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Nurition and Mechanical Ventilation: a Review Article

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Abstract: Patients with critical illnesses are frequently need mechanical ventilation as part of their care, in addition to or instead of spontaneous breathing. In certain situation, poor CO_2 elimination (ventilation failure) is the primary issue. Malnutrition is one of the issues that can occur in patients on mechanical ventilation. Patients in critical condition are typically incapable of consuming enough food to meet their metabolic needs. Enteral nutrition, parenteral nutrition, or mix of two are able to provide nutritional intake. Enteral nutrition can help maintain the intestinal wall's functional integrity by protecting intraepithelial cells, increasing blood flow, and encouraging the production of endogenous trophic agents. In the meantime, parenteral nutrition (PN) must be administered if the patient's nutritional needs are not satisfied within three days, as malnutrition typically develops eight to twelve days following surgery and/or ICU admission. Numerous studies comparing the effects of (enteral nutrition) versus PN nutrition on ICU LOS and mechanical ventilation have found no discernible differences between the two. When comparing EN to PN nutrition, there is a noticeable difference in how well EN reduces infectious complications.

Keywords: Critical illness, intensive care unit, mechanical ventilation, nutrition

Introduction

Anorexia and an inability to take oral intake are symptoms of critical illness, particularly in patients who are mechanically ventilated. Frequent alterations in intestinal absorption and catabolism are also linked to critical disease. Malnutrition (under- or over-nutrition) is a common pre-existing condition among patients with serious illnesses. This causes patients to have a higher risk of morbidity and mortality, nutritional deficiencies, muscular wasting, delayed wound healing, and slower recovery. There is agreement that additional nutritional assistance is required and improves patient outcomes even if there has lately been much disagreement over the kind, time, and volume of nutritional treatment that mechanically ventilated patients need (McClave et al., 2016).

Instead of simply providing meals to prevent malnutrition, nutritional support in the ICU is intended to accomplish metabolic optimization and attenuation of stress-induced immunological responses. As a result, providing nutritional support is thought to be a crucial part of managing critically ill patients. The enteral route is favored for delivering early nutritional support, according to European, Canadian, and American clinical

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practice standards (Padilla et al., 2019). This explanation serves as the foundation for the discussion of nutritional support provided to patients with serious illnesses who utilize mechanical ventilator.

Providing nutrition to patients with mechanical ventilation is very important, because the patient is critical and cannot consume nutrition orally. Utilizing better substrates, preventing mucosal atrophy, maintaining intestinal integrity, which can support the release of gastrin and other gastric hormones, and maintaining immunoglobulin A levels, which can help modulate the systemic immune response to stress and lessen the severity of disease are some of the positive effects of EN (McClave et al., 2016).

In certain cases, giving these nutrients to people who are experiencing chronic pain does not produce the desired outcomes. High amounts of stomach waste may accumulate after EN treatment, germs may colonize, and the risk of aspiration pneumonia may rise (McClave et al., 2016).

Parenteral nutrition (PN) is a supplementary or alternative option when other routes have not worked (though not always completely), or when using other channels is not feasible or safe. Parenteral nutrition's (PN) key objective is to safely deliver a combination of nutrients that are closely matched to demands while avoiding difficulties. Parenteral nutrition (PN) given to critically ill patients right away is frequently accompanied by a number of problems. In addition, if there are contraindications for enteral nutrition (EN), the 2018 ESPEN recommendations advise that parenteral nourishment might be administered within 24-48 hours. Parenteral nutrition (PN) should be administered right away, ideally within 44 minutes, as this can shorten the time spent on the ventilator and increase mortality (Singer et al., 2019).

Mechanical Ventilation

When under general anesthesia or in the intensive care unit, mechanical ventilation is typically necessary as a form of support. Over 300 million operations are thought to be carried out annually, with the majority of those involving patients on mechanical ventilation (Weiser et al., 2016). Over 4 million patients are admitted to intensive care units (ICUs) annually in the United States alone; roughly 40% of these patients are on invasive mechanical ventilation at any given time. Given the vast number of patients worldwide who require mechanical ventilation, it's critical to think about the kind of monitoring that should be employed to reduce patient risk while on mechanical ventilation (Wunsch et al., 2014).

