

Management of Type 1 (short term reversible) Intestinal failure

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Type 1 intestinal failure (IF) is a short-term, self-limiting, and often perioperative, event resulting in the need for parenteral nutrition (PN). It can be due to an ileus, obstruction, enteric fistula or mucosal disease (e.g. after chemotherapy). Most cases are managed on surgical or critical care units. To prevent malnutrition and dehydration, these patients need PN under the guidance of a multidisciplinary nutrition support team (NST) who are in close collaboration with the primary team (e.g. surgical, oncological, haematological, etc).

Key points

1. The causal mechanism needs to be identified and treated.
2. If the cause has not resolved after 5 days (sooner if already malnourished) the patient should be considered for PN.
3. Nutritional assessment should include a detailed diet history, percentage weight loss (%WL) in the last 3-6 months, body mass index (BMI) and a functional assessment (e.g. grip strength).
4. Screening for the risk of refeeding problems should be undertaken and documented.
5. Predictive equations and/or the use of indirect calorimetry (e.g. in critical care) can be used to estimate energy requirements. Gastrointestinal losses of sodium, potassium and magnesium (e.g. vomiting, stoma or fistula losses) need to be taken into account when calculating estimated electrolyte needs.
6. A bespoke nutritional treatment plan with clear goals, including when to stop/wean PN, should be agreed.
7. Most patients' nutritional needs can be met with a lipid containing multi-chamber bag (MCB) with additional micronutrients; however, depending on fluid and electrolyte requirements, some may require specially compounded regimens.
8. It is important to check individual ingredients with the supplier if the patient has a documented allergy to egg, soya, nuts or fish.
9. The PN should be given through a central venous catheter (CVC) that has its tip at the superior vena cava/right atrial junction.
10. All clinicians handling the CVC should use an Aseptic Non-Touch Technique (ANTT®).
11. All PN bags should be protected from light during the infusion and administered via a filter no greater than 1.2 µm.
12. If catheter-related bloodstream infection (CRBSI) is suspected, the diagnosis should be made using paired (central and peripheral vein) blood sampling.

13. All patients should undergo regular ward-based National Early Warning Scoring (NEWS 2) and daily blood tests (see **Table 1**). The frequency of blood tests may be reduced if PN continues for a longer duration (e.g. a week) under the advice of the NST.
14. Assessment should look for symptoms/signs that IF is resolving (e.g. hunger, passing flatus/stool, less abdominal swelling, gastric aspirates or fistula fluid reducing/stopping and return of bowel sounds). When oral intake is resumed, the PN is gradually weaned.
15. If a patient remains on PN after 28 days, with no anticipated discontinuation, or develops complications beyond local expertise, they should be referred to an expert centre (e.g. an integrated IF centre or home parenteral nutrition [HPN] centre in England), especially if reconstructive surgery and/or long-term PN is likely to be needed.

Table 1: Minimum monitoring requirements for patient receiving PN

Ward monitoring	Temperature, heart rate, blood pressure and respiratory rate, oxygen saturation, level of consciousness or new confusion (NEWS 2 score)	Baseline then 6 hourly
	Blood glucose	Baseline then 6 hourly for 2 days then twice daily if normal blood glucose
	Fluid balance	Baseline then daily
	Body weight	Baseline then twice weekly
Blood test monitoring	Urea & electrolytes, calcium, phosphate and magnesium	Baseline then daily
	Full blood count, liver function tests, albumin and CRP	Baseline then twice weekly or as indicated

