

# **HEALING BEYOND WOUND ORIGIN: Managing the Biological and Social Impediments to Healing**

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# Faculty Disclosures

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# Learning Objectives

- Analyze the impact of psychosocial factors – including patient compliance – on wound care outcomes
- Examine the principles of effective wound treatment by addressing underlying etiologic factors and focusing on management of healing impediments rather than wound origin
- Analyze case outcomes addressing psychosocial factors and healing barriers, emphasizing their impact over wound origin

# **Social Determinants of Health**

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# Introduction: The Global Burden of Wounds

- Chronic wounds affect millions globally
- Impact: Morbidity, mortality, and reduced quality of life
- Examples: Diabetic foot ulcers (DFUs), pressure injuries (PIs), venous leg ulcers (VLUs), arterial ulcers
- High economic burden on healthcare systems and individuals
- Prevalence: Estimates vary, but chronic wounds affect millions of people annually in the U.S.
- Cost: Annual cost of wound care in the U.S. estimated at more than \$50 billion
- Impact: Can lead to amputation, sepsis, long-term disability, and social isolation

# Biological Determinants of Wound Care

Understanding how biological processes influence wound healing outcomes

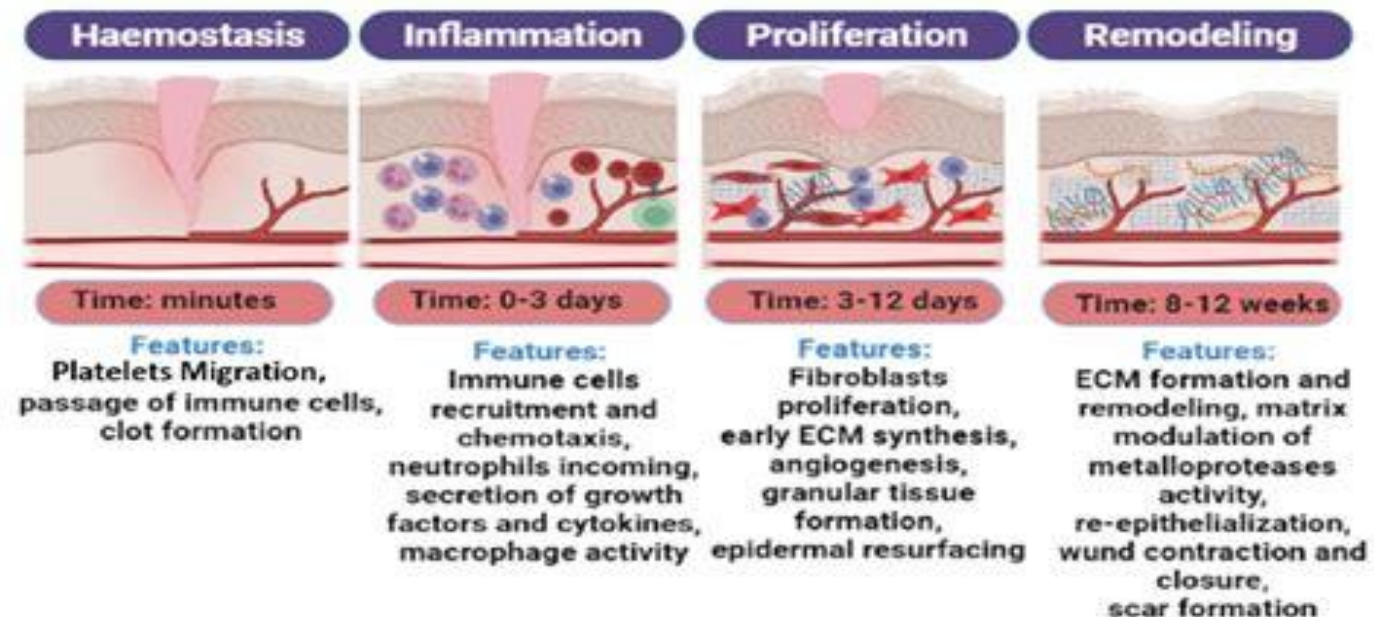


# Introduction to Biological Determinants

Wound healing is a dynamic process influenced by

- Inflammation control
- Cellular proliferation
- Collagen synthesis and remodeling
- Oxygenation and angiogenesis

These determinants shape healing speed and patient outcomes



# Key Cellular and Molecular Players

- Fibroblasts → Collagen synthesis and ECM
- Keratinocytes → Epithelialization
- Endothelial cells → Angiogenesis
- Macrophages and neutrophils → Immune response
- Growth factors (VEGF, PDGF, TGF- $\beta$ ) → Regeneration

# Systemic Biological Factors

- Age → Slower healing, reduced vascularity
- Diabetes → Impaired immunity and angiogenesis
- Nutrition → Protein, vitamins and zinc critical
- Oxygenation → Hypoxia delays repair
- Comorbidities → Vascular disease, chronic infections



# Clinical Implications and Future Directions

Understanding these determinants enables

- Better patient stratification
- Personalized wound care strategies
- Optimized treatment choices

Emerging therapies

- Biologic skin substitutes
- Stem cell therapies
- Gene-modulated growth factors

# What Are Social Determinants of Health (SDOH)?

- Definition: The non-medical factors that influence health outcomes
- The conditions in which people are born, grow, live, work, and age
- Shaped by money, power, and resources at global, national, and local levels
- Key categories: Economic stability, education access and quality, healthcare access and quality, neighborhood and built environment, social and community context

