Nutritional Management of Critically ill Patients.

PNDS Continuing Nutrition Education Seminar
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Saima Rasheed
MSC (Foods and Nutrition) R.D
Vice President, PNDS
Overview

- Hospital Malnutrition.
- Metabolic Profile during illness.
- Enteral Nutrition.
- Naso Gastric Tube feeding Protocols.
- Parenteral Nutrition.
Introduction

- Malnutrition has been estimated to occur in at least 50% of hospitalized patients.
- Often nutritional status declines during a hospital stay. Reasons may include anorexia, surgery, medication interaction, chemotherapy and radiation therapy.
- Malnutrition may increase the incidence of sepsis, poor wound healing and decrease absorption of nutrients.

Causes of Malnutrition

- Failure to record height and weight
- Prolonged glucose, saline IV feedings
- Failure to observe food intake
- Withholding meals because of tests
- Unrecognized increased needs due to injury or illness
- Delayed or inadequate nutrition support

Complications Associated with Underfeeding

- Underfeeding
- Decreased respiratory muscles strength
- Decreased ventilatory drive
- Failure to wean from mechanical ventilation
- Impaired organ function
- Immunosuppression
- Poor wound healing
- Increased risk of nosocomial infections
- Low transport protein levels
Nutritional Assessment

- Some clinicians do a nutritional assessment based on history, physical examination (like muscle wasting, edema) called subjective global assessment
- SGA is sensitive and specific for malnutrition

**Nutritional Risk Index:**

- Based on serum albumin (g per dl), UBW
- \[ \text{NRI} = 15.19 \times \text{serum albumin} + 0.417 \times \% \text{UBW} \]
- \( \text{NRI} > 100 \) indicates normal nutrition
- \( \text{NRI} 97.5 - 99.9 \) indicates mild malnutrition
- \( \text{NRI} < 97.5 \) indicates moderate to severe malnutrition
Glasgow Coma Scale (GCS)

- **GCS** is a *neurological scale* that aims to give a reliable, objective way of recording the conscious state of a person for initial as well as subsequent assessment. A patient is assessed against the criteria of the scale, and the resulting points give a patient score between 3 (indicating deep unconsciousness) and either 14 (original scale) or 15 (the more widely used modified or revised scale).
Eye response

- There are four grades starting with the most severe:
  - No eye opening (SCORE 1)
  - Eye opening in response to pain stimulus. (SCORE 2)
  - Eye opening to speech. (Not to be confused with the awakening of a sleeping person; such patients receive a score of 4, not 3.)
  - Eyes opening spontaneously. (SCORE 5)
Verbal Response

- There are five grades starting with the most severe:
- No verbal response
- Incomprehensible sounds. (Moaning but no words.)
- Inappropriate words. (Random or exclamatory articulated speech, but no conversational exchange)
- Confused. (The patient responds to questions coherently but there is some disorientation and confusion.)
- Oriented. (Patient responds coherently and appropriately to questions such as the patient’s name and age, where they are and why, the year, month, etc.)
Motor Response

- There are six grades:
- No motor response
- Extension to pain (extensor posturing: abduction of arm, external rotation of shoulder, supination of forearm, extension of wrist, decerebrate response)
- Abnormal flexion to pain (flexor posturing: adduction of arm, internal rotation of shoulder, pronation of forearm, flexion of wrist, decorticate response)
- Flexion/Withdrawal to pain (flexion of elbow, supination of forearm, flexion of wrist when supra-orbital pressure applied; pulls part of body away when nailbed pinched)
- Localizes to pain. (Purposeful movements towards painful stimuli; e.g., hand crosses mid-line and gets above clavicle when supra-orbital pressure applied.)
- Obeys commands. (The patient does simple things as asked.)
Metabolic Profile

- In the early period of trauma, hyperglycemia exists.
- This results from increased glycogenolysis, and gluconeogenesis with tissue insulin resistance.
- To support the increased need for glucose, there is breakdown of muscle protein and are used for fuel purposes.
- There is reprioritization of protein synthesis with the production of acute phase protein. C-reactive, alpha trypsin.
Metabolic Profile

- Glutamine and alanine account for the 70% of the amino acids released from the muscle.
- Glutamine is the energy source for entrecotes, and immune system.
- Also important for hepatic synthesis of glutathione.
- BCCA are also used as oxidative fuels.
- With net catabolism, loss of protein is about 20 g/day.
Glutamine trials

- Modest reduction in mortality/infections in 9 studies of glutamine-supplemented PN
- Improvement in morbidity and mortality in 2 studies of enteral glutamine in burns and trauma patients
- CCCN recommend enteral glutamine for burns and trauma and IV glutamine to be given with parenteral nutrition
- SIGNET and REDOXs awaited
Metabolic Profile

- Traumatic insult also results in alterations in trace elements and minerals.
- Iron metabolism is altered; it is not advisable to give iron because it encourages growth of bacteria.
- Zinc levels may be low; zinc is essential for several metabolic pathways accelerated in stress.
- Fluid and electrolyte changes can lead to loss of phosphorus, calcium, and magnesium.
Critical Illness

- Heterogeneous patients
- Extreme physiological stress/organ failure
- Acute phase response: TNF, IL-6, IL-1β
- Immuno-suppression: monocytes, MØ, NK cells, T and B lymphocytes
- Insulin resistance: hyperglycaemia
- Protein loss and fat gain in muscle
- Impaired gut function
Shall we NG Feed Mr Jones?

