Slide 2

Objectives
- To explain the indications for use of Enteral (EN) and Parenteral Nutrition (PN)
- To discuss potential complications and treatments for EN and PN
- To state the benefits of EN vs. PN
- To discuss disease specific EN formulas
- To calculate case-based PN scenarios

Slide 3

Defining EN
- Per ASPEN
  - “Nutrition provided through the gastrointestinal tract via a tube, catheter, or stoma that delivers nutrients distal to the oral cavity.”
  - “If the stomach empties use it!”

“ If the gut works, use it!” - previous
EN - General Indications

- Expected inadequate oral intake for 7-14 days
- Residents who can’t eat
- Residents who won’t eat
- Residents who shouldn’t eat
- Residents who can’t eat enough

Provision of EN

- Failure of voluntary oral intake to meet nutrient requirements
- Impaired Ability to Ingest Food
- Coma, Mechanical Ventilation
- Alterations in Nutrient Requirements
- Following severe trauma or burns
- Changes in Digestion/Absorption
- Adaptive phase of short bowel syndrome (SBS)

Advantages of EN vs. PN

- Proven to be safer with less complications
- Metabolic: Dextrose, Fluid, electrolyte
- Catheter Related: Mechanical & Sepsis
- Maintain Gastrointestinal function
- Preserves GI mucosal integrity (GALT)
- TPN results in loss of GI function: atrophy
- Immune function: Prevents bacterial translocation
Advantages of EN vs. PN

- Less Costly
- Formula and delivery system
- Less patient care time
- Ease of System
- Simpler administration

EN- Contraindications

- Intractable vomiting
- Severe diarrhea
- High-output enterocutaneous fistulas (>500 ml/day)
- Total bowel rest
- Severe inflammatory bowel disease
- UGI hemorrhage (caused by esophageal varices, portal HTN, cirrhosis)
- Short bowel syndrome (<100 cm of small bowel remaining)
- Intestinal obstruction (location dependent)
- Well-nourished residents expected to resume oral intake within 7 days
- A prognosis that does not warrant aggressive nutrition support

EN-Formula Composition

- Carbohydrate
  - Cornstarch, Corn syrup solids, Sucrose (for oral beverages)
- Fiber
  - Soluble—Converted to SCFA may lessen diarrhea
  - Insoluble—Improves stool consistency
- Lipid
  - Corn and Soybean Oil – Omega 6 Fatty Acids
  - MCT: Medium Chain Triglycerides for Malabsorption
- Protein
  - Soy protein, lactalbumin, free amino acids
  - Arginine and Glutamine
  - Branched Chain Amino Acids
EN-Formula Categories

- Standard/Polymeric
  - Residents with normal gastrointestinal function
  - Nutritionally complete
  - Intact Nutrients
  - One or Two sources of Protein, Carbohydrate, and Fat
  - With and Without Fiber
  - Fiber Containing
    - Beneficial for prevention or treatment of bowel problems – diarrhea or constipation
    - Should be used unless contra-indication exists

- Monomeric
  - Residents with Malabsorptive states, GI intolerance
  - Short Bowel Syndrome, Fistulas, Severe Acute Pancreatitis
  - Pre-digested nutrients for impaired gastrointestinal function
  - May be lower in fat
  - May contain MCT oil

Examples

- Standard fiber-containing formula
  - Jevity 1.2
- High Calorie Feedings for fluid restriction or volume control
  - Two Cal HN

Examples of Semi Elemental:
- Perative, Peptamen 1.5, Crucial

Examples of Elemental:
- Vivonex RTF

Disease Specific EN Formulas

- Renal
  - Electrolytes are modified
  - Calorically dense, 1.8-2.0 kcal/ml
  - Blend of essential amino acids
  - Intended to provide adequate protein and energy with modified fluid and electrolyte intake
Disease Specific EN Formulas

- Hepatic
  - Lower in protein
  - Low in Aromatic Amino Acids (AAA) and methionine
  - High in Branched Chain Amino Acids (BCAA)
  - Not Fully Supported in the literature

- Diabetic
  - Lower in carbohydrate and higher in monounsaturated fat
  - Intended to improve blood glucose control
  - Newest guidelines found weak evidence to recommend Diabetic formulas