# SDOH and Their Connection to Health Outcomes

- SDOH are fundamental drivers of health disparities across various diseases and conditions
- Influence health through multiple pathways: Exposure to risk factors (eg, poor housing → infections, lack of healthy food → chronic disease)
- Access to protective factors (eg, good education → health literacy, safe neighborhoods → physical activity)
- Stress and biological responses: Chronic stress from insecure living conditions impacts the body's systems
- These factors often compound, creating a cycle of poor health

# Why SDOH Matter in Wound Care

- Wound development and healing are profoundly influenced by social context
- SDOH impact
  - Risk of wound development (eg, homelessness and pressure injuries; lack of access to diabetes care and DFUs)
  - Progression of wounds (eg, poor nutrition delaying healing; lack of transportation preventing follow-up)
  - Adherence to treatment (eg, inability to afford dressings; lack of understanding of complex regimens)
  - Preventive behaviors (eg, inability to afford proper footwear for diabetic patients)
  - Wounds can be seen as “sentinels” – indicators of underlying social and economic inequities

# Economic Stability and Wound Care: Income and Poverty

- Low-income status limits access to nutritious food, safe housing, and essential medications; impairs ability to afford over-the-counter wound care supplies or co-pays for specialist visits
- Food insecurity directly impacts protein and micronutrient intake essential for healing
  - People who live in poverty are disproportionately affected by chronic disease, like diabetes and cardiovascular disease, which are precursors to many wounds
  - Malnutrition is prevalent in vulnerable populations, directly impairing immune function and tissue repair

# Economic Stability and Wound Care: Employment Status

- Unemployment or precarious employment often means no health insurance or limited benefits
- Lack of paid sick leave or inability to take time off for appointments leads to delayed care
- Physically demanding jobs can contribute to wound risk (eg, standing for long periods for venous ulcers, repetitive strain injuries)
- Loss of income due to disability from a wound creates a vicious cycle

# Economic Stability and Wound Care: The Cost of Wound Care

- Direct costs: Specialist visits, surgical procedures, advanced dressings, antibiotics, hospitalization
- Indirect costs: Lost wages, transportation to appointments, caregiving burden on family
- A single DFU hospitalization can cost tens of thousands of dollars; average cost of treating a chronic wound over time can run into hundreds of thousands

# Education Access and Quality: Health Literacy and Wound Care

- Low health literacy impairs understanding of wound care instructions, medication regimens, and early warning signs of complications
- Difficulty navigating complex healthcare systems and insurance paperwork impacts shared decision-making with healthcare providers
- Estimates suggest nearly 9 out of 10 adults have difficulty understanding and using everyday health information

# Education Access and Quality: Education Level and Lifestyle Choices

- Higher education levels are often correlated with better health outcomes due to increased awareness of healthy behaviors (eg, diet, exercise)
- Greater access to resources and information
- Higher income, enabling healthier choices
- Conversely, lower education can limit understanding of chronic disease management, contributing to conditions that cause wounds (eg, uncontrolled diabetes, vascular disease)

# Education Access and Quality: Parental Education and Childhood Health

- Parental education level influences childhood nutrition, access to early healthcare, and adoption of healthy habits
- Early life exposures (eg, childhood obesity, poor nutrition) can set the stage for chronic disease later in life, increasing wound risk, and can create a generational cycle of health disparities

# Healthcare Access and Quality: Access to Healthcare Services

- Geographic barriers: Patients in rural areas may lack local wound care specialists or clinics
- Transportation issues: Inability to get to appointments due to lack of a car, public transit, or funds for taxis
- Clinic hours
  - Inflexible hours can prevent working individuals from attending
  - Long wait times for appointments

# Healthcare Access and Quality: Health Insurance Coverage

- Lack of insurance or inadequate insurance leads to delayed or forgone care
- Patients may avoid necessary specialist visits, advanced dressings, or medications due to high out-of-pocket costs
- Can prevent access to preventive screenings that could detect underlying conditions early
- Uninsured individuals are less likely to receive timely medical care and more likely to have poor health outcomes

# Healthcare Access and Quality: Quality of Care and Culturally Competent Care

- Disparities in treatment protocols: Some populations may receive less aggressive or up-to-date treatments due to implicit bias or systemic issues
- Lack of culturally competent care: Healthcare providers who don't understand cultural beliefs or language can lead to mistrust, poor communication, and non-adherence
- Importance of patient-centered care that respects individual values and traditions

# Healthcare Access and Quality: Supply Chain Issues and Availability of Resources

- Availability of specific wound care products (eg, advanced dressings, negative pressure wound therapy units) can vary by region or facility
- Drug shortages, particularly antibiotics, can impact infection management for wounds
- Rural hospitals or clinics may have limited resources compared to urban centers

# Neighborhood and Built Environment: Housing and Homelessness

- Homelessness drastically increases risk of pressure injury, cellulitis, and chronic wounds due to
  - Lack of clean water and sanitation for wound hygiene
  - Inability to rest and elevate limbs
  - Poor nutrition
  - Exposure to extreme weather
  - Difficulty storing medications and dressings
  - Unstable or substandard housing (eg, mold, pests, unsafe stairs) can contribute to injuries and hinder healing

# Neighborhood and Built Environment: Access to Healthy Food (Food Deserts)

- Living in a “food desert” (area with limited access to affordable, nutritious food) leads to reliance on processed, calorie-dense, nutrient-poor foods
- Poor nutrition directly impairs wound healing, as adequate protein, vitamins (C, A, Zinc), and minerals are crucial for tissue repair and immune function
- Contributes to chronic diseases like obesity and diabetes, which are major risk factors for wounds