Let's not complicate things!
If the Gut works Use It!

- Research shows the importance of maintaining healthy gut mucosa in critically ill patients.
- TPN without any enteral feeding appears to cause intestinal mucosal atrophy.
- The use of enteral nutrition should be considered whenever possible.
Gastro-intestinal Disease

- Gastro-intestinal disease and its treatment including surgery can have a profound impact upon digestion, absorption and nutritional status.
- Appropriate nutritional support should be implemented as quickly as possible to lessen the severity of nutritional depletion.
- Poor dentition, stomatitis and dysphagia can cause decrease food intake.
GI Diseases

- If stomatitis is so severe that no food can be ingested, enteral support should be initiated by a nasogastric tube.
- An isotonic intact formula is well tolerated.
- Dysphagia may or may never resolve.
- If patient cannot manage to swallow for adequate nutrient intake, he may be a candidate for enteral nutritional support via a nasogastric tube, or gastrostomy feed.
Esophagus

- Esophagus problems affecting feeding
- Stricture can narrow the esophagus so no food passes thru
- If a low carbohydrate low protein and high fat does not help and enteral tube feeding with an isotonic formula delivered through gastrostomy is indicated
- Esophageal resection include early satiety dumping syndrome oral intake is usually slow
- Patient should have enteral nutritional support via a jejunostomy tube of isotonic feeds.
Stomach

- Conditions affecting nutritional status include gastrectomy, gastroparesis and gastric outlet obstruction.
- Patients who cannot tolerate adequate oral intake may be supplemented with duodenal feedings utilizing an isotonic formula at an appropriate volume to allow for tolerance.
Duodenum

- Initial absorption of fatty acids, amino acids and simple sugars begins in duodenum.
- If any portion is resected the initial phases of digestions are affected.
- So therefore readying of nutrients for absorption are also affected.
Jejunum

- Because the jejunum is the site for many digestive and absorptive functions it is often selected for placement of feeding tubes.
- Jejunum feeding are beneficial because they utilize the digestive and absorptive capacities of the GI tract.
- Elemental or intact nutrient formulas can be utilized if the tube is placed 6-8” distal to the ligament of Treitz.
Ileum

- Any disease or resection of the ileum may cause severe malabsorption or steatorrhea.
- Nutritional treatment may include TPN and enteral formula with MCT as a fat source are best formula.
- Since MCT do not require bile salts for absorption.
Pancreas

- The goal of nutritional support in pancreatic disease is to replete the nutritional stores.
- Elemental feedings below the ligament of Treitz can cause some secretion of hormones. However, studies indicate the feedings are well tolerated.
Stress and Sepsis

- Stress and sepsis can impact the status of many nutrients
- Loss of body cell mass causes loss of potassium, magnesium, phosphorus, zinc and sulfur
- Anabolism increases the need for zinc, vitamin C, phosphorus and magnesium
Stress and Sepsis

- Enteral feedings should be initiated slowly into the duodenum, jejunum and ileum. Since they do not develop ileus.
- Early feeding with the gut and especially into the duodenum, ileum and jejunum appears to play a role in preserving the gut mucosal lining and to decrease the hyper metabolic response to stress.
- Feedings into this part of the GI tract also reduces the risk for aspiration.
Nutrition Support in Head Injury

- Enteral support remains the preferred route of nutrition therapy.
- Gastric function is altered in head injury, therefore gastric feedings are poorly tolerated, resulting in higher residuals and risk of aspiration.
- Therefore, duodenal and jejunal feedings become more successful. The jejunal route is preferred.
- Nutrient dense formulas are recommended for fluid restriction.
Enteral Tube Feeding Protocols
Position of Body

- Make sure patient’s head is elevated at an angle of at least 45 degrees from the bed.
- Patient should remain in this position during and up to 30 to 60 minutes after feeding is finished. This will reduce the risk of aspiration.
- Always use formula that is at room temperature.
Gastric residuals

- Check the gastric residuals prior to each feeding.
- Note how much stomach contents or residuals can be withdrawn, and then slowly push it back to stomach. Flush with minimum 30 ml water.
- Any gastric residuals must be returned to the stomach.