- Pulmonary
  - Lower in carbohydrate and higher percentage of total fat
  - Intended to decrease RQ and CO₂ retention
  - Literature recommends avoidance of over-feeding, not to restrict carbohydrate

- Immune-enhancing Formulas
  - Contain Arginine, Glutamine, Omega-3 Fatty Acids
EN- Modular Products

- Provide one additional nutrient
- Nutritionally incomplete
- Examples:
  - Protein: Pro-Stat, Beneprotein, Promod
  - Fat: MCT Oil
  - Carbohydrate: Polycose
  - Amino Acids: Arginine, Glutamine

Practice Recommendation - Selection of Enteral Access Devices

1. Patients with persistent dysphagia should have a long-term enteral access device placed. (B)

Practice Recommendation - Long Term Enteral Access

1. Long-term feeding devices should be considered when the need for enteral feeding is at least 4 weeks in adults, children, and infants after term age. (C)
2. Evaluation by a multidisciplinary team is indicated prior to insertion of a long-term feeding device to establish whether:
   a. Benefit outweighs the risk of access placement
   b. Insertion of feeding tubes near end of life is warranted
   c. Insertion of feeding tubes is indicated in the situation where patients are close to achieving oral feeding (B)
EN- Tube Placement

- Placement must be confirmed radiographically
- Withdrawing gastric contents to check for volume, appearance, and pH
- Ask the resident to speak
- Radio graphically
  - Gold Standard

EN- Feeding Types

- Continuous
  - Attached to a pump
  - Less nursing time
  - Better tolerance
  - Better compliance
- Bolus
  - Less costly
  - Resident has more mobility
  - Gastric feedings
- Cyclic
  - Via pump
  - Over 8-20 hours
  - Often at higher infusion rates
  - For residents that do not tolerate bolus
- Transitional feedings

EN- Practice Recommendation

- Use of a standard order form to ensure needs are met for order clarity is recommended.
- EN orders should include:
  - Patient/Resident identifiers
  - Enteral Formula
  - Enteral Access Site
  - Administration Method and Rate
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**EN- Practice Recommendation**

- Safety
  - Disposable gloves should be used with EN administration
- Ready to Hang system preferred
- Sterile
- Closed System
- 24-48 hours per manufacturers guidelines

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**EN-Monitoring Tolerance**

- Monitor for the following:
  - Pain
  - Abdominal distention
  - Diarrhea
  - Nausea/Vomiting
  - Weight
  - Fluid Status

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**EN-Monitoring Tolerance**

- Nausea and Vomiting
  - It increases the risk of aspiration, pneumonia, and sepsis
  - Most often from delayed gastric emptying
  - Hypotension, stress, sepsis, post op - anesthesia
  - Medications
    - Opiate analgesics (morphine, codeine, fentanyl)
  - Rapid infusion of feeding
  - Very cold feeding – Should be room temperature
  - High fat feeding

Reported in 20%
EN-Monitoring Tolerance

• Nausea and Vomiting
  • What to do if delayed emptying persists?
    • Consider reduces narcotic meds
    • Changing to a low fat formula
    • Room temperature
    • Reduce the rate
    • Provide a prokinetic medication
      • Metoclopramide (Reglan)
      • Erythromycin
      • Antiemetics to reduce nausea

Practice Recommendations - Gastric Residual Volume (GRV)

1. Evaluate all enterally fed patients for risk of aspiration. (A)
2. Keep the head of the bed elevated at 30-45° (A)
3. Check gastric residuals every 6-8 hours. (C)
4. If the GRV is > 250 ml for the 2nd time a pro-motility agent should be considered in adult patients. (A)
5. TF should be held for GRV > 500 ml and tolerance should be re-assessed (physical and GI assessment) (B)
6. If GRV consistently > 500 ml, consider small bowel tube placement (B)
EN-Monitoring Tolerance
• Malabsorption/Maldigestion
  • Clinical Manifestations
    • Unexplained weight loss
    • Steatorrhea
    • Diarrhea
    • Anemia
    • Tetany
    • Bone pain and pathologic fractures
    • Bleeding
    • Dermatitis
    • Edema

