Adult Parenteral Nutrition Clinical Practice Standard

1. Purpose

The purpose of this policy is to establish minimum practice standards for the care and management or parenteral nutrition (PN) throughout the WA Country Health Service (WACHS).

This policy is to be used in conjunction with:

- WACHS Nutrition Clinical Practice Standard
- WACHS Enteral Tubes and Feeding - Adults Clinical Practice Standard
- WACHS Adult Refeeding Syndrome Clinical Guideline.

2. Scope

This policy provides standards for the management of nutrition and medical care for adult patients requiring PN in any acute, subacute or residential aged care facilities (RACF) within WACHS.

All WACHS health care professionals are to work within their scope of practice appropriate to their level of training and responsibility. Further information may be found via HealthPoint or the Australian Health Practitioner Regulation Agency.

Further information relating to specialty areas including Child and Adolescent Health Service (CAHS), Women and Newborn Health Services (WHNS) can be found via HealthPoint if not covered in this policy

3. General Information

Parenteral Nutrition (PN) refers to the provision of nutrition via a central or peripheral vein and is required when oral and enteral nutrition is insufficient or unsafe[1].

PN is continuously infused over 24 hours via a controlled infusion pump into a high flow vein, usually the superior vena cava adjacent to the right atrium. Infrequently, some patients receive cyclic PN infusions (running for a period of between 8 to 18 hours each day) or intermittent PN infusions (only on some days) if not tolerating continuous infusion. Long term parenteral nutrition can be delivered at home safely.

The standard PN products used at WACHS sites are Olimel N9 and Olimel N7.

Macronutrients form the base solution which consists of carbohydrates (usually glucose), protein (amino acids), essential fatty acids (lipid emulsion) and electrolytes.

Micronutrients such as vitamins, minerals and trace elements, and additional electrolytes are infused separately.

4. Indications

PN is indicated in patients who are malnourished or at risk for malnutrition when a contraindication to EN exists, or the patient does not tolerate adequate EN or lacks sufficient bowel function to maintain or restore nutrition status[2] as per the following examples:

- Impaired gastrointestinal tract (GIT) absorption or loss of nutrients (such as short bowel syndrome, complications of bariatric surgery, intestinal atresia, gastroschisis, volvulus, meconium ileus, necrotizing enterocolitis, mesenteric thrombosis, trauma)
- High output intestinal fistula (more than 500ml/d)
- Mechanical bowel obstruction
- Need to allow bowel rest (such as ischemic bowel, severe pancreatitis, fistula)
- Inability to maintain enteral access.

PN may be indicated peri-operatively in severely malnourished patients who cannot be adequately orally fed[3].

Note: Patients should be assessed on an individual basis where they have poor nutritional status. For example, when malnutrition is suspected or confirmed; or where there is high nutritional risk such as burns, critical illness, trauma, malignancy or severe GI disease[8] .

Recommended time frames for initiating PN[2]:

- Initiate PN after 7 days for well nourished, stable adult patients who have been unable to receive significant (50% or more of estimated requirements) oral or enteral nutrients.
- Initiate PN within 3 to 5 days in those who are nutritionally at risk and unlikely to achieve desired oral intake or EN.
- Initiate PN as soon as is feasible for patients with baseline moderate or severe malnutrition in whom oral intake or EN is not possible or sufficient.

4.1 Contraindications

PN is contraindicated in patients who:

- Are well-nourished
- Have functional and accessible GIT
- Are expected to return to adequate oral/enteral feeding within 3 days in malnourished and/or high nutritional risk patients (e.g. critically ill), or in 5 days for all others
- Are receiving end of life care (e.g. end stage palliative care).

5. Procedural Information

5.1 Nutrition Assessment by Dietitian

- All patients requiring PN should be referred to a Dietitian prior to commencement of feeding.
- Please refer to WACHS Nutrition Clinical Practice Standard for more information on nutrition assessments.

