NUTRITION

Sotiris Papaspyros

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Assessment

History

Physical examination

Anthropometric measurements

Laboratory investigations

Assessment

History

- Dietary history
- Significant weight loss within last 6 months
  - > 15% loss of body weight
  - compare with ideal weight
  - Beware the patient with ascites/ oedema

Assessment

Physical Examination

- Evidence of muscle wasting
- Depletion of subcutaneous fat
- Peripheral oedema, ascites
- Features of Vitamin deficiency
  - eg nail and mucosal changes
- Echymosis and easy bruising
- Easy to detect >15% loss

Assessment

Anthropometry

- Body Mass Index (<19, or >10% decrease)
- Triceps-skinfold
- Mid arm muscle circumference
- Hand grip dynamometry

Assessment

Lab investigations

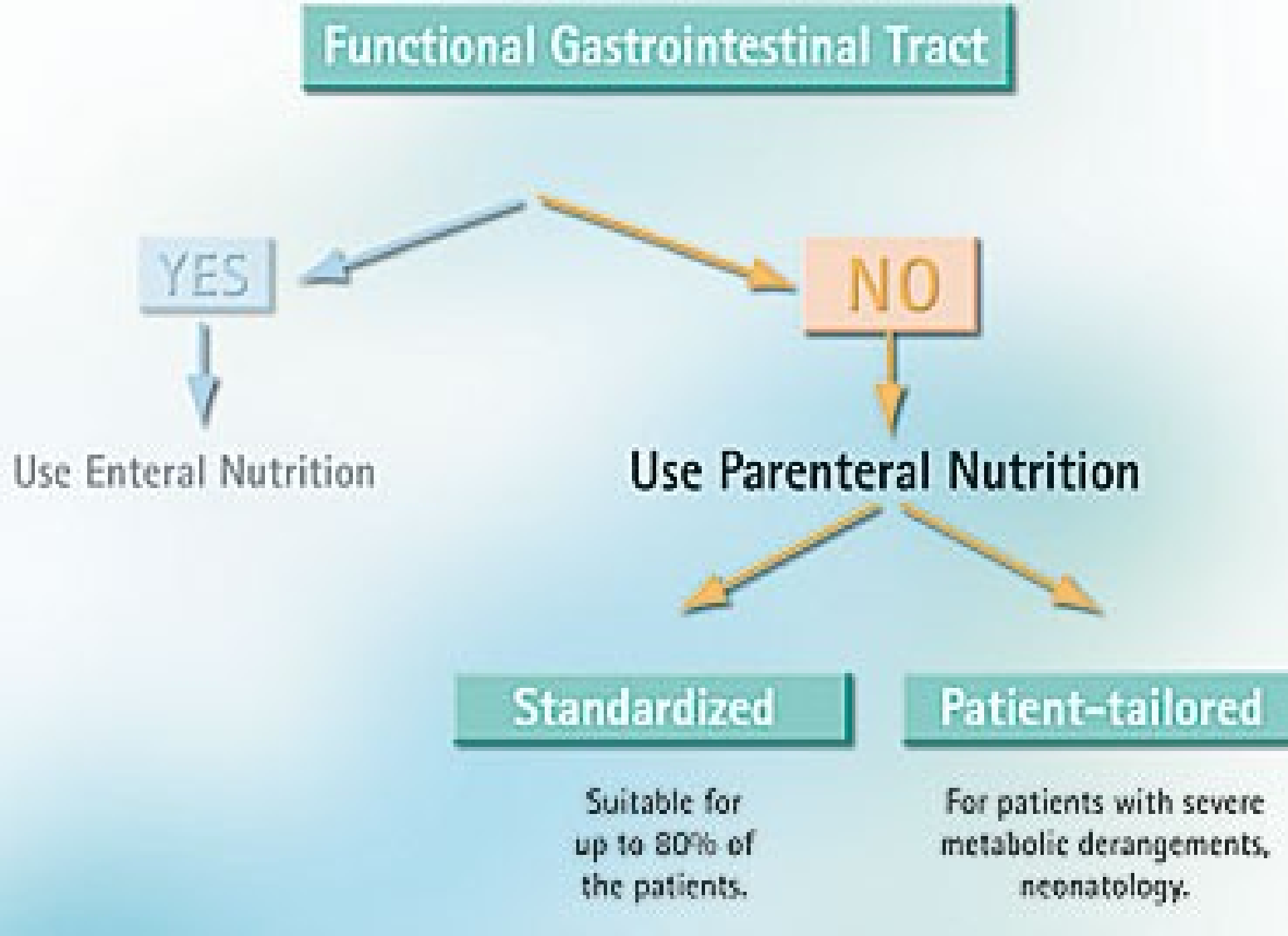
- pre-albumin <12 albumin < 30 mg/dl
- transferrin < 150 mmol/l
- total lymphocyte count < 1800 / mm^3
- tests reflecting specific nutritional deficits
  - *eg Prothrombin time*

