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Approval Process

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Contents Table:

Acknowledgments.....3

Acronyms:.....5

.1 Introduction5

2. Scope5

3. Purpose5

4. Definitions5

5. Procedure6

6. Responsibilities..... 17

7. Document History and Version Control..... 19

8. Related Documents:..... 19

9. References:.....20



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Acronyms:

BMR	Basal Metabolic Rate
CCU	Critical Care Unit
CO2	Carbon Dioxide
GI	Gastrointestinal
IBW	Ideal Body Weight
ICU	Intensive Care Unit
ITU	Intensive Treatment Unit
NGT	Naso Gastric Tube
PEG	Post Esophageal Gastrostomy
PEJ	Post Esophageal Jejunostomy
PGE1	Prostaglandin E1
MUST	Malnutrition Universal Screening Tool
NUTRIC	Nutrition Risk in Critically ill score
IL-6	Interleukin 6



ICU Medical Nutrition Therapy Guidelines for Directorate and Referral Hospitals

1. Introduction

The number of critically ill patients with long term disabilities has increased, leading to impaired quality of life and significant healthcare costs. Implementing medical nutrition therapy in intensive care, as part of the overall medical intervention, has demonstrated in many studies to improve the patient's quality of life, reduce complications, reduce length of ICU stay and hospital stay, and reflect positively on the medical and non-medical costs.

This guideline has been centrally established and reviewed by healthcare professionals from directorate and referral hospitals, with the intention of addressing critically ill patient's dietary requirements during ICU stay.

2. Scope

The following set of guidelines covers dietitians, nurses, intensivists, and nurses.

3. Purpose

The purpose of this guideline is to provide a platform where healthcare professionals working in ICU implement medical nutrition therapy in critically ill patients of all ages, genders, and disease conditions

4. Definitions

- 4.1 **Enteral Nutrition:** a form of nutrition indicated for patients who have a functioning gastrointestinal (GI) tract but cannot ingest enough nutrients orally because they are unable or unwilling to take oral feedings
- 4.2 **Nasogastric:** a plastic tubing device that allows delivery of nutritionally complete feed directly into the stomach; or removal of stomach contents. It is passed via the nose into the oropharynx and upper gastrointestinal tract.
- 4.3 **Nasoenteric:** a plastic tubing device that allows delivery of nutritionally complete feed directly into the small intestine; or removal of stomach contents. It is passed via the nose into the oropharynx and upper gastrointestinal tract.



- 4.4 **PEG:** is an endoscopic medical procedure in which a tube (PEG tube) is passed into a patient's stomach through the abdominal wall, most commonly to provide a means of feeding when oral intake is not adequate (for example, because of dysphagia or sedation).
- 4.5 **PEJ:** A PEJ (percutaneous endoscopic jejunostomy) procedure is similar to the PEG, except the tube has to be placed into the intestine (jejunum) instead of the stomach
- 4.6 **ICU:** An intensive care unit (ICU), also known as an intensive therapy unit or intensive treatment unit (ITU) or critical care unit (CCU), is a special department of a hospital or health care facility that provides intensive care medicine.

5. Procedure

Recommendations	Rationale
Recommendation 1: Start early enteral nutrition in all critically ill patients within 48 hours, preferably within 24 hours when there is no reason to delay enteral nutrition	Early enteral nutrition is associated with lower risk of infections and preserves the gut function, immunity and absorptive capacity
Recommendation 2: Delay early enteral nutrition in case of enteral obstruction	Feeding proximal of an obstruction will lead to blow out or perforation
Recommendation 3: Delay early enteral nutrition in case of compromised splanchnic circulation (blood supply to the gastrointestinal tract, liver, spleen, and pancreas) such as uncontrolled shock, overt blown ischemia, abdominal compartment syndrome, hemodynamic compromise, initial resuscitation of fluids, vasopressors, and during intra-abdominal hypertension, when feeding increases abdominal pressure	Absorption of nutrients demands oxygen and energy. In state of low flow ischemia, forcing feeding into the ischemic gut may aggravate ischemia and lead to necrosis or perforation



Recommendation 4: delay early enteral nutrition in case of high output fistula than cannot be bypassed	Enteral feeding will be spilled into the peritoneal space or increase the fistula production
Recommendation 5: Delay early enteral nutrition in case of active gastrointestinal bleeding (leading to hemorrhagic shock)	Enteral feeding will limit the visualization of the upper gastrointestinal tract during endoscopy

(Zanten et al 2019)

