# 432 Surgery Team

# 1 Nutrition Support


**Done By:**
Fahad AlShayhan

**Reviewed By:**
Shahad alqreen



جامعة الملك سعود
King Saud University


**COLOR GUIDE:** • Females' Notes • Males' Notes • Important • Additional

# Objectives

Not given

This work is based on doctor’s slides and it's different from your manual to surgery 351

# Nutrition

- Nutrition—provides with all basic nutrients and energy required for growth, repair and maintenance of the body function.
- Nutrition comes from carbohydrate, fat, protein, electrolytes, minerals, and vitamins

## • Malnutrition:

Causes of Malnutrition

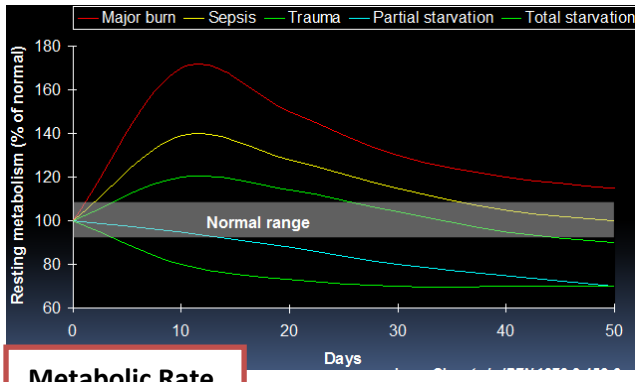
1. Come from extended inadequate intake of nutrient
2. Severe illness burden on the body composition and function affect all systems of the body

## • Types of malnutrition:

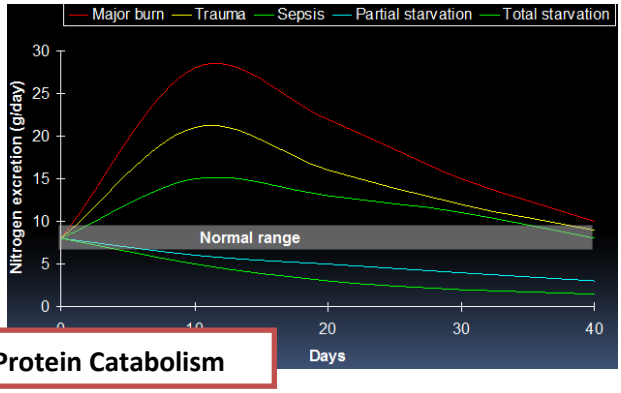
1. **Kwashiorkor:** protein malnutrition "Inadequate intake of proteins with adequate energy intake" (e.g. Liver cirrhosis, kidney disease, burn patients)
2. **Marasmus:** protein-calorie malnutrition "Inadequate intake of energy with adequate protein intake" (e.g. Cancer patient)

## • Risk factors for malnutrition:

1. Medical causes
2. Psychological
3. Social causes




Metabolic Rate




Protein Catabolism

***Note(s):431***

*When we through any of the conditions above (sepsis, trauma, etc), metabolic rate increases so we need more calories. Glycogen will be used as a source of energy in the first 3 days then fat after that catabolize so ketones are generated; the problem is some cells cannot use ketones as a source of energy so they need glucose which will come from gluconeogenesis from proteins in our muscles*

1. Medical causes:
   - Recent surgery or trauma
   - Sepsis (high catabolic rate)
   - Chronic illness
   - Gastrointestinal disorders (celiac, lactose intolerance, crohn's disease)
   - Anorexia, other eating disorders
   - Dysphagia
   - Recurrent nausea, vomiting, or diarrhea
   - Inflammatory bowel disease

- Consequences of Malnutrition:
  - Malnutrition places patients at a greatly increased risk for morbidity and mortality
  - Longer recovery period from illnesses
  - Impaired host defenses (Infections)

  If we have 2 Pts. with the same disease. 1st one : good nutrition status 2nd one : poor nutrition status The prognosis of the 1st one will be better than 2nd one)

- Refer to the original slides for slide 12,13 and 14 "it is about some studies"
- **Severe weight lost: "important"**

| Time | Significant Weight Loss (%) | Severe Weight Loss (%) |
|---|---|---|
| 1 week | 1-2 | >2 |
| 1 month | 5 | >5 |
| 3 months | 7.5 | >7.5 |
| 6 months | 10 | >10 |