EN-Monitoring Tolerance
• Malabsorption/Maldigestion
  • Testing/Diagnosis
    • Intake/Output balance
    • Fecal Fat Tests
    • Biopsies

EN-Monitoring Tolerance
• Abdominal Distention
  • Bloating and Cramping
  • Ileus
  • Obstruction
  • Ascites
  • Rapid Administration
  • Diagnose
  • Abdominal girth increases more than 8-10 cm
  • X-ray
EN-Monitoring Tolerance

**Diarrhea**
- Abnormal volume or consistency of stool that results in fluid and electrolyte or acid-base imbalances.
- Normal stool water content 250-500 ml
- Diarrhea defined as > 500 ml q 8 hours or more than 3 stools per day for at least two consecutive days

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**Constipation**
- The accumulation of excess waste in the colon, often the transverse colon or even the cecum.
- Diagnosed by an X-ray to rule out an obstruction. If there was an obstruction the bowel would be dilated.

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**It is important to determine the etiology**
- Bacterial overgrowth/enteric pathogens
- Medications: Sorbitol, Antibiotics, Bowel meds
- Disease/Malabsorption
- Advancement of the feeding

More difficult to define, since it is dependent upon what is normal for the resident.
EN-Monitoring Tolerance

- Constipation
  - Possible Etiologies
    - Dehydration
    - Excessive Fiber
    - Inadequate Fiber
    - Inadequate Physical Activity

- Prevention
  - Frequent Rectal Exams
  - Adequate Fluids, Minimum of 1 ml per calorie

EN-Mechanical Complications

- Tube Clogging
  - Polyurethane material clogs less
  - Warm water/sodium bicarbonate solution

Practice Recommendations-Flush Solutions to Prevent Tube Clogging

1. Flush feeding tubes with 30 mL of water every 4 hours during continuous feeding or before and after intermittent feedings in an adult patient. (A)

2. Flush the feeding tube with 30 mL of water after residual volume measurements in an adult patient. (B)
**EN- Mechanical Complications**

- **Aspiration**
  - Occurs in 0.8% - 95%
  - Clinically significant aspiration pneumonia in 1% - 4%
  - Symptoms – dyspnea, wheezing, rales, tachycardia, anxiety, agitation, cyanosis
  - Blue Dye Method – no longer safe to use
  - Glucose oxidase strip method

**FDA Advisory**

**EN- Metabolic Complications**

- **Dehydration**
  - Possible Etiologies
    - Excessive Fluid loss, inadequate fluid intake, or concentrated formulas
  - To Prevent/Therapy
    - Monitor Daily Fluid Intake (I/O)
    - Monitor Weights
    - Monitor Electrolytes
    - Provide adequate water flushes
EN-Metabolic Complications

• Overhydration
  • Possible Etiologies
  
  • Excessive fluid intake
  • Rapid refeeding
  • Catabolism of lean body mass
  • Renal, liver or cardiac insufficiency

• To Prevent/Therapy:
  • Monitor daily fluid intake (I/O)
  • Monitor weights
  • Consider more concentrated formula
  • Diuretic therapy

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EN-Metabolic Complications

• Hyperglycemia
  • Possible Etiologies
  
  • Refeeding syndrome, Diabetes, infection, catabolism, insulin resistance, Glucocorticoids, excessive carbohydrate intake

• To Prevent/Therapy:
  • Correct serum blood glucose before initiating EN
  • Monitor serum blood glucose every 6 hours
  • Treat underlying disease
  • Consider using a lower carbohydrate formula
  • Consider a product with fiber

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EN-Metabolic Complications

• Hypoglycemia
  • Possible etiologies
  
  • Abrupt cessation of EN in a resident that is receiving oral hyperglycemic agents or insulin

• To Prevent/Therapy:
  • Monitor serum blood glucose every 6 hours
  • Treat with IV dextrose to increase to 100 mg/dL
  • Taper EN gradually
EN-Metabolic Complications

- "Refeeding Syndrome - The metabolic and physiologic consequences of depletion, repletion, compartmental shifts, and interrelationships of phosphorus, potassium, magnesium, glucose metabolism, vitamin deficiency, and fluid resuscitation"