5.2 Ordering and Prescribing Parenteral Nutrition

- PN is to be ordered and prescribed by the Senior Medical Officer/Registrar (Intensivist as available) including route, choice of formula and rate on MR60.1.11 WACHS Adult Parental Nutrition Form. The form is to be kept with patient's bedside medication chart at all times
- The Senior Medical Officer/Registrar (Intensivist as available) orders and manages all PN in consultation with Pharmacy, the treating medical/surgical team and Dietitian.
- The following table outlines nutrition composition of standard N7 and N9 PN solutions

Standard N9* TPN (e.g. Olimel® N9)	**Standard N7* TPN** (e.g. Olimel® N7)
2000mL Parenteral Nutrition Solution with Electrolytes **800mL** Amino Acids 14.2% (113.9g) **800mL** Glucose 27.5% (242g) **400mL** Lipid (ClinOleic) 20% (80g) Na:70mmol, K: 60mmol, Mg: 8mmol; Ca:7mmol; Phos:30mmol	**2000mL** Parenteral Nutrition Solution with Electrolytes **800mL** Amino Acids 11.1% (88.6g) **800mL** Glucose 35% (308g) **400mL** Lipid (ClinOleic) 20% (80g) Na:70mmol, K: 60mmol, Mg: 8mmol; Ca:7mmol; Phos:30mmol

Note: Olimel is contraindicated in patients with a known hypersensitivity to egg or soya proteins, peanut protein, corn (maize) and corn products.

- Continuous administration of PN is the preferred method of infusion.
- Typical infusion rates vary between 40-150ml/h. The usual starting rate is 40mL/h, increasing by 30mL/h every 4 hours until target rate is reached, according to the patient's clinical condition.
- If Refeeding Syndrome (RFS) risk is suspected, PN can commence at 50% of the patient's basal requirement (e.g. 5-10kcal/kg) and increase gradually as per Dietitian's recommendations. A common starting rate for patients with RFS risk is 20mL/h PN over 24 hours.
- Commence trace elements and multivitamins for injection/infusion daily and chart on Inpatient Medication Chart
    - Trace Element Solution (eg. ADTE) Dilute 1 syringe in 100mL of glucose 5% and administer intravenous infusion over 1 to 4 hours.
    - Multivitamins for injection (eg Cernevit®) Dissolve 1 vial in 5mL water for injections and administer intravenous over 10 mins.

- Vitamin K: Cernevit® does not contain any Vitamin K and the pre-mixed bags Olimel N7-960E & Olimel N9-840E contain 24-40µg Vitamin K per 2000ml bag.
- For patient's receiving PN for >1 week additional 2mg Vitamin K weekly supplementation should be considered.

Note: may be contraindicated in patients on Vitamin K antagonists (e.g. Warfarin) as adding Vitamin K can destabilize the patients' INR, only to be given upon authorising team's request.

5.3 Commencing Parenteral Nutrition After Hours

When a Dietitian or Pharmacist is not available the following can be commenced:

- Recommend to use Olimel® N9 as standard PN solution until reviewed by Dietitian or Pharmacist.
- If patient is not at risk of RFS, commence 40 mL/h PN of choice over 24 hours on MR60.1.11 WACHS Adult Parental Nutrition Form.
- If at risk of RFS PN can commence at 20 mL/h PN of choice over 24 hours on MR60.1.11 WACHS Adult Parental Nutrition Form.
- In addition to the Cernevit® multivitamin and trace elements, IV thiamine stat 200-300mg dose then chart 100mg daily thereafter4.
- Potassium (2-4 mmol/kg/day), phosphate (0.3-0.6 mmol/kg/day), magnesium (0.2mmol/kg/day IV or 0.4 mmol/kg/day orally) and calcium (albumin adjusted) should be replaced prior to commencing TPN and monitored daily with replacement as required once PN has commenced1.

Please refer to WACHS Adult Refeeding Syndrome Clinical Guideline for more information on Re-feeding Syndrome

5.4 Administering Parenteral Nutrition

- The PN solution and line is changed every 24 hours to minimise risk of infection, ideally during the nursing dayshift e.g. between 1400 and 1600 hours.
- There must be a seamless continuation of PN delivery to prevent changes to blood glucose levels. The nurse must anticipate when the changeover from one bag of PN and line/filter is to be replaced by another and ensure PN and associated consumables to hand to perform aseptic procedure of infusion change.
- PN is only administered via a Central Venous Access Device, typically a Central Venous Catheter (CVC) or a Peripherally Inserted Central Catheter (PICC) – request CVAD with at least 3 lumens and designate one lumen **exclusively** for administration of PN.
- Other additives/infusions including Cernevit® or trace elements must not be co infused by via the same lumen as PN. If the patient is having IV insulin for maintenance of normal blood sugar, it is preferred that this infusion be infused via a separate lumen instead of with the PN.