One life-saving technique frequently employed in inpatient care is invasive mechanical ventilation. The number of patients requiring mechanical ventilation is rising as a result of several factors, including an aging population (Walter et al., 2018). Patients who are extremely sick frequently need mechanical ventilation in addition to or instead of spontaneous breathing. In certain situations, poor CO2 elimination (ventilation failure) is the primary issue. Under certain circumstances, mechanical ventilation might be utilized as a supplement to treat hypoxemia (Butterworth et al., 2022).

An endotracheal, or ET, tube is inserted into the mouth, nose, and down the throat of the patient to connect them to the ventilator. Gas—air plus oxygen—is blasted into a person's lungs by a ventilator when necessary. It can assist someone by doing their breathing for them or just by helping them with their breathing. Higher oxygen levels than those offered by masks or other devices can be obtained with ventilators. Positive end expiratory pressure (PEEP) is another feature that ventilators can offer. This keeps the lungs open and prevents the collapse of the air sacs. If a person has a mild cough, a tube in the throat also facilitates mucus expulsion (Tobin et al., 2017).

Positive pressure ventilation and negative pressure ventilation are the two methods that are available. Lung inflation is accomplished during positive pressure ventilation by delivering positive pressure to the upper airway on a regular basis via a tracheostomy or tracheal tube (noninvasive mechanical ventilation) or a tight-fitting mask. Inspired gas flow and pressure can be adjusted to overcome increased airway resistance and decreased pulmonary compliance. Changes in ventilation-to-perfusion relationships, possible adverse effects on the circulatory system, and the possibility of pulmonary barotrauma and volutrauma are the main drawbacks of positive pressure ventilation (Tobin et al., 2017).

Because blood flow (which is influenced by gravity) is dependent on areas in need, whereas gas flow is directed to more compliant and nondependent lung areas, positive pressure ventilation results in an increase in physiological dead space. Increased intrathoracic pressure impairs blood return to the heart, which is the primary cause of decreased cardiac output. While volutrauma is linked to recurrent alveolar collapse and reexpansion, barotrauma is closely associated with recurrent high peak inflation pressures and underlying lung disease (Butterworth et al., 2022; Tobin et al., 2017).

Ventilator Mode

Ventilator mode is a combination of control variables, breath sequence, and target scheme. Control variables are independent variables in ventilator mode. The options are pressure, volume, and flow. In pressure-controlled ventilation (PCV), pressure is an independent variable, and the pressure waveform is defined (e.g., rectangular waveform). In volume-controlled ventilation (VCV), volume waveforms have been described (Butterworth et al., 2022).

Until the predetermined tidal volume is reached and the ventilator cycle transitions to an exhalation, the VCV supplies gas flow. Airway resistance, lung and chest wall compliance, and other factors can affect the inspiratory pressure generated in the pulmonary system, even though the machine's tidal volume remains constant from breath to breath. For instance, even though the delivered tidal volume stays constant, the inspiratory pressure will rise if lung compliance falls or airway resistance rises. According to Gallagher (2018), VCV is the mode that is most frequently used in conjunction with synchronized intermittent mandatory ventilation (SIMV) or breath delivery assist-control (AC) ventilation (Gallagher, 2018).

Rather than being delivered to a predetermined tidal volume, PCV delivers the gas flow to a targeted inspiratory pressure limit. Until the ventilator cycles to exhalation, the inspiratory pressure limit is maintained for the predetermined amount of time. Breath to breath, pressure is regulated or limited, but tidal volume is subject to change based on lung and chest wall compliance as well as airway resistance. For instance, inspiratory pressure may be reached more quickly when pulmonary compliance falls or airway resistance rises, which would limit the tidal volume given. On the other hand, higher pulmonary compliance could lead to higher tidal volumes being delivered. PCV can be paired with SIMV and AC ventilation, just like VCV. Moreover, PCV can be utilized with the pressure support (PS) feature (Gallagher, 2018).

In ventilator mode, a breath sequence can be either mandatory or spontaneous. Three different breath sequences are possible. A sequence known as continuous spontaneous ventilation (CSV) involves only spontaneous breathing. A breathing pattern known as intermittent mandatory ventilation (IMV) alternates mandatory breaths with spontaneous breaths. All breathing, including the patient's own, is required under continuous mandatory ventilation (CMV) (Butterworth et al., 2022). Five breathing patterns are obtained by combining three breath sequences with two types of control variables (volume control [VC] and pressure control [PC]): VC-CMV, VC-IMV, PC-CMV, PC-IMV, and PC-CSV. The patient controls the duration and volume of their breaths in the sixth, VC-CSV, mode. Nevertheless, the patient is unable to gauge their breath size in VC mode (Pham et al., 2017).