# Neighborhood and Built Environment: Environmental Hazards

- Exposure to pollution (air, water) can worsen inflammatory conditions and impair immune response, indirectly affecting wound healing
- Unsafe living environments
  - Exposure to toxins, pests, or lead
  - Lack of safe spaces for physical activity (eg, parks, sidewalks) contributes to sedentary lifestyles and obesity
  - Crime and violence in neighborhoods can lead to stress and direct injuries

# Neighborhood and Built Environment: Transportation

- Lack of reliable, affordable transportation is a significant barrier to accessing timely wound care appointments, specialist referrals, and pharmacies
- Can lead to missed follow-up appointments, delayed dressing changes, and non-adherence to treatment plans
- Especially challenging for elderly, disabled, or low-income individuals

# Social and Community Context: Social Cohesion and Support Networks

- Strong social support (family, friends, community) can improve adherence to treatment, provide practical assistance (eg, help with dressing changes, transportation), and offer emotional encouragement
- Social isolation and loneliness are linked to poorer health outcomes, including slower wound healing due to increased stress hormones and inflammation
- Lack of social support can lead to depression and reduced motivation for self-care

# Social and Community Context: Discrimination and Racism

- Experiences of discrimination (racial, ethnic, gender, LGBTQ+, disability) can lead to chronic stress, impacting physiological healing processes
- Can result in implicit bias in healthcare settings, leading to lower quality of care, less trust, and less adherence among marginalized groups
- Systemic racism affects access to education, employment, and housing, creating cumulative disadvantages

# Social and Community Context

## Language Barriers

- Patients with limited English proficiency can struggle to understand complex medical information, consent forms, and discharge instructions
- Can lead to misdiagnosis, incorrect self-care practices, and medication errors
- Reliance on untrained family members for translation can lead to inaccuracies and privacy breaches
- Impacts shared decision-making

# Social and Community Context: Stress and Chronic Disease

- Chronic stress (from financial insecurity, discrimination, unstable housing) leads to sustained activation of stress hormones (cortisol), which suppresses the immune system and delays inflammation resolution
  - Directly impairs wound healing
  - Increases susceptibility to infection
- Chronic stress also exacerbates conditions like diabetes and hypertension, which are major drivers of wounds

# Moving Forward: Screening for SDOH in Clinical Settings

- Integrate routine screening questions about housing, food security, transportation, and social support into patient intake
- Use validated screening tools (eg, PRAPARE, Accountable Health Communities)
- Train healthcare staff on how to ask sensitive questions and respond appropriately
  - Purpose: Identify patient needs beyond clinical symptoms to provide holistic care

# Moving Forward: Interventions at the Individual Level

## Connect patients with resources

- Community resources: Food banks, housing assistance programs, transportation services, legal aid
- Patient navigation services: Dedicated staff to help patients overcome barriers to care, schedule appointments, and coordinate services
- Tailored education: Providing wound care instructions in plain language, with visuals, and in preferred languages
- Motivational interviewing: To address adherence challenges

# Moving Forward: Interventions at the Community Level

- Community partnerships: Healthcare organizations collaborating with local non-profits, churches, and social service agencies
- Advocacy for local policy changes: Supporting initiatives for affordable housing, improved public transportation, and access to fresh food
- Community health worker programs: Utilizing trusted community members to bridge gaps between healthcare and community needs
- Mobile health clinics: Bringing wound care services directly to underserved populations

# Moving Forward: Policy and Systemic Changes

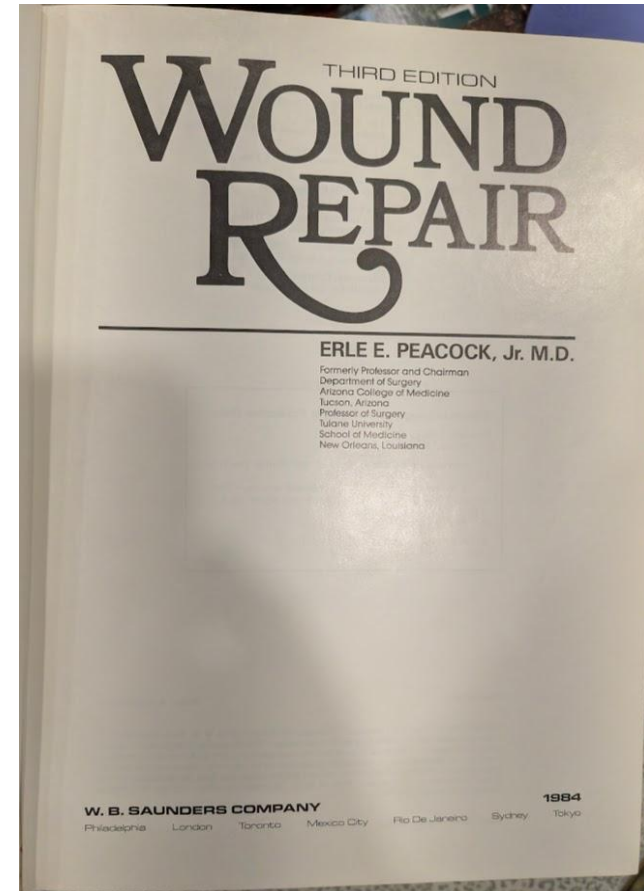
- Healthcare Reimbursement Models: Incentivize healthcare systems to address SDOH (eg, value-based care, accountable care organizations)
- Investment in Public Health Infrastructure: Strengthen public health departments to address social needs at a population level
- Cross-sector Collaboration: Encourage collaboration between healthcare, education, housing, and transportation sectors
- Legislation for Health Equity: Policies that reduce disparities in income, housing, and education