- Two nursing staff, one of whom must be a RN, are required to perform the checking procedure which include programing the pump and sign the MR60.1.11 WACHS Adult Parental Nutrition Form on commencement and changes to bag/infusion rate.
- Check the patient's identity (ID) band against the patient ID label on the MR60.1.11 WACHS Adult Parental Nutrition Form and PN infusion bag.
- Check the PN prescription against the components listed on the label on the outside of the PN bag. If there is a discrepancy, do not connect PN to the patient. Page the clinical pharmacist for confirmation.
- Check the PN solution total volume, administration rate, expiry date and time.
- Olimel PN bags do not need to be covered with light protective bags while being infused as part of routine care. Alternative formulations may require this and should be reviewed on a case by case basis.
- Hand hygiene must be carried out as per the 5 moments for hand hygiene; before and after touching a patient, before and after performing a procedure, and after touching the patient's surroundings, and before and after donning and doffing of gloves.
- Roll the PN bag to break the solution chambers and gently oscillate to mix the solution.
- The PN solution is administered by a volumetric pump at the prescribed rate and is recorded on the fluid balance chart. An accurate fluid balance chart must be maintained.
- An in-line 1.2 micron filter should always be used as small particles of plastic may be present in the solution after the bag is mixed.
- Monitor blood glucose readings closely when PN is commenced, the rate is increased or decreased, the formula is changed and/or when PN is interrupted or ceased to reduce risk of sudden hyper/hypoglycaemic events.
- If blood glucose is > 10mmol/L or patient is diabetic, avoid using glucose as an additional fluid source (if additional hydration is prescribed). Refer to MR157A WACHS Insulin Infusion order chart for commencement of insulin and revised protocol for blood glucose monitoring. MO to suggest referral to Diabetes Educator as required for review of diabetes management.

5.5 Ceasing Parenteral Nutrition

- Wean PN when oral intake and/or EN achieve 50%–75% of requirements for energy, protein, and micronutrients, unless impaired gastrointestinal function precludes 100% absorption of nutrient needs2.
- Before ceasing PN the delivery rate must be gradually reduced. When weaning, reduce PN rate by 20mL per hour every 4 hours until PN ceased (or as per the dietitian/MO instructions) with monitoring BGL (1 hour after cessation, then 2-6 hourly for 24 hours). Rate changes to be prescribed on the rate change section of the MR60.1.11 WACHS Adult Parental Nutrition Form.

- Once PN is ceased and the line disconnected, (using aseptic technique) flush port with 10mL 0.9% sodium chloride to enable use for other infusions.
- Review insulin infusion if being administered.
- Abrupt cessation/interruption of PN should be avoided where possible to reduce the risk of hypoglycaemia. If PN was abruptly ceased or interrupted, MO to prescribe 10% Glucose and administer at the same rate as the discontinued PN until PN is replaced/resumed. If PN is not to be recommenced, MO to wean IV glucose/insulin infusion (if being administered) as per typical PN weaning (as per above) with monitoring BGL (1 hour after cessation, then 2-6 hourly for 24 hours).

5.6 Overnight/Cyclic/Intermittent Parenteral Nutrition

- Used for some in-patients or long-term Home PN patients
- Rates are determined according to the volumes and formula required in consultation with Dietitian and Senior Medical Officer/Registrar (Intensivist as available). If compounded bags were to be used, the team would also need to be in consultation with a Clinical Pharmacist.

5.7 Home Parenteral Nutrition

- For patients admitted to WACHS facility already commenced on home PN, the following is recommended:
  - Contact tertiary hospital managing home PN patient so they are aware of the admission and check infusion rates and solution.
  - Continue PN infusion as per home PN program unless otherwise indicated by admission.
- Please refer to Appendix 3 for commencing a patient on home PN prior to be discharged from a WACHS facility.

