# Nutrition in Surgery Patients

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# Objectives

- Types of malnutrition
- When to feed
- Types of nutrition
- Early vs later
- Monitoring & complication of nutrition


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# Notes

- Studies not imp
- Concentrate on outcome and complication


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# Goal of Nutritional Therapy

- Fulfillment nutrition requirement
- Preservation of vital organs
- Decrease mortality and morbidity rate
- Decrease hospital cost


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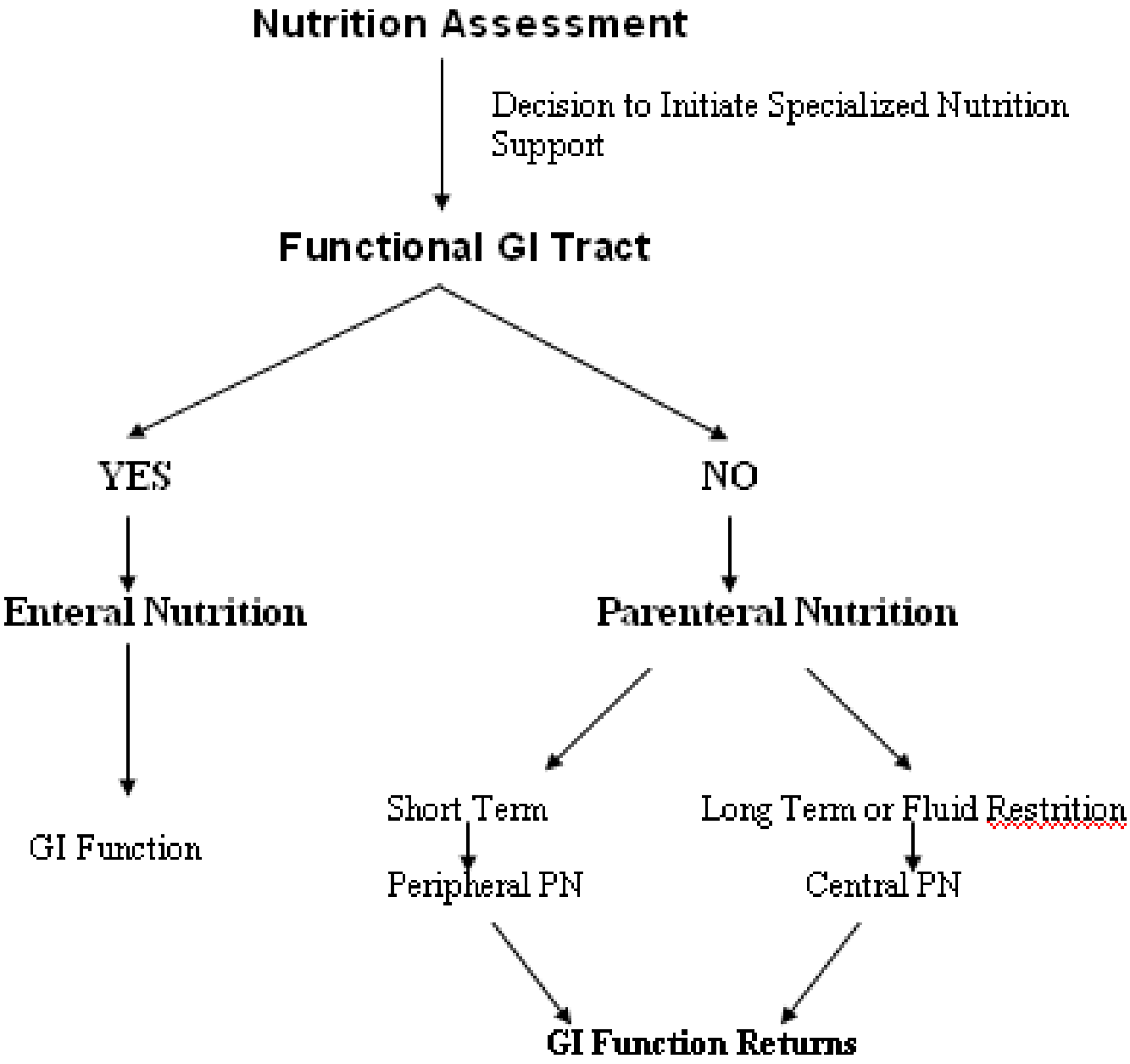
Nutrition Assessment
Decision to Initiate Specialized Nutrition Support
Functional GI Tract
YES
NO
Enteral Nutrition
Parenteral Nutrition
GI Function
Short Term
Long Term or Fluid Restrition
Peripheral PN
Central PN
GI Function Returns