  - Those at risk
    - Unfed residents for 7-10 days
    - Elderly individuals with several chronic medical conditions and poor nutrient intake

Parenteral Nutrition

- PN is a means of providing protein, carbohydrate, fat, vitamins and minerals through central venous access to those unable to efficiently absorb nutrients through the GI tract

  - The decision to use parenteral nutrition requires:
    - An understanding of the resident's clinical condition and anticipated outcome
    - Knowledge of the clinical efficacy of parenteral nutritional support from pertinent clinical trials
    - Appreciation of the desires and needs of the resident and his or her family

PN-Indications

- Pre-existing nutritional deprivation
  - Severe malnutrition or catabolism when the resident is unable to eat 5 or more days
  - Well nourished, non-stressed adults can have 7 – 14 days of inadequate oral intake before considering nutritional intervention
  - Patients with lower energy reserves or subject to catabolic stress require earlier intervention
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**PN-Indications**

- Pre-existing nutritional deprivation
  - Subjective and objective assessment
  - Weight change
  - Dietary intake change
  - Functional status and duration
  - Full capacity to bedridden
  - Physical exam
    - Loss of subcutaneous fat
    - Muscle wasting
    - Ankle and sacral edema
    - Ascites

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**PN-Indications**

- Anticipated, desired, or actual inadequate energy intake by the GI tract
  - Non-functioning GI tract
  - Severe malabsorption
  - Short bowel syndrome
  - Intractable vomiting or diarrhea
  - Paralytic ileus
  - GI fistula: unless enteral access can be placed distal to the fistula or output is <200 ml/day
  - Bowel rest
  - Severe necrotizing pancreatitis
  - Acute exacerbations of Crohn’s disease

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**PN- Contraindications**

- Treatment anticipated for less than 5 days in a patient without severe malnutrition
- Inability to obtain central venous access
  - Hypertonic PN should be infused in a central vein to reduce the risk of initial damage
  - Catheter tip should be placed in a vessel with high flow for rapid dilution reducing the risk of thrombophlebitis
  - Risk of PN are judged to exceed the potential benefits
- A prognosis that does not warrant aggressive nutritional support
- The GI tract functions and enteral access is appropriate
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**PN- Contraindications**
- Functioning GI tract
- Maintained by processing of bulk nutrients along the GI tract
- Improved epithelial function and structure
- Enhanced mucosal immunity
- More rapid enhancement of enteral feeding
- Complete bowel rest is accompanied by progressive atrophy and disruption of the intestinal mucosa

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**Key Safe PN Safe Practice Recommendations**
- There should be an appropriate indication for PN which is documented in the medical record
- There is appropriate IV access
- The indication is noted on the PN order sheet
- Appropriate energy and protein goals shall be determined for the patient’s condition based on published guidelines and evidence.
- All PN ingredients shall be ordered in amounts per day or amounts per kg per day

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**PN- Complications**
- Hepatobiliary
  - Abnormalities in liver function tests
  - Increase in SGPT, SGOT, and bilirubin
  - Usually occurs in TPN for > 3 weeks
**Slide 52**

**PN Complications**

- Hepatobiliary
  - Elevations in serum aminotransferase, alkaline phosphatase, and bilirubin
  - Usually asymptomatic
  - May have right upper quadrant tenderness
  - May occur within 1–2 weeks of TPN
  - Possible etiology
    - May be due to excess calories
    - May be due to excess carbohydrate
  - Usually resolves in 10–15 days

**Slide 53**

**PN Complications**

- Gastrointestinal Atrophy
  - Bacterial Translocation
  - Bowel becomes shortened, with thinner walls
  - Villi numbers remain the same, just closer together
  - Possible etiology
    - May occur from lack of EN stimulation
    - Providing just 10% of calorie needs via the enteral route can help prevent this

**Slide 54**

**PN Complications**

- Underfeeding
  - Decreased respiratory function
  - Impaired immune function
  - Increased infection
  - Weight loss
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PN- Complications

