Nutrition Therapy in the Patient with COVID-19 Disease Requiring ICU Care

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Introduction

- ***Following outbreak of Covid-19:*** Intensive care units (ICU) worldwide have become overwhelmed with the severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2)
- ***In ICU:*** the cornerstone in managing critically ill patients with COVID-19 is Good supportive care remains
- One of the important component of these supportive care: ***Nutrition***.

- The nutritional management of the ICU patient with COVID-19: very similar to any other ICU patient.
- Many of these recommendations are based on indirect evidence from critically ill patients in general and those with sepsis and ARDS.
- **Risk factors:** Obesity, Diabets, CVD, Malnutrition, ….

Topics

- Timing of Nutrition Delivery
- EN or PN: Tube Placement and Method of Nutrition Delivery
- Nutrition Goal, and Adjustments
- Formula Selection
- Monitoring Nutrition Tolerance
- Nutrition for the Patient Undergoing Prone Positioning
- Vitamins and minerals

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Timing of Nutrition Delivery

- Most important issue is timing of nutrition delivery.
- **Goal:** Initiating early enteral nutrition (EN) within 24-36 hours of admission to the ICU or within 12 hours of intubation.

- Early EN is recommended by both 2016 SCCM/**ASPEN** and 2019 **ESPEN** guidelines.

- **Meta-analyses:** provision of **early EN** to interventional patients improved **mortality** and **reduced infections** compared to controls for whom such therapy was delayed or withheld (McClave SA, et al., 2018 & Taylor BE, et al., 2016)

- ***EN has priority over PN***
- The majority of covid patients with sepsis or circulatory shock have been shown to tolerate early EN.
- **Unless** enteral feeding combined with escalating **vasopressors**: EN intolerance with symptoms of **ileus** (abdominal distention, vomiting).
- **In such cases: Early PN should be initiated**

- **High-risk patients include:**

1. those with sepsis or shock requiring vasopressors,
2. when high pressure respiratory support is required (NIV).

- **Bowel ischemia** is rare in shock (0.3%). But in COVID-19 disease concern for ischemic bowel may be greater and a prolonged ICU stay is expected, the threshold for switching to PN may need to be lower.

- **Different situations in COVID 19 patients:** Early **PN** will subvert concerns for **ischemic bowel** and **reduce droplet aerosol** transmission to healthcare

Tube Placement and Method of Nutrition Delivery

- ***EN is preferred to parenteral nutrition (PN).***
- **Stomach** via 10-12 Fr feeding nasogastric tube requires **minimal expertise** and facilitates earlier initiation of feeding.

- **If gastric feeding** is **unsuccessful** due to enteral **feeding intolerance**, use of a **prokinetic** agent to enhance motility is recommended as
- **The second step: Post pyloric EN** delivery

- **Difficulties:** airborne isolation and exposure to healthcare providers
- If possible, keep the patient's mouth covered during placement

- **Attention:** Post-pyloric feeding tubes tend to be smaller caliber and therefore are more likely to become **clogged**
- **Therefore,** in these high-risk patients, **frequent abdominal exams**.

- ***Continuous rather than bolus*** EN is strongly recommended, this is supported by both the **ESPEN** and **SCCM/ASPEN** guidelines.

- **Multiple meta-analyses** have shown a significant reduction in **diarrhea** with no differences in other outcome parameters with **continuous EN**.

- If the ***patient room allows for pumps*** to be placed "**outside**" the room, this should also include the feeding pump and bag set if possible.

- ***Early EN may not be preferential in a subset of patients with COVID-19 with gastrointestinal (GI) involvement.***

- **Before the onset of respiratory symptoms**, some patients initially present with **diarrhea**, **nausea**, **vomiting**, **abdominal discomfort** and in some cases **gastrointestinal bleeding**.

- **Some evidence** suggests that the development of **GI symptoms indicates greater disease severity**.

- **when present** early use of PN should be considered, transitioning to EN when GI symptoms subside.