# Conclusion: A Holistic Approach to Healing

- Effective wound care demands a holistic perspective that extends beyond the clinic walls
- Addressing social determinants is not just good practice; it is a moral imperative for achieving health equity
- By understanding and acting on SDOH, we can improve healing outcomes, reduce healthcare costs, and build healthier, more resilient communities “healing wounds, healing lives, healing communities”

# Words of *Wound Repair* Wisdom

*“Again, critical analysis takes into consideration all of the other benefits which accrue to a wound treated by an allograft as compared to one that is allowed to epithelize or contract naturally.”*



# Managing the Biological and Social Impediments to Healing

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# Biological Impediments to Healing

- Vascular
  - Arterial
  - Venous
  - Lymphatic
- Infection
- Diabetes
- Neuropathy
- Nutrition
- Age
- Bioburden
- Systemic conditions
  - Gout
  - RA
  - HLA-B27
- Chronic kidney disease (CKD)
- Obesity
- Trauma/pressure
- Medications

# Biological Impediments to Wound Healing

- **Vascular (arterial, venous, lymphatic):** Decreased blood flow, hypoxia of wound bed
- **Infection:** Bacteria consumes nutrients, destroys tissue, toxins cause inflammation
- **Diabetes:** Compromises microcirculation, nerves, immune response, kidneys, eyes
- **Neuropathy:** Critical cause of DFUs
- **Nutrition:** Protein, vitamins (A,C,K), enzyme co-factors (zinc, copper, iron)
- **Bioburden:** Stalls the wound in the inflammatory phase
- **Systemic Conditions (gout, RA, HLA-B27):** May help to impede a wound's closure
- **Age:** Decreased collagen synthesis, immune response, vascular, thinner skin
- **CKD:** Can lead to anemia, calciphylaxis, impaired immunity
- **Obesity:** Increased fluid in tissues, impaired nutrient/waste exchange
- **Trauma/Pressure:** Tissue damage, pressure

# Psychosocial Barriers and Wound Barriers

- Non-compliance
- Non-adherence
- Smoking
- Non-compliance
- Stress
- Depression/anxiety/fear

- Non-compliance
- Pain
- Socioeconomic issues
- Substance abuse

# Biological Impediment to Wound Healing: Vascular



# 56y Male with Diabetes, PVD Presents with Non-Healing Wounds and Threat of Below-Knee Amputation



PVD = peripheral vascular disease.

# 56y Male with Diabetes, PVD Presents with Non-Healing Wounds and Threat of Below-Knee Amputation

- Post debridement and application of CVUT, CVAM, and NPWT



# One Month Later...



# Continued Progress...



# Closed in 5½ Months



# Biological Impediment... Addressed



# 52y Male with Diabetes Referred for Hallux Amputation

- Etiology: diabetes  
biological impediment  
(vascular)



# Post Debridement

- Peripheral bleeding, application of CVCM (cryopreserved viable chorionic membrane)



CVCM = cryopreserved viable chorionic membrane.

# Post-Operative Hope...



# Time for a New Graft



# Angiogenesis and Tissue Regeneration



# Continued Tissue Regeneration



# Always Address Patient's Vascular Status/Impediment: You Can't Buy Toes on Amazon



# Biological Impediment(s)?



# 71y Female Presents with Non-healing Wounds of the Left Foot



# Biological Impediments: Vascular (Lymphatic) and Infection



# 2 Wks Post Debridement

- Wrapping of the foot and digits, cultures, and application of CVPM



# Progress...



# New Ulcerations Discovered...

- Initiate collagen with PHMB (polyhexamethylene biguanide)



PHMB = polyhexamethylene biguanide.

Wait for it...Wait for it...



**Closure!!!**



# Biological Impediments: Addressed



# Biological Impediments to Healing: Bioburden



# Clinical Bioburden

- Seen in 80% of treated wounds, helps to keep the wound in the inflammatory phase



