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Review Article

Nutrition therapy in critically ill elderly patients

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ABSTRACT

Nutrition therapy in critically ill patients is as important as curative pharmacotherapy or advanced cardiac life support. Nutrition support indeed improves the disease outcomes and must be given due importance in any therapeutic regimen. High incidence of co-existent malnutrition in elderly patients emphasizes the added value of nutrition therapy in this subgroup of patients. Enteral route of nutrition therapy is always preferred over parenteral route until and unless indicated otherwise, by virtue of being non-invasive and easy to administer. In addition it has local gut protective effects, lesser incidence of infectious morbidity and better cost-effectiveness. However, parenteral route may be the only viable option in certain clinical scenarios.

Keywords: Nutrition, Parenteral, Enteral, Critical illness

INTRODUCTION

Feed and succeed

Nutrition is a vital component of in-patient management and is much more important in critically ill patients. This aspect requires special attention not only to the amount of nutritional requirement but also to the route of administration. Nutrition therapy in critically ill patients (such as patients with sepsis, acute renal and hepatic failure, adult respiratory distress syndrome, pancreatitis, polytrauma, those requiring ventilator support and henceforth) is one of the most crucial aspects of management of these patients. It is no longer considered as an adjunctive support measure to tide over acute crisis. Recent advances and meta-analysis of various studies have confirmed its role as a therapeutic strategy capable of favourably altering the clinical outcome of such patients in terms of overall mortality, length of hospital stay, ICU care and duration of mechanical ventilation etc.[1]

Nutrition therapy deserves all the more importance and priority in critically ill patients as there is a high incidence of malnutrition among these patients. This incidence has been evaluated to be in the range of 38% to 100% among patients requiring mechanical ventilation and about 20%-35% among hospitalised patients as a whole.[2,3] In elderly patients co-existent malnutrition is still more frequent with observed incidence ranging from 30-40% in various clinical settings and is often attributable to chewing difficulties, physical and economic dependence.[4-6] In acutely hospitalized elderly patients, malnutrition has translated into longer hospital stays, delayed wound healing & higher rates of infection and increased mortality.[7-10] Moreover the risk for nutritional deterioration, is greater than the prevalence of actual malnourishment reported.[11-12] Holyday et al. demonstrated that targeted nutritional interventions reduced the length of hospital stay and re-admissions in malnourished elderly patients.[13]

Still further, there is potential scope of nutrition therapy as immune-modulating therapy i.e. specific nutrient supplemented nutrition therapy with intent to modulate the immune system, facilitate wound healing and to reduce oxidative stress.[1] Thus medical teams involved in management of such critically ill patients ought to have a reasonable degree of exposure to the theoretical nuances and clinical experience regarding nutrition therapy.

WHAT LED TO PATIENT BEING FED?

The basic indication for nutrition therapy is preventing and treating malnutrition among patients unable to sustain adequate oral intake. Further course of nutrition therapy depends on a composite evaluation of the severity of malnutrition, severity of underlying disease and expected duration of recovery and associated co-morbidities. Malnourished patients with underlying disease severe enough that increased metabolic demands can't be met with oral intake alone, or similar cases with no expected improvement in oral intake over next 2-3 days; associated co-morbidities having significant impact on nutritional demands and status are most likely to benefit from nutrition therapy.