• Hypoglycemia
  • Possible etiologies
  • Excess insulin in the TPN bag
  • Usually put in .1 unit of insulin per gm of carbohydrate
  • 1 unit per 10 grams carbohydrate
  • Slowly taper the TPN when discontinuing so hypoglycemia doesn’t occur

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PN- Complications

• Azotemia
  • Excess Amino Acids
  • Increased BUN

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PN- Complications

• Essential Fatty Acid Deficiency (EFAD)
  • Will occur if no lipids are provided
  • Can occur within 1-3 weeks
  • To prevent, provide 2-4% of calories from linoleic acid or 250 ml 20% fat or 500 ml 10% fat 2x per week

**Changed, note it used to be 3x per week**
**Slide 58**

**PN- Complications**

- **Hyperlipidemia**
  - Possible etiologies
  - Excess amounts
  - Rapid administration
  - High serum triglyceride levels
  - To prevent/treat
    - Reduce the dose and length of the infusion
    - < 250 mg/dL 4 hours after lipids
    - < 400 mg/dL for continuous lipid infusion

**Changed, note it used to be 3x per week**

**Slide 59**

**PN- Complications**

- Fluid and Electrolytes
- Hypo or Hyper States
  - Dehydration
  - Overhydration

**Changed, note it used to be 3x per week**

**Slide 60**

**PN-Complications**

- Metabolic Bone Disease
  - Long Term
  - Possible Etiologies
  - Protein Load
  - Calcium Intake
  - Aluminum contamination
  - Monitor
    - Vitamin D concentration
    - Cycling regimen
PN- Complications

- Infections
  - Most frequent life threatening complication
  - 200,000 nosocomial blood stream infections (BSIs) annually
  - Most related to intravascular devices
  - CVCs account for 90% of CR-BSIs
  - U.S. - 5 million CVCs inserted yearly
  - Using a conservative estimated infection rate of 8%-400,000 patients with CVC related septicemia per year

- Infections
  - $29,000 to treat an episode of CR septicemia
  - Increases ICU stay by 6.5 days
  - Associated with increased morbidity and a 20-40% mortality rate
  - Most CVC infections are preventable
  - Awareness of risk factors is key to prevention
  - Insurance will no longer reimburse cost of CVC related nosocomial infections

Always start TPN through a clean (new) or “virgin” line to minimize infectious risk
The TPN line or port is considered dedicated to TPN only
The infusion of meds, fluids, blood products are strictly prohibited
With a TLC, the remaining 2 ports can be used for other infusions

Risk Factors
Immunosuppression
Cancer- RT or CT
Malnutrition
HIV/AIDS
Creating a TPN Order

• Step by Step Approach
  • 75 kg adult male with no nutritional inadequacies, and no need for volume restriction
  • Step 1
    • Assess the resident’s nutrient requirements
    • For this example let’s use 25 kcal/kg and 1.2 gm pro/kg
    • For this resident, the estimated nutrient requirements are:
      • 1875 kcals
      • 90 grams protein

• Step 2
  • Distribute the calories between the macronutrients
  • Typically for TPN
    • Amino Acids 20%
      • 75 kg, x 1.2 = 90 gm protein
      • Protein = 25 kcal/gm
    • Dextrose 50%
      • 1875 kcals x .5 = 937.5 kcal
      • Dextrose = 3.4 kcal/gm
      • 937.5 kcal / 3.4 kcal/gm = 275.7 or 276 grams dextrose
    • Lipids 30%
      • 1875 kcals x .3 = 562.5 kcal
      • IV Fat = 10 kcal/gm
      • 562.5 kcal / 10 kcal/gm = 56.25 or 56 grams of fat

• Step 3
  • Writing the Recommendation
    • Safe Practice Recommendations suggest writing all recommendations in grams:
      • 90 gm Protein
      • 287 gm Dextrose (or Carbohydrate)
      • 56 gm Lipid (Or Fat)
  • However, not all facilities may be doing this even though guideline has been in place since 2004.
Creating a TPN Order

