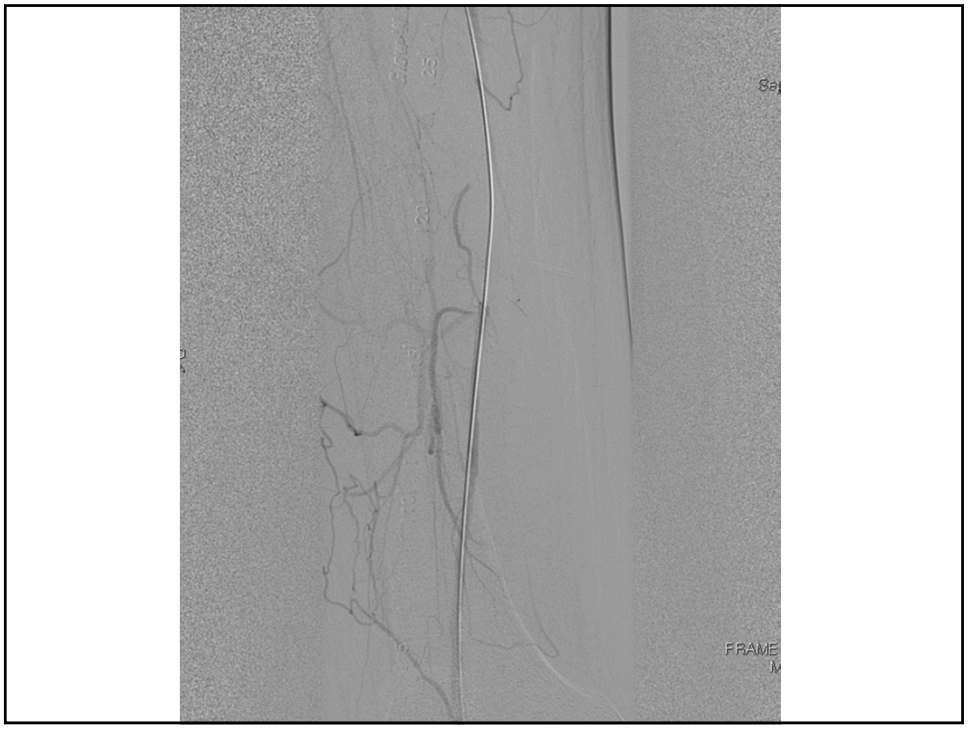
Treatment of Rest Pain or Tissue Loss

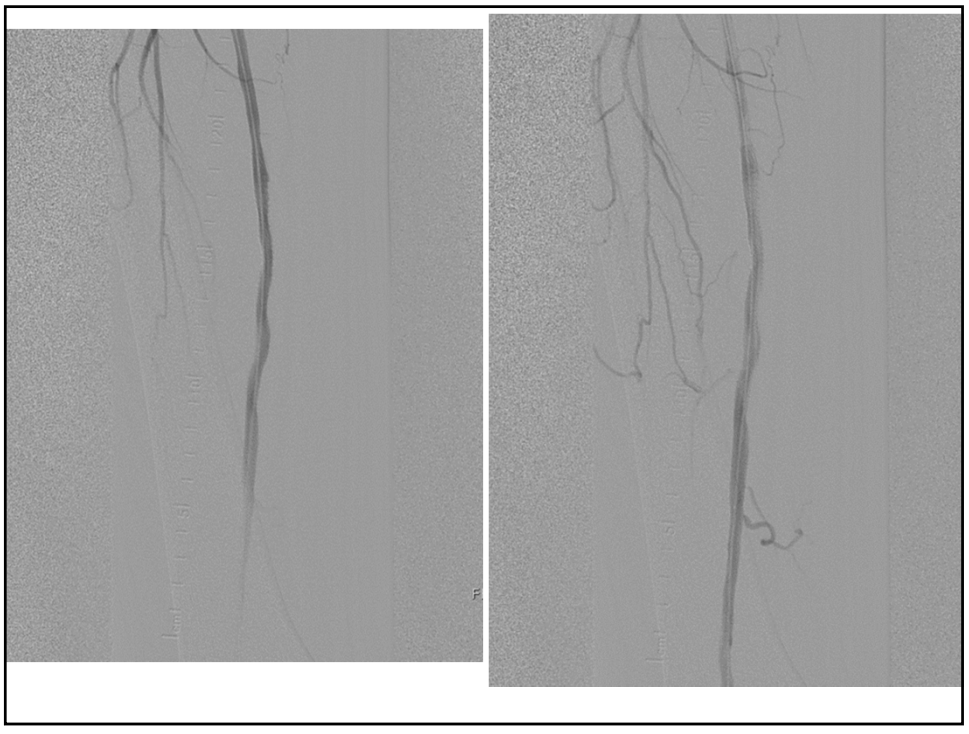
- Risk factor modification
- Restoration of in-line vascular flow
- Management of the wound
- Often, this is related to multi level or distal disease
  - popliteal
  - tibial
  - ABI 0.3

Endovascular Intervention









Angioplasty

- 1 year primary patency 50-60% (in optimal lesions)

Bare Metal Stenting

- 1 year primary patency 73-81% (in optimal lesions)

Laird JR et al. Circ Cardiovasc Interv. 2010. 3: 267-76.
Matsumura JS et al. J Vasc Surg. 2013. 58: 73-83.
Dake MD et al. Circ Cardiovasc Interv. 2011. 4: 495-504.