5.8 Patient Monitoring[1, 2, 4]

- Weight:
  - Baseline weight then daily
  - Monitor for signs of fluid retention / overload
  - Once stable, 2 -3 times per week
- Vital signs
  - 4 hourly observations (or as per MO instructions)
  - Daily once stable

- BGL monitoring
  - Hourly for first 4 hours of initiation and rate changes
  - Followed by 4 – 6 hourly until maintained between 5 – 10mmol/L for 24 hours
  - Once stable, monitor twice daily or as clinically indicated. Medical Officer to be contacted:
    - If BGL < 4.0mmol/L or
    - If BGL > 10.0mmol/L or patient has diabetes refer to MR157A WACHS Insulin Infusion order chart for commencement of insulin and revised protocol for blood glucose monitoring
- CVAD examination
  - Daily assessment with x-ray confirmation at CVAD placement
  - Report any signs of CVAD insertion site deterioration to MO
  - Refer to WACHS Central Venous Access Devices Management CPS.
- Patient energy and macronutrient intake by Dietitian weekly or as change in medical condition, activity level or enteral / oral intake commences
- Output measures:
  - Urine, stools, ostomy, fistula, etc.: daily until stable

5.9 Short-term Clinical Monitoring (<1 month)[2, 4]

Clinical Indicator	Frequency of Monitoring – Acute
Weight	Daily if there are concerns regarding fluid balance, otherwise second daily in first 1-2 weeks of PN
Height	On admission only
Vital signs Observation	Daily once stable
Intake of Nutrition support (i.e. orally, enteral or parental)	Daily
Fluid balance (output measures)	Daily
Oedema / ascites	Daily or as clinically indicated
Nutrition Impact Symptoms (i.e. nausea, vomiting, appetite)	Daily
Wound staging	Daily or as clinically indicated
Refeeding syndrome specific monitoring	Daily until clinically stable – please refer to Adult Refeeding Syndrome Clinical Guideline

5.10 Recommended Biochemistry Monitoring[2]

Measure	Acute care PN			Long term
	Baseline	Week 1	Stable	PN stable
Glucose, urea, creatinine, electrolytes, calcium, magnesium, phosphorus	Yes	Daily x 3 or until stable	1-2 each week or as clinically indicated	Monthly
FBC	Yes	Daily x 3 or until stable	1-2 each week or as clinically indicated	Monthly
LFT (bilirubin, AST, ALP, APT)	Yes	Weekly	Weekly	Monthly
TG levels	Yes	Weekly	Weekly	Monthly
Serum proteins (albumin, prealbumin	Yes		Weekly	Monthly
Zinc, copper, manganese, chromium			As clinically indicated	3-6 months
Vitamin A, D, E, B12, folate	Yes	As clinically indicated		6-12 months
TSH		As clinically indicated		

6. Roles and Responsibilities

Role	Responsibilities
Senior Medical Officer/Registrar (Intensivist as available)	• Order & prescribe daily PN on MR60.1.11 WACHS Adult Parental Nutrition Form • Liaise with the dietitian (if possible) for recommendations on formula and rate • Chart trace element & multivitamin injection as per guideline on MR 60.1.11 & on MR170A WA Hospital Medication Chart–Short Stay • Order daily morning blood while the patient is receiving PN • Review blood & maintenance fluids • Ensure that a central VAD is present & patent
Dietitian	• Review the nutritional history, status & requirements • Formal assessment of anthropometry, biochemistry, clinical & diet history • Establish re-feeding syndrome risk • Calculate energy & protein requirements • Liaise with team regarding the selected pre-mixed formula • Provide guidelines to the team about how rapidly to increase to rate of delivery of formula & what formula to use daily • Monitor weight, fluid balance, biochemistry, blood glucose levels, NGT aspirates & bowel function or stoma output • Transitional feed once oral or enteral intake commences

