BAPEN
Putting patients at the centre of good nutritional care

Top Tips for the Use of Parenteral Nutrition in Critically Sick Patients with COVID-19

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This document aims to give guidance to healthcare staff who may be involved in providing nutritional support to patients with COVID-19 on a critical care unit. It addresses why, when and how parenteral nutrition (PN) may be used. Patients suffering from COVID-19 infection often have gastrointestinal (GI) tract symptoms (including diarrhoea/constipation) and the virus, detected in the stool of about 50%, is shed in the stool for a mean of 11 days after clearance from the respiratory tract. A loss of taste, smell and poor appetite occurs early in the illness and more severe GI dysfunctional problems, which may impair absorption, occur later in the disease. There are 2 types of patients: those with a primary COVID-19 infection and those who have another condition (e.g. postoperative, trauma, sepsis, etc.) and have a secondary COVID-19 infection. There are large national/international differences in the proportion of patients with COVID-19 being given PN (low prevalence in UK). This may reflect the ease of access to naso-enteric tube insertion services (also the tubes and pumps) and a worry about increasing the risk of venous thrombosis. This document assumes all staff are dressed in full personal protective equipment (PPE).

Key points

1. Patients may be undernourished or at risk of undernutrition when they are admitted to ICU (includes sarcopenic obesity) and may be at risk of refeeding problems. They should have a careful nutritional assessment and there should be a high suspicion of nutritional risk.
2. There should be early recognition of when enteral nutrition (EN) is unlikely to be successful, is not being successful and when it may be harmful.
3. Procedures for EN (e.g. nasogastric or nasojejunal tube insertion) are aerosol generating procedures (AGP) and have a risk of the healthcare worker being exposed to the virus.
4. Discussions about escalating treatment should commence early in the admission of severely affected patients and include the rationale for starting EN and where necessary progressing to PN.
5. PN should be started when EN is not possible, deemed to be unsuccessful (EN goals are not being achieved) or is harmful, in severely malnourished patients or those with intestinal failure.
6. PN is a relatively safe procedure with a low rate of catheter-related blood stream infection (CRBSI) and metabolic abnormalities (includes liver function tests) if the amount of PN is not excessive and there is good catheter care. Expert support/review should be available in the event of complications.
7. A dedicated, unused lumen of a central venous catheter (CVC) or peripherally inserted central catheter (PICC) with its tip at the vena cava/right atrial junction should be used for PN and cared for meticulously by appropriately trained staff.
8. PN should commence slowly, taking into account the risk of refeeding problems. Target requirements (energy and protein) are reached by day 3-5 (or day 4-7 if refeeding problems).
9. The energy contribution from non-nutrition sources should be considered when choosing a PN regimen (e.g. propofol) and the impact of extracorporal membrane oxygenation (ECMO) and haemofiltration/ dialysis should be considered when calculating energy and protein targets.
10. Hyperglycaemia is common and in severe cases the plasma glucose aims to be well controlled (generally less than 10-14 mmol/l depending upon the local ICU policy).
11. PN should be provided in the lowest volume possible to deliver adequate nutrition and so optimise the fluid volume flexibility outside of PN.
12. The fluid contribution from PN should be clearly documented and fit in with the fluid replacement goals.

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Explanations

1. **Nutritional screening/assessment:** Nutrition screening by a healthcare worker with relevant skills/experience should be carried out when the patient is first admitted to hospital using a tool that encompasses body mass index (BMI) and percentage weight loss (%WL), such as 'MUST'. A patient has typically been unwell, with little oral intake (food and drink), for about 14 days before being admitted to ICU; most of this time will have been at home. They are likely to have developed sarcopenia. Patients requiring admission to critical care should have a more detailed assessment by a healthcare worker with relevant skills/experience (usually a dietitian). Often the BMI and %WL will have to be estimated. Nutritional assessment should include nutritional status, nutritional requirements, risk of refeeding syndrome and a clear plan for meeting nutritional goals. It should consider premorbid state and co-morbidities.

   Most patients with severe COVID-19 have underlying health problems, including diabetes and hypertension, often associated with obesity. In these cases, with potential sarcopenic obesity, the nutritional goals and the risk of underfeeding must be taken into account.

