

### Education

Brown University  
Providence, RI  
BA, BSc.

Harvard University  
Cambridge, MA  
Post Baccalaureate Curricula

Yale School of Medicine, Department of Epidemiology &  
Public Health  
New Haven, CT  
Master of Public Health

Howard University College of Medicine  
Washington, DC  
Doctor of Medicine

### Training

Fellowship in Diving and Hyperbaric Medicine  
Hospital of the University of Pennsylvania  
Department of Emergency Medicine  
Philadelphia, PA

Combined Residency in Internal and Preventive Medicine  
Yale New Haven Hospital and Griffin Hospital  
Derby, CT

Residency in General Surgery  
University of Connecticut  
Farmington, CT

### Clinical Expertise

Advanced wound care, hyperbaric & dive medicine, growth-factor technology, bioengineered skin grafting, non-invasive vascular testing, total contact casting, minimally invasive laser technology and more.

### Referrals Accepted

Rady Children's Hospital affiliates, Sharp HealthCare affiliates, Scripps affiliates, Palomar affiliates, Tri-City, Alvarado affiliates, VA affiliates.



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# Geriatrics/Psychiatry

## Wound Care Principals & Considerations



Caesar A. Anderson, M.D., M.P.H.  
Medical Director, UCSD Advanced Wound Healing  
& Hyperbaric Medicine, Encinitas CA.



# Disclosures

No relevant financial or commercial relationships.

## My Background

- General Surgery
- Combined Internal & Preventive Medicine
- Hyperbaric Medicine & Advance Wound Care



Triple Board Certified

# Goals and Objective

1. Discuss Key Wound Healing Clinical Principals.
2. Review Critical Elements Involved in Delayed Wound Healing.
3. Discuss Wound Management Options specifically related to Geriatric/Psychiatric/ Palliative population.
4. Review Variety of Related Wound Cases.



# Wound Case

- What's Needed to improve this wound?
- Complete H&P
  - 83 y/o, multiple fall history, A&O x 4, diabetic (HbA1c 8) afib
  - Skin tear 1 week ago
  - Seen in Urgent
  - Cultures negative



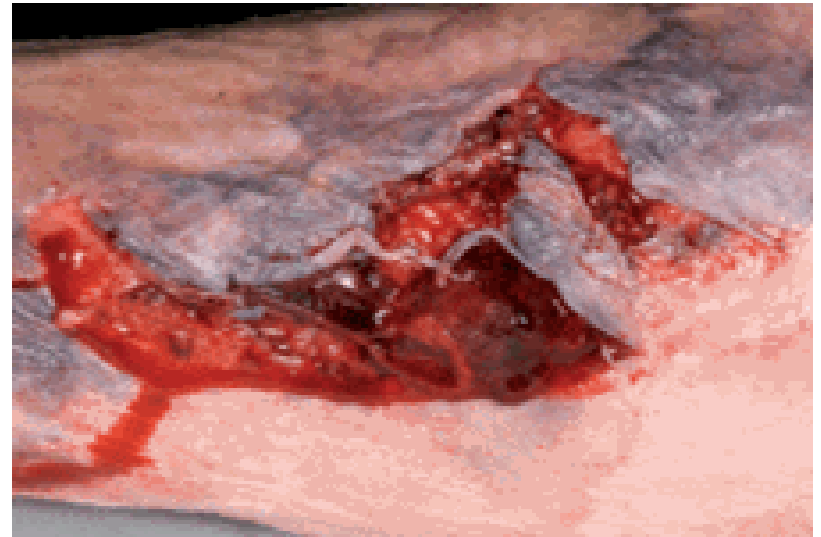
# SKIN TEARS



Category 1



Category 2



Category 3

# GERI SLEEVE



# The WOUND



- Wound Defined
  - Disruption of normal anatomic structure and function of skin.
  
- Wound Healing: Restoration
  - Anatomic continuity
  - **Functional restoration**





# WOUND BED DESCRIPTION



A. Biofilm



B. Slough



C. Normal granular base



D. Hypergranulation

# Scope of the Problem

- Venous leg ulcers (VSD)
  - Most common chronic wound
  - 10 times more common than PAOD
  - 2% of Venous Insufficiency pts develop ulcers
  - Affected 1.5% population with 50% having ulcers >10 years
- Pressure ulcers
  - 2.7-29.5% incidence in hospitalized patients
  - 9.2% prevalence
  - Total annual cost exceeds \$6.5 billion

# Scope of the Problem

- Diabetic Neuropathic Ulcers and LE Amputations
  - 25 million with DM in US
  - 25% will develop foot ulcer in their lifetime
  - 60% recurrent ulcers
  - 70% of all leg amputations in the diabetic
  - 85% of diabetic amputations preceded by foot ulcers