Nurse	• Oversee the care of the central VAD • Manage the infusion & associated equipment • Ensure accurate patient weight & height is documented at admission & daily weight as required by the team • Perform & document baseline vital signs • Monitor regular blood glucose levels (BGL) & liaise with MO if outside acceptable parameters • Review the patient's previous 24-hour fluid balance status & assess the current total intake and output. Consider concurrent IV therapy regimens • Liaise with MO to incorporate maintenance IV fluid requirements into PN prescription as necessary
Pharmacist	• Oversee the choice of formulation & additives with the team • Review medications & anticipate drug-drug interactions, drug-nutrient interactions & medications that may adversely affect a patients electrolytes

7. Compliance Monitoring

Failure to comply with this policy document may constitute a breach of the WA Health Code of Conduct (Code). The Code is part of the Integrity Policy Framework issued pursuant to section 26 of the *Health Services Act 2016* (WA) and is binding on all WACHS staff which for this purpose includes trainees, students, volunteers, researchers, contractors for service (including all visiting health professionals and agency staff) and persons delivering training or education within WACHS.

WACHS staff are reminded that compliance with all policies is mandatory.

8. Records Management

Health Record Management Policy

9. Evaluation

Review of this policy will be undertaken as per the WACHS policy review schedule.

10. Relevant Standards

National Safety and Quality Healthcare Standards: 1.1, 1.2, 1.3, 1.4, 1.5, 1.7, 1.25, 1.27, 2.6, 2.11, 2.14, 3.1, 3.3, 3.5, 3.8, 3.10, 5.1, 5.2, 5.4, 5.5, 5.6, 5.7, 5.8, 5.12, 5.14, 5.27, 5.28, 6.11

11. References

1. National Institute for Health and Clinical Excellence (NICE). Nutrition support for adults: oral nutrition support, enteral tube feeding and parenteral nutrition. 2017. Available from https://www.nice.org.uk/Guidance/CG32
2. ASPEN 2017, 'When is Parenteral Nutrition Appropriate?', Journal of Parenteral and Enteral Nutrition, vol. 41. No.3, pp. 324-377
3. Pittiruti M, Hamilton H, Biffi R, MacFie J, Pertkiewicz M. ESPEN guidelines on parenteral nutrition: Central venous catheters (access, care, diagnosis and therapy of complications). Clin Nutr. Aug 2009;28(4):365-377.
4. Rockingham Peel Group Clinical Practice Manual. Total Parenteral Nutrition (Acute) Guideline. 2019
5. Pratt RJ, Pellowe CM, Wilson JA, et al. epic2: National evidence-based guidelines for preventing healthcare-associated infections in NHS hospitals in England. The Journal of hospital infection. Feb 2007;65 Suppl 1:S1-64.
6. Gillanders LB, P.; Hardy, G.; Smith, R.; Chapman-Kiddell, C.; Hope, J.; Strauss, B.; Russell, D.; Angstmann, K. AuSPEN clinical practice guideline for home parenteral nutrition patients in Australia and New Zealand. Nutrition. 2008;24:998-1012
7. Dietitians Association of Australia. Parenteral nutrition manual for adults in health care facilities. Deakin, ACT: DAA; 2014: http://daa.asn.au/.
8. ASPEN 2016, 'Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: SCCM and ASPEN', Journal of Parenteral and Enteral Nutrition, vol. 40. No.2, pp. 159-211.

12. Related Forms

MR111 WACHS Nursing Admission, Screening and Assessment Tool - Adults

MR120 WACHS Adult Nursing Care Plan

MR140A Adult Observation and Response Chart (AORC)

MR 144 WACHS Fluid Balance Work Sheet

MR 144c WACHS Food Intake Chart

MR156A Insulin Subcutaneous Order and Blood Glucose Record - Adult

MR170A WA Hospital Medication Chart – Short Stay

MR184 WACHS Inter-hospital Clinical Handover Form

MR60.1.10 WACHS Adult Enteral Feeding Form

MR60.1.11 WACHS Adult Parental Nutrition Form

MR60.1.12 WACHS Oral Nutrition Support Chart

MR64B Dysphagia Screening Tool (Royal Brisbane Women's Hospital [RBWH]

