BOCA RATON REGIONAL HOSPITAL

Indication and Appropriate use of TPN (Total Parenteral Nutrition)

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Definition of Total Parenteral Nutrition

- A method of providing nutrition to patients by infusing a mixture of all necessary nutrients directly into the circulatory system
- By definition this means bypassing the patient's natural conduit to absorb nutrients, the gastro-intestinal system
- And as we all know…being unnatural is frowned upon today!

The most important takeaway from today's presentation…

FOLLOW THE GOLDEN RULE OF NUTRITION!!!

and that is…..

The Golden Rule for Nutrition

- The gut should always be the preferred route for administration of nutrients!
- Whenever possible it should be used either through direct oral or indirect enteral feedings with feeding tubes
- If TPN is to be used, indication needs to be clearly validated and based on strict evidence based medicine

WHY???

While TPN may well be life saving in certain ill and critically ill patients, TPN is fraught with potentially life threatening complications, as well as being a major cause of patient morbidity!!!

Make certain that you make a wise clinical decision!!!

ASPEN

American Society for Parenteral and Enteral Nutrition

- Have created guidelines for the appropriate and ethical use of total parenteral nutrition
- Considered the defining “gold standard” for nutritional consideration

Cardinal Rules for the use of TPN

- Timing and duration
- Indications – absolute and relative
- Prognosis of patient (tolerance of potential risks)
- Can and enteral alternative be used?

Timing and Duration

- TPN is never indicated when it's use is anticipated to be less than 72 hours!
  - Whatever disease process exists, one should only consider using TPN if the period of starvation is expected to exceed 7 – 10 days for well-nourished adults
- Severely malnourished patients may be considered for earlier intervention if indicated

What are the Physiologic Indications for the Potential use of TPN?

- Short bowel syndrome
- Chronic malabsorption syndromes
- GI anatomic abnormalities (e.g.. Enterocutaneous Fistulas)
- Severe acute malabsorption syndromes → severe malnutrition
- S/P major GI surgery where gut cannot be used
- Prolonged small bowel obstruction
- GI Ischemia
- Hemodynamic instability preventing the ability to advance enteral nutrition
- No enteral feeding access (T-E fistula, Gastric Outlet Obstruction)
- Upper GI Hemorrhage
- Severe (hemorrhagic) Pancreatitis
- Severe trauma or severe burns
- High risk of aspiration and severe malnutrition

Absolute Indications for TPN in Adults

- Permanent inability to absorb adequate nutrients via the gut
  - Massive small bowel resection
    - < 100cm small bowel
    - <60cm small bowel but with an IC valve and colon
  - Chronic malabsorption from disease (Crohn's Disease) or from external anatomic damage (radiation)
- Entero – Cutaneous fistulas
  - 7 days or more of bowel rest required for healing (pre and post OP period included)
  - High output EC-Fistula worsened by enteral feeding

Relative Indications for TPM

1. Severe malnutrition (Prealbumin < 10) along with:
   - GI malabsorption syndrome or inability to absorb nutrients > 7 – 10 days
   - Major GI surgery or post-op bowel obstruction >7-10 days
   - GI ischemia
   - Mechanical SBO > 7-10 days
   - Hemodynamic instability precluding use of gut because of hypotension and pressers > 5 days
   - Enteral feeds not possible because of mechanical issues (oral/pharyngeal/esophageal obstruction, gastric outlet obstruction, T-E fistula
2. Upper GI hemorrhage with no enteral access available for 5-7 days
3. Severe hemorrhagic pancreatitis requiring bowel rest > 7days (3 or more of early Ranson's Signs)

TPN not Indicated

- Terminal illness where live expectancy is less than three months (TPN has not been shown to increase quality in end of life situations; rather the opposite)
- Patient refuses enteral access
- TPN used < 7 days (no clinical benefit)
- Poor gastric emptying alone
- Short term colonic ileus

TPN IS NOT INDICATED WHENEVER PATIENT HAS A FUNCTIONAL GUT!!!

While TPN can be an important adjunct to optimal patient care, particularly in those critically ill, it has the potential to be harmful as well…

So how is TPN administered and what are its potential complications?

Nutritional Requirements of TPN

- Energy
  - Glucose
  - Lipids
- Amino acids: nitrogen
- Fluid and electrolytes
- Vitamins
- Trace elements

Energy Requirements

Patient Condition	Basal Metabolic Rate	Approximate Energy Requirement (kcal/kg/day)
No postoperative complications, GIT fistula without infection	Normal	25-30
Mild peritonitis, long-bone fracture, mild to moderate injury, malnourished	25% above normal	30-35
Severe injury or infection	50% above normal	35-45
Burn 40 – 100% of total body surface	Up to 100% above normal	45-80

Energy Requirements

Energy Source: Glucose

- The most common source of parenteral energy supply is glucose, being:
  - Readily metabolized in most patients
  - Provides the obligatory needs of the substrate, thus reducing gluconeogenesis and sparing endogenous protein
  - 1gm of glucose gives 4kcals
- Most stable patients tolerate rates of 4-5mg.kg/Min but insulin resistance in critically ill patients may lead to hyperglycemia even at these rates, so insulin should be incorporated according to blood sugar levels

Energy Requirements

Energy Source: Lipid

- Fat mobilization is a major response to stress and infection
- Triacylglycerols are an important fuel source in those conditions, even when glucose availability is adequate
- Need to be restricted in patients with hypertriglyceridemia
- Lipids are also a source for the essential fatty acids which are the building blocks for many of the hormones involved in the inflammatory process as well as the hormones regulating other body functions
- Ideally, energy from fat should not exceed 40% of the total (usually 20-30%)

