Best Practices in Wound Care

OPTIMISTIC Providers Meeting
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Disclosures

- Smith & Nephew ~ Speaker’s Bureau
  - Consulting fee for speaking engagements

- Kindred Long Term Acute Care Hospital ~ Central
  - Medical director duties with reimbursement

- Community East Advanced Wound Center
  - Medical director duties with reimbursement
Objectives

- Review pathophysiology of chronic wounds
- Outline signs and symptoms of skin and wound infection
- Identify characteristics of pressure ulcers and staging
- Differentiate common etiologies of chronic wounds
- Outline treatment choices for each type of wound
Chronic Wounds
Pathophysiology
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”

Masoro and Austad, 2006
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 and medical care per year.
- $15.3 billion estimated expense on wound care products in 2010.

...the Cost of “Success”?

Skin 101: Anatomy
Skin 101: Functions

- **Protects** Internal Structures
- **Sensory** Perception
- **Temperature and Fluid Regulation**
- **Metabolism and Absorption**
- **Immunologic Role**
- **Social Communication**
Wound Repair Is a Complex Cellular and Biochemical Response to Injury
Wound Healing Physiology

Phases of Wound Healing

- **Hemostasis** (0-3 hours)
  - Vasoconstriction, platelet release, clot formation

- **Inflammatory** (0-3 days)
  - Vasodilation
  - Neutrophils/macrophages clean the wound and produce growth factors

- **Proliferative** (3-21 days)
  - Angiogenesis / Granulation tissue
  - Collagen fiber synthesis by fibroblasts

- **Remodeling/Maturation** (21 days – 1.5 years)
  - Shrinking and strengthening of the scar
CHRONIC WOUNDS

Stagnant in the INFLAMMATORY and PROLIFERATIVE phases of wound healing

### Biochemical Differences

<table>
<thead>
<tr>
<th>Healing Wounds</th>
<th>Chronic Ulcers</th>
</tr>
</thead>
<tbody>
<tr>
<td>✨ ↑ Cell mitosis</td>
<td>✨ ↓ Mitogenic activity</td>
</tr>
<tr>
<td>✨ ↓ Pro-inflammatory cytokines</td>
<td>✨ ↑ Pro-inflammatory cytokines</td>
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<tr>
<td>✨ ↓ MMP’s</td>
<td>✨ ↑ MMP’s</td>
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<tr>
<td>✨ ↑ Growth factors</td>
<td>✨ Varied levels of growth factors (deficiencies)</td>
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→ *Cells capable of rapid response*

→ *Senescent cells*

When Things Go Wrong…

We need to become *Wound Detectives*

- **History**
- **Location**
- **Size**
- **Appearance** of the wound’s
  - Edge
  - Bed
  - Periphery
Comprehensive PATIENT Assessment
Let’s Look **Beneath** the Wound...

- **When** did the wound occur?
- **Who** has taken care of the wound?
- **What** treatment has been successfully used in the past?
- **What** studies have been performed (i.e., arteriogram)?
Size DOES Matter

**Size**

**Width**

**Length**

**Depth**

**Tunneling**

**Undermining**
Multiple Compromising Factors

- Blood flow
- Bacterial Colonization & Infection
- Moisture, Drainage & Exudate
- Pressure, Shear & Mechanical Forces
- Tissue Slough, Fibrin & Necrosis
- Cellular & Growth Factors
- Nutrition & Hydration
- Acute and chronic medical problems and their treatments
Multiple Compromising Factors

- Lifestyle factors
  - Activity
  - Financial status
  - Cultural/religious beliefs

- Psychological Factors
  - Stress
  - Depression
  - Compliance issues
Prepare Patient for Wound Healing

- Wound management priorities
  - Reduce/eliminate the cause
  - Provide systemic support
  - Appropriate topical therapy
Can we heal every wound?

No.
Complex and Palliative

- **Advanced**
  - Patients with wounds which are likely to heal within 14 weeks.
  - This wound management plan is the usual practice in the CENTER for most patients.

- **Complex**
  - Patients with wounds which are likely to heal but NOT within 14 weeks.
  - Assignment into this management plan may occur after 12 weeks of Advanced Wound Management.

