

# Protecting Your Limbs When You Have Diabetes..... a Team Approach

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# Disclosure

**I have no conflict of interest**

# Diabetic Foot Care

- Prevention as a first step to good health
  - Diabetics are at risk for foot complications
- Diabetes can have an impact on the nerves and blood vessels in the feet, which can lead to numbness or make it hard to heal injuries and resist infections.
- Foot problems most often happen when there is nerve damage (diabetic neuropathy)
  - tingling pain or a weakness in the foot
  - loss of feeling in the foot

# More about diabetic foot risk...

- Nerve damage and poor blood flow can also lead to changes in the shape of your feet and toes
- People with diabetes may have peripheral arterial disease (PAD)
  - condition can reduce the blood flow to the feet
- Prone to ulcers and infections

# Taking care of your feet in diabetes



**1** Wash your feet daily with lukewarm water and soap.



**2** Dry your feet well especially between the toes.



**3** Apply moisturising lotion, but do not apply between the toes.



**4** Check your feet for blisters, cuts, redness, etc. If present, consult your doctor.



**5** Trim your nails straight across and file the edge with a nail file.



**6** Change socks daily; avoid dirty and tight socks.



**7** Never walk barefoot either indoors or outdoors.



**8** Examine your shoes daily for cracks, stones, nails which may irritate feet.

- Get them checked regularly by a foot and ankle doctor
- Choose correct shoes
- Stop smoking

# 12 *diabetic* FOOT CARE TIPS

- 1 Check your feet daily for injuries.
- 2 Wash your feet carefully, each day.
- 3 Moissurize feet, ankles, & legs daily — do not use between toes.
- 4 Cut your toenails straight across to prevent ingrown toenails.
- 5 Keep your feet warm and dry.
- 6 When cold, wear loose-fitting socks to bed.
- 7 Wear comfortable closed-toe shoes.
- 8 Never walk barefoot, even indoors.
- 9 Do not smoke.
- 10 Ask your podiatrist about orthotics and insole options.
- 11 Ingrown toenails, corns or calluses? Seek advice from podiatrist.
- 12 Discuss your condition with your primary care physician.





# Reasons to be Concerned

- Sores or wounds on your feet
- Calluses, corns, or bunions
- Open sores that take too long to heal
- Changes in skin color or temperature
- Dry and cracking skin around the heel
- Swelling in the foot or ankle
- Hammer toes
- Increasing numbness, tingling, or pain
- Unexplained redness

# Diabetes Mellitus

- Diabetes affects 18 million people and is increasing
- 16 million Pre-diabetes
- Diabetic foot problems are common and are estimated to affect 15% of all diabetics during their lifetime
- More than half of lower leg amputations occur in diabetics
- Amputation rates increase with age, in males and among members of certain racial and ethnic minorities



# **Risk Factors for Peripheral Vascular Disease**

- Smoking
- Hypertension
- Hyperlipidemia
- **Diabetes**
- Family History of cardiac or vascular disease
- Sedentary Lifestyle



# Probing the Diabetic Wound







# Unique to Diabetics

**Neuropathy:**  
Sensory  
Motor  
Autonomic

**Signaling Molecules**  
Growth Factors  
Cytokines

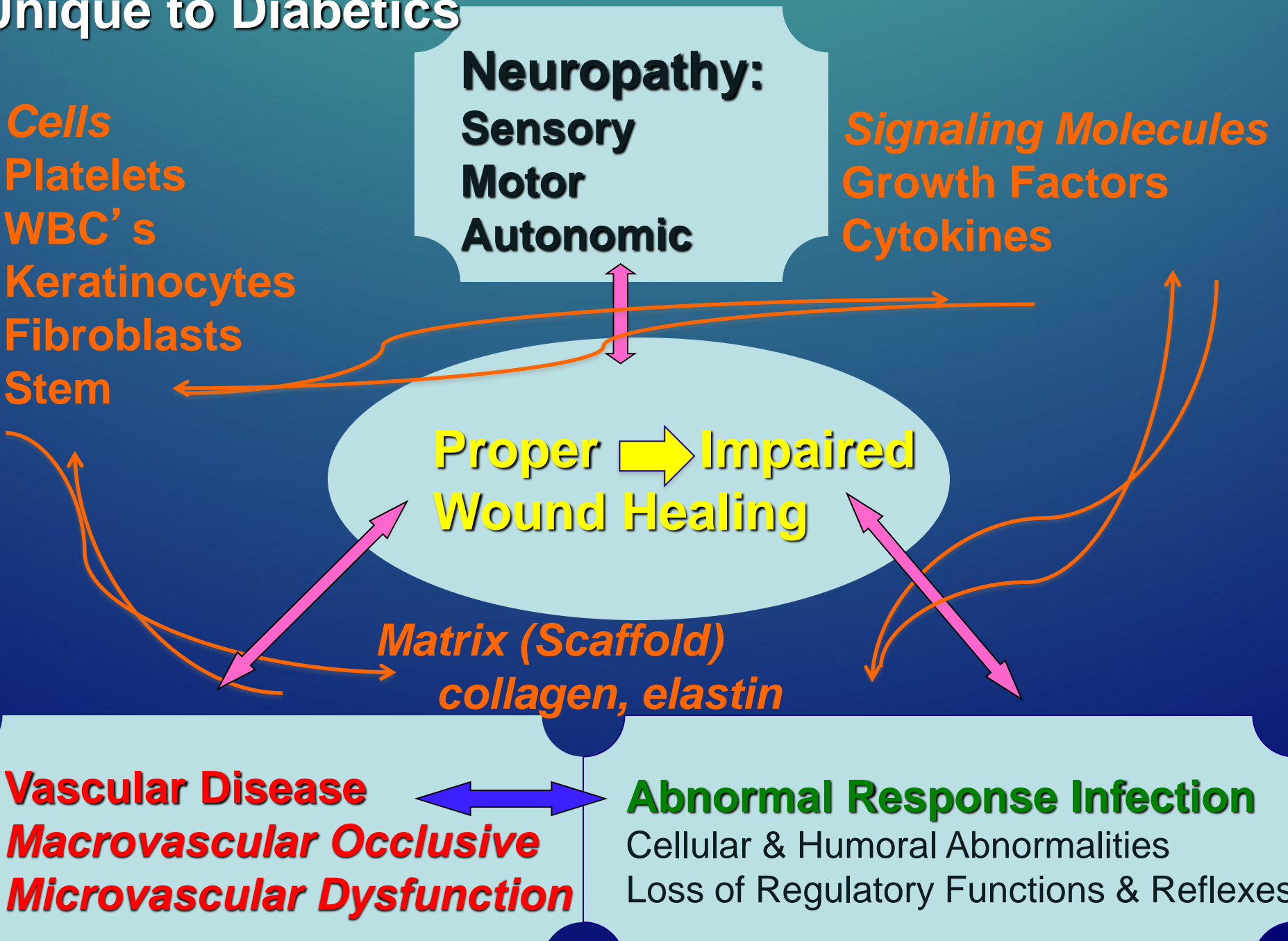
**Cells**  
Platelets  
WBC's  
Keratinocytes  
Fibroblasts  
Stem