Oxygen and Nutrition Needs in Critical Patients

Hypoxemia, or extremely low blood oxygen levels, can result from critical illness and cause tissue damage as well as death. Thus, the primary goal of emergency medical response to critical illness is to prevent hypoxemia. On the other hand, elevated inspired oxygen levels can cause atelectasis, coronary and cerebral vasoconstriction, and other direct damage to lung tissue. Apart from the direct and indirect effects of oxygen therapy, aggressive compensation used to normalize oxygen saturation may cause lung damage in certain patients, and some patients become difficult to ventilate (O’driscoll & Smith, 2019).

The British Thoracic Society's 2017 guidelines for emergency oxygen use suggest a saturation target of 94–98%. The most recent recommendations from Siemieniuk et al. are ≤ 96% for all patients receiving additional oxygen therapy, 92–94% for the majority of patients, and 90–92% for certain conditions like myocardial infarction or stroke (O’driscoll & Smith, 2019).

It's crucial to provide nourishment to manage the changes that come with Critical Illness. It's critical to assess energy requirements in order to understand the goals set for nutrition provision. Even for brief periods of time, overfeeding can result in hyperglycemia and increase the amount of time a patient spends on a ventilator. On the other hand, a greater calorie deficit may also lengthen the need for a ventilator (Gallagher, 2018).

The most commonly used or recommended method is indirect calorimetry (IC), but most institutions may not have access to or be able to afford it, making it challenging to predict a patient's energy needs during a critical illness. An easy formula to calculate energy needs is 25–30 kcal/KgBB/day. When providing nutritional therapy, it is important to consider the additional energy provided by fluids containing dextrose and lipid-based medications like propofol in order to meet target goals (McClave et al., 2016).

Immune function protein synthesis will rise in stressful circumstances, like a serious illness, to aid in healing. There is a chance that skeletal muscle mass will be rapidly lost during this process, which would supply precursor amino acids (Lambell et al., 2020). As a result, patients who get enough protein survive longer than those who don't, spend less time in the intensive care unit, and spend less time disconnected from a ventilator. The estimated protein target in critical illness, according to the SCCM/ASPEN guidelines, is 1.2–2.0 g/KgBW/day; however, patients with specific clinical conditions (such as burns, obesity, and multiple traumas) must receive higher protein (Lambell et al., 2020).

Critical Patient Nutrition

According to McClave (2016), patients with critical illness exhibit a hypercatabolic state characterized by a systemic inflammatory response, prolonged hospitalization, increased morbidity, and disproportionate mortality. In light of this, nutritional support serves as an intervention therapy to stop body mass loss and metabolic damage (Elke et al., 2016). Since food is a basic human need for survival, health, and development at every stage of life, it is crucial to provide it in hospital settings, particularly in the intensive care unit. For the record, administering nutrition as a supporting therapy is a medical therapy that requires caution and estimation based on needs because improper management can result in side effects (Sharma et al., 2019).

How to calculate and administer nutrition to critical patients

In critically ill patients, the goal of nutrition is to provide enough calories and protein while avoiding overfeeding or refeeding syndrome, which can lead to hypercarbic respiratory failure, hyperglycemia, hyperosmolar non-ketotic coma, hyperlipidemia, uremia, and hypertonic dehydration (Lambell et al., 2020).

