DIABETIC FOOT WOUND: A PATH TO PREVENTION

Presented by
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Objectives

1. Discuss the pathophysiology of Diabetic Foot Wounds

2. Evaluate various etiologies of the Diabetic Foot Wound on physical examination

3. Recognize advanced therapeutic modalities in the treatment of Diabetic Foot Wounds
DIABETES: ANY GIVEN DAY...

Prevalence: 8-10% of diabetics have a DFU right now
Providers/Hospitals/Payers are Challenged by Treating Wounds

• By having an outpatient Wound Healing Center, the problems of treating difficult and expensive wounds can be helped

• The Advisory Board estimated that inpatient wounds were costing hospitals on average:
  • Four additional days per discharge
  • 7.2% increase in mortality discharges
  • $5,423 additional costs per discharge

• Often, a transfer to an outpatient wound healing center may lead to reduced lengths of stay and costs
• Care will be regular on a weekly basis for visits to reduce complications and readmissions
• Care is coordinated with all providers on an outpatient basis

including Home Health Nurses, dressing companies, PCP’s
By the Numbers...

- Chronic wounds affect 6.5 million Americans per year at a treatment cost of $25 billion per year.
- Additional $39 billion in lost wages per year.
- $15.3 billion estimated expense on wound care products in 2010.
If Diabetes Mellitus was a Country...

Population Density (B), 2014

- Brazil: 0.203
- Indonesia: 0.237
- US: 0.319
- Diabetica: 0.347
- India: 1.26
- China: 1.26

‘DIABETICA’
“Diabetes has increased dramatically over the past 20 years. That proves that diabetes is caused by global warming!”
Diabetes-related complications, including amputations, lower-extremity neuropathies and premature cardiovascular disease are a major cause of chronic wounds.
Consequences...

DFUs increase the risk of lower extremity amputation: 15-46%
The Potential Impact Of A Diabetic Foot Ulcer
LOSE A LIMB...LOSE A LIFE

- There are nearly 2 million people living with limb loss in the US—most commonly due to PAD and DM
- 5 year mortality after amputation ~ 50%
- 3 x > breast cancer
- 6 x > prostate cancer
- 55% of diabetic amputees will require amputation of the second leg within 3 years
AMPUTATIONS’ MORTALITY RATES COMPARE TO CANCER

Patients with amputations and diseases related to diabetes die at a rate as high as many cancers.

Five-Year Mortality Rates

<table>
<thead>
<tr>
<th>Condition</th>
<th>Cancer Rate</th>
<th>Diabetic related amputations Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>Pancreatic Cancer</td>
<td>97</td>
<td></td>
</tr>
<tr>
<td>Lung Cancer</td>
<td>86</td>
<td></td>
</tr>
<tr>
<td>PAD</td>
<td>64</td>
<td></td>
</tr>
<tr>
<td>Ishemic Ulcer</td>
<td>55</td>
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<tr>
<td>Colon Cancer</td>
<td>48</td>
<td></td>
</tr>
<tr>
<td>Amputation</td>
<td>47</td>
<td></td>
</tr>
<tr>
<td>Neuropatic Ulcer</td>
<td>45</td>
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<tr>
<td>Hodgkins</td>
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</tr>
<tr>
<td>Breast Cancer</td>
<td>18</td>
<td></td>
</tr>
<tr>
<td>Prostate Cancer</td>
<td>18</td>
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</tr>
</tbody>
</table>

Sadly, 30% of chronic wounds left untreated result in amputation; over 47% of amputees die within five years.
This Is Not Okay
We Know the Causes...

**DFU Pathophysiology**

![Diagram showing the pathophysiology of DFU](image-url)
Glycemic Control vs Amputation

Twofold increase risk of leg ulcers including gangrene in Diabetic individuals with higher blood glucose levels vs lower blood glucose levels

Statistically significant increased amputation risk in these Diabetic individuals with higher blood glucose levels vs lower blood glucose levels

What is a Chronic Wound?

• “An insult or injury that has failed to proceed through an orderly and timely repair process to produce anatomic and functional integrity”
NORMAL WOUND HEALING

Cellular Activity

Chemotactic Migration
Mitosis
Angiogenesis
Synthesis of ECM
Inflammation
Proliferation
Remodeling
Proteolytic Turnover of ECM
Chronic Wound Delayed Healing

Repeated Trauma
Local Tissue Ischemia
Necrotic Tissue
Heavy Bacterial Burden
Tissue Breakdown

Degrades ECM
• impaired cell migration
• impaired connective tissue deposition

Degrades Growth Factors

Prolonged Inflammation
Stimulation of macrophage and neutrophils to wound bed

Activation of macrophages with release of cytokines

↑ Production MMPs and ↓ TIMPs

TNFα and IL-1β
DIABETIC ULCER

Location: typically, plantar aspect of the foot beneath a bony prominence

Appearance: ill-defined borders, prominent callus, and palpable pulses
Diabetic Ulcer
“Seven Elements of Standard Wound Care”:

Assessment of patient’s vascular status and documentation of correction of any vascular problems in affected limb, if possible

Optimization of nutritional status

Optimization of glucose control

Debridement by any means to remove devitalized tissue

Maintenance of a clean, moist wound bed of granulation tissue with moist dressings

Appropriate off-loading

Necessary treatment to resolve any infection that might be present

Wagner Scale

**Grade 3** – Lesion has penetrated deeper than grade 2 and there is abscess, osteo, pyarthrosis, plantar space abscess, or infection of the tendon and tendon sheaths