**Proper → Impaired  
Wound Healing**

**Matrix (Scaffold)**  
collagen, elastin

**Vascular Disease**  
Macrovascular Occlusive  
Microvascular Dysfunction

**Abnormal Response Infection**  
Cellular & Humoral Abnormalities  
Loss of Regulatory Functions & Reflexes



# Blood Glucose: The Gold Standard for Managing Diabetes

- **Hemoglobin A1c level less than 7%**
  - Blood Pressure less than 130/80 mmHg
  - LDL-C less than 100 mg/dl
  - Daily aspirin use for patients age 41-75
  - Documented as tobacco-free in medical record
- 

- Data from clinics in Minnesota 2006:
- % of a clinic's patients who achieved all 5 parameters
- Highest = 30%: Average less than 20%
- Park Nicollet (International Diabetes Center) 25%

Poorly compliant



# Best Medical Therapy for PAD

- First-line treatment for claudication and mild PAD
- Modification of risk factors
  - Smoking cessation
  - Control hypertension (<130/85)
  - In diabetics, Hgb A1C < 7
  - Statin therapy (LDL < 100 mg/dL)
  - Antiplatelet agent (aspirin or clopidogrel)
  - Healthy diet
  - Walking for 30 minutes a day; walk through the pain
- Cilostazol - shown in randomized trials to double the walking distance without pain

# High hemoglobin A<sub>1c</sub> associated with increased adverse limb events in peripheral arterial disease patients undergoing revascularization



Shipra Arya, MD, SM,<sup>a,b</sup> Zachary O. Binney, MPH,<sup>c</sup> Anjali Khakharia, MD, MS,<sup>a</sup> Chandler A. Long, MD,<sup>d</sup> Luke P. Brewster, MD, PhD,<sup>a,b</sup> Peter W. Wilson, MD,<sup>e,f</sup> William D. Jordan Jr, MD,<sup>a</sup> and Yazan Duwayri, MD,<sup>a</sup>  
*Atlanta and Decatur, Ga; and Durham, NC* (J Vasc Surg 2018;67:217-28.

- Elevated perioperative HbA1c associated with higher incidence of long-term amputation and mMALE for PAD patients.
- HbA1c levels show dose-response relationship between degree of glycemic control and adverse limb outcomes.
- Patients with poorest glycemic control at twice long-term risk of amputation.

# Cilostazol for Claudication

- Improves walking distance and quality of life in patients with peripheral arterial disease
- Well-tolerated, safe, and efficacious treatment for PAD patient
- Improves patients' symptomatology and quality of life
- Appears to have beneficial effects on arterial compliance, possibly through its lipid-lowering property

# Impact of cilostazol after endovascular treatment for infrainguinal disease in patients with critical limb ischemia

Yoshimitsu Soga, MD,<sup>a</sup> Osamu Iida, MD,<sup>b</sup> Keisuke Hirano, MD,<sup>c</sup> Kenji Suzuki, MD,<sup>d</sup> Daizo Kawasaki, MD,<sup>e</sup> Yusuke Miyashita, MD,<sup>f</sup> Taketsugu Tsuchiya, MD,<sup>g</sup> and Masakiyo Nobuyoshi, MD,<sup>a</sup> *Kitakyushu, Amagasaki, Yokohama, Sendai, Nishinomiya, Nagano, and Kanazawa, Japan*

J Vasc Surg 2011;54:1659-67

- Reduces restenosis and repeat revascularization after endovascular therapy in claudicants
- Improvement of Amputation Free Survival
- No significant difference in overall survival, repeat revascularization, and surgical conversion between groups

# Cilostazol and freedom from amputation after lower extremity revascularization

J. David Neel, MD,<sup>a</sup> Robin L. Kruse, PhD,<sup>b</sup> Viktor Y. Dombrovskiy, MD, PhD, MPH,<sup>c</sup> and Todd R. Vogel, MD, MPH,<sup>a</sup> *Columbia, Mo; and New Brunswick, NJ*

J Vasc Surg 2015;61:960-4

- Evaluated in conjunction lower extremity revascularization
- From 2007 to 2008 Medicare Provider Analysis
- 22,954 patients undergoing LER: 8128 (35.4%) claudication, 3056 (13.3%) rest pain, and 11,770 (51.3%) ulceration/gangrene
- 1999 patients (8.7%) used cilostazol before LER
- Cilostazol use was associated with improved 1-year freedom from amputation
- Patients with renal failure and diabetes also demonstrated a significant benefit from taking cilostazol

# Limb Threatening Clinical Picture

- Assess the vascular status of a patient with lower extremity ulcer
- Clinical presentation of arterial ulcer
- Diagnostic Procedures to evaluate Peripheral Vascular Disease
- Medical Therapy
- Revascularization Options





# Key Factors Leading to Failure to Heal

- Underlying pathophysiology: venous and/or arterial insufficiency, diabetes and neuropathy, prolonged immobilization
- Infection or high bacterial colonization
- Immunosuppression
- Co-morbid conditions
- Nutritional deficits
- Adverse effects of medications on the healing process

Kane DP, Krasner D, eds. *Chronic Wound Care: A Clinical Source Book for Healthcare Professionals*. 2nd ed. Health Management Publications Inc, 1997;1-4. Falanga V, ed. *Cutaneous Wound Healing*. Martin Dunitz; 2001.

# DIABETES

- an epidemic with growing numbers
- More than 60% of nontraumatic lower limb amputations, and at least 80% of amputations are preceded by ulcer
- additive effects of neuropathy, minor trauma, ulceration, faulty healing, ischemia, and infection leading to amputation
- Outcomes of a multidisciplinary team to prevent amputation
  - During a 4-year period, there was an 82% reduction in major amputations. <sup>1,2</sup>
- 62% reduction in major amputations and 40% decrease in all amputations during an 11-year period after a diabetic foot care service was started. <sup>3</sup>

<sup>1</sup> Driver VR, et al. Diabetes Care 2005;28:248-53.

<sup>2</sup> Driver VR, et al. J Am Podiatr Med Assoc 2010;100:235-41.

<sup>3</sup> Krishnan S, et al. Diabetes Care 2008;31:99-101.

