Nutrition Support in the Hospital Patient

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November 2, 2005
What is Nutritional Support

“The provision of nutrients orally, enterally, or parenterally with therapeutic intent. This includes, but is not limited to, provision of total enteral or parenteral nutrition support, and provision of therapeutic nutrients to maintain and/or restore optimal nutrition status and health.”

ASPEN, 2002
Who Should Get Nutritional Support?

Patients who:

• Cannot meet nutrient requirements
• Have documented inadequate oral intake
• Have unpredictable return of GI function
• Need a prolonged period of NPO/bowel rest
Indications for Supplementary Nutrition Support (SNS)

**Nutrition support**
- As primary therapy for a disease
- As an adjunct to primary therapy

**To treat malnutrition**
- To avoid development of malnutrition from low energy & nutrient intake or increased needs
Determining Requirements

Harris-Benedict Equation

**Females:**
655 + (9.6 x W) + (1.8 x H) - (4.7 x A)

**Males:**
65 + (13.7 x W) + (5 x H) - (6.8 x A)

Adjust for activity, stress, illness, injury
Components of Energy Expenditure

- **EEPA** – Energy Expenditure from Physical Activity
- **TEF** – Thermogenic Effect of Feeding
- **REE** – Resting Energy Expenditure

- **EEPA ~ 15-30%**
- **TEF ~ 10%**
- **REE ~ 60-75%**
Energy Expenditure

Indirect calorimetry should be the preferred standard for measurement of oxygen consumption in severely injured patients.

Epstein et al, Critical Care Medicine 2000
Enteral Nutrition

• Use of formulae as oral supplements or meal replacements when oral intake is inadequate or contraindicated

• Delivery of nutrients via a tube into the GI tract
Benefits of Enteral Nutrition


- Maintains gut mucosal physiology
- Preserves gut barrier function
- Promotes peristalsis
- May modulate immune response
- Inexpensive compared with Parenteral Nutrition

Fed Orally

Fed by TPN
Appropriate Candidates for Tube Feeding

- Functional GI tract
- Oral intake is inadequate:
  - to restore nutritional status
  - to maintain nutritional status
Conditions that often Require Enteral Nutrition

- Impaired Nutrient Digestion
- Inability to Consume Adequate Oral Nutrition
- Impaired Digestion, Absorption, Metabolism
- Severe Wasting or Growth Retardation
Is EN Feasible?

**Guiding Principles**

- A clinical assessment of intestinal function is required to ensure safety.
- EN should be prescribed only if safety and a low complication rate can be ensured.
- A good determinant of safe tolerance of EN is a GI output of less than 600 ml/24 hr (e.g., effluent from a nasogastric tube, ostomy, fistula or rectal tube).
Enteral Access Selection

- Anticipated length of therapy
- Degree of aspiration risk or tube displacement
- Presence or absence of normal digestion
- Planned surgical/endoscopic intervention
- Administration and infusion schedule
- Patient comfort/quality of life
Nasogastric Tube Feedings

- Short term < 30 days
- Intact gag reflex
- Normal gastric function
- Low risk of aspiration
- Easy tube placement
- Surgery not required
- Easy to check gastric residuals
- Accomodates bolus or intermittent infusions
Nasoenteric Tube Feeding

- Compromised gastric function
- Early enteral feeding
- May decrease aspiration risk
- Surgery not required

- Transpyloric placement may be difficult
- Frequent dislodgement
- Tube malposition common
Gastrostomy Tube

- long term > 30 days
- bolus, intermittent or continuous feedings
- meal times
PEG G/J Tubes

Allows gastric decompression & simultaneous JT feeding
Enteral Formula Selection

- Gastrointestinal function
  - digestive and absorptive capacity
- Physical characteristics of the formula
  - osmolality
  - lactose content
  - fiber content
  - caloric density
  - metabolic needs/organ dysfunction
  - fluid and electrolytes
Categories of Enteral Formula

- Standard
- Hydrolyzed/Pre-Digested
- Elemental
- Disease Specific
- Rehydration
- Modular
Standard Formula

- Normal or minimally impaired digestion
- Requires absorption
- Intact protein, “meal replacement”
- 1, 1.2, 1.5, 2 cal/ml
- May contain fiber
Hydrolyzed Formula

- GI compromise
- Improved digestion
- Protein typically small peptides
Elemental Formula

- Limited GI function
- Minimal residue
- Protein is “free amino acids”
- Minimal fat
Disease Specific Formula

- Designed for specific organ dysfunction or metabolic abnormality
- May not be nutritionally complete
- Hepatic, Renal, Pulmonary, Diabetes, Immuno, Trauma
- Evaluate carefully for efficacy and benefit
Tube Feeding Administration

- Bolus
- Gravity
- Pump
Infusion Schedule

- Meal Time
- Intermittent
- Continuous
- Cyclic - “Overnight”
  - No magic to 12 hours
Complications of Enteral Nutrition

- Access Problems
- Administration Problems
- Gastrointestinal
- Metabolic
- Psychologic
Parenteral Nutrition: Indications for use

- GI tract is not functioning well enough to meet nutritional needs of patient so nutrients put in bloodstream intravenously.