- If the amount of residuals is >100ml, wait 30 to 60 minutes and deduct that amount from the next feed. Recheck the amount of residuals every hour.
Infection Control Consideration:

- Wash out the food container before and after each use.
- Use a clean food container for each feeding.
- Before you prepare patient’s tube feed, wash your hands to reduce risk of infection.
- Wear gloves
- If reusing the feeding bag with tubing, rinse with warm water and dish soap 3 times a day.
Special Consideration

**Giving Medications:**
- Medications may be given through the nasogastric tube.
- Order prescriptions in liquid form, if possible. Do not mix and crush medications with feed. They should be given separately.

**Feeling Sick (Nausea):**
- Feed your patient more slowly.

**Dry mouth or feeling thirsty:**
- Always follow your patient’s schedule for water.
- For immediate relief, swab patient’s mouth with moistened sponge-tipped toothett.
Osmolarity and Osmolality

- Inversely proportional to size of particles
  - Smaller particles (e.g., amino acids, monosaccharides) generate more osmolarity
  - Larger particles (e.g., proteins, polysaccharides) contribute less to osmolarity.

**Osmolarity**

MilliOsmoles per unit of volume

mOsm /L

**Osmolality**

MilliOsmoles per unit of weight

mOsm /kg water
Classification:

Nutritionally Complete

Polymeric

Semi-elemental (hydrolyzed) elemental

• adults
• pediatrics

Modular

• Carbohydrates
• Proteins
• Lipids
Enteral Feeding Needs: How to Calculate

- Step 1: Estimate patient’s nutritional needs
- Step 2: Select tube feeding formula
- Step 3: Select method of feeding (bolus vs continuous)
- Step 4: Determine volume of feeding to meet estimated calorie and protein needs
- Step 5: Document
- Step 6: Reevaluate feeding on a regular basis
# National Medical Centre

## ENTERAL NUTRITION FEEDING PLAN

- **Name:** Mr. Haidar Amr
- **IPD #:** 6601
- **Age:** 21.4y
- **Weight:** 48.9
- **Kcal Req.:** 1750
- **Rate of Feeding:** Bole 160g (250ml/13 hrs/d)
- **Type of Feed:** 1750ml/d

<table>
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<tr>
<th>TIME</th>
<th>FOOD ITEM</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00am</td>
<td>3 saps j50ccml</td>
<td>250ml</td>
</tr>
<tr>
<td>9:00am</td>
<td>11</td>
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</tr>
<tr>
<td>12:00pm</td>
<td>11</td>
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<tr>
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<tr>
<td>9:00pm</td>
<td>11</td>
<td>250ml</td>
</tr>
<tr>
<td>12:00am</td>
<td>4</td>
<td>250ml</td>
</tr>
</tbody>
</table>

**Total Fluids:**
- **Total Calories:**
  - **Total Calories:** 1722kcal/d

**Dietician:**

- **Date:** 22/01/14
- **Dietician Signature:**

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**Notes:**
- **Careful Diet**
- **Some Recall**
# National Medical Centre
## ENTERAL NUTRITION FEEDING PLAN

**Name:** Mr. Siddiqui Zekeilla  
**IPD #:** R-#308  
**Age:** 32 yrs  
**Weight:** 40 Kgs  
**Kcal Req.:** 1600 kcal/day  
**Rate of Feeding:** P.E.G tube  
**Type of Feed:** Bolus feeding (250ml / 3 hours)  
**Total Volume:** 1750 ml/day

<table>
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<tr>
<th>TIME</th>
<th>FOOD ITEM</th>
<th>VOLUME</th>
</tr>
</thead>
<tbody>
<tr>
<td>6:00am</td>
<td>3 scoops 45 kcal Chicken soup +</td>
<td>250ml</td>
</tr>
<tr>
<td>9:00am</td>
<td>2 scoops Bone broth + 2 glasses olive oil</td>
<td>250ml</td>
</tr>
<tr>
<td>12:00pm</td>
<td>2 glasses 45 kcal Beef soup + 2</td>
<td>250ml</td>
</tr>
<tr>
<td>3:00pm</td>
<td>Scoops Bone broth + 2 glasses olive oil</td>
<td>250ml</td>
</tr>
<tr>
<td>6:00pm</td>
<td>5 glasses 45 kcal Apple sauce + 50 ml Yogurt lessi</td>
<td>250ml</td>
</tr>
<tr>
<td>9:00pm</td>
<td>3 scoops 45 kcal Chicken soup +</td>
<td>250ml</td>
</tr>
</tbody>
</table>
| 12:00am  | 484 kcal  
|          | 260 kcal  
|          | 554 kcal  
|          | 1578 kcal/day |

**Date:** 24/01/14  
**Dietician:** [Name]

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**Notes:**
- 2/1/14: Foods eaten this day.
- 2/5/14: 2 glasses = 45 kcal
Parenteral Nutrition.
Total Parenteral nutrition is defined as the intravenous nutrition (partial or complete), without the use of the gastrointestinal tract.
Indications for TPN

- Non functioning GI tract
- Severe diarrhea and vomiting
- Severe malabsorption
- Severe pancreatitis
- Patient requiring additional nutritional support (trauma, burns, malignant disease, chemotherapy)
- Intestinal fistula
- Inflammatory bowel disease (IBD)
- Massive intestinal resection (70%)
- Complete intestinal obstruction
Delivery modes

PN is administered through either a peripheral or a central vein.

