Clinical Nutrition in critically ill COVID-19 patients caused by new coronavirus SARS-CoV-2

OBJECTIVE
Fighting coronavirus SARS-CoV-2 is currently the major task for Healthcare professionals (HCP) all over the world. This fact sheet is giving a brief overview of the nutritional support needed during the treatment of severe ill COVID-19 patients.

SUMMARY
• ASPEN and ESPEN call for action: do not forget nutrition therapy in patients with COVID-19.⁹,¹⁰
• Nutritional status of each infected patient should be evaluated.⁸
• All guidelines and recommendations available, regarding Clinical Nutrition in critically ill patients also apply for severely ill COVID-19 patients.¹¹
• Provide sufficient calories – enteral: 27–30 kcal/kg/d; parenteral (ICU): < 70% of energy expenditure (EE) in early phase, 80–100% after d³ ¹¹,¹²,¹³
• Provide sufficient protein/amino acids – enteral ≥ 1g/kg/d; parenteral (ICU): 1.3 g protein equivalents/d delivered progressively¹¹,¹²

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CLINICAL NUTRITION IN CRITICALLY ILL COVID-19 PATIENTS CAUSED BY NEW CORONAVIRUS SARS-COV-2

GENERAL INFORMATION ABOUT THE IMPACT OF THE NUTRITIONAL STATUS ON ELDERLY AND CRITICALLY ILL PATIENTS

Prevalence of malnutrition in hospitalized patients is generally high, especially in elderly people (Fig. 1). More than 55% of the geriatric patients in hospitals are malnourished. 2 A retrospective observational study in 6,518 adult critically ill patients has shown, that the survival of patients treated in medical and surgical intensive care units is connected to malnutrition. 3 In critically ill patients, malnutrition is independently associated with an increased risk of 28-day mortality. 4 Nutritional adequacy with respect to the compliance provided to prescribed calories matters. In critically ill patients requiring prolonged mechanically ventilation, the positive association between nutritional adequacy and long-term outcome has been confirmed. Patients receiving > 80% of their prescribed target energy have shown a significantly [after adjusting for covariates] lower 6-month mortality, compared to patients receiving between 50-80% (adjusted HR 1.0 (0.7 - 2.3)*) or compared to patients receiving only between 0-50% (1.7 (1.1 - 2.6)) of their energy target 5 (Fig. 2).

In respect to protein requirements a time-dependent association of protein intake and mortality was found. Ventilated patients show the lowest 6-month mortality when increasing protein intake from low (˂0.8 g/kg/day) on day 1-2 to intermediate (0.8-1.2 g/kg/day) on day 3-5 and high (≥1.2 g/kg/day) after day 5. Overall higher (> 0.8 g protein / day) or overall lower protein provision (< 0.8 g protein / day) results in lower survival rates. 4

FIG. 1 | Malnutrition in hospitals – association with age 

PREVALENCE OF MALNUTRITION [%]

<table>
<thead>
<tr>
<th>AGE (YEARS)</th>
<th>18-29.9</th>
<th>30-39.9</th>
<th>40-49.9</th>
<th>50-59.9</th>
<th>60-69.9</th>
<th>70-79.9</th>
<th>≥ 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>SGA A</td>
<td>20</td>
<td>30</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td></td>
</tr>
<tr>
<td>SGA C</td>
<td>40</td>
<td>50</td>
<td>60</td>
<td>70</td>
<td>80</td>
<td>90</td>
<td></td>
</tr>
</tbody>
</table>

FIG. 2 | Association of nutritional adequacy*** and long-term outcome in ventilated patients

SURVIVAL PROBABILITY

<table>
<thead>
<tr>
<th>SURVIVAL TIME IN DAYS</th>
<th>0</th>
<th>12</th>
<th>28</th>
<th>60</th>
<th>90</th>
<th>120</th>
<th>150</th>
<th>180</th>
</tr>
</thead>
<tbody>
<tr>
<td>N=475 pts mechanically ventilated in the ICU &gt;8 d.</td>
<td></td>
<td></td>
<td></td>
<td></td>
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</tr>
<tr>
<td>0-50% of target kcal</td>
<td>0.2</td>
<td>0.4</td>
<td>0.6</td>
<td>0.8</td>
<td>1.0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>50-&lt;80% kcal</td>
<td>0.6</td>
<td>0.8</td>
<td>1.0</td>
<td>0.8</td>
<td>0.6</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>&gt;80% kcal</td>
<td>0.8</td>
<td>1.0</td>
<td>0.8</td>
<td>0.6</td>
<td>0.4</td>
<td></td>
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</tbody>
</table>

SPECIAL INFORMATION REGARDING COVID-19

The mortality of critically ill patients with SARS-CoV-2 pneumonia is considerable. The survival time of the non-survivors is likely to be within 1-2 weeks after ICU admission. Older patients (>65 years) with comorbidities and Acute Respiratory Distress Syndrome (ARDS) are at increased risk of death. 6

The clinical course and the risk factors for mortality of adult patients with COVID-19 was investigated in Wuhan, China. Beside other factors, Albumin plasma concentration (in g/l) on admission, as a marker for protein synthesis, has been found to be very low 7 (9.1 (2.6 - 31.3)**** in non-survivors [n=54] compared to survivors (3.6 (3.0 – 36.4); n = 137; p < 0.0001).