The Common Modality Of Failure:

Intimal Hyperplasia

Drug Elution Therapy

- **Inhibition of SMC proliferation and migration**
- **Decreased restenosis**

Durable Clinical Effectiveness With Paclitaxel-Eluting Stents in the Femoropopliteal Artery

5-Year Results of the Zilver PTX Randomized Trial

Michael D. Dake, MD; Gary M. Ansel, MD; Michael R. Jaff, DO; Takao Ohki, MD; Richard R. Saxon, MD; H. Bob Smouse, MD; Lindsay S. Machan, MD; Scott A. Snyder, PhD; Erin E. O'Leary, PhD; Anthony O. Ragheb, PhD; Thomas Zeller, MD; on behalf of the Zilver PTX Investigators

IN.PACT SFA Trial Summary

IN.PACT SFA Randomized Controlled Trial[1]		
Objective	Determine safety and efficacy of IN.PACT Admiral in treating femoropopliteal disease	
Number of subjects / sites	331 subjects randomized 2:1 57 sites world-wide	
Key inclusion criteria	Clinical: Angiographic:	Rutherford 2-4 SFA and proximal popliteal artery Lesion length 4-18cm Occlusions ≤ 10cm Vessel diameter 4-7mm
Primary endpoints	Safety: Efficacy:	Composite 30-day device- and procedure-related death and 12-mo treatment limb amputation, and clinically-driven reintervention Primary patency (defined as PSVR ≤ 2.4 and freedom from TLR) at 12mo

Tepe G et al. Circ. 2015. 131: 495-502.

IN.PACT SFA 1-year Results (@360d)				
	IN.PACT Admiral	Standard PTA	P-value	Delta
Primary patency	82.2%	52.4%	<0.001	26.2%
Freedom from TLR	97.5%	79.3%	<0.001	18.2%

IN.PACT SFA 2-year Results (@720d)[1]				
	IN.PACT Admiral	Standard PTA	P-value	Delta
Composite safety	87.4%	69.8%	<0.001	17.6%
Primary patency	78.9%	50.1%	<0.001	28.8%
Freedom from TLR	91.0%	72.2%	<0.001	18.8%

Risk of Death Following Application of Paclitaxel-Coated Balloons and Stents in the Femoropopliteal Artery of the Leg: A Systematic Review and Meta-Analysis of Randomized Controlled Trials

Konstantinos Katsanos, MD, PhD, MSc, EBIR; Stavros Spiliopoulos, MD, PhD; Panagiotis Kitrou, MD, PhD; Miltiadis Krokidis, MD, PhD; Dimitrios Karnabatidis, MD, PhD

Background—Several randomized controlled trials (RCTs) have already shown that paclitaxel-coated balloons and stents significantly reduce the rates of vessel restenosis and target lesion revascularization after lower extremity interventions.

Methods and Results—A systematic review and meta-analysis of RCTs investigating paclitaxel-coated devices in the femoral and/or popliteal arteries was performed. The primary safety measure was all-cause patient death. Risk ratios and risk differences were pooled with a random effects model. In all, 28 RCTs with 4663 patients (89% intermittent claudication) were analyzed. All-cause patient death at 1 year (28 RCTs with 4432 cases) was similar between paclitaxel-coated devices and control arms (2.3% versus 2.3% crude risk of death; risk ratio, 1.08; 95% CI, 0.72–1.61). All-cause death at 2 years (12 RCTs with 2316 cases) was significantly increased in the case of paclitaxel versus control (7.2% versus 3.8% crude risk of death; risk ratio, 1.68; 95% CI, 1.15–2.47; —number-needed-to-harm, 29 patients [95% CI, 19–59]). All-cause death up to 5 years (3 RCTs with 863 cases) increased further in the case of paclitaxel (14.7% versus 8.1% crude risk of death; risk ratio, 1.93; 95% CI, 1.27–2.93; —number-needed-to-harm, 14 patients [95% CI, 9–32]). Meta-regression showed a significant relationship between exposure to paclitaxel (dose-time product) and absolute risk of death (0.4±0.1% excess risk of death per paclitaxel mg-year; $P<0.001$). Trial sequential analysis excluded false-positive findings with 99% certainty (2-sided α, 1.0%).

Conclusions—There is increased risk of death following application of paclitaxel-coated balloons and stents in the femoropopliteal artery of the lower limbs. Further investigations are urgently warranted.

Clinical Trial Registration—URL: www.crd.york.ac.uk/PROSPERO. Unique identifier: CRD42018099447. **(*J Am Heart Assoc*. 2018;7:e011245. DOI: 10.1161/JAHA.118.011245.)**

Percutaneous Treatment Results Are Better…

- Proximal vessels (aorta > iliacs > SFA > tibials)
- Short lesions
- Focal lesions
- Stenoses > occlusions

Percutaneous Treatments Are Worse…

- Distal or smaller vessels
- Long lesions
- Diffuse lesions
- Occlusions
- At joints or bifurcations
  - common femoral
  - profunda
  - popliteal

Percutaneous Treatments

- Local anesthesia
- Fewer cardiopulmonary complications
- Outpatient procedure
- Radiation
- Nephrotoxicity
- Arterial injury
- Embolization
- Pseudoaneurysm
- Rarely as durable as bypass or open repair

Surgery

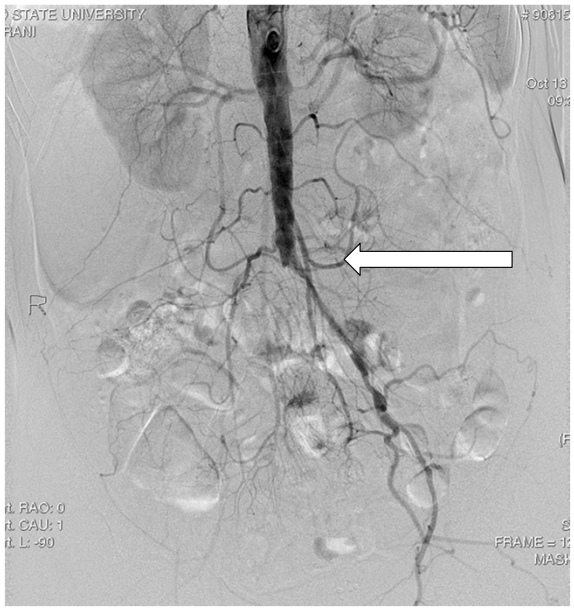
- Procedural intervention for claudication is reserved for patients with lifestyle-limiting claudication and failure of medical therapy
- Rest pain
- Tissue loss