2. **Intolerance/risks of oral/enteral feeding:** Patients who are sedated and ventilated will require artificial nutrition to address their nutritional needs; this is usually via a nasogastric feeding tube initially unless there are pre-existing problems with GI function. In accordance with the ESPEN 2019 Guidelines for the Nutrition in ICU, EN is considered the route of choice for artificial nutrition (except if severely malnourished or if intestinal failure with a secondary COVID-19 infection). The success of EN is not reported to be adversely affected by posture although there are reports of increased vomiting when prone. It can be difficult to determine if an enteral feed is being adequately absorbed. GI intolerance (inadequate absorption) is common and suggested by abdominal distention, vomiting/high aspirates, frequent watery/fatty stools, loss of weight (exclude fluid changes). It can be the result of the disease and/or the treatments (paralysis, sedation, opiates). If gastric residual volumes are measured in COVID-19 infection (not recommended in some guidelines due to the risk of aerosol generation); GI intolerance is suggested by an aspirate of more than 300 ml/4 hours. If absorption is suspected to be poor, drugs that reduce gut motility (e.g. opiates and cyclizine) and level of sedation (high levels delay gastric emptying) are reviewed, but it can be difficult to reduce the doses. Promotility drugs (metoclopramide or erythromycin), laxatives/enemas for constipation and a peptide EN feed may be tried to optimise GI tolerance.

   Patients with a continuous positive airway pressure (CPAP) hood might not have a naso-enteric tube placed due to concerns about its impact on hypoxia.

   If the dose of vasopressor drug is increasing, a switch to PN must be considered as the EN risks causing bowel ischaemia.

   There may be a reduced availability of experts in naso-jejunal tube insertion so that a change from gastric to jejunal feeding (which is the common therapeutic change when gastric feeding is unsuccessful) may not be easy to accomplish. Infrequent and remote review may contribute to a reluctance to acknowledge when the patient is not tolerating enteral nutrition. Nutrition strategies should be agreed to facilitate the regular review of patients requiring enteral nutrition in critical care units in order to identify those patients who are not achieving nutritional goals via the enteral route and these patients should have PN. For those with a secondary COVID-19 infection, an awareness of any underlying GI conditions, previous surgery and current GI anatomy are important and affect EN tolerance.

3. **AGPs:** NG and NJ tube placement are AGPs and are acknowledged as such in the European guidance (and by BAPEN). Aspiration of gastric residuals and of being in contact with stool may also pose a risk due to enteric viral shedding thus PPE is essential for staff performing these tasks.

4. **Discussions about PN:** The overall likely outcomes and plans for escalation of treatment, including recognition of malnutrition, poor tolerance of EN and when PN may be started, should be discussed early in the admission. The benefits of PN in giving a known amount of energy/fluid/vitamins and minerals should be stressed.

5. **Indications for PN:** PN is indicated in patients who are failing to tolerate EN for longer than 72 hours, despite maximum treatment (e.g. prokinetics, laxatives and naso-jejunal feeding). If EN fails to consistently deliver more than 60% of nutritional needs (energy and/or protein), supplemental or total parenteral nutrition should be considered.

6. **Safety of PN and reviews:** Currently there should not be a reluctance to use PN which reliably gives a patient all their nutritional needs (macronutrients, water, vitamins and minerals). Recent ICU non COVID-19 trials of EN compared with PN, where nutritional intake has not been excessive in the PN group, show there is no difference in infectious or metabolic complications, ICU length of stay or mortality. While PN may be perceived as complicated, the use of a standardised solution (multi-chamber bag [MCB]) in ICU is no different in principle to the use of a standardised enteral solution. A daily review by a full multidisciplinary nutritional support team is not needed and a sensible protocoled guidance (as for EN) should suffice. Approaches to review PN in critical care may need to be modified during COVID-19, due to the restrictions on staff entering critical care. However, arrangements are needed to ensure that appropriate calorie/protein goals are set for both EN and PN.

7. **Catheter care:** PN should be given via a dedicated, labelled, unused lumen of PICC or CVC (ideally the most distal lumen). It can be difficult to give meticulous attention to aseptic handling of a PN catheter in critical care as there are many reasons to access a catheter. Critical care nursing skills should include parenteral feeding catheter care as outlined in the BIFA standardised parenteral support catheter guidelines that include PN connection/disconnection and dressing change. The catheter tip should be cultured when removed if the patient has a fever or if there is a concern about CRBSI. Although it may be difficult in a pandemic, ideally PN should be connected and disconnected by nursing staff who have the required skills and competence.

8. **Initial hypocaloric PN:** Patients requiring PN are frequently at risk of refeeding problems and thus feed is commenced slowly, usually at 10-20 kcal/kg. The energy provision target is typically 70-80% of that predicted during the first week of critical illness (ESPEN 2020), and then increased to full requirements thereafter; these are calculated in the same way as for EN. Micronutrients/vitamins should be administered as standard. The protein goal of 1.3 g/kg/day is delivered progressively. There is no necessity to continue 'trophic' EN.

