

PARENTERAL NUTRITION ADMINISTRATION - SCH

PRACTICE GUIDELINE[®]

DOCUMENT SUMMARY/KEY POINTS

- RNs nurse must have successfully completed the learning and assessment competency for both IV medications and fluids and management of central venous access devices.
- PN must be ordered by a medical officer and faxed to sterile pharmacy. Orders must be in sterile pharmacy by 10am on weekdays and orders for the weekend should be sent by 10am Friday. No PN will be supplied without an order form.
- PN is ordered on the **Paediatric Parenteral Nutrition Order Form**
- Dietitian must be consulted for a nutritional assessment
- The Parenteral Nutrition Team must be consulted prior to commencement of PN

This protocol is to be read in conjunction with the following

- SCHN [Central Venous Access Device \(CVAD\) Practice Guideline](#)
- SCH [IV Fluid and Electrolyte Therapy Practice Guideline](#)

This document reflects what is currently regarded as safe practice. However, as in any clinical situation, there may be factors which cannot be covered by a single set of guidelines. This document does not replace the need for the application of clinical judgement to each individual presentation.

Approved by:	SCHN Policy, Procedure and Guideline Committee	
Date Effective:	1 st October 2015	Review Period: 3 years
Team Leader:	Clinical Nurse Consultant	Area/Dept: Gastroenterology SCH

CHANGE SUMMARY

- Note: Interim review –a project is underway that will review all Parenteral Nutrition processes: as a result, this document will be amended accordingly.
- Due for mandatory review- several changes have been made throughout this document: recommended re-reading the full document.

READ ACKNOWLEDGEMENT

- All clinical staff who prescribe and administer parenteral nutrition should read and acknowledge this document.
- Dietitians and Pharmacy staff should read and acknowledge this document.

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1 Parenteral Nutrition (PN)

Parenteral Nutrition (PN) is a means of providing patients with their daily nutritional requirements. It is used in a variety of situations and ideally each child should be individually assessed by a member of the PN team prior to commencement of PN. In infants, 2 to 3 days, and in older children 4-5 days, without adequate intake is an indication to discuss the appropriateness of starting parenteral nutrition with the PN team. However, the GI tract should be used whenever possible (even if volume of enteral feeding is non-nutritional) as enteral feeding maintains the structural and functional integrity of the gastrointestinal tract.¹

For this document, Parenteral Nutrition (PN) refers to glucose/amino acid solution and fat emulsion. Due to the nature of PN there is an increased risk of complications such as infection, compared to enteral feeding. It is therefore essential that all procedures undertaken are to utilise a clean non-touch technique. A modified sterile technique should be used if the clinician anticipates that the procedure will be lengthy or complex and there is a risk of contamination.¹²

The main components of PN are:

- A solution of glucose, amino acids and electrolytes
- Fat emulsion
- Vitamins
- Trace Elements (Zinc, Copper, Manganese, Chromium, Selenium and Iodine).

2 Standard

- Prior to undertaking PN management, the registered nurse must have successfully completed the learning and assessment competency plan for both intravenous medications and fluids and management of central venous access devices².
- PN must be ordered by a medical officer and faxed to sterile pharmacy. Orders must be in sterile pharmacy by 10am on weekdays and orders for the weekend should be sent by 10am Friday. No PN will be supplied without an order form.
- The PN dietitian, or their proxy, must be consulted for a nutritional assessment.
- In general, prescribers should use the standard PN formulations S ONC, S20, S4/20 or S10. Non-standard formulations may be requested but will only be dispensed after consultation with the PN Team.
- PN is ordered on the **Paediatric Parenteral Nutrition Order Form**.
- PN orders must be written up on the Fluid and Medication Prescription Chart. The orders should state the date, PN formulation, rate of infusion and period to be infused. In CICU orders may be written as "Ventilated/Non-Ventilated maintenance".
- If PN is to be titrated then the order needs to clearly state when and by what increment.
- Lipids are to be included in the total daily volume of maintenance fluids as a large proportion of fat emulsion is water⁹.

- Dextrose content should not exceed 10% in a peripheral line, i.e. S10 solution is 10% dextrose. However, a slightly higher concentration (of no more than 12%) is occasionally specified by the medical officer in extenuating circumstances (usually while awaiting a central catheter).
- PN solutions (bag & burette/syringe) should be protected from sunlight and phototherapy to reduce alteration of specific components and quality of PN solution ⁵.
- In children who have a Central Venous Access Devices (CVAD) for the **sole purpose** of providing total parenteral nutrition, blood sampling from the CVAD is **only** permitted if performed in conjunction with obtaining blood cultures. If a patient is clinically unstable this may not be achievable and should be discussed with senior medical staff.
- All PN and fat emulsion solutions must be changed every 24 hours. ^{1,2,4} Line changes for fat emulsions are performed every 24 hrs. ^{1,2,4}
- If the fat emulsion that is being infused requires utilisation of a secondary set via an appropriate pump, only the fat emulsion line needs to be changed every 24 hours.
- Line changes for PN solutions are performed every 72 hours as per SCHN CVAD Practice Guidelines. ^{1,2,4}
- **Peripheral lines:** PN solutions ideally should be administered via a central venous access device. Where the patient does not have a central venous access device in place or is unable to have one inserted S-10 PN solution may be administered via a peripheral line. **NOTE:** Some patients requiring PN can be managed using peripheral veins. Line management is vital to avoid complications such as extravasation and infection/line sepsis. If a patient requires PN for longer than 2 weeks, then central access should be provided for ongoing administration. ^{9,10}
- Fat emulsion (all strengths) is isotonic and may be administered peripherally.
- PN must be checked against the PN order form and medical treatment chart by two members of medical or nursing staff one of whom must be an RN prior to hanging. If there is a discrepancy between the PN solution and the orders clarify with the prescribing medical officer and/or the on-call pharmacist.
- PN must be checked at the beginning of each shift against the medical order by the RN caring for the child.
- Glucose/amino acid solution is usually administered over a 24-hour period. In some instances it will be administered over shorter periods upon advice from the PN team.
- Fat emulsion is usually administered over a 24 hour period. There are some instances where it will be administered over shorter periods, upon advice of the PN Team.
- PN should be removed from the refrigerator 1 hour prior to commencement of infusion in order to allow it to reach approximate room temperature. ¹¹
- If PN ceased/cycled/ weaned or stopped abruptly BSL should be measured after one hour to monitor for hypoglycemia¹ and/or as specified by the PN team. Accepted glucose levels may vary from patient to patient and should be discussed with the attending medical officer. If BSL is abnormal contact medical officer for advice.

3 Indications

Prior to commencement

- PN is indicated when Enteral Nutrition is insufficient or not possible to sustain nutritional requirements or; insufficient Enteral Nutrition is likely to continue for more than 5 days. The PN team must be consulted prior to commencement.

4 Initial assessment

An initial assessment of the patient should include a clinical history, which encompasses the underlying disease, the age of the child, metabolic demands, including growth requirements and fluid requirements and a re-feeding risk assessment must be performed. Appropriate measures (including investigations) to be instigated at the time of commencement of PN in order to prevent onset of re-feeding syndrome.

1. TPN Team Consultation:

When the decision is made that a child requires parenteral nutrition, please contact the PN Team. The PN Team will provide a full management service for the administration of PN from the initial referral and commencement to the cessation of PN. Daily rounds in the morning will provide ongoing management of PN⁹. PN will be prescribed by the PN Team for the primary medical team with the exception of CICU & oncology patients who will be reviewed by their own teams/dietitian and referred to PN team as required.

2. Baseline growth assessment:

Each patient requiring PN must have baseline growth parameters measured. The PN Team dietitian will ensure that all measurements are plotted on an age-appropriate growth chart. Weight (kg) and height (cm) (and head circumference (cm), in children aged less than 3 years) should be recorded.

3. Initial Nutritional Assessment:

The PN Team Dietitian will undertake a full nutritional assessment and will establish clear nutritional goals. In CICU and oncology the dietitian may determine this. These goals will include calculations of required energy, protein, carbohydrate, fat and fluid requirements and risk of re-feeding on an individual basis.

4. Baseline Investigations:

A number of baseline investigations must be performed prior to commencement of PN. These are:

- Glucose (urinary and blood sugar) UEC
- FBC
- LFT's
- Phosphate, Ca, Mg
- Cholesterol, Triglycerides

5 Monitoring

The following guidelines are the minimal requirements for the commencement of PN. The monitoring regimen must be tailored to the patient.

