Nutrition in surgical patient

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INTRODUCTION

1)Definition of nutrition & malnutrition

2)Causes &consequences of malnutrition

3)Assessment of nutritional status

4) Fluid , electrolytes &energy Requirements

5)Nutrition support

Nutrition & Malnutrition

- Taking in and metabolism of nutrients(food and other nourishing material) by an organism so that life is maintained and growth can take place

- A disorder of nutrition or a wasting condition resulting from energy and protein deficiency , sometimes with vitamin and trace element deficiency as well

Causes of malnutrition

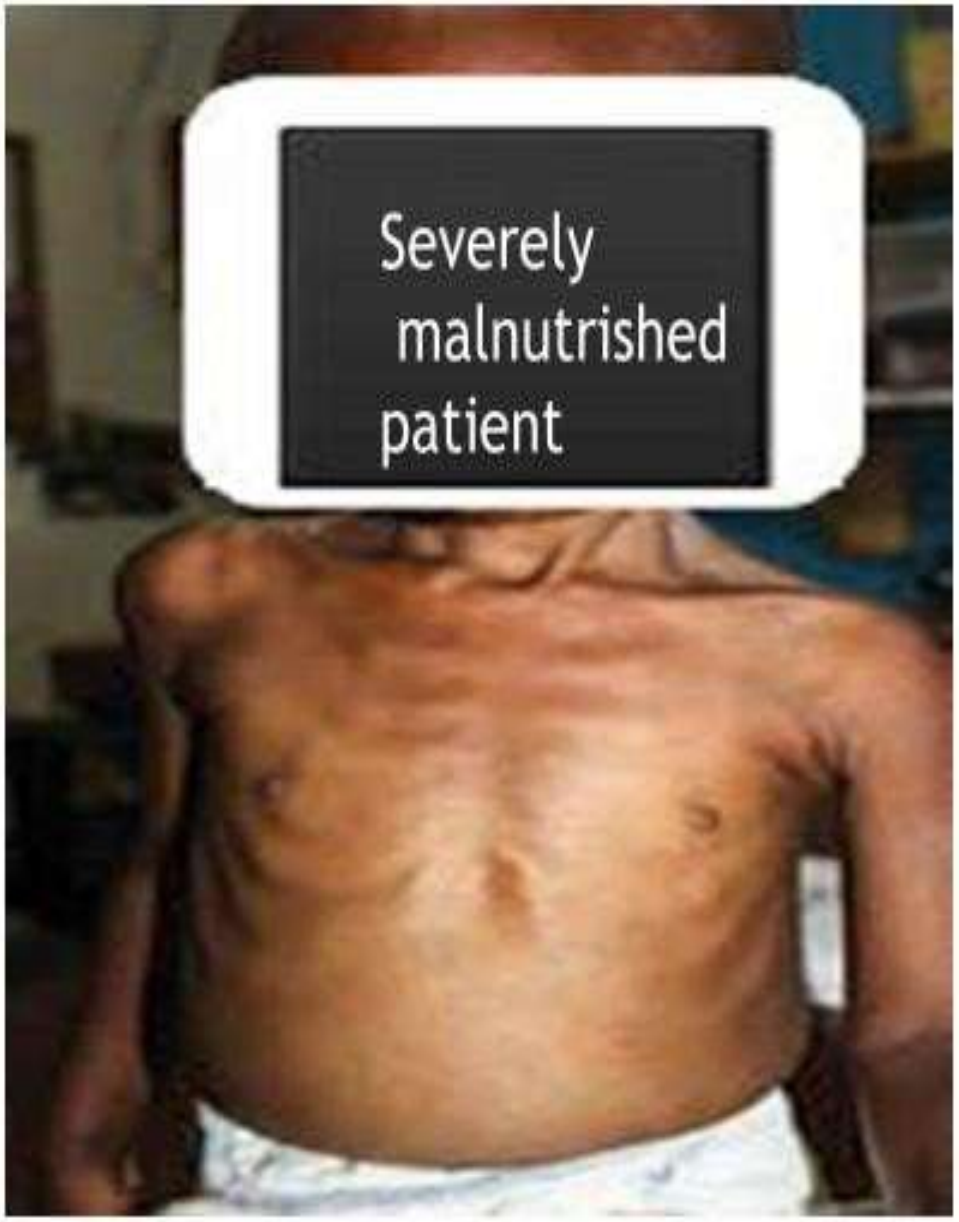
- Reduce food intake :
- Fasting ,anorexia
- Pain on swallowing ,Physical or mental impairment
- Malabsorption
- Impaied digestion or absorption
- Excess loss from gut
- Altered metabolism
- Trauma ,Burns ,Sepsis ,Surgery ,Cancer