- **Palliative**
  - Patients whose overall medical status has been severely compromised such that the ability to achieve wound healing is unlikely or strongly diminished.
  - Assignment into this management plan may occur at the initial visit if patient meets criteria for inclusion.
Criteria for Inclusion into Complex

- Nutritional support is required based on laboratory results and physical examination, has been offered to patient, but has declined

- Evaluation by a vascular surgeon has determined that the patient is not a revascularization candidate

- Patient requires a surgical procedure in order to achieve wound healing, but the physician determines the patient is not a surgical candidate due to medical status, or the patient does not wish to undergo the recommended surgical procedure

- Patient has remarkable or complex co-morbidities requiring medications or treatments that prevent wound healing or extend wound healing time
Patient is unable to adhere to an Advanced Wound Management plan

The patient has limited personal or cognitive resources, or has no access to appropriate ongoing care providers, such that it is unreasonable to expect a level of compliance with prescribed Advanced Wound Management treatments necessary to achieve desired healing outcomes

The patient, the patient’s family or care provider(s), or primary care physician requests supportive care rather than Advanced Wound Management
Criteria for Inclusion into Palliative

- The patient has a living will that specifies no extraordinary measures and Advanced Wound Management would expose the patient to those extraordinary interventions.

- The patient has a terminal condition (life expectancy of < 6 months) and Advanced Wound Management would impact the patient’s quality of life.

- The goals of palliative wound care include reducing:
  - Pain
  - Odor
  - Exudate
  - Bleeding
  - Infection
Palliative Wound
Any questions?
Skin & Wound Infection
Multiple Compromising Factors

- Blood flow

- **Bacterial Colonization & Infection**
  - Moisture, Drainage & Exudate
  - Pressure, Shear & Mechanical Forces
  - Tissue Slough, Fibrin & Necrosis
  - Cellular & Growth Factors
  - Nutrition & Hydration
  - Acute and chronic medical problems
Bacterial Burden
Contamination – Infection Continuum

- Contamination
- Colonization
- Critical Colonization
- Infection
  - Local
  - Systemic
Contaminated

- Surface bacteria
- Non-proliferating
- No delay in healing

Colonization (or Critical Colonization)

- Surface Bacteria
- Proliferating
- Competes for wounds resources
- Delay in wound healing or halts

Infection

- Proliferating (10^6 colonies/gm)
- Invades and damages tissues
- Delays or arrests healing

Sibbald G, Woo K, Ayello E
Wounds UK, 2007, Vol 3, No 2
Clinical Presentation: Critical Colonization of Wound

- Delayed healing
- Change of color (bed)
- Friable granulation tissue
- Absent/abnl gran tissue
- ↑ or abnormal odor
- ↑ serous drainage
- ↑ pain at wound site
Bacterial Biofilms

- Highly organized bacterial communities that allow individual organisms to interact with each other providing a means to exchange nutrients and metabolites
- Represent a protected foci for infection and bacterial resistance within the wound
- Provides protection against antimicrobial agents

Clinical Presentation: Skin / Wound Infection

New onset:

- Advancing erythema
- Induration
- Fever
- Warmth
- Edema / swelling
- Pain (new onset)
- Purulence / Exudate
Infected Wounds
Diabetic Patient
Infected Wounds
Culture… to do or not to do?

- Tissue culture preferred
- Swab cultures may be inadequate and misleading
- Swabs of wound exudate ~ usually taken before wound cleansing and NOT a good indication of infection

Swab Culture Techniques

General comments:

- Cleanse wound prior to culture
- Moisten the swab with normal saline or transport medium
  - believed to provide more precise data than dry swab
- Culture viable tissue, not necrotic tissue or eschar
Swab Culture Techniques

- **Broad Z-stroke**
  - Rotate swab, swab wound from margin to margin in a 10-point zigzag fashion
  - May only reflect contamination

- **Levine technique**
  - Rotate swab over 1 sq cm area with sufficient pressure to express fluid from within the wound tissue
  - Reflects tissue involvement more accurately
Wound Cleansing

- Normal saline
- Noncytotoxic wound cleanser
Antimicrobials
(topical antiseptics)

- Cytotoxicity

- Used selectively
  - Stimulation of unresponsive chronic wound
  - Treatment of critically colonized / infected wounds
  - Eradication of resistant organism

- Newer Agents
  - Bactericidal with ↓ cytotoxicity
    - Cadexomer iodine (Iodoflex®/Iodosorb®)
    - Silver preparations
Topical Antibiotics