Assessment

- No index of nutritional assessment is shown to be superior to clinical assessment

Malnutrition

- Delayed wound healing
- Reduced ventilatory capacity
- Reduced immunity (increased risk of infection)


Functional Gastrointestinal Tract
YES
NO
Use Enteral Nutrition
Use Parenteral Nutrition
Standardized
Patient-tailored
Suitable for up to 80% of the patients.
For patients with severe metabolic derangements, neonatology.

Enteral Nutrition

- Advantages
  - ⇩ Metabolic stress
  - ⇧ Nitrogen balance
  - Better glycemic control
  - ⇧ Visceral protein synthesis
  - Mucosa barrier function
  - ⇧ GALT, fewer infections
  - ⇧ Variety of nutrients
  - ⇧ Visceral blood flow
  - ⇧ Anastomotic strength
  - Cost effective
- Disadvantages
  - GI dysmotility
  - Aspiration risk
  - Distention
  - Diarrhea
  - Gut ischemia
  - Access difficulty
  - ? Underfeeding

GI complications in the critically ill

- Stress-related mucosal damage is very common
- Clinically relevant haemorrhage occurs in 1-4%
- Causes
  - Acid/pepsin erosion and ulceration
  - Bacterial translocation (SIRS and MODS)
- Consequences – mucosal ischaemia, reperfusion injury etc