- Strict fluid balance as over hydration and dehydration are two possible complications of PN therapy.
 - 4/24 Temperature, Pulse &, Respirations. Increased temperature may indicate potential PN related sepsis. The attending medical officer should be informed and consult with the PN Team. Blood pressure monitoring as clinically indicated.
 - All patients receiving PN must have a daily urine analysis for glucose as glycosuria could be an indication of decreased glucose tolerance. If positive, blood glucose level should be measured (finger/heel prick) and team informed. In CICU an arterial line may be used for the BSL sample. Specific gravity of urine should be tested to help determine hydration.¹⁰
 - Twice weekly formal serum glucose testing - additional testing as required.
 - All patients commencing on TPN must have 6 - 8 hourly blood glucose levels until established on PN, usually 48-72 hours.
 - Patients are to be weighed twice weekly (Monday & Thursday) where the medical condition allows. Some patients will require more frequent weight measurements for clinical reasons.
 - Height/length and head circumference should be measured monthly in children under three years of age, and as clinically indicated in children greater than three years.
 - Initial daily bloods;
 - urea
 - sodium
 - potassium
 - chloride
 - phosphate
 - calcium
 - magnesium until stable
 - Then twice weekly:
 - sodium
 - potassium
 - chloride
 - phosphate
 - magnesium
 - calcium
 - Once weekly bilirubin (total/conjugate), ALT, AST, GGT, ALP, albumin, triglyceride.
- Long term PN biochemistry monitoring must be performed every three months. See [Appendix 1](#) "Long Term Parenteral Nutrition Blood Monitoring".

6 Other Considerations

Addition of Drugs to TPN

No drugs to be added into PN solution /bags/lines^{6,8}. It is desirable to administer other medication via a separate lumen –. Where this is the case, connect a drug infusion line to the PN line at the relevant line change. This line should then remain unbroken until the next line change is due. In CICU this practice may vary and is dependent on the medical condition of the patient.

Fat Emulsion:

The standard fat emulsion used is Clinoleic. The PN Team must be consulted when considering any other lipid emulsion. Monitoring of bloods and triglyceride levels are to be taken as per the PN team.

Cycling of PN:

Cycling of PN is a method of reducing PN that must be consulted by the PN Team prior to commencement. Cycling of PN involves weaning the PN to a rate specified by the PN team and then ceasing the PN for a specified time frame. This method of cycling will provide time off PN with a decreased risk of hypoglycaemia.

Weaning

The decision to wean PN is made by the medical officer in charge in conjunction with the PN team. A general recommendation is to wean the PN progressively as guided by the PN team to prevent complications such as hypoglycaemia. Optimal nutrition and euglycaemia should be maintained whilst moving from PN to enteral nutrition.

7 Complications

- If the glucose/amino acid solution runs out, a medical officer must assess the patient for hypoglycaemia and fluid overload, intravenous fluids containing saline and 10% dextrose or S10 must be infused; and pharmacy must be informed to assess why the solution ran out. If the line becomes disconnected or the bag leaks, cease infusion, notify the medical officer and replace line/s fluids with a solution containing saline and 10% dextrose. Refer to side 2 of the Fluid and Medication Prescription chart.
- BSL must be performed if PN solution is off for more than one hour. If a child becomes hyper/hypoglycemic, notify the medical officer immediately.
- **Cholestasis:** TPN related cholestasis maybe associated with prolonged administration glucose/amino acid solution, lack of enteral intake, previous GI surgery, prematurity, and a history of sepsis.³ Consult the Gastroenterology team if cholestasis occurs; observe for rising bilirubin and in particular a rise in the conjugated fraction.
- **Extravasation:** Hypertonic glucose solutions that have extravasated may result in tissue damage. This should be documented in the patient notes and an IIMS notification should be completed.

- **Glycosuria:** Some young infants have a low renal threshold for glucose. Glycosuria may occur despite normal serum glucose levels. An osmotic diuresis and subsequent dehydration may occur unless the glucose concentration in the PN solution is reduced. Electrolyte losses occur rapidly with diuresis and should be monitored, especially Na, K, PO₄ and Mg. Urine glucose monitoring is important but should not substitute completely for blood glucose monitoring.
- **Refeeding:** see the re-feeding guidelines and consult the PN team.

8 Outcome

- Patients receiving PN will maintain or improve nutritional status.
- Infection risk in children receiving PN will be minimised.
- Safe and effective administration of PN in a standard manner.

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Appendix 1: Long Term Parenteral Nutrition Blood Monitoring

1-3 monthly if stable

1. FBC + glucose
2. UEC
3. LFT's + triglycerides
4. CMP
5. Zinc
6. Copper
7. Vitamins A, B12, D & E
8. Selenium
9. Manganese
10. Chromium
11. Copper
12. Coagulation Studies
13. Ammonia
14. Iron Studies
15. CRP
16. Anti Xa if children are on Clexane injections (4 hours post administration)