# Limb Threatening Ischemia

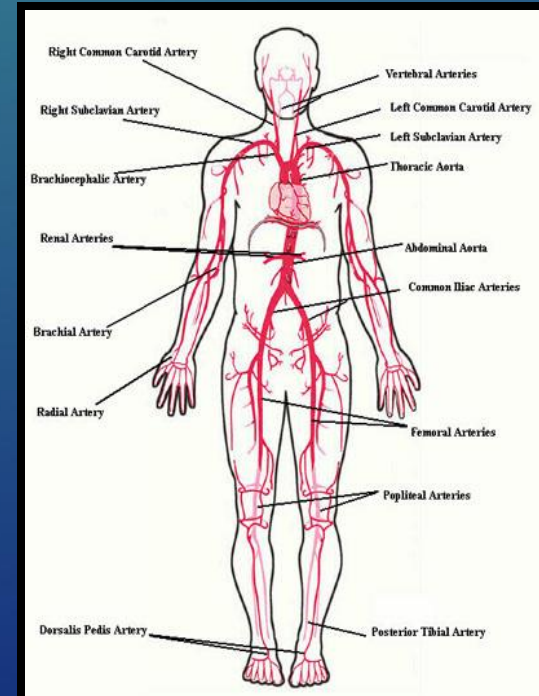
- **Arterial Ulceration**
  - Pale base
  - No bleeding
  - Often distal on the leg and involving the feet and toes



Thin, hairless skin; thickened nails; pallor; delayed capillary refill after elevation or dependent rubor

# Evaluate the vascular perfusion to the foot

- Physical Exam
  - Pulse exam
- Ankle Brachial Index





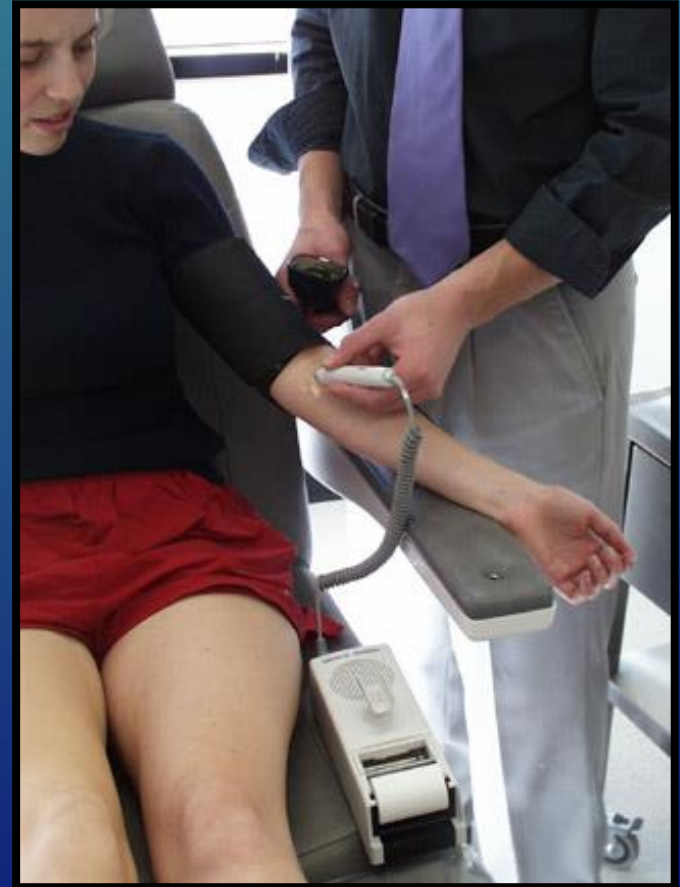
# Inability to feel a pulse

- Use the Pencil Doppler to listen to the signal



# Ankle Brachial Index

- Measure ankle pressure
- Measure brachial pressure
- Calculate ratio



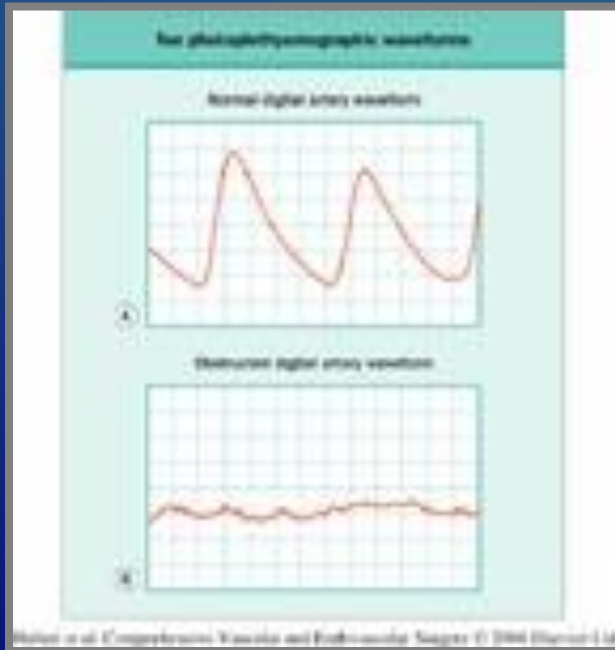
Toe Brachial Arterial Pressure Index or TCPO<sub>2</sub> for Diabetics



# Non-invasive Vascular Laboratory

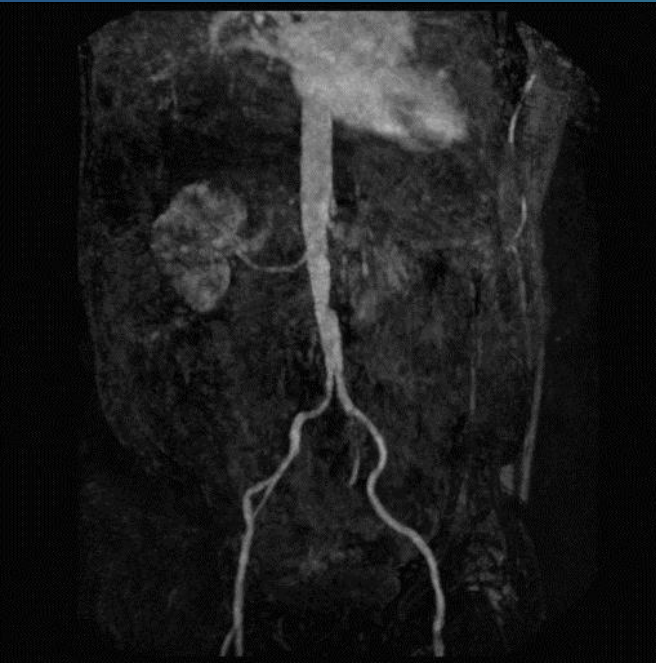


Arterial Duplex



Pressure measurements

# Magnetic Resonance Angiography



Limitation: metal, stents, patient movement, renal failure

# CT Angiography



Limitation: Calcification, renal impairment

# Angiogram is the gold standard



**Aortic Stenosis**



**Iliac Occlusion**



**Superficial  
Femoral Artery  
Occlusion**

# **SVS Lower Extremity Threatened Limb Classification System: Risk stratification based on Wound, Ischemia and foot Infection (Wlfi)**

- Classification for threatened lower extremity
- Term CLI being replaced
- Historical classifications were not to be applied to Diabetics
- Needed a method to better stratify patients to perform meaningful outcomes analysis
- Inclusive of perfusion, wound extent, presence and severity of infection

# Wound Management Guidelines

- Implement Prevention Protocols
- Correct Etiologic Factors
- Relieve pressure, shear, friction
- Control edema, moisture
- Protect high risk areas
- Provide systemic support for wound healing
- Nutrition:
  - 30-35 cal/kg/day,
  - 1.5 gm protein/kg/day,
  - Vit C, MV, Trace elements
- **Blood Sugar: Optimal Control**



# Wound Management Guidelines

## Dressings

- Dressings Don't Replace Debridement
- Purpose
  - **Provide Moistened Wound Environment**
  - Absorb exudate
  - Protect wound
  - Minimize bacterial contamination
  - Stimulate proper wound healing response
- Continually evaluate progress and reassess