- ***Pay attention when you want to prescribe PN:***

- Critically ill patients with COVID-19 disease have been reported to be **older** with multiple **comorbidities**.
- Such patients are often **at-risk of refeeding syndrome**.
- Thus, identifying pre-existing **malnutrition** or other **risk factors for refeeding syndrome** in critically ill patients is vital.

- **The first 72 hours** of feeding is the period of highest risk.

- **If refeeding syndrome risk** is present, we recommend starting at approximately **25% of caloric goal**, in either EN or PN fed patients, combined with frequent monitoring of serum **phosphate**, **magnesium** and **potassium** levels as calories are slowly increased.

Nutrition Goal, and Adjustments

- Feeding should be initiated with **low dose EN**, defined **as hypocaloric**, advancing to **full dose EN** slowly over the **first week of critical illness** to meet energy goal of **15-20 kcal/kg** actual body weight (ABW)/day (which should be 70-80% of caloric requirements).

- protein goal of **1.2-2.0 gm/kg ABW/day**.

- Nutrition requirements should take into consideration the use of **propofol** in terms of **lipid calories** and total calories needed.

Formula Selection

- A **standard high protein (> 20% protein**) polymeric **isosmotic enteral** formula should be used in the early acute phase of critical illness. As the **patient's status improves** and **vasopressor requirements abate**, addition of **fiber** should be considered.

- If there is **significant GI dysfunction** a **fiber free formula** may be better tolerated.
- **A fiber** containing formula or supplement should be attempted for the non-nutritional benefits to the **gut microbiota**.

- Animal models and a few small human trials suggest that **fish oil** containing formulations may be of benefit in **immune modulation** and helping to clear viral infections.

- ***If PN is required in the first week of ICU:***
- stay during **the acute inflammatory phase of COVID-19**, limiting steps should be taken for use of pure **soybean lipid emulsions** as outlined in published guidelines.

- Who receive **propofol** are rapidly developing severe **hypertriglyceridemia**. **Monitor serum triglyceride** levels in these patients receiving propofol and/or **intravenous lipid emulsions** early in their course (perhaps within 24 hours) after initiation of lipid containing products.

Monitoring Nutrition Tolerance

- **Enteral feeding intolerance** (EFI) is common during the early and late acute phases of **critical illness**.
- Early experience with COVID-19 patients suggests that **gastrointestinal symptoms (which might manifest as EFI) are associated with greater severity of illness.**
- **Gastric residual volume (GRV) monitoring is not reliable** for detection of delayed gastric emptying

- Patients should be monitored by daily **physical examination** and confirmation of **passage of stool and gas**.

Nutrition for the Patient Undergoing Prone Positioning

- SARS-CoV-2 may lead to acute respiratory distress syndrome (ARDS), necessitating invasive mechanical ventilation with lung protective and open lung ventilation. Despite these measures, some ARDS patients develop refractory ***hypoxemia*** **and prone positioning is an inexpensive technique to improve oxygenation and increase bronchial secretion clearance.**
- This strategy has been associated with **decreased ventilator-induced lung injury** and **increased survival in patients with severe acute** respiratory distress syndrome (ARDS) with refractory hypoxemia.
- Several retrospective and small prospective trials have shown EN during prone positioning is not associated **with increased risk of gastrointestinal or pulmonary complications**, thus we recommend the patient requiring prone positioning receive early EN.
- When EN is introduced during prone positioning, we recommend keeping the head of the bed elevated) to at **least 10 to 25 degrees to decrease** the risk of aspiration of gastric contents, facial edema and intra-abdominal hypertension.

