Nutrition and Wound Care

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Objectives

- Identify patients that are at risk for pressure ulcers
- Interpret Braden Scale/Scores
- Review nutrients involved in the wound healing process and supplementation guidelines
- Learn about evidenced-based laboratory indicators
Who is at risk for developing a pressure ulcer?

- Elderly
- Poor circulation
- Being bedridden or immobile
- Malnutrition
  - Inadequate intake of nutrients
- Cognitive or neurologic impairments
- Incontinence
- Diabetes or Vascular diseases
- End-Stage Renal Disease
- 15% unintentional weight loss
Pressure Ulcer Stages

- Stage I
- Stage II
- Stage III
- Stage IV
- Unstageable
  - Full thickness tissue loss
  - Base of ulcer is covered by slough (yellow, tan, gray, green or brown) and/or eschar (tan, brown or black) in the wound bed.
- Deep Tissue Injury

NPUAP 2007
Pressure Ulcer

- Pressure ulcer
  - Localized injury to the skin and/or underlying tissue usually over a bony prominence
    - result of pressure, or pressure in combination with shear and/or friction.

[Images of different stages of pressure ulcers with captions: Stage I, Stage II, Stage III, Stage IV.]

*Pictures Courtesy of Coloplast Corp.*
Nutrition Risk and Wounds

- Stage III or greater triggers an automatic consult on admission
- Stage II or greater increases risk needs nutrition screen
- Non-healing or worsening wound
- Poor intake
- Unintentional weight loss
Braden Scale
Assess risk for skin breakdown

- Sensory Perception
- Moisture
- Activity
- Mobility
- Nutrition
- Friction and Shear

- Total Braden Score
  - 15-16 Mild Risk
  - 12-14 Moderate Risk
  - Less than 12 High Risk
  - 15-18 Mild risk for those older than 75
Braden Score- Nutrition

• Excellent (4 pts)
  – Eats most of every meal
  – Does not require supplementation

• Adequate (3 pts)
  – Eats greater than 50% of most meals
  – Tube feed or Total Parenteral Nutrition
  – Will consume supplement
Braden Score- Nutrition

• Probably Inadequate (2 pts)
  – Rarely eats a complete meal (30%)
  – Occasionally consumes supplement
  – Clear or Full liquid diet greater than 3 days

• Very Poor (1 pt)
  – Never eats a complete meal; less than 30%
  – Does not take supplement
  – NPO or clear liquid greater than 5 days
Nutrition Intervention

- Estimate nutritional needs
- Food tolerance and preferences
- Liberalize restrictive diets to optimize oral intake
- Provide oral supplements
- Routinely reassess
- Alternative nutrition support
  - Tube feed or Total Parenteral Nutrition
- Recommending vitamins or minerals if deficiency exists
RN Information Needed

• Flow sheet
  – % po consumption
  – Accurate height and weights
  – Intake and Output
  – Wounds
    • Type and affected area
Nutrients Involved in the Wounds Healing Process

- Calories
- Protein
  - Arginine
  - Glutamine
- Lipids
  - Omega-3 Fatty Acids
- Fluid
- Vitamin A, C, E
- Copper
- Iron
- Magnesium
- Selenium
- Zinc

Nutrients Involved: Calories

• Spares protein for cellular and muscle maintenance and synthesis

• Signs of deficiency
  – Decreased lean muscle mass
  – Mild to moderate protein-energy malnutrition
    • Diagnosed by lab levels
      – Albumin, total lymphocyte count, % ideal body weight, % usual weight, BMI
Nutrients Involved: Calories

• Recommendations for wound healing
  – Non-obese
    • 30-35 kcal/kg/day (actual body weight)
  – Obese
    • 20-25 kcal/kg/day (actual body weight)
  – Indirect calorimetry
Nutrients Involved: Protein

• Tissue maintenance and repair
• Signs of deficiency
  – Kwashiorkor
    • Distended abdomen
    • Edema
    • Thinning hair
    • Fatty liver
  – Muscle wasting
Nutrients Involved: Protein

• Recommendations for wound healing
  – Intact Skin: .8 -1.0 gm/kg
  – Stage I-II: 1.25-1.5 gm/kg
  – Stage III-IV: 1.5-2 gm/kg
  • Note: Increasing protein intake above 1.5 gm/kg/day may not increase protein synthesis
  – 20-25% of total calories

National Pressure Ulcer Advisory Panel Feb 2007
Nutrients Involved: Arginine

• Nonessential amino acid
  – Formed in the urea cycle
  – Adequate supply relies on the precursors of glutamine

• “Conditionally Essential Amino Acid”
  – During times of growth or stress a dietary source may be necessary

• Regulates metabolic and physiologic functions involved in wound healing and tissue repair
Nutrients Involved: Arginine

• Sole substrate for nitric oxide
  – regulated collagen formation and cell proliferation

• Increases wound and gut profusion

• CAUTION with septic patients*
  – Sepsis has been postulated to be an arginine-deficient state and/or a syndrome with elevated levels of nitric oxide.
  – Continuing research needed to prove otherwise

Nutrients Involved: Arginine

• Recommendations for wound healing
  – Ideal dose unknown
  – 17-24 gm/day have shown some benefit without adverse effects
  – 15 gm/day has shown increase in collagen deposits
  – Up to 30 gm/day for up to one week has been tolerated but may cause GI upset

• Dietary sources
  – Meats, dairy, nuts, spinach, parsley, cabbage

Nutrients Involved: Glutamine

- Nonessential amino acid
- “Conditionally Essential Amino Acid”
- Tissue repair and cell proliferation
- Found in muscle tissue
  - Fuel for fibroblasts, platelets, macrophages, lymphocytes
  - Stimulates release of human growth hormone
  - Stimulates early inflammatory and immune response
Nutrients Involved: Glutamine

- In catabolic stress and during sepsis
  - Glutamine utilization increases and results in intracellular depletion of glutamine
    - skeletal muscle
    - subsequent **breakdown of lean tissue**!
  - Lack of glutamine causes loss of gut integrity


Nutrients Involved: Glutamine

• Recommendations for wound healing
  – Ideal dose unknown
  – 0.5-0.6 g/kg/day for critically ill patients
  – Typical dietary consumption in less than 10 gm/day
  – Up to 40 gm/day has been tolerated in a catabolic state

• Dietary sources
  – nuts, brown rice, raisins, coconut, gelatin, buckwheat, barley, cereals, chocolate, corn, dairy products, meats, oats

Nutrients Involved: Lipids

• Cellular energy and cell membrane integrity
• Omega-3 Fatty acids (flax, fish, eggs)
  – are not precursors of inflammatory response
  – Omega-6 are precursors (vegetable oil, nuts)
• Recommendations for wound healing
  – Optimal ratio of n6:n3 is 2:1 or less
Nutrients Involved: Fluid

- Normal cell function and tissue integrity
- Adequate blood volume and hydration
- Supports wound repair
- Monitor Intake and Output
Fluid Recommendations

<table>
<thead>
<tr>
<th>Wound Stage</th>
<th>mL/day</th>
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<tbody>
<tr>
<td>Intact, High Risk/ Stage I, II</td>
<td>30 mL/day, minimum of 1,500 mL/day</td>
</tr>
<tr>
<td>Intact, High Risk/ Stage I, II for QUADs and PARAs</td>
<td>35 mL/day, minimum of 2,500 mL/day</td>
</tr>
<tr>
<td>Complicated Stage II, III, IV, Unstageable, Non-healing</td>
<td>35 mL/day, minimum of 2,000 mL/day</td>
</tr>
<tr>
<td>Complicated Stage II, III, IV, Unstageable, Non-healing for QUADs and PARAs</td>
<td>35-40 mL/kg/day</td>
</tr>
</tbody>
</table>

• Add 10-15 mL/kg for air fluidized beds

• For BMI greater than 30
  • use 1-1.5 mL per Kcal
  • use Adjusted Body Weight for protein and Kcal calculations
Vitamin A

- Fat soluble vitamin that promotes collagen synthesis
- Associated with reversal of the anti-inflammatory effect of steroids on healing
- Required for intact immune response
- Signs of deficiency
  - Fat malabsorption disorders
    - Crohn’s, Cystic Fibrosis
  - Night blindness
  - Dermatitis
Vitamin A

- Recommendations for wound healing
  - Supplement only if deficiency is suspected or for those receiving high dose steroids
    - Clinical deficiency is rare
    - Up to 25,000 IU/day for up to 7-21 days (3,000 micrograms)
    - High doses can be toxic
      - caution in renal and liver disease

Vitamin C

• Water soluble vitamin that contributes to collagen synthesis
• Fibroblast proliferation
• Antioxidant function to help neutralize free radicals
• Signs of deficiency: Scurvy
  – Wound dehiscence
  – Bleeding
  – Dry, splitting hair
Vitamin C

• Recommendations for wound healing
  – Up to 2000 mg day in divided doses
    • Upper limit
  – Lacking and conflicting scientific evidence to support the use of supplementation in patients without deficiency
  – Toxicity may result in kidney stones, diarrhea, gastritis and nausea

Vitamin E

- Antioxidant and fat soluble vitamin
- Maintains and stabilizes cellular membrane integrity
- Supports immune response
- Signs of deficiency
  - Impaired healing
  - Fat malabsorption
Vitamin E

• Recommendations for wound healing
  – Daily Reference Intake
    • 15 mg day for males and females
  – Ideal dose is unknown
    • Supplement only if deficient
      • 1000 mg/day
  – Excess Vitamin E has impaired wound healing
    • In animal studies

Copper

- Antioxidant that strengthens the metabolism of hemoglobin, collagen and elastin
- Enzyme catalyst
- Signs of deficiency
  - Neutropenia
  - Microcytic anemia (iron deficiency)
Copper

• Wound healing recommendations
  – 2 mg copper per 25 mg zinc/day
    • 2-4 mg/day
Iron

- Oxygen transport
- Collagen synthesis
- Signs of deficiency
  - Anemia
  - Impaired collagen synthesis
- Recommendations for wound healing
  - 20-30 mg daily
  - Daily Reference Intake 18 mg
Magnesium

• Cofactor for numerous enzymes involved in protein synthesis
• Provides structural integrity of ATP
• Decreases inflammatory response
• Signs of deficiency
  – Impaired healing
  – Altered immune response
  – Muscle weakness
Magnesium

- Recommendations for wound healing
  - Standard Dietary Reference Intake
    - 420 mg for men age 31 and older
    - 320 mg for women age 31 and older
Selenium

• Oxidation of glutathione
• Antioxidant
• Signs of deficiency
  – Impaired immune function
  – Free radical damage
• Recommendations for wound healing
  – 100-400 mcg/day
Zinc- Essential trace mineral

- Cofactor for enzymes involved in protein synthesis and supports growth of healthy tissue
- Collagen formation and cellular replication
- Stabilizes cell membranes
- Signs of deficiency
  - Diarrhea
  - Alopecia
  - Dermatitis
  - Hypogeusia (decreased sense of taste)
Zinc

• Deficiency can occur through
  – wound drainage
  – gastrointestinal losses
  – prolonged low dietary intake

• Recommendations for wound healing
  – 25-50 mg elemental zinc 1 time/day up to 14 days
    • Equal to 110-220 mg zinc sulfate

 Zinc

• Supplementation should only be given to patients with deficiency
  – Potential toxic effects
    • affect absorption of Calcium and Copper
    • impaired immune function
    • may interfere with antibiotics and NSAIDS
Laboratory Values

• Albumin and Prealbumin
  – Hepatic transport proteins
  – Negative acute-phase reactant
  – Decrease with acute inflammatory and infectious processes
  – Many factors influence levels
    • Hydration status
    • Renal
    • Pregnancy
    • Liver
    • Sepsis
Albumin

- Half life 18-20 days
- Normal range
  - 3.4-5.4 g/dL
- Low levels are a strong predictor of mortality and increased length of stay
- Does NOT specify significant losses in Lean Body Mass

Forse RA, Shizgal HM. Serum albumin and nutrition status. *JPEN* 1980;4 450-454
Prealbumin

• Shorter half-life than albumin
  – 2 days
  – Normal range
    • 17-40 mg/dL

• NOT a sensitive indicator of nutritional status

Why are they still routinely used?

• ICD9 Codes
  – For reimbursement
  – Albumin is used as diagnostic criteria for malnutrition

• Clinicians not up-to-date on evidenced based practice
If labs can’t tell us… then what?

- Subjective Global Assessment
  - Physical assessment tool
    - Weight change
    - Dietary intake
    - Gastrointestinal symptoms
    - Functional impairment
- Braden Scale
- Clinical judgment
Supplements!

- RESOURCE Arginaid Extra (Nestle)
  - Box drinks
  - Powder
- Crucial (Nestle Nutrition)
  - Tube feeding formula
- Pivot 1.5 (Ross/Abbott)
  - Tube feeding formula
- Perative (Ross/Abbott)
  - Tube feeding formula
Summary

• Only supplement vitamin/minerals if deficient
• If a “wound care” supplement is ordered, discontinue other additional vitamin supplementation
• Be on the look out for new research on Arginine and Glutamine
• Albumin and Prealbumin not indicators of nutrition risk
Questions?