- Have minimal use in the management of chronic wounds
  - No controlled trials demonstrating superiority over antiseptics
  - Lead to resistance
  - Allergic reactions are common


Bacterial Colonization & Infection

- Assess whole patient
  - Assess nutrition and / or supplement
  - Offload as indicated with routine turning
  - Manage co-morbidities, i.e. hyperglycemia

- Assess wound daily

- Decrease bacterial burden
  - Debridement
  - Appropriate antimicrobials
  - Directed antibiotics
Clinical Presentation: Skin / Wound Infection

New onset:

- Advancing erythema
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Any questions?
Pressure Ulcers
Wound Etiology:
Types of Chronic Wounds

- Pressure Ulcers
- Venous Stasis
- Arterial
- Diabetic Foot Ulcers / Neuropathic
  - Mechanical
    - Burns, surgical, skin tears, bites, trauma
  - Malignancy
  - Vasculitic
Pressure Ulcers
Pressure Ulcers
Controversies

- All pressure ulcers are preventable. False.
- All pressure ulcers can heal with appropriate treatment. False.
- The presence of a pressure ulcer implicates negligence. False.
- High pressure ulcer rates indicate poor care. False.
Localized injury to the skin and/or underlying tissue usually over a bony prominence, as a result of pressure, or pressure in combination with shear and/or friction.

A number of contributing or confounding factors are also associated with pressure ulcers; the significance of these factors is yet to be elucidated.

Staging system based on degree of anatomical tissue loss (NPUAP)
Pressure Ulcer Stages

- Stage I
- Stage II
- Stage III
- Stage IV
- Unstageable
- DEEP TISSUE INJURY (DTI)
Pressure Ulcer: Stages

Stage I:

- Nonblanchable redness of intact skin.
- Darkly pigmented skin may not have visible blanching; its color may differ from the surrounding area.
- Area may be painful, firm, soft, warmer or cooler as compared to adjacent tissue.
- May be difficult to detect in dark skin tones.
Pressure Ulcer: Stage I
Pressure Ulcer: Stages

Stage II:

- Partial thickness loss of dermis presenting as a shallow open ulcer with a red or pink wound bed, without slough or bruising.

- Intact or open / ruptured serum-filled blister

- Should NOT be used to describe skin tears, tape burns, perineal dermatitis, maceration or excoriation
Pressure Ulcer: Stage II
Stage II Pressure Ulcer
Pressure Ulcer: Stages

**Stage III:**

- Full thickness tissue loss. Subcutaneous fat may be visible but bone, tendon or muscle are not exposed.
- Slough may be present but does not obscure depth of tissue loss
- May include undermining or tunneling
- Depth varies on anatomical location.
Stage III:

Further description: The depth of a stage III pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and stage III ulcers can be shallow. In contrast, areas of significant adiposity can develop extremely deep stage III pressure ulcers. Bone/tendon is not visible or directly palpable.
Pressure Ulcer: Stage III
Pressure Ulcer
Stage III
Pressure Ulcer: Stages

Stage IV:

- Full thickness tissue loss with exposed bone, tendon or muscle. Slough or eschar may be present on some parts of the wound
- Depth varies depending on anatomical location
- Often include undermining and tunneling
- Exposed bone / tendon is visible or directly palpable
Stage IV

Further Description:
The depth of a stage IV pressure ulcer varies by anatomical location. The bridge of the nose, ear, occiput and malleolus do not have subcutaneous tissue and these ulcers can be shallow. Stage IV ulcers can extend into muscle and/or supporting structures (e.g., fascia, tendon or joint capsule) making osteomyelitis possible. Exposed bone/tendon is visible or directly palpable.
Pressure Ulcer: Stage IV
Pressure Ulcer: Stage IV
Right trochanter
Unstageable:

Full thickness tissue loss in which the base of the ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed.

Until enough slough and/or eschar is removed to expose the base of the wound, the true depth, and therefore stage, cannot be determined.
Pressure Ulcer: Unstageable
Unstageable: Obscuring Eschar
Pressure Ulcers
Unable to Stage
Pressure Ulcer
Unable to Stage
Suspected Deep Tissue Injury

- Purple or maroon localized area of discolored intact skin or blood-filled blister due to damage of underlying soft tissue from pressure and / or shear.

- Area may be preceded by tissue that is painful, firm, mushy, boggy, warmer or cooler as compared to adjacent tissue.
Pressure Ulcer: Deep Tissue Injury
Deep tissue injury may be difficult to detect in individuals with dark skin tones.