Contraindications to Surgery

- Prohibitive medical comorbidities
  - coronary
  - pulmonary
- Unreconstructible vessels
- Nonambulatory status (consider primary amputation)
- Extensive tissue loss (consider primary amputation)

Level of Disease Determines Options

- Aortoiliac
  - aortoiliac endarterectomy
  - aortofemoral bypass
  - axillary femoral bypass
- Femoropopliteal
  - femoral endarterectomy
  - femoropopliteal bypass
- Tibial
  - femorotibial bypass
  - popliteal tibial or pedal bypass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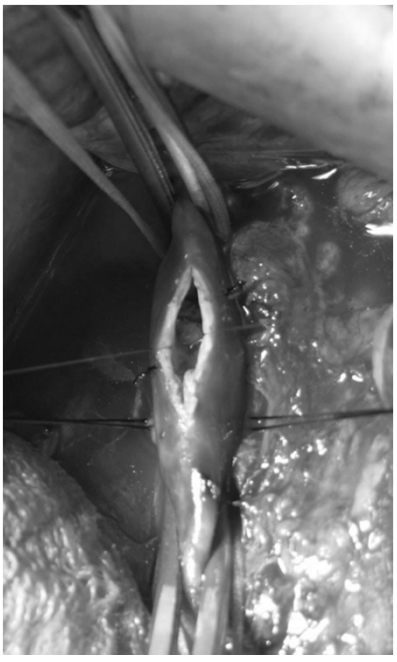

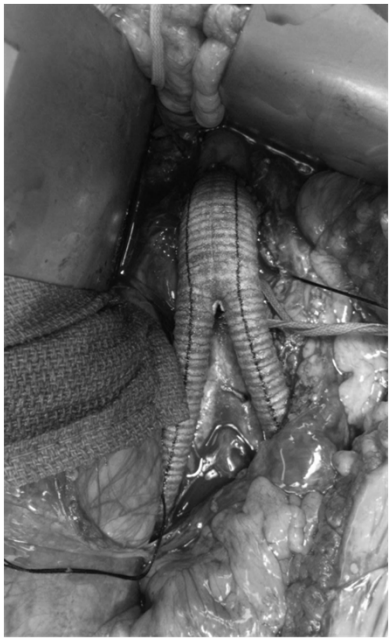

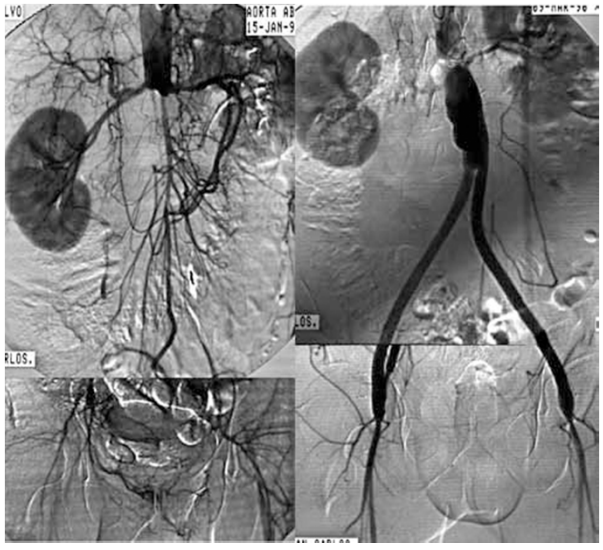
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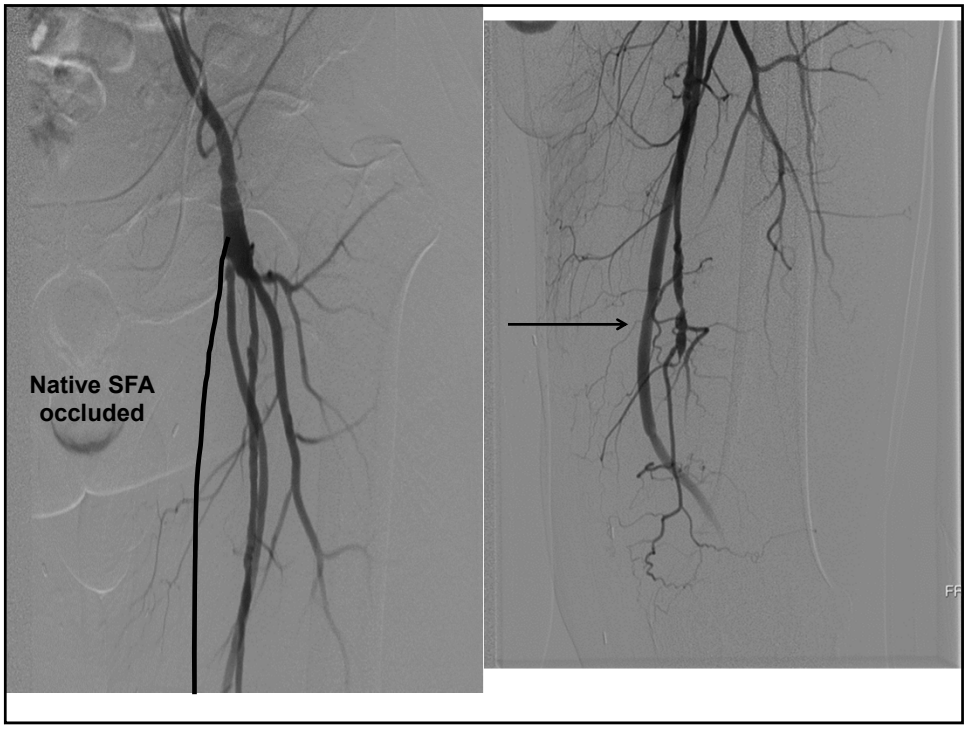
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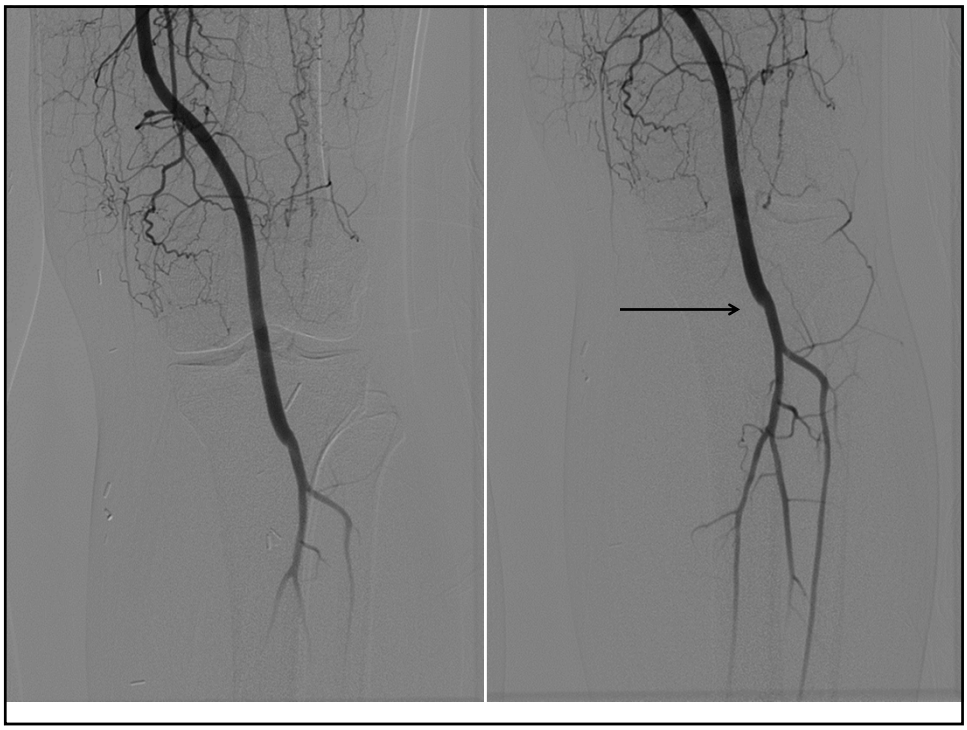
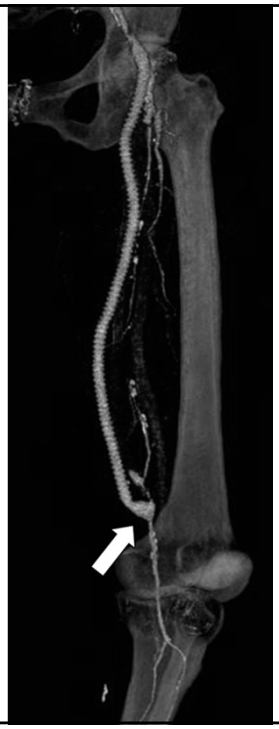