Analyzing the patient's nutritional status should be the first step in determining their calorie and protein requirements when dealing with critically ill patients. It is advisable to look for a history of anorexia, weight loss, nausea, vomiting, and diarrhea. Nutritional deficiencies (dermatitis, cracked skin, glossitis, or poor wound healing) should be looked for during a physical examination (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

When calculating calorie and protein requirements for critically ill patients, a patient's body weight is typically used as a shortcut due to the numerous measurements needed and the general impracticality of doing so. The daily requirements for calories are 25–30 kcal/kg and protein are 1.2–2.0 gr/KgBB. Protein needs can rise in patients with multiple trauma and burns by 2-2.5 g/kg. Generally, between 60% and 80% of total calories come from carbohydrates, 20% to 40% from fat, and 10% to 20% from protein (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Indirect calorimetry or the Harris-Bennedict equation formula (table 1) can be used to estimate energy requirements. In patients with hypermetabolism, the stress factor needs to be supplemented with the Harris-Bennedict equation. Research, however, indicates that the energy requirements formula derived from this procedure tends to overestimate energy expenditure in patients with critical illnesses by as much as 15%. Many professionals determine daily caloric requirements using the "Rule of Thumb," which is a straightforward formula that reads 25–30 kcal/kgbb (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

In addition, before giving nourishment, the Resting Energy Expenditure (REE) needs to be ascertained. The amount of energy required to sustain life at rest and for 12 to 18 hours after eating is measured by a test called REE. BER (Basal Energy Requirement), BMR (Basal Metabolic Rate), and BEE (Basal Energy Expenditure) are other common names for REE. Precise BEE estimations can lessen the consequences of overnutrition, or overfeeding, including pulmonary compromise and fatty infiltration of the liver. There are numerous ways to estimate BEE; one of the most well-liked approaches is calorimetry, which is advised for use in measuring BEE in patients who are very sick. Depending on the patient's condition, BEE can change by up to 40% or down by up to 30% (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017)

Table 1. Formula for estimating energy needs (Olerich and Rude, 1994)

Calculation of Basal Energy Expenditure (BEE)

Harris-Benedict equation:

Man: 66,47 + (13,75 x weight) + (5 x height) - (6,76 x Age)

Woman: 655,1 + (9,56 x weight) + 1,85 x height) – (4,67 x Age)

The average BEE is close to 25 kcal/kgbb/day

Stress Factors

Corrections to the calculation of degree energy requirements hypermetabolism:

* Postoperative (without complications) 1.00 – 1.30

* Cancer 1.10 – 1.30

* Peritonitis / sepsis 1.20 – 1.40

* Multiple organ failure syndrome 1.20 – 1.40
* Burns 1.20 – 2.00
(BEE estimate + % body surface area burned)

Correction for energy requirements (kcal/day) = BEE x stress factor

Enough protein is needed to support paracrine messengers, active immune cells, protein synthesis, and the healing process of wounds. It is necessary to keep serum glucose levels between 100 and 200 mg/dL. Uncontrolled hyperglycemia increases the risk of sepsis, which has a 40% fatality rate, and non-ketotic hyperosmolar coma. One of the most dangerous metabolic side effects of Refeeding Syndrome is hypophosphatemia. Life-threatening complications such as respiratory insufficiency, cardiac abnormalities, central nervous system dysfunction, erythrocyte dysfunction, leukocyte dysfunction, and difficulty quitting respirator use are linked to severe hypophosphatemia (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Implementation of Assuring Nutrition in Patients with Mechanical Ventilation

As of right now, the biggest obstacle to providing adequate nutrition for ICU patients is that between 30 and 50 percent of them do not get enough protein and energy each day (Peev et al., 2015). Enteral nutrition is typically not fulfilled to the desired level in critically ill patients, particularly those on mechanical ventilation. An international multicenter study's findings revealed that, on average, patients undergoing mechanical ventilation and receiving enteral nutrition were only meeting 59% of their total energy requirements (Stewart et al., 2016).

Enteral nutrition can be given through a number of different tubes, such as nasojejunal, nasoduodenal, gastrostomy, jejunostomy, and others. According to Ferrie et al. (2011), the gastric route has several benefits over other routes for enteral nutrition delivery, including a large capacity, cost effectiveness, ease of installation, and the ability to administer boluses without the need for a drug pump. Prokinetics that increase intestinal motility include erythromycin and/or metoclopramide(Stewart et al., 2016). Prokinetic medications are advised to be administered if the gastric residual volume (GRV) is greater than 250 mL, according to the guidelines set forth by the American Society for Parenteral and Enteral Nutrition (ASPEN) (Robinson et al., 2018).