As far as assessment of baseline nutritional status of patient is considered, the most reliable factor is historical evidence of recent significant involuntary weight loss i.e. more than 5% of weight loss in last 1 month, >7.5% in 3 months and >10% in 6months.[1,14] History regarding food fads, usual dietary intake and any recent alterations in it and reason to should be sought. Reasons such as loss of denture, social neglect, chronic debilitated states/co-morbidities, depression, lack of awareness etc. may account for malnutrition in elderly patients. Bedside clinical indicators of malnutrition include hollowing of temporal fossa, undue bony prominence, loss of the buccal pad of fat, decreased respiratory muscle strength, poor performance on hand grip manometry and signs relating to specific nutrient deficiencies. Body Mass Index (BMI) i.e. total body weight (kg) divided by square of height (m) is a useful assessment tool for nutritional status. A BMI of less than 18.5 Kg/m^2 is considered underweight, greater than 25 Kg/m^2 connotes overweight and a BMI greater than 30 Kg/m^2 indicate obesity. A BMI of 14-15 Kg/m^2 is associated with high mortality rates.[15] A number of laboratory parameters such as serum albumin levels, serum pre-albumin levels, retinol binding protein and serum transferrin levels have also been evaluated as an estimation tool for nutritional status but none has been a reliable one, although low serum albumin levels have consistently been associated with poor prognostic value. With particular reference to critically ill elderly patients, a composite score called Geriatric Nutritional Risk Index (GNRI) comprising serum albumin levels and ideal body weight has been devised and validated for malnutrition grading with prognostic implications. Geriatric Nutritional Risk Index: a new index for evaluating at-risk elderly medical patients.[16] Recently GNRI has been utilized to accurately stratify hospitalized elderly patients according to the risk for developing health care associated infections.[17]

IMPLEMENTATION OF NUTRITION SUPPLEMENTATION

Once it is decided that patient needs nutrition therapy, next step is to formulate a nutrition care plan regarding the metabolic demands, route and dosage of nutrition support with a careful watch on related complications, achievement of nutritional goals and further decision regarding continuation, alteration or termination of nutrition therapy.

I. Metabolic demands

It includes assessment of daily caloric and protein requirements, need for fluid supplementation. Lipids, electrolytes, minerals and vitamins are usually prescribed in recommended standard dosages unless a modification is a warranted as per individual patient profile.

A. Caloric requirement

Caloric requirements can be either estimated from predictive equations like Harris-Benedict equation, Fick's equation or indirectly measured by indirect calorimetry. Predictive equations can be used bedside but require multiple calculations as they yield Basal Energy Expenditure (BEE) which in turn has to be multiplied by activity and stress factor to calculate Total Energy Expenditure (TEE).

Harris-Benedict equation:

Male: BEE (kcal) = 66 + (13.7 X weight in Kg) + (5 X height in cm) – (6.8 X age in years)

Female: BEE (kcal) = 655 + (9.6 X weight in Kg) + (1.85 X height in cm) – (4.7 X age in years)

Fick's equation: BEE = (SaO_2 – SvO_2) X CO X Hb in g% X 95.18

Here, the difference in arterial and venous oxygen saturation is multiplied by cardiac output (CO) and haemoglobin concentration (Hb) along with a factor of 95.18.

Indirect calorimetry measures oxygen consumption and carbon dioxide production. Energy expenditure is calculated using respiratory quotient. This method may be more reliable in case of obese patients but the calorimetric is a technically demanding procedure and its routine use cannot be recommended. One of the simpler methods is to use body weight as a guide to caloric requirements adjusted to the severity of illness of patient (Table 1).[3]

Of the total caloric requirement around 50-60% is to be provided by carbohydrate source, 20-30% by fats and the rest 15-20% by proteins.

Table 1: Daily caloric requirements as per body weight adjusted to the clinical status.

Clinical status of the patient	Daily caloric requirements
Sedated mechanically ventilated patients	20 - 24 kcal/Kg
Unsedated mechanically ventilated patients	22 - 24 kcal/Kg
Spontaneously breathing critically ill patients	24 - 26 kcal/Kg
Spontaneously breathing ward patients (maintenance)	24 - 26 kcal/kg
Spontaneously breathing ward patients (repletion)	25 - 30 kcal/Kg

B. Protein requirement

While daily protein requirement for an adult is around 0.8g/kg body weight, it has to be adjusted for underlying disease severity. Critically ill older patients are typically hypercatabolic and require 1.2 to 2 g/kg (body weight) of protein while in cases of acute renal failure it is around 1.5-1.8 g/kg and for chronic renal failure on renal replacement therapy it is near 1.2-1.5 g/kg.