Bypass Conduit

- Greater saphenous vein
- Other autogenous vein
  - lesser saphenous
  - cephalic
  - basilic
- Prosthetic (polyester or Polytetrafluoroethylene)

Amputation

- Nonambulatory patients with CLI
- Patients with extensive tissue loss
- Unreconstructible patients
  - foot sepsis
  - intractable pain

Amputation

- The more distal the amputation, the better the functional outcome
- The more proximal the amputation, the better the likelihood of healing
- Feel for a pulse one level above the proposed amputation
- The skin should be warm and pink at the level of the proposed amputation
- A pressure of 50 mmHg at the level of the proposed amputation predicts healing

Peripheral Arterial Disease and Limb Preservation

Said Atway, DPM, FACFAS
Assistant Professor - Clinical
Department of Orthopaedics
The Ohio State University Wexner Medical Center

Health-Related Quality of Life of Patients With Diabetes and Foot Ulcers

Andrew R. Evans, B.S.; Michael S. Pinzur, M.D.
Maywood, IL

ABSTRACT

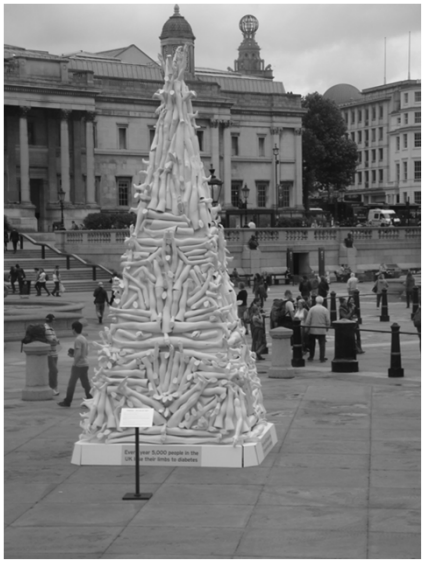
Thirty-four patients with diabetes who attended a university diabetic foot clinic for treatment of a foot ulcer completed the American Academy of Orthopaedic Surgeons Musculoskeletal Outcomes Measure. The purpose of the study was to measure the impact of foot ulcers in patients with diabetes on the physical, mental, emotional, and social aspects of patients' lives. Thirty had at least a high school education. Only six were employed at the time. Nineteen were retired or disabled due to poor health. Sixteen were obese, 10 were considered overweight, and eight had a BMI within the acceptable range. Subjects had an average of four to five bodily systems

individuals will develop a foot ulcer during the course of their lifetime, with foot ulcer progressing to over 50,000 lower extremity amputations yearly in the United States.[1,9–12] Approximately 7% of individuals with diabetes and peripheral neuropathy will develop their first ulcer each year. Foot ulcers in patients with diabetes produce substantial patient morbidity and consume a great deal of health system resources.[4,6,14] In the Medicare population alone, the aggregate spending for treatment of lower extremity foot ulcers in patients with diabetes was $1.5 billion in 1995, 74% of which was for inpatient therapy.[4,9,10]