IMPORTANCE OF NUTRITION IN SURGERY

- Surgical procedures (and subsequent fasting) after admission can cause these patient to go into severe malnutrition quickly ,often before the treating team realizes it

- There is evidence that patient with severe protein depletion have greater incidence of postoperative complications such as : pneumonia,wound infection and prolonged hospital stay

- The aim of nutritional support is to identify those patient at risk of malnutrition and to ensure that their nutritional requirement are met by most appropriate route and in way that minimize complication

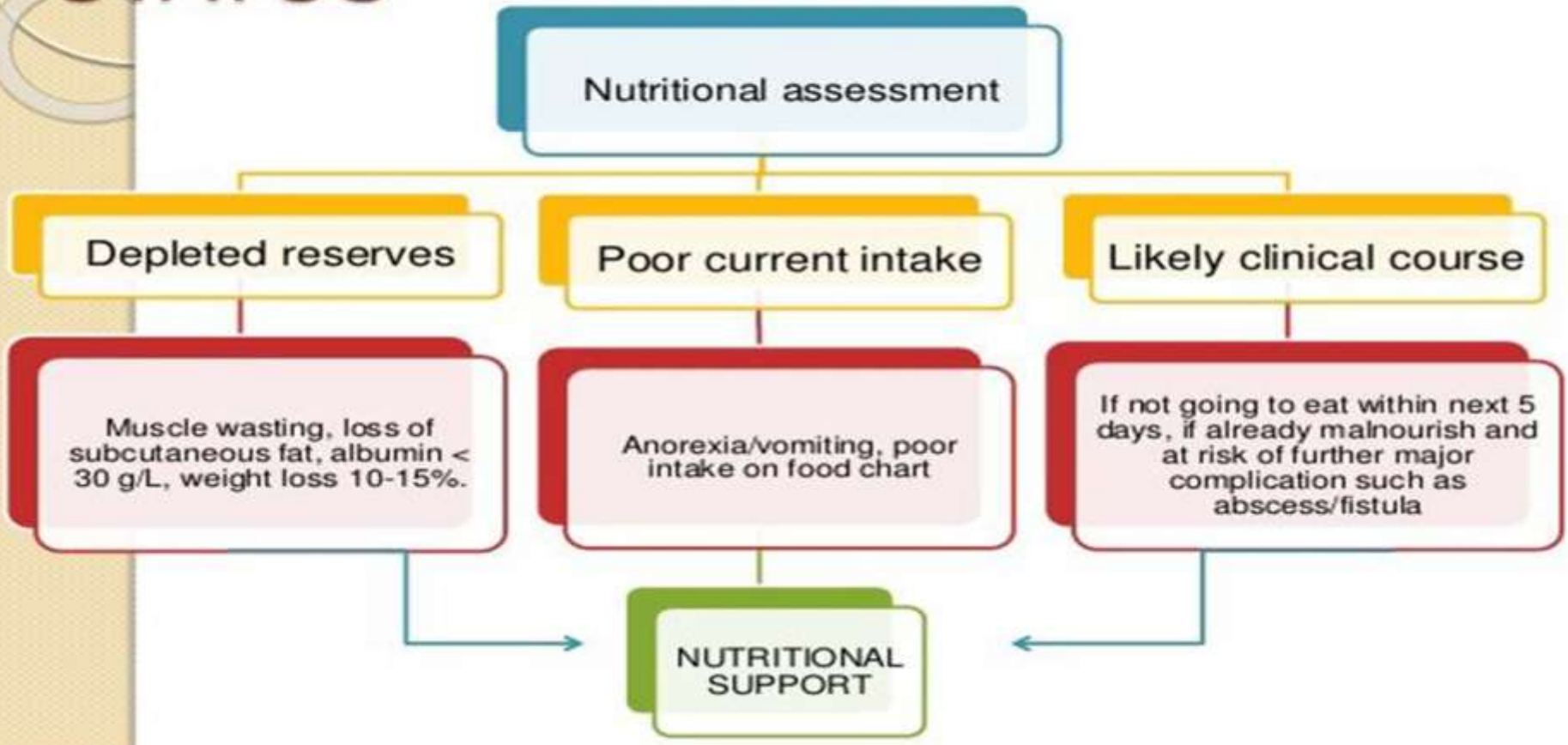


with wasting
of fat
and muscle

- short term under nutrition is frequently unrecognized and consequently patient often don't receive appropriate support associated with critical illness, major trauma , burns or surgery

- while in long standing protein -calorie malnutrition is easy to recognize

ASSESSMENT OF NUTRITIONAL STATUS



ASSESSMENT OF NUTRITIONAL STATUS

- 1 - Body weight and anthropometry

- A simple method of assessing nutritional status is to estimate weight loss. Measured body weight is compared with ideal body weight obtained from tables or from the patient's usual or premorbid weight

- (weight loss of more than 10% of patient weight in 6m is good prognostic indicator of poor outcome)

- (body mass index less than 18.5 indicates nutritional impairment) (BMI below 15 is associated with significant hospital mortality)

ASSESSMENT OF NUTRITIONAL STATUS

- 2-Laboratory techniques
- to detect subclinical nutritional deficiencies in patient :

- Nitrogen balance :it provide an index of protein gain and loss