**Reduce wound 50% / 4 weeks:**

**Re-evaluate, consider adjuvants**



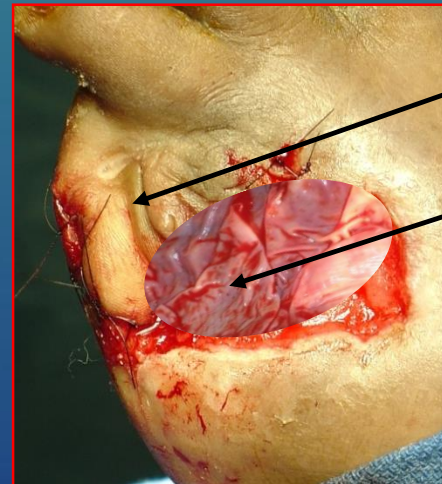
# Off Loading Wounds

- Crutches
- Wheelchair
- Walking boots
- Felted foam dressings
- Freedom leg brace
- Roll about walker
- Total Contact casting



# ***Advanced Therapies to Accelerate Closure***

**Vacuum Assisted  
Closure  
for Wound Bed  
Preparation**



**Toe Flap**

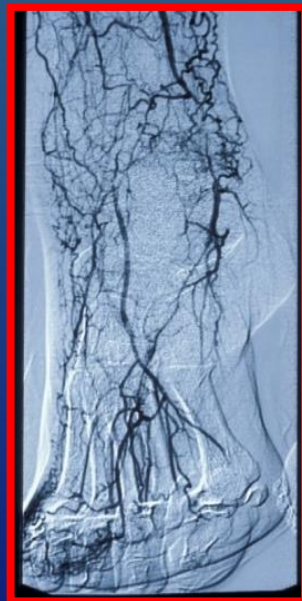
**Bi-layered  
living cell therapy**

**Hyperbaric  
Oxygen Therapy**



# *Immediate Evaluation & Treatment of Ischemia*

If wound edges dusky →



Severe Tibial/  
Peroneal Disease



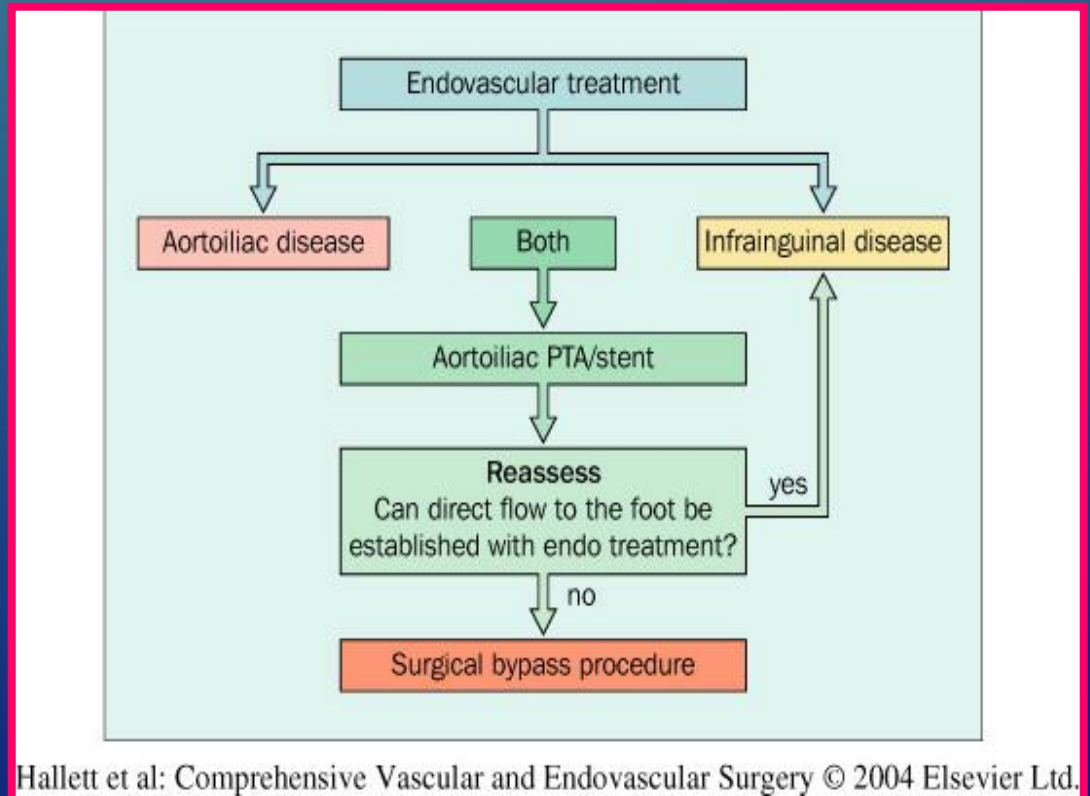
Dorsalis Pedis Bypass



Saphenous Vein  
Conduit

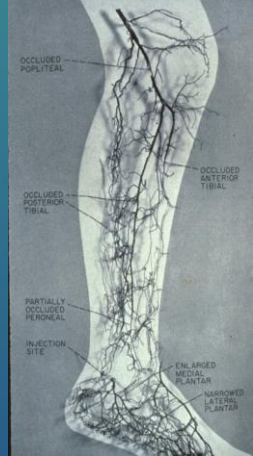
# Approach to Multi-level Disease

- **Primary Endovascular**
  - Open as bail out
- **Primary Open**
  - Endo as bailout
- **Hybrid approach**
  - Endo + Open





# ***DIABETIC VASCULAR DISEASE***



## **Macrovascular Occlusive Disease**

- Predilection for Tibial/Peroneal Arteries
- Sparing of Dorsalis Pedis & Foot Arteries
- Calcification of Intima & Media
- Poor collateral circulation (esp. arteries surrounding knee)

## **Microvascular Dysfunction**

- Not occlusive anatomic lesion
- Endothelial dysfunction
- Loss of
  - Autoregulatory function
  - Vasoconstrictor response
  - Neurogenic regulatory response
- Impaired hyperemic response to heat & inflammation
- Increased AV shunting
- Impaired Oxygen diffusion & leukocyte migration



# **BEST CLI Trial**

- **Randomized, Multicenter, Controlled Trial to Compare Best Endovascular versus Best Surgical Therapy in Patients with Critical Limb Ischemia**
- **Superiority trial**
- **Any commercially available device used in open vascular or endovascular surgery, excluding cryoplasty**
- **Goal: 2100 subjects aged 35 years or older ; 120 multidisciplinary vascular centers and practices in the US and Canada**
- **Evaluate the effectiveness of best endovascular (EVT) compared to best surgical (OPEN) revascularization in patients with CLI and the cost associated with each**

## Potential Economic Benefits of Lower-Extremity Amputation Prevention Strategies in Diabetes

Daniel A Ollendorf, MPH, James G Kotsanos, MD, MS, William J Wishner, MD, Mark Friedman, MD, Tamara Cooper, RN, CDE, Marisa Bittoni, MS and Gerry Oster, PHD

Diabetes Care 1998 Aug; 21(8): 1240-1245.