# Debridement Is Critical



# Applying Native Collagen with PHMB to Control Bioburden



# Biological Impediment to Wound Healing: Bioburden... Addressed



# Biological Impediments to Wound Healing: Infection



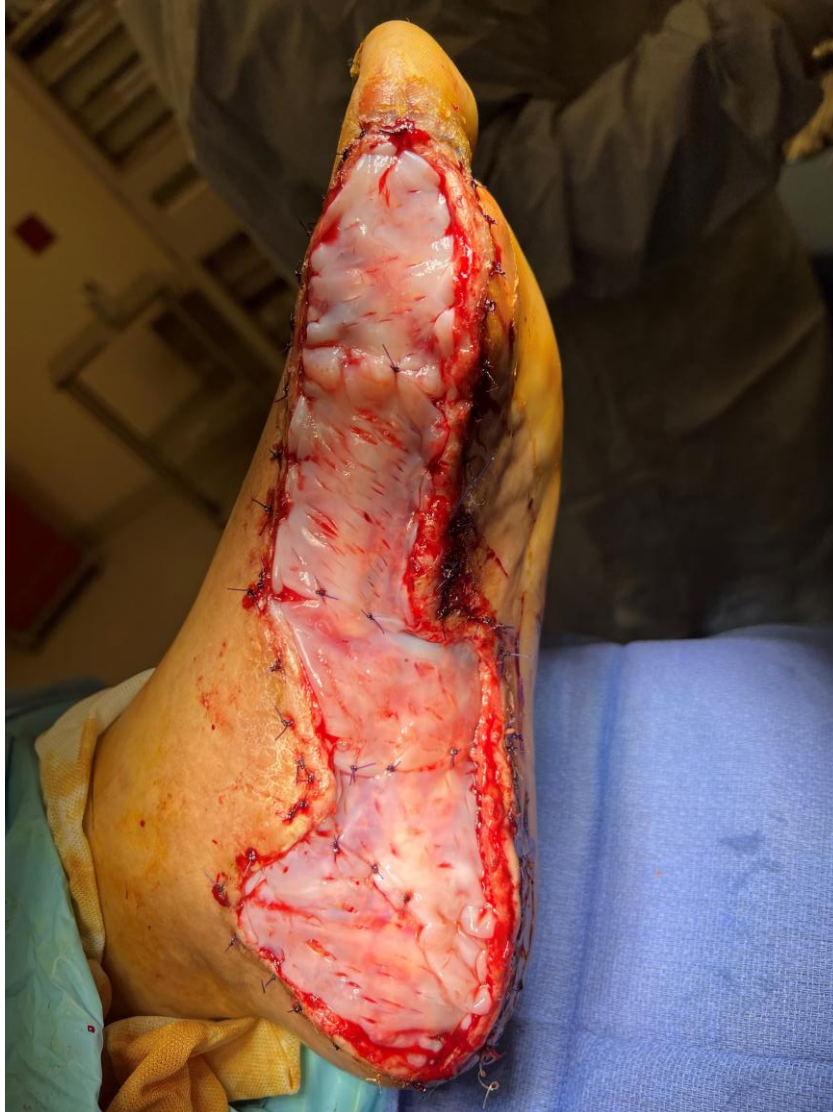
# Post Extensive Debridement of Necrotizing Fasciitis



# Use of NPWT with Instillation



# Application of CVUT with NPWT



# Application of Cellular Bioengineered Viable Fibroblast Graft



# Continued Progress...



# Application of Acellular Collagen with PHMB to Address Residual Biological Bioburden





# Progression to Closure



# Biological Impediment(s): Infection and Bioburden Addressed



# Biological Impediment to Healing: Pressure



# Post Application of CVAM



# Progress: Second Application of CVAM



# Progression to Closure



# Offloading Is Critical...



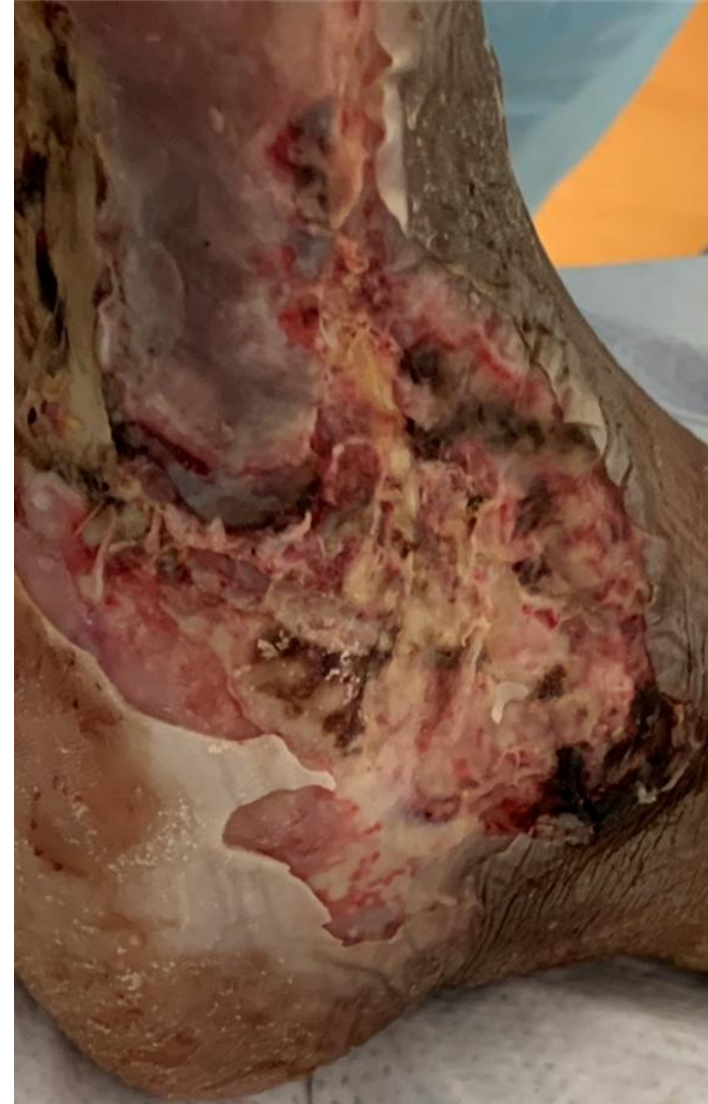
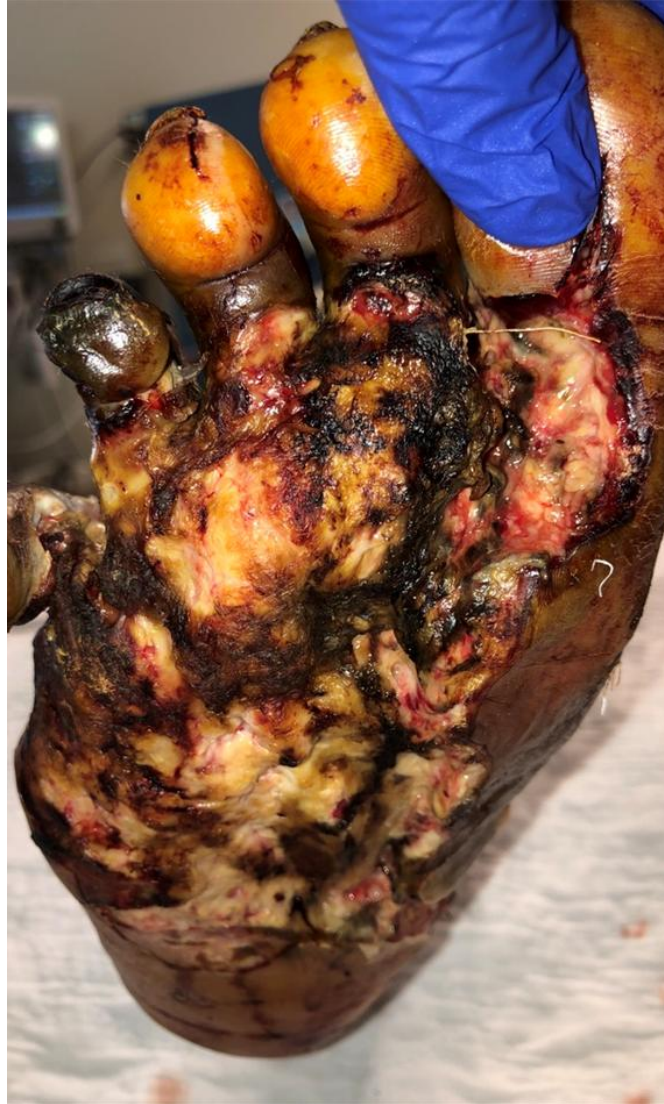
# Biological Impediment: Pressure... Addressed