Enteral nutrition should be started in the first 24-48 hours following a critically ill patient's admission to the intensive care unit (ICU). There is a 48-72 hour "window of opportunity" to achieve optimal nutritional levels, which can impact morbidity and mortality. Food must be given within 24 to 48 hours in order to preserve the intestinal mucosa's structural integrity, low intestinal permeability, gut-associated lymphoid tissue, and decreased bacterial translocation in the intestine, all of which lower the risk of infection-related morbidity. Early enteral nutrition was found to significantly lower the incidence of infectious complications and hospital stay in a meta-analysis study (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

In order to avoid not meeting nutritional needs and prolonging periods of ileus, it is important to minimize the act of fasting a patient for diagnostic or other procedures. Before enteral nutrition is not required, patients receiving treatment in the intensive care unit should have their bowel movements, flatus, or defecation assessed (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Dietitians Association of Australia: Many literatures provide nutrition varying between 15-50 mL/hour for initial administration and then increasing. Boluses of 100-400 mL in 15 to 60 minutes at the same interval or continuously are among the options for enteral nutrition administration provided by the association. 10–50 mL/hour every four to twenty-four hours (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Bolus administration, according to ASPEN, begins with 120 mL administered three to eight times a day and, if tolerated, is increased to 60 to 120 mL every eight to twelve hours. This is accomplished 48 to 72 hours after the start of administration (Kim et al., 2012). providing nutrition in phases. In other words, nutrition is provided in the following manner: after four hours of test feeding with a 10% dextrose solution at a rate of 20 milliliters per hour, the GRV is measured, and if retention is less than half, liquid food is added gradually each day (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Nutritional needs should ideally be met 48–72 hours before metabolic disorders manifest. The amount of time needed to meet a patient's complete nutritional needs can affect their morbidity and mortality. The number of calories must have reached at least more than 50% to 65% of the target calorie needs in the first week of treatment in the intensive care unit. It is essential to meet calorie requirements of over 50% to 65% in order to avoid increased intestinal permeability. Nosocomial infections may become more common if calorie requirements are not met to the full 25 percent target (Elke et al., 2016; Lambell et al., 2020; McClave et al., 2016; Reintam Blaser et al., 2017).

Even though enteral nutrition needs to begin as soon as possible, there are a number of issues that must be resolved beforehand, making this challenging at times. Only after the patient's resuscitation has ended and their condition is stable, or as a result of a gradual nutritional procedure, can nutrition be administered. Gastrointestinal tract intolerance, which is characterized by symptoms of nausea, vomiting, ileus, abdominal distension, diarrhea, or high residual gastric volume, is another factor that can lead to the discontinuation of enteral nutrition (Yip et al., 2014).

Discussion

Patients with critical illnesses frequently need mechanical ventilation as part of their care. Patients who are extremely sick frequently need mechanical ventilation in addition to or instead of spontaneous breathing. In certain situations, poor CO2 elimination (ventilation failure) is the primary issue. In other situations, mechanical ventilation might be utilized as a supplement to positive pressure therapy (usually) to treat hypoxemia. In order to evaluate fluid balance in patients utilizing mechanical ventilation, precise monitoring of fluid intake and output is required. Malnutrition is one of the issues that can occur in patients on mechanical ventilation. When malnutrition is present, ventilator weaning needs to be corrected. Malnutrition is linked to decreased respiratory muscles and impaired ventilation drive in critically ill patients, which can result in a prolonged reliance on ventilators and an increased risk of infectious morbidity and mortality (Sharma et al., 2019).

Patients experiencing critical illness are susceptible to malnourishment and gastrointestinal disturbances, leading to the translocation of intestinal flora and endotoxins. This can consequently cause an immune system imbalance and exacerbate the patient's condition (Liu et al., 2020). According to Bouharras et al. (2015), patients in the intensive care unit (ICU) frequently have varied degrees of inflammation, which can lead to decreased energy and protein intake, increased energy expenditure, and protein catabolism. Regardless of prior malnourishment, every critical-illness patient has extremely varied immune and metabolic reactions to injury or disease, which may or may not be helpful and which may be influenced by nutrition (Bouharras et al., 2015; Padilla et al., 2019).

Patients with critical illnesses typically require nutritional support as part of their medical care because they are typically unable to maintain adequate nutritional intake to meet their own metabolic needs. Enteral nutrition, parenteral nutrition, or a mix of the two may be used in this (McClave et al., 2016). Enteral nutrition is a common fluid formulation that is infused via a stoma, catheter, or tube into the digestive tract to supply nourishment deep into the oral cavity (Robinson et al., 2018). Enteral feeding can be administered by nasogastric, nasoenteral, or percutaneous tubes inserted into the duodenum, jejunum, or stomach (post-pyloric). On the other hand, parenteral nutrition refers to the intravenous delivery of nourishment through a central or peripheral venous catheter (Robinson et al., 2018).

Patients who received food sooner—within 24 to 48 hours—had lower levels of food intolerances and a higher proportion of calories and protein. By maintaining intraepithelial cells, increasing blood flow, and encouraging the release of endogenous trophic agents (such as gastrin, cholecystokinin, bombesin, and bile salts), EN administration can support the functional integrity of the intestine (Robinson et al., 2018).

Here, preserving structural integrity can help mucosa-associated lymphoid tissue in distant locations like the lungs, liver, and kidneys by preserving the height of the villi and supporting the mass of secretory IgA-producing immunocytes that make up gut-associated lymphoid tissue. Time will determine how changes in intestinal permeability brought on by compromised intestinal integrity will manifest; if left unchecked, these changes will raise the risk of systemic infection, multiorgan dysfunction syndrome, and an increase in bacteria (McClave et al., 2016).

Intervention is necessary to provide perpetual nutrition for certain disease conditions. High CO2 levels in lung failure patients may affect when mechanical ventilation should be stopped (Robinson et al., 2018). Since EN has little clinical benefit overall, it is generally not advised to use high-fat, low-carbohydrate formulas (McClave et al., 2016).

Because of their multiple comorbidities and organ dysfunction, patients with kidney disease present a challenging nutritional assessment for those who need mechanical ventilation. Specifically, EN is given to help avoid electrolyte imbalances. Potassium is the serum electrolyte that needs to be taken into account; abnormalities in potassium can lead to arrhythmias and, in severe cases, death (McClave et al., 2016).

The use of EN is a wise decision for patients with liver disease since it can enhance nutritional status, lessen complications, and increase the patients' length of life. However, there is an increase in the serum concentration of amino acids, particularly glutamine, in cases of fulminant hepatic disorders, which results in an inefficient metabolism of nutrition. Therefore, the administration of EN is delayed in order to prevent an increase in ammonia and to give the injured liver a respite from metabolism and nutrient storage during stressful times (Reintam Blaser et al., 2017).

Individuals who are admitted to the intensive care unit and are put on mechanical ventilation frequently suffer from hypotension, which is frequently linked to septic shock, as well as multiple organ failure. If a patient's hemodynamics are stable, EN should be administered. 48-hour EN nutrition is advised due to the higher initial disease severity associated with early EN administration (Ortiz-Reyes et al., 2022). Mechanical ventilation is frequently necessary for patients with severe pancreatitis. Because EN administration can shorten hospital stays and reduce infectious complications, it is advised (Reintam Blaser et al., 2017).

In the event that the patient's nutritional needs are not satisfied within three days, parenteral nutrition (PN) must be given. This is because malnutrition typically develops eight to twelve days following surgery and/or admission to the intensive care unit (ICU). Enteral nutrition (EN) should be administered to all ICU patients who are not on a full oral diet within three days in order to prevent malnutrition and its associated side effects (Singer et al., 2009). For ICU patients, enteral nutrition (EN) is advised as the first line of treatment (Alsharif et al., 2020).

Enteral nutrition (EN) should be started 24 hours after ICU admission or 24–48 hours later, according to European (ESPEN) and Canadian (CSCN) clinical guidelines, respectively. Furthermore, since it has been shown that enteral nutrition (EN) reduces mortality more than parenteral nutrition (PN), if indicated, should also begin 24–48 hours after ICU admission. Contraindications to EN (bowel obstruction, short bowel syndrome, abdominal compartment syndrome, mesenteric ischemia, etc.) affect ten to twenty percent of intensive care unit patients (Singer et al., 2019).

The goal of recommendations for the amount of nutrition given to critically ill ICU patients during acute illness is to reduce negative energy balance by providing energy and measurable energy expenditure. ICU patients should be given 25 kcal/kg/day in the absence of indirect calorimetry, with the goal being reached in the next two to three days. Approximately 2g/kg of glucose per day is the minimal amount of carbohydrates required (Singer et al., 2019).