Enteral Feeding is indicated

When nutritional support is needed

Functioning gut present

No contra-indications

no ileus, no recent anastomosis, no fistula

Types of feeding tubes

Naso-gastric tubes

Oro-gastric tubes

Naso-duodenal tubes

Naso-jejunal tubes

Types of feeding tubes

Gastrostomy tubes

- *Percutaneous Endoscopic Gastrostomy (PEG)*
- *Open Gastrostomy*

Jejunostomy tubes

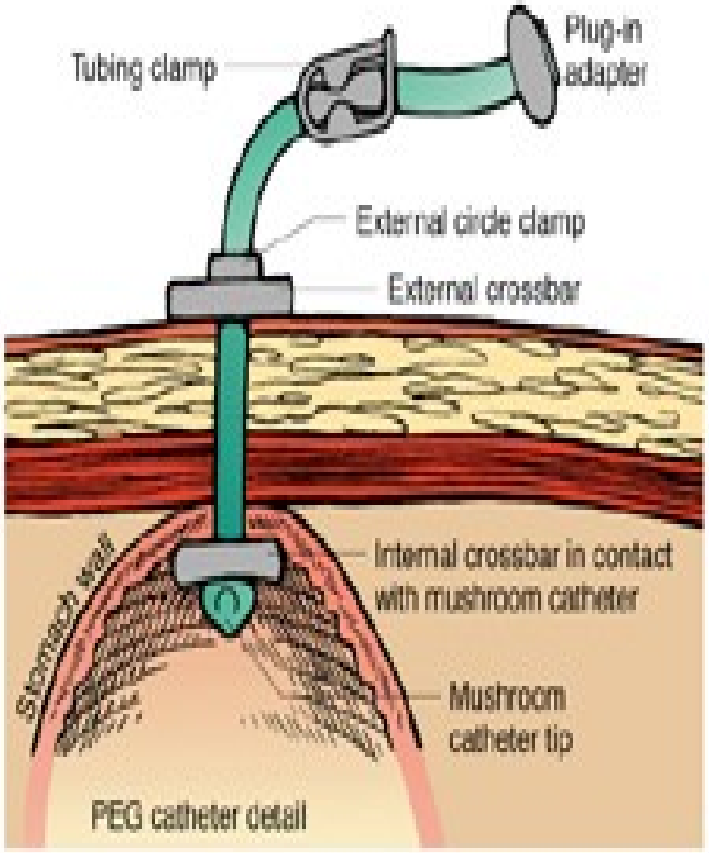
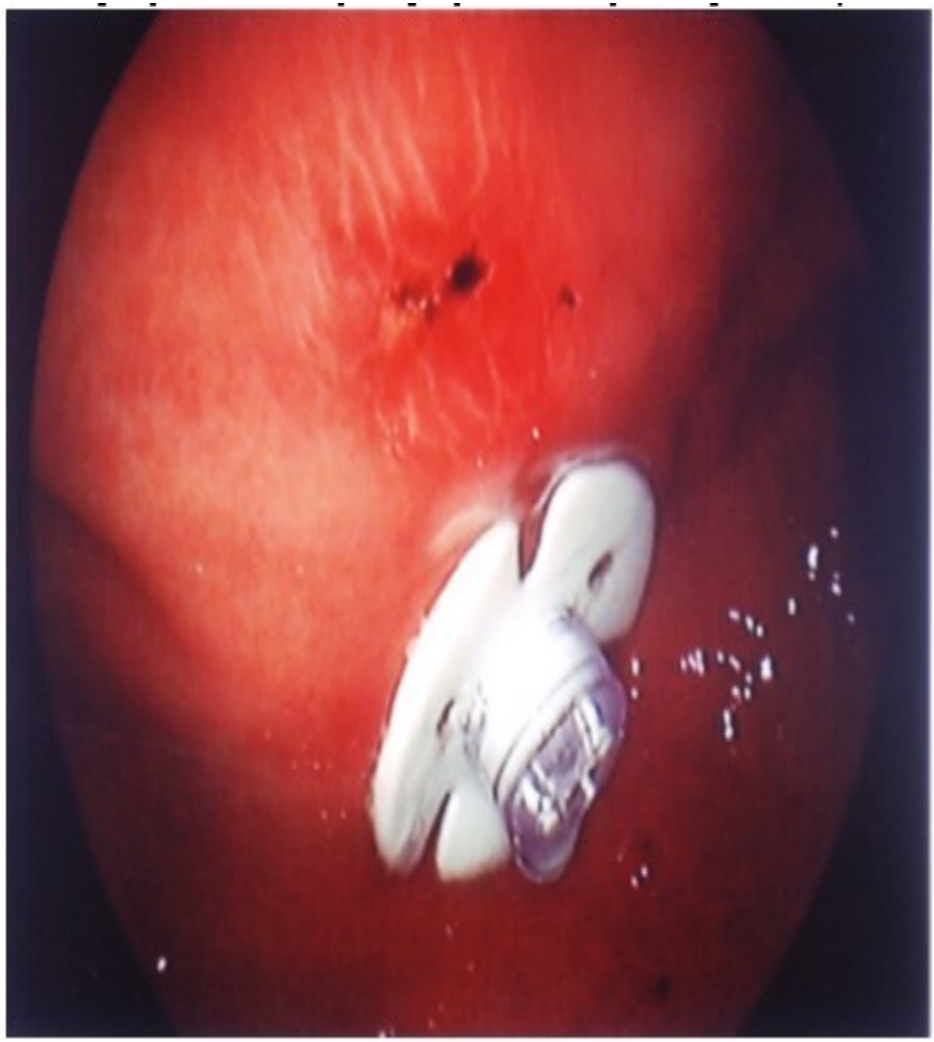


Figure 42-7 Percutaneous endoscopic gastrostomy tube in place in the stomach. (Smeltzer, S. C., & Bare, B. G. [2004]. *Brunner and Suddarth's textbook of medical surgical nursing* [10th ed., p. 998]. Philadelphia: Lippincott Williams & Wilkins.)