Evolution may include a thin blister over a dark wound bed. The wound may further evolve and become covered by thin eschar.

Evolution may be rapid exposing additional layers of tissue even with optimal treatment.
Deep Tissue Injury

Skin surface is intact
Unavoidable

Resident developed a pressure ulcer despite

- Evaluate clinical condition and risk factors
- Define and implement interventions
- Monitor and evaluate the interventions
- Revise as appropriate
Resident developed a pressure ulcer

Facility did NOT do one or more of the following:

- Evaluate clinical condition and risk factors
- Define and implement interventions
- Monitor and evaluate the interventions
- Revise as appropriate
Pressure Ulcers
Important Points

- When eschar present, accurate staging is NOT possible until eschar has been removed and wound base is visible.

- Pressure ulcers do NOT always progress from Stage I to Stage IV in that order.

- Pressure ulcers are NOT staged backwards when healing (once a Stage IV, always a Stage IV, appropriate to say “healing Stage IV”).
Now... you’re the expert!
Stage It!
Stage 3

- Into subcutaneous tissue
- No exposed muscle, bone, or tendon
Stage 2

- Small area of partial thickness ulceration
Stage It!

(Partial thickness ulceration along the gluteal cleft)
Intertriginous Dermatitis

- Etiology is moisture with or without shear
- Ulcerative dermatitis rather than pressure ulcer
- Maceration or tinea often present
- Seen in gluteal cleft or groin, under pannus or breast
- NPUAP added caveat to Stage 2 description to exclude skin tears, tape burns, incontinence, maceration, or excoriation
Stage It!

(Note the adult diaper)
Incontinence Associated Dermatitis

• Etiology is inflammation from stool or urine
• Partial thickness, “top down” ulceration
• Seen in perianal, perineal, thigh areas
• As with any wound, treat the underlying cause
Pressure Ulcer: Management Principles

- Off-Loading
- Nutrition
- Surgery
- Osteomyelitis
- Dressings
- Goal setting

HIGH PRESSURE
Off-Loading: General

- Reposition every two hours
- Avoid sliding when transferring
- Avoid doughnut cushions
Off-Loading: Wheelchair

- Limit time in wheelchair
- Seating clinic
- Pressure mapping
- Roho vs. custom molded
Off-Loading: Mattress

- Limit head elevation, time and degree
- High specification foam mattress
- Overlays
- Alternating pressure
- Low air loss
- Air-fluidized
Nutrition: Treatment

• Hydration
• Protein repletion
• Glycemic control
• Arginine / glutamine / HMB supplements
• Debridement

• Flaps have a high long term failure rate if appropriate postoperative support measures are not secured

• Patient selection is key – motivation, resources (eg LTAC), comorbidities, lifespan

• Consider diverting colostomy or urostomy
Osteomyelitis

• Aggressive, comprehensive approach
  ♦ Surgical debridement
  ♦ Flap coverage
  ♦ Bone culture to guide antibiotic choice
  ♦ Adjunctive HBO if refractory to usual care

• Palliative approach
Dressings

To be determined...
Goal Setting

- Patient adherence is crucial
- Identify patient’s goals
- Assess and reassess for depression
- Determine whether the appropriate goal would be healing or palliation
Take Away

• Identify the etiology, pressure vs ulcerative dermatitis
• Identify the goal, healing vs palliation
• Reconsider albumin / prealbumin testing
• Pay attention to detail
• Re-evaluate weekly
References

- http://www.npup.org/


- The Role of Nutrition for Pressure Ulcer Management: National Pressure Ulcer Advisory Panel, European Pressure Ulcer Advisory Panel, and Pan Pacific Pressure Injury Alliance White Paper. Posthauer, Mary Ellen RDN, LD, CD, FAND; Banks, Merrilyn PhD; Dorner, Becky RDN, LD, FAND; Schols, Jos M. G. A. MD, PhD


Wound Etiologies
Wound Etiology: Types of Chronic Wounds

- Pressure Ulcers
- Venous Stasis
- Arterial
- Diabetic Foot Ulcers / Neuropathic
- Atypical
  - Mechanical
    - Burns, surgical, skin tears, bites, trauma
  - Malignancy
  - Vasculitic
- Malignancy
- Vasculitic
Venous Ulcers
Venous Insufficiency