# Type of Malnutrition

- **Marasmus**

Protein – calorie malnutrition

The patient's oral diet may include an acceptable protein : calorie ratio but is inadequate in quantity and calories.

(depleted somatic proteins, normal visceral proteins)

Normal Albumin and transferrin

Patients look thin and malnourished.

e.g. Patients with mild to moderate starvation, common severe burns, systemic infections, cancer etc or conditions where patient does not eat like anorexia nervosa


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# Clinical Manifestations

- Weight loss
- Reduced basal metabolism
- Depletion skeletal muscle and adipose (fat) stores
- Decrease tissue turgor
- Bradycardia
- Hypothermia


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# Type of Malnutrition

- **Kwashiorkor (Kwa-shior-kor)**

Protein malnutrition

*the diet contains various amounts of nonprotein calories (inadequate, adequate, or excessive) from carbohydrates and fats, but is deficient in total protein and essential amino acids.*

(normal somatic proteins depleted visceral proteins)

↓ Serum Albumin and transferrin

Patients appear normal or overweight

e.g. Hypercatabolic critical care patients, chronic diarrhea, chronic kidney disease, trauma , burns, hemorrhage, and liver cirrhosis


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# Clinical Manifestations

- Marked hypoalbuminemia
- Anemia
- Edema and ascites
- Muscle atrophy
- Delayed wound healing
- Impaired immune function


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# Type of Malnutrition

- **Mixed**

**Marasmus-Kwashiorkor:**

(depleted somatic and visceral proteins)

All above data are reduced

Patients appear cachexic and severely malnourished.

e.g. *Chronic hypercatabolic patients (250 to 500g loss of weight)

*Prolonged starvation

Marasmic-kwashiorkor is a mixed form of any PCM symptoms.

It frequently occurs when the marasmic patient experiences the catabolic stress of illness or trauma.


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# Medical causes (Risk factors for malnutrition)

- Recent surgery or trauma
- Sepsis
- Chronic illness
- Gastrointestinal disorders
- Anorexia, other eating disorders
- Dysphagia
- Recurrent nausea, vomiting, or diarrhea
- Pancreatitis
- Inflammatory bowel disease
- Gastrointestinal fistulas
- Cancer


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# After surgery

- After ileus
- Small intestinal recovers quickly
- Colom/ stomach delayed
- Small bowel feeding
  - Hemodynamically stable
  - Splanchnic perfusion
  - Bowel sound unnecessary


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# Factors affecting early nutrient delivery

- Patient stability
  - Need hemodynamical stability
  - Adequately resuscitated
  - ? Visceral ischemia, bowel necrosis
- Available access
  - Central venous in most ICU patients
  - NGT in most ICU patients
  - Small bowel feeding access varies
- Ability to deliver the nutrition
  - NOP for procedures
  - Inadvertently loss access
  - Intolerance to feedings (reflux, diarrhea, distention, emesis)
- Belief in potential benefits


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# Early feeding

- Early vs delay
- Early enteral vs delay TPN significant decrease complication as abscess
- Early enter vs early TPN significant decrease pneumonia


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# When to Feed

- When = Time
  - 24 to 48 hr for **post-admition** patients
  - > 7 days for NPO patients (**TPN**)
  - 1-2 weeks for **pre-surgery** patients
  - 3rd day for **post-surgery** patients


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# Does delivered nutrition get absorbed in the early postop period?