- Multi Podus boot



# Biological Impediments to Healing

- Infection
- Bioburden
- Pressure
- CKD
- Diabetes



# Post Application of NPWT with Instillation



# Post Application of CVUT and NPWT



# Making Great Progress... Until...



# Until Pressure... AND Bioburden Developed

- The extended care facility's dressing strangulated her hallux



# Migrating the Viable Tissue from the Dorsum of the Toe to the Area of the Deficit Utilizing CVAM and CVCM



# Application of Native Collagen with PHMB to Address the Bioburden



# Back to Progress...



# Continued Regeneration of the Hallux Tissue and Progress on the Remaining Ulcerations



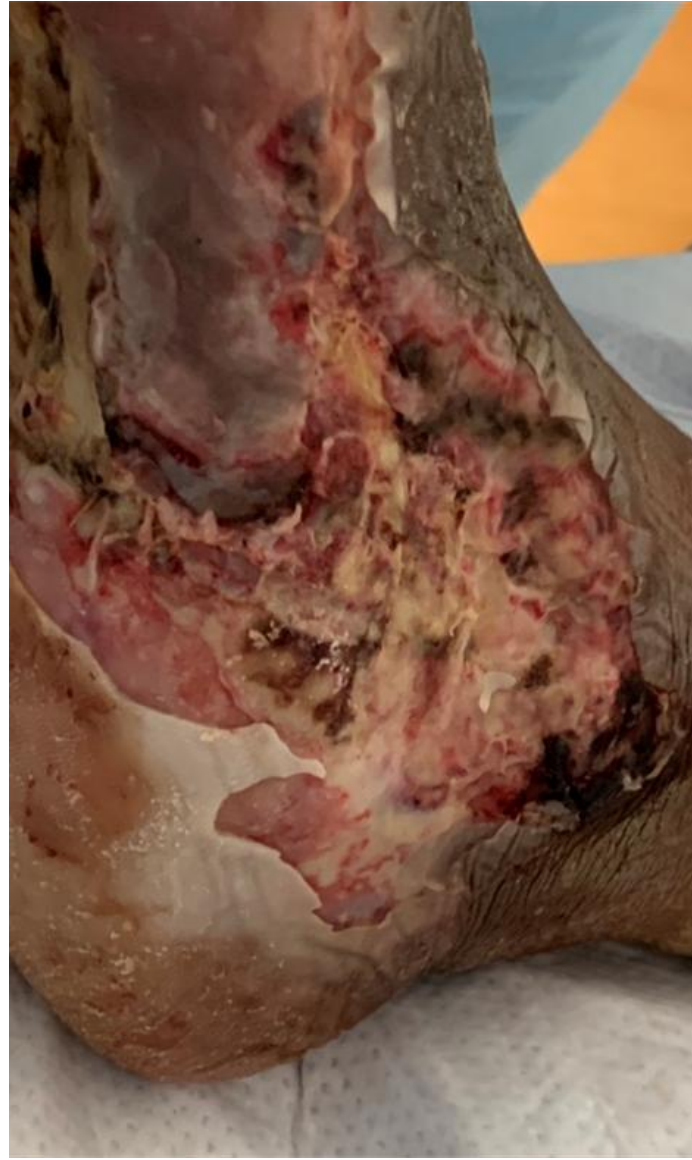
# Closure

- Despite infection, CKD



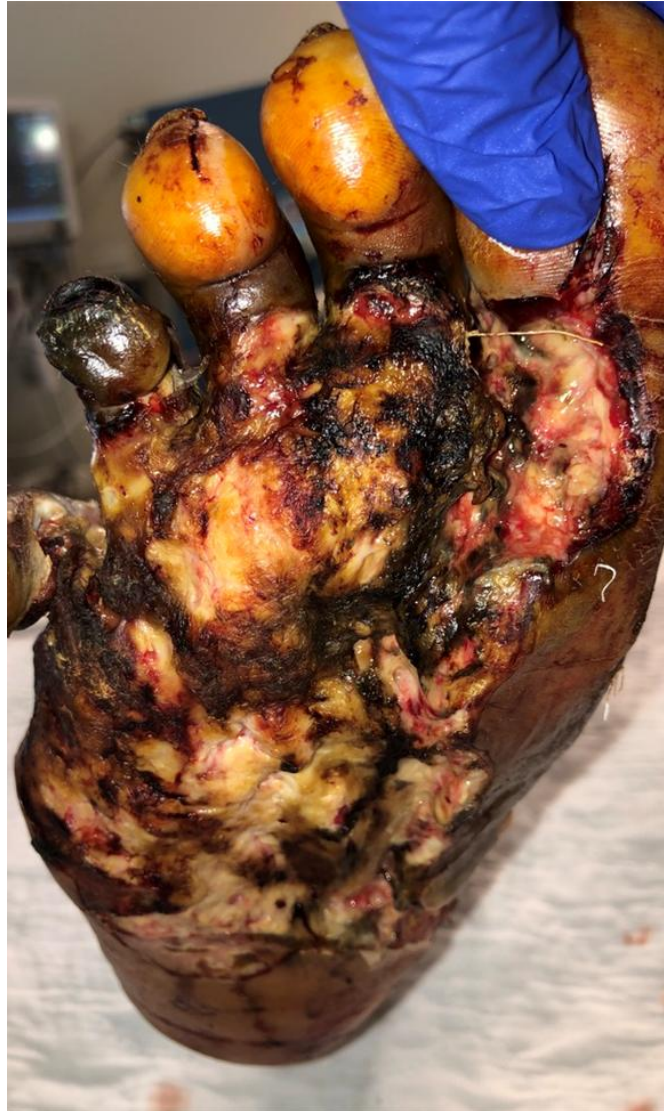
# Closure

- Despite bioburden



# Closure

- Despite pressure and diabetes
- Teamwork, the right tools, commitment, and compliance



# Biological Impediments to Healing: TRAUMA

- 27y Male with diabetes, post motorcycle accident



# Biological Impediments to Healing: TRAUMA

- Trauma ripped out metatarsals 1,2,3,4,5 plus all skin, neurovascular, and musculotendinous structures



# Biological Impediments to Healing: TRAUMA

- Scheduled for below-knee amputation at the first hospital's emergency department, then referred for a transmetatarsal amputation at our facility



