MEDICAL COMORBIDITIES AND THEIR IMPACT ON WOUND HEALING

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Wound Care is Only Part of the Story…

Success Depends on How You Manage the Rest of the Patient’s Problems
Damaged vessels constrict to slow blood flow. Platelets aggregate to stop bleeding. Leukocytes migrate into tissue to initiate inflammatory process.

Neutrophils secrete chemicals to kill bacteria. Macrophages engulf and digest foreign particles and necrotic debris. Macrophages release angiogenic substances to stimulate capillary growth and granulation tissue.

Fibroblasts proliferate in the wound and secrete glycoproteins and collagen. Epidermal Cells migrate from the wound edge. Granulation tissue is formed from macrophages, fibroblasts and new capillaries.

Fibroblasts secrete collagen to strengthen wound. Wound remodeling occurs to reorganize fibers. Wound contracts increasing tissue integrity. Epidermal cells grow over connective tissue to close wound.
Hemostasis
Inflammatory
Proliferative
Remodeling
Abnormal Wound Healing

- Failure to progress through normal orderly stages of wound healing in a timely fashion

- Chronicity has been defined by failure to progress to closure over a 90 day period.

- Chronicity may also be defined by wound characteristics

The Chronic Wound

- Has failed to proceed through and orderly and timely process to produce anatomical and functional integrity, or proceeded through the repair process without establishing a sustained anatomic and functional result.

The Chronic Wound

- Out of control inflammatory response that is self-sustaining
- Equilibrium between synthesis and degradation has been shifted
- Visually: inadequate granulation, persistent or excessive exudate, deficient wound contraction and/or absence of neo-epithelialization

“A chronic wound is an acute wound with an impediment”

T.K Hunt, M.D.

“The impediment may be the treating physician”

Harriett Hopf, M.D.
WE FROZE HIM UNTIL MEDICAL SCIENCE KNOWS HOW TO CURE SPEAR WOUNDS.
Systemic Co-morbidities

- Vasculitis
  - Rheumatoid disease
  - Lupus (SLE)
  - Scleroderma
  - Wegener’s
  - Granulomatosis
  - Polyarteritis Nodosa

- Diabetes
- Polycythemia Vera
- Renal failure
- Chemotherapy
- Radiation
- Pyoderma Gangrenosum
Good H&P

- HPI – Wounding
- PMH
- PSH
- Past wounding hx

  Etiology
  Location
  Treatment
  Response

- Meds
- Family hx
- ROS
- Thorough exam

  Skin
  Wounding
  Vascular supply
  Infection
General Appearance

- Cushingoid (puffy) appearance
- Rheumatoid joints
- Cachexia
- Scleroderma skin
General Appearance

- Abnormal affect and behavior
- Focal neurologic deficit
- Tobacco
Diabetes

- Cell Membrane
- A.G.E.'s
- WBC Function
- Ischemia
- Angio-genesis
- Neuropathy
- Tissue Compliance
UKPDS: Lower A1C Reduces Risk for Chronic Complications

- Direct relationship between risk of complications of diabetes and glycemia over time
- No glycemic threshold for change in risk of diabetes complications

Motor Neuropathy

- Anterior tibial weakness
- Pedal muscle atrophy
- Fat pad atrophy
- Increased peak pressures
- Ulcerations over deformities

Khan K, Derksen T, Steinberg J in Wound Care Practice 2nd Ed. Sheffield P, Fife C (eds) Volume 1, pp. 407-424
Sensory Neuropathy

- Diabetic sensory polyneuropathy
- Peri-nerve edema
- Increased wounding risk due to L.O.P.S.
- Unable to feel pressure or pain
- Ulcerations develop without knowledge

Khan K, Derksen T, Steinberg J in Wound Care Practice 2nd Ed. Sheffield P, Fife C (eds) Volume 1, pp. 407-424
Autonomic Neuropathy

- Faulty sweat gland activity
- Dry, fissured skin leads to infection and ulceration
- Uncontrolled vasodilatation due to decreased arteriolar tone
Autoimmune Disorders