- Serum Albumin :serum albumin level falls during the acute stress of surgery ,sepsis or other acute inflammatory illness
- Creatinine excretion
- Immunological function

Albumin is not a measure of nutritional status. Although a low serum albumin level (<30 g/L) is an indicator of poor prognosis and infectous complication

hypoalbuminaemia invariably occurs because of alterations in body fluid composition and because of increased capillary permeability related to ongoing sepsis

ASSESSMENT OF NUTRITIONAL STATUS

- 3-Clinical
- A clinical assessment of nutritional status involves a focused history and physical examination, an assessment of risk of malabsorption or inadequate dietary intake and selected laboratory tests aimed at detecting specific nutrient deficiencies

EVALUATION OF MALNUTRITION (HISTORY)

- Clinical nutritional history based on understanding of the etiologies and pathophysiology of malnutrition.

- History of poor nutrient intake
  - Anorexia
  - Nausea
  - Vomiting
  - Early satiety
  - Food preference

- Loss of body weight (see table)
  - Weight loss of more than 10-15% during the past 6 months

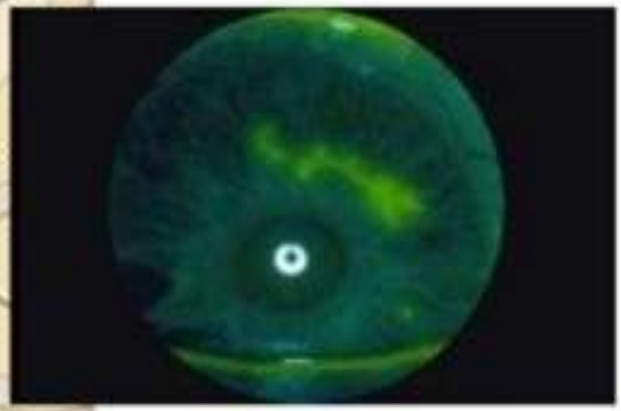
EVALUATION OF MALNUTRITION (HISTORY)

- Social & economic condition that may lead to poverty & malnutrition
  - Inadequate income
  - Homeless
  - Drug abuse
  - Chronic alcoholism
- Gastrointestinal symptoms
  - Dysphagia
  - Recurrent vomiting
  - Chronic diarrhea
  - Food intolerance
- Other chronic medical illnesses
  - Disseminated cancer
  - COPD
  - Chronic inflammatory disease

EVALUATION OF MALNUTRITION (PHYSICAL EXAMINATION)