# Estimating Energy/Calorie

- ## Basic energy expenditure (BEE):
  - Basal metabolic rate (BMR), also called the basic energy expenditure (BEE) support the body's most basic functions when at rest in a neutral, or non-stressful, environment.
  - It accounts for the largest portion of total daily energy requirements (up to 70%)
- ## Harris–Benedict Equations: " no need to memorize calculation"
  - Energy calculation:
  - (MALE) BEE = 66 + (13.7 x actual wt in kg) + (5x ht in cm) – (6.8 x age in y)
  - (FEMALE) BEE = 655 + (9.6 x actual wt in kg) + (1.7 x ht in cm) – (4.7 x age in y)
- ## Total Energy Expenditure:
  - TEE (kcal/day) = BEE x stress/activity factor
- ## A correlation factor that estimates the extent of hyper-metabolism :
  - 1.15 for bedridden patients
  - 1.10 for patients on ventilator support
  - 1.25 for normal patients
  - The stress factors are:
  - 1.3 for low stress
  - 1.5 for moderate stress
  - 2.0 for severe stress
  - 1.9-2.1 for burn
- ## Calculation" no need to memorize calculation"

  patient Wt = 50 kg Age = 45 yrs Height = 5 feet 9 inches (175 cm)
  BEE = 66 + (13.7 x actual wt in kg) + (5x ht in cm) – (6.8 x age in y)
  =66 + (13.7 x 50 kg) + (5 x 175 cm) – (6.8 x 45)
  =66 + ( 685) + (875) – (306) = 1320 kcal
  TEE = 1320 x 1.25 (normal activity) = 1650 kcal
- ## Calories
  - 0 to 60% of the caloric requirement should be provided as glucose
  - The remainder 20% to 30% as fat
  - 20% can be from protein
  - To include protein calories in the provision of energy is controversial specially in parentral nutrition

# Fluid Requirements:

## • Fluids:

- The average adult requires approximately 35-45 ml/kg/d
- NRC* recommends 1 to 2 ml of water for each kcal of energy expenditure

*NRC= National research council

More accurate way of calculating fluid requirement in adult and pediatric patients

Example 70 kg adult

1st 10 kg = 100 ml per every kg x 10 = 1000 ml

2nd 10 kg = 50 ml per every kg x 10 = 500 ml

70 -20 = 50 kg

= 30 ml per every kg x 50 = 1500 ml total = 2700 ml

## • Protein

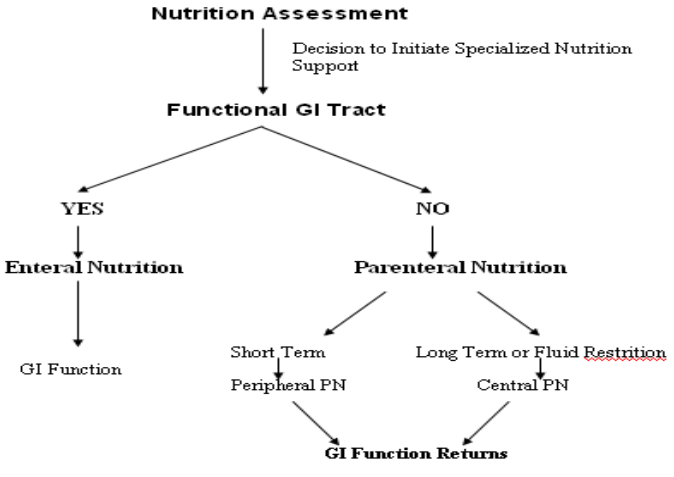
- The average adult requires about 1.5 gm/kg 0r average of 100 grams of protein per day
- Stress or activity level Initial protein requirement (g/kg/day)
  - Baseline 1.5 g/kg/day
  - Mild stress 1.8 g/kg/day
  - Moderate stress 2.0 g/kg/day
  - Severe stress 2.2 g/kg/day