- Developed a model to estimate the expected incidence and associated costs of lower-extremity amputation in a hypothetical cohort of 10,000 people with diabetes.
- Prevention strategies were assumed to be targeted at individuals with a history of foot ulcer, and benefits were estimated over a period of 3 year
- Total potential economic benefits from \$2.0 to \$3.0 million (\$2,900 to \$4,442 per person with foot ulcer) over 3 years.
- Most benefits were found among individuals aged  $\geq 70$  years

# The Team Approach

- Vascular Surgeons
- Vascular Interventionalists
  - Cardiology and Radiology
- Vascular Medicine/ Cardiology
- Diabetologists
- Podiatry/Orthopedics
- Infectious Disease
- Physical Medicine & Rehabilitation
- Physical & Occupational Therapy
- Nutritionists
- Social Workers
- Prosthetists
- Wound Care Specialists

# The costs of diabetic foot: The economic case for the limb salvage team

Vickie R. Driver, MS DPM, FACPAS,<sup>a</sup> Matteo Fabbi, MD,<sup>a</sup> Lawrence A. Lavery, DPM, MPH,<sup>b</sup> and Gary Gibbons, MD,<sup>a</sup> *Boston, Mass; and Georgetown, Tex* J Vasc Surg 2010;52:17S-22S.

- Patient education, early assessment, and aggressive treatment by a multidisciplinary team represent the best approach to manage high-risk patients with diabetes.
- Clinical and economic outcomes demonstrate reduced amputations, length of stay, and costs
- Early recognition and prevention of diabetic foot disease has been proven to be effective in the US
- limb preservation services are frequently consulted late in the disease process

# Unplanned 30-day readmission in patients with diabetic foot wounds treated in a multidisciplinary setting

Courtenay M. Holscher, MD,<sup>a</sup> Caitlin W. Hicks, MD, MS,<sup>b,c</sup> Joseph K. Canner, MHS,<sup>d</sup>  
Ronald L. Sherman, DPM, MBA,<sup>b,c</sup> Mahmoud B. Malas, MD, MHS,<sup>d,e</sup> James H. Black III, MD,<sup>c</sup>  
Nestoras Mathioudakis, MD, MHS,<sup>b,f</sup> and Christopher J. Abularrage, MD,<sup>b,c,d</sup> *Baltimore, Md*

*J Vasc Surg* 2018;67:876-86.

- 460 admissions in 206 patients during the study period, including 99 total readmissions (21.5%)
- Most frequent reasons for unplanned 30-day readmission were deterioration of the foot wound (41%), vascular complications (15%), gastrointestinal complications (10%), cardiac complications (8%), and acute kidney injury (8%)
- Only current smoking and hypertension were independent predictors of readmission after risk adjustment



# The Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIFI) classification system correlates with cost of care for diabetic foot ulcers treated in a multidisciplinary setting

Caitlin W. Hicks, MD, MS,<sup>a,b</sup> Joseph K. Canner, MHS,<sup>c</sup> Hikmet Karagozlu, MBA,<sup>d</sup>  
Nestoras Mathioudakis, MD, MHS,<sup>a,e</sup> Ronald L. Sherman, DPM, MBA,<sup>a,b</sup> James H. Black III, MD,<sup>b</sup> and  
Christopher J. Abularrage, MD,<sup>a,b,c</sup> Baltimore, Md

**Objective:** We have previously demonstrated that the Society for Vascular Surgery Wound, Ischemia, and foot Infection (WIFI) classification correlates with wound healing time in patients with diabetic foot ulcers treated in a multidisciplinary setting. Our aim was to assess whether the charges and costs associated with care increased with higher WIFI stages.

**Methods:** All patients presenting to our multidisciplinary diabetic limb clinic from January 2012 to June 2016 were enrolled in a prospective database. Inpatient and outpatient charges and costs were compared for wound healing time, revenue from initial visit until complete wound healing were compared for wound healing time.

**Results:** A total of 319 wound episodes in 214 patients were enrolled, including 31% WIFI stage 1, 16% stage 2, 30% stage 3, and 24% stage 4 wounds. Limb salvage was achieved in 85% ± 2%. The mean number of overall inpatient admissions was significantly higher for stage 4, 3.40 ± 0.27;  $P < .001$ ), procedure-related admissions (stage 1, 1.86 ± 0.45 vs stage 4, 3.40 ± 0.27;  $P < .001$ ), and inpatient vascular interventions (stage 1, 0.14 ± 0.10 vs stage 4, 0.80 ± 0.12;  $P < .001$ ) with increasing WIFI stage. There were no significant differences in mean number of outpatient interventions or outpatient procedures between groups ( $P \geq .10$ ). The total cost of care per wound increased progressively from stage 1 (\$3995 ± \$1047) to stage 4 (\$50,546 ± \$4887) wounds ( $P < .001$ ). Inpatient charges were significantly higher for advanced stage wounds (stage 1, \$21,296 ± \$4445 vs stage 4, \$54,513 ± \$5001;  $P < .001$ ), whereas outpatient procedure costs were not significantly different between groups ( $P = .72$ ). Overall, hospital total revenue increased with increasing WIFI stage (stage 1, \$4182 ± \$1185 vs stage 4, \$55,790 ± \$5540;  $P < .002$ ).

**Conclusions:** Increasing WIFI stage is associated with a prolonged wound healing time, a higher number of surgical procedures, and an increased cost of care. While limb salvage outcomes are excellent, the overall cost of DFU care from presentation to healing is substantial, especially for patients with advanced (WIFI stage 3/4) disease treated in a multidisciplinary setting. (J Vasc Surg 2018;67:1455-62.)

Team approach allows for demonstration of cost related to advanced WIFI stage but excellent outcomes

## COMMENTARY

## THE BENEFITS OF A LIMB SALVAGE PROGRAM

May 2, 2016



## Authors:

Craig Walker, MD

*Editor's note: Watch the [VDM May issue video editorial here](#).*

In the May issue of *Vascular Disease Management*, Sanguily et al discuss the impact of a dedicated limb salvage program at their institution. Although it has been previously well established that dedicated limb salvage programs can drastically improve the care given to patients with critical limb ischemia (CLI) and lower rates of major amputation, this article gives practical tips on how a limb salvage program can be established at any institution that cares for patients with CLI.



Craig Walker, MD  
Clinical Editor  
Interventional Cardiology  
Founder, President, and  
Medical Director  
Cardiovascular Institute of the South  
Clinical Professor of Medicine  
Tulane University School of Medicine  
Louisiana State University School  
of Medicine

Critical components of a limb salvage program include the following:

1. Community screening/awareness programs to evaluate for evidence of PAD;
2. A mechanism for early referral to vascular specialists;
3. Interventional specialists;
4. Skilled surgeons;
5. Podiatrists;
6. Orthopedists;
7. Wound-healing specialists;
8. Diabetic specialists;
9. Neurologists;
10. Established follow-up programs; and
11. Smoking cessation experts.

## The Limb

1-855-LIMB-RWJ or 1-855

The Limb Preservation Program at Johnson University Hospital offers advanced treatment options for patients who require amputation as a result of reducing the prevalence of diagnostic, surgical and wound care. The Limb Preservation Program not only improves the quality of life of the patient.