- Afflict 1% of the population and 3.5% of persons over 65 years of age
- Venous ulcers account for 90% of all chronic wounds on the lower leg
- Result from disorders of the superficial and deep venous systems

Venous Ulcers

Predisposing factors:

- Deep Vein Thrombophlebitis and Thrombosis (DVT)
- Prior pregnancy
- Leg trauma
- Cardiac disease
- Poor nutrition
- Absence of/or poor calf muscle pumps
Pathophysiology

- **Origin**: Venous valve incompetence
  - Venous hypertension
  - Extravascular blood loss/edema
    - RBCs → hemosiderin staining
    - WBCs → enzyme-mediated tissue destruction
Not all swelling is venous disease: systemic causes of edema

- Heart failure
- Nephrosis
- Liver failure
- Endocrine disorders
- Medication side effects:
  - Calcium channel blockers
  - Nonsteroidal and other anti-inflammatory agents
  - Oral hypoglycemics
Not all swelling is venous disease: local causes of edema

• Local problems such as ruptured popliteal cyst
• Hematoma
• Mass such as from neoplasms
• Lymphedema
• Prolonged dependent positioning of legs; such as nursing home patients
Venous Ulcer Assessment

- Edema
- Hemosiderin
- Pulses present +/-
- “ankle flaring”
- Lipodermatosclerosis
- Dermatitis
- Scarring from previous ulcer
Venous Stasis Ulcers

- Peripheral edema present (worse at night)
- Shaggy / Irregular borders
- ± Painful
- Exudative (serosanguninous)
- Noncompliance
Venous Hemosiderin Staining
Venous Ulcers: Treatment

Eliminate swelling

- **Leg Elevation**
  - 6 inches above heart

- **Sodium Reduction**
  - <2000 mg daily

- **Compression Therapy**
  - Multilayer
  - Short stretch
  - Prescription compression hose

- **Pneumatic Compression Pumps**
Lymphedema
Before compression
Lymphedema
After compression
Venous compression helps heal most venous leg ulcers

- Study that looked at compliance with venous compression therapy showed 95% of compliant patients healed at 5 months
- 55% healing in those not compliant with compression therapy
- Exercise with compression therapy helps re-establish the calf muscle pump and additionally lowers venous pressure
Venous Ulcers: Treatment

- Debridement

- Appropriate dressings (moisture control)
  - Alginates
  - Antimicrobial dressings (Iodosorb®, Hydrofera Blue®, silver)

- Trental/Antibiotics

- Closure
  - Skin graft
  - Skin substitutes (Apligraf®/Dermagraft®)

- Endo-venous closure (laser ablation: ELVS)
Venous Leg Ulcer

- Once wound is completely epithelialized...

- The patient will continue wearing compression stockings and then will be assessed for venous insufficiency treatment
After venous ulcers heal... do they come back?

- Standard of care is compression therapy life long to prevent recurrence
- With compliant patients 29% recur within 5 years
- With non-compliant patients 100% recur within 3 years
- Current recommendations is all patients with venous ulcers to be evaluated and treatment of underlying venous hypertension
Wound Etiology: Types of Chronic Wounds

- Pressure Ulcers
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- Arterial
- Diabetic Foot Ulcers / Neuropathic
  - Mechanical
    - Burns, surgical, skin tears, bites, trauma
  - Malignancy
  - Vasculitic
Arterial Ulcer
Arterial Insufficiency/Ulceration

Predisposing factor/cause:

- Peripheral Vascular Disease (PVD)
- Diabetes Mellitus
- Advanced Age
- Smoking
- Hypertension
Arterial Assessment

- Weak/absent pulses
- Absence of leg hair
- Thickened nails
- Dependent rubor
- Pain

- Cool feet
- Skin shiny, dry, pale
- Elevational pallor
- ABI < 0.8
Arterial Ulcer Location

- Distal toes
- Heel
- Pretibial area
- Lateral malleolus
Arterial Ulcer Characteristics

- Painful ulceration
- Pale wound bed, desiccated
- Minimal drainage
- Appearance – “punched out”
- May be necrotic
- Peri-wound skin pale
Arterial Wounds in Smoker
Progressive Changes
Arterial Ulcers
S/p bypass
Embolus post CABG
Arterial Ulcers
Treatment

Decision: Conservative vs. Aggressive

- Aggressive
  - Evaluate extent of insufficiency
  - Arterial Dopplers / Angiogram
  - Referral to Vascular Surgery: PTA / bypass