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What can we give in tube feeding?

Blenderised feeds

Commercially prepared feeds

- *Polymeric*
  - *eg Isocal, Ensure, Jevity*
- *Monomeric / elemental*
  - *eg Vivonex*

Complications of enteral feeding

Gastrointestinal complications

Mechanical complications

Metabolic complications

Infectious complications

Complications of enteral feeding

Gastrointestinal

Distension

Nausea and vomiting

Diarrhoea

Constipation

Intestinal ischaemia

Complications of enteral feeding

Infectious

Aspiration Pneumonia

Bacterial contamination

Complications of enteral feeding

Mechanical

Malposition of feeding tube

Sinusitis

Ulcerations / erosions

Blockage of tubes

Parenteral Nutrition

Allows greater caloric intake

BUT

Is more expensive

Has more complications

Needs more technical expertise

Who will benefit from parenteral nutrition?

Patients with/who

- Abnormal Gut function
- Cannot consume adequate amounts of nutrients by enteral feeding
- Are anticipated to not be able to eat orally by 5 days
- Prognosis warrants aggressive nutritional support

Indications

- Enterocutaneous fistulae
- Acute pancreatitis
- Prolonged ileus
- Major burns/trauma
- Severe inflammatory bowel disease

Two main forms of parenteral nutrition

- Peripheral Parenteral Nutrition
- Central (Total) Parenteral Nutrition

Both differ in

- composition of feed
- primary caloric source
- potential complications
- method of administration

Peripheral Parenteral Nutrition

Given through peripheral vein

- short term use
  - (significant problem with thrombophlebitis, change cannula every 24-48 hours)
- mildly stressed patients
- low caloric requirements
- needs large amounts of fluid
- contraindications to central TPN

What to do before starting TPN

Nutritional Assessment

Venous access evaluation

Baseline weight

Baseline lab investigations

Baseline Lab Investigations

- Full blood count
- Coagulation screen
- U&E
- LFTs
- Ca^{++}, Mg^{++}, PO_4^{2-}
- Lipids
- Other tests when indicated

Steps to ordering TPN

1. Determine total fluid volume
2. Determine caloric needs (fat/protein ratio)
3. Determine protein requirements
4. Determine Electrolyte & Trace element requirements
5. Determine need for additives

How much volume to give?

- Cater for maintenance & on going losses
- Normal maintenance requirements
  - By body weight
  - alternatively, 30 to 50 ml/kg/day
- Add on going losses based on I/O chart
- Consider insensible fluid losses also
    - eg add 10% for every ^{o}C rise in temperature

Caloric requirements

Based on Total Energy Expenditure

- Can be estimated using predictive equations

  TEE = BEE(BMR) + Stress Factor + Activity Factor

  - **Women**: BMR = 655 + (9.6 x weight in kilos) + (1.8 x height in cm) - (4.7 x age in years)
    Men: BMR = 66 + (13.7 x weight in kilos) + (5 x height in cm) - (6.8 x age in years)

Caloric requirements stress factor

- *Malnutrition + 30%*
- *Peritonitis + 15%*
- *soft tissue traum +15%*
- *fracture + 20%*
- *fever (per oC) + 13%*
- *Moderate infection + 20%*
- *Severe infection + 40%*
- *<20% BSA Burns + 50%*
- *20-40% BSA Burns + 80%*
- *>40% BSA Burns +100%*

Caloric requirements
Activity factor Harris-Benedict formula

1. If you are **sedentary** (little or no exercise) : Calorie-Calculation = BMR x 1.2
2. If you are **lightly active** (light exercise/sports 1-3 days/week) : Calorie-Calculation = BMR x 1.375
3. If you are **moderately active** (moderate exercise/sports 3-5 days/week) : Calorie-Calculation = BMR x 1.55
4. If you are **very active** (hard exercise/sports 6-7 days a week) : Calorie-Calculation = BMR x 1.725
5. If you are **extra active** (very hard exercise/sports & physical job or 2x training) : Calorie-Calculation = BMR x 1.9

How much CHO & Fats?