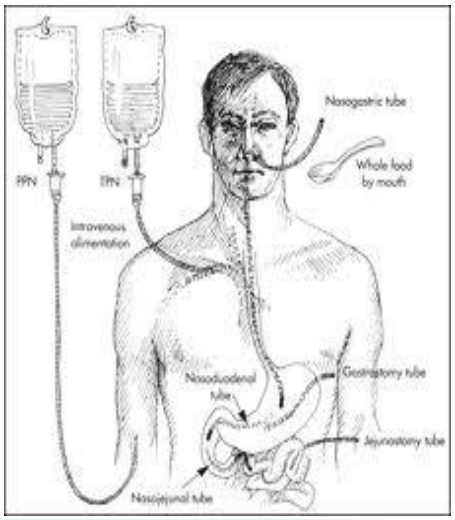
## • Intralipid

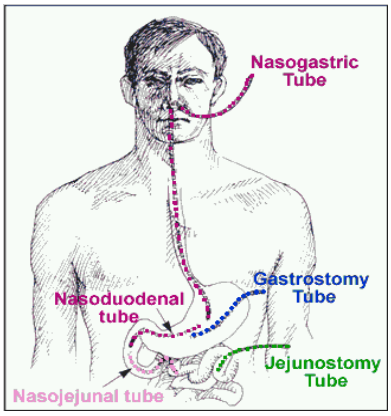
- intravenous lipid emulsions can be administered safely at a rate of 0.7 g/kg up to 1.5 g/kg over 12–24 h (Grade B)

## • Routes of Nutrition Support

- The nutritional needs of patients are met through either parenteral or enteral delivery route
- Give parenteral in case of GI obstruction or after GI surgery to rest the GI Ex: severe pancreatitis






# Enteral Nutrition

- The gastrointestinal tract is always the preferred route of support (Physiologic)
- EN is safer, more cost effective, and more physiologic that PN
- "If the gut works, use it"

# Potential benefits of EN over PN

- Nutrients are metabolized and utilized more effectively via the enteral than parenteral route

# Safety "not mentioned by doctor"

- **Complications from central line insertion:**
  - Catheter sepsis
  - Pneumothorax
  - Catheter embolism
  - Arterial laceration

# Contraindications

- Gastrointestinal obstruction
- Severe acute pancreatitis
- High-output proximal fistulas
- Intractable nausea and vomiting or osmotic diarrhea "N/V can lead to aspiration pneumonia "

# Enteral nutrition (EN)

- **Long-term nutrition:** "more than 3 months ,Ex: Dysphagia"
  - Gastrostomy "If you going to feed in the stomach you need contact food But in duodenum you need partially digested food"
  - Jejunostomy "We give in the duodenum in case of: Gastrectomy and most important one is aspiration pneumonia"
- **Short-term nutrition:**
  - Nasogastric feeding
  - Nasoduodenal feeding
  - Nasojejunal feeding

# Total Parenteral Nutrition "Parenteral Goal"

- Provide patients with adequate calories and protein to prevent malnutrition and associated complication
- PN therapy must provide:
- Protein in the form of amino acids
- Carbohydrates in the form of glucose
- Fat as a lipid emulsion
- Electrolytes, vitamin, trace elements, minerals

# Patient Selection

## • General Indications

- Requiring NPO > 5 - 7 days
- Severe gut dysfunction or inability to tolerate enteral feedings.
- Cannot eat as in obstruction, will not eat as in nausea and vomiting, should not eat as in pancreatitis

## • Special Indications :

- After major surgery
- Pt with bowel obstruction
- Pt with enterocutaneous fistulas (high and low)
- Massive bowel resection
- Malnourished patients undergo chemotherapy
- NPO for more than 5 days for any reasons
- Necrotizing pancreatitis
- Burns, sepsis, trauma, long bone fractures
- Premature new born
- Renal, hepatic, respiratory, cardiac failure (rarely)