Findings	Interpretation
General appearance	
▪ Weight loss	Malnutrition < 90% of ideal weight
▪ Decreased temporal & proximal extremity muscle mass	Decreased skeletal protein
▪ Decreased "pinch test"	Decreased body fat stores
Skin, nails, hair	
▪Easily plucked hair	Protein
▪Spooning of nails	Iron

Findings	Interpretation
Skin, nails, hair	
▪Easy bruising, perifollicular hemorrhage	Vitamin C
▪"Flaky paint" of the lower extremity	Zink
▪Coarse skin, papular keratitis "goose bumps"	Vitamin A
▪Peripheral edema	Protein
Eyes	
▪Conjunctival pallor	Anemia (non-specific)
▪Bitot spot	Vitamin A
▪Opthalmoplegia	Thiamine



Papular keratitis

Bitot spot

Perifollicular hemorrhage

Nasolabial seborrhea

Flaky paint of lower limb

Fluid and electrolytes

Body fluid compostion and compartments

- Body fluid composition is water and dissolved substances consisting of solutes and electrolytes
- Total body water is 60%
- Intracellular fluid of body weight is 40% or 25L
- Extracellular fluid of body weight is 20% or 15L :
- ISF 75% or 11L
- IVF 25% or 5L

Daily electrolytes requirements

electrolyte	Daily requirment
Na	1-2 meq/kg
K	0.5-1.0meq/kg
Ca	0.2-0.3 meq/kg
Mg	0.35-0.45meq/kg
Cl	Equal to Na
Hco3 / c2h3o2	Use with chloride to balance cations and help ph

Fluid replacement

guidelines for the administration of maintenance crystalloid fluids. The mass- based formula uses what is known as the "4-2-1" rule:

- 0-10 kg: +4 mL/kg/hr
- 10-20 kg: +2 mL/kg/hr
- >20 kg: +1 mL/kg/hr

Example: 100kg patient: 20 kg (40 + 20 mL/hr) + 80 kg (80 mL/hr) = 140 mL/hr

Or by 100-50-20 rule (Day)

0-10 kg : + 100

10-20 kg + 50

>20 kg + 20

Energy Requirements

Determining Energy Requirements

- Reasons to assess energy needs
  - Energy needs are highly variable
  - Prevent underfeeding
    - decrease organ mass and function
    - impaired wound healing
    - impaired immune response
  - Prevent overfeeding
    - excessive co2 production
      - respiratory acidosis
    - hyperglycemia and insulin resistance
    - fluid retention and fat gain

- The total number of calories you burn for energy each day is your **total daily energy expenditure** or TDEE.
- Total daily energy expenditure can vary from person to person depending on body size, gender, body composition, genetics, and activity level. The total energy expenditure for a small sedentary woman may be 1800 calories or less per day. But the TDEE for a large man may be 2000 calories or more.
- It is **calculated** by first figuring out your Basal Metabolic Rate, then multiplying that value by an activity multiplier
- **TDEE= BMR *A**

- Commonly used equations
  - Mifflin
  - Harris-Benedict
  - WHO
  - NIH
  - University of Vermon

Harris-Benedict

Uses age, height, and weight to estimate basal metabolic rate **(BMR)** which is the minimum number of calories required for basic functions at rest.

- **BMR Formula :**
- **In men:**

BMR (kcal/day) = 66.5 + (13.8 X W) + (5.0 X H) – (6.8 X A)

- **In women:**

BMR (kcal/day) = 655.1 + (9.6 X W) + (1.8 X H) – (4.7 X A)

- Where W = weight in kilograms, H = height in centimeters and A = age in years

Calculating TDEE	
Activity Level	**Multiplier**
Sedentary *(little to no exercise; desk job)*	**Sedentary** = BMR x 1.2
Light Activity *(Light exercise/activity 1-3 days/wk)*	**Light Activity** = BMR x 1.375
Moderate Activity *(Mod. exercise/activity 3-5 days/wk)*	**Moderate Activity** = BMR x 1.55
Heavy Activity *(Intense exercise/activity 6 days/wk)*	**Heavy Activity** = BMR x 1.725
Excessive Activity *(Intense daily exercise/ physically demanding job or exercise multiple times/day)*	**Excessive Activity** = BMR x 1.9

