Wound Care in Critical Limb Ischemia

Kirk Grantham, MD, CWSP
Willis-Knighton Hyperbaric and Wound Care Center in Bossier
Promise Hospital Shreveport and Bossier: Wound Care Director
Objectives

* Identify ulcers due to arterial insufficiency
* Review Non-Invasive Diagnostics, specifically Transcutaneous Oximetry
* Discuss management of wounds in CLI
* Understand the basics of hyperbaric oxygen and its role in this patient population
* List the approved indications for hyperbaric therapy
Arterial Ulcers

- Location: Distal sites such as toes and lateral malleolus
- Appearance: Pale, dry. Eschar or gangrene common. Well demarcated when dry. Boggy and Foul smelling when wet.
- Limb characteristics: Pale skin, decreased distal hair, cool to palpation, nail dystrophy, poor skin turgor, prolonged cap. refill, absent or diminished pulses
Arterial Ulcers
Arterial Ulcers
Arterial Ulcers
Arterial Ulcers
Diagnosis

* Clinical history and physical exam
* ABI
* Arterial ultrasound
* Pulsed Volume recordings
* Transcutaneous Oximetry
* Angiogram
* Identifies the partial pressure of oxygen in the periwound
* TcPO2 > 40 mmHg is adequate for wound healing
* Critical Limb Ischemia usually has TcPO2 < 30 mmHg
* Determines if an amputation is likely to heal at a particular level
  * (TcPO2 < 40 mmHg and <10 mmHg rise with 100% O2)
* Determines if Hyperbarics will be beneficial to wound healing
  * (>50% rise in TcpO2 value on 100% O2)
Management

* Simultaneous Referral to
  * Interventional Cardiologist
  * Wound Care and Hyperbaric Specialist
Protect surrounding skin

Moisturize dry skin

Avoid Adhesives

Reduce friction between toes (cotton or toe spacers)

Provide padding to ischemic tissues

Address wound bed

DIME protocol (DEBREDDM, I

nfection/Inflammation, M

oisture balance, E

edge effect)

Exception is dry, stable eschar. Avoid debridement until revascularization

Maximize circulation

Avoid compression

Choose footwear to accommodate bandages and decrease stress to the wound

Educate patient/caregivers

Local Wound Care
Coordinate Care

Wound Care Physician

- Cardiologist
- Dietician
- Physical Therapy
- Podiatrist
- General Surgeon
- Endocrinologist
- Infectious Disease
- Orthotist/Prosthetist
- Primary Care
- Vascular
- Plastics
- Nursing: Home Health, SNF, NH, Hospital, LTAC
Hyperbaric oxygen is a treatment, in which a patient breathes 100% oxygen intermittently while inside a treatment chamber at a pressure higher than sea level pressure (i.e. >1 ATA). Usually 2.0 or 2.4 ATA.

- The oxygen becomes dissolved in plasma, and under hyperbaric conditions the partial pressure of O2 can increase to > 1000 mmHg.
* Reverses Hypoxia
  * May be able to restore PO2 to normal or elevated levels
  * Non-healing ulcers or wounds, skin grafts
* Enhances epithelization
* Enhances collagen Deposition
* Enhances fibroblast proliferation
* Promotes angiogenesis
* Promotes bacterial killing
* Reduces Edema
CMS approved Indications

**Infectious**
* Necrotizing Fasciitis
* Gas Gangrene
* **Diabetic Foot wounds with Osteomyelitis** (30 day trial of standard treatment first)
* **Chronic Refractory Osteomyelitis** (6 weeks of standard treatment first)
* Refractory Actinomycotic Infection (6 weeks of standard treatment first)

**Ischemia**
* Crush injuries or suturing severed limbs
* Compartment Syndrome
* Acute Traumatic Peripheral Ischemia (trauma to major artery leading to ischemia)
* Acute Peripheral Artery Insufficiency (due to embolus or thrombus)
* **Compromised Graft or Flap**
* Carbon Monoxide and/or Cyanide
* Radiation Damage (late onset)
  * Osteoradionecrosis
  * Soft tissue Radionecrosis
    * Non-healing wounds secondary to prior radiation
    * Radiation Cystitis
    * Radiation Enteritis
    * Any soft tissue injury
* Air Embolism
* Decompression Illness
Multiplace Chamber
Monoplace Chamber
55 year old married middle-school P.E. teacher with PMH of HTN, T2DM, Obesity, Non-Smoker.

PAD s/p balloon angioplasty and laser atherectomy to right anterior tibial, posterior tibial, dorsalis pedis, and pedal arch 4 months ago.

Amputation of 5th toe 4 months ago, Amputation of 2nd-4th toes 2 months ago for dry gangrene, STSG 1 month ago to cover defect with subsequent infection and osteomyelitis confirmed by MRI currently on Maxipime.
* TCOM:
  * room air: -----22 (moderate hypoxia)
  * on 100% O2: -85 (indicates adequate response)
  * 2.4 ATA: --------1133
Assessment/Plan

* **Compromised Flap/DFU**
  * Hyperbarics
  * DIME protocol
  * Apligraf skin substitute

* **Critical Limb Ischemia**
  * Informed Cardiology of Tcom results
  * Repeat angioplasty and laser atherectomy to sequential lesions in proximal and distal anterir tibial, posterior tibial, and deep pedal arch

* **Uncontrolled Diabetes**
  * Discussed daily accuchecks with PCP
  * PCP modified insulin regimen and reinforced diabetic diet with patient’s wife

* **Diabetic Neuropathy**
  * Offloading shoe, Total Contact Cast

* **Osteomyelitis**
  * IV Antibiotics
  * Would cultures with debridements. Communicated results with Infectious Disease.

* **Anemia** (Hb 8)
  * Referral to GI. Pre-cancerous polyp removed

* **Venous Insufficiency**
  * Light compression (ABI’s consistent with calcified vessels)
64 year old male with history of PAD developed this wound 2 months ago, unsure of cause.

History of PAD with abnormal ultrasound and subsequent Aortogram. Patient was told that intervention could not be performed due to the extent of his PAD.

Active smoker that is interested in quitting

Transcutaneous oximetry

- 11 distal to the ankle
- 28 at the ankle with increase to 52 on 100% O2
Laser Atherectomy and Angioplasty to 100% occluded superficial femoral artery and to diffusely diseased right anterior tibial artery

Immediately followed with DIME and Hyperbarics
Cases
Questions