

## **Etiology based definitions for adult malnutrition:**

### **Role of inflammation**

### **A systematic approach to nutrition assessment**

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### **Objectives**

Review approach to definitions

Systematic approach to nutrition assessment

Case presentations

Where do we go from here?

### **References**

1. Jensen GL, et al, Clinical Nutrition 29: 151-3 (2010) and JPEN 34: 156-9 (2010).
2. Jensen GL, et al, Nutrition Screening and Assessment, in ASPEN Adult Nutrition Support Core Curriculum, 3<sup>rd</sup> edition, In Press, 2012.

### **Proposed etiology-based terminology for adults in the clinical practice setting**

Starvation-related malnutrition

- Chronic starvation without inflammation – anything that limits access to food; for example anorexia nervosa

Chronic disease-related malnutrition

- Inflammation is chronic and of mild to moderate degree – organ failure, pancreatic cancer, rheumatoid arthritis, sarcopenic obesity

Acute disease or injury-related malnutrition

- Inflammation is acute and of severe degree – major infection, burns, trauma or closed head injury

### **Proposed systematic approach to assessment**

- History and clinical diagnosis
- Clinical signs / physical exam
- Anthropometric data
- Laboratory indicators
- Dietary assessment
- Functional outcomes

### **History and clinical diagnosis**

Weight history

- >10% weight loss associated adverse outcomes
- Medical records, family, and caregivers

Medical / surgical history

- Recognize conditions or disease that are associated with inflammatory response
- Recognize conditions or disease that place one at nutritional risk

Medication history

### **Conditions or diseases associated with inflammation**

Severe acute inflammatory response

- Critical illness, major infection / sepsis, ARDS, SIRS, severe burns, major abdominal

surgery, multi-trauma, and closed head injury

Mild/moderate chronic inflammatory response

- Many other conditions or diseases – CVSD, CHF, Cystic fibrosis, COPD, Crohn's disease, Celiac disease, chronic pancreatitis, rheumatoid arthritis, diabetes, sarcopenic obesity, metabolic syndrome, malignancies, infections, CVA, dementia, neuromuscular disease, pressure wounds, periodontal disease, organ failure / transplant

### **Conditions or diseases associated with nutrition risk**

- Such conditions or diseases may increase nutritional requirements, or may compromise intake or assimilation.
- In addition to the critical illness conditions noted previously, other conditions that may place one at nutritional risk include previous gastrointestinal surgery, severe gastrointestinal hemorrhage, enterocutaneous fistula, gastrointestinal obstruction, mesenteric ischemia, severe acute pancreatitis, chronic pancreatitis, inflammatory bowel disease, solid or hematologic malignancy, bone marrow transplant, acquired immune deficiency syndrome, and organ failure / transplant - kidney, liver, heart, lung or gut.

### **Clinical signs and physical exam**

- Nonspecific clinical indicators of inflammation may include fever, hypothermia or tachycardia.
- Note physical findings of weight loss. Marked edema may mask weight loss.
- Examine of parts of the body where high cell turnover occurs (e.g. hair, skin, mouth, tongue) as they are among the most likely to exhibit specific signs of nutritional deficiencies.

### **Anthropometric data**

Body weight

- Measure to monitor weight change trends
- Reliance on self-reported weights or other sources of data may be unreliable

Height

- Measure in standing position if possible
- Height can be roughly estimated by doubling the arm span measurement (from the patient's sternal notch to the end of the longest finger).
- Height in older persons can be estimated from knee height

### **Anthropometric data**

Weight standardized for height

- Reference tables ideal body weight – limited by subjective interpretation of frame size and inadequate reference data for many population groups.
- Body mass index (BMI,  $\text{kg/m}^2$ ) – practical measure of body size and indirect measure of body fatness.

### **Anthropometric data**

Skin-folds and circumferences

- Reliable measurements require training so they have had limited practical application
- NHANES III Anthropometric Procedures Video

Other body composition tools

- BIA, DEXA, CT, and MRI – portability issues for all except BIA
- May be possible to take advantage of CT or MRI studies that are being done for other clinical purposes to evaluate musculature – Baracos VE, AJCN 2010; 91: 1133S-1137S.

### **Laboratory indicators**

- No single laboratory test or panel that allows one to diagnose a malnutrition syndrome, so laboratory findings must be appropriately used in combination with other assessments.
- Albumin and prealbumin are reduced by the acute systemic inflammatory response to injury, disease or inflammation.
- C-reactive protein is a positive acute phase reactant that can be measured to help discern whether active inflammation is present.
- Cytokines and in particular interleukin-6 have also demonstrated potential as indicators of inflammatory status.

### **Laboratory indicators**

- Nonspecific indicators that may suggest inflammatory response include leukocytosis and hyperglycemia.
- Further tests include 24-hour urine urea nitrogen and indirect calorimetry.
  - Negative nitrogen balance and elevated resting energy expenditure are anticipated in severe acute systemic inflammatory response.

### **Dietary assessment**

#### Modified diet history

- If necessary, information can be obtained from medical records, family, and caregivers.
- Dietary practices and use of nutrition supplements should also be noted.
- Since patients will often present with acute events superimposed upon significant chronic health conditions, it is not unusual for patients to have had compromised dietary intakes and malnutrition for extended periods prior to admission.

### **Dietary assessment**

#### Nutrition support

- Monitor how much of the requested nutrition is actually being administered to and received by the patient.
- Enteral feedings in particular are frequently interrupted or held for procedures, tolerance issues, feeding tube displacements, and other events.
- With transition to oral intake it is important to monitor amounts of food and / or supplements consumed as well as patient tolerance.
- Anorexia is commonly associated with ongoing inflammatory response.