Carbohydrates supplementation before surgery

- . Providing a carbohydrate drink reduces insulin resistance and tissue glycosylation through surgery, helps postoperative glucose control, and enhances return of bowel function. The amount of carbohydrate required to induce an effect must be enough to shift the body from a fasted to a fed state

- the first dose given as an **800-ml** volume (containing 100 g carbohydrate) around 12 h before surgery
- the second dose given as a **400-ml** volume (containing 50 g carbohydrate) 2-3 h before surgery

Post operative nutrition

- Substantial evidence indicates that early enteral nutrition within 24 hours of surgery is associated with significant reductions in morbidity and mortality specially in traumatic patient .
- Early stimulation of the gastrointestinal tract maintains the mucosal barrier and prevents the bacterial translocation described in gut starvation.

- The stress of surgery or trauma creates a catabolic state, increasing protein and energy utilization.
- Macronutrients (fat, protein, and glycogen) from the labile reserves of fat tissue and skeletal muscle are redistributed to more metabolically active tissues such as the liver and visceral organs. This response can lead to the onset of protein calorie malnutrition within a few days .
- The rate of development of postoperative malnutrition in a given individual depends upon their preexisting nutritional status, the nature and complexity of the surgical procedure, and the degree of hypermetabolism.

Refeeding syndrome

- Refeeding is the process of re-introducing food after malnourishment or starvation. Refeeding syndrome is a serious and potentially fatal condition that can occur during refeeding. It's caused by **sudden shifts in the electrolytes** that help your body metabolize food.

● Refeeding syndrome can affect anyone. However, it typically follows a period of:

- malnourishment
- fasting
- extreme dieting
- famine
- Starvation

● Certain conditions may increase your risk for this condition, including:

- anorexia
- alcoholism
- cancer
- difficulty swallowing (dysphagia)

Why does it happen ?

- Food deprivation changes the way your body metabolizes nutrients. For example, insulin is a hormone that breaks down glucose from carbohydrates. When carbohydrate consumption is significantly reduced, insulin secretion slows.

- In the absence of carbohydrates, the body turns to stored fats and proteins as sources of energy. Over time, this change can deplete electrolyte stores. Phosphate, an electrolyte that helps your cells convert glucose into energy, is often affected.

- When food is re-introduced, there's an abrupt shift from fat metabolism back to carbohydrate metabolism. This causes insulin secretion to increase. Cells need electrolytes like phosphate to convert glucose to energy, but phosphate is in short supply. This leads to another condition, called hypophosphatemia

- Hypophosphatemia is a common feature of refeeding syndrome. Other metabolic changes can also occur. These include:

- abnormal sodium and fluid levels
- changes in fat, glucose, or protein metabolism
- thiamine deficiency
- hypomagnesemia
- hypokalemia

Symptoms

- fatigue
- weakness
- confusion
- inability to breathe (respiratory acidosis due to co2 accumulation)
- high blood pressure
- seizures
- heart arrhythmias
- Fluid retention
- coma
- death

Risk factors

- You have a body mass index (BMI) under 16.
- You've lost more than 15 percent of your body weight in the past 3 to 6 months.
- You've taken in little to no food for the past 10 or more consecutive days.
- A blood test has revealed your serum phosphate, potassium, or magnesium levels are low.

treatment

- Treatment usually involves replacing essential electrolytes and slowing down the refeeding process.

- Electrolyte levels are monitored with frequent blood tests. Intravenous (IV) infusions based on body weight are often used to replace electrolytes. But this treatment may not be suitable for people with:

- impaired kidney function
- hypocalcemia (low calcium)
- hypercalcemia (high calcium)

overfeeding

- "overfeeding syndrome" has its own disadvantages. If the overfed patient is able to tolerate such large gastric volume (which frequently they cannot), they will develop diarrhoea as the result of high osmotic load. Malabsorption of the nutrients may result. If they absorb everything, they may develop metabolic complications of dietary protein and carbohydrate excess.