Energy Requirements

Energy Source: Nitrogen

- protein (or amino acids, the building blocks of proteins) is the functional and structural component of the body, so fulfilling patient's caloric needs with non-protein calories (fat and glucose) is essential
- Protein requirements for most healthy individuals are 0.8g/kg/day
- With disease, poor food intake, and inactivity, body protein is lost with the resultant weakness and muscle mass wasting
- Critically ill patients may need as high as 1.5 – 2.5g protein/kg/day depending on the disease process (major trauma or burn > standard)
- The amount should be reduced in patients with kidney or liver disease

Requirements

Nitrogen: daily protein requirements

Condition	Example	Requirement
Basic requirements	Normal person	0.5 – 1g/kg
Slightly increased requirements	Post-operative, cancer, inflammatory	1.5g/kg
Moderately increased requirements	Sepsis, polytrauma	2g/kg
Highly increased requirements	Peritonitis, burns	2.5g/kg
Reduced requirements	Renal failure, hepatic encephalopathy	0.6g/kg

Requirements

Fluid and Electrolytes

- 20 – 40mL/kg – daily – young adults
- 30mL/kg – daily – older adults
- Sodium, potassium, chloride, calcium, magnesium and phosphorus (as per table)
- Daily lab tests to monitor electrolyte status

Requirements

Fluids and Electrolytes

Nutrient	Requirements
Water	20 – 40 mL
Sodium	0.5 – 1.0 mmol
Potassium	0.5 – 1.0 mmol
Magnesium	0.1 – 0.2 mmol
Calcium	0.05 – 0.15 mmol
Phosphate	0.2 – 0.5mmol
Chloride/Acetate	So as to maintain acid-base balance (normally 0.5 mmol for Cl^-, & 0.1mEq for Acetate

Requirements

Fluid and Electrolytes

- Normalization of acid-base balance is a priority and constant concern in the management of critically ill patients
- Most electrolytes can be safely added to the parenteral amino acid/dextrose solution
- Sodium bicarbonate in high concentrations will tend to generate carbon dioxide at the acidic pH of the amino acid/glucose mix

Requirements

Vitamins

- These requirements are usually met when standard volumes of a nutrient mix are provided
- Increased amounts of vitamins are usually provided to severely ill patients
- Vitamins are either fat soluble (A, D, E, K) or water soluble (B, C), separate multivitamin commercial preparations are not available for both

Requirements

Trace Minerals

- These are essential components of the parenteral nutrition regimen
- A multi-element solution is available commercially, and can be supplemented with individual minerals
- May be toxic at high doses
- Iron is excluded, as it alters stability of other ingredients; it is given by separate injection (iv or im)
- minerals excreted via the liver, such as copper and manganese, should be used with caution in patients with liver disease or impaired biliary function

Requirements

Trace Minerals

Mineral	Recommended Dietary allowance (RDA) for daily oral intake (mg)	Suggested Daily Intravenous Intake (mg)
Zinc	15	2.5 – 5
Copper	2 – 3	0.5 – 1.5
Manganese	2.5 – 5	0.15 – 0.8
Chromium	0.05 – 0.2	0.01 – 0.015
Iron	10 (males)/18 (females)	3

How must TPN be administered?

Central venous access is absolutely required and TPN administration should be isolated and infused only with an accurate pump

What are the potential complications of TPN?

Line Related Complications

- Traumatic Insertion - Pneumothorax
- Air embolus
- Catheter related thrombosis
- Catheter placement
- Central line associated bloodstream infections

BRRH Experience

- 2011 – BRRH CLABSI rate 2.1/1000
- 2012 – Retrospective review on all cases
  - 80% of CLABSI related to administration of TPN
- 2012 – Analyzed indications for TPN as per ASPEN criteria
  - 78% did not meet criteria
- 2013 – Strict criteria put into place via MEC
- 2013 – No CLABSI for 11 consecutive months

Metabolic Complications

- Fluid overload
- Hyperglycemia/hypoglycemia
- Hepatotoxicity(TPN related cholestasis)
    - Can be fatal
- Acid base disorders
    - CO_2 retention
- Electrolyte abnormalities
- Mineral imbalance
- Osteoporosis (long term TPN)

Other Complications

- Intestinal bacterial translocation
  - Normal gut flora subject to tropism, and altered gut permeability → compromised ability of patient to return to enteral feeds
    - Additional increased risk of GI related sepsis
- GB sludge
  - TPN > 4 weeks
- Refeeding Syndrome
  - Occurs when nutritional support is given to those patients severely malnourished
  - Catabolic state → anabolic state →insulin ↑
  - Insulin increase triggers cellular reuptake of potassium, phosphate and magnesium → arrhythmias (slow gradual increase is best treatment)

Quality of Life Considerations

- Inconvenient
- Disturbed sleep
- Activity and work are secondary to feedings
- Social isolation
- Expense
- Fear/anxiety/depression

Take-Home Messages

- TPN can be life saving in a very select patient population
- TPN should never be used when an intact gut is present and enteral nutrition is possible
- If TPN is used, it is critical that those who manage it are skilled at both initiating this nutritional program as well as maintaining it safely
- TPN can be associated with life threatening complications

SO…..

TPN should never be used when an intact gut is present and enteral nutrition is possible

Boca Raton Regional Hospital

ADVANCING THE BOUNDARIES OF MEDICINE