Examples:
- Small bowel resection
- Bowel obstruction (small or large)
- Large output fistula
  - below enteral feeding site
Parenteral Nutrition - Access Sites

- Central access: surgical / radiological placement of catheter in large, high blood flow vein – TPN (total parenteral solution)
- PICC line: catheter inserted in vein in arm; solution taken to high blood flow vein – TPN
- Peripheral access (also, midline): catheter tip placed in vein in arm. Requires more dilute peripheral parenteral solution – PPN
Solutions: CHO = Dextrose

- Supplied as dextrose: 10% to 35%
  10% = 100 gm/L, 25% = 250 gm/L
- Dextrose provides 3.4 Kcal/gm
  1 liter of 10% soln = (100gm x 3.4Kcal/gm) = 340 Kcal
- PPN – Peripheral Parenteral Nutrition is put into small (peripheral) vein so cannot use more than D_{10}
Solutions: Protein (2.5% A/A) + D$_{15}$

@ 60cc/hr

- Supplied as A/A – essential & nonessential:
- Choices:
  - 2.5, 4.25, 5% solutions
  - 2.5% = 25 gm/L; 4.25% soln = 42.5 gm/L
- Protein provides 4 Kcal/gm
  - often not be included in total Kcal
- 60 cc x 24 = 1.44 L x 25 g/L = 36 gms in 24 hrs & 144 kcal of prot
- 1.44 L x 150 gm/L = 216 g dextrose x 3.4 kcal/gm = 734 kcal in 24 hrs
Parenteral Nutrition Solutions: Lipids

- Supplied as aqueous suspension of soybean or safflower oil with egg yolk phospholipids as the emulsifier.
- Glycerol is added to suspension.
- 2 levels of emulsions:
  - 10% solution: 1.1 kcal/mL
  - 20% solution: 2.0 kcal/mL
D$_{15}$ with 2.5% aa @ 60cc/hr and 10% IL at 11 cc/hr

11 cc/hr x 24 hr = 264 cc x 1.0 kcal/cc = 264 kcal/day
Total kcal: 1142
Kcal from fat: 264 (23%)
Kcal from CHO: 734 (64%)
Kcal from prot: 144 (13%)
Parenteral Nutrition Solutions

Guidelines for amounts of each to provide:

- Protein: 15 - 20% of kcal
- Lipids: ~30% of kcal
- CHO: 50-65% of kcal
- Electrolytes, vitamins, trace elements: lower than DRI
- Fluid: 1.5 - 2.5 liters total
- Kcal: N ration: 125 kcal:1 gm N
Parenteral Nutrition Solutions

• Prepared aseptically & delivered 2 ways:
• “3 in 1” solution: pro, fat, CHO in one bag and 1 pump is used to infuse solution
• “3 in 2” solutions: 2 bag method: protein & CHO in 1 bag & lipid solution in glass bottle; each is hooked up to pump; solutions enter vein together
• Given continuously or cyclically (8-12 hrs/day)
• Insulin may be added to solution
Parenteral Nutrition Solutions: Selected Complications

- Mechanical: thrombophlebitis
- Infection and sepsis of catheter site
- Gastrointestinal: villous atrophy
- Metabolic: hyperlipidemia, trace mineral deficiencies, electrolyte imbalance
- Liver disease
- Refeeding syndrome
Transitional Feeding

• A process of moving from one type of feeding to another with multiple feeding methods used simultaneously

• Examples:
  - parenteral feeding to enteral feeding
  - parenteral feeding to oral feeding
  - enteral feeding to oral feeding
Transitional Feeding
parenteral to enteral

1. Introduce enteral feeding – 30 cc/hr while giving parenteral
2. If tolerated, gradually ↓ parenteral while increasing enteral
3. Once patient can tolerate 75% of needs enterally, d/c parenteral

Process is called a stepwise decrease
Transitional Feeding
parenteral to oral and enteral to oral

• Use step-wise decrease method; wait until patient accepting 75% oral and then decrease parenteral or enteral method
• But may need to:
• Offer oral during the day & cycle other from 6pm -6am in order to ↑ provide motivation & reestablish hunger patterns
• Some children & adults may continue on oral during the day and enteral at night
Nutrition Support

• Most effective when provided by team: RD, RN, Pharm D in conjunction with MD
• Regular monitoring of electrolytes, LFTs, CBC & nutritional markers
• Use appropriately to maximise cost-benefit
  – Specialised supplements are more expensive / benefit often unproven
• Know patient’s wishes – living will or advance directive