**Electrolyte requirements**

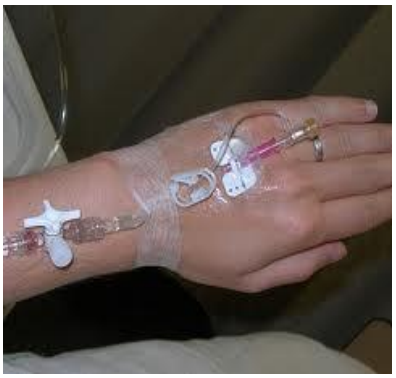
| | Usual adult range | Infants/children |
|---|---|---|
| **Sodium** | 60 to 200 mEq/day | 2 to 4 mEq/kg/day |
| **Potassium** | 60 to 200 mEq/day | 2 to 4 mEq/kg/day |
| **Magnesium** | 8 to 40 mEq/day | 0.25 to 0.5 mEq/kg/day |
| **Calcium** | 10 to 30 mEq/day | 0.5 to 3 mEq/kg/day |
| **Phosphorus** | 10 to 40 mMol/day | 0.5 to 2 mMol/kg/day |
| **Chloride** | As needed to maintain acid-base balance | Same as adults |
| **Acetate** | As needed to maintain acid-base balance | Same as adults |

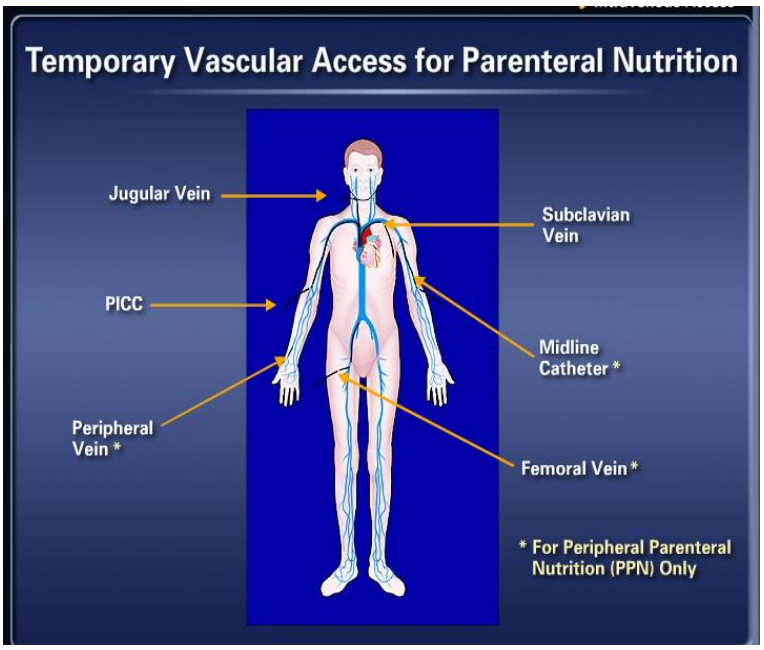
| | Standard Range | Maximum |
|---|---|---|
| **Calories** kcal/kg/day | Infants = 90 - 100<br>Children = 70 - 100<br>Adolecents = 40 - 55<br>Adults = 28 - 30 | Adults = 40 |
| **Protein** g/kg/day | Infants = 2.0 - 2.5<br>Children = 1.5 - 2.0<br>Adolecents = 0.8 - 2.0<br>Adults = 0.8 - 1.0 | Adults = 2.0 |
| **Dextrose rate** | 4 - 5 mg/kg/min | 7 mg/kg/min |
| **Fat** | 15 - 30% kcal | 60% kcal |