Process Step	Rationale
Step 1 <i>weight based equation (IBW) – 20-30kcal/day</i>	Equations are inaccurate and overfeeding is associated with increased morbidity and mortality. Early endogenous energy production cannot be inhibited by feeding
Step 2 Subtract the amount of non-nutritional calories provided from propofol, glucose or citrate Propofol (1.1 kcal/ml) Glucose (0.2 kcal/ml) Citrate (0.5 kcal/mmol)	Non-nutritional calories can add to the total daily amount of calories and may lead to overfeeding when combined with full-dose feeding
Step 3 calculate the daily limit for overfeeding (maximum calories allowed for feeding)	A step wise build up is recommended, for example, after ICU admission, go to target in steps of 25% to reach the target on day 4
Step 4 Select the amount of protein per day	Concentrated high energy feeds increase the risk of overfeeding, while not meeting the protein target. When the protein ratio of total calories is higher than 30-32% in most patients, no additional protein supplements are needed



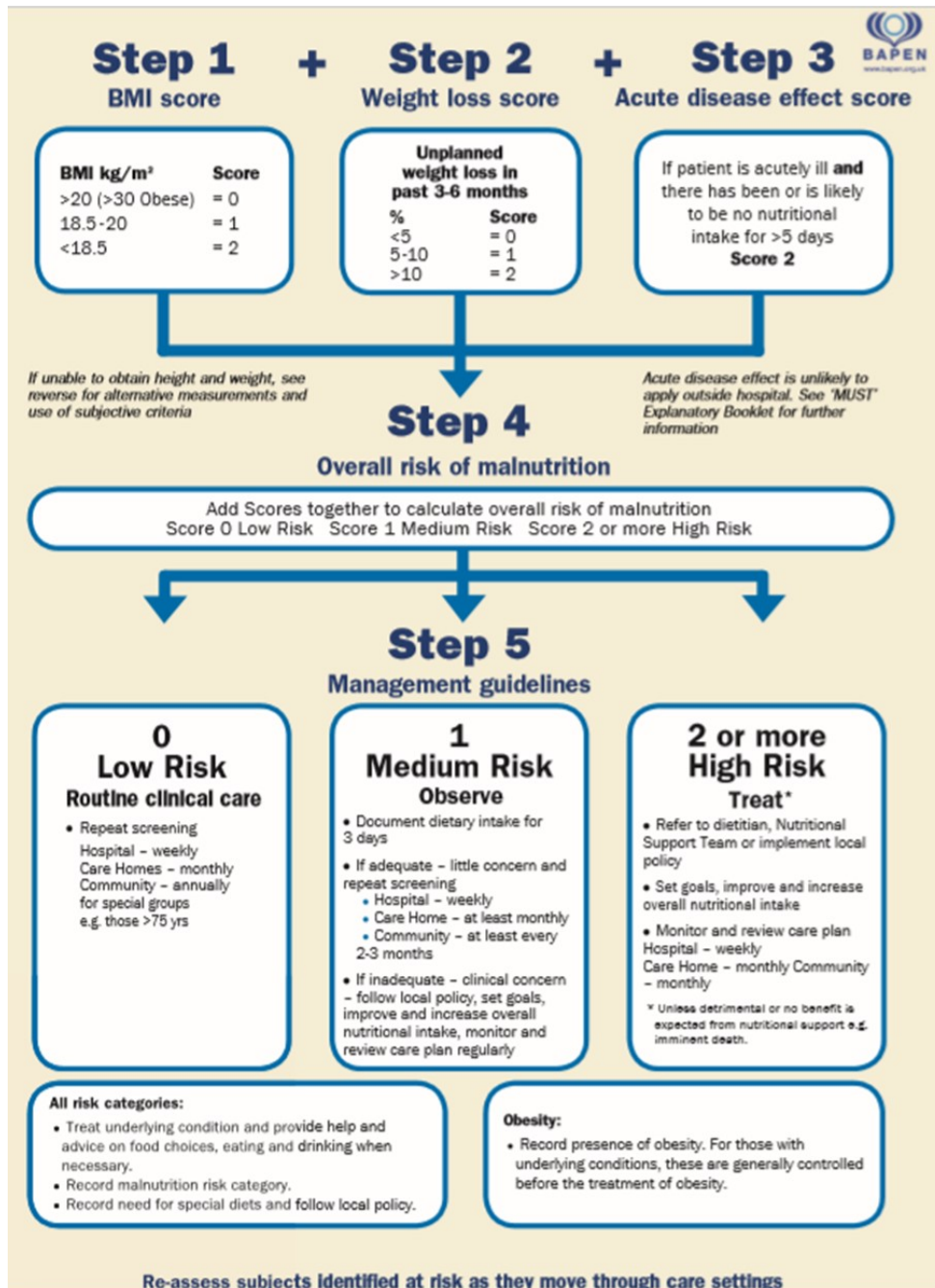
<p>Step 5 Monitor the actual intake during the day and progress to higher than calculated infusion rates for a limited time in case of previous interruptions of administration (stoppages) and use volume based strategies</p>	<p>There are many interruptions while feeding the critically ill. Therefore increasing the administration for short periods of time to compensate for the lost hours is a good strategy to meet the daily targets</p>
<p>Step 6 Add enteral protein supplements in case more enteral feeding will lead to overfeeding when increasing the administration dose. Use no protein supplements during the very early phase (Day 1- Day 3) <i>this needs to be elaborated more and it needs to be provided (suggestion: Communicate with pharmacy or catering?)</i></p>	<p>In obese or overweight patients, the protein needs are very high while the caloric targets are not: then, even when using very high protein feeds, supplemental enteral protein supplements should be considered</p>

(Zanten et al 2019)

5.1 Screening and Assessment:

The following screening and assessment tools are designed to aid related healthcare workers in understanding the nutrition-related condition of the patient admitted to ICU.

5.1.1 MUST Tool:



5.1.2 NUTRIC Score Tool:

5.1.2.1 The NUTRIC Score is designed to quantify the risk of critically ill patients developing adverse events that may be modified by aggressive nutrition therapy. The score, of 1-10, is based on 6 variables



Variable	Range	Points
Age	<50	0
	50 - <75	1
	≥75	2
APACHE II	<15	0
	15 - <20	1
	20-28	2
	≥28	3
SOFA	<6	0
	6 - <10	1
	≥10	2
Number of Co-morbidities	0-1	0
	≥2	1
Days from hospital to ICU admission	0 - <1	0
	≥1	1
IL-6	0 - <400	0
	≥ 400	1

NUTRIC SCORE if Il-6 is available

Sum of points	Category	Explanation
6-10	High Score	<ul style="list-style-type: none"> ➤ Associated with worse clinical outcomes (mortality, ventilation). ➤ These patients are the most likely to benefit from aggressive nutrition therapy.
0-5	Low Score	<ul style="list-style-type: none"> ➤ These patients have a low malnutrition risk.

NUTRIC SCORE if Il-6 is not available

Sum of points	Category	Explanation
5-9	High Score	<ul style="list-style-type: none"> ➤ Associated with worse clinical outcomes (mortality, ventilation). ➤ These patients are the most likely to benefit from aggressive nutrition therapy.
0-4	Low Score	<ul style="list-style-type: none"> ➤ These patients have a low malnutrition risk.

5.1.3 For pediatrics, It is recommended to perform anthropometric measurements on admission and regularly during admission, and to express these measurements in z-scores, including weight, height/ length mid upper arm circumference and head circumference in young children

5.2 Energy Requirements:

5.2.1 Energy requirements are to be calculated using the Harris Benedict Equation:



- 5.2.1.1 For Men: $BMR = 13.75 \times \text{weight (kg)} + 5 \times \text{height (cm)} - 6.78 \times \text{age (years)} + 66$
- 5.2.1.2 For Women: $BMR = 9.56 \times \text{weight (kg)} + 1.85 \times \text{height (cms)} - 4.68 \times \text{age (years)} + 655$
- 5.2.1.3 Or use 25kcal/kg/day as a general rule (in some guidelines the recommendation is 30 – 20 kcal/kg/day so it is best to use clinical judgement at all times)
- 5.2.1.4 Fever: increase by 10% for each 1oC above 37oC (up to max of 40oC)
- 5.2.1.5 Sepsis: increase by 9% regardless of temperature
- 5.2.1.6 Surgery: increase by 6% if patient has had surgery or trauma
- 5.2.1.7 Burns: increase by 100% if any size over 30% (or use Toronto formula)
- 5.2.1.8 In children, Schofield equation (for age and gender and using an accurate weight) is recommended to estimate resting energy expenditure

5.3 Protein Requirements:

- 5.3.1 Provide approximately 1.5 g/kg/day (range 1.2 to 2.0 g/kg/day for ICU patients)
- 5.3.2 Use 2g/kg/day if severely catabolic eg. severe sepsis/burns/trauma
- 5.3.3 For 0 – 2 years; 2-3g/kg/day
- 5.3.4 For 2-13 years; 1.5-2g/kg/day
- 5.3.5 For 13-18 years; 1.5 g/kg/day

5.4 Nutrition Support

If at all possible oral or enteral are the preferred routes for nutritional support. They are far cheaper, more physiological, reduce the risk of peptic ulceration, minimize mucosal atrophy (food in the gut lumen is a potent stimulus for mucosal cell growth) and may reduce translocation of bacteria from the intestinal lumen. Situations previously thought to preclude enteral nutrition, including major gastrointestinal surgery or acute pancreatitis, have now been shown to be best treated with enteral nutrition.



Nutritional support can be given through one of three routes:

- 5.4.1 **Oral:** If the patient can eat then they should be encouraged to do so, ideally by giving them food they enjoy and helping them if necessary. It is important to know how much the patient is eating to see whether they are receiving adequate nutrition. If not they will need supplementation either orally or enterally.
- 5.4.2 **Enteral - via a tube directly into gastrointestinal tract :**
- 5.4.2.1 **Nasogastric** - this is the most common method of feeding in Intensive Care. Potential problems include malposition, difficulty swallowing or coughing, discomfort, sinusitis and nasal tissue erosion.
- 5.4.2.2 Insertion can be difficult in intubated patients as the tube can catch on the piriform sinuses or the arytenoid cartilages. This can be minimised by either ipsilateral lateral neck compression or by turning the head (if it is safe to do so) 90° to the side towards the nostril being used for insertion. The insertion of a nasal tube is contraindicated in a patient with a base of skull fracture due to the risk of intracranial penetration.
- 5.4.2.3 **Oral tubes** – not suitable for awake patients however should be considered in intubated patients to reduce sinusitis (a risk factor for ventilator-associated pneumonia).
- 5.4.2.4 **Enterostomy – gastrostomy or jejunostomy** and can be placed at the time of surgery or as a separate procedure. Once inserted they are well tolerated, however there are risks associated with insertion, displacement and infection (including peritonitis). Evidence from non-ICU patients suggests that there are significant benefits for those who require nutritional support for over 4 weeks.
- 5.4.2.5 **Post-pyloric feeding – nasojejunal or jejunostomy.** A nasojejunal tube should be over 120cm long to ensure correct placement. Feeding directly into small bowel avoids the problem of gastroparesis. Small



bowel ileus is much less common than gastric ileus and tends to be less prolonged; the small bowel recovers normal function 4-8 hours post laparotomy. Post-pyloric feeding is recommended for patients at high risk of aspiration, those undergoing major intra-abdominal surgery and patients who are intolerant of gastric feeding.

5.4.3 **Steps:**

- 5.4.3.1 Tube position must be confirmed both clinically and radiographically if possible. Otherwise it is easy to administer feed directly into the lungs.
- 5.4.3.2 Secure tube well, there should always be a high index of suspicion that the tube may have become dislodged.
- 5.4.3.3 . Sit patient up, the patient should be sat up to an angle of at least 30o to minimise the risk of reflux and subsequent aspiration of gastric contents. This can still occur around a cuffed tracheal tube.
- 5.4.3.4 Start feeding early (for both adults and children) as early feeding (within 24 hours of admission or surgery) has been shown to reduce septic complications, length of hospital stay and readmission rates in patients after both upper and lower gastrointestinal surgery. Enteral feeding does not appear to increase, and may in fact decrease, the incidence of anastomotic breakdown.
- 5.4.3.5 Enteral nutrition should be considered in term neonates with umbilical arterial catheters
- 5.4.3.6 Enteral nutrition should be considered in critically ill term neonates on PGE1 infusion if managed in a critical care unit with adequate observation and monitoring
- 5.4.3.7 Aspirate regularly (eg. 4 hourly) to ensure that gastric residual volume is less than 200mls. Volumes above this greatly increase the risk of reflux and subsequent pulmonary aspiration and feeding rates should be reduced accordingly. This procedure can be via the feeding



tube itself if the distal lumen is in the stomach and if it is wide enough. Otherwise (eg. if a fine bore tube or if jejunal feeding is being used) a separate gastric tube should be used. Once feeding is established this can stop.

- 5.4.3.8 Avoid bolus feeds, large volumes of feed in the stomach will increase the risk of aspiration of gastric contents so bolus feeding should be avoided if possible.
- 5.4.3.9 Use pro-kinetics If the patient is not tolerating enteral feed (ie large volumes of feed are being aspirated from the gastric tube) then pro-kinetic agents should be given such as metoclopramide 10mg iv tds +/- erythromycin usually 250mg iv tds (recent research suggests this can be reduced to erythromycin 70mg iv tds.)

5.4.4 **Which enteral feed to use?**

- 5.4.4.1 Please use the formulas provided through the catering section of the hospital (this might change in the future and an update will be provided) and as per the physician and dietitian's recommendations
- 5.4.4.2 Polymeric preparations, these contain intact proteins, fats and carbohydrates, which require digestion prior to absorption, in addition to electrolytes, trace elements, vitamins and fibre. Fibre is broken down by colonic bacteria to produce a variety of compounds including butyric acid, an energy substrate for colonic enterocytes. These feeds tend to be lactose-free as lactose intolerance is common in unwell patients. The different preparations vary in their osmolality, calorie: nitrogen ration and carbohydrate: lipid ratios and can provide between 0.5 and 2 kcal/ml although most are around 1kcal/ml. Commonly used ingredients include the protein casein (from milk), soy protein, maize and soya oils and the carbohydrate maltodextrin. The vast majority of patients can be given standard polymeric feeds.



- 5.4.4.3 Elemental preparations, these preparations contain the macronutrients in a readily absorbable form (i.e. proteins as peptides or amino acids, lipids as medium chain triglycerides and carbohydrates as mono- and disaccharides). They are expensive and only really indicated for patients with severe malabsorption or pancreatic insufficiency.
- 5.4.4.4 Disease-specific formulae, are usually polymeric and include feeds designed for:
 - 5.4.4.4.1 Liver disease - low sodium and altered amino acid content (to reduce encephalopathy)
 - 5.4.4.4.2 Renal disease - low phosphate and potassium, 2kcal/ml (to reduce fluid intake)
 - 5.4.4.4.3 Respiratory disease - high fat content reduces CO₂ production.
- 5.4.4.5 Specific additives, there is a lot of interest in the effects of various additives to nutritional support including omega-3-fatty acids and glutamine. Glutamine is thought to promote anabolism and may be an important intestinal growth factor however the benefits are still unclear. In general these feeds tend to be more expensive and there is no consensus as to their role in critically ill patients.
- 5.4.4.6 Carbohydrate - given as glucose.
- 5.4.4.7 Electrolytes & Micronutrients - some may be included in the emulsion. If not, they need to be given separately. Guidelines for requirements for electrolytes, vitamins and trace elements are given in the appendix although patients may have abnormal losses depending on the pathology involved. Patients with sepsis have been shown to have large vitamin A losses in their urine, burns patients lose selenium, zinc and copper via their exudates and trauma patients lose selenium and zinc through their drains.



5.5 Complications of nutritional support

There are a number of complications it is important to be aware of and to look for in patients receiving nutritional support.

5.5.1 Refeeding syndrome

5.5.1.1 Patients who are severely malnourished or have undergone a significant period of starvation are at risk of refeeding syndrome during the first few days of nutritional support regardless of route. The clinical features include weakness, respiratory failure, cardiac failure, arrhythmias, seizures and death. Starvation causes a loss of intracellular electrolytes, secondary to leakage and reduced trans-membrane pumping, and intracellular stores can become severely depleted even though serum levels may be normal. When carbohydrate is available again there is an insulin-dependent influx of electrolytes into the cells which can result in rapid and severe drops in serum levels of phosphate, magnesium, potassium and calcium.

5.5.1.2 At risk patients should be identified and feeding must be introduced slowly, starting with only 25-50% of energy requirements and gradually increasing after four days. The above electrolytes should be generously supplemented at the same time as starting feeding and should be closely monitored. Thiamine and other B vitamins should also be given intravenously before starting feeding and then daily for at least three days.

5.5.2 Overfeeding

5.5.2.1 Deliberate overfeeding has been tried in an attempt to reverse catabolism but this does not work and is associated with a poor outcome. It can cause uraemia, hyperglycaemia, hyperlipidaemia, fatty liver (hepatic steatosis), hypercapnia (especially with excess carbohydrates) and fluid overload. It is probable that at least some of the risks of parenteral nutrition are actually related to overfeeding and



some people now recommend deliberate underfeeding (aiming to meet roughly 85% of requirements).

- 5.5.2.2 Propofol (either 1% or 2%) comes in 10% Intralipid and where it is being used for sedation this must be included in the calculations for nutritional support if over feeding is to be avoided.