- Conservative
  - Prevent infection and trauma
  - Conventional wound care

- Augmentation:
  - HBO
Arterial Ulcers: Treatment

- Keep clean and dry
- Avoid pressure or trauma
  - Including routine surgical debridement
- Pain control
- Nitropaste
  - Apply to artery just proximal to wound
Arterial Ulcers: Restore Blood Flow

- Large vessel bypass/endarterectomy/profundoplasty
- Endovascular procedures
  - Balloon angioplasty (with or without stent)
  - Laser ablation
  - Atherectomy
Mixed: Arterial and Venous

- Difficult wounds
- Complete vascular assessments
- Modified compression
Wound Etiology: Types of Chronic Wounds

- Pressure Ulcers
- Venous Stasis
- Arterial
- Diabetic Foot Ulcers / Neuropathic
  - Mechanical
    - Burns, surgical, skin tears, bites, trauma
  - Malignancy
  - Vasculitic
Diabetes

- Poor healing ulcer, usually on feet, caused by combination of foot neuropathy and vascular disease, leading to ischemia in the soft tissues compressed against bone

- Hyperglycemia impairs leukocyte function and collagen synthesis
Diabetic Ulcer Assessment

- Diminished or no sensation in foot
- Foot deformities
- Palpable pulses
- Warm foot
- If has PVD, same assessment as arterial
Diabetic Foot Ulcers
Facts

- Located on pressure areas
  - Plantar aspect of foot
  - Over metatarsal heads
  - Under heel

- Usually round, smooth margins

- Painless ulcers

- Surrounded by calloused skin

- Shallow to deep

- Easily infected
Charcot Foot Deformity

- Occurs as a result of decreased sensation
- Necrosis may occur leading to plantar ulcerations
- Unnoticed microfractures in the bones result in disfigurement, swelling, and additional bony prominences
Diabetic Ulcer
Plantar Surface of Foot
Diabetic Foot Ulcers
Treatment

- Off-loading is key to wound healing!
- Diabetes control
- Moist, wound environment
- Control of bioburden
- Debride necrotic tissue & hyperkeratotic rim
- Replacement of growth factors
Multiple Compromising Factors

- Blood flow
- Bacterial Colonization & Infection
- Moisture, Drainage & Exudate

**Pressure, Shear & Mechanical Forces**

- Tissue Slough, Fibrin & Necrosis
- Cellular & Growth Factors
- Nutrition & Hydration
- Acute and chronic medical problems
Pressure & Mechanical Forces

- Offloading
- Custom shoes
- Crutches
- Contact casting
- Felt and foam
- Chair cushions / positioning devices (PT/OT)
- Specialty mattresses
Up to 25% of individuals with diabetes will develop a foot ulcer during their lifetime.


Foot wounds are now the most common diabetes-related cause of hospitalization and are a frequent precursor to amputation.

Individuals with diabetes have a **30-fold** increased risk of undergoing a lower-extremity amputation.

DFU: Management Principles

- Off-loading... off-loading... off-loading...
- Debridement/dressing selection (clean, moist wound bed)
- Evaluate and correct ischemia/osteomyelitis
- Adjunctive therapy
  - Skin substitutes (Apligraf®/Dermagraft®)
  - HBOT

“Its about MECHANICS, not MEDICINE...
It’s more important what you TAKE OFF the wound than what you PUT ON”

Dr. Paul Brand
Atypical Wounds

- Depend upon **causative** factors
  - Examples:
    - Brown Recluse spider bite
    - Post radiation treatment
    - Malignancy
    - Autoimmune process
Atypical Wounds: Autoimmune 

RA, Sojourns

Pyoderma

Vasculitis
Make the Diagnosis

Malignant Melanoma (Stage 4)
Bottom line…

You must identify and / or reveal the underlying cause of why the wound is there or remains non-healing or your healing rates will be very low 😞
Any questions?
Tissue Type, Debridement & Dressing Selection
Multiple Compromising Factors

- Blood flow
- Bacterial Colonization & Infection
- Moisture, Drainage & Exudate
- Pressure, Shear & Mechanical Forces

**Tissue Slough, Fibrin & Necrosis**

- Cellular & Growth Factors
- Nutrition & Hydration
- Acute and chronic medical problems
T = Tissue Viability
Treatment Plan Options For:

- Tissue Slough, Fibrin & Necrosis
  - Necrotic wounds
    - Eschar
    - Slough
  - Granular wounds
The Necrotic Wound

- **Eschar**
  - Dead, avascular tissue
  - White/gray to yellow or tan and finally to black or brown
  - Tissue consistency changes as the tissues dry

- **Slough**
  - Dead cellular debris on wound surface
  - Yellow/yellow-white
  - Mucunous, stringy → firm
Why Debride?