**FOCUS ON THE NEUROPATHY not ONLY GLUCOSE CONTROL**



# Stairway to Amputation



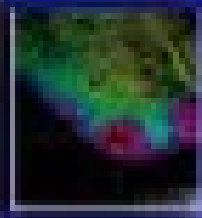
amputation



infection



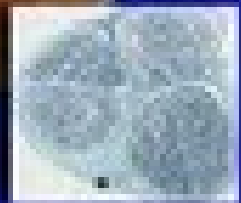
+/-  
vascular disease



ulceration



neuropathy



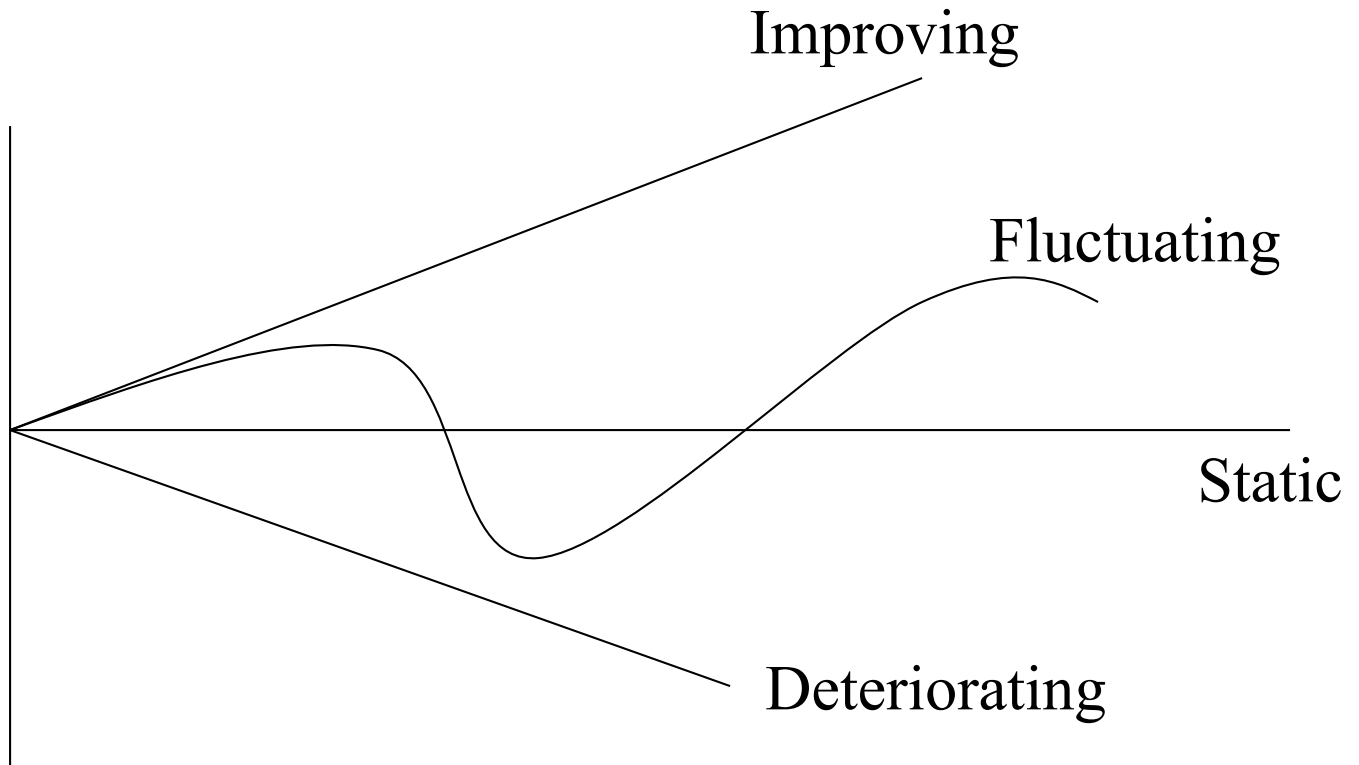
diabetes



# Wound Care Costs

- Estimated \$25 billion spent annually on chronic wounds which affect more than 6.5 million patients in the United States
- >8 million Americans would benefit from specialized wound care services
- Less than 1 million patients treated in a dedicated wound care setting.

# Wound Life Cycle



# Acute vs Chronic Wound

- ACUTE
  - Even distribution of growth factors
  - Upregulated PDGF receptors
  - Limited resistance to infection/bacterial contamination
- CHRONIC
  - Fails to proceed in an orderly and timely process to produce anatomic and functional integrity.
  - Downregulated PDGF receptors
  - Uneven distribution of GFs
  - Increased resistance to infection (not DM)