C. Fluid requirement

The usual requirement is about 30-40ml/kg body weight with further titrations according to fluid-electrolyte balance and hemodynamic status of the patient.

II. Route and dosage of nutrition support

Perhaps the most crucial decision related to nutrition support is the route of administration as all further considerations are solely based on the route of administration. The two options available are enteral and parenteral route.

A. Enteral nutrition: enteral nutrition (EN)

It is the preferred route of feeding over Parenteral Nutrition (PN) for critically ill patients who require nutrition support therapy. EN is associated with much lesser incidence of infectious complications, maintains gut functions, and has low cost and greater variations in supplemental formulations. However, there are few contraindications to EN, which are intestinal obstruction, ileus, peritonitis, bowel ischemia and intractable diarrhoea or vomiting.

While few studies have shown a differential effect on mortality, the most consistent outcome effect form EN is reduction in infectious morbidity. Moreover early initiation of EN (within 24-48 hours) among critically ill patients who require nutrition support has proven to reduce infectious morbidity and length of hospital stay.[18] The importance of early EN is strengthened by evidence of mortality benefits even in patients with acute severe pancreatitis.[1,19] On short term basis (<4-6weeks) it can be administered using nasogastric, nasoduodenal or nasojejunal tubes and on long term basis EN can be given through feeding gastrostomy or jejunostomy either by percutaneous endoscopic approach or open surgical approach especially in patients with fixed upper GI obstruction (strictures, malignancies), neuromuscular disorders (motor neuron disease) or candidates for abdominal surgeries.

PRACTICAL ISSUES AND RECOMMENDATIONS RELATED TO EN

a) Early initiation of EN (within 24-48 hours) is of utmost importance as delayed feeding has been associated with higher incidence of gut permeability and release of inflammatory cytokines.[20]

b) Feeding advanced towards goal over next 48-72 hours with a minimum target of achieving >50-65% of goal calories.[21]

c) If unable to meet energy requirements (100% of target goal calories) after 7-10 days of enteral route alone, consider initiating supplemental PN. However, initiating supplemental PN prior to this period may be detrimental to the patient in view of the fact that PN has its own inherent risks of hyperglycemia, dyselectrolytemia, immune suppression and potential infectious morbidity.

d) In setting of hemodynamic compromise (patients requiring high dose of vasopressor or inotropic support and/or large volume blood product or fluid resuscitation), EN should be withheld until patients are fully resuscitated and stable.[21] In such settings EN is known to precipitate subclinical bowel ischemia / reperfusion injury involving intestinal microcirculation. Bowel ischemia is a rare complication of EN, occurring in <1% of cases but related mortality rate is very high.[21]

e) Permissive Underfeeding or hypocaloric Feeding is recommended for critically ill obese patients (BMI >30) with goal of EN regimen being not to exceed 60-70% of target energy requirements or 11-14 Kcal/Kg actual body weight.[20] Severe obesity adversely affects patient care in the ICU and increases risk of comorbidities (e.g. insulin resistance, sepsis, DVT). Achieving some degree of weight loss may increase insulin sensitivity, improve nursing care and reduce risk of co-morbidities.

f) Monitoring Tolerance of EN- Patient intolerance to EN accounts for one third of cessation time, but only half of this represents true intolerance.[20] Thus, it is imperative to monitor these patients for any signs of intolerance to EN. Look for complaints of abdominal pain or distension, non-passage of stools and flatus, frequency of bowel sounds, high Gastric Residual Volumes (GRV) and abdominal radiographs. Again, it is the multiplicity of these signs that should be the decisive factor rather than one single sign. Even though gastric residual volume is most commonly practiced evaluator but there also withholding EN for gastric residual volumes <500 ml in the absence of other signs of intolerance should be avoided.[22] However GRV in between 200-500 ml should raise concern and lead to implementation of measures to reduce risk of aspiration like head end elevation to 30-45º in all intubated patients receiving EN, switching to continuous infusion of EN, post-pyloric feeding and use of prokinetic agents like metoclopramide and erythromycin. Also, isolated finding of diminished or even absent bowel sounds should not lead to withholding of EN as enteral feed would act as a stimulator of gut motility via release of gastrin and motilin and in fact may reverse ileus.[1,23]