- Necrotic tissue prolongs the inflammatory phase and delays wound healing
- Necrotic tissue is a medium for bacterial growth
- Facilitates visualization of wound base
- Interrupts the cycle of the chronic wound
Debridement Contraindications

- Ischemic wound covered with dry eschar, no signs/symptoms of infection
- Heel ulcer covered with dry eschar, no signs/symptoms of infection
- Wounds with dry gangrene
Types of Debridement

- **Surgical** – excision/wide resection of necrotic tissue ± viable tissue (surgeons)
- **Sharp** – removal of dead tissue above viable tissue
- **Mechanical** (irrigation, wet-to-dry dressings)
- **Autolytic** (phagocytic cells, proteolytic enzymes)
- **Enzymatic** (collagenase Santyl®)
- **Biological** (maggot therapy)

Select the method most appropriate for the patients condition and goals
Sharp Debridement

WOUND#: 1  ID#
DATE: 4/12/01  INITIALS: JB
Sharp Debridement
Sharp Debridement
Schultz, 2003

Continuous removal of necrotic burden throughout the life of the wound
- Difficult to fully remove all debris with single debridement
- Necrotic burden continues to accumulate
- Temporary improvement → deterioration

Stimulates the “stunned” wound
Enzymatic Debridement

- The application of a substance to chemically digest and remove necrotic tissue

- Can (and should) be employed in conjunction with other forms of debridement and moist wound healing
Candidates for Enzymatic Debridement

- Patients that are not surgical candidates
- Patients on blood thinners
- Patients at a facility where a skilled sharps/surgical debridement specialist is unavailable
- Patients receiving care at home
- Patients with necrotic tissue close to a bone or tendon
- In conjunction with other forms of debridement
Enzymatic Treatment Options for Necrotic Wounds

COLLAGENASE SANTYL® OINTMENT, Smith & Nephew, Inc., Largo, Florida
COLLAGENASE SANTYL®
Pharmacology

- DIGESTS COLLAGEN IN THE PHYSIOLOGICAL pH AND TEMPERATURE RANGE
- CONTRIBUTES TOWARD THE FORMATION OF GRANULATION TISSUE AND SUBSEQUENT EPITHELIALIZATION
- DOES NOT AFFECT COLLAGEN IN HEALTHY TISSUE OR IN GRANULATION TISSUE
Enzymatic Debridement Considerations

- Use of any enzyme should be terminated when debridement of necrotic tissue is complete and granulation tissue is well established
Granulation Tissue

- Desired healing process for wounds which involves the growth of small blood vessels and connective tissue
  - *Healthy*: firm, moist, red, shiny
  - *Unhealthy*: dark red/blue vs. pale, dehydrated, dull, friable
Multiple Compromising Factors

- Blood flow
- Bacterial Colonization & Infection

**Moisture, Drainage & Exudate**

- Pressure, Shear & Mechanical Forces
- Tissue Slough, Fibrin & Necrosis
- Cellular & Growth Factors
- Nutrition & Hydration
- Acute and chronic medical problems
M = Moisture Balance
Moisture, Drainage & Exudate
Chronic Wound Fluid

- Slows/blocks the proliferation of cells
  - Keratinocytes, fibroblasts & endothelial cells
- Contains MMP’s
  - Break down essential matrix proteins needed for movement of cells and re-epithelialization
- Macromolecules bind/trap growth factors
- HEAVY exudate (even clear, malodorous)
  - Indicate uncontrolled edema ± bacterial burden and potential wound infection
“Hanging Wet-to-Dry Dressings Out to Dry”

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1960’s: both animal and human studies documented that wounds in which the tissue remained moist healed 2 x faster than those allowed to dry out\(^{14}\)

Moist wound healing = Standard of Care\(^{15}\)

Now available polymeric materials
- Moisture-retentive / semi-occlusive
- >50 manufacturers, >10,000 products
“Hanging Wet-to-Dry…”