When parenteral nutrition (PN) is recommended, a balanced mixture of amino acids should be infused daily at a rate of 1.3–1.5 g/kg ideal body weight in addition to a sufficient supply of energy to meet protein requirements. Parenteral nutrition (PN) is recommended for ICU patients, and when amino acid administration is necessary, the amino acid solution should include 0.2–0.4 g/kg/day L glutamine (e.g. 0.3–0.6 g/kg/day alanyl dipeptide -glutamine) (Singer et al., 2009 (Singer et al., 2019).

In October 2006–2011, 1372 participants were recruited from hospital intensive care units in Australia and New Zealand for a multicenter study. The subjects were split into groups that received immediate parenteral nutrition (n=686) and standard care (n= 686). The evaluation criteria included body composition, infection, quality of life (QOL), and 60-day mortality. It is known from this study that the death rate on the sixtyth day did not significantly change. When compared to standard care, the parenteral nutrition group needed less time to administer parenteral nutrition (Doig et al., 2013).

There was no statistically significant difference observed in the day 60 all-cause mortality or ICU infection rates among critically ill patients who received parenteral nutrition within 24 hours of ICU admission and had short-term relative contraindications to enteral nutrition. Early parenteral nutrition patients required much less invasive mechanical ventilation; however, this did not translate into a statistically significant reduction in ICU or hospital stay duration. In this trial, early parenteral nutrition did not result in any harm. During the first six days of their ICU stay, patients who received early parenteral nutrition consumed significantly more energy and amino acids/protein (Doig et al., 2013).

Elke et al. conducted a meta-analysis that examined the impact of nutritional route (PN versus EN) on clinical outcomes. The study included 18 randomized controlled trials, totaling 3347 adult patients with critical illnesses. In general, there was no distinction in mortality between the two feeding methods. When EN was used instead of PN, there was a notable decrease in the amount of infectious complications and ICU LOS (length of stay), but there was no discernible difference in hospital LOS or mechanical ventilation (Elke et al., 2016).

Canadian clinical practice guidelines support this as well. Twelve level 2 and one level 1 study compare EN with PN in patients with critical illness who have an intact gastrointestinal tract. The groups receiving EN or PN did not appear to have different death rates when the data from these studies were statistically pooled. EN is linked to a notable decrease in infectious complications when compared to PN (Doig et al., 2013).

The meta-analysis carried out by Alsharif and colleagues. This showed that PN + EN was not linked to longer hospital stays, ICU stays, or the need for mechanical ventilation when compared to EN alone. But without changing other clinical outcomes, PN + EN was linked to lower ICU mortality and hospital-acquired infections. Furthermore, adult critically ill patients who receive both EN and PN consume more protein and energy (Alsharif et al., 2020). When comparing early versus delayed EN, the ESPEN guideline demonstrates that early EN results in fewer infectious complications (Singer et al., 2019).

Results of the study by Altintas et al. showed that in ICU patients, the outcomes of patients receiving PN were not significantly different from those of patients receiving EN, and feeding goals could be achieved with PN effectively, despite the fact that EN is generally recommended over PN in patients receiving mechanical ventilation and critical illness(Elke et al., 2016).

Conclusion

For the majority of patients who are critically sick, early internal nutrition administration is advised. However, patients with uncontrolled hypoxemia and acidosis, uncontrolled GI bleeding, marked intestinal ischemia, intestinal obstruction, and uncontrolled shock—in which hemodynamics and tissue perfusion goals are not met even with fluids and vasopressors—need to have enteral nutrition administered. Whereas in cases where enteral nutrition (EN) is contraindicated, parenteral nutrition (PN) can be administered within 24 to 48 hours. Parenteral nutrition (PN) must be administered immediately, with a mean time of approximately 44 minutes. This can shorten the duration of ventilator use and is linked to mortality.

Numerous studies comparing EN and PN nutrition have found no discernible differences between the two when it comes to ICU LOS and mechanical ventilation. When comparing EN to PN nutrition, there is a noticeable difference in how well EN reduces infectious complications. Thus, we assume that early EN should continuously applied to be first-line nutritional therapy in adult critical illness patients with a functional gastrointestinal tract, in line with recent guidelines.

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