SECTION 2: DRUG AND INTRAVENOUS (IV) THERAPY

2.7 Parenteral Nutrition (PN)

Contents

1. Parenteral Nutrition

Aims

1. To maintain the child's nutritional status when enteral intake is not possible or is unable to meet to requirements.
2. To administer Parenteral Nutrition so as to minimise the risk of complications.

Background

Parenteral nutrition enables the delivery of essential nutrients and calories directly into the circulatory system for patients who are critically ill or with gastrointestinal tract failure which result in problems with ingestion, digestion and/or absorption of sufficient nutrients.[1-3]

The term Total Parental Nutrition is often used to describe PN however this is a misnomer as the majority of patients are also receiving enteral nutrition.[4]

Possible Complications of Parenteral Nutrition[2, 3, 5-13]

- Intravascular catheter related blood stream infection
- Metabolic disturbances ie. hyperglycaemia/glucose intolerance
- Re-bound hypoglycaemia (from ceasing infusion too rapidly)
- Electrolyte disturbance
- Liver damage
- Re-feeding syndrome
- Fluid overload
- Metabolic bone disease (infants and neonates)

2. Preparation for Administration of Parenteral Nutrition

Under the guidance of the Gastroenterology team, monitor the patient closely to both determine efficacy of the therapy and to detect/prevent complications.[2, 5, 6, 8, 9, 12-15]

Prior to Commencement of the Infusion

1. Check that results of baseline bloods are available ie. FBC, electrolytes, glucose, calcium, phosphate, magnesium, liver function.
2. Seek correction of electrolyte imbalance.
3. Weigh the child and obtain height/length.
4. Seek review by the dietitian if required by the Gastroenterology Team.

Confirm Compatibility

1. ***Some IV medications are incompatible with PN***[3, 7, 8, 10, 11, 14] Confirm drug compatibility prior to administration by consulting with the Pharmacy Department. **Do not** add medications to a PN line.
2. ***PN solutions are incompatible with blood transfusions*** Unless a multiple lumen catheter or connector with no common tubing (ie. V-set) is used or another IV site is accessed, **stop the PN infusion for the duration of a blood transfusion**.
3. ***Patients receiving IV medications or having blood samples aspirated from the same line*** If a single lumen line is in situ, to minimise disconnection and breaking of the line attach a 3-way tap with needle free bung or a Y connector.

3. Management of the Patient Receiving Parenteral Nutrition

Monitoring the Patient

Note: The frequency and duration of specific monitoring will vary depending whether the PN is continuous or cyclical and a short or long term therapy.

- Monitor bloods daily for the first three days or until stable, then weekly, or as directed by the Gastroenterologist. Daily blood sugar levels may also be requested.
- Maintain accurate fluid balance charting. NB. If running behind schedule do not speed up PN infusions.[10]
- Monitor TPR 4 hourly.
- Daily urinalysis of glucose and ketones; report to medical team if present
- Weigh the child daily. Measure height/length as requested.
- Ensure dietitian reviews child at least weekly.
- Observe the patient for signs of dehydration OR over-hydration. Report to medical team if present

Review

All prescriptions will be reviewed daily and re-ordered on a PN prescription[10, 14] via the Consultant or Registrar of the Gastroenterology Team responsible for the care of the patient.

4. Vascular Access

Peripheral Access Devices

Use for short term administration of PN.

Due to the increased risk of thrombophlebitis and extravasation, use only hypotonic solutions (<10% Dextrose).[5, 9, 13-15]

Observe and document hourly checks of the IV catheter insertion site for signs of complications ie. phlebitis, infiltration, extravasation, occlusion, migration and infection.[6, 7, 14, 15]

CENTRAL VENOUS ACCESS DEVICES (CVAD)

- Used in preference to peripheral devices for the administration of PN.[6, 7]
- Prior to the initial use; check that the correct position of the indwelling CVC/PICC has been confirmed (via x-ray) and documented in the notes.[9, 16]
- Follow standard practice for care of CVAD's as per PNPM 2.4 Central Venous Catheters.
- If a multi lumen CVAD is to be used, identify a dedicated line for PN. [13, 17-20]
- **Frequency of Checks** Check the CVAD insertion site (and exit site for the tunneled CVAD) at least once per shift and prior to any access for signs of complications ie. phlebitis, infiltration, extravasation, occlusion, migration and/or infection.[6, 7, 13, 14] Document findings on the Daily Intake/Output Record and report adverse findings as necessary. Refer to PNPM 2.3.5 Monitoring and Maintaining Intravenous (IV) Access and IV Tubing Safety.
- Minimise catheter manipulation.[8]
- Flush the CVAD at least every 24 hours using a pulsatile push-pause technique to assess patency and to promptly detect any complications.