## Our Multidisciplinary

## The Multidisciplinary Team

- Interventional Cardiology
- Podiatry
- Infectious Disease
- Plastic Surgery
- Physical Therapy

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Vascular &gt; Services We Provide &gt; Limb

er in Central Massachusetts. Our team of  
ients at high risk for foot and leg

ss to our Limb Preservation Center in

S

(D), and those at risk for developing these  
ilar surgeon with expertise in the healing  
able to evaluate both arterial and venous

on, the team works collaboratively to heal  
endent walking.

y, endovascular intervention, and stem cell



# Development of a Limb-Preservation Program

Richard F. Neville   Ahmed Kayssi

Blood Purif 2017;43:218–225

DOI: 10.1159/000452746

Inova Heart and Vascular Institute, Division of Vascular Surgery, Department of Surgery, Inova Fairfax Medical Campus, Falls Church, VA, USA|

- requires coordinated effort from physicians, nurses, allied health professionals, and administrators dedicated to the cause of saving and maintaining functional limbs
- the cost of rehabilitation after an amputation is shown to double the original cost of the amputation itself
- Prompt and appropriate diagnosis followed by a multidisciplinary treatment program is critical to treat these complex patients successfully

# Development of a Limb-Preservation Program

Richard F. Neville   Ahmed Kayssi

Blood Purif 2017;43:218–225

DOI: 10.1159/000452746

Inova Heart and Vascular Institute, Division of Vascular Surgery, Department of Surgery, Inova Fairfax Medical Campus, Falls Church, VA, USA]

- Reduction in the occurrence of chronic foot ulceration through patient education and primary care surveillance of the foot in diabetics impact limb loss in a significant way
- Rise in the prevalence of diabetes will lead to an increase in lower extremity ulceration and limb loss.
  - affect the quality of life
  - has a negative impact on the longevity of patients
  - a significant mortality associated with major amputation
  - 30-day mortality ranges from 15 to 20% and 5-year mortality rate approaches 50%

# Development of a Limb-Preservation Program

- Standardize care for patients with critical limb ischemia and limb-threatening ischemia
- Amputation is prevented by revascularization, whether endovascular or open surgical bypass
- Amputation rates are lower in centers with higher volumes of revascularization procedures
- Multidisciplinary Approach
  - fosters protocol-driven care involving a full complement of diagnostic and therapeutic modalities
  - program fosters education and research regarding wound healing and advanced revascularization techniques
- leads to enhanced healing, limb preservation, and increased patient satisfaction through a decrease in morbidity and mortality associated with limb loss



# Development of a Limb-Preservation Program

## Staff:

- Physician team, administrative support, physician extenders, nursing, and secretarial support.
- A medical director who has the authority and initiative to bring together other team members
- Marketing and Community Relations
- Space
  - Should be an identifiable outpatient space, which is accessible by the patients who have mobility problems
  - identifiable hospital ward
  - nursing staff on an identifiable ward becomes familiar with the medical issues surrounding the threatened limb patients

# Conclusions

- Multidisciplinary care for patients with ischemic wounds increases amputation-free survival compared with standard wound care
- Team approach can increase clinical efficiency, increase patient referrals, and provide opportunities for clinical research
- The institution of a limb-preservation program can preserve limbs and improve the longevity and quality of life of our patients. Limbs can be preserved and amputations avoided in the context of a viable financial entity to the hospital and healthcare system



**TBI 0.34 Right  
CT Scan + for  
osteomyelitis of  
calcaneal  
tuberosity**

## **Case: 58 y.o male**

**Medically high risk  
Diabetes Mellitus  
PAD  
Smoker  
Chronic Renal Insufficiency  
CAD & CHF  
Heel ulcer started as heel crack**



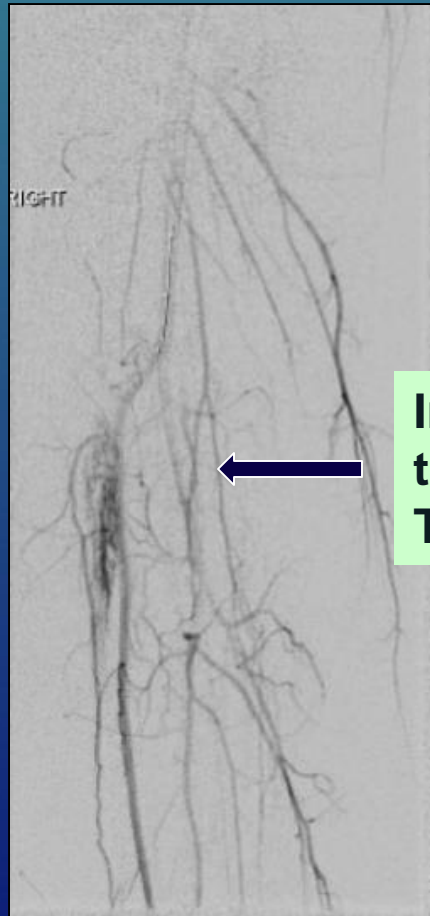
**Superficial  
femoral  
artery  
stenosis**



**Anterior  
tibial artery  
occlusion**

# Endovascular Revascularization

- CO2 angio
- SFA angioplasty with DEB



Inability to advance thru total occlusion of Anterior Tibial Artery

TBI 0.40 Right

# Wound Management

- Heel debridement down to bone
- Wound VAC application
- Flowable /mesh bi- layer matrix /VAC



- Bone cultures positive for MRSA, enterococcus, Bacteroides fragilis
- 6-week course of antibiotics

Wound healing stalled





# Additional Revascularization with Continued Wound Care

- SFA to DP bypass with ipsilateral GSV
- Indirect revascularization
- Debridement to bone, calcaneus of right heel and wound VAC
- Application bi-layered living cell therapy