- Nutrition induced vasodilation
- Absorption ↑ energy requirement
- Cardiac bypass literature
  - Near normal absorption
  - No adverse side effects
  - Effects on intestinal hyperemia
    - No bile salts in proximal gut: GLU>protein > fat
    - Bile salt present: LCT > GLU > protein


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# Early Postoperative enteral nutrition improves gut oxygenation reduces costs compared with TPN

- RCT; n=257; Major UGI cancer
- TPN (D1 @ 50% needs) vs TEN (6hrs @ 10/hr)
- Isocaloric, isonitrogenous (25kcal/kg/d)
- Followed: outcome, nutrition, immunologic, inflammation, intestinal O2 tension
- Conclusions
  - Nutrition goal: 79% ENT, 97% TPN (p<.001)
  - Complication rate 40% TPN vs 35% TEN
  - ↑O2 recovery TEN (43 vs 31 mmHg, p<.001)
  - TEN- 4x ↓ expense

Braga, CCM 2001


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# Does delivered nutrition get absorbed in the early postop period?

- Unable to meet nutritional needs for 5-10 days orally (7-14 days in general pts)
- Enteral preferred over parenteral
- Parenteral if enteral not feasible:
  - Preoperative TPN
  - Severely malnourished + major surgery
  - Severe postop complication
  - Unable to meet needs enterally

ASPEN Guidelines, JPEN 2002


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# Meta-analysis: early enteral vs. early parenteral outcomes

skipped

- RCT (30) (1966-2002)
  - 10 Medical, 11Surg, 9 Trauma
  - "Early" ≤ 96 hrs of hospitalization
- PN associated with
  - Infectious complications (p=.001)
  - Catheter related blood stream infections (p=.003)
  - Non-infective complication (p=.04)
- EN associated with
  - Diarrheal episodes (p=.001)
- No mortality effect with type of feeding route

CCM, 2005


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# Meta-Analysis: Early enteral nutrition

- Reviewed RCT; early vs delayed TEN in ICU (±36hrs)
- 15 studies; n=753 pts
- Outcomes
  - Infections
  - Noninfectious complications
  - LOS
  - Mortality
- Results
  - ↓ Incidence infectious with early feeds (
  - ↓Hospital LOS (p=.0012)
  - No significant difference in mortality or noninfectious complications

Marik, CCM 2001


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# Dietary Composition

- Must be individualized depend on patient and type of surgery


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# What to Feed?

- Energy 25-30 kcl
- CHO 55% IMP!
- Protein 1-1.5 g/kg IMP!
- Lipid 20% 0.5-1.5 g/kg
- Electrolyte
- Antioxidant
- MTV


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# When Reach the Target

- First day 25% of nutrition requirement
- Second day 50% of nutrition requirement
- Third day full requirement if patient tolerate feeding without any complication


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# Enteral Nutrition

- Nasogastric feeding
- Starting within 48hrs of administration
- Goal 80ml/hr or 2000 kcl/day
- Oral = Start with clear fluid then semi-elemental or soft food
- Normal food


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# Early Enteral Nutrition after Bowel resection

- Start oral diet within post-operative week If hemodynamically & clinically stable
  - Sips of isotonic oral rehydration solution
  - Small quantities of foods containing complex of CHO & protein (600-1000kcal/d individualized)
  - Limit oral intake if GI losses are high
- Tube feeding if intolerance to food items
  - Polymeric enteric formulary → advance slowly
  - Use of nasal or surgical placed gastric or SB feeding tubes


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# Complication IMP!

**Enteral feeding**

- Aspiration
- Pneumonia
- Diarrhea

**Parenteral feeding**

- Catheter sepsis
- Hyperglycemia IMP!
- Pneumothorax & hemothorax
- electrolyte imbalance
- Azotemia
- Increase LFT IMP!


