

ENTERAL AND PARENTERAL NUTRITION

Gayle Minard, MD
Department of Surgery
The University of Tennessee
Health Science Center

Objectives

- Recognize when nutritional support is warranted
- Choose route of nutrition (enteral vs parenteral)
- Plan nutrient prescription
- Discuss benefits vs complications of enteral and parenteral nutrition
- Describe how to monitor patients receiving nutrition support

Why Is Nutrition Important?

Importance of Nutrition

- Hippocrates - "Let food be your medicine and medicine be your food."
- Wound healing/recovery from illness
- Prevention/resistance to infection
- Maintenance of vital functions
 - Respiratory muscle function
 - Cardiac function
 - Coagulation cascade
 - Electrolyte and hormonal balance
 - Renal function.

Effects of Injury and Critical Illness

- Insulin resistance
- Reduction in insulin-like growth factor, growth hormone
- Release of catecholamines, glucagon, cortisol
- Release of inflammatory cytokines, oxygen radicals

When Is Nutritional Support Warranted?

- Well nourished patients who will be unable to eat for > than 5-7 days
 - Surgery, stroke, ventilator
- Malnourished patients
- High risk patients
 - Trauma, burns, sepsis

Malnutrition

- **Marasmus**
 - Inadequate protein and calories
 - Wasting of fat and muscle
 - Aids, advanced renal failure, elderly
- **Kwashiorkor**
 - Inadequate protein
 - Edema and fatty infiltration of liver
 - Fad diets, ETOH abuse

If NS warranted, if so, when, what route, what access, what type?

- 77 year old previously healthy female with severe dysphagia following a CVA
- 59 year male with COPD and esophageal cancer who has lost 20 pounds
- 18 year male s/p SGW to abdomen with stomach, pancreas, duodenal and colon injury

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- High risk patient - Trauma

CAVEAT

***Nutrition support should maintain or improve quality of life**

Enteral vs Parenteral?

- **When the gut works use it!**
- **Using the gut can be a pain in the butt**

Benefits of Enteral vs Parenteral Nutrition

- **Maintains morphologic, functional integrity of GI tract**
- **Avoid mechanical, metabolic complications of TPN**
- **Decreased cost**
- **“Easier”**

Morphologic Benefits of Enteral vs Parenteral Nutrition

- **Maintenance of gut permeability**
- **Prevention of gut stasis**
- **Maintenance of gut mass**
- **Maintenance of gut-associated lymphoid tissue - GALT**

Clinical Benefits of Enteral vs Parenteral Nutrition

- **Decreased length of ICU and hospital stay**
- **Decreased infectious complications**
- **Decreased hypermetabolism**

Enteral Contraindications

- **Hemodynamic instability**
- **Pressors**
- **Peritonitis**
- **Bowel obstruction**
- **Proximal fistula***
- **High output fistula**
- **Bowel ischemia**

Enteral Access

- **Nasogastric/nasojejunal tube**
- **Gastrostomy**
 - **PEG, radiologic, operative**
- **Jejunostomy**
 - **PEG, radiologic, operative**

Complications of Any Enteral Access

- Aspiration
- Infection
- Bleeding
- Occlusion
- Displacement

Even Worse Complications of Enteral Access

- **Bowel obstruction**
- **Perforation**
- **Bowel infarction**

More Complications of Enteral Feeding

- **Diarrhea/constipation**
- **Abdominal distention**
- **Nausea/vomiting**

BUT!!!! TPN Has Some Pretty Sporty Complications, Too

- **Line related**
 - Infection
 - Arrhythmia's
 - Thrombosis
 - Adjacent organ perforation
- **Metabolic**
 - Hyperglycemia

Where to Start

- Determine enteral vs parenteral
- Determine calories required
- Determine protein required

Caloric Requirements

- **Formulas such as Harris-Benedict**
- **Kcal/KG method**
- **Indirect calorimetry**

Caloric Requirements

- **Harris-Benedict for women**
 - $BEE = 655.1 + (9.563 \times \text{kg}) + (1.85 \times \text{cm}) - (4.676 \times \text{age})$
- **Harris-Benedict for men**
 - $BEE = 66.5 + (13.75 \times \text{kg}) + (5.003 \times \text{cm}) - (6.7756 \times \text{age})$ Multiply by a stress factor
- **Multiply by a stress factor**

Caloric Requirements

KCAL/KG METHOD	
Maintenance	25
Minor infection, surgery	25-30
Trauma, Major surgery, sepsis	30-35
Burns	Xie

Protein Requirements

G/KG/DAY	
Maintenance	1.0
Moderate stress or repletion	1.5
Severe stress	2-2.5
Renal failure without dialysis	0.3-0.5
Renal failure with dialysis	1.0

Putting It Together - Enteral -

- Figure out the calories/day you want to give
- Calculate volume per day to deliver calories
- Calculate amount of protein that will be delivered
- Add protein to the feeding to make up the difference