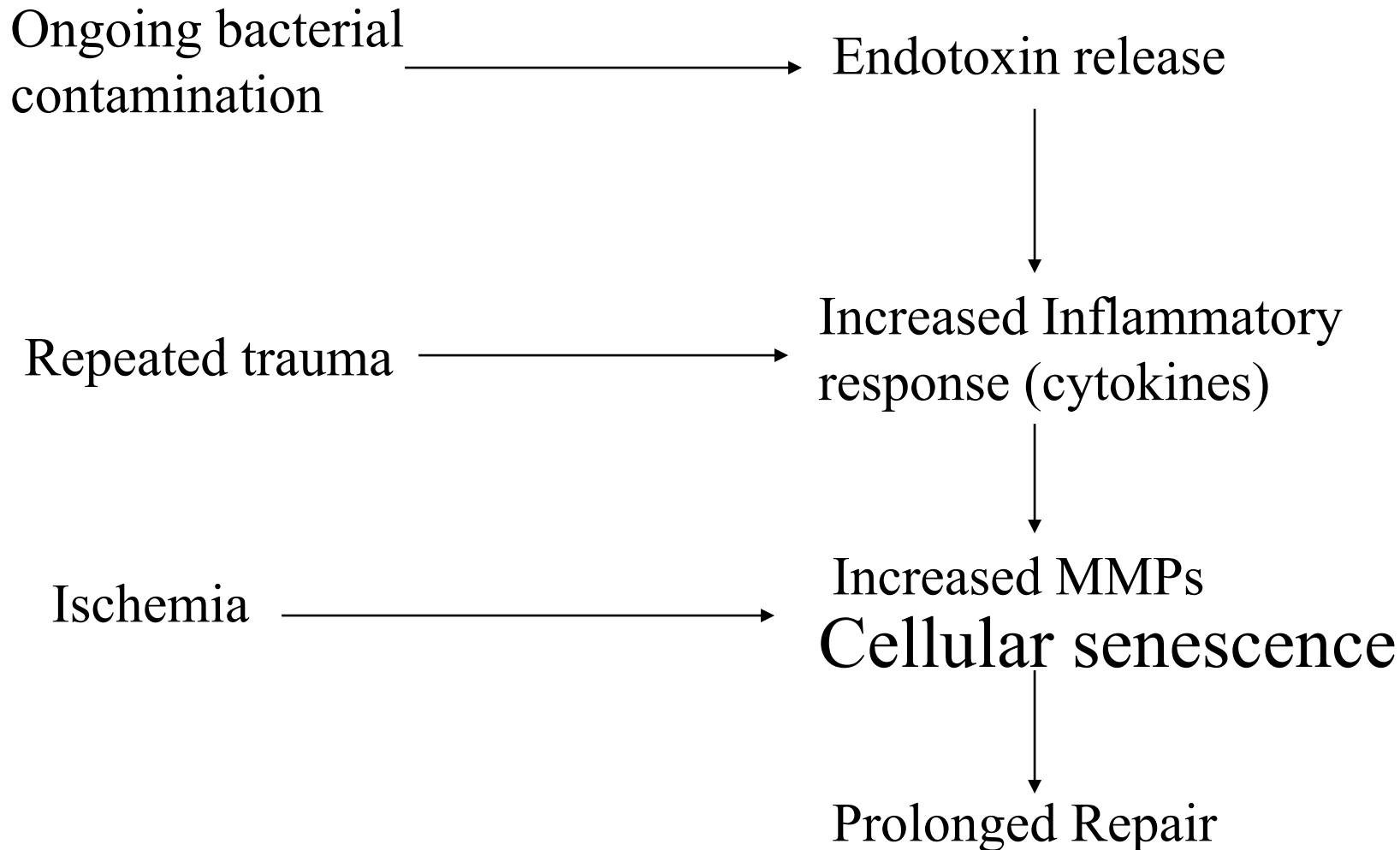
# Local Wound Factors

- Ischemia
- Infection
- Edema
- Scarring
- Radiation injury
- Topical steroids
- Local toxins
- Trauma, pressure
- Foreign bodies
- Local malignancy

# Systemic Wound Factors

- DM
- Smoking
- Pain
- Renal failure
- Nutritional deficiencies
- Hereditary disorders
- Alcohol use
- Distant malignancy
- Systemic infections
- Connective Tissue Disease
- Immunological disorders
- Chemotherapeutic agents
- Extremes of age
- Systemic steroids
- Hepatic failure

# Proinflammatory Contributors





# Wound Care 101: What does it encompass?

-Off loading efforts

-Edema control

-Pain control

-Limiting bacterial burden

-Nutrition

-Choosing the right agent

-Optimize vascular status

# Wound Case

- What's Needed to improve this wound?
- Complete H&P
  - 85 y/o female with Htn, CAD, dementia
  - Wound for >3 months
  - Afebrile
  - Non-smoker, No Etoh, No IVDA
  - Prealbumin 4
- Standard wound care elements?
  - Interdisciplinary team approach
  - Pressure off-loading (q2h turn, air mattress)
  - Nutrition supplement (?PEG)
  - When would you institute Moist Wound Care?
  - What type of dressing (antimicrobial, barrier)?
  - Surgical vs Enzymatic debridement ?
  - Use of betadine to temporize prior to debridement
  - Role for wound vac?
  - Any role or contraindication to HBO?














Sacral Pressure Injury

# Pressure Off-Loading

- Decubitus ulcers
  - Repositioning, mobilization, foam, gel, air mattress (Group 2 Air compression)
  - Avoid ring donut-type cushions (Crewe 1987): causes venous congestion and ulcer formation.
- Plantar foot surface ulcers
  - Complete bed rest
  - Wheel chair confinement
  - Total contact casting
  - Total contact splinting



	 Total Contact Cast	 CROW Boot	 Prefabricated Walker			 PostOp Shoe			 MABAL Shoe
 Dorsal Digit						●			
 Plantar Digit	●	●	●						●
 Plantar Metatarsal	●	●	●						●
 Medial Metatarsal	●	●	●						●
 Lateral Metatarsal	●	●	●						●
 Heel	●	●	●						●

# Wound Case

- What's Needed to improve this wound?
- Complete H&P
  - 75 y/o obese homeless male
  - LLE wound s/p trauma
  - BLE edema, prior LLE DVT and tibial fx
  - Notes BLE pain that wakes him
  - Multiple ER visits for cellulitis
- Standard wound care elements?
  - Edema/ Lymphedema Control
  - Vascular studies (ABI, TCOM, Angio)
  - Vascular Ablation Option
  - Debridement of biofilm
  - Antimicrobial dressing/ Dakins WTD qd
  - Preventative efforts (life long compression stockings/pump, leg level position, weight loss)