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# The Goals of Preoperative Nutrition Support

- ↓ surgical mortality
- ↓surgical complications and infection
- Reduce the catabolic state and restore anabolism
- ↓the hospital length of stay
- Speed the healing/recovery process


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# Total Parenteral Nutrition

- Indication
- Requirement
- Type centrally or peripherally


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# When to feed

Aggressive nutritional support **(parenteral)** should be considered in minimum 3 of:

- Looks clinically malnourished.
- Has a low serum albumin <3.5g/dL.
- Has a recent loss of 10% or greater within
- Has a history of recent poor intake.
- Who as a consequence of his illness is going to be or has been NPO for 5-7 days.


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# Total Parenteral Nutrition Indication

- When normal oral feeding is not possible.

e.g.: Chron's disease, gastric & esophageal carcinoma, paralytic ileus, generalized peronitis, GI. obstruction, intractable vomiting.

- When food is incompletely absorbed.

e.g.: Major burns, multiple injuries, radiation therapy, ulcerative colitis, chemotherapy treatment, short bowel syndrome.

- When food intake is undesirable, in case it is prudent to rest the bowel.

e.g.: Post GIT surgery, chronic inflammatory diseases, intractable diarrhea.


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# Total Parenteral Nutrition Indication

- In patients who are able to ingest food, but refuse to do so.

e.g.: Geriatric post-operative patients, adolescents with anorexia nervosa, some psychiatric patients with prolonged depression.

- In patients who, as a consequence of their illness are going to be, or have been NPO for 5 – 7 days.


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# Preoperative Nutrition Assessment-1

## 1. Medical & Nutritional History

Medical history includes acute or chronic disease, medication, surgeries, & other therapies (i.e., chemotherapeutics, immunosuppressive)

Nutrition History includes recent changes in appetite or weight, activity level, use of diet.

Subject Global Assessment (SGA)


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# Preoperative Nutrition Assessment-2

**2. Physical examination**

Logical assessment from head to toe

**3. Anthropometric parameters**

- % of IBW = Actual weight x 100/Ideal body weight
- Triceps Skinfold Thickness (TSF) for assessing fat reserve. It is decreased when fat stores are depleted.
- Midarm muscle circumference (MAC) to assess the degree of somatic protein depletion. TSF and Mid Arm Circumference are no more recommended as an accurate measurement.
- Creatinine Height Index (CHI) to assess somatic protein stores.

  Serum Protein Determination to assess the degree of visceral protein depletion, e.g. Albumin, Transferring, Prealbumin.
- Measure Total Lymphocyte Count (TLC) to assess Immune function becomes impaired

**4. Lab assessment**


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# Pretreatment Work up

- CBC, BUN, Scr , electrolyte, LFT, albumin, pre-albumin, PT & PTT .
- Establish central line.
- X-Ray for central line position.
- Infuse D10%w at prior TPN solution.


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# Question To Be Asked

- How much fluid can the patient tolerate and need?
- What is the patient's energy need?
- How much protein/nitrogen does the patient need per day?

(cont.)


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# Questions To Be Asked

- Which electrolytes are needed and how much?
- Which vitamins and mineral are needed?
- What is the osmolality of the solution?
- What is the route of feeding used?


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# Adjunctive parenteral nutrition after bowel resection

- Major source of nutrients, fluid, electrolytes
- Protein: (~ 1.5g/kg): GI losses, surgery stress
- Energy: adequate for needs and nutritional goals
- Fluid: as needed for adequate hydration
- Electrolytes: maintain plasma levels; measure GI losses and urinary excretion
  - Na, K, Mg etc
- Trace elements and vitamins: as indicated
  - Zinc; high losses (12-15 mg/L), deficit may worsen diarrhea by ↓ mucosal regeneration


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# Parenteral Nutrition

## *Central Nutrition*

- Subclavian line
- Long period
- Hyperosmolar solution
- Full requirement
- Minimum volume
- Expensive
- More side effect

## *Peripheral Nutrition*

- Peripheral line
- Short period < 14days
- Low osmolality
  < 900 mOsm/L
- Min. requirement
- Large volume
- Thrombophlebitis