5.5.3 **Hyperglycaemia**

- 5.5.3.1 Hyperglycaemia can be related to overfeeding but is often not; critically ill patients become insulin resistant as part of the stress response. Strict control of blood glucose has been shown to have a profound effect on mortality in a study primarily of post surgical intensive care patients, reducing ICU mortality by almost half (from 8.0% to 4.6%) as well as reducing in-hospital mortality, length of stay, ventilator days, incidence of septicaemia and requirements for both dialysis and blood transfusion. The patients who benefited most were those who stayed on ICU for more than 5 days.
- 5.5.3.2 Medical patients on ICU for more than 3 days have also been shown to derive some benefit from tight glycaemic control however the effects were not so marked and there was an apparent increase in mortality in patients on ICU for less than 3 days. It has been suggested that prevention of hyperglycaemia should be the target of treatment in the first three days (glucose < 8.3 mmol/l or 150mg/dl) and then if the patient is still critically ill to then aim for tighter control (4.4 – 6.1 mmol/l or 80 – 110 mg/dl).

5.5.4 **Specific complications of enteral nutrition**

- 5.5.4.1 The complications that relate to the various routes of enteral feeding have already been discussed. The commonest risk with enteral feeding is aspiration of feed causing pneumonia. The implementation of a combination of measures similar to those listed earlier as well as a nurse education programme and good oral hygiene has been shown to



decrease the risk of ventilator-associated pneumonia. Diarrhoea can also be a problem but is not an indication to stop feeds. Other causes of diarrhoea need to be excluded but if enteral feeds are the cause then a feed with more fibre can be tried.

6. Responsibilities

6.1 Role of the Dietician:

- 6.1.1 Effectively identifies patients who are malnourished
- 6.1.2 Implements appropriate nutritional treatment plans
- 6.1.3 Development and implementation of evidence-based guidelines and protocols
- 6.1.4 Contributes to provision of teaching and education for clinicians, nurses and allied health professionals
- 6.1.5 Participate in consultant-led ward rounds
- 6.1.6 Advise on the most appropriate evidence-based nutritional treatment plans
- 6.1.7 Setting nutritional goals
- 6.1.8 Providing ongoing monitoring and support.
- 6.1.9 Educate junior doctors on electrolyte replacement, prokinetic agents, bowel management, and feeding complications

6.2 Role of the Physician:

- 6.2.1 Referral to a certified dietician within the healthcare setting to conduct a nutrition assessment and nutrition prescription
- 6.2.2 Discuss type of nutrition support to be provided and continuously monitor this patient's outcomes until ICU and hospital discharge
- 6.2.3 Meet regularly with the nutrition support team to discuss current and past cases and identify gaps that need to be filled so that future cases can be managed smoothly



6.3 Role of the Nurse:

- 6.3.1** Assist in screening the ICU patient.
- 6.3.2** Ensure to follow the proper timing of delivering the nutrition therapy and the proper dosing that has been prescribed, to avoid over or underfeeding and to enhance proper recovery metabolism.
- 6.3.3** Assess patients for any signs of overfeeding indigestion or complications and report it immediately with the doctor.
- 6.3.4** Make sure to document caloric intake, complications encountered and further remarks in tools, and in the nursing Kardex.
- 6.3.5** Meet regularly with the nutrition support team to discuss current and past cases and identify gaps that need to be filled so that future cases can be managed smoothly.



7. Document History and Version Control

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8. Related Documents:

There is no related document for this guideline



9. References:

Title of book/ journal/ articles/ Website	Author	Year of publication	Page
Nutritional support for children during critical illness: European Society of Pediatric and Neonatal Intensive Care (ESPNIC) metabolism, endocrine and nutrition section position statement and clinical recommendations/Intensive Care Med	Lyvonne N. Tume ^{1,2*} , Frederic V. Valla ³ , Koen Joosten ⁴ , Corinne Jotterand Chaparro ^{5,6} , Lynne Latten ⁷ , Luise V. Marino ⁸ , Isobel Macleod ⁹ , Clémence Moullet ^{5,6} , Nazima Pathan ¹⁰ , Shancy Rooze ¹¹ , Joost van Rosmalen ¹² and Sascha C. A. T. Verbruggen ⁴	2020	46:411-425
Nutrition Therapy and Critical Illness: Practical Guidance for the ICU, Post ICU, and Long Term Convalescence Phases/ Critical Care	Arthur Raymond Hubert van Zanten, Elisabeth De Waele, and Paul Edmund Wischmeyer	2019	23:368
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