- **Step 3**
  - Writing the Recommendation by Calculating the Volume
  - Amino Acid is available in 10 and 15% solutions
    - Divide grams of protein by solution percentage
    - 90 grams/0.15 = 600 ml
  - Dextrose is available in a 70% solution for TPN
    - 276 grams/0.70 = 394.2 ml or 394 ml
  - Lipid is available in a 30% solution
    - 56 grams/0.30 = 187.6 ml or 187 ml

Creating a TPN Order

- **Step 3**
  - Total fluid for this example is **1181 ml**
    - 600 ml + 394 ml + 187 ml
  - 150 ml is always added for additives (electrolytes, vitamins and minerals) for a total of **1331 ml**
  - Divide total fluid by 24 hours for a rate of **55 ml/hr**

Dextrose-General Recommendations

- High dextrose infusion rates can increase risk for fatty liver, overfeeding, increased TG and poor glycemic control
  - Dextrose infusion rate is not to exceed 5-7 mg/kg/min
  - Diabetics and critically ill patients may maintain better glucose control with infusion rates not more than 4-5 mg/kg/min
**Dextrose-General Recommendations**

Grams dextrose x 1000 / wt(kg) / 1440 (minutes) = mg/kg/min

276 grams CHO
1440 minutes in a day
75 kg weight

\[
\frac{276 \text{ gm Dex x 1000}}{75 \text{ kg}} = \frac{276000}{75} = 3680/1440 = 2.55 \text{ mg/kg/min}
\]

**Lipid- General Recommendations**

- Lipid infusion rate is not to exceed 0.12 g/kg/hr
- Increased lipid rates can increase TG levels

Grams of lipid / wt(kg) / 24 hrs = g/kg/hr

For this example: 56 gm Lipid  75 kg weight

\[
\frac{56 \text{ g}}{75 \text{ kg}} = 0.746/24 = 0.031 \text{ g/kg/hr}
\]

**PN- General Information**

- Consider Volume/Fluids
  - Restrict
  - Renal Failure
  - Low ejection fractions/CHF
  - Team Rounds
- Increase
  - To meet estimated fluid needs, TPN is only source of fluid

Try not to change the rate daily – instead, keep TPN at lowest rate and allow IVF to be adjusted
General Recommendations

- Non-protein calories to nitrogen ratio
- Add lipid and dextrose for non-protein calories
- Divide protein in grams by 6.25 to give grams nitrogen
  - (1 g nitrogen = 6.25 g protein)
- Severe stress – <100:1
- Moderate stress – 150:1
- Maintenance – 200 – 300:1

General Information

- Insulin
  - Should never be used in the first day’s bag
  - Do not add unless > 10 units is necessary as insulin sticks to the bag
  - Generally the rule of thumb is to add 1/2 to 2/3 of the previous day’s insulin the new bag

Very sick patients may be better managed with an insulin gtts

General Recommendations

- Hepatamine
  - Provides BCAA for patients with liver cirrhosis and are encephalopathic with increased ammonia levels
  - Hepatamine is in a 8% solution
  - May need to add L-cystine to keep the TPN stable
  - 40 mg/g amino acid
General Recommendations

- **Triglycerides**
  - If TG > 300 mg/dl, ensure that dextrose is not being overfed
  - Lipids should be decreased in the TPN to meet minimal estimated needs only
  - Generally the TPN is not stable with less than 30 grams of lipid
  - If TG > 500 mg/dl, lipids should be held

- **All Residents should receive an MVI and trace elements daily in TPN- 10ml**
  - 5ml in cases with renal failure or insufficiency
  - Thiamine and folic acid should be added for patients with ETOH abuse, or malnutrition

- **Standard Daily Ranges For Electrolytes**
  - Sodium 1-2 mEq/kg
  - Potassium 1-2 mEq/kg
  - Chloride as needed to maintain acid base balance
  - Acetate as needed to maintain acid base balance
  - Calcium 10-15 mEq
  - Magnesium 8-20 mEq
  - Phosphate 20-40 mmol
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**General Recommendations**
- Ascorbic Acid 200 mg
- Retinol 1 mg
- Ergocalciferol 5 mcg
- Thiamin 6 mg
- Riboflavin 3.6 mg
- Pyridoxine 6 mg
- Niacinamide 40 mg
- Dexpanthenol 15 mg
- Dl-alpha Tocopherol acetate 10 mg
- Biotin 60 mcg
- Folic acid 600 mcg
- Cyanocobalamin 5 mcg
- Phylloguinone 150 mcg