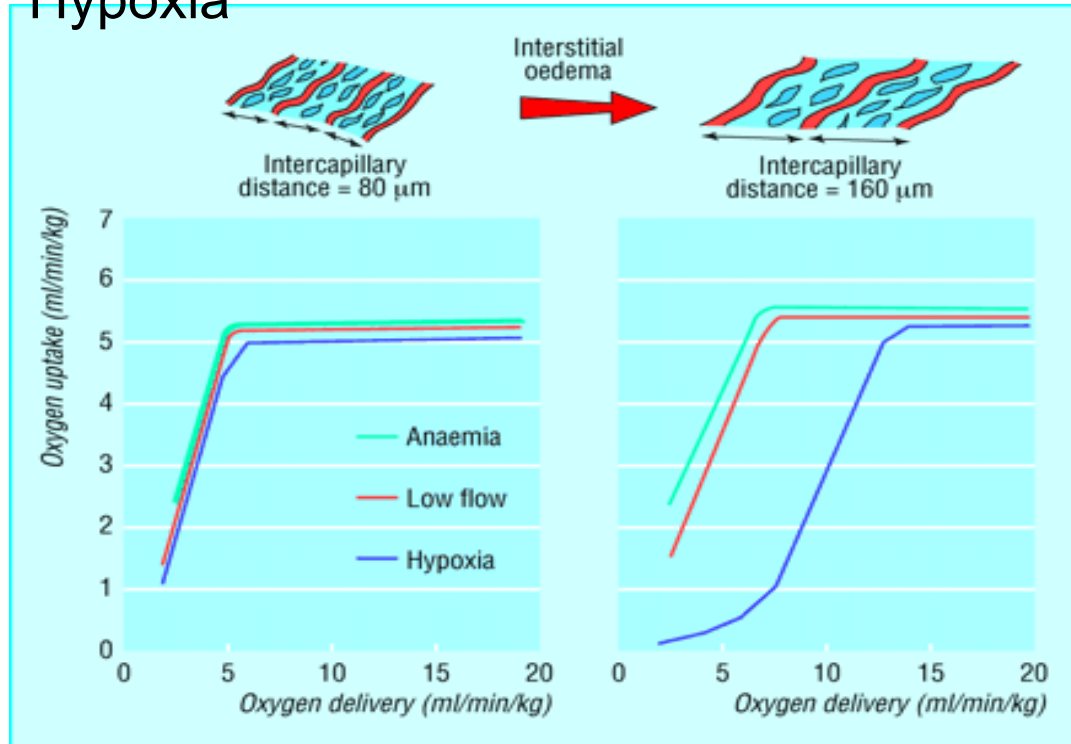
Venous Stasis Ulcer

# EDEMA CONTROL

- One of the most often neglected interventions
- Stemmer's sign: pinch dorsal toe skin
- Legs level position (Not above level of heart)
- Compression wraps/ Unna boot (If ABI > 0.7)



# Edema is Evil- Exacerbation of Tissue Hypoxia



Tissue edema and hypoxia synergize to reduce oxygen delivery and thus utilization.



# BENEFITS OF COMPRESSION

- **Edema Reduction**
  - Fluid shift into non compressed region
  - Improvement in lymphatic drainage
- **Effects on veins**
  - Increased venous blood flow velocity
  - Reduction of venous pooling
  - Improved venous pump function
- **Effects on microcirculation and cytokines**
  - Increase of shear stress
  - Release of anti-inflammatory mediators
- **Effects on arterial inflow**
  - Increased arterial flow once compression pressure below perfusion pressure



[Beidler SK, Douillet CD, Berndt DF, et al. Multiplexed analysis of matrix metalloproteinases in leg ulcer tissue of patients with chronic venous insufficiency before and after compression therapy. Wound Repair Regen 2008; 16:642.](#)

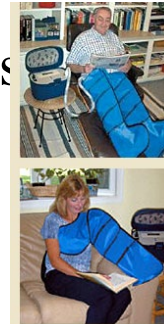
# Assess Vascular Supply

- Types of studies (ABI, angiograms)
- Arterial Duplex Evaluation
- TCOMs/ Sensilase Testing
- Optimize wound hypoxia/  
Hyperbaric Oxygen Therapy (HBOT)



# TYPES OF COMPRESSION

- Garments/ hosiery stockings
- Devices/ pumps for mechanical compression
- Elastic/ Inelastic (Unna boot)
- Single layer/ Multilayer (Profore)
- Systematic reviews/meta-analyses of randomized trials found that adding a component of elastic compression therapy results in faster ulcer healing compared with inelastic compression therapy alone.
- High compression appears to be more effective compared with low compression, and multilayer bandages are more effective for achieving the desired level of compression.

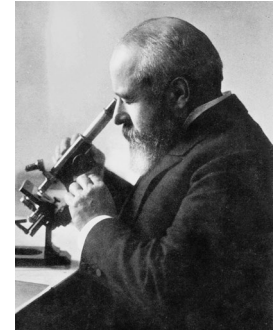


# CONSIDERATIONS IN CHOOSING COMPRESSION

- Level of pain
- Presence, condition, size of the venous ulcer
- Logistics related to type and frequency of dressing changes
- Patient compliance
- Local use and expertise
- Availability of resources (Home Healthcare, Non-physician specialists who can apply and reapply complex bandaging systems).

# UNNA BOOT THERAPY

- Inelastic compression therapy provides best compressor
  - no resting pressure
  - degree of compression decreases over wear time.
- Unna boot is the most common method of inelastic compression therapy
  - single-component moist bandage that is impregnated with calamine or zinc oxide (+/- glycerin)
  - hardens after application.



[Zarchi K, Jemec GB. Delivery of compression therapy for venous leg ulcers. JAMA Dermatol 2014; 150:730.](#)

[Mosti G, Partsch H. Inelastic bandages maintain their hemodynamic effectiveness over time despite significant pressure loss. J Vasc Surg 2010; 52:925.](#)

[de Araujo T, Valencia I, Federman DG, Kirsner RS. Managing the patient with venous ulcers. Ann Intern Med 2003; 138:326.](#)

# CONTRAINDICATIONS

- **Peripheral artery disease (PAD)** – Prior to compression, confirm absence of critical ischemia
  - Do a Peripheral Vascular Exam: maintain low threshold for arterial testing/ ABI
  - In diabetics, consider toe pressure (TBI > 0.6) or bilateral arterial duplex (potential for falsely elevated ABIs related to medial calcinosis).
  - ABI  $\leq 0.5$  proposed as an absolute contraindication to compression therapy.
- Study evaluated compression therapy in 25 patients with mixed ulcers found that arterial perfusion was not impeded with INELASTIC compression up to 40 mmHg, provided the ABI was >0.5 and the absolute ankle pressure was >60 mmHg.
- **Superficial or deep vein thrombosis (DVT)** – Caution regarding use of compression therapy in the setting of suspected or known acute lower extremity venous thrombosis.
- **Heart failure** – Be careful of fluid volume shifts affecting cardiac function.

[Mosti G, Iabichella ML, Partsch H. Compression therapy in mixed ulcers increases venous output and arterial perfusion. J Vasc Surg 2012; 55:122.](#)

[Mills JL Sr, Conte MS, Armstrong DG, et al. The Society for Vascular Surgery Lower Extremity Threatened Limb Classification System: risk stratification based on wound, ischemia, and foot infection \(WIFI\). J Vasc Surg 2014; 59:220.](#)

[Lattimer et al, 2012](#)

# LIFE LONG COMPRESSION



- Compression stockings (If ABI > 0.7)
- External sequential compression pumps



**HOW MUCH COMPRESSION SHOULD YOU WEAR?**

Graduated compression hosiery fits tighter at the ankle than at the knee or thigh. The compression decreases as the hose runs up the leg. Proper fit is essential, so take your measurements carefully, or call our Certified Fitters for assistance!

and healthy blood circulation. The measurement which is the most important is the blood pressure. The more compression you wear, the higher the compression, the more severe the condition.