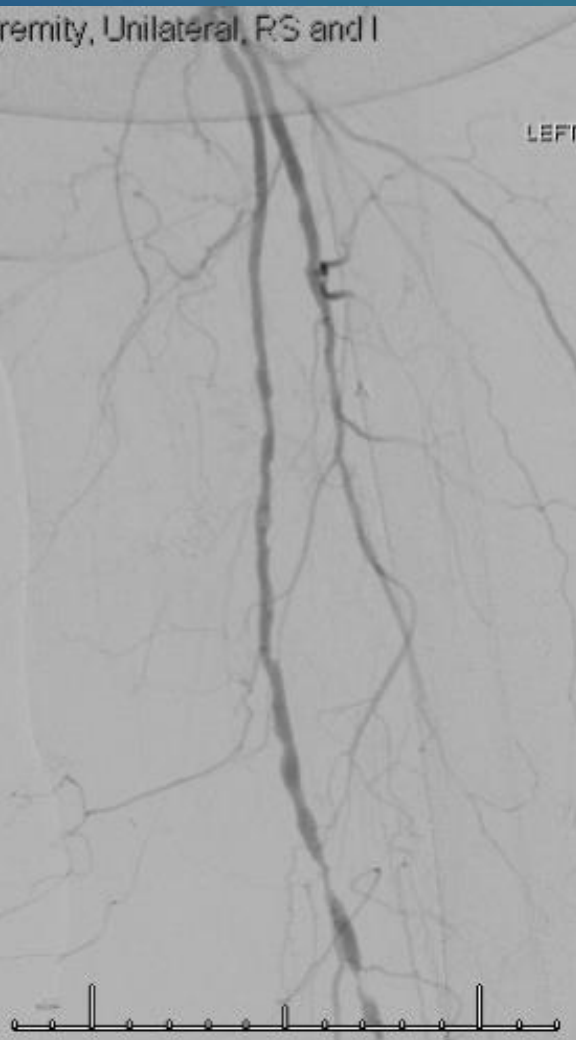


# Case AG

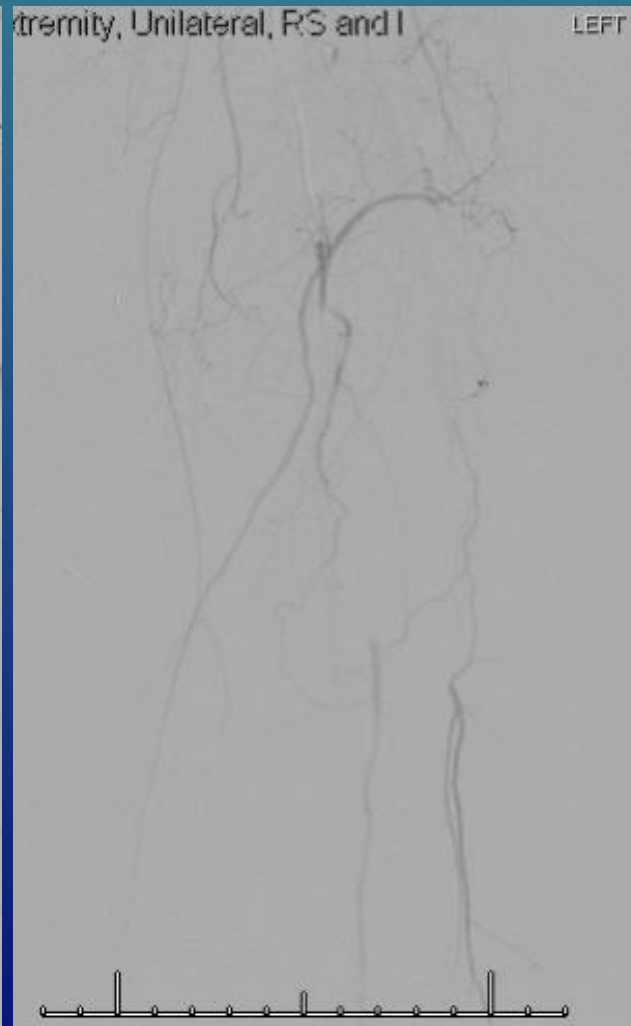
- 58 year old morbidly obese female with DM and CRI (baseline creatinine 1.7), s/p CABG who developed tissue loss of her left 5<sup>th</sup> toe and plantar aspect of foot after trimming a callus
- Diagnostic Angiogram - severe arterial occlusive disease at multiple levels
- Medical assessment suggested that she was moderate to high risk for bypass
- Lack of conduit of left lower extremity (vein harvest for CABG)
- Broad spectrum antibiotics started