AT&T LTE
10:54 AM
73%
Done

Foot Infection

- Any infra-malleolar infection in a person with diabetes
- Common and costly problem
  - DM related amputation cost 3B per year
    - *Diabetes Care 2003*
- Most common reason for a diabetic to be admitted
  - *National Hospital Discharge Data*
- Most common non-traumatic cause of amputation
  - 60% of LEA
  - Most common cause of nontraumatic lower extremity amputation
    - *Lancet 2005*



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- Most common non-traumatic cause of amputation

Approximately 80% of diabetes-related lower extremity amputations are preceded by a foot ulcer. The patient de-

- *Lancet 2005*

Importance of Diabetic Wound care

- **Diabetic foot ulcers present >4 weeks have a 5 fold higher risk of infection**
- **Infection in a foot ulcer increases the risk for hospitalization 55.7 times and risk for amputation 155 times**
- **5 year mortality after limb amputation is 68%**
  - ***NIH publication 1995***

Importance of Diabetic Wound care

- **Diabetic foot ulcers present >4 weeks have a 5 fold higher risk of infection**

- ***Evidence.*** Percentage reduction in wound size is an early predictor of treatment outcome.[35,96-99] Wound area reduction of 10% to 15% per week or ≥50% area reduction in 4 weeks results in increased likelihood of healing with decreased complications of infection and amputation.
- **5 year mortality after limb amputation is 68%**
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Consensus Development Conference on Diabetic Foot Wound Care

7–8 April 1999, Boston, Massachusetts

AMERICAN DIABETES ASSOCIATION

Among people with diabetes, 15% will experience a foot ulcer in their lifetime; foot ulcers are a major predictor of future lower-extremity amputation in patients with diabetes. Indeed, about

the U.S. are moving the health care system toward becoming more cost-effective; this highlights the priority for identifying the most cost-effective methods for treating and preventing foot wounds.

QUESTION 1: What is the value of treating a diabetic foot wound?

The term "diabetic foot wound" refers to a variety of pathological conditions. Ulcers, the most frequent and characteristic type of lesions, are defined as any break in the cutaneous barrier, but they usually extend through the full thickness of the dermis(3). Certain infections of the foot, e.g., cellulitis