Prone position

Vitamins and minerals

B vitamins

- B vitamins are water-soluble vitamins and work as part of coenzymes.
- Each B vitamin has its special functions.
- For example, vitamin B2 (riboflavin) plays a role in the energy metabolism of all cells.
- ***According to the ASPEN guideline in ICU patients:*** Vit B1 deficiemcy is common
- ***According to the literature:*** Vitamin B1 supplementation in ICU patients could reduce mortality rate

- **Vitamin B1 300 infusion for 1 week**

Vitamin C

- Vitamin C is another water-soluble vitamin
- Vitamin C is best known for its role in the synthesis of collagen in connective tissues and acts as an antioxidant.
- Also support immune functions and protects against infection caused by coronavirus.
- ***According to ASPEN vitamin C*** deficiency is common in ICU patients.

- ***According to the literature:*** COVID-19: Up to 82% critically ill patients had low Vitamin C values

Tomasa-Irriguible and Bielsa-Berrocal *Nutr J* (2021) 20:66
https://doi.org/10.1186/s12937-021-00727-z

Nutrition Journal

SHORT REPORT Open Access

COVID-19: Up to 82% critically ill patients had low Vitamin C values

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Abstract

There are limited proven therapeutic options for the prevention and treatment of COVID-19. We underwent an observational study with the aim of measure plasma vitamin C levels in a population of critically ill COVID-19 adult patients

Dose????

- ***Iran ministry of health and medical education guideline***: 1 gr daily in combination with vitamin E
- ***According to other literature:***
- Ying Wang et al., 2019: a meta-analysis: intravenous Vit C reduces the duration of vasopressor support and mechanical ventilation; **3–10 g** AA results in lower **overall mortality rates**.
- Jing Zhang, et al., 2021: A pilot clinical trial in China randomized 56 adults with **COVID-19** in the intensive care unit to receive intravenous (IV) vitamin C **24 g per day** or placebo **for 7 days**.
- The study reported improvements in **oxygenation**

- Fowler AA, et al., 2019: In a randomized controlled trial in critically ill patients with sepsis-induced ARDS (n = 167), patients who received IV vitamin C **200 mg/kg per day for 4 days** had levels of **inflammatory markers that were similar** to those observed in patients who received placebo. However, **28-day mortality** was lower in the treatment group.

- **Dimple Rawat, et al., 2021: A systematic review and meta-analysis of randomized controlled trials**
- Total 6 RCTs including n = 572 patients were included. Vitamin C treatment didn't reduce mortality, ICU length of stay, hospital length of stay and need for invasive mechanical ventilation.
- Well-designed RCTs with standardized control group needed on this aspect.
- Alberto Boretti, et al., 2020: **500 to 2000 mg**/d reduce **cytokines storm** in acute respiratory distress syndrome.
- NIH: Covid-19 treatment guidline: It is important to note that high circulating concentrations of vitamin C may affect the accuracy of point-of-care glucometers.

Vitamin C

Last Updated: April 21, 2021

Vitamin C (ascorbic acid) is a water-soluble vitamin that is thought to have beneficial effects in patients with severe and critical illnesses. It is an antioxidant and free radical scavenger that has anti-inflammatory properties, influences cellular immunity and vascular integrity, and serves as a cofactor in the generation of endogenous catecholamines.[1,2] Because humans may require more vitamin C in states of oxidative stress, vitamin C supplementation has been evaluated in numerous disease states, including serious infections and sepsis. Because SARS-CoV-2 infection may cause sepsis and acute respiratory distress syndrome (ARDS), the potential role of high doses of vitamin C in ameliorating inflammation and

Vitamin D

- Vitamin D is not only a nutrient but also a hormone, which can be synthesized in our body with the help of sunlight. In addition to its role in maintaining bone integrity, it also stimulates maturation of many cells including immune cells.
- 2,000 International Units daily. (Start with 5,000 IU/day for two weeks, then reduce to 2,000) ((Andrew W. Saul, et al., 2020; Seth R. Bauer, et al., 2020).

Zinc

- Zinc is a powerful antioxidant and is essential for many biochemical pathways.
- It has been shown to be effective in helping the body fight infections.
- A recommended dose is **20-40 mg/day** for adults (Andrew W. Saul, et al., 2020; Mujeeb Olushola Shittu, et al., 2020; Jennifer Hunter, et al., 2020).