g) Development of diarrhoea associated with enteral tube feeding warrants further evaluation regarding excessive intake of hyperosmolar medications such as sorbitol, use of broad spectrum antibiotics, Clostridium difficle pseudomembranous colitis and other infectious etiologies. If infectious etiology is ruled out, use of anti-motility agents, bulk additives and shift to elemental diet may be attempted. Lactose intolerance is not a cause of EN related diarrhoea as commercial EN preparations do not contain lactose.

B. Parenteral Nutrition (PN)

It is the route of last resort i.e. where EN is either contraindicated or not tolerated in spite of best corrective measures. Even in critically ill patients where EN is not feasible, aggressive nutritional support should be withheld for initial 7 days. These patients, despite of critical illness, sepsis and multiple organ dysfunction, are better managed with standard therapy (dextrose based intravenous fluids but no specialised nutritional support) with no PN support over this initial period. If EN is still not feasible after initial 7 days of standard therapy, PN supplementation should be started.[20]

Only if there is protein calorie malnutrition and EN is not feasible, should PN be given preference over standard therapy in the first week.[1,20] There are certain specific indications for PN such as active gastrointestinal bleeding, high output enterocutaneous fistula (>500 ml/day), and in severe acute flare up of inflammatory bowel disease. Once PN is started, frequent evaluations and attempts to introduce EN should be made. PN formulations are available as 2-in-1 formulations containing carbohydrate and protein supplements or there are total nutrition admixtures (TNA or PNA) having lipid contents also. Separate lipid formulations are also available as 10% or 20% emulsions and have a caloric value of 1 Kcal/ml and 2 Kcal/ml respectively.

Access for PN administration can be either central (central venous catheter or peripherally inserted central catheters) for anticipated long term supplementation or peripheral for short term supplementation with PN formulation of osmolarity <750 mosm/L. For long term supplementation of PN subcutaneous infusion pumps and tunnelled catheters are also available which appear to reduce infectious complications associated with PN supplementation.

PRACTICAL ISSUES AND RECOMMENDATIONS RELATED TO PN

a) In all ICU patients requiring PN, initial permissive underfeeding should be considered. Once energy requirements are determined, 80% of these requirements should serve as the ultimate goal or dose of parenteral feeding.[20] This strategy avoids the potential for insulin resistance, greater infectious morbidity or prolonged duration of mechanical ventilation associated with excessive caloric intake. For obese patients (BMI >30), the dose PN with regard to protein and calorie provision should follow the same recommendations as for EN.

b) In the first week of hospitalisation in the ICU, when PN is required and EN is not feasible, patients should be given a parenteral formulation without long chain fatty acids (i.e. soy-based lipids) as the long chain fatty acid have been shown to be immunosuppressive.[19] Full dose PN may also exacerbate stress induced hyperglycemia.

c) Moderately strict glycemic control must be achieved. A range of 110-150 mg% may be the most appropriate.[20]

d) In patients stabilised on PN, periodically repeated efforts should be made to initiate EN. As tolerance improves and volume of EN calories delivered increases, the amount of PN calories supplied should be reduced. PN should not be terminated until >60% of target energy requirements are being delivered by the EN route.

Table 2: Complications of parenteral nutrition.

Complications	Examples
Mechanical/local	Pneumothorax, hemothorax, venous thrombosis, brachial plexus injury, thrombophlebitis, central line displacement
Microbial	Thrombophlebitis, cellulitis, bacteremia, septicemia
Metabolic	Hyperglycemia, hypophosphatemia, dyselectrolytemia, gall stone disease, cholestasis, re-feeding syndrome

e) The complications associated with PN are summarized in Table 2. Mechanical complications include those occurring during central line insertion and local site complications such as pneumothorax (1-5% cases of subclavian vein catheterisation), haemothorax, brachial plexus injury, catheter misplacement into azygos vein or retrograde into jugular vein and local venous thrombosis. Most of the mechanical complications can be avoided if the procedure is carried out by trained personnel. The preferred site for Central Venous Catheter (CVC) insertion is subclavian or jugular vein as femoral CVCs are associated with a higher risk of venous thrombosis and catheter associated sepsis.[18] Peripherally Inserted Central Catheters (PICC) obviate pneumothorax but are difficult to place and cause local skin irritation.[1] Some clinicians add heparin and hydrocortisone to PN solutions whereas others place a nitroglycerine patch over the catheter site in order to reduce the chances of local venous thrombosis.

f) Metabolic complications include hyperglycemia, dyselectrolytemia esp. hypokalemia and hypophosphatemia. The frequency of monitoring for these metabolic complications should depend on the severity of illness and degree of malnutrition. Daily or more frequent monitoring is required in patients who are critically ill, are at risk of re-feeding syndrome or have experienced complications associated with nutrition support therapy. In stable patients with documented stable laboratory parameters, monitoring may be needed weekly or as clinically indicated.[3]

Hyperglycemia is particularly encountered in patients with severe stress or sepsis, steroid use and diabetic patients. Because hyperglycemia has been shown to be associated with decreased measures of immune function and increased risk of infectious complication, efforts to monitor and control blood glucose are prudent.[24] It is preferable to add insulin therapy than to reduce glucose intake unless there is excessive hyperglycemia (>250 mg %) despite high insulin doses.[15] Insulin therapy in these patients can precipitate hypokalemia and hypophosphatemia. It is imperative to monitor for these complications and treat as required. Only Regular Insulin can be mixed with PN solutions and it is still better to start separate insulin infusion for better glycemic control in the range of 110-150 mg%.[25]

g) Re-feeding syndrome: It is a life threatening complication seen with aggressive nutrition support therapy in chronically semi-starved marasmic older patients. It has been reported more commonly with PN therapy, although it may occur with EN supplementation as well. Acute metabolic perturbations characteristic of this syndrome include hypophosphatemia, hypokalaemia and hypomagnesaemia and the resultant clinical complications can be acute pulmonary edema, congestive heart failure, fatal arrhythmias and ventilator insufficiency. Re-feeding nutritionally depleted elderly patients (>10% loss of body weight over <6 months) must be done carefully so as not to overload a metabolic system that has adapted to minimal or no food intake. Feeding such patients should be below Resting Energy Expenditure (REE) and intake should be increased stepwise over 7-10 days. Patients must be monitored for signs of fluid overload, pulmonary edema and dyselectrolytemia and close monitoring of serum phosphate, magnesium, potassium and glucose are imperative.[26] Corrective measures must be sought on emergency basis and electrolyte abnormalities are treated as per standard guidelines.

h) Microbial or infectious complications are the most frequent and potentially lethal complication of PN supplementation. The incidence of central catheter related bloodstream infections ranges from 0.3% to 30% per thousand catheter days and are most often caused by Staphylococcus aureus, Staphylococcus epidermidis or Candida species.[3] Mortality attributed to catheter related infections is as high as 25%.[3] In order to reduce the chances of catheter related infections manipulation of the venous line should be kept to a minimum and that too, using sterile precautions. Access ports should be wiped with appropriate antiseptic prior to catheter manipulations.[3, 27, 28] If a multilumen catheter is used, one port should be designated exclusively for PN administration. The catheter insertion site must be examined regularly for signs of inflammation. Also, the administration sets for total nutrition admixtures should be changed every 24 hours.[27]

CONCLUSION

Critically ill elderly patients are hypercatabolic and have increased nutrient demands. Nutritional support in these patients not only aims at providing the necessary nutrient substrates, but also attempts to alter the course and outcome of the disease. Although most centres are increasingly realizing the need of intensive nutritional therapy in sick patients, many areas of nutritional support remain controversial. However, lot of clinical judgement is required in identifying those elderly who are at high risk of nutritional depletion and are more likely to benefit from nutritional therapeutic interventions.

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