13. Related Policy Documents

WACHS Adult Refeeding Syndrome Clinical Guideline
WACHS Allied Health Clinical Handover Policy
WACHS Central Venous Access Devices Management Clinical Practice Standard
WACHS Enteral Tubes and Feeding – Adults Clinical Practice Standard
WACHS High Risk Medications Procedure
WACHS Inter-hospital Clinical Handover Form Procedure
WACHS Medication Administration Policy
WACHS Nutrition Clinical Practice Standard
WACHS Patient Identification Policy
RPBG Parenteral Nutrition Management Clinical Practice Standard

14. Related WA Health System Policies

MP0095/19 Clinical Handover Policy
OD0122/19 Clinical Incident Management Policy
MP0086/18 Recognising and Responding to Acute Deterioration Policy
MP0053/17 WA Clinical Alert (Med Alert) Policy
OD0657/16 WA Health Consent to Treatment Policy
OD0561/14 WA High Risk Medication Policy

15. Policy Framework

Clinical Governance, Safety and Quality

16. Acknowledgement

Acknowledgment is made of the previous SMHS / WACHS site endorsed work used to compile this Adult Parental Nutrition Clinical Practice Standard. Additional acknowledgement to the WACHS Dietetic Area Coordinator, Dietetic Working Party, Chief Pharmacist and other relevant pharmacy, medical and general nursing staff involved in consultation.

17. Appendices

Appendix 1 – Troubleshooting Equipment Issues
Appendix 2 – Troubleshooting Patient Complications
Appendix 3 – Home Total Parenteral Nutrition

This document can be made available in alternative formats on request for a person with a disability

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Appendix 1 – Troubleshooting Equipment Issues[4,5]

Problems	Management
TPN line breakage/ accidental disconnection	DO NOT reconnect a damaged or disconnected TPN line to the CVAD: • Clamp and cap the CVAD. • Clamp the disconnected TPN bag, line and filter; place in a sealed plastic container and save for inspection by pharmacy. • Notify the MO and clinical pharmacist. • Contact the MO to prescribe 10% glucose and administer at the same rate until TPN, bag line and filter is replaced. • Continue to monitor BGL as clinically indicated in liaison with the MO.
Filter breakages, blockages, or missing filter	DO NOT connect TPN to patient: • Notify the clinical pharmacist and the MO. • Contact MO to prescribe 10% glucose and administer at the same rate of TPN until TPN bag, line and filter is replaced. • Continue to monitor BGL as clinically indicated in liaison with the MO.
Central VAD compromise	• Includes infected insertion site, cracked ports, accidental dislodgement, leakage of solution at insertion site. • Stop and disconnect TPN; clamp and save TPN solution and line for inspection by pharmacy. • Notify the clinical pharmacist and the MO. • MO to prescribe 10% glucose and administer at the same rate of TPN via peripheral IV cannula, to prevent rebound hypoglycaemia. • New CVAD should be organised as soon as possible by MO. • Recommence TPN when the next bag is available and new CVAD has been deemed safe to use. • Continue to monitor BGL as clinically indicated in liaison with the MO.
TPN infusion completed and next bag is not available	• Notify Clinical Pharmacist and MO. • Contact MO to prescribe an infusion of 10% glucose and administer at the same rate of TPN until replacement TPN is available. • Continue to monitor BGL as clinically indicated in liaison with MO.
TPN order is incorrect or the bag is perforated, leaking or contaminated	DO NOT connect the TPN • Notify the clinical pharmacist and the MO. • Clamp the disconnected TPN bag, line and filter; place in a sealed plastic container and save for inspection by pharmacy. • Contact MO to prescribe 10% glucose and administer at the same rate as TPN until TPN is replaced. • Continue to monitor BGL clinically indicated in liaison with the MO.
Patient undergoing a surgical or other procedure	• Continue TPN as prescribed unless ordered otherwise by MO. • Send Total Parenteral Nutrition Infusion Chart (RGMR176A) with patient. • If the TPN infusion is to be ceased for the procedure, reinforce with the procedural staff that the TPN line should remain connected to the patient. • If the line is disconnected, the solution has to be discarded and a new bag of PN obtained

Appendix 2 - Troubleshooting Patient Complications[4,5]