5. PARENTERAL NUTRITION SOLUTIONS

Aminosols

- A yellow solution of dextrose, amino acid, electrolyte, vitamins and trace elements packaged in blue, light-opaque bags.
- DO protect from light.[15, 16]
- DO refrigerate solutions.[21]
- Refer to label for expiry date.

Administration of Aminosols

- Remove from refrigeration prior to infusing to allow the bag to reach near room temperature to touch. (Approximately one hour for small bags and *up to* four hours for larger bags).[22]
- Complete infusions within 24 hours.[23]
- Change continuous infusion IV giving set and any add-on devices every 72 hours.[23, 24]
- On completion of intermittent infusions, discard IV giving set and aminosol bag.

Lipid Solution

- White fat emulsion, packaged in orange light-opaque syringes or clear bags packaged in blue, light-opaque sleeve.
- Contained between the lipid bag and its over pouch is an integrity indicator. If the indicator has turned black, oxygen has penetrated the pouch and the product **should not be used**.
- DO protect from light.[25]
- DO refrigerate lipids provided in 50mL syringes.[26] All other lipids can be stored at room temperature.[21]
- Refer to label for expiry time.

Administration of Lipids

Do not filter lipids.

- When using one Plum A+ Pump, administer via the Lifecare 5000 Secondary IV pump set (no filter).
- When using two Plum A+ pumps run both lipids and aminosols via a primary line.
- Complete the infusion within 24 hours.
- Change the IV giving set and any add-on device, every 24 hours.7, 23, 24, 29 Refer to PNPM 2.3.1
- Lipids may interfere with blood samples. Refer to table below for requirement to discontinue lipids before sampling;

Test	**Turn Lipids off**
Full Blood Count	1 hour prior[27]
Cross match/ Transfusion medicine samples	1 hour prior[27]
Coagulation samples	Check with the lab
Immunology tests and	Check with the lab
Biochemistry sampling	Turn off not required[28]
Antibiotic levels	Turn off not required
Blood cultures	Turn off not required
Stat bloods taken for analysis in the ICU satellite lab	Turn off not required

