

CORRELATIVE MEDICINE SERIES

NUTRITION: ENTERAL NUTRITION

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Objectives:

After reviewing the **Enteral Nutrition** handout including use of all references, the student should be able to:

1. Identify indications for the use of enteral nutrition support.
2. Recognize the different types of enteral nutrient solutions.
3. Compare and contrast the risks and benefits of enteral access devices including gastric and small bowel feeding tubes used for long and short-term purposes. Distinguish the appropriate type of feeding tube given specific patient needs.
4. Explain the steps in NG tube insertion.
5. Identify the four types of complications associated with enteral nutrition support.
6. Given a patient's G.I. status, fluid status, and disease state, select the most appropriate enteral product for that patient.

Enteral Nutrition Support

I. Enteral nutrition as an adjunct treatment for pathological conditions

A. Indications

1. Functional gut and inadequate oral intake secondary to:
 - a. Anorexia of disease, injury, illness, drugs, depression
 - b. Increased energy requirements due to stress, injury, illness, trauma, burns (any hypermetabolic states)
 - c. Dysphagia (CVA, pulmonary intubation)
 - d. Upper GI tract obstruction
 - e. Gastrointestinal disease- ulcerative colitis, short bowel syndrome, low output enterocutaneous fistulas

B. Types of short-term enteral access devices

1. Poly-vinyl chloride tubes
 - a. used for gastric decompression or feeding
 - b. vented to avoid adherence to gastric mucosa
 - c. available in large bore sizes
 - d. stiff and should be changed every 7-10 days
2. Silicone
 - a. used for gastric decompression or feeding
 - b. vented
 - c. more pliable and can remain in longer than PVC tubes
3. Polyurethane
 - a. small bore feeding tube
 - b. non-vented
 - c. weighted or non-weighted
 - d. gastric or small bowel feeding

C. Determining best access device for short term use

1. Purpose: feeding or gastric decompression
2. Gastric or jejunal feedings
3. Extended use of device expected

D. Bedside placement of access device

1. Gather supplies, wash hands, explain to patient
2. Elevate head of bed and check for nasal patency
3. Measure from nasal alae to ear lobe to tip of sternum and mark tube
4. Lubricate end of tube with water soluble lubricant
5. Insert tube along floor of nasal cavity
6. Advance tube as patient swallows
7. Secure in place

E. Verification of tube placement

1. Aspiration and auscultation
2. PH testing
3. X-ray

F. Long term access devices

1. Endoscopically placed
2. Surgically placed
3. Radiologically placed

G. Assess calorie and protein needs, then determine maximum rate

H. Administration

1. Continuous drip
 - a. Begin at 25 cc/hr
 - b. Begin with isotonic solution
 - c. Advance by 25ml per day increments
2. Bolus drip
 - a. Usually one can of Sustacal Plus four times daily
3. Elevate HOB 30
4. Measurement of gastric residuals
 - a. Do not hold feeding unless residual is greater than twice the hourly drip-rate or 100 cc for a rate less than 50 cc/hr

II. Enteral nutrient solutions

A. Modular components- used in addition to food intake or tube feedings

1. Not nutritionally complete- one macronutrient used to boost caloric or protein content
2. Nutrients, osmolality, and residue content
3. Examples:

Polyose:	2 Kcal/cc
Propac, Casec:	3 gm protein per tablespoon
MCT Oil:	7.7 Kcal/cc
Safflower oil:	8.0 Kcal/cc
4. Administration: oral- added to foods and drinks, or by tube

B. Meal replacements -require intact digestive and absorptive capacity

1. Nutritionally complete
2. Low residue, lactose free
3. Isotonic feedings (Osmolality: 300 mOsm): Isocal, Osmolite, Isocal HN
4. Flavored formulas
 - a. Examples: Sustacal, Sustacal Plus, Ensure
 - b. Osmolality: 470-670
5. Cost: \$3-10/L
6. Administration: oral or tube