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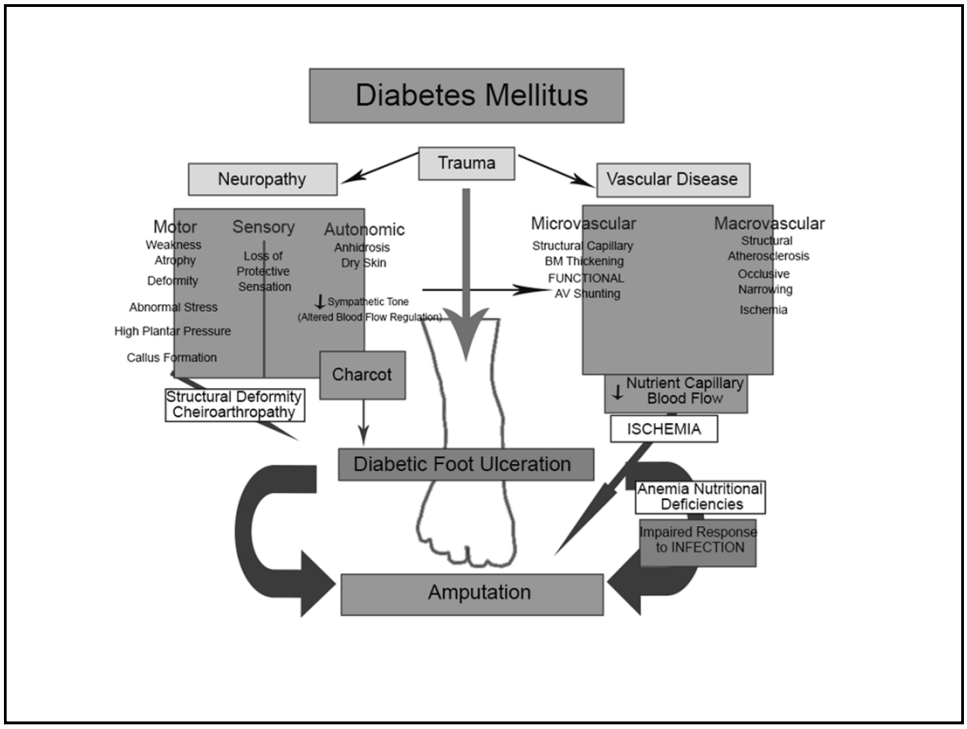
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Trauma
Neuropathy
Vascular Disease
Motor
Weakness
Atrophy
Deformity
Abnormal Stress
High Plantar Pressure
Callus Formation
Sensory
Loss of Protective Sensation
Autonomic
Anhidrosis
Dry Skin
Sympathetic Tone
(Altered Blood Flow Regulation)
Microvascular
Structural Capillary
BM Thickening
FUNCTIONAL
AV Shunting
Macrovascular
Structural
Atherosclerosis
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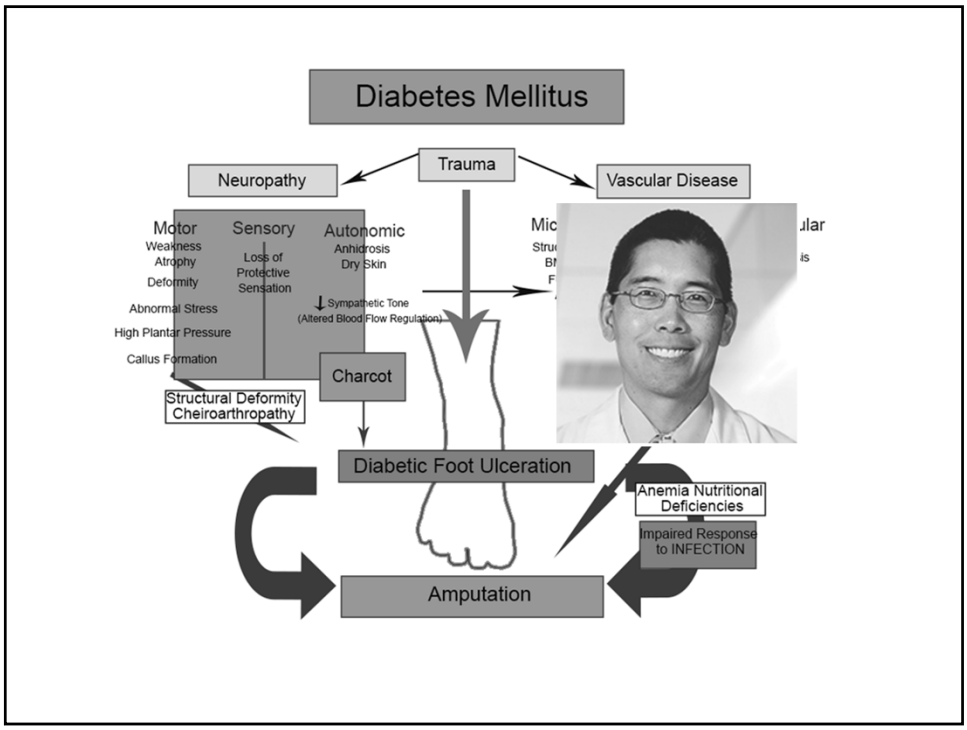
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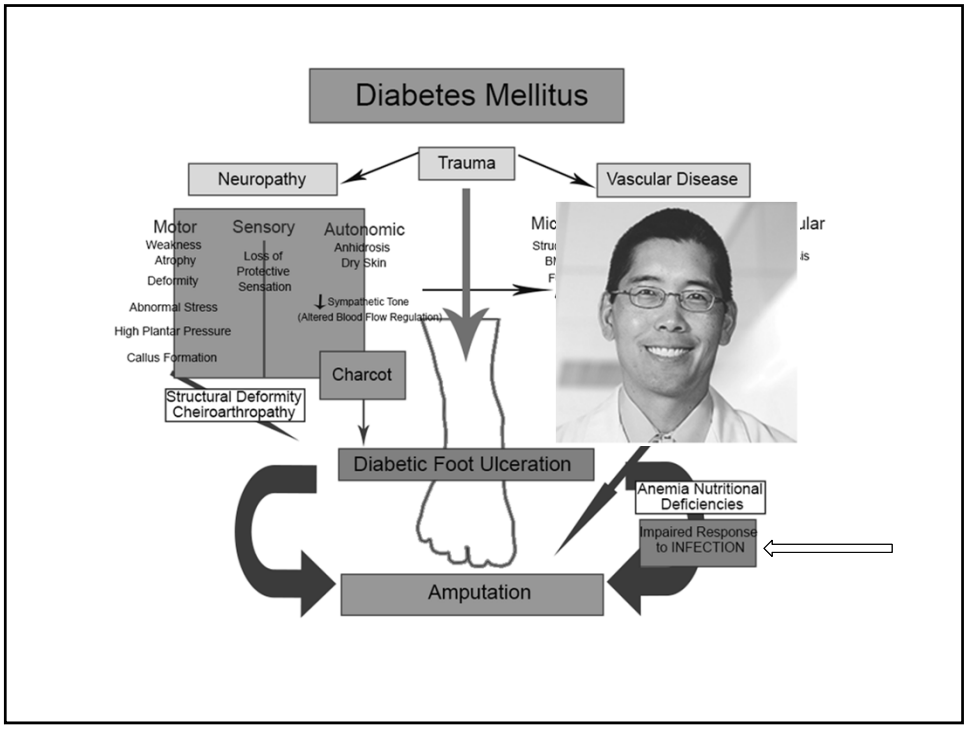
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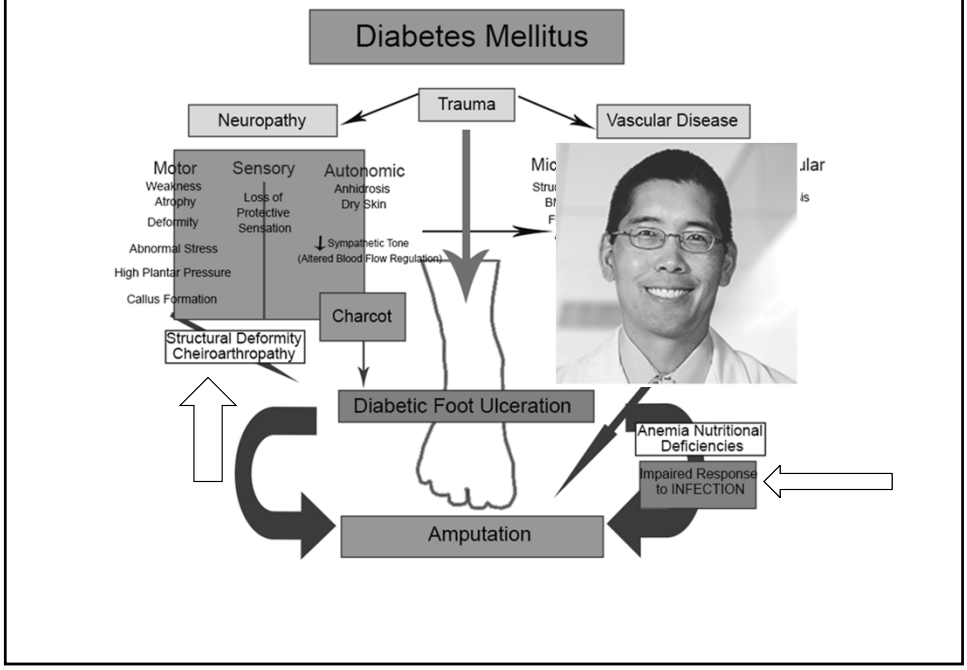
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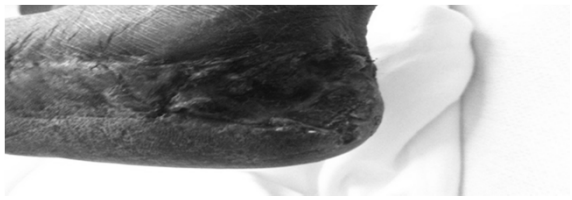
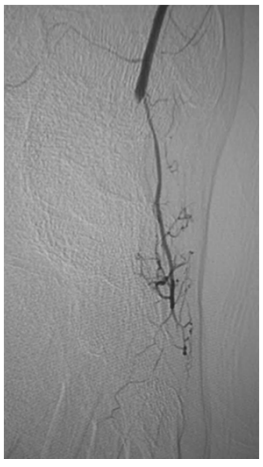