6. Administration of PN Solutions via Peripheral line or CVAD

Aim

To administer PN solutions so as to minimise the risk of complications

Key points

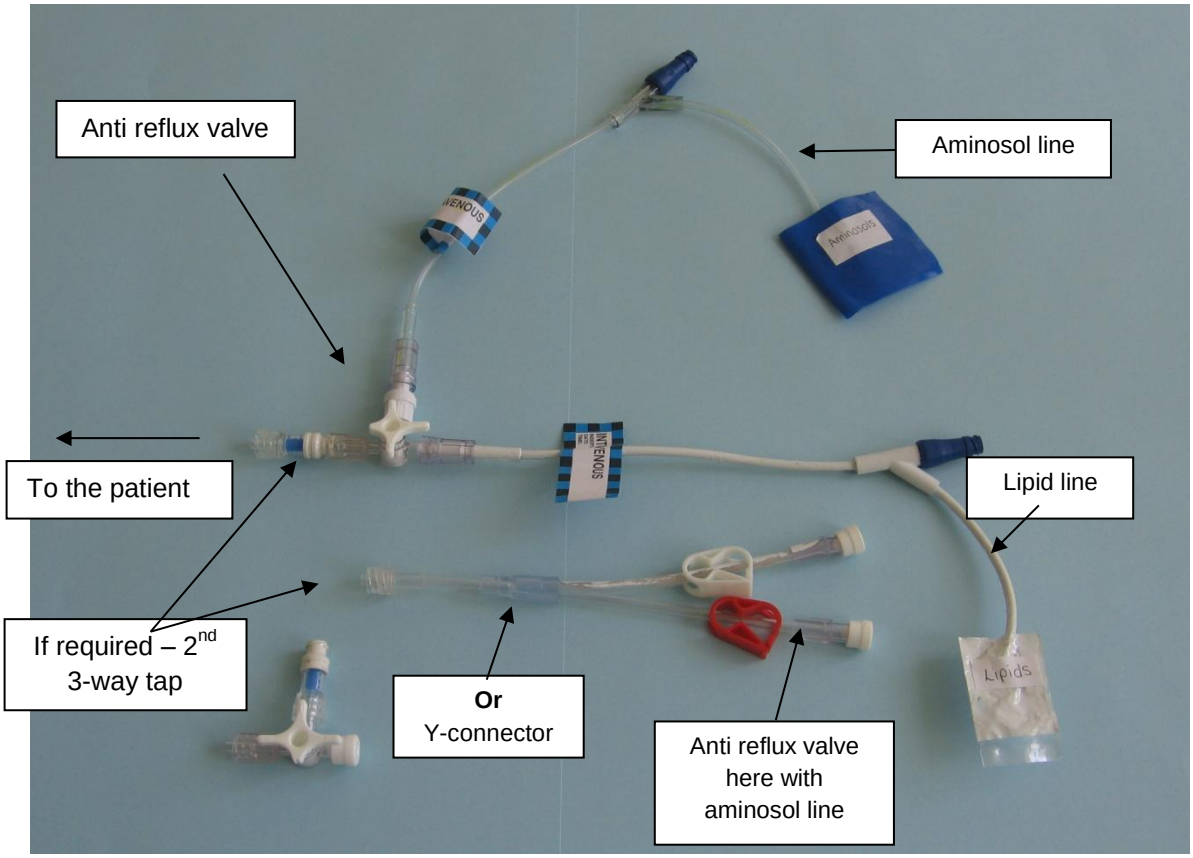
1. PN solutions are administered via volumetric infusion pump(s)[14] using an aseptic non touch technique.
2. All connections must be Luer lock.[7]
3. Maintain a closed system using a needle free bung or positive displacement device.[2, 14, 15]
4. Line manipulation should be kept to a minimum.[1, 13]
5. Change administration sets and any add on devices for aminosols every 72hrs. PNPM 2.3.2 Peripheral Intravenous Access: Principles and Management.
6. If the aminosols are a continuous infusion and a line change is not due then the bag can be changed, utilising an aseptic non touch technique.
7. Administration sets plus any add on devices for lipids will be changed every 24 hours.
8. Assess patency of the CVAD every 24 hours (e.g. at the time of lipid line change) by checking for blood flashback and flushing using a pulsatile push-pause technique. See CVAD guidelines.

Equipment

70% Alcohol (for decontaminating trolley/work surface)
Working surface (that can be decontaminated) or dressing pack
70% Isopropyl Alcohol and 2% Chlorhexidine Gluconate wipes
10ml syringe(s)
Normal saline ampoule
Non-Beveled needle
Anti-reflux valve(s) (if using two separate pumps)
Y connector or three way tap(s)
Needle free port(s) or positive displacement device
IV line labels
IV administration sets/extension tubing
Infusion device(s)

Procedure	Additional Information
Two nurses[14, 15, 30] • Check the components listed on the label of the PN correspond with the prescription. If there is a discrepancy DO NOT connect to patient • Check the patient's identity • Check expiry dates • Inspect the solution/s for clarity, turbidity and absence of particles	See PNPM 2.1.2 Checking and Administration of Medications. Prepare labels as per PNPM 2.12.1 Guidelines for the Safe Labeling of Fluid Bags, Syringes and Drug Administration Lines to Identify End Target Tissue. Inspect the lipid bag integrity indicator and **do not** use if it has turned black.
Decontaminate trolley or work surface with alcohol 70% prior to procedure set up. Put on plastic apron. Perform hand hygiene.	There should be no contact by hands or other non-sterile surface and the ends of sterile connections or other items that will touch the susceptible site.
Open equipment onto decontaminated work surface or dressing pack.	
Assemble the IV administration sets. Place 3-way taps as close to the patient as possible.	3-way taps are not required if using Y-connector, and a second lumen is available for medications/blood sampling.
Leave end caps in place until ready to connect. Attach to fluid containers.	
Draw up sodium chloride into the 10mL luer lock syringe with a non-beveled drawing up needle.	Maintains asepsis. Syringes smaller than 10mL can rupture central line catheters.[22]
Prime the lines ensuring key parts do not become contaminated by hands, surfaces or environment.	
Option 1 If using one Plum A+ pump. Aminosols on primary line. Lipids (bag) on secondary port via the Lifecare 5000 IV pump set (no filter). 50mL Syringe may be attached to secondary port only if a sling holder is available.	