C. Disease Specific Formulas

1. Elemental solution
 - a. Indication- malabsorption or short bowel syndrome
 - b. Nutritionally complete, low fat, hydrolyzed or partially hydrolyzed protein.
 - c. Minimal residue, lactose free
 - d. Osmolality: 630-650 mOsm/kg water
 - e. Cost: \$7-30/L
 - f. Examples: Criticare HN, Vivonex T.E.N.
 - g. Administration: tube
2. Renal solutions
 - a. Indication- nondialyzed renal patient
 - b. Nutritionally incomplete, minimal to no electrolytes or trace elements, low protein
 - c. Minimal residue, lactose free
 - d. Contains essential amino acids
 - e. Osmolality: 600mOsm

- f. Cost: \$10-20/L
- g. Administration: tube
- h. Example: RenalCal, Amin Aid
- i. Formulas marketed for Renal –dialyzed patients: Nepro, Magnacal Renal

3. Hepatic solutions

- a. Indications- liver dysfunction with hepatic encephalopathy
- b. Nutritionally incomplete- low amount of electrolytes, no trace elements, restricted in protein.
- c. Minimal residue, lactose free
- d. High % of branched chain amino acids
- e. Osmolality: 560-690 mOsm
- f. Cost: \$40/L
- g. Examples: Nutri Hep, Hepatic-Aid
- h. Administration: oral or tube

4. High nitrogen solutions

- a. Indication- burns, trauma, hypermetabolic state
- b. Nutritionally complete, high protein
- c. Minimal residue, lactose free
- d. Osmolality: 340-490 mOsm
- e. Cost: \$3-10/L
- f. Examples: Traumacal, Protain
- g. Administration: oral or tube

5. Concentrated solutions

- a. 1.5-2.0 Kcal per cc
- b. 60-70 gm protein per Liter
- c. cost \$3-10/L
- d. Examples: Comply, Nepro
- e. Osmolality 410-635 mOsm/kg H₂O
- f. Indications: renal dialyzed patients or fluid restricted patients

III. Potential complications

1. Mechanical

- a. Clogging
- b. Kinking
- c. Tube malposition
- d. Frequent removal

2. Gastrointestinal complications

- a. Diarrhea
- b. Nausea, vomiting
- c. Constipation

3. Metabolic complications

- a. Fluid overload
- b. ECVD
- c. Electrolyte imbalance
- d. Hyperosmolality

4. Infectious complications

- a. Aspiration pneumonia
- b. Gastroenteritis

Tube feedings available at TMC:

Per 1000 ml	Pro (g)	Fat (g)	CHO (g)	Calories	Na (mEq)	K (mEq)	P04 (mg)	Water (ml)	Mosm/k
Isocal HN	44	45	124	1060	40.4	41.3	850	850	270
Protain XL *	57	30	129	1000	37.4	38.4	800	830	340
Comply	60	61	180	1500	48	47	1200	770	410
Traumacal	83	69	145	1500	52	36	750	780	490
Criticare HN**	38	5.3	220	1060	27.5	34	530	830	650
Renal Cal	34.4	82	290	2000	0	0	0	704	600
NutriHep	40	21	290	1500	14	34	1000		690
Oral Supplements	per	240 ml	serving						
Sustacal	14.5	5.5	33	240	9.7	12.9	220	201	650
Sustacal Plus	14.4	13.6	45	360	8.9	9	200	187	670

* contains fiber ** elemental product

Metamucil fiber supplement may be given to patients on TF. 1-2 packets daily followed by water bolus flush.

MCT Oil = 7.7 kcal/cc 20cc=154 kcal can be bolused with TF to increase calories. Usually given TID.

Polycose=2 kcal/cc , may be bolused with tube feedings, or powder (23 kcal per T) may be added to food and beverages to increase calories.

Propac = 3 gm protein per tablespoon

Current standard tube feeding is Isocal HN. Tube feedings may be started at 25cc/hr and increased by 25cc/hr increments every 24 hours depending on patient tolerance and length of time prior to enteral feeding that the patient has been without nutrition. Tube feedings are generally considered to be tolerated if gastric residuals are not greater than twice the rate or 100cc, which ever is greater. If a patient has been without nutrition for greater than 7 days and or the patient has been eating poorly for an extended period of time tube feeding rate may need to be increased more cautiously.

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