Angiosome directed vascularization



Clinical Practice Guidelines

- **Management of etiologic factors**
  - **Adequate perfusion**
    - **PAD (Twice as common in DM)**

    Gregg et al 2004

    Rarely lead to ulcer directly
    Contributes to 50% of ulcers
    Diabetes Metab 2008

  - **Debridement**
    - **Sharp debridement of infection**
    - **Urgent for gas/necrotizing infection**

  - **Infection Control**
    - **IDSA guidelines**

  - **Pressure Mitigation**
    - **Offloading**
      - **Surgical**
      - **Nonsurgical**
    - **Total contact cast**

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Debridement. Sharp debridement of devitalized tissue from the wound area at frequent intervals has been shown to heal neuropathic wounds more rapidly. Most noninfected neuropathic wounds can be debrided on an outpatient basis by a trained health care provider using a scalpel and forceps. The extent of debridement for non–limb-threatening wounds is controversial, with recommendations and protocols varying widely. There are little data to

WOUND REPAIR AND REGENERATION
THE INTERNATIONAL JOURNAL OF TISSUE REPAIR AND REGENERATION

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First published: 14 September 2010 | https://doi.org/10.1111/j.1524-475X.2010.00619.x | Cited by: 40

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Robert S. Kirsner, MD, PhD, Wound Healing and Regenerative Medicine Research Program, Department of Dermatology and Cutaneous Surgery, University of Miami Miller School of Medicine, 1600 NW 10th Ave. RMSB 2023A, Miami, FL 33136, USA. Tel: +1 305 243 4472; Fax: +1 305 243 6191;
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Debridement?

Indications:
Decreased pulses in feet (785.9). Numbness. Left foot wound. H\O LLE angioplasty.

Clinical Examination:
BP: Right 180/Left 182/

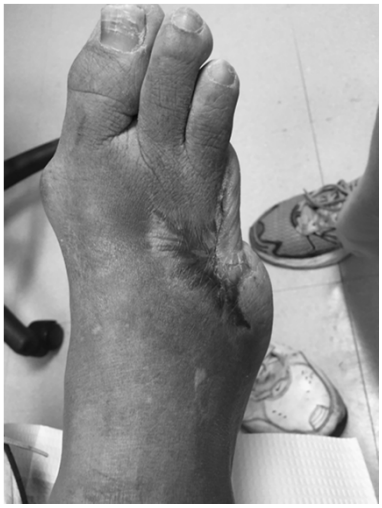
Segment	*Right*				
	Pressure	ABI	Waveform	Calc	PPG
Ankle (PT)	161	0.88	Triphasic		
Ankle (DP)	140	0.77	Biphasic		
1st Digit	77	0.42			Mildly Diminished

Segment	*Left*				
	Pressure	ABI	Waveform	Calc	PPG
Ankle (PT)	129	0.71	Biphasic		
Ankle (DP)	92	0.51	Biphasic		
1st Digit	21	0.12			Moderately Diminished

Pressure: Pressure; ABI: BPI; Waveform: Waveform; Calc: Calcinosis; PPG: PVR Waveform

Impression:
Right Lower Limb
Disease Severity: Mild decrease in arterial perfusion to the lower extremity
The great toe pressure is mildly decreased

Left Lower Limb
Disease Severity: Moderate decrease in arterial perfusion to the lower extremity
The great toe pressure is severely decreased



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2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis and Treatment of Diabetic Foot Infections[a]

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[1]Department of Medicine, University of Washington, Veterans Affairs Puget Sound Health Care System, Seattle; [2]Bone Infection Unit, Nuffield Orthopaedic Centre, Oxford University Hospitals NHS Trust, Oxford; [3]Department of Medicine, University of Washington, Veteran Affairs Puget Sound Health Care System, Seattle; [4]Divisions of Hospital Medicine and Infectious Diseases, MetroHealth Medical Center, Cleveland, Ohio; [5]Department of Internal Medicine, VU University Medical Center, Amsterdam, The Netherlands; [6]Southern Arizona Limb Salvage Alliance, Department of Surgery, University of Arizona, Tucson; [7]Northern Michigan Infectious Diseases, Petoskey; [8]Department of Medicine, University of Manitoba, Winnipeg, Canada; [9]Division of Podiatric Surgery, Department of Surgery, Roxborough Memorial Hospital, Philadelphia, Pennsylvania; [10]Department of Medicine, Division of Infectious Diseases, Beth Israel Deaconess Medical Center, Harvard Medical School, Boston, Massachusetts; [11]Department of Orthopaedic Surgery and Rehabilitation, Loyola University Medical Center, Maywood, Illinois; and [12]Department of Infectious Diseases, Dron Hospital, Tourcoing, France

2012 Infectious Diseases Society of America Clinical Practice Guideline for the Diagnosis

Antibiotic therapy is necessary for virtually all infected wounds, but it is often insufficient without appropriate wound care.

Recommendation 1. In patients with a DFI with an open wound, we suggest doing a probe to bone (PTB) test to aid in diagnosis (Grade 2C).