<p><b>Mild</b> 8-15 mmHg</p> <p>Relieve tired/aching legs Reduce minor ankle/leg swelling Alleviate pain from mild varicose veins Improve circulation</p>	<p><b>Moderate</b> 15-20 mmHg</p> <p>Reduce mild/moderate leg swelling Relieve chronically tired/aching legs Treat early varicose veins (spider veins) Post-operative safeguard for minor surgery Reduce risk of Deep Vein Thrombosis (DVT) for normal risk patients/sedentary travelers</p>
<p><b>Firm</b> 20-30 mmHg</p> <p>Reduce moderate swelling/edema/leg pain Treat early varicose veins (spider veins, sclerotherapy, sclerotherapy recommendation) Reduce risk of Deep Vein Thrombosis (DVT) Treat mild Lymphedema</p>	<p><b>Extra Firm</b> 30-40 mmHg</p> <p>Treat chronic venous insufficiency Reduce severe swelling/edema Treat more severe varicose veins Relieve chronic leg fatigue &amp; heaviness Treat Moderate Lymphedema DVT/Postphlebotic Syndrome</p>
	<p><b>Severe</b> 40-50 mmHg</p> <p>For severe edema/Lymphedema/chronic venous insufficiency, in conjunction with management of open venous ulcers</p>

Always consult with your regular doctor!



# Debridement

- Transform CHRONIC to ACUTE
- Minimize biofilm
- Types of debridement
  - Autolytic
  - Enzymatic (fast acting, need secondary dsg, costly)
  - Biologic (maggot)
  - Surgical Sharp debridement
    - Topical Lidocaine (EMLA 2.5 - 5%: Seran wrap)
  - Mechanical debridement:
    - Whirl pool (maceration risk)
    - Pulsed lavage (site specific)
    - Wet to dry (>70% necrotic tissue, painful: avoid moistening when removing)



# Enzymatic Debridement Agents

- Collagenase
  - Santyl



- Papain-urea
  - Accuzyme, Gladase, Kovia

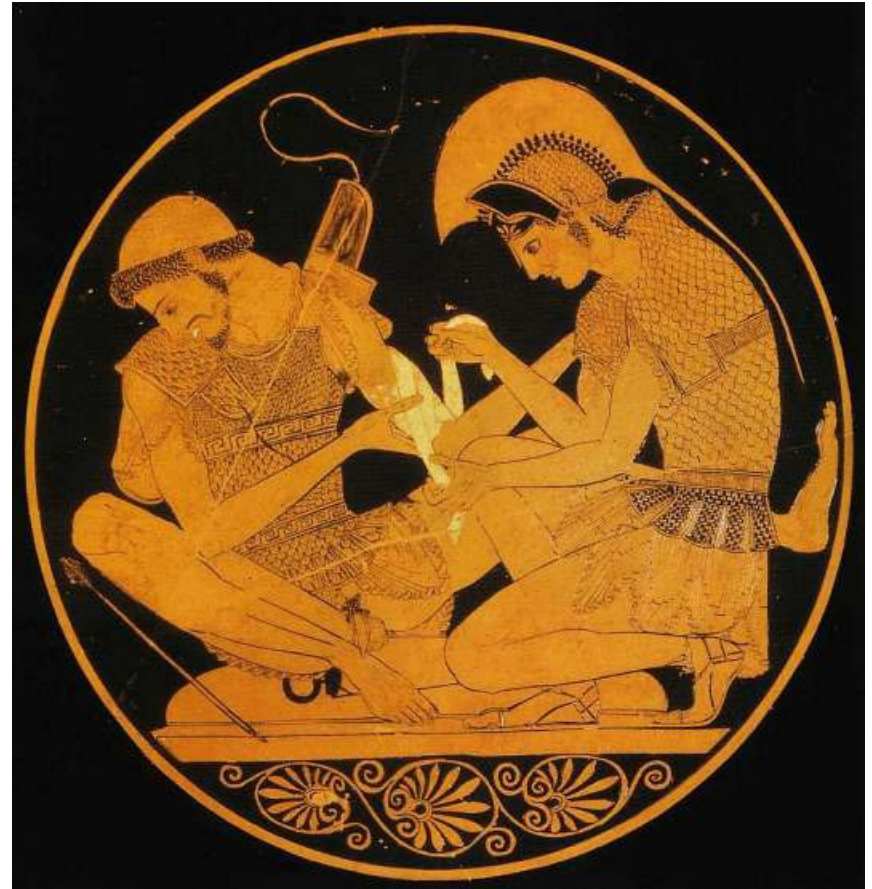


- Papain-urea with Chlorophyllin Copper
  - Panafil/Zioxx



# Choosing Wound Agents

- Evolution of Wound Agents
  - Ancient Greece
    - Cleanse, apply animal fat, wrap
  - Roman Empire
    - Cleanse, apply ashes, oil, herbs, and wrap
  - Middle Ages
    - Wax plus herbs or boiling oil
  - 1800s
    - Heat or ice
  - Early 1900s
    - Expose wound, apply tannic acid or variety of pigments to dry wound
  - 1950-present
    - Topical antibiotic
  - 1960-present
    - **Moist wound healing approach**
    - Nutrition status
    - Rapid wound closure with surgery



[Achilles](#) binding the wounds of his friend [Patroclus](#), from a c. 500 BC

# Moist Wound Environment

- Epithelialization
  - Keratinocyte proliferation
  - Keratinocyte migration
  - Keratinocyte differentiation
  
- Fibroplasia
  - Fibroblast proliferation
  - Collagen matrix synthesis

- Angiogenesis
  - Endothelial cell proliferation
  - New blood vessel formation





# Antimicrobial Agents



- Iodine-releasing agent
  - Iodosorb/Iodoflex
  - Some formulations have been shown to impede normal wound healing (in vitro)
  - Need concentration >1%
  - Cadexomer iodine preparations are safe, economical, and broadly effective