Explanations

1. The most common causes of Type 1 IF are post-operative, including ileus, mechanical obstruction (can be complete, partial or intermittent), enteric fistula, or extensive mucosal disease (for example, from chemotherapy). Enhanced recovery after surgery (ERAS) initiatives have reduced the incidence of post-operative ileus by rationalisation of intravenous crystalloid prescribing, minimising opioid medication, pre-operative carbohydrate drinks, and optimisation of surgical techniques to minimise bowel handling.
 2. PN should be considered in patients who are malnourished or at risk of malnutrition and have either an inadequate or unsafe oral and/or enteral nutritional intake; or a non-functional, inaccessible or perforated gastrointestinal tract. Patients at risk of malnutrition are those with little or no oral intake for more than 5 days and/or are likely to have little or no oral intake for 5 days or longer with poor absorptive capacity and/or high nutrient losses and/or increased nutritional needs. Patients who have undergone extensive surgery +/- bowel content spillage may be suitable for early PN.
 3. Nutritional assessment should include detailed diet history and weight history to help devise a bespoke nutritional care plan. This will also help the NST plan any long-term needs for nutritional support (e.g. tube feeding or oral supplements once the Type 1 IF resolves). Part of the ERAS programme promotes early mobilisation in the post-operative period to counteract the adverse physiological consequences of surgical stress and immobilisation.
 4. Clinicians need to be aware of refeeding problems and assume most malnourished patients are at risk. Intravenous thiamine should be given to patients starting PN if they are deemed at risk of refeeding problems. Hypophosphataemia is the most reported marker for a refeeding problem and occurs when artificial nutritional support is started; hypomagnesaemia, hypokalaemia, hypoglycaemia (occasionally hyper) and thiamine deficiency may occur. Refeeding syndrome carries a risk of death. As the sodium/potassium pump is reactivated, sodium is expelled from cells into the interstitial space and may cause oedema. Non-protein energy is given as 50/50 carbohydrate/lipid and initially at about 50% of estimated requirements for those at moderate risk of refeeding problems. For patients with a high risk of refeeding problems, a more cautious approach of 10 kcal/kg/day may be appropriate. Patients at risk of refeeding are likely to be deficient in vitamins (especially thiamine) and have a high risk of Wernicke-Korsakoff syndrome, so intravenous B vitamins (especially thiamine) are given. An intravenous dose of 200-300 mg thiamine on initiation of PN and then once daily for 3-5 days together with a balanced multivitamin/trace element preparation within their parenteral support is recommended.
 5. Estimated energy requirements are based on resting energy expenditure (REE). Additional factors (e.g. physical activity) are added to provide a figure for total energy expenditure (TEE). An appropriate estimation of TEE for patients requiring PN, once refeeding issues have been fully addressed, is 20-25 kcal/kg plus 20%. For mechanically ventilated patients in intensive care units the Penn State University equations may be more appropriate for calculating estimated energy expenditure. Indirect calorimetry may be valuable to help determine resting REE, particularly in the critically ill patients, although this may not be widely available. Obese patients' requirements should be adjusted to ideal bodyweight.
- For underweight and overweight patients, seek guidance from the Parenteral and Enteral Nutrition Group (PENG) Handbook for adjustments in estimations of energy requirements. Additional fluid and sodium needs are considered when estimating daily requirements. A small bowel output usually contains about 100 mmol/L sodium (range 80-140 mmol/l). In patients with fluid overload a dry weight should be used for estimating requirements. Consider prescribing smaller volumes of fluid (less than 20-25 ml/kg/day) for patients who are elderly, frail, have renal impairment or cardiac failure, malnourished and/or at risk of refeeding problems. Obese patients' requirements should be adjusted to ideal body weight, using the lower volume in this range.
6. An individual treatment plan should be given with clear aims and criteria for stopping/weaning from PN.
 7. Most hospitals will have a formulary with specific MCBs available for use. Micronutrients may be added by the manufacturer, appropriately resourced compounding units, or given by separate infusion.
 8. As with all medicinal products, patient allergies should be checked before prescribing PN. Lipid-containing PN contains eggs and soya and should be avoided in patients with egg/soya allergies. Cross-allergic reactions between soya and peanut proteins have also been observed and may impact on the use of certain intravenous (IV) multivitamin preparations. Manufacturers also advise against the use of lipid PN in patients with some nut allergies, and some lipid products contain fish oils that should be avoided in patients with a fish allergy (check with the supplier).
 9. PN in Type 1 IF is mostly administered through non-tunnelled multi lumen catheters, but can be administered via peripherally inserted central catheters (PICC) or tunnelled cuffed (Hickman™) devices, if the latter is already in place. The external diameter of the catheter should not exceed one third internal diameter of the vein. The tip of these devices should be between the lower third of the superior vena cava at the cavo-atrial junction. As non-tunnelled multi lumen catheters have different entry points into the bloodstream the most distal lumen should be used to administer PN. The least amount of vascular access devices to meet the patients' intra-venous requirements should be used. The CVC needs to be inserted using maximal sterile precautions.
- Non central vein (small or medium sized veins) (peripheral PN) can be considered if the patient has good venous access, and their requirements can be met with an appropriate PN regimen (osmolality less than 850 mOsm/kg). Short peripheral cannulas, extended dwell time peripheral cannulas or midline catheters may be used. To reduce thrombophlebitis, peripheral devices are ideally inserted using ultrasound, and as with CVC, the external diameter of the catheter should not exceed one third internal diameter of the vein. If a peripheral small vein cannula is used, the site should be changed every 72 hours to reduce the risk of local phlebitis.
10. Catheters for PN need to be inserted using maximal sterile precautions. The care of centrally and peripherally inserted catheters should use an ANTT® to reduce the risk of CRBSI. CRBSI is a major, potentially life-threatening, complication for patients receiving PN. Where PN is given by continuous infusion there may not be a spike in temperature, making CRBSI harder to recognise.