# Diagnostic Angiography



SFA stenoses

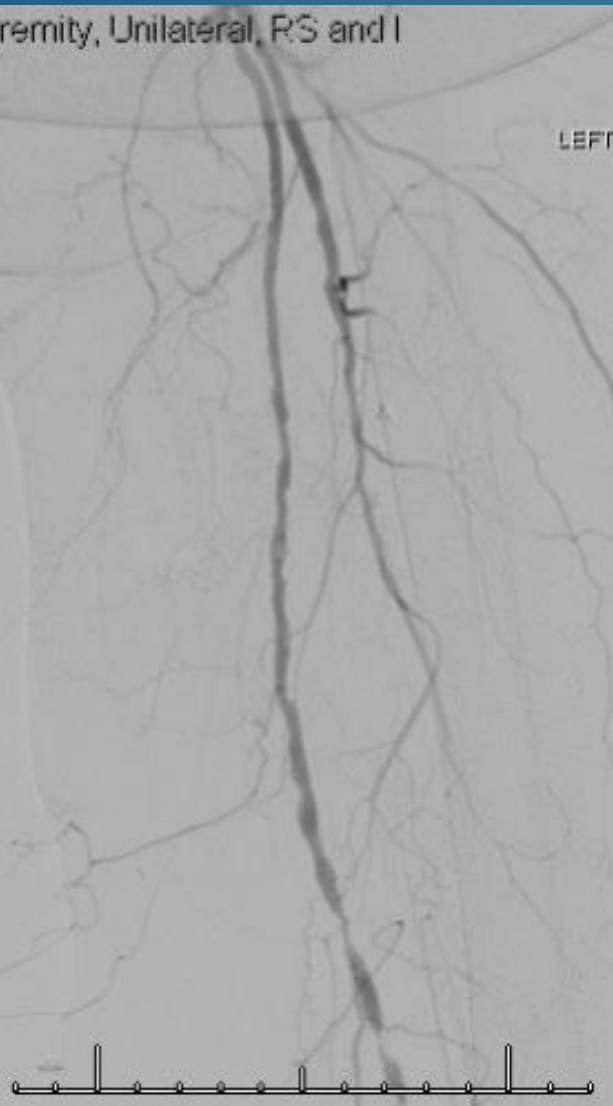


Popliteal, TP trunk occlusion



Peroneal reconstitutes DP, PT

# Diagnostic Angiography



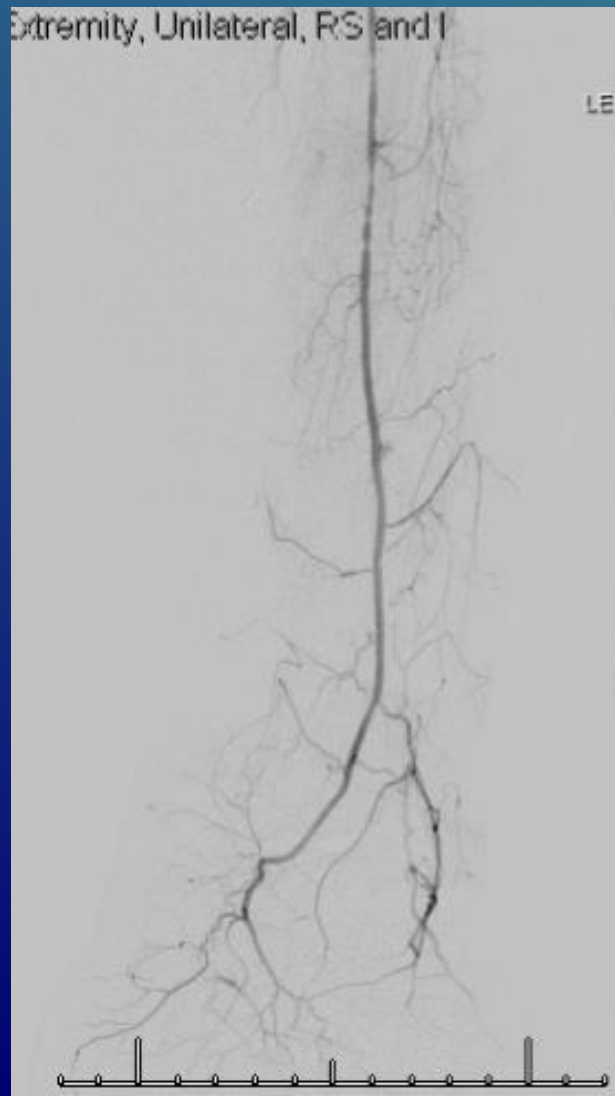
Cross occlusion



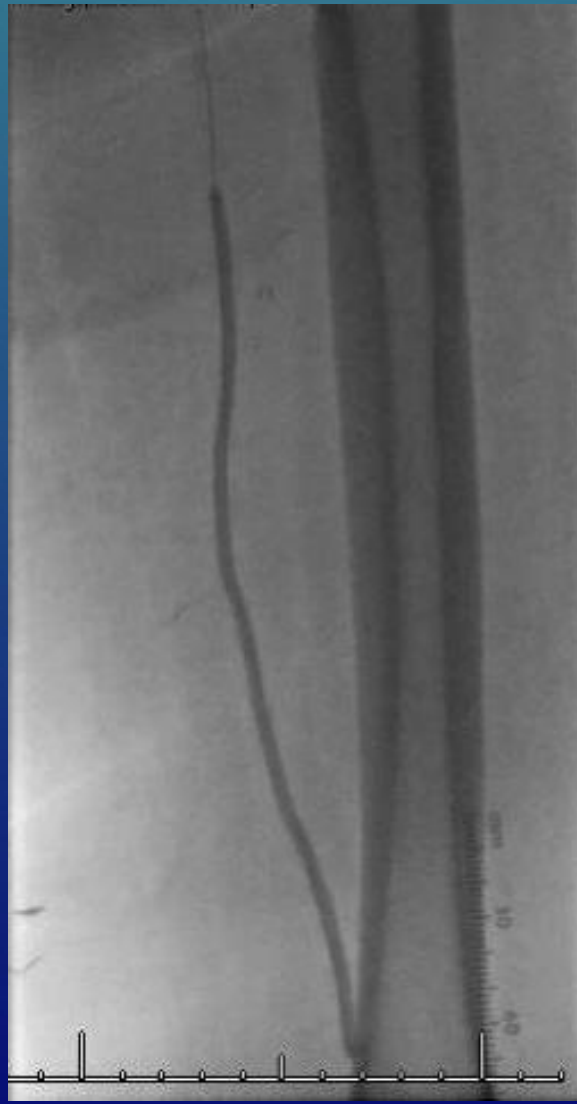


# Intervention

Tibial Run off



angioplasty





# Results

Indirect revascularization  
Toe brachial index 0.65

Peroneal

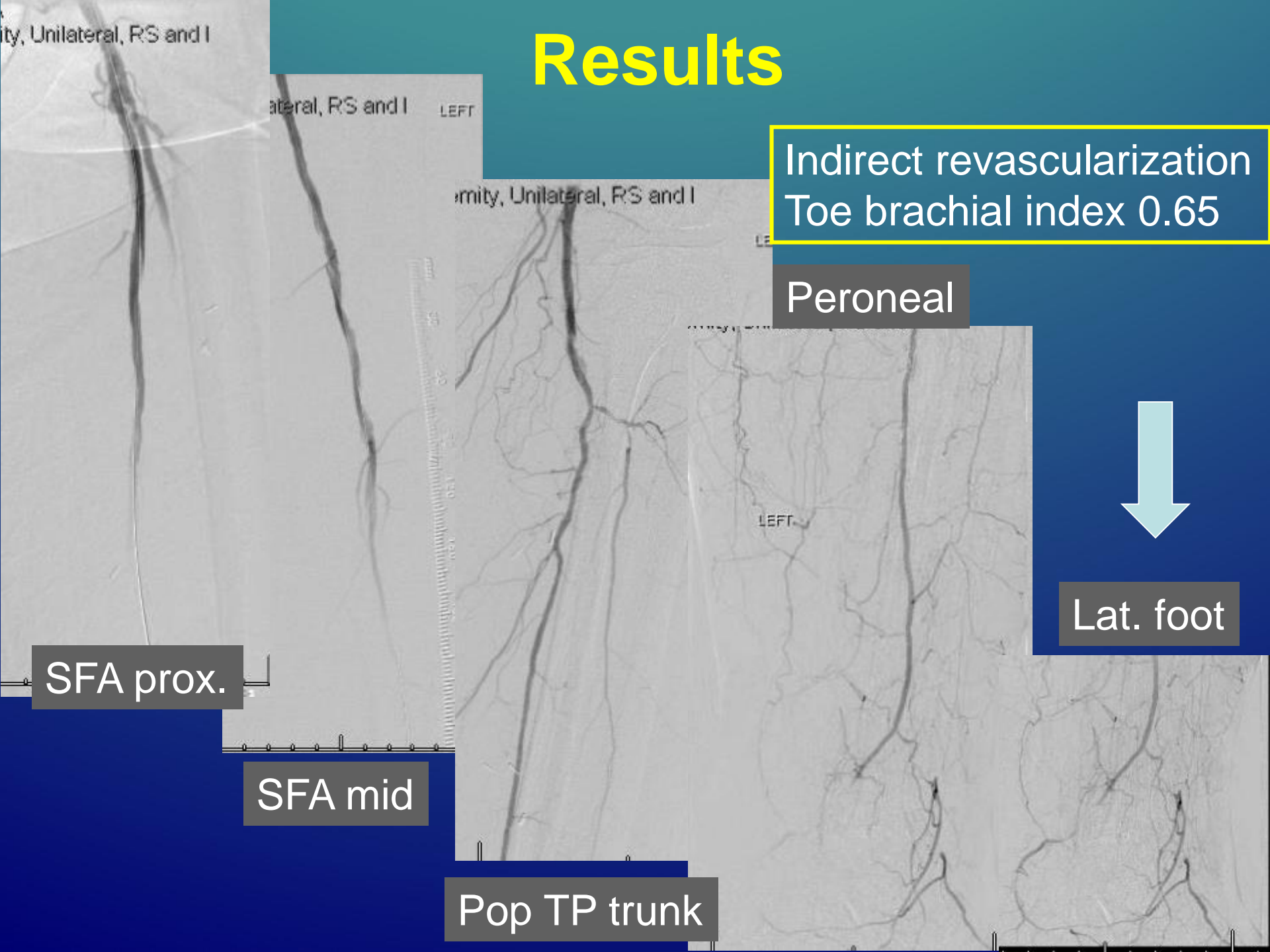


Lat. foot

SFA prox.

SFA mid

Pop TP trunk





**4-weeks post op**



**6-weeks post op**



**4-months post op**



**5-months post op**

- Indirect revascularization
- Co-morbid conditions
- Optimal wound care
- Off loading
- Advanced wound therapies

# THANK YOU