### **Functional outcomes**

- Advanced malnutrition syndromes are associated with loss of muscle mass and function that result in measureable declines in strength and performance.
  - Hand-grip strength
  - Physical performance batteries
- Malnutrition also results in impaired respiratory muscle function and compromised wound healing.
- Other potential outcomes – cognitive, physiologic, and molecular

### **Anorexia nervosa: Starvation-associated malnutrition**

- 26 yr old female with longstanding history of restrictive eating behavior.
- Ht 167 cm and Wt 37 kg. Lost 1/3 of body weight over 6-mos. BMI 13.2 kg/m<sup>2</sup>.
- Afebrile. Heart rate 50. Loss muscle and SQ fat. MAC <5%. Lanugo hairs noted.

- Labs - CRP 0.7 mg/dL, WBC 6,200, albumin 4.0 g/L, prealbumin 25 mg/dL, glucose 75.

### **Anorexia nervosa: Starvation-associated malnutrition**

#### History and clinical diagnosis

- Consistent with starvation w/o inflammation

#### Clinical signs / physical exam

- Consistent with severe malnutrition w/o inflammation

#### Anthropometric data

- Weight loss, underweight status, and MAC consistent with severe malnutrition

### **Anorexia nervosa: Starvation-associated malnutrition**

#### Laboratory indicators

- Do not suggest active inflammation

#### Dietary intake

- Severely compromised for months.

#### Functional outcomes

- Would likely have diminished grip strength and physical performance

### **Cirrhosis: chronic disease associated malnutrition**

- 52 yr old male with history cirrhosis and portal hypertension in setting of ethanol abuse.
- Ht 173 cm. Wt 73 kg. Gained 4.5 kg over past 2 wks. Family member reported his food intake had been poor for weeks.
- Afebrile. Massive ascites. Mild encephalopathy, asterixis, scleral icterus. Loss of muscle and SQ fat.
- Labs – TB 3.8, AST 96, ALT 111, AP 162, CRP 27, albumin 1.7, prealbumin 6.8, WBC 3,700, Hb 8.0, Hct 32, PT 18 sec, glucose 107.

### **Cirrhosis: chronic disease associated malnutrition**

#### History and clinical diagnosis

- Consistent with malnutrition and chronic inflammation.

#### Clinical signs / physical exam

- Consistent with malnutrition in setting of chronic liver disease / cirrhosis.

#### Anthropometric data

- Ascites and weight gain mask true underweight status.

### **Cirrhosis: chronic disease associated malnutrition**

#### Laboratory indicators

- Consistent with cirrhosis and cannot be reliably interpreted to support malnutrition or inflammation.

#### Dietary intake

- Severely compromised for weeks.

#### Functional outcomes

- Likely to have diminished grip strength and physical performance.

### **Sarcopenic obesity: chronic disease- associated malnutrition**

- 70 yr old female with longstanding obesity / metabolic syndrome. Ht 157 cm. Wt 91 kg. BMI 37.
  - Housebound – limited resources and mobility. Difficulty obtaining meals. May have lost 9.0kg over past 6-mos.
  - Hypercholesterolemia – Rx statin, diabetes – Rx oral agent, painful knee DJD –

Rx NSAID.

- Afebrile, BP 135/85, pulse 72. Exam truncal obesity. Waist circumference 96 cm. Difficulty arising from chair and ambulating. Decreased strength.
- Labs – glucose 130, HbA<sub>1c</sub> 7.0, cholesterol 180, HDL-cholesterol 45, TG 125, CRP 48, albumin 4.1, WBC 5,100.

### **Sarcopenic obesity: chronic disease- associated malnutrition**

#### History and clinical diagnosis

- Obesity / metabolic syndrome with compromised dietary intake and weight loss are consistent with malnutrition and chronic inflammation. Clinical dx sarcopenic obesity.

#### Clinical signs / physical exam

- Consistent with obesity and limitations in mobility associated with painful knee DJD and loss of strength.

#### Laboratory indicators

- Elevated CRP typical of that seen with obesity.

### **Sarcopenic obesity: chronic disease- associated malnutrition**

#### Anthropometric data

- BMI / waist circumference consistent with obesity. Loss of muscle difficult to appreciate with simple anthropometrics. Use DEXA, CT or MRI.

#### Dietary intake

- Compromise secondary to homebound status and limited resources.

#### Functional outcomes

- Physical performance battery will confirm degree of functional impairment.

### **Multi-trauma: acute disease or injury-associated malnutrition**

- 38 yr old male MVA with ruptured spleen, grade III liver lac, L femur fx, and bilat pulm contusions.
- S/P damage control celiotomy, splenectomy, and liver packing. Admitted to trauma ICU on ventilator with open abdomen.
- Post op day 2 – T 39, HR 98, R 26, 6.8 kg wt gain with edema, WBC 25K, CRP 45, albumin 2.6, prealbumin 11.0, glucose 220, and REE 3,000 kcal.
- Dietary intake anticipated to be compromised for week or more. Reportedly well nourished previously.

### **Multi-trauma: acute disease or injury-associated malnutrition**

#### History and clinical diagnosis

- Multi-trauma consistent with severe acute systemic inflammatory response and high nutritional risk.

#### Clinical signs / physical exam

- Consistent with severe acute inflammatory response.

#### Anthropometric data

- Weight gain consistent with edema.

### **Multi-trauma: acute disease or injury-associated malnutrition**

#### Laboratory indicators

- Supportive of severe acute inflammation.

#### Dietary intake

- At risk for extended duration of compromise.

#### Functional outcomes

- Grip strength and physical performance testing not feasible in acutely injured and sedated patient. Malnutrition may impair respiratory muscle and wound healing functions.