11. PN contains light sensitive components that are susceptible to degradation and, in some cases, cause harm if precipitates form within the bag. We recommend all PN is light protected during infusion. Light protective covers are usually provided by the PN manufacturer. PN should always be infused via a rate-controlled infusion pump and an IV administration set with a filter with pore size no greater than 1.2 µm.
12. Paired central and peripheral blood cultures are required to diagnose CRBSI, using qualitative (differential time to positivity) and/or quantitative assessment. Diagnostic failure may result in inappropriate intervention, including premature CVC removal or unnecessary delay in the provision of PN. All hospitals should audit their PN CRBSI rates on an annual basis.
13. When patients are started on PN they should be monitored to ensure that they do not develop complications associated with its administration. PN should not be started in any patient without prior baseline clinical and laboratory results. It is safer to wait until results of laboratory tests are available. **Table 1** describes the minimal monitoring requirements for patient receiving PN. It is important to note that serum albumin concentration is not a marker of nutritional status (a low value commonly reflects saline excess or inflammation) and should not be used to assess a response to PN. Serum micronutrients can be reviewed when CRP is less than 15 mg/L.
14. NICE guidance for starting PN is quite clear, but it is more difficult to be precise about guidance for stopping it. For most Type 1 IF patients it is clear when the need for PN is coming to an end. Resolution of ileus is suggested when the patient feels hungry, has less/no gastric aspirate, passes wind/stool, and bowel sounds return. It often occurs when oedema resolves (often associated with the albumin rising) and/or opioids/anticholinergic drugs have been stopped. A resolution of obstruction is when vomiting stops and stomal output/stool output/returns. There may be diarrhoea as obstruction resolves resulting in a need to adapt parenteral fluid prescriptions. Enterocutaneous fistulas may close spontaneously within 6 weeks; persistence beyond this time suggests that this will not happen. Those who have had an obstruction or fistula are advised to continue eating a diet low in fibre to reduce the chance of recurrence. The resolution of mucositis following chemotherapy is suggested by a return of appetite and the passage of a more normal stool. There is no minimum duration for PN support; PN should be stopped once adequate oral and/or enteral nutrition is established. Careful thought and caution should be given to patients at higher risk of poor or inadequate nutritional intake on stopping PN. Care should be taken about patients who were very malnourished before their acute event/operation, and for those whose energy and nitrogen (protein) requirements may be higher going forward (e.g. those with ongoing sepsis, acute pancreatitis, etc.). It may be appropriate for patient to receive longer term dietetic follow-up from the relevant speciality.
15. In some cases, patients with Type 1 IF may develop complications with progression to Type 2 or Type 3 IF. Such patients should be referred to an appropriate specialist centre (e.g. an NHS England designated integrated IF or HPN centre).

Suggested reading

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