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**PPN can infuse through central line but**

**Central TPN can NOT**

**infuse through the peripheral line**



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# Monitoring

- Avoid overfeeding
- Avoid respiratory problem
- Promote nitrogen retention
- Triglyceride clearance
- Fluid and electrolyte
- Weight
- Liver function


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# Monitoring for Complications

- Malnourished patients at risk for refeeding syndrome should have serum phosphorus, magnesium, potassium, and glucose levels monitored closely
- In patients with diabetes or risk factors for glucose intolerance, insulin infusion should be initiated with a low dextrose infusion rate and blood and urine glucose monitored closely.
- Liver function tests should be monitored periodically in patients receiving PN.


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# Monitoring for Complications

- Serum electrolytes (sodium, potassium, chloride, and bicarbonate) should be monitored frequently until measurements are stable.

- Patients receiving intravenous fat emulsions should have serum triglyceride levels monitored until stable and when changes are made in the amount of fat administered.


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# Complication

- ***Mechanical:*** occlusion, fibrin sheath formation, catheter removal, improper rate, thromboses.
- ***Infection:*** catheter related
- ***Metabolic:*** re-feeding syndrome, hyperglycemia, fluid & electrolyte.

(cont..)


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# Complication

- ***Organic system:***
  - hepatobiliary complication
  - respiratory
  - cardiovascular
  - renal


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# Transitional Feeding

- Maintain full PN support until pt is tolerating 1/3 of needs via enteral route
- Decrease TPN by 50% and continue to taper as the enteral feeding is advanced to total
- TPN can reduce appetite if >25% of calorie needs are met via PN
- TPN can be tapered when pt is consuming greater than 500 calories/d and d-c'd when meeting 60% of goal
- TPN can be rapidly d-c'd if pt is receiving enteral feeding in amount great enough to maintain blood glucose levels


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# Cessation of TPN

- Rebound hypoglycemia is a potential complication
- Decrease the volume by 50% for 1-2 hours before discontinuing the solution to minimize risk
- PPN can be stopped without concern for hypoglycemia


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# Administration

Initiation of Parenteral nutrition (PN)

Should be gradually to:

- Avoid glucose intolerance.
- Avoid re-feeding syndrome.
- Low concentration of dextrose and protein.


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# Fluid Requirements

- Amount of fluid requirement needed depend on age
- Pediatric: 1st 10kg = 100ml/kg,
  2nd 10kg = 50ml/kg
  3rd 10kg & up 20ml/kg.
- Adult: 30-35ml/kg

- Additional fluid for vomiting, nasogastric tube output, diarrhea, large open wound, fever, hyperventilation, fistula drainage.


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# Carbohydrate Source

- Primary energy substrate
- The amount of carbohydrate is determined by
  - patient's calorie requirement
  - glucose oxidation rate
  - optimal balance of carbohydrate and fat
- Maximum oxidized rate 4 - 7mg/kg/min (adult).


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# Calories Requirements

- Obesity: 11-14kcal/kg/day of ABW OR

  21-24kcal/kg/day of IBW
- Normal need: 25-30kcal/kg/day
- Elective surgery: 28-30kcal/kg/day
- Severe injury: 30-40kcal/kg/day
- Extensive trauma/burn: 40-45kcal/kg/day


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# Fat Emulsion

- Fat is formed mainly of essential linoleic acid stabilized by egg yolk phospholipids
- Delivered in the form of an emulsion
- Concentrated source of calories, isotonic
- Source of essential fatty acids (EFAs)
- Substitute for carbohydrate in diabetic & fluid restricted patients
- Also fat is an alternative source to dextrose to the patients with compromised respiration since it does produce little CO2 in its metabolism. While dextrose, when oxidized, it produces CO2 which must be eliminated via lungs.