# 1 Wk Post Debridement and Application of CVUT



8 Wks



12 Wks



14 Wks



16 Wks



**Closure!**



# Biological Impediment: TRAUMA... Addressed



# Biological Impediment to Healing: Gout



# Diagnosing Gout...



# 54y Male with Diabetes with Ulcerative Gout



# 4 Wks Post Debridement and Application of CVAM



# 11 Wks to Closure



# Considerations for Future Prevention: Allopurinol, Febuxostat, Pegloticase



# Biological Impediments to Healing: Nutrition

- Do diabetics eat well? Can the patient afford to buy food?
- Check albumin/globulin levels
- Key pearl: Primary co-factor of soft tissue healing?
- Vitamins C, A, K are important for collagen formation, epithelialization, and immune function
- Protein: Key for collagen synthesis and tissue repair
- Zinc, copper, iron: Key enzymes for collagen synthesis, immune function, and O<sub>2</sub> transport
- B Complex: Critical to address neuropathy
- Malnutrition: Leads to impaired cellular function and decreased tensile strength of new tissue

# Biological Impediment to Wound Healing: Neuropathy

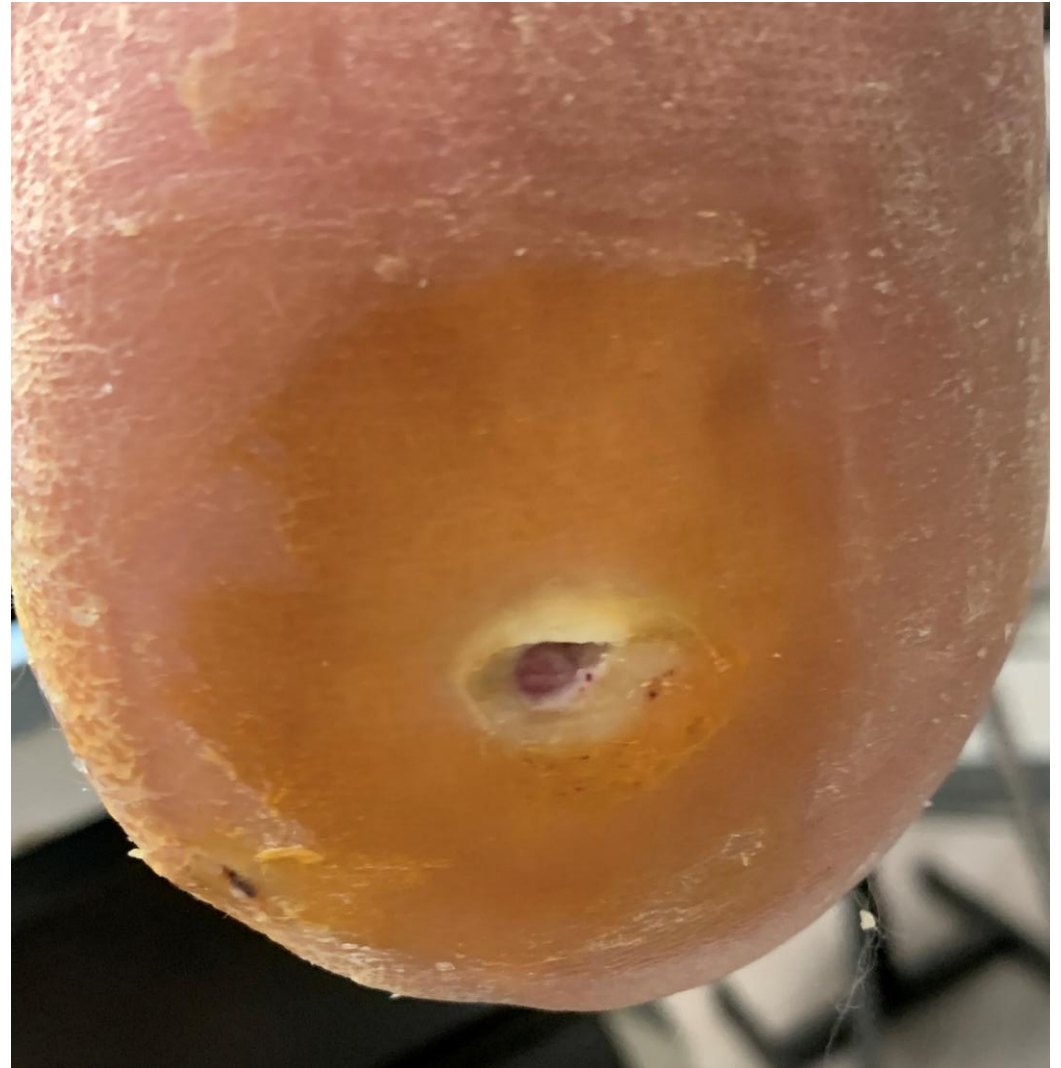
- 77y Male with diabetes presents with chief complaint, “I can’t take my shoe off”