- DAKIN's Solution
- Acetic Acid



- Silver-releasing agent
  - Silver sulfadiazine (1%) widely used.
  - Newer ionic silver dressings may have dual efficacy
    - Acticoat/ Aquacel Ag
    - Antibacterial, antifungal
    - Reduction of MMP activity in Chronic Wound

Drosou A, et al. Wounds. 2003;15:149-165

Wright JB, et al. Wound Rep Reg 2002;10:141-151



# Antimicrobial Coverage

- Mupirocin (Bactroban)

## Mupirocin, Antibacterial Activity & Uses

### ❖ Antibacterial Activity

- Mupirocin is active against many gram-positive and selected gram-negative bacteria
- It has good activity with MICs of  $<1 \mu\text{g/ml}$  against *Streptococcus pyogenes* and methicillin-susceptible and methicillin-resistant strains of *S. aureus*
- It is bactericidal at concentrations achieved with topical application
- Mupirocin cannot be used for extended periods of time, or indiscriminately, as resistance does develop, and could, if it becomes widespread, destroy mupirocin's value as a treatment for MRSA

### ❖ Uses

- Mupirocin is available as a 2% cream and ointment for dermatologic use and as a 2% ointment for intranasal use
  - ❖ The dermatologic preparations are indicated for treatment of traumatic skin lesions and impetigo secondarily infected with *S. aureus* or *S. pyogenes*
  - ❖ The nasal ointment is approved for eradication of *S. aureus* nasal carriage. Mupirocin is highly effective in eradicating *S. aureus* carriage
    - Mupirocin is currently the world's most widely used topical antibiotic for the control of MRSA

- Xeroform (Bismuth)



Advanced Materials and their Applications - Micro to nano scale

1

## 1 ***Antimicrobial and Antibiofilm Activities of a Bismuth Lipophilic Nanoparticles Hydrogel against Methicillin-resistant Staphylococcus aureus biofilm***

Rene Hernández-Delgado<sup>1</sup>, Erika Cecilia Espinoza-Villarreal<sup>1</sup>, Casiano Del Angel-Mosqueda<sup>1</sup>, Osvelia Esmeralda Rodríguez-Luis<sup>1</sup> and Claudio Cabral-Romero<sup>1</sup>

<sup>1</sup>Universidad Autónoma de Nuevo León, UANL, Facultad de Odontología, Laboratorio de Biología Molecular, Monterrey, Nuevo León, México

### Outline

Introduction.....	2
Antimicrobial and antibiofilm activities of BisBAL NPs-Gel on MRSA .....	4
Characterization of the BisBAL NPs-Gel by SEM .....	5
Determination of MIC of BisBAL NPs-Gel on MRSA growth .....	6
Antibiofilm activity of BisBAL NPs-Gel on MRSA biofilm .....	7
Cytotoxicity of BisBAL NPs-Gel on Human Gingival Fibroblasts (HGFs).....	9
Conclusion.....	9
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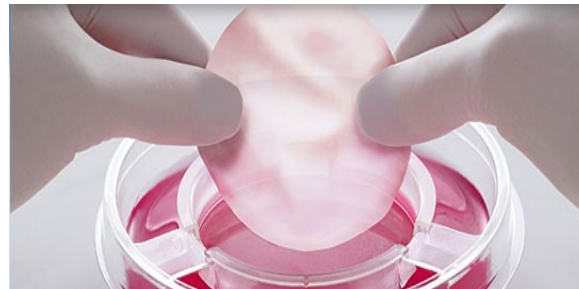
# SKIN CANCER DETECTION

- Diabetic Neuropathic Ulcers and LE Amputations
  - Most common risk factor for both non-melanoma and melanoma skin cancer is chronic UV light exposure
  - Skin cancer can mimic appearance of chronic wound
- Consider Wound Biopsy if:
  - Wound cause uncertain
  - Wound at post surgical site for malignancy (mastectomy incision line)
  - Skin subject to long standing chronic inflammation.



# Advanced Adjunctive Modalities

- Negative Pressure Wound VAC therapy
  - Promote granulation tissue formation
  - Avoid on bone/ tendon/ prior malignancy wounds
- Cellularized Tissue products
  - Optimize growth factor availability for healing
- Human Cadaver Scaffold grafts
  - Provide wound healing scaffold
- Hyperbaric Oxygen Therapy(HBOT)
  - Stimulate angiogenesis, fibroplasia
  - Down regulate inflammation, infection.





# Wound Case : Chronic Calvarium Exposure



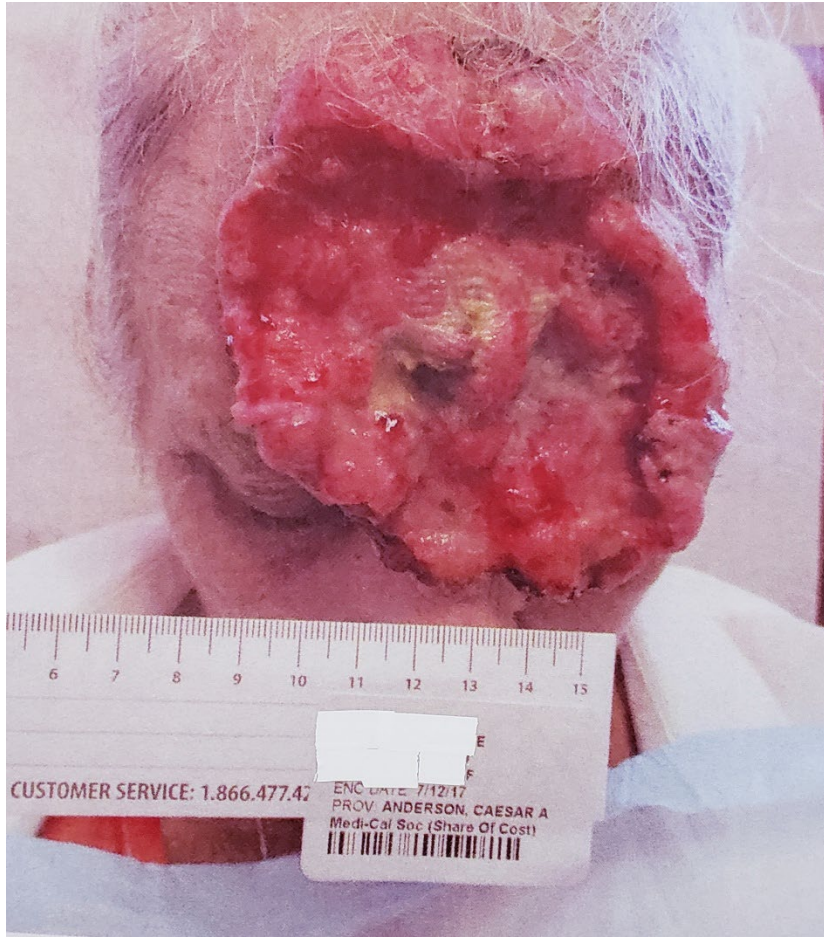
# Wound Case :