- Not more than 4 mg / kg / min Dextrose
  (less than 6 g / kg / day)
  Rosmarin et al, Nutr Clin Pract 1996
- Not more than 0.7 mg / kg / min Lipid
  (less than 1 g / kg / day)
  Moore & Cerra, 1991

How much CHO & Fats?

- Fats usually form 25 to 30% of calories
  - Not more than 40 to 50%
  - Increase usually in severe stress
  - Aim for serum TG levels < 350 mg/dl or 3.95 mmol / l
- CHO usually form 70-75 % of calories

Electrolyte Requirements

Cater for maintenance + replacement needs

Na^+	1 to 2 mmol/kg/d	(or 60-120 meq/d)
K^+	0.5 to 1 mmol/kg/d	(or 30 - 60 meq/d)
Mg^{++}	0.35 to 0.45 meq/kg/d	(or 10 to 20 meq /d)
Ca^{++}	0.2 to 0.3 meq/kg/d	(or 10 to 15 meq/d)
PO_4^{2-}	20 to 30 mmol/d	

Trace Elements

Total requirements not well established

Commercial preparations exist

- Zn 2-4 mg/day
- Cu 0.3 to 0.5 mg/day
- Mn 0.4 to 0.8 mg/day

Other Additives

- Vitamins
  - Give 2-3x that recommended for oral intake
  - Multiple vitamin preparations used
  - May not include Vit K
    - can give 1 mg/day or 5-10 mg/wk

Other Additives

- Medications
  - Insulin
    - can give initial dose based on sliding scale (keep <11 mmol/l)
    - once stable, give 2/3 total requirements in TPN & review daily
    - alternate regimes
      - 0.1 u per g dextrose in TPN
      - 10 u per litre TPN initial dose
  - Other medications

TPN Monitoring

Clinical Review

Lab investigations

Adjust TPN order accordingly

Clinical Review

- clinical examination
- vital signs
- fluid balance
- catheter care
- sepsis review
- blood sugar profile
- Body weight

Lab investigations

- **Full Blood Count** – weekly, unless indicated
- **Renal function** – daily until stable, then 2x/wk
- **Ca^{++}, Mg^{++}, PO_4^{2-}** – daily until stable, then 2x/wk
- **Liver Function Test** – weekly
- **Iron** – weekly
- **Lipids** – 1-2x/wk
- **Nitrogen Balance** – weekly

Nutritional Balance

Nutritional Balance = $N_{input} - N_{output}$

1 g N = 6.25 g protein

N_{input} = (protein in g x 6.25)

N_{output} = 24h urinary urea nitrogen + non-urinary N losses

(estimated normal non-urinary Nitrogen losses about 3-4g/d)

Complications related to TPN

- Mechanical
- Metabolic
- Infectious
- Central line insertion

Central line insertion Complications

- pneumothorax
- air embolism
- arterial injury
- bleeding
- brachial plexus injury
- catheter malplacement
- catheter embolism
- thoracic duct injury

Mechanical Complications

Venous thrombosis

catheter occlusion

Metabolic Complications

hyper / hypoglycaemia

electrolyte abnormalities

acid-base disorders

hyperlipidaemia

Metabolic Complications

Hepatic complications

Biochemical abnormalities

Cholestatic jaundice

- *too much calories (carbohydrate intake)*
- *too much fat*

Acalculous cholecystitis

Infectious Complications

- Insertion site contamination
- Catheter contamination
  - *improper insertion technique*
  - *use of catheter for non-feeding purposes*
  - *contaminated TPN solution*
  - *contaminated tubing*
- Secondary contamination
  - *septicaemia*

Stopping TPN

- Stop TPN when enteral feeding can restart
- Wean slowly to avoid hypoglycaemia
- Monitor glucose during wean
  - Give IV Dextrose 10% solution at previous infusion rate for at least 4 to 6h
  - Alternatively, wean TPN while introducing enteral feeding and stop when enteral intake meets TEE

- Thank you