In the absence of direct treatments for the COVID-19 virus, general treatments, coronavirus-specific treatment as well as antiviral treatments should be used. Nutritional status should be evaluated before starting of the general treatments. 8

The need for adequate nutritional support for COVID-19 patients is now also highlighted by different nutrition societies. ASPEN (American Society of Parenteral and Enteral Nutrition) is reminding all clinicians taking care for patients with coronavirus, that nutrition care is vital, particularly in patients with infections. 9

ESPIN (European Society of Parenteral and Enteral Nutrition) is highlighting on their website that of course, saving lives from acute complications is the first goal in the treatment of COVID-19. Nevertheless, nutritional status and nutritional care plays a very relevant role in defining both short- and long-term outcomes of these patients. In the growing COVID-19 patient population, the older, frail and comorbid individuals are those more at the risk for negative outcome and risks arising from related malnutrition. For the nutritional treatment of COVID-19 patients, ESPEN refers to the respective ESPEN guidelines for ICU, polymorbidity, geriatrics and home care. 10 11

SPECIAL INFORMATION FROM ESPEN AND PRACTICAL GUIDANCE FOR NUTRITIONAL MANAGEMENT OF INDIVIDUALS WITH SARS-COV-2 INFECTION 12

Recently, the ESPEN published their "ESPEN EXPERT STATEMENTS AND PRACTICAL GUIDANCE FOR NUTRITIONAL MANAGEMENT OF INDIVIDUALS WITH SARS-COV-2 INFECTION" 12.

In this document, the society is providing a detailed guidance for nutritional management in COVID-19 patients by proposing 10 practical recommendations. As there are currently no specific studies on the nutritional management in COVID-19 infection, the following ESPEN considerations are based on the best of knowledge and clinical experience at present.

DO NOT FORGET NUTRITION THERAPY IN PATIENTS WITH COVID-19.

* Adjusted for age, APACHE II, Charlston Comorbidity Score, organ failure; ** 95% Confidence interval; ***Total intake from EN, PN and propofol Ø 1,800 kcal prescribed (≤ 25 kcal / kg); ****Normal range 35 – 50 g/l; *****Given as median (inter-quartile range).
1. CHECK FOR MALNUTRITION
Patients at risk for worst outcomes and higher mortality following infection with SARS-CoV-2, namely older adults and polymorbid individuals, should be checked using the MUST criteria on, for hospitalized patients, the NRS-2002 criteria.
For the MUST criteria please refer to: https://www.bapen.org.uk/screening-and-must/must-calculator

2. OPTIMIZATION OF THE NUTRITIONAL STATUS
Subjects with malnutrition should undergo diet counseling from an experienced professional. Target is to optimize their nutritional status.

3. SUPPLEMENTATION WITH VITAMINS AND MINERALS
Subjects with malnutrition should ensure supplementation with vitamin A, vitamin D and other micronutrients. As part of the general nutritional approach for viral infections prevention is supplementation and for provision of vitamins to potentially reduce disease negative impact.
In general, low levels or intakes of micronutrients such as vitamin A, E, B6 and B12, Zn and Se have been associated with adverse clinical outcomes during viral infections. This notion has been confirmed in a recent review from Lei Zhang and Yuntui Liu who proposed that besides vitamins A and D also B vitamins, vitamin C, omega-3 polyunsaturated fatty acids, as well as selenium, zinc and iron should be considered in the assessment of micronutrients in COVID-19 patients.
ESPEN experts thus suggest to ensure the provision of daily allowances for vitamins and trace elements to malnourished patients at risk for or with COVID-19, aimed at maximizing general anti-infectious nutritional defense.

4. REGULAR PHYSICAL ACTIVITY
Patients in quarantine should continue regular physical activity while taking precautions. Prolonged home stay may lead to increased sedentary behaviors, such as spending excessive amounts of time sitting, reclining, or lying down for screening activities (playing games, watching television, using mobile devices); reducing regular physical activity and hence lower energy expenditure. Thus quarantine can lead to an increased risk for and potential worsening of chronic health conditions, weight gain, loss of skeletal muscle mass and strength and possibly also loss of immune competence.
There is a strong rationale for continuing physical activity at home to stay healthy and maintain immune system function in the current precarious environment.
Every day > 30 min or every second day > 1h exercise is recommended to maintain fitness, mental health, muscle mass and thus energy expenditure and body composition.

5. ORAL NUTRITIONAL SUPPLEMENTS (ONS)
ONS should be used whenever possible to meet patient’s needs, when dietary counseling and food fortification are not sufficient to increase dietary intake and reach nutritional goals.
ONS should provide at least 400 kcal/day including 30 g or more of protein/day and shall be continued for at least one month. Efficacy and expected benefit of ONS should be assessed once a month.

6. ENTERAL NUTRITION (EN)
In patients, whose nutritional requirements cannot be met orally, EN should be indicated or unsufficient.
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7. MEDICAL NUTRITION IN NON-INTUBATED ICU PATIENTS
If the energy target is not reached with an oral diet, ONS should be considered first and then EN treatment. If there are limitations for the enteral route it could be advised to prescribe peripheral PN in the population not reaching energy-protein target by oral or enteral nutrition.

8. MEDICAL NUTRITION IN INTUBATED ICU PATIENTS I
EN should be started through a nasogastric tube; post-pyloric feeding should be performed in patients with gastric intolerance after prokinetic treatment or in patients at high-risk for aspiration.

9. MEDICAL NUTRITION IN INTUBATED ICU PATIENTS II
In ICU patients who do not tolerate full dose EN during the first week, initiating parenteral nutrition (PN) should be weighted on a case-by-case basis.

10. NUTRITION IN ICU PATIENTS WITH DYSPHAGIA
Texture-adapted food can be considered after extubation. If swallowing is proven unsafe, EN should be administered. In cases with high aspiration risk, postpyloric EN or, if not possible, temporary PN during swallowing training can be performed.


The identification of at risk or presence of malnutrition should be an early step in general assessment of all patients, especially including older adults and individuals suffering from chronic and acute disease conditions.

Overlooking administration of adequate calorie-protein may result in worsening of nutritional status with malnutrition and related complications. Adequate assessment of energy intake is recommended with treatment with oral nutrition supplements or with enteral nutrition if oral route is insufficient.

80–100% of day 3. If predictive equations are used to estimate the energy need, hypercaloric nutrition > 70 % estimated needs should be preferred over isocaloric nutrition for the first week of ICU stay.

Energy requirements: During critical illness, 1.3 g/kg protein equivalents per day can be delivered progressively. Obese patients in the absence of body composition measures 1.3 g/kg “adjusted body weight” protein equivalents per day is recommended. Adjusted body weight is calculated as ideal body weight + 20 –100 % after day 3. If predictive equations are used to estimate the energy need, hypercaloric nutrition > 70 % estimated needs should be preferred over isocaloric nutrition for the first week of ICU stay.

Limitations and precautions: Progression to full nutrition coverage should be performed cautiously in patients requiring mechanical ventilation and stabilization.

Contraindications: EN should be delayed:
- in the presence of uncontrolled shock and unmet hemodynamic and tissue perfusion goals;
- in case of uncontrolled life-threatening hypoxemia, hypercapnia or acidosis.

Precautions during the early stabilization period: low dose EN can be started as soon as shock is controlled with fluids and vasopressors OR inotropes, while remaining vigilant for signs of lowest ischemia;
- in patients with stable hypoxemia, and compensated or permissive hypercapnia and acidosis.

General comments: In stabilized patients even in prone position, EN can be started ideally after measurement of IC with a target of 30 % of measured energy expenditure.

Increase energy administration progressively. Energy increases; predictive equation recommending 20 kcal/kg/day can be used, energy increased to 50–70 % of the predicted energy at d2 to 80–100 % at d4.

The protein target of 1.3 g/kg/day should also be reached by day 3 – 5. Gastric tube is preferred but in case of large gastric residual volume (above 500 mL), duodenal tube should be inserted quickly.
Enteral omega-3 fatty acids may improve oxygenation but strong evidence is missing.
If intolerance to EN is present, PN should be considered.
Blood glucose: maintained at target levels between 6–8 mmol/L.
Monitoring of blood triglycerides and electrolytes including phosphate, potassium and magnesium is recommended.

The post-extubation swallowing disorder could be prolonged for up to 21 days mainly in the elderly and after prolonged intubation, which makes this complication particularly relevant for COVID-19 patients.

INDIVIDUALS AT RISK OR INFECTED WITH SARS-COV-2

ICU PATIENTS INFECTED WITH SARS-COV-2
LITERATURE

9. ASPEN homepage: https://www.nutritioncare.org/Guidelines_and_Clinical_Resources/Resources_for_Clinicians_Caring_for_Patients_with_Coronavirus/