Protein excess :

- **Azotaemia**
- The key issue here is protein. Already in your critical-illness-induced hypercatbolic state the hormones and the cytokines have mobilised metabolic fuel susbtrates, and amino acids are awarm in the circulation. The liver and kidneys are struggling to maintain some sanity by rapidly excreting these molecules by the conventional mechanism, which turns them into urea. Urea tends to rise in critical illness as a result of this activity.

- **Hyperammonaemia**
- If one has a defective urea cycle, or if one's liver has been damaged by many years of overindulgeance, one may find oneself rather more confused by the administration of a large protein load. Ammonia will be generated by the deamination of the excess amino acids, and it will accumulate, giving rise to hepatic encephalopathy.

Fat excess

- Fat Overload Syndrome
- Rather than a complication of excess enteric feeding, this tends to happen when one administers an excessively large amount of lipid-containing TPN emulsion to their patient.

- Acute respiratory failure, manifesting as pulmonary edema
- Coagulopathy, manifesting as abnormal platelet function, as well as proper DIC
- Headache, fever and jaundice
- Hepatosplenomegaly

Carbohydrates excess

- Fatty liver : due to conversion of glucose into fatty acids ,over saturation and deposition of fat on the liver.
- Hypercapnea : excess production of co2 from carbohydrates metabolism, which turn to cause dyspnea
- Hyperglycemia :specific for diabetic patients (they will have hyperglycemia for any sugary enteral or tpn feeding)

Nutrition support

Nutrition support

•enteral

Through mouth

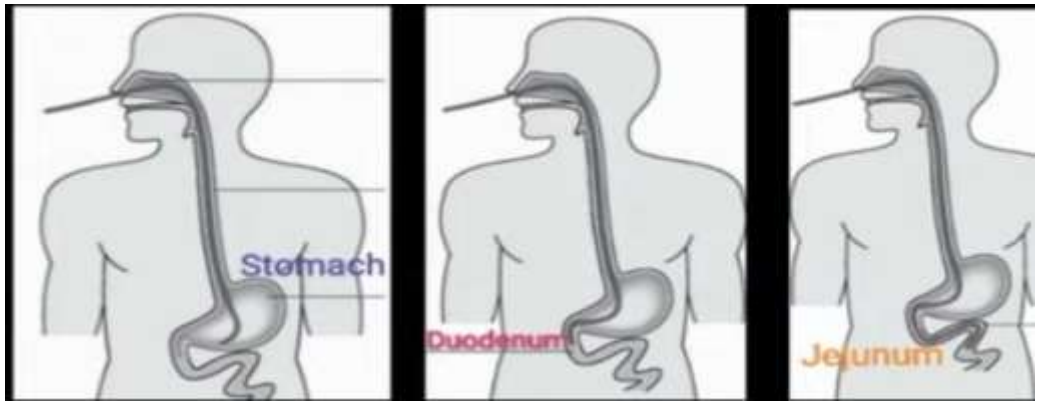
- normal food
- Oral supplement

Tube feeding techniques

- Nasogastric tube
- Nasoduodenal tube

•Nasojejunal tube

For less than 4 week



For longer than 4 week

- Gastrostomy

Percutaneous endoscopic gastrostomy

- Jejunostomy

When gastric feeding is contraindicated or risk

Indications for enteral rout

- Gut is working normally
- There are no GIT contraindication
- Patients who not expected to be in full oral diet within 7 days postopertively
- Patients who have undergone major surgery :

Initiate enteral nutrition 24-48 hrs postoperatively

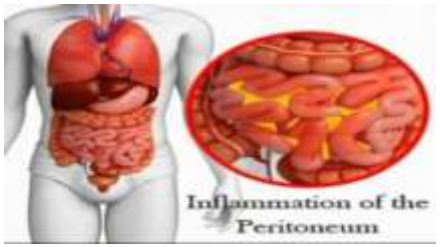
Contraindications for enteral rout

1. Intractable vomiting or Diarrhea refractory to medical treatment

2. Intestinal Obstruction

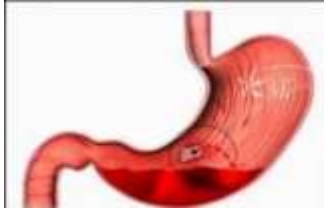
3. Paralytic ileus

4. Peritonitis

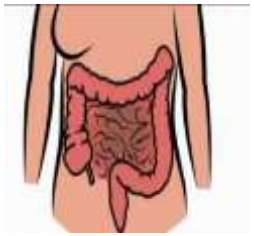


5. Severe shock .

6. Severe GI hemorrhage



7. Severe GI Malabsorption



8. Distal high output intestinal fistula

9. Inability to gain access to GIT.

10. When the need for nutrition is expected for < 7days

Mood of delivery of nutritional support

Enteral

1. Bolus feeding

Feeding are given at 50-100 ml every 4 hours

Nasogastric , gastrostomy tube

Precaution : elevate head of bed at 30-40 during and for 1-2 hrs after feeding

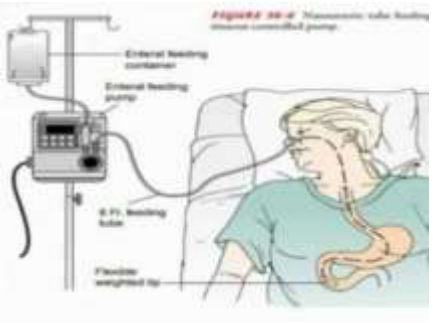
Continuous infusion

Feed is given slowely over a no. of hours using a pump that controls flow rate

Nasojejunal , nasodudenal , jejunostomy tube

Feeding are given at 20ml\hr

Increment: 10-20 ml\hr every 4-6 hrs



Feeds

- Polymeric :

Whole protine , carbohydrate and fats

- Small molecules

Short peptides , free amino acid

- Specific feeds

e.g low Na diet in liver failar

Main complication of enteral nutrition

Aspiration •

Gastrostomy (G) tube feedings can cause pulmonary aspiration. Multiple • factors contribute to aspiration, including recent hemorrhagic stroke, high gastric residual volume (GRV), high bolus feeding volumes and supine positioning

Tube malpositioning or dislodgment

During initial placement, the feeding tube may be positioned improperly. To • prevent this problem, the tube should be placed by experienced personnel and its position confirmed radiographically. After initial placement, the tube may become fully or partially dislodged, causing such problems as bleeding, tracheal or parenchymal perforation, and GI tract perforation.

Fluid imbalance •

Most patients need supplemental free-water flushes to maintain adequate • hydration; on average, they need 30 mL/kg of water per day, given either as free-water flushes or I.V. hydration.

Other complication

- Tube related
  - Displacement
  - Blockage
- Metabolic
  - Hypernatremia
  - Hyponatremia
  - Hyperglycemia
  - Hyperkalemia
  - Hyperkalemia
  - Nausea , vomiting , diarrhea

Common conditions that may benefit from enteral feeding include:

A stroke •

Cancer •

Dysphagia (difficulty swallowing) •

Neurologic or movement disorders (Parkinson’s disease or • Alzheimer’s disease)

Critical injuries •

There are six main types of enteral feeding, including:

- Nasogastric tube (NGT). A nasogastric tube is inserted through a nostril and into the stomach.
- Orogastric tube (OGT). An orogastric tube is inserted through the mouth and into the stomach.
- Nasoenteric tube. A nasoenteric tube is inserted through a nostril and into the intestines. (There are two subtypes of nasoenteric tubes, including nasojejunal tubes and nasoduodenal tubes. These tubes are run into a specific part of the intestine, either the jejunum or duodenum.)
- Oroenteric tube. An oroenteric tube is inserted through the mouth and into the intestines.
- Gastrostomy tube. A gastrostomy tube is inserted through a small incision in the abdomen, directly into the stomach.
- Jejunostomy tube. A jejunostomy tube is inserted through a small incision in the abdomen, directly into the jejunum, a part of the small intestine.

Parenteral nutrition

Parenteral nutrition is like enteral nutrition in that it helps • prevent malnutrition. However, it's designed to assist individuals who have gastrointestinal issues that prevent them from properly digesting food .

