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Nutrition and Acute Illness:
Learning Objectives

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1. Define protein-calorie, or protein-energy malnutrition (PEM) and state its prevalence in the acutely ill.
2. Describe the interrelationship between protein-energy (PEM) and acute illness.
3. Distinguish between starvation, stress (hypermetabolism), and hypercatabolism.
4. Identify the three types of nutrition support available in the hospital, when each should be used and the strengths and weaknesses.

Nutrition and Acute Illness: Answers to Learning Objectives

1. Define protein-calorie, or protein energy malnutrition (PEM) and state its prevalence in the acutely ill.

Definition:

Protein-energy malnutrition is a condition arising from a sustained inadequacy in the quantity of protein and/or energy needed to meet the metabolic demands of the body. *Primary PEM* occurs when this inability to meet metabolic demands arises from insufficient dietary intake. *Secondary PEM* arises when illness or other factors impair the uptake or utilization of nutrients, increase protein or energy requirements, or increase metabolic losses beyond nutrient availability. Acute illness usually creates PEM through a combination of primary and secondary mechanisms.

Diagnosis:

An unintentional loss of >10% of usual body weight is often thought to be the threshold beyond which significant declines in clinical outcome are observed.

Prevalence:

Several studies indicate a 30-60% prevalence of significant malnutrition in hospitalized patients.

2. Describe the interrelationship between protein-energy malnutrition (PEM) and acute illness.

PEM's Effect on Acute Illness:

- Ten percent (10%) unintentional loss of usual body weight = 15-20% loss of total body protein. A loss beyond 20% of total body protein is that level of depletion where widespread impairments in physiologic systems are observed (impairments in immunologic, pulmonic, cardiac, skeletal muscle function).
- Essentially all these adverse effects of PEM are reversible with aggressive nutritional support.
- Adverse clinical outcomes of substantial PEM include: higher rates of morbidity and mortality, an extended period of rehabilitation or hospitalization, and a higher cost of medical care. These may be mitigated by diligent attention to nutritional needs.

Acute Illness' Effect on PEM:

- Acute illnesses cause systemic inflammatory response.
- Systemic inflammation causes hypermetabolism and hypercatabolism.
- Resulting malnutrition has undesirable physiologic and clinical consequences.
- Aggressive nutritional support can mitigate some of these adverse consequences.

3. Distinguish between starvation, stress (hypermetabolism), and hypercatabolism.

Starvation:

Starvation is characterized by **decreased energy expenditure**, utilization of alternative fuel sources, and decreased protein wasting. The response to chronic inadequate food intake is adaptive, aimed at preserving lean body mass. Stored glycogen, the primary fuel source in early starvation, is depleted in about 24 hours. Glucose is available from gluconeogenesis (amino acids derived from muscle). In late starvation, fatty acids, ketones, and glycerol provide the energy source for all tissues except the glucose-obligated brain and nervous system, and red blood cells.

During the adaptive state of starvation, protein catabolism is reduced and hepatic gluconeogenesis decreases.

Stress (Hypermetabolism):

Conversely, in the hypermetabolic state, energy expenditure, glucose production, glucose cycling, amino acid availability secondary to ongoing net muscle catabolism, and oxidation of fatty acids all increase.

Stress (Hypercatabolism):

Hypercatabolism is part of the hypermetabolic state. Muscle protein breakdown is accelerated, resulting in an increased peripheral release of amino acids to provide the liver with the amino acids for enhanced protein synthesis and gluconeogenesis. The mobilization of acute-phase amino acids results in rapid loss of lean body mass and an increased negative nitrogen balance, which continues until the cause of the stress is relieved. Breakdown of protein tissue also causes increased urinary losses of potassium, phosphorus, and magnesium.

Clinical Distinction:

The hypermetabolic patient exhibits hyperglycemia, increased urea production, large urinary nitrogen losses, and lean body mass wasting to a far greater extent than that seen in simple starvation.

4. Identify the three types of nutrition support available in the hospital, when each should be used and the strengths and weaknesses.

“Aggressive Nutritional Support”: Roughly defined, is using whatever means is necessary to provide sufficient nutrition to meet the ill patient’s needs. Types of aggressive support:

Oral supplementation or appetite stimulants

- Reported that only 10% of elderly w/ PEM can eat the volume of food required to overcome deficiencies.
- Medical nutritional supplements designed to provide extra calories, protein and nutrients.
- 1-2.0 cal/cc, each supplement generally meets 1/3 of the DRIs for most nutrients.

- Can increase kcal, protein, and nutrients with instant breakfast shakes, high calorie/high protein snacks, and meals.

Enteral tube feeding (nasogastric, gastric (G-tube), or intestinal (J-tube into jejeunum)

- Criteria: for patients who cannot achieve adequate oral intake and who have at least a partially functioning GI tract that can be used safely. Generally should be considered for anyone NPO > 5 days, or on clear liquids/IV fluids only for > 5 days.
- Provides nutrients and hydration.
- Method of delivery and formula composition depends on status of GI tract and needs. Generally, you want to use as much of the GI tract as is functioning.
- Tube should be placed surgically if required for an extended period of time.
 - To decrease risk of aspiration→ start slowly (usually full strength), raise HOB 30-45%
 - Most complications can be troubleshot with help of RD
 - Cheaper, safer and more natural than parenteral nutrition (exposes GI to nutrients and natural immune response)

Parenteral nutrition

- Appropriate only when gut unusable (Crohn's, ulcerative colitis, obstruction, etc.) and NPO for > 7-10 days
- Requires very close metabolic monitoring
- PPN (peripheral parenteral nutrition) of limited use because of the need for low concentration solutions requiring large volumes of fluid
- TPN central line infections can be fatal

Decision-Making for Feeding Site Selection

