

The Recipe for Success in Nutrition and Wound Healing

Nancy Collins, PhD, RDN, LDN, NWCC, FAND

Today's Menu

- Identify the six characteristics of adult disease-related malnutrition according to the 2012 Academy/A.S.P.E.N. international Consensus guidelines
- Review how nutritional deficiencies affect wound healing
- Implement at least two new nutritional interventions

Facts About Malnutrition¹

- Defined as a lack of adequate calories, protein, or other nutrients needed for tissue maintenance and repair
- Occurs along a continuum of inadequate intake and/or increased requirements, impaired absorption, altered transport, and altered nutrient utilization
- Until 2012, no consensus was available on how to diagnose malnutrition:
 - Electronic health records and interoperability made this evident and necessary

The New Definition of Malnutrition¹

- The new definition:
 - Provides a standardized set of diagnostic characteristics used to identify and document malnutrition
 - Is etiologically based diagnostic nomenclature
 - Accounts for what we know about inflammatory response
 - Allows for data collection to add to scientific literature

Risk of Never Events With Preexisting Malnutrition/Weight Loss²

- Fry et al examined more than 880,000 surgical patient cases from 1368 hospitals to describe risks for never events and hospital-acquired infections:
 - Reported as odd ratios (the numbers indicate the increased risk for development of a certain condition with preexisting malnutrition and/or weight loss)
- Results:
 - For patients with malnutrition and/or weight loss, the risk for surgical site infection is 2.5 times greater compared to patients who do not have malnutrition and/or weight loss
 - For patients with mediastinitis after a coronary artery bypass graft (inflammation in the mid chest or mediastinum, either acute or chronic), the risk for infection is 5.3 times greater
 - For patients with a catheter-associated urinary tract infection, the risk is 5.1 times greater
 - For patients with pressure injuries, the risk is 3.8 times greater
- Continuity of care and planning at discharge really can help

Diagnosis of Malnutrition³

- Diagnosed when at least two or more of the following six characteristics are present:
 - Insufficient energy intake
 - Weight loss
 - Loss of muscle
 - Loss of subcutaneous fat
 - Localized or generalized fluid accumulation that may sometimes mask weight loss
 - Diminished functional status as measured by hand grip strength

Energy Intake³

- Malnutrition is the result of inadequate food and nutrient intake compared to estimated requirements:
 - Review food and nutrition history

- Estimate optimal needs
- Compare estimates to consumption
- Report inadequate intake as a percentage of needs
- Report weight change as a percentage lost from baseline

Body Fat³

- Loss of subcutaneous fat:
 - Orbital, triceps, fat overlying ribs
- Tools to determine body composition:
 - Skinfold thickness
 - Bioelectrical impedance
 - Bod Pod®
 - Nutrition-focused physical exam:
 - Exam that uses physical assessment and function to help determine nutritional status and diagnose malnutrition
 - Systematic approach (head to toe)

Muscle Mass³

- Loss of lean mass at:
 - Temples (temporalis muscle)
 - Clavicles (pectoralis, deltoids)
 - Shoulders (deltoids)
 - Interosseous muscles
 - Scapula (latissimus dorsi, trapezius, deltoids)
 - Thigh (quadriceps)
 - Calf (gastrocnemius)

Fluid Accumulation^{3,4}

- Evaluate generalized or localized fluid accumulation
- Weight loss sometimes masked by generalized fluid accumulation
- Intake/output records
- Assessment of edema:
 - Dent depth
 - Duration

Functional Status^{5,6}

- Hand grip strength:
 - Measure by dynamometer
 - Validated by proxy for lean body mass (LBM)
 - Independent predictor of poor nutritional status
- 4-meter/other walk tests
- Stair climbing/chair rising/balance
- Peak expiratory flow
- Measure overall energy, strength, endurance (ability to perform activities of daily living):
 - Consider non-malnutrition causes (eg, neuromuscular diseases, medication, age-related issues, trauma, activity/mobility)
 - Correlate with other characteristics (weight loss, intake)
- Norman et al offers strongest correlation to date with muscle mass and nutritional status

