Overview On Wound Care and Hyperbaric Medicine
Wound Healing
and
Hyperbaric Medicine Center
Educational Background

- Medical School
  - Wright State University School of Medicine

- Specialty
  - Emergency Medicine (Board Certified)

- Subspecialty Training
  - Hyperbaric & Undersea Medicine (Board Certified)
  - Diving Medical Officer US Navy
  - Wound Care Specialist
Our Wound Healing Center

How is it different from other centers?

- Over 15 years of experience Opened in June 1999
- Dedicated Physician 5 days/week and a staff that is wound care certified
- Treatment Options
  - Hyperbaric Chambers (12 Person Chamber)
  - Casting Technicians
  - ONLY UHMS Certified Facility with Distinction in Ohio
Why Use a Wound Center

- Studies show when wounds are evaluated weekly and treated aggressively 68% will heal in the first 30 days.
- This reduces cost of care and better patient satisfaction.
- Wound centers provide education and provide patients with adjunctive modalities to aid in their healing.
How to we approach the Problem Wound?
Every Wound Should Heal ?
PROBLEM WOUND

- FAIL TO RESPOND AND PROGRESS TO MEDICAL AND SURGICAL MANAGEMENT IN THE EXPECTED TIME FRAME
- GREATER THEN 30 DAYS
- USUALLY IN A COMPROMISED HOST
COMPROMISED HOST

- SYSTEMIC
  - ADVANCED AGE
  - DIABETES
  - INFECTION
  - EDEMA
  - CIRCULATORY DEFICIT
  - MOTION, PRESSURE

- LOCAL
  - IMMUNOSUPPRESSION
  - FOREIGN BODIES
  - NECROTIC TISSUE
  - DEAD SPACE
  - RADIATION
  - NUTRITIONAL DEFICIT
Main causes
Ask yourself what is the underlying pathophysiology of the wound

- Edema (Venous, Post-op swelling)
- Circulation (Vascular)
- Pressure (Bed Ridden, Diabetic Foot Ulcer)
- Other (Dermatological, Cancers, Foreign Body)
Initial Wound Care Visit

- Review past and current history
- Complete patient history
- Complete Physical exam
- Address complicating factors
  - Vascular
  - Edema
  - Pressure
  - Nutrition
  - Systemic condition
- Consider consults
- Determine etiology and initiate treatment
Treatment Must Address:

- Debridement
- Infection Control
- Pressure Relief
- Edema Reduction
- Revascularization
- Oxygen
- Nutrition/Hydration
- Medical
  - Glucose control
- Social Needs
  - Trauma
  - Smoking
- Rehabilitation
- Long Term Education
- Debridement
- Infection Control
- Pressure Relief
- Edema Reduction
- Revascularization
- Oxygen
- Nutrition/Hydration
- Medical
  - Glucose control
- Social Needs
  - Trauma
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- Rehabilitation
- Long Term Education
Approach Problem Wound Involves:

- Reassessment
- Evaluation
- Education
- Treatment

Problem Wound
Venous Disease
Cellulitis vs. Venous Stasis

- Not all swollen draining legs are cellulitis
- Most can be managed with compression and +/- antibiotics
(937)257-8603

Date: 9/17/04 Case #: 1517
Edema Control

- Elevation of extremities
- Multilayer Compression Wrap
- Profore and Unna boots
- Graded compression stockings
- External sequential compression pumps
Edema Control

- Fibrinogen and peri-capillary cuffing
- Decreases nutrients and oxygen tensions
- Pro-inflammatory proteinacious mixture
- Matrix metalloproteinases (MMP)
- Controlling edema is a major goal in promoting chronic wounds to heal.
Multilayer Compression Wraps
Lymphedema Pumps
Compression Stockings
Circ-Aids
Pressure Relief

- Decubitus Ulcers
  - Repositioning
  - Foam or air mattresses

- Planter Foot Ulcers
  - Complete bed rest
  - Total contact casting
  - Custom bivalved othosis
  - DH Walker boot
  - Others
Alternating Air Flow mattress
Limb Salvage
Nutrition

- Albumin level of $< 3.5$
- Pre-Albumin levels $> 15$
Infection and Bioburden

- Stimulates an inflammatory response
- Deprives tissues of nutrients and oxygen
- MRSA
- Beta- Hemolytic Strep
- Staph Aureus
- Pseudomonas
- Later: E. Coli, Proteus and Klebsiella
- Deeper Wounds: Anaerobes
- Most become Polymicrobial over time
- Probe the wound for the presence of bone and tendon
- Looking for foreign material
- Deep tissue cultures
- Sed Rate CBC C-Reactive Protein
- MRI Bone Scan Plain Flim
How to Limit Bioburden and Bacteria Counts

- Local wound cleaning
  - Irrigation with 4-15 psi
- Excision of necrotic tissue and Biofilm
Types Of Debridement

- Surgical/ Sharp Debridement
- Mechanical (wet to dry)
- Enzymatic
- Autolytic
- Biological
Debridement
Hyperbaric Oxygen
What is Hyperbaric Oxygen

- Hyperbaric medicine is the process whereby a patient breaths 100 % oxygen in a chamber at pressure levels greater than sea level.