- Rheumatoid Arthritis
- Crohn’s Disease
- Pernicious Anemia
- Ulcerative Colitis
- Antiphospholipid Syn.
- Graves Disease
- Wegener’s Granulomatosis
- Psoriasis
- Systemic Lupus
- Polymyositis
- Dermatomyositis
- Ankylosing Spondylitis
- Sjogren’s Syndrome
- Autoimmune Hemolytic anemia
Autoimmune Mechanism

- Protective component of immune system mounts attack on normal structures
- 75% women of childbearing age
- Auto-antibodies generated against normal body structures or abnormal materials deposited on normal structures
- Auto-antibodies may be continuously, intermittently or transiently produced, determining temporal nature of process
Rheumatoid Disease

- Systemic autoimmune disorder of unknown etiology
- Leg ulcerations in 8 – 9% of patients
- Ulcer is smooth, irregularly shaped and painful
- Felty’s Syndrome; Combination of RA, splenomegaly, granulocytopenia and leg ulcers
Rheumatoid Disease

- **Systemic Treatment:** High dose steroids, cyclophosphamide, Dapsone, disease modifying agents

- **Wound treatment:** Standard wound care, bioengineered skin, growth factors
Rheumatoid Leg Ulcers
Systemic Lupus (SLE)

- Systemic autoimmune disease of unknown etiology
- Well defined margins with purulent wound bed and varying granulation
- Surrounding skin normal or erythematous with atrophie blanche
- Leg ulcer prevalence approx. 2%
- Commonly in pre-tibial areas and painful
- Treatment challenging – systemic and intra-lesional steroids and topical retinoic acid

Lupus Related Leg Ulcer
Scleroderma (C.R.E.S.T.)

- Autoimmune disorder of unknown etiology
- Ulcers usually over digits, pre-tibial area and bony prominences
- Subcutaneous calcification makes epithelialization difficult
- Occlusive dressings and moist wound care

Polycythemia Vera

- Increased production of RBC’s by bone marrow
- Genetic mutation – men > women
- Treatment:
  Phlebotomy
  Hydroxyurea (problem)

www.mayoclinic.org/diseases-conditions/polycythemia-vera
Wegener’s Granulomatosis

- Rare disease of uncertain cause
- Inflammatory process primarily affecting upper resp. tract and kidneys
- Can cause vasculitis leading to wound healing problems
- Suspicion = testing (ANCA)

www.medicinenet.com/wegeners_granulomatosis/article.htm
Cryoglobulinemia

- Abnormal proteins in blood which thicken when exposed to cold
- Types I, II, III (mixed)
- Protein antibodies thicken and occlude capillaries leading to skin wounding and necrosis
- II and III associated with other autoimmune conditions

www.vasculitisfoundation.org/education/forms/cryoglobulinemia/
Raynaud’s

- Intermittent, severe ischemia of fingers/toes
- Sympathetic vasoconstriction
- Soft-tissue atrophy and ulceration
- Precipitated by cold or localized trauma
- Vasodilators, anti-platelet agents, rheologics, PD-5 inhibitors. (Nifedipine)
- Moist wound care

Goundry B, Diagnosis and Management of Raynauds Phenomenon. BMJ 2012 : 344:e289
Vasculitis

- Inflammation of blood vessels of unknown etiology
- Thrombosis of capillaries leading to local tissue hypoxia
- Prevalent in elderly
- Male = female

American College of Rheumatology
www.rheumatology.org
Vasculitis

- Flat, red nodules, macules or purpura
- Lesions frequently ulcerate and are difficult to heal
- Biopsy for diagnosis
- Moist wound care
- Anti-platelet agents and steroids
Factor V Leiden Mutation

- Protein C resistance
- Increased risk of thrombosis, venous > arterial
- Progressive thrombotic occlusion leads to poor venous outflow
- Venous ulcers as result
- Multilayer compression and moist wound care

Sickle Cell Disease

- RBC’s sickle or crescent shaped rather than spherical
- Capillary occlusion leads to skin hypoxia and ulceration
- Autosomal recessive - leads to trait or disease
- Characterized by painful crises