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# Protein (Amino Acid)

AAs are the vital components of body protein. The primary aim of providing AAs to the body is to prevent:

- Disease related catabolic state.
- The development of manifest protein deficiency with subsequent impaired wound healing.
- Disturbances of blood clotting.
- The impairment of hepatic and renal function.
- A reduced immuno-competence.


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# Electrolytes

- Na, K, CL, Ca, Mg, $PO_4$, & acetate.
- Electrolytes given to maintain normal serum concentration or to correct deficit.
- Requirements for specific electrolytes will vary according to the patients disease state


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# Multivitamin and Trace Minerals

- Standard form of multivitamin & trace mineral use.
- Zinc, copper, manganese & chromium.
- Additional of trace mineral required depend on GI losses.
- Renal failure patients reduce dose
- Biliary stasis disease, avoid copper & manganese


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# Increased the Goal feeding

**If the patient can tolerate adequate volume:**

- Capillary glucose value is < 10mmol/L, dextrose is increased to goal.
- The protein content of the PN is increased to goal.
- Serum triglycerides are less than 4.5mmol/L lipid are administered.


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# Renal Failure Considerations IMP!

- Present with problems of volume limitation and poor tolerance of nitrogen wastes.
- Treated with 0.5-0.8g/kg amino acid, higher glucose and lipid concentration.
- Limit amounts of sodium, potassium, magnesium, and phosphate.


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# Liver Failure Considerations IMP!

- Inability to tolerate large fluid volume and difficulty with nitrogen loads
- Maintain glucose
- Supply moderate protein(1.0-1.3g/kg) and fat intake up to 30% of T.k.calorie
- Restrict fluid and salt intake
- BCAA


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# Fluid Restricted Considerations

- As pulmonary, cardiac failure, head injuries, and elderly.
- Special concentrated TPN solution.
- High fat emulsion, low glucose.
- Normal protein requirement.
- Normal electrolyte.


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# Respiratory Failure IMP!

- Non-protein calories to nitrogen ration is not a major consideration.
- Major problem total calories, either from CHO or fat or both
- Protein increases oxygen consumption demands and that is not indicated to reducing protein


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# Other Considerations

- Pancreatic disease, sepsis, diabetes and neonates, all have certain degree of carbohydrate intolerance.

- Fat Emulsion can be used in place of glucose calories


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# Going to surgery

- **In postoperative** surgical patients;

TPN is indicated if the patient is indicated to stay NPO for 5 – 7 days in malnourished patients, and 7 – 10 days in well-nourished patients.

- **In preoperative** patients;

TPN should be considered in patients who cannot
or
should not eat for more than 3 – 5 days.


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# Practice Guidelines Preoperative

- NS should be administered for 7-14 days to moderately or severely malnourished patients undergoing major GI surgery

- PN should NOT be routinely given in the immediate postoperative period to patients undergoing major GI procedures


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# OR Patient

- Hold TPN during OR if it is more than 1 1/2 hrs
- 2hrs pre-operation:
  - ↓ TPN rate 50% for 1hr
  - Hold TPN
  - Start D10% infusion at same TPN rate
- 6hrs post – operation
  - Start new TPN bottle at 50% of TPN rate for 1hr
  - ↑ TPN rate as in order
- MONITORING BLOOD SUGAR


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# Additives in PN

- INSULIN: For hyperglycemia when glucose is spilling in urine.
- HEPARIN: To promote blood circulation (especially with peripheral TPN) and to prevent thrombophlebitis.
- HYDROCORTISONE: To prevent thrombophlebitis in patients receiving peripheral TPN.
- ACETATE: For acidosis.
- ZINC: Extra amount is needed for patient with severe stress, diarrhea, and ileostomy.


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# Defense Against PN Complications

- Select appropriate patients to receive PN
- Aseptic technique for insertion and site care of IV catheters
- Do not overfeed
  - Maintain glycemic control <150-170 mg/dl
  - Limit lipids to 1 gm/kg and monitor TG levels
  - Adjust protein based on metabolic demand and organ function
- Monitor fluid/electrolyte/mineral status
- Provide standard vitamin and trace element preps daily


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