- This system increases the amount of dissolved oxygen in plasma.
Approved Indications for Hyperbaric Oxygenation

Emergency & Routine
Emergency Indications

- Air or Gas Embolism
- Decompression Sickness
- Carbon Monoxide Poisoning
- Gas Gangrene

- Crush Injuries
- Necrotizing Fasciitis
- Thermal Burns
Appropriate Wound Etiology (Routine)

- Refractory Osteomyelitis
- Necrotizing Soft Tissue Infections
- Gas Gangrene
- Compromised Skin Grafts and Flaps
- Crush Injuries and Compartment Syndrome
- Acute Traumatic Ischemias
- Thermal Burns
- ORN
- Soft Tissue Radionecrosis
- Other Wounds with Demonstrated Tissue Hypoxia
Refractory Nature

- Refractory to conventional therapy
- Low tissue oxygen tensions
- TCOM correlation
Hyperbaric Treatment Protocol

Diabetic Non-Healing Wounds of the Lower Extremities

Yes
- Complete History.
- Physical Examination.
- Labs.
- Transcutaneous oxygen assessment.
- Vascular assessment and correction.
- Wound photography.
- Wound measurements.
- Wagner III or >.
- Chest X-ray.
- ECG.

Diabetic Patient.
Wound >30 days standard conventional wound care w/o clinical response.

Institute Non-Healing Wound Table
2.4 ATA QD

Re-assessment after every 20 treatments.
Wound must show measurable signs of healing

Continue treatments if wound is showing measurable signs of improvement.
- Follow-up
- Wound Photography.
- TCOM
- Diabetes Education.
- Nutritional assessment and education

No
- Wound must be treated with standard conventional wound care for > 30 days.

Discontinue if the wound fails to show measurable signs of healing.

Treatment Threshold
30 treatments
OSTEOMYELITIS
Osteomyelitis

- Ischemic & Infectious disease
- Bone & muscle infection with draining sinus
- Trauma or idiopathic
- Poor blood supply causes lowered oxygen tension
- Impedes collagen formation, fibroblast activity & leukocyte response
Osteomyelitis

- Poor blood supply impedes introduction of antibiotics
- Surgery to remove infected bone & tissue
- High dose antibiotics
- If failing despite surgery and antibiotics consider HBO
Osteomyelitis

- HBO reverse tissue anoxia
- Promotes collagen formation
- Stimulates osteoclast’s
- Augments some antibiotics including aminoglycides
Gas Gangrene

- Caused by introduction of Clostridium Perfringens via trauma or post-surgery
- Other Clostridial organisms are not gas gangrene, but can be terrible infections
- Acute, rapidly progressive, non-pyogenic, invasive muscle infection
- Profound toxemia, extensive edema, massive tissue death & variable amount of gas production
Gas Gangrene Rx

- Surgery
- Antibiotics
- Hyperbaric oxygen 3 times per day at 60’ fsw for :80- :90 minutes X 2 days, then BID for 2 or 3 days
Gas Gangrene

- Gas gangrene is a rapidly progressive myonecrosis caused by Clostridial species
- Alpha toxin facilitates infection virulence
- Surgery removes dead tissue
- Antibiotics kill bacteria
- HBO halts alpha toxin production and preserves ischemic tissue

***Bactericidal action is not sought***
Radiation Injuries

- Osteoradionecrosis
- Soft tissue radionecrosis
- Radiation enteritis
- Radiation cystitis
Delayed Radiation Injury (Soft & Bony Tissue Necrosis)

- Radiation causes the endothelium of blood vessels to proliferate
- Blood supply decreases or is obliterated
- Radiated area becomes ischemic and fibrotic
- Tissue often survives the hypoxia
- Subsequent injury leads to infection & enlargement of the wound
Treatment Goals

- Reverse, hypo cellular, hypo vascular and hypoxic tissue changes (3Hs)
  - HBOT
- Resect necrotic tissue
- Reconstruct tissues
- Preserve/restore function, esthetics and quality of life
Medical / Social Needs
Medical / Social Needs

- Metabolic Control
  - Hg A1c
- Cessation of Smoking
- Nutritional Support
- Other Medical Conditions
- Pain Relief
Topical Wound Management
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<th>Drainage</th>
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Topical Wound Management

- Wound Care “Preparation of Wound Bed
- Appropriate Dressing
- Do they need off loading or compression
- Advanced Dressing ie Grafix or Skin Graft
Education

Patient
Family
Other Health Care
Wound Healing and Hyperbaric Medicine Center
Case Study

Wound Healing and Hyperbaric Medicine Center

Nov. 15, 00

K 296
Treatment Goals

- Preserve/restore function, esthetics and quality of life
Case Study
10-27-05  Case#: 2025

(937)257-8603
Periodic Reassessment

- Look for consistent progress
- Regularly reevaluate the wound
- Failure to progress needs prompt reevaluation
Wound Physician Consult Program

- Bringing the excellence of the Outpatient Wound programs to the Inpatient Arena

- Advanced Wound Care

- Continuum of Care
  - Inpatient consults
  - Follow up in KHN Outpatient Wound Centers
  - Follow up in LTC facilities

- Decreased readmission rate for exacerbation of wound pathology
Who Needs a Referral?

Patients with:
- Pressure ulcers – Stage II, III, or IV
- Lower extremity ulcers
- Lymphedema
- Diabetic foot ulcers
- Non-healing surgical wounds
- Any wound that will follow the patient upon discharge
### Placing a Wound Physician Consult

**IP Consult to Wound Care**

**Contact info:** (937) 477-8552 / (513) 543-1861

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<thead>
<tr>
<th>Name</th>
<th>Code</th>
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Summary:

- Problem
- Wound
- Reassessment
- Evaluation
- Education
- Treatment
Questions: