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WOUND HEALING
FOOD FOR THOUGHT
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PROGRAM OVERVIEW AND OBJECTIVES

Discuss the role of dehydration and malnutrition impeding wound healing
Discuss barriers impeding wound healing
Explain the role specific vitamins and minerals play in the wound healing process

ACKNOWLEDGEMENTS

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HYDRATION AND NUTRITION

Nursing Homes
- 500,000 residents may suffer from malnutrition or dehydration
- 50% of residents need help with eating
- 21% are completely staff dependent for eating
- 50% - 75% of nursing home residents have dysphagia
- 52% of hospital patients admitted with a diagnosis of dehydration will come from a nursing home
- 1999 and 2002 - 13,890 nursing home residents nationwide died from malnutrition and dehydration
- $6.5 million awarded to an Ohio widow

-Nursing home lawsuit filed over the dehydration death of her husband allegedly caused when he was not provided with enough water during a temporary nursing home stay
WOUND MANAGEMENT

Barriers to Wound Healing
- Medications
- Lack of Knowledge
- Aging
- Impaired Immunity
- Peripheral Vascular Disease
- Metabolic Disorders
- Tumors
- Stress
- Infection

WOUND MANAGEMENT

Stress Response
- ↑ catabolic hormones (cortisol and catechols)
- ↑ metabolic rate
- ↑ body temperature
- ↑ glucose demand and liver gluconeogenesis
- ↓ anabolic hormones (human growth hormones and testosterone)
- Rapid skeletal muscle breakdown
- Amino acid use as an energy source
- Lack of ketosis (fat not the major caloric source)
- Unresponsiveness of catabolic to nutrient intake

WOUND MANAGEMENT

Skin Breakdown
- General catabolic state
- Fight or flight (stress hormones)
- Suppression of the synthesis of protein, glycogen, triglycerides
- Protein energy malnutrition (PEM)
- A resident with a PrU who continues to lose weight needs:
  - Additional caloric intake
  - Correction (where possible) of conditions that are creating a hypermetabolic state
  - Registered Dietician or nutritionist

WOUND MANAGEMENT

Body Mass Index
- Sarcopenia
- Underweight and overweight
  - Same nutritional risks
  - Diagnostic tool for both obesity and protein-energy malnutrition
  - <16 = severe underweight
  - 17 - 18 = underweight
  - 19 - 24 = normal
  - 25 - 30 = grade I obesity (mild)
  - 31 - 40 = grade II obesity (moderate)
  - >40 = grade III obesity (severe)

WOUND MANAGEMENT

Tube Feeding
- 7.5% - 40.1% of resident population
  - ≥30% LBM loss
    - Decreased healing, weakness, increased infection, thinning of the skin, mortality increased by 30%
  - ≥40% LBM loss
    - Too weak to sit, PrUs develop, pneumonia, wound healing ceases, mortality increased by 50%

LEAN BODY MASS

Muscle Mass Decrease
- ↓ energy requirements decline
- ↓ protein reserves during periods of stress
- ↓ total body water increases chances of dehydration
- ↑ distribution volume of fat-soluble drugs
- Elimination of fat-soluble drugs is delayed

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**LEAN BODY MASS**

Creatine Height Index (%)  
- Marker for skeletal muscle mass  
- Decreases (protein depletion)  
- Amount of creatine excreted in a 24 hour period divided by the amount of creatine excreted by a normal healthy individual of the same height and sex  
  - >80% = normal protein  
  - 60% - 80% = moderate protein depletion  
  - <60% = severe protein depletion

**ANOREXIA AND CACHEXIA**

**Anorexia**  
- Loss of appetite/loss of interest in seeking and consuming food  
- A psychiatric eating disorder  
- Physical - low body weight  
- Psychological - image distortion  
- Emotional - depression  
- Behavioral - obsessive fear of gaining weight

**Cachexia**  
- Loss of appetite in someone who is not actively trying to lose weight  
- Insidious loss of weight, muscle atrophy, fatigue and weakness  
- Directly related to inflammatory states  
- Rheumatoid arthritis, AIDS, chronic renal failure, COPO, Cancer, Immunodeficiency syndrome  
- Resistance to hypercaloric feeding  
- Tx dependent of diagnosis of underlying

**WOUND MANAGEMENT**

**Registered Dietician Assessment**  
- Diet and intake history  
- Weight history  
- Regular weighing  
- Physical examination  
- Skin assessment  
- Hydration and nutritional diagnosis  
- Co morbidities (e.g. diabetes)  
- Estimation of hydration, nutrient requirements  
- Hydration, nutritional PoC

**Triggers for Assessment**  
- Resident food consumption - fluid, food and/or supplement served  
- Fluid amount accepted daily  
- Resident refusal of fluid, diet, meals or supplements (why, alternatives, notification, documentation)  
- Frequency of RD visit and discuss the PoC with the resident or staff  
- Residents weight status monitored (loss or gain)  
- Laboratory values requested - appropriate  
- Frequency of PoC evaluated and updated  
- Hydration and nutritional component of the PoC appropriate  
- Competency of resident and staff to understand the risks and benefits of the hydration and nutritional intervention
**WOUND MANAGEMENT**

**Exudate (Type)**
- **Inflammatory**
  - Serous - watery plasma, thin, clear or light color
  - Serosanguineous - plasma and red blood cells, thin, light red to pink
  - Sanguineous - thin, red, bloody
- **Infection**
  - Seropurulent - contains some white blood cells and living or dead organisms, cloudy, yellow to tan
  - Purulent (pus) contains white blood cells and living or dead organisms, thick, creamy yellow, green, or brown
- **Exudate (Amount)**
  - Scant, Moderate, Heavy - clinical judgment

**WOUND MANAGEMENT**

**Moisture-Associated Skin Damage (MASD)**
- **Incontinence-associated dermatitis**
- **Intertiginous dermatitis**
- **Periwound moisture-associated dermatitis**
- **Peristomal moisture-associated dermatitis**

**Treatment**
- Use non-alcohol based moisturizers
- Establish continence training
- Bowel or bladder training programs
- Avoid skin contact with plastic surface to reduce sweating
- Maceration, friction, shear

**WOUND MANAGEMENT**

**Incontinence**
- **Urinary**
  - Evaluate to identify whether reversible causes exist
  - Urea converted to ammonia (pH)
- **Reversible causes**
  - Urinary tract infection
  - Medications
  - Confusion
  - Polyuria due to glycosuria or hypercalcinema
  - Restricted mobility due to restraints
  - Managing excessive moisture (sweating)

**WOUND MANAGEMENT**

**Incontinence**
- **Fecal**
  - Bile acids and enzymes in feces
  - Differentiate between pressure ulcer and skin breakdown due to dermatitis
  - Feces irritate the epidermis and make the skin more susceptible to breakdown
  - Maceration, shear, friction
  - Fecal impaction

**WOUND MANAGEMENT**

**Maintain Skin Integrity**
- **Daily skin inspections**
  - Over bony prominences
  - Assess for compromised peripheral circulation
- **Promote skin hygiene**
  - Cleanse skin after soiling
  - Cleanse skin with saline and skin cleanser
  - Avoid alkaline agents which increase skin irritation
  - Avoid bioburden build up and risk of infection
  - Use skin protectants or barriers
  - Do not massage or rub over bony prominences
- **Moisture Control**
  - Use non-alcohol based moisturizers
  - Establish continence training bowel or bladder training programs
  - Avoid skin contact with plastic surface to reduce sweating

**WOUND MANAGEMENT**

**Support Surface (Powered)**
- **Moderate** - high risk or resident has a PrU on turning surfaces and the ulcer
- **Residents unable to assume a variety of positions**
  - Flexion contractures
  - Reduce pressure on bony prominences or prevent breakdown from skin-to-skin contact
  - Additional 10 to 15 ml fluid/kg of body weight
  - Prevent dehydration occurring from the drying effects of the specialty beds
HYDRATION

Daily Fluid Intake vs. Daily Fluid Loss

- Daily fluid intake
  - Liquid consumed + fluid in foods consumed + bodily by-product water
- Daily fluid losses
  - Any body fluid
  - Kidney use (urine) + GI tract use (feces) + evaporation from skin + respiration evaporation
- The body does not store water

Adapted from Krause's Food, Nutrition & Diet Therapy, 11th Edition

HYDRATION

Dehydration

- Reduction in total body water
- Hyponatremia (water and sodium loss)
- Hyperosmolar (water loss - due to ↑ sodium or glucose)
- Electrolyte imbalance (3% body weight)
- Long Term Care
  - Sign of poor care
  - Combination of physiological or disease process
  - Not primarily due to lack of access to water

HYDRATION

Blunted Thirst Mechanisms

- Aging
- Homeostasis declines
- Infection
- Respiratory, GI, GU
- Fluid loss or increased fluid need
- Diarrhea, fever, vomiting
- Incontinence
- Reduce fluid intake
- Fluid restriction
- Renal dialysis
- Medications
- Diuretics, sedatives, antipsychotics, tranquilizers

- Cognitive or functional impairment
  - Aphasia - unable to communicate effectively
  - Dementia or Alzheimer’s disease
  - Neurological impairment
  - Coma or decreased sensorium
  - Tube feedings
  - Dysphagia
  - Reduce fluid intake
  - NPO
  - Reduce fluid intake
  - Use of supplementation
  - Thick
  - Difficult to swallow

HYDRATION

Dehydration Screening

- Pale skin
- Sunken eyes
- Red swollen lips
- Swollen and/or dry tongue with scarlet or magenta hue
- Dry mucous membrane
- Poor skin turgor

- Cachexia
- Bilateral edema
- Muscle wasting
- Calf tenderness
- Reduced urinary output
- Dark urine

HYDRATION

Persistent subclinical dehydration

- Anxiety
- Panic attacks
- Agitation
- Fluctuation in tissue hydration
- Inattention
- Hallucinations
- Delusions
- Severe dehydration
- Somnolence
- Psychosis
- Unconsciousness

HYDRATION

Functional Decline of the Renal System

- Abnormal lab values to identify dehydration
  - Abnormal glucose, calcium, potassium
  - Abnormal serum bicarbonate
  - Abnormal creatinine
  - Hemoglobin and hematocrit
  - Urine specific gravity
  - Serum sodium
  - Albumin
  - Blood Urea Nitrogen (BUN)*

*BUN is only useful in absence of renal disease
Intervention
- Monitor fluid intake and output
  - Adult: 30-35 mL/kg body weight/day
  - Minimum of 1500 mL/day
- Maintain circulation blood volume (reduce hypovolemia - fluid/salt)
- Maintain fluid and electrolyte balance

Source: American Medical Directors Association Dehydration and Fluid Maintenance, Clinical Practice Guidelines, Columbia MD

Prevention and Management
- Education (staff and family members)
- Barriers to getting water and ice to the resident
- Difficulty to routinely fill water pitchers
- Awareness of risk factors
- Early identification of fluid imbalance and acute illness
- “Sipper” takes a few sips at a time
- May benefit from being offered frequent small amounts of fluid
- Dementia resident
  - Able to drink but forgets
  - Use social cues
- Identification of MASD risk factor

Hydration Strategies
- Add cup holders to wheelchairs
- Give residents water bottles to carry around facility
- Offer beverages from beverage carts
- Take fluids on outings and offer frequently
- Include beverage break in all activities
- Offer glasses of water in dining room while waiting for meals
- Have fluids readily available
- Encourage fluids
- Offer choices
- Offer fluids after providing care
- Encourage ambulatory residents to drink all fluids offered with meals

Did You Know
- Malnutrition in nursing homes: 20% - 54%
- Residents
  - Having lost 5% of their weight in 30 days (acute): 9.9%
  - 10% of their weight in 180 days (chronic): 9.9%
  - Having albumin levels below 3.5 g/dL: 6% - 43%

Weight
- Reflects the balance between intake and utilization of energy (calorie and protein)
- Before instituting a nutritional care plan assess:
  - Eating times (10 - 60 minutes)
  - Severity of nutritional compromise
  - Individual’s prognosis
  - Projected clinical course
  - Resident’s wishes and goals (offer relevant alternatives)
**NUTRITION**

**Weight Measurement**
- Admission or readmission
- Weekly - first 4 weeks after admission
- Monthly (identify changes gain or loss)
- Frequent
  - Food intake has declined and persisted (more than a week)
  - Evidence of altered nutritional status or fluid and electrolyte imbalance
  - Consider terminally ill

**Severity of weight loss**
- **Severe weight loss**
  - ≥10% in 6 months
  - ≥7.5% in 3 months
  - ≥5% in one month
  - ≥2% in one week

**NUTRITIONAL ASSESSMENT**

**Malnutrition**
- Deficiency, excess or imbalance of energy, protein or other nutrients causing adverse effects on body form, function and clinical outcomes
- Due to increased total protein turnover
- Rapid loss of lean body mass
- Insufficient energy intake
- Weight loss
- Loss of subcutaneous fat
- Localized or generalized fluid accumulation (may mask weight loss)
- Diminished functional status (hand grip)

**Undernutrition**
- Form of malnutrition in which inadequate nutrition results from lack of food or failure of the body to absorb or assimilate nutrients properly

**NUTRITION**

**Laboratory Tests**
- None are specific or sensitive enough to warrant serial or repeated testing or determine a resident's nutritional status
- Determine whether the test will potentially change the resident's diagnosis, management or quality of life
- Laboratory test may be affected by age due to:
  - Hydration status
  - Chronic disease
  - Acute illness
  - Change in organ function

**NUTRITIONAL ASSESSMENT**

**Assessment Tool**
- Nutritional risks (six areas)
  - Oral health status
  - Ability to eat
  - Proper diet
  - Eating patterns
  - Chronic diseases affecting appetite
  - Medications affecting appetite
- Current weight status
- Detect under and over nutrition
- Malnutrition Screening Tool
- Short Nutritional Assessment Tool
NUTRITIONAL ASSESSMENT

2. Probably inadequate: Rarely eats a complete meal and generally eats only about 1/2 of any food offered. Protein intake includes only 3 servings of meat or dairy products per day. Occasionally will take a dietary supplement. OR receives less than optimum amount of liquid diet or tube feeding.

Care Requirements
- Baseline Labs
- Dietitian evaluates and recommends intake goals
- Supplements are provided, intake counted and recorded
- Provide support with eating
- Time meals, encourage family to feed
- Encourage favorite food and snacks

NUTRITIONAL ASSESSMENT

5. Adequate: Eats over half of most meals. Eats a total of 4 servings of protein (meat, dairy products) each day. Occasionally will refuse a meal, but will usually take a supplement if offered. OR is on a tube feeding or TPN regimen, which probably meets most of nutritional needs.

Care Requirements
- Monitor intake of food, tube feeding, TPN
- Food intake decreases - offer supplement
- Tube feeding or TPN decreases - monitor and ensure infusion of prescribed amount
- Evaluate adequacy of prescribed amount
- Dietitian evaluates intake of calories and protein if food intake is low
- Consider vitamin supplement
- Provide assistance with feeding as needed

NUTRITIONAL ASSESSMENT

Braden >18
- Monitor intake and weight
- Dietary Consult
- Usual criteria on admission database
- Intake consistently >75%
- Metabolically stressed state (trauma, fever etc.)
- Significant weight loss (non fluid)
- -2% in 1 week
- -5% in 1 month
- -7.5% in 3 months
- -10% in 6 months

NUTRITIONAL ASSESSMENT

Braden <18
- Inadequate hydration, protein and/or weight loss
- Complete nutrition assessment
- Meet fluid needs
- Visual assessment
- Follow up weekly
- Correct source of poor intake
- Food preferences, constipation, illness, depression, pain, medication causing poor appetite
- Evaluate need for anabolic agent and/or nutrition support
- BMI <20 change diet to high caloric, high protein
- Add therapeutic multivitamin/minimum supplement
NUTRITIONAL ASSESSMENT

Oral Health Status
-60 - 90% of residents have severe periodontal disease
- Gum recession
- Tooth loss (80%)
- Oral pain
- Mouth ulcers (20%)
- Chewing Abnormalities
- Dry mouth
- Gingivitis
- Periodontal disease
- Fitting dentures (50%)
- Swallowing Abnormalities (Dysphagia)
- Disease of the oropharynx and esophagus
- Dementia
- Stroke

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KEY MICRONUTRIENTS

Inflammatory
- Macrophages, neutrophils, blood clotting, vasoconstriction
- Vitamins and amino acids: A, K, Bromelain

Proliferative
- Angiogenesis, fibroblasts, collagen deposition
- Vitamins and minerals A, B, C, Cu, Fe, Mg, Zn

Remodeling
- Collagen maturation, stabilization, scar tissue formation
- Vitamin and minerals C, Cu, Fe, Zn

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KEY MACRONUTRIENTS

Calories
- Resident with PRUs or at-risk for development
- 25 - 35 kcs/kg body weight/day*
- Consuming enough calories, “spares” the use of protein for energy
- 30 calories/kg (15 calories/pound) prevent protein breakdown in non-obese

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Protein
- Building block for repair
- Angiogenesis
- Collagen synthesis
- Granulation tissue
- Epithelial cell proliferation
- Tensile strength
- Resistance to infection
- RDA
- 0.8 g/kg body weight
- Stress 1.2 to 1.5 g/kg body weight

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**KEY MICRONUTRIENTS**

**Vitamin A**
- Facilitates macrophage entry into the wound and enhances angiogenesis
- Antagonizes inhibitory effects of glucocorticoids (corticosteroids)
- Stimulates fibroplasia to increase collagen synthesis
- 5000 - 25000 International Units (IU) X 10 days

**Vitamin C (Ascorbic acid)**
- Not stored in the body
- Enhances leukocyte, macrophage activation, fibroblast, collagen synthesis
- Depressed levels found in elderly, smokers, and certain cancers
- 75g/day females and 90 mg/day males
- Supplementation 500 - 1000 mg/day for 2 weeks if deficiency suspected

**Vitamin E**
- Scar formation – conflicting reports
- Adversely affects vitamin A benefits
- May interfere with the healing of some types of wounds

**Vitamin K**
- Co-factor for coagulation
- Monitor prothrombin times (PT) rations (INR)
- Antibiotics may limit vitamin K

**Zinc**
- Increased demand during collagen and protein synthesis
- RDA
  - 11 - 15 mg/males (elemental zinc)
  - 8 - 12 mg/females (elemental zinc)
- Limit 40 mg/day
- Hypermetabolic state
- Urinary loss of zinc
- Zinc sulfate 220 mg tid
- Supplementation with 25 - 50 mg elemental zinc/day x 2 weeks
- Stage III - IV pressure ulcer
- D/C in 6 weeks - may impair copper absorption

**Glutamine**
- 60% intracellular amino acid pool
- Primary fuel source for epithelial cell division
- Stimulates lymphocytic proliferation
- wound infection
- 2 g - HGH release
- 0.3 - 0.4 g/kg/day (burn patients)
- Caution: Excess may result in ammonia levels
NUTRITION

Current evidence does not definitively support any specific dietary supplement unless the resident has a specific vitamin or mineral deficiency

- Multivitamins contain 7.5 to 15 mg of elemental zinc

WOUND HEALING

FOOD FOR THOUGHT

In Conclusion
- Nutrition plays an essential role in wound healing
- Implementing the nutritional plan and providing appropriate nutritional support to the individual requires involvement of the whole wound management team
- By combining knowledge of the wound healing process together with best practice provision of nutrition, healthcare professionals can help decrease the morbidity and mortality associated with chronic wounds as well as reducing their cost and impact

Thank you

Questions?

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