   Consideration should be given to the stock of MCBs available within hospitals and whether any changes are required in order to support the nutritional needs of patients requiring PN in critical care. Where PN and EN are both being delivered (e.g. when weaning off PN), care must be given to balance the nutrient provision from both routes and avoid overfeeding.

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9. **Other factors relating to macronutrient administration:** Due to the need for initial hypocaloric feeding and the potential contribution of calories from non-nutritional sources, including the high energy contributions from propofol (1.1 kcal/ml as soya based lipid emulsion), citrate in continuous renal replacement therapy (CRRT) circuits and glucose in peritoneal dialysis (PD) solutions, need to be taken into account. Triglyceride levels need checking especially while on propofol. The effects of ECMO and nutrient losses from haemofiltration/dialysis also need to be taken into account. There is no strong evidence for supplements of anti-oxidants/glutamine, although vitamin D may be given if the serum levels are low.
10. **Blood glucose:** Blood glucose control (6-10 mmol/L) is a key management aspect for all patients on ICU. Diabetics (both diagnosed and undiagnosed) are at higher risk of serious complications of COVID-19. In addition, blood glucose tends to be higher when the same amount of glucose is given in PN as in EN ('incretin' effect). Patients with COVID-19 may have pancreatitis, and those with the most severe illness are often diabetics. A sliding scale insulin regimen will be necessary for most patients. The total glucose load delivered from EN, PN, infusions and renal replacement therapies should be considered and care taken, especially as excess glucose may contribute to hyperglycaemia which increases carbon dioxide production and this may affect respiratory function.
11. **PN volume:** The PN bag on ICU aims to contain a standardised solution providing an appropriate basal electrolyte content in the smallest volume possible. This allows for separate electrolyte adjustment. This is different from PN given outside ICU, where the bag aims to include all a patient's fluid needs.
12. **Fluid goals:** These goals will differ according to whether the patient has a primary (generally kept on the dry side) or secondary COVID-19 infection and upon any GI or other fluid losses. Excess saline (0.9%) may be given to secondary COVID-19 patients usually with GI problems and can result in oedema, increased mortality, increased complications and increased length of the hospital admission. It is useful to remember that when 2 litres of saline were given to healthy subjects the albumin fell by 10 gm/L and this took 2 weeks to return to normal. Always take into account the amount of fluid, sodium and chloride given with medicines (e.g. intravenous antibiotics) before prescribing extra fluids or adding more electrolytes to PN.

Suggested reading:

- Barazzoni R, et al. ESPEN expert statements and practical guidance for nutritional management of individuals with SARS-CoV-2 infection. Clinical Nutrition 2020: https://doi.org/10.1016/j.clnu.2020.03.022
- Cawley C, Lal S, Nightingale J, Small M. British Intestinal Failure Alliance (BIFA) Guidance. Standardised Parenteral Support Catheter Guidelines: www.bapen.org.uk/pdfs/bifa/standardised-parenteral-support-catheter-guidelines.pdf
- Critical Care Specialist Group (CCSG) of the BDA. Guidance on management of nutrition and dietetic services during the COVID-19 pandemic: www.bda.uk.com/resource/critical-care-dietetics-guidance-covid-19.html and www.bda.uk.com/specialist-groups-and-branches/critical-care-specialist-group/covid-19-resources-and-links.html
- Harvey SE, Parrott F, Harrison DA, et al; CALORIES Trial Investigators. Trial of the route of early nutritional support in critically ill adults. N Engl J Med. 2014; 371(18): 1673-84.
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- Lobo DN, Stanga Z, Simpson JA, et al. Dilution and redistribution effects of rapid 2-litre infusions of 0.9% (w/v) saline and 5% (w/v) dextrose on haematological parameters and serum biochemistry in normal subjects: a double-blind crossover study. Clin Sci (Lond) 2001; 101(2): 173-9.
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- Martingdale R, Patel JJ, Taylor B, et al. Nutrition Therapy in patients with COVID-19 disease requiring ICU care. ASPEN 2020: www.nutritioncare.org/uploadedFiles/Documents/Guidelines_and_Clinical_Resources/Nutrition%20Therapy%20COVID-19_SCCM-ASPEN.pdf
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- Singer P, Blaser AR, Berger MM, et al. ESPEN guideline on clinical nutrition in the intensive care unit. Clin Nutr 2019; 38(1): 48-79.