## Palliative Basal Cell Carcinoma

- H&P
  - 68 y/o female w/basal cell on forehead
  - No medical care for over 10 years



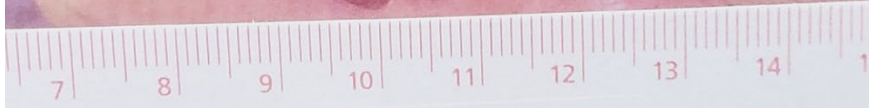
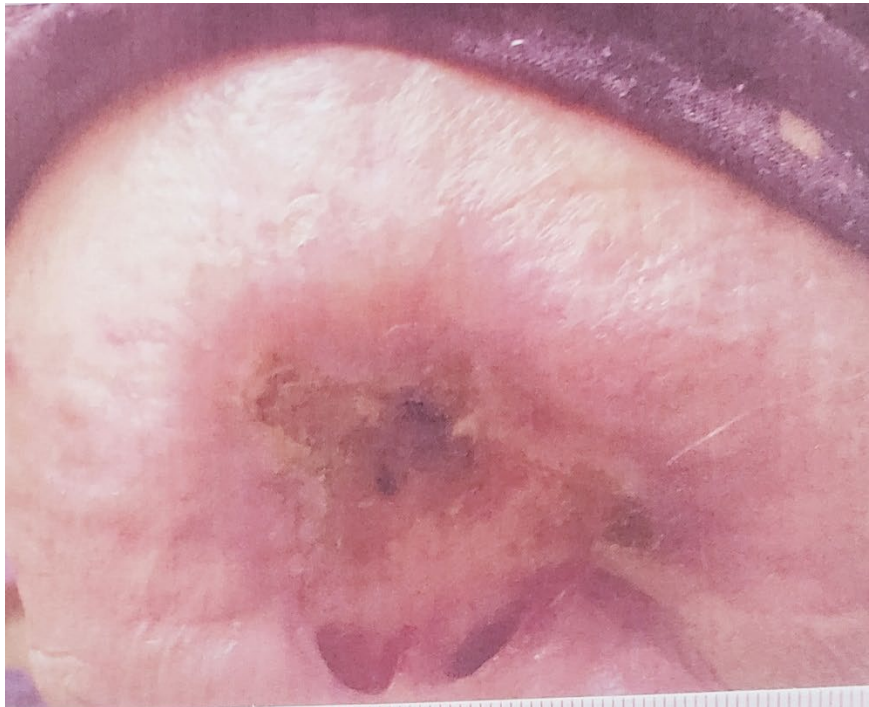




- Compliance issues with Dakin's WTD
- Used Oregano/Essential Oils

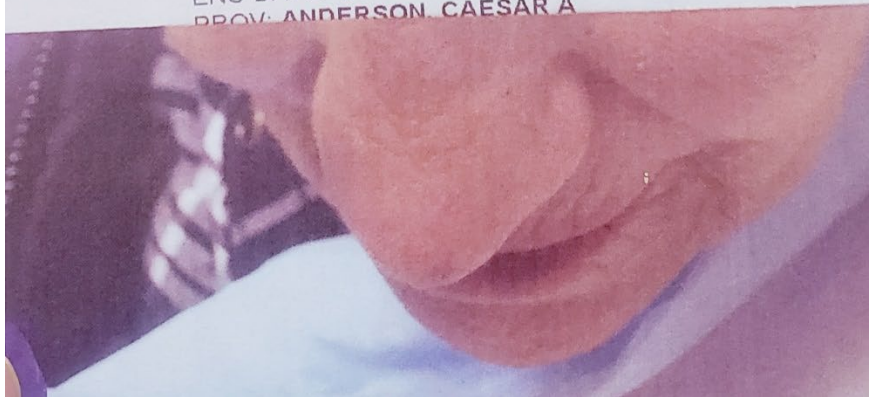






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# Wound Case : Forehead flap

- H&P
  - 79 y/o female
  - S/P multiple nasal cell basal cell ca rxn
  - Prior failed STSG
- Following forehead flap w/ischemic changes
  - Sent to HBOT POD #5