**Vitamin K**
- One manufacturer does have a Vit K free

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**General Recommendations**
- If a patient is at risk of refeeding syndrome, TPN should be started at or below the BEE
- Dextrose should not exceed 2mg/kg/min at first and may increase slowly to goal
- Start with ½ - ¾ of goal lipid
- Start at 1.0 – 1.2 g/kg for protein
- Unless further fluid restrictions are necessary, start fluid at goal rate

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**Slide 80**

**TPN Case Study #1**

This is a 70 year old nursing home resident just readmitted from an LTACH. Previous admission to an acute care facility with a diagnosis of sepsis. The resident had been intubated on a vent, and underwent a bowel resection from an ischemic bowel.

**Food/Nutrition Related History:**
- Current diet: NPO. Has TPN running via at 83 ml/hr PICC line. TPN labels states TPN providing: 100 gm Lipid, 200 gm dextrose, and 60 gm protein.
- Meds: Regular Insulin, Lantus, Vancomycin.

**Nutrition Related Past Medical History:**
- Type II Diabetes Mellitus, COPD, s/p respiratory failure on mechanical ventilation.

**Anthropometric Measurement:**
- Ht: 67”, Wt: 62 kg, UBW: 66kg 3 months ago, %UBW 94%, IBW: 62 kg, %IBW: 100%, BMI: 21.14
TPN Case Study #1
Biochemical Data/Medical Test/Procedures:
- BUN 22
- Crea 1.2
- GFR 79
- FBG 182
- Calcium 8.0
- Po4 1.9
- albumin 2.4
- prealbumin 13.3
- Fingersticks 177-225mg/dL

Upon D/C CT of abdomen reveals no obstructions, normal gas pattern, no areas.

Nutrition-Related Physical Findings:
- Skin: Intact, Braden Score 14
- Soft tender abdomen, hypoactive bowel sounds

Comparative Standards:
- Estimated energy needs: 1593 kcal
- Penn State Equation;
- Estimated protein needs: 92 gm/d (1.5 gm/pro/kg);
- Estimated fluid needs: 1840-2454ml/d (30-40ml/kg)

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TPN Case Study #1
• How many calories, grams of protein, grams of lipid, and volume is the TPN providing?
• Determine a new TPN Order
• Calculate grams of Protein
• Calculate grams of Dextrose
• Calculate grams of Lipid
• Calculate Volume

---

TPN Case Study #2
77 y.o. female nursing home resident readmitted from an acute care facility with a high output enterocutaneous fistula.

Food/Nutrition Related History:
- Resident is NPO, Has TPN running via at 43 ml/hr PICC line. TPN label states TPN is providing 40 gm Lipid, 100 gm dextrose, and 40 gm protein.
- New TPN recommendations are needed. Resident was not tolerating food well for six months due to abdominal pain. She was not receiving oral supplementation, although she did try Pro-stat. She did take a MVI daily.

Anthropometric Measurements:
- Ht: 60”,  Wt: 52 kg, UBW: 56kg 3 months ago, %UBW 93%, IBW: 45.5 kg, %IBW: 114%, BMI: 22.2
TPN Case Study #2

Biochemical Data/Medical Test/Procedures:
- BUN 20, Crea 1.2, GFR 80, FBG 146, Calcium 8.9, Phos 1.8, albumin 2.4, prealbumin 14.2, Fingertips 100-158 mg/dL

Nutrition-Focused Physical Findings:
- Bi-temporal and clavicular muscle wasting. Skin intact

Comparative Standards

Kcal Needs: 1300-1560  
25-30 kcal/kg

Protein Needs: 1.5-2.0 gm/kg = 78-104 gm protein/day

Fluid Needs: 30 ml/kg = 1560-1820 ml

TPN Case # 2

- How many calories, grams of protein, grams of lipid, and volume is the TPN providing?
- Determine a new TPN Order
- Calculate grams of Protein
- Calculate grams of Dextrose
- Calculate grams of Lipid
- Calculate Volume

References