# This Patient Has Been “Screwed”



# Post Debridement and Use of Collagen Matrix



**CLOSURE!**



# Key to Addressing Neuropathy: B Complex

- 7 out of 10 patients with diabetes have neuropathy
- 7 out of 10 people cannot break down OTC B complex (B1, B6, B12)
- Rule out additional possible causes of neuropathy
  - Radiculopathy
  - Neuropraxia
  - Alcohol
  - Chemotherapy
  - Infection (Lyme disease, shingles, HIV)
  - Autoimmune (RA, lupus, Sjogren's syndrome)
  - Hereditary (Charcot-Marie-Tooth)
  - Kidney and liver disease

# Psychosocial Impediments to Wound Healing

- **Non-compliance:** The patient doesn't listen
- **Non-adherence:** The patient makes a conscious choice not to listen
- **Smoking:** Affects circulation to the wound, heart, lungs, and extremities
- **Non-compliance:** The patient still doesn't listen
- **Stress:** Increased cortisol levels; suppresses immune response; prolonged inflammatory response
- **Depression/anxiety/fear:** Decreased quality of life; fear of not healing or limb loss
- **Non-compliance:** The patient becomes a full-fledged member of the NCAA
- **Pain:** Increased stress; decreased mobility; poor sleep; decreased appetite
- **Socioeconomic issues:** Limited access to nutritious food, housing, transportation
- **Substance misuse:** Impaired nutrition, decreased immune response, increased risk of infection

# Psychosocial Impediments to Wound Healing

**The N.C.A.A.**

# Psychosocial Impediments to Wound Healing

**The N.C.A.A.**

**(The Non-Compliant Association of America)**

# NCAA Officer

- “I tried to keep my bandage clean”



# Former NCAA President

- “I thought my appointment was one month, not one week!”



# NCAA President Emeritus

- “That’s the way they put this offloading dressing on.”



# Biological and Psychosocial Impediments Interacting Together and Exacerbating Each Other

## Neuropathy and Non-Compliance

- If the patient doesn't feel it, therefore it doesn't exist...
- If I don't feel pain in my foot, how can I possibly be hurting it?
- No pain...no gain

# Psychosocial Barriers to Wound Healing: Fear... Anxiety... Depression



# 56y Male with Diabetes, Amputee with Charcot, and Open Medial Wound and Exposed Tendon



# Post Application of CVUT



# Application of Collagen Matrix



# Application: Cellular Bioengineered Viable Fibroblast Graft



**Closure!**



# Limb Salvage via Cellular, Acellular, and Matrix-like Products (CAMPs)



CAMPs = cellular, acellular, and matrix-like products.

# Taking down Psychosocial Impediments: Teamwork, Commitment, Confidence, and CAMPs



# Psychosocial Impediment to Wound Closure: Substance Misuse



# Psychosocial Impediment to Wound Closure: Substance Misuse

- 50y Male with diabetes and a history of dorsal ulceration, secondary to drug injection into the dorsum of the foot



# Application of Collagen Matrix



# Closure...



# Making a Difference



# Clinical Pearls

- Before you use or “blame” a biological, be sure you prepare a wound properly and through a thorough history and physical, establish what biological and psychosocial factors exist in your patient’s everyday life
- Understand that treating not only the basic etiology of the wound, but the biological and psychosocial factors, are also critical to address
- Understand that some biological and psychosocial impediments interact and exacerbate each other causing complex challenges to closing wounds
- Realize that most of your patients belong to the NCAA (plan accordingly)
- Access available tools to address the Social Determinants of Health (finances, transportation access to food, work obligations, cost of medications, and more)
- Stress a proper diet, especially vitamin C 250-500 mg PO TID
- Neuropathy CAN be treated and needs to either have the patient break down OTC B complex or have the patient take a prescription B complex
- Work as a TEAM to address the biological and psychosocial factors to bring a wound to closure

**Questions?**

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**Thank You!**

**Evaluation Unlock Code**

**WOUNDCARE5**