EFFECTIVE NUTRITIONAL THERAPY

INTRODUCTION
Understanding the key concepts of optimal nutrition therapy in the pediatric ICU can assist in improving overall patient outcomes and hospital length of stay.

NUTRIENT PRESCRIPTION
- **Enteral** nutrition - delivery of feeds directly into the gastrointestinal system
- **Parenteral** nutrition - delivery of feeds intravenously
- The stress response in a critically ill child contributes to essential energy and protein requirements.
  - Examples of stress: major surgery, burns, sepsis, or trauma
- Metabolic stress response: mobilization of intrinsic substrates to synthesize energy and promote the body’s anti-inflammatory response and healing process.
  - If inadequate energy and protein exist during the metabolic stress response, then large amounts of muscle protein will be lost.
  - During the metabolic stress response there is also increased lipid breakdown and fatty-acid oxidation.
    - Infants and children are at high risk of muscle and fat breakdown.
    - Previously malnourished infants and children are at risk for essential fatty acid deficiencies.
- Prolonged stress response can lead to degradation of critical muscle mass (ex. diaphragm, cardiac muscle).
- There is a direct correlation between increasing amounts of energy and increasing amounts of protein needs.
- To reach a positive nitrogen balance, preserve lean body mass, and prevent underfeeding, consider:
  - A caloric intake minimum of 57 calories per kilogram per day
  - A protein intake minimum of 1.5 grams per kilogram per day
- During critical illness, energy demands rapidly rise due to cytokine release, but decrease over time. This pattern is unpredictable and varies with illness.

Risk of Overfeeding occurs when:
- Energy demands drop to normal or below normal rapidly after the initial critical illness phase
- Energy expenditure during illness is not as high as was estimated by initial assessment
- Energy expenditure equations overestimate energy demands
- *Indirect calorimetry* is the most effective method to accurately assess energy needs in the pediatric ICU (PICU).

Note: Both underfeeding (energy debt) and overfeeding (energy excess) have significant side effects and morbidity risk.
OPTIMAL ROUTE OF NUTRIENT DELIVERY
- Utilize the gastrointestinal tract if possible
- **Enteral nutrition** is preferred as it preserves both gut mucosal integrity and has beneficial immune effects.
  - Decreased risk of infection and decreased costs when compared to parenteral nutrition.
- Use parenteral nutrition when enteral nutrition is contraindicated or perceived to have failed.
  - In well-nourished children, consider parenteral nutrition around day 7 of illness if unable to tolerate enteral nutrition.
  - In malnourished children, consider parenteral nutrition around day 3-5 of illness if unable to tolerate enteral nutrition.
- Unnecessary fasting of a critically ill child may be detrimental to their recovery
  - Fasting leads to decreased gut permeability (decreased villus height) and mucosal atrophy.
- Enteral feeding routes include:
  - **Gastric**: directly into the stomach
    - Continuous or bolus feeds; typically start with continuous feeds and transition to bolus feeds as tolerated
    - Contraindicated in patients with high risk of gastric content aspiration.
  - **Post-pyloric**: directly into the small intestine
    - Used in patients who have failed gastric feeding or are at high risk of gastric content aspiration.
    - Requires feeding tube placement by an expert and access to resources to troubleshoot their management.
    - Evidence shows faster achievement of nutritional goals with post-pyloric feeding than gastric feeding but does not show improved outcomes.

NUTRITION DELIVERY
- Once the mode of feeding has been established, enteral nutrition proceeds in a protocolized fashion.
  1. Begin continuous feeds early, *within 24 hours of admission* when feasible
  2. Advance feeds gradually, following guidelines that detail the rate of advancement and provide a monitoring strategy for signs of feeding intolerance
  3. If full enteral feeds are not possible, consider *trophic feeds*, which deliver small amounts of nutrients to a patient who cannot yet tolerate large volumes.
- Barriers to achieving and maintaining nutrient delivery goals:
  - Fasting or fluid restriction in anticipation of procedures
  - Feeding intolerance
- Interruption of enteral nutrition in PICU patients has been shown to put them at risk of increased morbidities (i.e. infection) and prolonged ICU stays due to inability to deliver optimal nutrition. The majority of these interruptions may be avoidable.

SUMMARY
Optimal nutrient therapy requires a conscious effort to deliver the right amount of nutrients by the best route and close monitoring of nutritional goals during the patient’s entire hospitalization.

REFERENCES