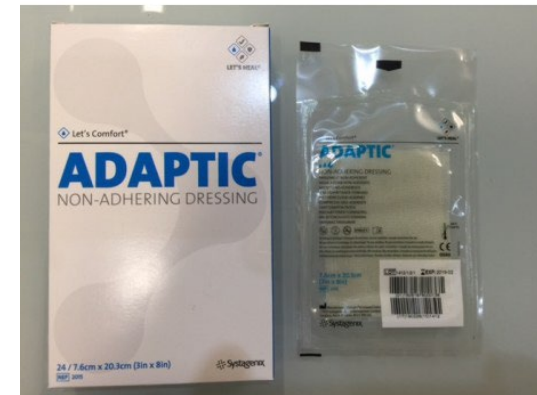








# Weekly Dressing Change Preferred









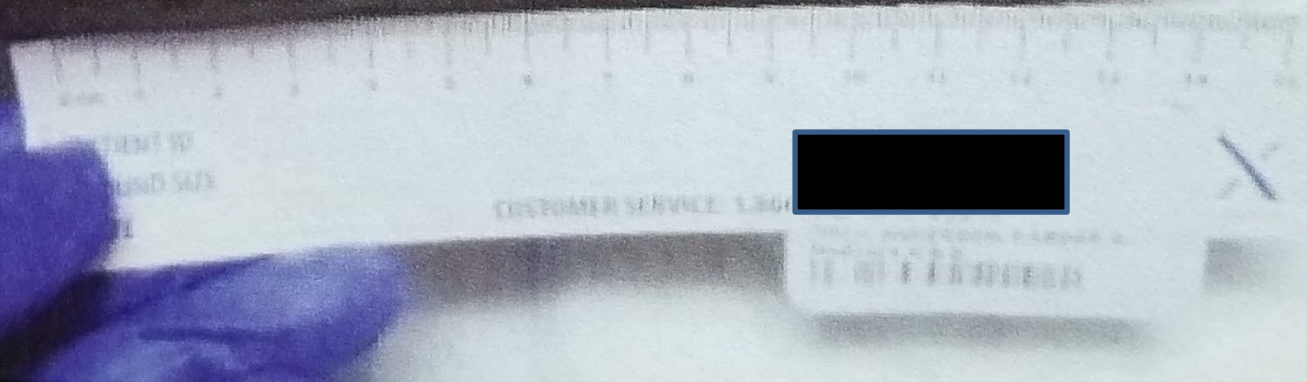




# Wound Case :Papillomatosis







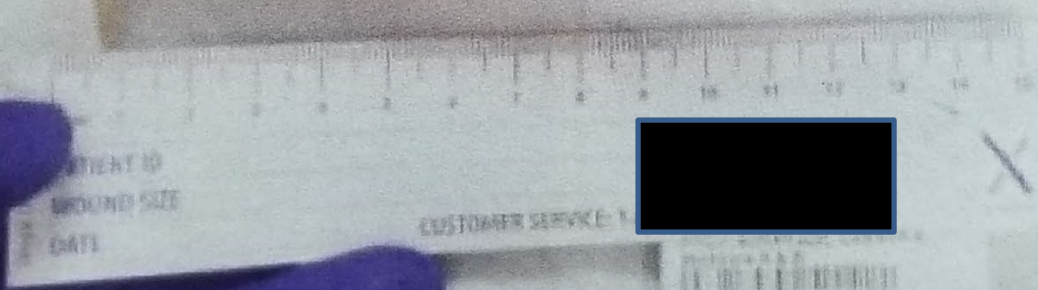




## Topical Selenium Sulfide for the Treatment of Hyperkeratosis

2018 Dec;8(4):639-646.

[Philip R Cohen](#)<sup>1</sup>, [Caesar A Anderson](#)<sup>2</sup>



PATIENT ID  
WOUND SIZE  
DATE

CUSTOMER SERVICE: 1-800-828-6887

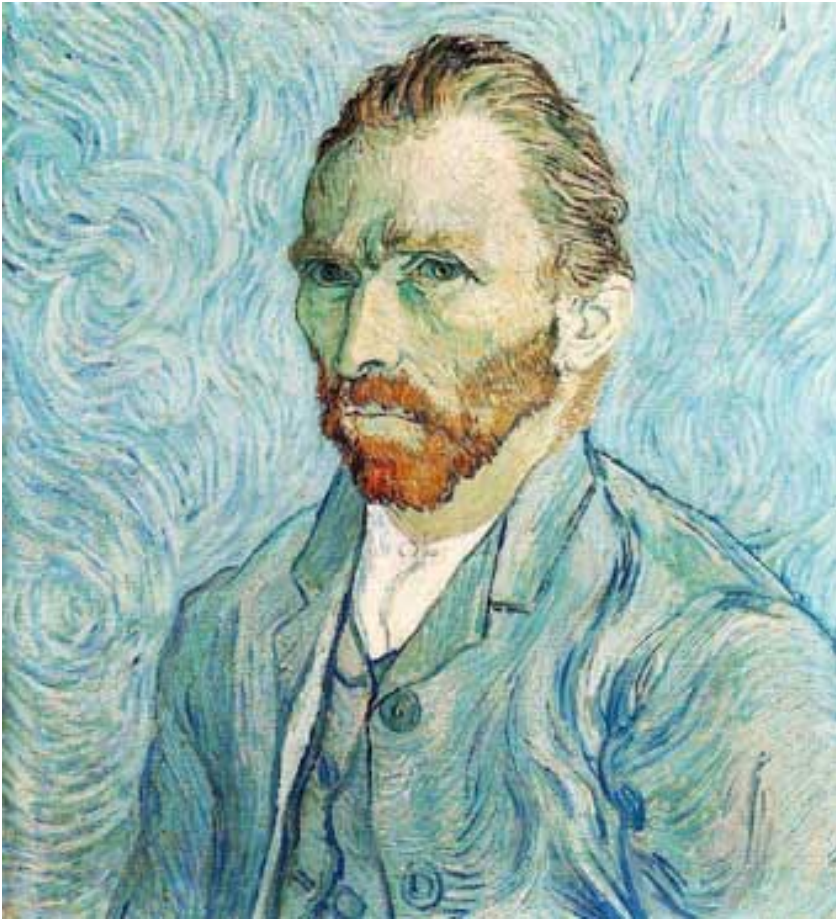




# Delusional Parasitosis



# Thank You





# Wound Case :

## Necrotic Diabetic Toe Ulcer

- H&P
  - 73 y/o diabetic male
  - HbA1C 10
  - Chronic wound >4 weeks
  - Refused amputation



# PAY YOUR DUES: OXYGENATE

- S/P 5 HBOT
  - Serial Targeted Debridement
  - Continue to oxygenate
  - Wait for window for skin coverage





# Re-necrosis



# GAME OVER

- HBOT facilitates demarcation
  - Continue serial targeted debridement
  - Continue to oxygenate
  - Wait for window for skin coverage













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ENC DATE: 9/19/17  
PROV: ANDERSON, CAESAR A  
Community Health Group Medi-C