- **Central Parenteral Nutrition**: often called Total Parenteral Nutrition (TPN); delivered into a central vein

- **Peripheral Parenteral Nutrition (PPN)**: delivered into a smaller or peripheral vein
Comparison

**Peripheral PNT**
- Infused via peripheral vein
- Therapy is expected to be short term ≤ 10 days
- Osmolarity <700-900 mOsm/l (Hyperosmolar solutions cause thrombophlebitis in peripheral veins)
- Inadequate calories

**Central venous PNT**
- Infused via central line
- Therapy is expected to be long term ≥ 10 days (>2 weeks)
- Osmolarity >1300-1800 m0sm/l
- Adequate calories

Comparison

**Peripheral PNT**
- Amino Acid <3% final concentration
- Maximum volume (2.5-3/L day)
- Dextrose concentration (5%-10% final)

**Central venous PNT**
- Amino Acid 5%-15% final concentration
- Start slowly (1 L 1st day; 2 L 2nd day)
- Dextrose concentration (10% - 25% or more)
TPN Complications
Glucose Metabolism

- Hyperglycemia
  - excessive dextrose administration
  - Diabetes Mellitus

- hyperosmolar nonketotic coma

- Hypoglycemia
  - May occur if TPN interrupted for > 30 min
  - suddenly stopping constant concentrated dextrose infusions
  - Excessive insulin

- CO₂ Retention and Increased O₂ consumption
  - Occurs in pts with resp. dz. (ie. COPD)
  - Occurs with overfeeding
TPN Complications
Protein Metabolism

- **Azotemia**
  - Occurs in pts with renal failure
  - Excess protein administration
  - Prevention: restrict protein
    - AKI: 0.6-0.8gm/kg/d
    - CKD: 0.8-1 gm/kg/d

- **Hyperammonemia and Hepatic Encephalopathy (HE)**
  - Occurs in pts with liver failure
  - Restrict protein as necessary
    - ie. 0.6 gm/kg/d
TPN Complications
Fat Metabolism

- **Essential Fatty Acid Deficiency**
  - EFA = linoleic acid
  - Cause: TPN without fat

- **Hyperlipidemia**
  - If trig too high (>400 mg/dL) give IV fat emulsion for EFA only

- **Egg allergy**

- **Hypertriglyceridemia**

- **Abnormal LFTs**
  - Elevated liver function tests
    - AST (SGOT)
    - ALT (SGPT)

- **Possible cause: fatty infiltrates of liver (hepatic steatois)**
  - Exceed rate of glucose metabolism
    - 5-7 mg/kg/min
What Guidelines available?

- Canadian Critical Care Network 2003/2007: Clinical Practice Guidelines
- ICS: Practical Management of Parenteral Nutrition in Critically Ill Patients 2005
- ESPEN: Enteral Nutrition 2006
- ESPEN Guidelines on Parenteral Nutrition; Gastroenterology/Intensive Care 2009
- ASPEN guidelines for Enteral and Parenteral Nutrition 2013
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.
- The ICU patient’s chance of survival without nutritional support is unknown but the increased metabolic needs related to stress are likely to accelerate the development of malnutrition, a condition associated with impaired clinical outcome.

ESPEN Guidelines on Parenteral Nutrition; Gastroenterology/Intensive Care 2009
When should we start PN?

- **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.

- **Comments:** The ESPEN guidelines on EN5 state that “The insufficient provision of nutrients is likely to result in undernutrition within 8-12 days following surgery and/or ICU admission.”
Should we use central venous assess for PN administration?

- A central venous access device is often required to administer the high osmolarity PN mixture designed to cover the nutritional needs fully (Grade C).
- 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).

ESPEN Guidelines on Parenteral Nutrition; Gastroenterology/Intensive Care 2009
Conclusion

- Thus enteral nutrition plays a vital role in alleviating signs and symptoms of malnutrition providing nutritional repletion in the critically ill in all diseased states.
- Patients should be fed because starvation or underfeeding in ICU patients is associated with increased morbidity and mortality.
- If Enteral feeding is not possible then start PN as soon as possible.