- **Hindfoot osteomyelitis – a challenge met by all those treating the foot and ankle**
- **Osteomyelitis secondary to diabetic foot ulceration is an unfortunate complication that may require**
  - **Long term intravenous antibiotics**
  - **Operative debridement**
  - **Amputation, and commonly a combination of these.**
- **Debridement/complete excision of infected bone**
  - **Soft tissue coverage**
  - **Compliance of patients**

Antoniou D, Conner AN. Osteomyelitis of the calcaneus and talus. J Bone Joint Surg Am 1974;56:338–45.

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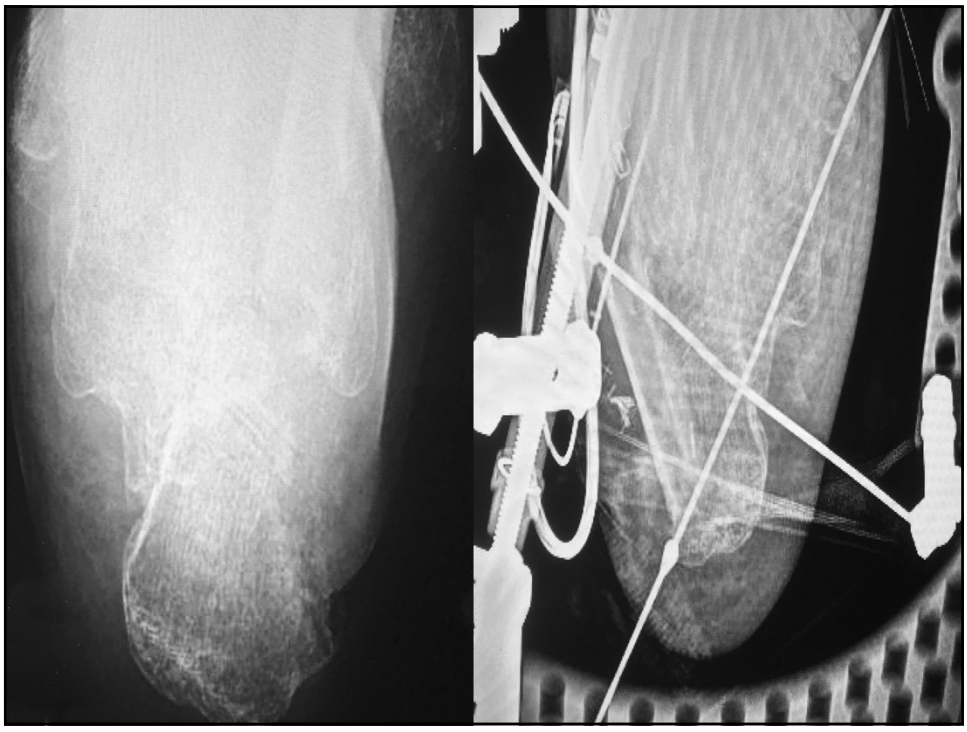

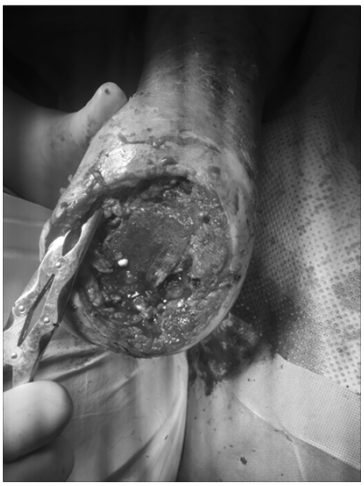

Deformity

- **Pathophysiologic mechanism complex**
  - **Neuropathy**
  - **Repetitive trauma**
  - **Focal tissue ischemia**
  - **Tissue Destruction**
- **Foot deformities**
  - **Charcot**
    - **Neuroarthropathy**
- **Limited joint mobility**
  Glycosylation of soft tissue

Charcot Neuroarthropathy/Abnormal pressure

- **"The Majority of foot ulcers appear to result from minor trauma in the presence of sensory neuropathy" McNeely**
- **Critical Triad: (65% of diabetic foot ulcers)**
  - **Neuropathy**
  - **Deformity**
  - **Trauma**

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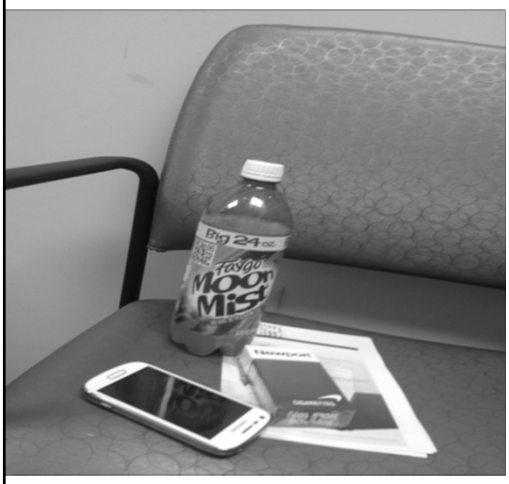

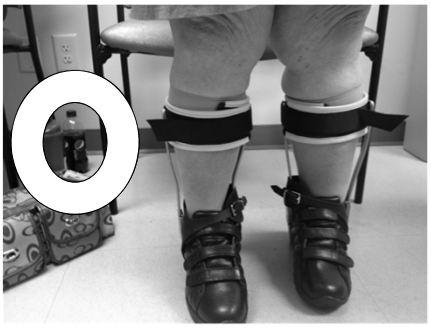

Foot Care

- **Prevention**
  - **Ulcer Prevention**
  - **Diabetic foot exams**
- **Offloading**
  - **Surgical offloading**
  - **Prosthetic offloading**
- **Ulcer Care**
  - **Debridement**
  - **Infection prevention**
  - **Optimize wound healing**

Venous

- Majority of Leg ulcers
- Innactivates normal antibacterial property
- Inhibits mitogenic activity
- Etiology uncertain
  - Fibrin cuff
    - Fibrin leaks creating cuff
  - WBC
    - Increased inflammatory mediators
    - Mast cell stimulation

Venous

Thank You