Complication	Potential Causes	Treatments
Infection from catheter site resulting in general sepsis	Fungal/bacterial contamination	Antibiotics Re-educate on hygienic procedures for site management
Technical complications	Vein thrombosis, pneumothorax, haemothorax, haematoma, embolism, vein perforation	Refer to MO
Hyperglycaemia	High glucose infusion rate, preceding sepsis, diabetes, stress response	Reduce glucose infusion rate, consider insulin, monitor BGL 4-hourly
Hypoglycaemia	TPN infusion rate reduced too fast during discontinuation of feeding/feed stopped suddenly	Slow tapering of feed over 1-2 hours
Abnormal LFTs	Multifactorial, relating to disease. Can be related to overfeeding.	Does not require TPN to be ceased - refer to ICU Consultant for advice
Low Mg/ca/ PO4/electrolytes/ Na/ K	Refeeding Syndrome or malnutrition, excessive diuretics	Correct electrolytes (IV) before increasing infusion rate, monitor bloods regularly, *consider* reducing rate
High Mg/ ca/ PO4/ electrolytes/ Na/ K	Renal or liver? Disease, medications e.g. Tazocin	Regularly monitor bloods, *consider* reducing rate, *consider* insulin to ↓ K
Micronutrient deficiencies	Long term TPN	Regular blood monitoring, replacement of micronutrients, check Zn, Cu, Fe, Vit K
Fatty liver/hepatobiliary complications	Excessive energy/TPN rate (ensure carbohydrate intake no more than 5g/kg/day)	Dietician to re-assess energy requirements and modify as required, monitor LFTs, check baseline LFTs prior to feeding
Respiratory failure	Excessive glucose (unlikely in all-in-one bags)	Ensure glucose < 5mg/kg per minute
Hypertriglyceridaemia	High lipid component (unlikely in all-in-one bags)	Decrease lipid component; minimum is 3 x / week, check baseline triglycerides prior to
Fluid overload	Excessive fluid intake/administration Compromised renal or cardiac function Re-feeding syndrome	• Review volume of parenteral nutrition and other fluids received • Monitor fluid status using a fluid balance chart • Discuss appropriate fluid allowance/sources with MO • Consider changing to a more concentrated parenteral nutrition formulation • Initiate parenteral nutrition gradually

Appendix 3 - Home Total Parenteral Nutrition[1,6]

Patients with intestinal failure who are clinically stable and able to receive therapy outside an acute care setting may be suitable for home parenteral nutrition (HPN). Prior to commencing HPN, the following needs to be considered:

- Perform a thorough evaluation of medical and psychosocial factors that influence suitability for HPN.
- Address financial considerations/insurance coverage and patient responsibilities with patient and caregiver.
- Patients requiring long term PN may be discharged home with self-managed parenteral nutrition.
- It is recommended that parenteral nutrition requirements are determined by professionals with relevant skills and training.
- The prescription for Home PN should usually provide:
  - 30-35 ml fluid/kg/day
  - 0.8-1.4g protein/kg/day
  - 20-35 kcal/kg/day total energy (including that from protein), with 1/3 provided by lipid
- Home PN formulation should also include adequate electrolytes and micronutrients. Consider the intestinal status of the patient.
- Infusion should be cyclical to minimise metabolic complications and impact on quality of life.
- These patients should be trained for several weeks before discharge in how to hang and administer their PN

- The patient should be stable on their home regimen before discharge and be competent in the following tasks:
  1. Maintaining aseptic technique for line care
  2. Changing the Positive Pressure Valve (PPV)
  3. Connection and disconnection
  4. Flushing of the line
  5. Programming the volumetric infusion pump and commencing the infusion
  6. PN regimen (including rate, hours of infusion, tapering procedure if applicable and dosing schedule for micronutrient additives if applicable)
  7. Caring for their dressing
  8. Storing/handling their PN products correctly
  9. Recognising/managing problems that may occur
  10. Weight monitoring
  11. Monitoring of BGL if required
  12. Spiking the PN bag and priming the line depending on PN supplier
- The patient must have appropriate facilities and support at home, and continue to receive regular assessment, monitoring and health support by a multidisciplinary team