- Despite progress… gauze is still the most widely used wound dressing and may be erroneously considered “standard of care”

- 1999 (Pieper, et al16)
  - 40% - dry gauze
  - 15% - saline moistened gauze
  - 25% - no dressings
  - < 25 % - “moisture – retentive dressings”
“Hanging Wet-to-Dry…”

- **Wet-to-Dry**
  - Intended for debridement of devitalized tissue
  - Nonselective – removes healthy tissue
  - Painful

- **Wet-to-Moist**
  - Intended to remain moist, but often dries
“Hanging Wet-to-Dry…”

- Increases Infection Rates
- Released bacteria into air
- Bacteria can penetrate through 64 layers of gauze
- Local tissue cooling
- Labor intensive (BID → TID)
- More expensive
- More painful
E = Edge of Wound
Wound Dressings
Facts to Consider

- Depth of wound / undermining / tunneling
  - Cover vs. Filler
  - Need to fill all the “dead space” by packing lightly

- Exudate: maintain optimal wound environment
  - Hydration vs. absorption

- Location

- Condition of wound bed

- Bacterial burden

- Protection of the periwound area
The “Perfect Wound Dressing”

- Relieves pain
- Provides moist wound-healing environment
- Protects from further damage
- Removes drainage and necrotic debris
- Promotes granulation tissue
- Protects from bacterial contamination
- Packs dead space

Inappropriate Dressings

- **Compromise** peri-wound integrity
  - Maceration
  - Tape injury
  - Contact dermatitis
- **Delay** wound healing
  - Wound bed injury
  - Hypergranulation
  - Dehydration
- **Increase** Pain
- **Increase** risk of Infection
Wound Dressings

- Hydrocolloids (occlusive)
- Hydrogels
- Alginates
- Collagens
- Foams

- Hydrofibers
- Wound fillers
- Silver
- Transparent films
- Contact layers
Dressing Decision Tree

Dry or Dessicated
CPG: W05.05

Minimally Draining
CPG: W05.05

Moderate to Heavy Draining
CPG: W05.05

Macerated Wound Edges
CPG: W05.05

Increased Bio-Burden
CPG: W05.05

Odor Control
CPG: W05.05

Pain Control
CPG: W05.05

Enhanced Tissue Growth
CPG: W05.06

Resolve Edema
CPG: W05.04

Relieve Pressure
CPG: W05.07

Hydrate
Maintain Adequate Hydration/Moisture

Absorb Drainage

Protect Wound Margins
Decrease Bio-burden
Control Odor Eliminate Cause
Minimize Discomfort
Optimize Tissue Growth
Compression
Pressure Reduction/Relief

Moisture Barriers
- Zinc Oxide
- Dimethicone
- Skin Preparation Products
- Petroleum
- Dressing Barriers
- Films
- Hydrocolloid
- Ceramic Fiber
- Negative Pressure Wound Therapy

Cadexomer Iodine
Manuka Honey
Silver dressings
Topical Antimicrobials
Topical Antiseptics
Activated Charcoal
Dressing Barriers
Cerium
Maltodextrin
Topical Aloe
Topical Metronidazole

Hydrate or Restore Moisture Balance
Topical Analgesics
Systemic Analgesics
Non-Adherent Contact Dressing
Beacapemmin
Bi-Layered skin substitute
Human Fibroblast Derived Dermal Substitute
Dermal Regeneration Template
Biologically derived Extracellular Matrices
Negative Pressure Wound Therapy
MMP Inhibitors
Collagen
Advance Biological Dressings

ABI Drives, Compression Selection
- Elastic Compression
- Static Compression
- Stockings
- Intermittent Pneumatic Compression

Foot Ulcers
- Total contact cast
- Removable cast walker
- Walking boot
- Wedge shoe (use with caution)
- Surgical Shoe with pressure relief insole
- Felt/Foam
- Wheelchair with offloading footwear
- Multipodus Boot
- Assistive offloading device

Torso
- Mattress Overlay
- Specialty Bed
- Wheelchair Cushion
Adjunctive Modalities

- Electrical stimulation
  - Meta-analysis shows provides significant healing in many wound etiologies

- Negative Pressure Wound Therapy
  - Wound V.A.C.®

- Anodyne® Therapy System
  - MIRE (monochromatic infrared energy)

- MIST Therapy™ System

- HBOT
Any questions?