Parenteral Feeding

Parenteral feeding is the intravenous administration of nutrients. This may be supplemental to oral or tube feeding, or it may provide the only source of nutrition as total parenteral nutrition (TPN).

Patient selection

Parenteral nutrition should be considered for all patients who are malnourished or at risk of malnutrition and have a non-functioning or inaccessible gastrointestinal (GI) tract, preventing enteral feeding. [1]

There is much evidence to support enteral over parenteral feeding in inpatients with functioning GI tracts. [2, 3]

Access

Peripheral lines may be used to deliver short-term nutritional support, but central access is necessary for parenteral feeding of more than two weeks' duration. Lines should be dedicated to feeding and must not be used for drug administration or blood sampling:

- **Central** catheters and ideally tunneled subclavian vein central lines, inserted using the full aseptic technique are the optimal method of access:
  - Parenteral nutrition solution is thrombogenic and an irritant to veins.
  - Central access allows delivery of more concentrated formulations into high-flow vessels.

- **Peripheral** administration is achieved through peripherally inserted central catheters (PICCs) or standard cannulae, inserted with an aseptic technique:
  - Tolerance to peripheral lines is increased with feeds of low osmolality and neutral pH and the use of soft paediatric cannulae.

The most appropriate site for central venous access will take into account factors such as the patient's conditions and the relative risk of infective and non-infective complications associated with each site. Ultrasound-guided venepuncture is strongly recommended for access to all central veins. [4]

Feed preparations

TPN solutions contain a balanced mix of essential and non-essential amino acids, glucose, fat, electrolytes and micronutrients:

- Iso-osmotic lipid emulsions are used to provide an energy-rich solution and reduce irritation of veins.
- Such preparations also permit a lower concentration of glucose to prevent hyperglycaemia or hyperosmolar dehydration.

A wide selection of preparations are produced under sterile conditions and are available as 3-litre bags of prepackaged solution.

Parenteral nutrition should be introduced at a low rate and gradually increased: [1]

- TPN is usually delivered at a continuous flow rate but cyclical regimens may suit longer use.
- Vitamins including folic acid are infused with the solution, but vitamin B12 must be prescribed separately.
Complications of parenteral feeding

**Re-feeding syndrome**

During starvation, intracellular electrolyte stores, particularly phosphate, are depleted despite normal serum concentrations. Feeding stimulates the cellular uptake of electrolytes and can lead to electrolyte disturbances with profound hypophosphataemia.

Clinical features usually develop within four days of re-feeding, but are often nonspecific. Later manifestations include rhabdomyolysis, cardiac failure, hypotension, arrhythmias, respiratory failure, seizures and coma. See separate article *Nutritional Support in Primary Care*.

**Catheter-related complications**[5]

- Immediate complications are mainly related to insertion and include haemorrhage, pneumothorax or haemothorax, arrhythmias or cardiac tamponade.
- Long-term catheter complications include thrombosis and pulmonary embolism, pleural or pericardial effusion, subacute bacterial endocarditis, chylothorax and venopulmonary fistula.

**Infection**

- This occurs in 1.3% to 26.2% of patients with central venous catheters used to administer parenteral nutrition.[6] Higher rates are found across the world, particularly in high-risk groups - eg, intravenous drug users.[7]
- More recently, parenteral nutrition products have been implicated in septicaemia in neonates.[8]
- Infections with staphylococcal and enterococcal species are common.[5] Candida spp., Klebsiella pneumoniae, and Pseudomonas aeruginosa are also found. In the long-term TPN population, approximately 60% of infections are caused by coagulase-negative staphylococci.
- There must be strict adherence to asepsis and solution bags and giving sets must be discarded after 24 hours of use.[4]

**Liver and gallbladder dysfunction**

- The majority of patients develop mild cholestasis with elevation of transaminases and alkaline phosphatase.
- Gallstones and gallbladder sludging may also occur.

**Hyperglycaemia**

Up to 30% of patients receiving nutritional support are hyperglycaemic. Tight glycaemic control is important in sick patients and so treatment with oral hypoglycaemic agents or insulin is often required.

**Monitoring**

Monitoring should include the general observations and laboratory schedule recommended for all forms of nutritional support.[1] The following schedule is recommended for all patients receiving parenteral nutrition:

- Baseline levels should include FBC, B12 and folate, U&Es including magnesium, phosphate and calcium, and glucose; LFTs, albumin, prealbumin, C-reactive protein (CRP), zinc and copper.
- Blood glucose should be monitored every 4-6 hours.
- Daily FBC, U&Es plus magnesium and phosphate should be taken if there is a high risk of re-feeding syndrome.
- LFTs, lipid profile, calcium, albumin, prealbumin, transferrin and CRP should be performed once/twice weekly.
- Zinc, iron, selenium and copper levels should be monitored every 2-4 weeks.
- Manganese and 25-OH vitamin D levels should be taken 3-6 monthly.

The frequency of most tests can be reduced once the patient's condition is stable. In addition there should be daily attention to:

- Peripheral lines for signs of thrombophlebitis.
- Centrally sited lines for signs of infection or inflammation.
Home therapy

Demand for home parenteral nutrition (HPN) - to facilitate hospital discharge - is rising, but access to local services may be limited. There are only two designated Intestinal Failure Units nationally: St Mark's Hospital, London and Hope Hospital in Salford. They are the only units to receive specific funding for this role, and are now oversubscribed.

Patients must receive training and information on HPN prior to discharge. An individual nutritional care plan is drawn up which includes feeding regimens and the required multidisciplinary input. Patients must be competent in the management of feeding systems and aware of common problems. All patients must be supported by a skilled team, which includes specialist nutrition nurses, dieticians and district nurses. Partnership with homecare companies for provision of HPN solutions and equipment is encouraged. GPs must also be closely involved to liaise with services and recognise potentially life-threatening complications.

Further reading & references

5. Complications of TPN Tutorial; RxKinetics
8. Torjesen I; Parenteral nutrition product is suspected as cause of 18 cases of septicaemia in neonates. BMJ. 2014 Jun 5;348:g3763. doi: 10.1136/bmj.g3763.
9. Malnutrition Universal Screening Tool (MUST); British Association of Parenteral and Enteral Nutrition (BAPEN)

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