Example of line assembly when using two pumps



Procedure	Additional Information
Option 2 Lipids (syringe) on syringe pump, aminosols on Plum A+ pump. Attach an anti-reflux valve to the end of the aminosol line if connected by 3-way tap or Y-connector (see above diagram).	Syringes >30mL should not be used on the secondary port of the Plum A+ infusion pump unless supported with a sling holder. Use a syringe pump instead.
If using a syringe driver, use an orange coloured line extension for administering lipids.	
Perform hand hygiene.	
Hold and encircle the end of the IV line bung with a 70% Isopropyl Alcohol and 2% Chlorhexidine Gluconate wipe.	It is not necessary to swab the sterile connection on the new bags or syringes.
Applying friction cleanse the bung for at least 20 seconds, using different parts of the wipe. Allow to dry for 20-30 seconds.	

Procedure	Additional Information
Apply gentle suction to check for aspiration of blood into the line and discard syringe. Flush with 2-3mL sodium chloride, using the pulsating push-pause and positive pressure technique.[11, 28]	See PNPM 2.3.2 Peripheral Intravenous Access: Principles and Management.
Using a non-touch technique securely connect infusion lines to the patient's IV access.	Do not over lock as this increases the risk of cracked connections and risks infection.
Set the infusions at the prescribed rate. Two nurses to check and both countersign the prescription.	Rates should be checked by two nurses. See PNPM 2.1.2 for Checking and Administration of Medications.
Protect the parenteral solutions from light.	Aminosols and lipids should come from pharmacy in blue, light-opaque bags.
Commence infusions and open the line connection/clamps. Label all lines as per PNPM 2.12.1.	
To change PN infusion if in progress: • Perform hand hygiene • Clamp all lines. • Stop the infusion • Perform hand hygiene • Disconnect bag from infusion line using non touch technique	Use clamp(s) closest to the patient to maintain positive pressure, prevent back flow of blood into the lines and any risk of anti-syphoning.
Connect new aminosol bag/lipids to the infusion line. Re-commence infusion at prescribed rate.	
Discard used fluids appropriately and perform hand hygiene.	

7. Discontinuation of Intermittent PN Solutions

Aims

1. To encourage optimal growth and development by encouraging oral intake and usual activities during the day and supplementing nutritional requirements with PN overnight.
2. To maintain nutritional requirements while withdrawing PN.

Key Points

- This procedure is for use during the initial stages of weaning PN. The Gastro Team will review once the patient is stable, as the procedure may not need to continue on a daily basis.
- Continuous PN must be withdrawn gradually. Rapid withdrawal may result in rebound hypoglycemia.[13] To prevent this, Dextrose 5% or 10% may be ordered by the RMO and is usually equivalent to Dextrose percentage in aminosol.

Procedure	Additional Information
Decrease the aminosol rate by half for one hour.	Lipid solution need not be gradually withdrawn.
Decrease the aminosol rate by half again for another hour. After the second hour has elapsed, cease the infusion.	The medical officer may order a more rapid reduction rate for patients receiving oral intake or a lower concentration of glucose in the aminosol. This should be documented in the patient's progress notes.
If ordered, perform a blood sugar level (BSL). If the result is >3.0 disconnect the infusion.	
If the BSL is <3.0, continue infusion for another ½ hour and repeat BSL.	If the result is still <3.0 – consult with the gastro team caring for the patient, prior to any disconnection.
Lock the line using the appropriate prescribed flush.	Refer to PNPM 2.3.8 Flushing and Heparin Locking of Peripheral and Central Venous Access Devices.

Related policies, procedures and guidelines.
PNPM 2.3.2 Peripheral Intravenous (PIV) Access - Principles and Management
PNPM 2.3.5 Monitoring and Maintaining Intravenous Access and IV Tubing Safety;
PNPM 2.4.8 Principles of Care for Central Venous Access Devices
PNPM 2.3.8 Flushing and Heparin Locking Peripheral and Central Venous Access Devices

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