THE INGREDIENTS OF SUCCESS

Ingredient #1: Energy (or Calories)

- Insufficient caloric intake=weight loss
- Unintended weight usually is loss of LBM

Relationship Between LBM Loss and Wound Healing^{7,8}

- <10%—wound healing has priority for protein substrate
- >10%—stimulus to restore LBM competes with the wound for protein
- >20%—correction of LBM takes precedence, wound healing stops

NPUAP Clinical Practice Guidelines: Caloric Intake⁹

- If patient cannot achieve nutritional requirements by dietary intake, offer fortified foods and/or high-calorie, high-protein oral nutritional supplements between meals
- Strength of Evidence=B; Strength of Recommendation=👍👍
- 👍👍 Strong positive recommendation, definitely do it

Ideas to Increase Calories¹⁰⁻¹²

- Favorite and culturally appropriate foods
- Socialization at meals
- Diet order liberalization
- Multiple smaller meals throughout the day
- Proper mealtime positioning
- Assistance at meals:
 - Cueing
 - Hand over hand
 - Mirroring
- Recipe modification
- Oral nutritional supplements:
 - Try varied forms, including juices, puddings, bars, shakes, cookies, ice creams
- Appetite stimulants

Ingredient #2: Protein

- Only nutrient containing nitrogen¹³
- Responsible for synthesis of enzymes involved in wound healing and collagen synthesis¹³
- Needed at every step of the healing process¹³

Estimating Protein Needs

- Protein needs assessed as grams of protein per kilogram of body weight (g/kg bw)
- Recommended Dietary Allowance (RDA)=0.8 g/kg bw:
 - For 140-lb patient=51 g or 7 oz
- Stressed, malnourished patient=1.2-1.5 g/kg bw:
 - For 140-lb patient=76-95 g or 11-14 oz
- Critically ill or injured patient=1.5-2.0 g/kg bw:
 - For 140-lb patient=95-127 g or 14-18 oz
- Important to:
 - Evaluate renal function
 - Provide adequate fluids

Protein Distribution¹⁴

- Optimal protein distribution:
 - Breakfast≈30 g protein

- Lunch= \approx 30 g protein
- Dinner= \approx 30 g protein
- Skewed protein distribution:
 - Breakfast= \approx 10 g protein
 - Lunch= \approx 20 g protein
 - Dinner= \approx 60 g protein

How to Get More Protein to Your Patient

- Food:
 - Eggs, beef, chicken
 - Nuts, legumes
 - Protein shakes
 - Recipe modifications
- Modular protein supplements:
 - Added to food
 - Given between meals or with medications

Modular Protein Supplement Choices

- Whey:
 - High biological protein source
 - Formulated from cow's milk
- Casein:
 - Milk protein extract
 - Less bioavailable than whey
- Soy or vegan:
 - Good biological legume
- Collagen:
 - Natural to the body
 - Main component of cartilage, ligaments, tendons, bones, and teeth

Deciding on a Protein Supplement

- Form:
 - Liquid
 - Powder
- Final volume
- Nutrient density
- Palatability
- Ease of administration
- Use of tube feedings
- Digestibility
- Cost

Ingredient #3: Amino Acids

- When protein is consumed:
 - The digestive system breaks it down into individual amino acids
 - The body's cells then combine the amino acids and link them together to form a new protein within the body

Classification of Amino Acids¹⁵

- Indispensable amino acids:
 - Histidine

- Isoleucine
- **Leucine**
- Lysine
- Methionine
- Phenylalanine
- Threonine
- Tryptophan
- Valine
- Dispensable amino acids:
 - Alanine
 - Aspartic acid
 - Asparagine
 - Glutamic acid
 - Serine
- Conditionally indispensable amino acids:
 - **Arginine**
 - Cysteine
 - **Glutamine**
 - Glycine
 - Proline
 - Tyrosine