Important Numbers That You Forgot a Long Time Ago

- Carbohydrates - 3.4 kcal/gram
- Lipids - 9 kcal/gram
- Protein - 4 kcal/gram
- Minimum of 75-100 grams carbs/day necessary (1 liter of D5W has 50)
- Minimum of 1-1.5 grams fat/day necessary (Big Mac at least 31)

Example - Enteral

- 27 year old, 55 kg, 5' 4" female involved in MVA with spleen and liver lacerations, pelvic fracture and bilateral pulmonary contusions
 - $\text{Kcal/day} = 55 \text{ Kg} \times 30-35 \text{ kcal/kg/day} = 1650 - 1925 \text{ Kcal/day}$
 - $BEE = 1356 \text{ kcal/day} \times 1.5 - 2 \text{ stress factor} = 2034 - 2712 \text{ kcal/day}$
 - $\text{Protein} = 2 - 2.5 \text{ gram protein} \times 55 \text{ kg} = 110 - 140 \text{ grams}$

Example - Enteral

- **Ensure Plus HN**
 - 1.5 kcal/cc
 - 44.4 grams protein/liter
- **Goal 1650-1925 kcal/day**
 - $1650 \text{ kcal} + 1.5 \text{ kcal/cc} = 1100 \text{ cc/day}$ ($\approx 45 \text{ cc/hr}$)
 - $1925 \text{ kcal} + 1.5 \text{ kcal/cc} = 1283 \text{ cc/day}$ ($\approx 55 \text{ cc/hr}$)

Example - Enteral

- $1100 \text{ cc/d} \times 44.4 \text{ gm protein/liter} = 49 \text{ gm protein/d}$
- $1283 \text{ cc/d} \times 44.4 \text{ gm protein/liter} = 57 \text{ gm protein/d}$
- **Goal Protein = 110 - 140 gm/d**
- **Add protein – pain for the nurses**
- **OR use a higher nitrogen formula**

Example - Enteral

- **Replete with Fiber**
 - 1.0 kcal/cc
 - 64 grams protein/liter
- **Goal 1650-1925 kcal/day**
 - $1650 \text{ kcal} + 1 \text{ kcal/cc} = 1650 \text{ cc/day}$ ($\approx 70 \text{ cc/hr}$)
 - $1925 \text{ kcal} + 1 \text{ kcal/cc} = 1925 \text{ cc/day}$ ($\approx 80 \text{ cc/hr}$)

Example - Enteral

- $1650 \text{ cc/d} \times 64 \text{ gm protein/liter} = 106 \text{ gm protein/d}$
- $1925 \text{ cc/d} \times 64 \text{ gm protein/liter} = 123 \text{ gm protein/d}$
- **Goal Protein = 110 - 140 gm/d**

Overfeeding

- **Steatosis**
- **Cholestasis**
- **Intrahepatic triglyceride accumulation**
- **Excessive CO₂ production**

Special Considerations

Renal failure	Reduce protein, Mg, Phos, K
Lung disease	Decrease carbs, increase lipids
Diabetes	Decrease carbs, increase lipids
Liver disease	Consider branched chain amino acids
Aspiration risk	Use concentrated formulas
CHF	Use concentrated formulas
Pediatrics	Don't ask me

Things to Watch Out For

- **Overfeeding/underfeeding**
 - Follow nitrogen balance
 - Follow BUN, CO₂
 - Follow albumin, prealbumin

Things to Watch Out For

- **Refeeding**
 - Hypokalemia
 - Hypomagnesemia
 - Hypophosphatemia
 - Hyperglycemia
 - Thiamine deficiency

Things to Watch Out For

- **Any and all electrolyte abnormalities**
- **Hypo/hyperglycemia**
- **Acidosis**
- **Fluid overload**

How and What Would We Feed Our Original Patients?

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 - Access route?
 - Type of formula?

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Summary

- **Recognize when nutritional support is warranted**
 - Malnourished
 - Expected to be without oral intake for 5 - 7 days
 - High risk patients

Summary

- **Choose route of nutrition (enteral vs parenteral)**
 - When the gut works use it
 - **MUST BE** closely monitored
 - TPN is significantly better than starving to death

Summary

- **Plan nutrient prescription**
 - Calculate caloric requirements
 - Calculate protein requirements
 - Determine amount of ENTERAL feeds based on CALORIC requirements, adjust PROTEIN

Summary

- **Discuss benefits vs complications of enteral and parenteral nutrition**
 - Physiologic and clinical benefits to enteral compared with parenteral
 - Both can be associated with **SIGNIFICANT COMPLICATONS** so patients must be monitored

Summary

- **Describe how to monitor patients receiving nutrition support**
 - Examine abdomen and **TALK TO PATIENT!**
 - Follow electrolytes, glucose, LFT' S
 - Monitor nitrogen balance, albumin, prealbumin

Parting Thoughts

- My personal goal for each patient followed by the Nutrition Support Service is to sign off
- That means that the patient is taking an adequate enteral or even better, an ORAL diet