Common conditions that may benefit from parenteral nutrition • include:

Crohn's disease •

Cancer •

Short bowel syndrome •

Ischemic bowel disease •

Low blood flow to the bowels •

Nutrition Parenteral

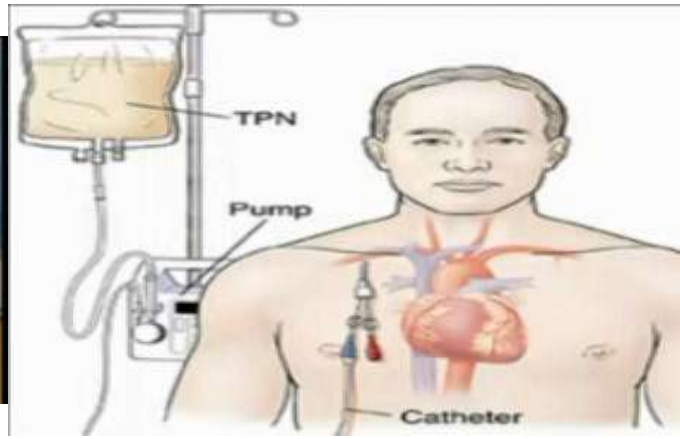
INDICATIONS

1. When energy & protein needs can not by enteral nutrition.
2. Compromised gut function.
3. When enteral route is contraindicated.

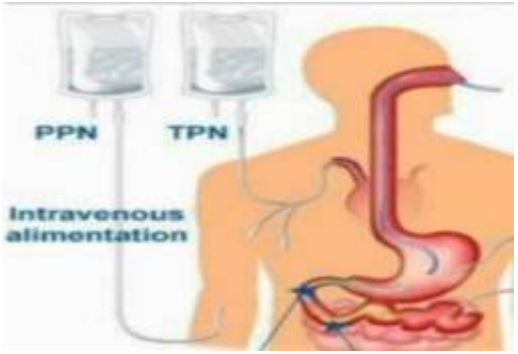
Nutrition Parenteral

TYPES

1. Total Parenteral Nutrition (TPN) -> all nutritional requirements are provided by IV route



2. Partial Parenteral Nutrition (PPN) ->Enteric route + IV rout



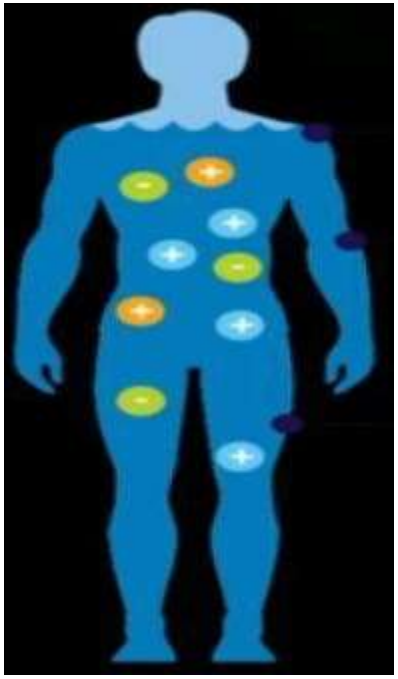
What is the difference between TPN and PPN?

- Total parenteral nutrition (TPN) is prescribed to people with damaged or poorly functioning digestive systems. Before your loved one can receive TPN, a surgeon places a vascular access device, like a peripherally inserted central catheter (PICC), into their superior vena cava.

- Peripheral parenteral nutrition (PPN) is less invasive. It's recommended for people who have temporary nutritional needs. With PPN, nutrition is administered via a traditional IV, through a needle, and into a vein .

Complications

1. Nutrient deficiency



Hypoglycemia

Hypocalcemia

Hypophosphatemia

Hypomagnesemia

Refeeding syndrome

2. Overfeeding

↑ Glucose

↑ Fat

↑ Amino acids

3. Catheter related sepsis

4. Complications related to line

- Pneumothorax
- Damage to adjacent artery
- Air embolism
- Thoracic duct damage
- Cardiac perforation or tamponade
- Pleural effusion
- Hydromediastinum
- Venous occlusion
- Venous thrombosis

Due to long term use

THANK YOU