Arginine¹⁶

- Nitrogen-rich—32% nitrogen
- Helps support immune function
- Precursor to proline
- Improves IGF-1
- Precursor to polyamines
- Substrate for nitric oxide synthesis:
 - Activates macrophages
 - Improves vasodilation
 - Increases collagen formation

Glutamine^{17,18}

- Most abundant amino acid in the body:
 - >20% total circulating AA
 - >60% intracellular AA
- Increased needs in trauma and sepsis
- Benefits of supplemental glutamine include:
 - Stimulating collagen synthesis
 - Regulating nitrogen metabolism in catabolic states
 - Supporting immunity
 - Supporting gut integrity

NPUP Clinical Practice Guidelines: Protein Intake⁹

- When an adult patient with a pressure ulcer Category/Stage 3 or 4 or multiple pressure ulcers cannot meet nutritional requirements with traditional high-calorie and protein supplements, supplement with high protein, arginine, and micronutrients
- Strength of Evidence=B; Strength of Recommendation=👍

Diabetic Foot Wounds¹⁹

- Targeted amino acid supplementation on diabetic foot wounds

- Results of this pilot data and review of the literature show:
 - Administration of a simple amino acid supplement may improve the healing of diabetic foot wounds via increased collagen

Leucine^{20,21}

- Branched chain amino acid
- Stimulates mTOR signaling
- Stimulates muscle protein synthesis under both in vitro and in vivo experimental conditions
- 5% of leucine is converted to β -hydroxy- β -methylbutyrate (HMB)

HMB²²⁻²⁵

- Is a metabolite of the amino acid leucine
- Precursor for the manufacture of cholesterol:
 - Helps maintain muscle membrane integrity
 - Slows muscle tissue breakdown
- Helps support immune system
- Anabolic support:
 - Reduces the inflammatory process
 - Decreases muscle breakdown
 - Builds LBM
 - Protects muscle from stress-related damage

Ingredient #4: Vitamins and Minerals

- Can meet needs with a healthy diet⁹
- Elderly, sick, infirm many not have optimal diet⁹
- Consider heavily draining wounds⁹
- Reasonable to give multivitamin daily⁹
- *"Offer vitamin and mineral supplements when dietary intake is poor or deficiencies are confirmed or suspected."*—NPUAP⁹

Vitamin C²⁶

- Works with proline and lysine during collagen synthesis
- Needed for carnitine production for fatty acid metabolism
- Tensile strength
- Body does not store vitamin C

Zinc²⁷

- Needed for all enzymatic reactions
- In deficiency state, may find low rate of epithelialization
- Deficiency causes decreased wound and collagen strength
- Urinary losses increase with stress and weight loss
- Body stores may become depleted in patients with malnutrition, chronic diarrhea, and chronic corticosteroid use
- Zinc overload:
 - Above 40 mg/day
 - Excess may interfere with wound healing via affecting lysyl oxidase, an enzyme involved in collagen synthesis
 - Excess interferes with copper and iron absorption and metabolism

Copper²⁷

- Cofactor for connective tissue proliferation

- Collagen polymerization
- Formation of cross linkages to enhance scar strength
- Erythrocyte formation

Ingredient #5: Fluids (Hydration)

- 1 mL fluid/calorie^{9,28}
- 30 mL/kg body weight^{9,28}
- Additional fluids for dehydration, fevers, vomiting, profuse sweating, diarrhea, heavily exuding wounds^{9,28}
- Evaluate the need for additional fluids for patients on air-fluidized therapy surface^{9,28}

RECIPE FOR WOUND HEALING

- Step 1: Evaluate for malnutrition
- Step 2: Add the right amount of:
 - Calories
 - Protein
 - Amino acids
 - Vitamins and minerals
 - Fluids
- Step 3: Monitor closely and refer to a registered dietitian nutritionist if necessary

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