**Grade 4** – Wet or dry gangrene in the toes or forefoot

**Grade 5** – Gangrene involves the whole foot or such a percentage that no local procedures are possible and amputation (at least at the BKA level) is indicated
DIABETIC FOOT WOUNDS: NEUROPATHIC VS ISCHEMIC
NEUROPATHIC
Loss of peripheral sensation

Typically seen in Diabetic patients

Lack of sensation over pressure points

Microtrauma

Tissue breakdown

Ulceration
ISCHEMIC
Compromised blood flow

Deprived oxygen to tissues

Discoloration and Necrotic tissue formation

“Punched out” appearance – well defined even Wound margins

Delayed capillary return

Hair loss

Atrophic skin / nail changes
"Whenever I complained that my feet were killing me, nobody believed me."
ARTERIAL ULCER
ARTERIAL ULCER

Location: distal lower extremity

Appearance: distinct margin (cookie cutter), with central necrosis in setting of PAD:

- Cool extremity
- Diminished /absent pulses
- Shiny skin /hair loss
FACTORS AFFECTING WOUND HEALING

Chronic Wound

Soft Tissue Infection
Systemic Illness
Osteomyelitis
Nutrition
Wound Environment

Perfusion
Oxygen
Pressure
Systemic Healing Ability
Compliance
Edema
Glycemic Control in Wound Healing

12 week randomized study from Boston Medical:

• Stressed importance of sustained blood glucose with Diabetic Wound Healing
• Elevated blood glucose (Hgb A1c) 15 % decreased incidence of healing with every 1% increase with HgbA1c
• Importance of HgbA1c monitoring
• Diet control is not just “controlling sugar”
• Goal is to control the entire metabolic syndrome including obesity, dyslipidemia and hypertension
• Multidisciplinary approach reinforced the importance of controlling blood glucose during wound healing
• Dietary recommendations i.e Protein dietary consumption 1.5-2 g/kg per day -may vary depending of wound type and renal status

"As you can see, your wife left a few messages reminding you to check your blood sugar."
CAUSES OF HYPOXIA IN WOUND HEALING

Key components of wound healing are all dependent on oxygen to function

Arterial Insufficiency
Diabetes – impaired microcirculation
ABI/TCOM/Vascular Studies
Smoking

Infection
Bacteria promote an oxygen

Dump
Edema
Compression required

Radiation tissue damage
Decrease in the quantity of blood vessels
ADVANCED THERAPIES
HYPERBARIC OXYGEN THERAPY (HBOT) DEFINITION

- The administration of 100% oxygen at greater than 1 atmosphere pressure absolute (ATA)
- Achieved in a chamber in which the whole body is instilled
- Only method of HBOT that is approved by CMS (Center of Medicare Service)
USING HBO THERAPY AS PART OF THE APPROACH

Hyperbaric Oxygen Therapy (HBOT) is a powerful adjunctive therapy, reimbursed by Medicare and most payers, that is indicated for 10-15% of patients with chronic wounds.

Medicare-Approved Non-Emergent Indications:

- Acute peripheral arterial insufficiency
- Acute traumatic peripheral ischemia
- Chronic refractory osteomyelitis
- Crush injuries and suturing of severed limbs
- Diabetic wounds of the lower extremities
- Osteoradionecrosis
- Compromised skin grafts
- Progressive necrotizing infection
- Soft-tissue radionecrosis

94% of diabetic foot ulcer patients treated with HBOT maintained an intact limb at 55 months post-treatment.
HYPOXIC TISSUE BENEFITS

- Restoration of microcirculation
- Decreased local edema
- Improved cellular energy metabolism
- Improved local tissue oxygenation
- Improved leukocyte-killing ability
- Improved effectiveness of antibiotics
Diabetic wounds of the lower extremity
Acute peripheral arterial insufficiency
Treatment of compromised skin grafts or flaps
Chronic refractory Osteomyelitis
Osteoradionecrosis
Soft tissue radionecrosis
Acute traumatic peripheral ischemia
Crush injuries and suturing of severed limbs
Progressive necrotizing infections
Gas gangrene
ADDITIONAL ADVANCED THERAPIES

- Debridement
- Advanced Dressing Selection
- Topical Growth Factors
- Compression
- Bioengineered Skin Substitutes
- Topical Antimicrobials
REFERRAL GUIDELINES FOR ADVANCED WOUND CARE
BENEFITS TO PATIENTS AS PART OF THE WOUND CARE CONTINUUM

• Faster healing and a shorter recovery period
• Limb salvage
• Restoration of health and mobility
• Improved quality of life
• Wound Care education to help patients understand their condition and prevent complications
What Can You Do?

- Recognize who is at RISK for chronic wounds
- Perform an accurate assessment of the WOUND and the PATIENT
- Implement PREVENTATIVE measures
- Nutritional support
- Surface offloading/ Skin protection
- Choose appropriate DRESSINGS
- Make prompt REFERRALS for wound care and HBOT
GUIDELINES FOR REFERRAL

- Full thickness wounds that fail to show significant improvement in 2 weeks or complete healing in 4 weeks
- All full thickness ulcers that involve tendon, ligament, bone and/or joint and/or are significantly infected
- Neuropathic ulcers in diabetic patients, especially those with accompanying foot deformity
- Any wound in a diabetic patient due to the compromised healing ability
- Ulcers in compromised patients
- Venous ulcers, especially those with arterial component or chronic lower extremity swelling
- Ulcers with significant ischemia
QUESTIONS?

AtlantiCare
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Wound Healing Center
A member of Geisinger

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