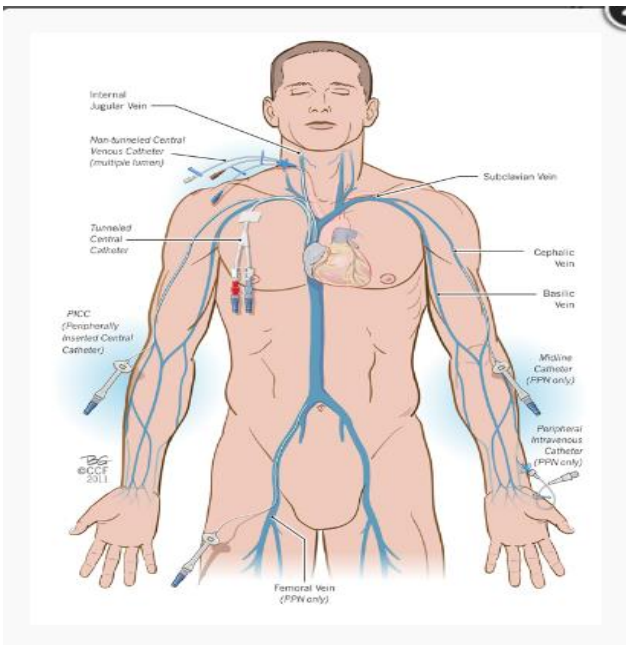
# Administration

**Central line**

**Peripheral line**






| Central Nutrition | Peripheral Nutrition |
|---|---|
| Subclavian line | Peripheral line |
| Long period | Short period < 14days |
| Full Calories | Min. Calories |
| Minimum volume | Large volume |
| More Infections | Thrombophlebitis |
| More complications | Less complications |
| High osmolality<br>> 2000 mOsm/L | Low osmolality<br>< 1000 mOsm/L |

- High osmolality can cause phlebitis in peripheral line

| | | | |
|---|---|---|---|
| Glucose | 3 times/day | 3 times/day until <200 consistently | 3 times/day until <200 consistently |
| Weight | Yes | Daily | 2 - 3 times/week |
| I & O | Daily | Daily | Daily |
| Nitrogen balance | PRN | PRN | PRN |

**Suggested monitoring schedule**

| | Baseline | Acute patient | Stable patient |
|---|---|---|---|
| Blood chemistry | Yes | 2 - 3 times/week | Weekly |
| Lytes, BUN, creatinine | Yes | Daily | 1 - 2 times/week |
| Triglycerides | Yes | Weekly | Weekly |
| CBC w/diff | Yes | Weekly | Weekly |
| PT, PTT | Yes | Weekly | Weekly |

# Complications of TPN:

## • Complications Associated with PN:

1. **Mechanical complication:**
   - Improper placement of catheter may cause pneumothorax, vascular injury with hemothorax, and cardiac arrhythmia
   - Venous thrombosis after central venous access
   - Catheter sepsis
   - Pneumothorax
   - Catheter embolism
   - Arterial laceration
2. **Septic complication (infectious complication):**
   - The mortality rate from catheter sepsis as high as 15%
   - Aseptic technique - inserting the venous catheter
   - Aseptic technique - compounding the solution
   - Catheter care at the site – regular dressing
3. **Metabolic complication:**
   - Early complication -early in the process of feeding and may be anticipated
   - Late complication - caused by not supplying an adequate amount of required nutrients or cause adverse effect by solution composition

- **Refeeding syndrome:** is electrolyte imbalanced because you feed them nutrition but without minerals
- If you give glucose→insulin release→electrolyte move inside the cells →arrhythmia. so you need to correct the electrolyte first and then give calories gradually
- Vitamins given with intralipid

**Metabolic complications of PN**

| Early complications | Late complications |
|---|---|
| Volume overload | Essential fatty acid deficiency |
| Hyerglycemia | Trace mineral deficiency |
| Refeeding syndrome | Vitamin deficiency |
| Hypokalemia | Metabolic bone disease |
| Hypophosphatemia | Hepatic steatosis |
| Hypomagnesemia | Hepatic cholestasis |
| Hyperchloremic acidosis | |

**Doctor stopped here!! He didn't mention these slides ☺**

## Summary:

- Nutritional support in the ICU (surgical setting) represents a challenge but it is fortunate that its delivery and monitoring can be followed closely.
- Parenteral (PN) represents an alternative approach when other routes are not succeeding or when it is not possible or would be unsafe to use other routes.
- The main goal of PN is to deliver a nutrient mixture closely related to requirements safely and to avoid complications.

## 1. Should we use (PN)? When should we start PN?

### Recommendation:

- Patients should be fed because starvation or underfeeding in ICU patients is associated with increased morbidity and mortality. (Grade C).

### Reasons:

- Increased metabolic needs related to stress in ICU pt. are likely to accelerate the development of malnutrition which associated with impaired clinical outcome.
- In a randomized study, 300 patients undergoing major surgery received continuous total PN or exclusively glucose 250–300 g/d intravenous administration for 14 days.
- Those on PN had 10 times less mortality than those on glucose.

2. **Should we wait for recovery and the ability of the patient to take normal nutrition or should we start PN in pt. who have not resumed normal intake within 10 days?**

**Recommendation:**

- **All patients who are not expected to be on normal nutrition within 3 days should receive PN within 24–48 h if EN is contraindicated or if they cannot tolerate EN.(Grade C).**

**Comments:**

- **PN is associated with more hyperglycemia than EN**
- **Hyperglycemia reduces neutrophil chemotaxis and was found to be an independent risk factor for short-term infection in patients undergoing surgery.**
- **Tight glucose control can overcome such infection in ICU.**

3. **Should we use central venous assess peripheral line for PN administration?**

**Statement:**

- **Peripheral venous access devices may be considered for low osmolarity (<850 mOsmol/L) mixtures designed to cover a proportion of the nutritional needs and to mitigate negative energy balance (Grade C).**

  **If peripherally administered PN does not allow full provision of the patient's needs then PN should be centrally administered (Grade C).**

### Comments:

- PN is usually administered into a large-diameter vessel, normally the superior vena cava or right atrium, accessed via the jugular or subclavian vein.
- For longer-term ICU use, a tunneled-catheter or implanted chamber is occasionally used as alternatives to a standard central venous access device.
- PICCs were associated with a lower risk of central venous catheter-associated blood stream infections (CVC-associated BSI).
- Antimicrobial-impregnated CVC reduced the risk of CVC-associated BSI.
- PICC lines offer a suitable middle way between peripheral catheters & conventional central lines.

## 4. How much parenteral nutrition should critically ill patients receive?

### Recommendation:

- ICU patients should receive 25 kcal/kg/day increasing to target over the next 2–3 days (Grade C).

## 5. Carbohydrates: which level of glycemia should we aim to reach?

### Recommendation:

- Hyperglycemia (glucose >10 mmol/L) contributes to death in the critically ill pt and should also be avoided to prevent infectious complications (Grade B).
- Tighter glucose control (4.5-6.1 mmol/L) increases in mortality rates have been reported in ICU patients.
- No unequivocal recommendation on this is therefore possible at present.

## —6.Should we use lipid emulsions in the parenteral nutrition of critically ill patients?

## —Statement.

- Lipid emulsions should be an integral part of PN for energy and to ensure essential fatty acid provision in long-term ICU patients. (Grade B).

## 7. Is it safe to administer lipid emulsions (LCT without or with MCT, or mixed emulsions) and at which rate?

### Recommendation:

- intravenous lipid emulsions can be administered safely at a rate of 0.7 g/kg up to 1.5 g/kg over 12–24 h (Grade B)

## Protein

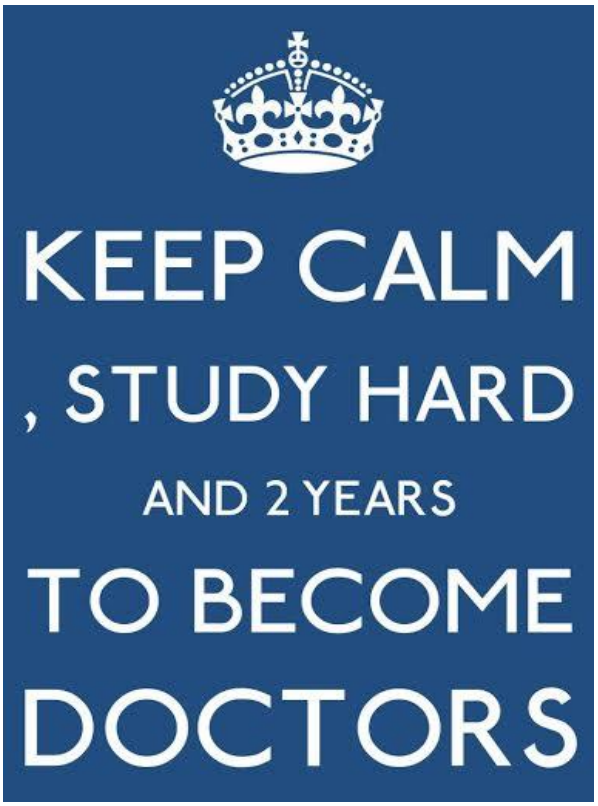
## 8. How much should be administered to meet protein requirements?

### Recommendation:

When PN is indicated, a balanced amino acid mixture should be infused at approximately 1.3–1.5 g/kg ideal body weight per day in conjunction with an adequate energy supply (Grade B)

—

—




## SUMMARY

1. Nutritional support in the ICU (surgical setting) represents a challenge but it is fortunate that its delivery and monitoring can be followed closely.
2. Parenteral (PN) represents an alternative approach when other routes are not succeeding or when it is not possible or would be unsafe to use other routes.
3. The main goal of PN is to deliver a nutrient mixture closely related to requirements safely and to avoid complications.

# Questions

## From your manual to surgery 351

1. All of the following are used to assess the nutritional status of the patient except:
    a. Platelet count
    b. Lymphocyte count
    c. Body weight
    d. Serum albumin
    e. Triceps skin fold
2. Which of the followings is (are) an indication(s) of nutritional support:
    a. Anorexia nervosa
    b. Intestinal fistula
    c. Malignancy
    d. All of the above
3. Metabolic changes after surgery include:
    a. Decreased glycogen breakdown
    b. Decreased lipolysis
    c. Decreased gluconeogenesis
    d. Decreased body weigh

## From 431 team

4. What is the definition of Kwashiorkor and what is the most common cause of it?

    a. It's a type of malnutrition caused by adequate intake of protein and inadequate intake of calories most commonly caused by systemic infections and cancer

    b. It's a type of malnutrition caused by inadequate intake of protein-calorie characterized by calories deficiency seen in severe burns injury or some conditions like anorexia nervosa

c. Its type of malnutrition caused by inadequate intake of protein in the presence of good calorie intake commonly caused by chronic kidney disease and liver cirrhosis

d. Its type of malnutrition caused by inadequate intake of protein in the presence of good calorie intake commonly caused by cancers

5. Patient comes to you with bradycardia, hypothermia and weight loss. Which ONE of the following diseases has this clinical feature?

a. Marasmus

b. Kwashiorkor

c. Liver cirrhosis

d. IBS

6. Which ONE of the following is considered as malnourished paint?

a. 3% weight loss over 6 months or 10 % weight loss over 1 month

b. 10 % over 6months or 5 % over 1 month

c. 30 % over 6 months or 50 % over 1 year

d. 10 % over 6 months or 3 % over 1 month

7. Patient with severely elevated Lipase and you suspect a pancreatic problem. Which ONE of the following route you choose to feed him?

a. Parenteral route

b. Enteral route

c. Normal feeding route from the mouth

d. Nasogastric tube route

8. Patient in the ward with severe heart failure and peripheral edema, now he is NPO. Which type of nutrition you choose for him?

a. High nitrogen

b. Peptide based

c. Caloric dense

d. Fiber containing

9. Which ONE of the following is not an indication for total parentral nutrition?

a. Patient who should not eat will not eat or cannot eat

b. NPO > 5-7 days

c. Enterocutaneous fistulas

d. After minor surgery

10. Patient came to you with severe malnutrition; you take a brief history from him, what is your next step?

a. Ask for 0.9 normal saline

b. Ask for Dextrose 5 %

c. Admit him to ICU

d. Check his potassium and phosphate before giving him dextrose 5% to avoid cardiac arrest

11. All of the following are used to assess the nutritional status of the patient except:

a. Platelet count

b. Lymphocyte count

c. Body weight

d. Serum albumin

e. Triceps skin fold

## 12. Which of the followings is (are) an indication(s) of nutritional support:

a. Anorexia nervosa

b. Intestinal fistula

c. Malignancy

d. All of the above

## 13. Metabolic changes after surgery include:

a. Decreased glycogen breakdown

b. Decreased lipolysis

c. Decreased gluconeogenesis

d. Decreased body weight


**Answers**:

1st Questions:A

2nd Questions:D

3rd Questions:D

4th Questions:C

5th Questions:A

6 th Question:B

7 th Question:A

8 th Question:C

9 th Question:D

10 th Question:D

11 th question:A

12 th Question:D

13 th question:D