Armstrong DG, Meyr AJ. Wound Healing and Risk Factors for Non-healing Up-To-Date 2014
Renal Failure

- Calciphylaxis rare and life-threatening
- Annual incidence is 1% in ESRD patients
- Female 3:1
- Microvascular calcification, thrombosis and occlusion lead to necrosis and gangrene
- Parathyroidectomy of some benefit but prognosis remains poor and mortality high
- HBO may be of benefit

Protein Energy Malnutrition

- Insidious onset. May be rapid.
- Elderly and lower socioeconomic groups at risk
- Good food is more expensive than bad food
- Hyperglycemia delays wound healing
- Multiple supplements and interventions
- Early diagnosis important
- Prealbumin and Transferrin good markers
- Nutrition/dietary consultation
## ABC’s of Nutrition Assessment

<table>
<thead>
<tr>
<th>Category</th>
<th>Indicators</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>A. Anthropometrics:</strong></td>
<td>Height, weight, skinfolds</td>
</tr>
<tr>
<td><strong>B. Biochemical:</strong></td>
<td>alb, pre-alb, transferrin, TLC, minerals, BUN/Cr, hgb, hct</td>
</tr>
</tbody>
</table>
| **C. Clinical Signs:** | Skin – pale, dry, scaly, swollen  
                           Hair – thin, dull, changed texture  
                           Eyes – sunken, scleral yellowing  
                           Mouth – cheilosis, tongue color, missing teeth, gums |
| **D. Dietary:**      | Calorie counts, % of consumption                                             |

Protein & Energy Stores

Figure 1. Balance between adequacy of macronutrients and net anabolism and catabolism and its impact on wound healing.
Loss of Lean Mass

Wound

Muscle

10% loss

20% loss

30% loss

Barbul and Kavalukas. Nutrition and Wound Healing, an Update
Aging

- ↑ Life expectancy
- Skin is largest organ we have
- Thinning of dermis and basement membrane
- ↓ density of vascularity and nerves
- ↓ amount of collagen and ability to produce collagen
- Multiple comorbidities

Aging

- ↓ Growth factors
- ↓ Epithelialization
- ↓ Angiogenic activity
- ↑ Multiple meds
- ↓ mobility and ↑ falls
- ↑ in mood disorders
- ↓ percentage of closed wounds in elderly by 25% as compared to younger population

Medications

- Systemic Steroids
- NSAIDS
- Methotrexate
- Heparin
- Hydroxyurea
- Amlodipine/Nifedipine
- Warfarin
- Select chemotherapeutics
- Povidone
Chemotherapy

- **Bevacizumab** - Monoclonal antibody against VEGF inhibits angiogenesis in tumor and healthy tissue alike.
- **BIG impediment to wound healing**

Radiation Therapy

- Impairs vascularity and depletes cell lines
- Impacts all phases of wound healing
- Progressive over time
- Good response to HBOT
- Radiation Proctitis

Clark, Cone et al, 2008

Feldmeier JJ. Hyperbaric Oxygen Therapy Committee Report Undersea and Hyperbaric Medical Society Gesell LB Ed.
Pyoderma Gangrenosum

- Painful ulcers of varying depth and size
- Purulent wound bed and blue-black edge
- Most commonly associated with underlying autoimmune or malignant disease
- Pathergy!
Factitious Disorder

- Accompanies various psychiatric disorders
- Lesions in various stages of healing
- Well circumscribed borders
- Areas accessible and reachable with hands
- Usually sparing back
ETOH Induced High-Velocity Pavement Wound
Smoking

Impedes healing by:

- Local vasoconstriction and hypoxia
- ↑ CO delivery to wound
- Endothelial and vasomotor dysfunction
- Accelerated atherosclerosis
- ↑ platelet activation
- ↓ collagen synthesis
- ↑ risk of post-op wound infection and rupture

Summary

- Careful H&P
- History of prior wounding
- Lifestyle and mobility questions
- Nutritional assessment
- Wound characteristics
- Prior treatment; successes and failures

Pay attention: When all else fails – take a history!
Thank you!

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