Royal Hospital for Women (RHW)
BUSINESS RULE
COVER SHEET

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SUMMARY	*This clinical business rule is developed to guide clinical practice at the Royal Hospital for Women for the use of parenteral nutrition.*

Royal Hospital for Women (RHW)
CLINICAL BUSINESS RULE

PARENTERAL NUTRITION (PN) - ADULT

1. BACKGROUND

- The parenteral nutrition clinical business rule should be used to ensure:
  - The safe and appropriate administration of parenteral nutrition for patients who are unable to meet their nutrition and hydration needs orally or enterally, and, to minimise potential PN associated complications (E.g., catheter, metabolic, infection)
  - That PN practices for adult inpatients at RHW, with respect to patient selection, PN setup/administration, monitoring and documentation are in line with current evidence and best practice guidelines.

Definitions:

Parenteral Nutrition: the provision of nutrients intravenously, thus bypassing the gastrointestinal tract. The intravenous solution consists of amino acids, glucose, lipids, electrolytes, vitamins, and trace elements.

CVAD– Central Venous Access Devices include any catheter that is placed so that the distal tip sits in a major or central vein. This is usually the Superior Vena Cava (SVC) although the Inferior Vena Cava may also be used, as is the case for femoral catheters. Catheters that belong to this group include short term central venous catheters (CVC) and peripherally inserted central catheters (PICC) as well as longer term tunnelled catheters (e.g., Hickman Catheter), and implanted venous ports (e.g. Port-a-Cath or PAS-Port).

PICC – Peripherally Inserted Central Catheters (see CVAD). A CVAD inserted via a peripheral vein i.e., basilic vein, brachial vein, and cephalic vein. See also, CVAD

2. RESPONSIBILITIES

Care for patients requiring PN is enhanced by a multidisciplinary team approach that acknowledges the skills and training of the individuals and professions involved. Members of the multi-disciplinary team involved in the management of patients on PN include:

- Medical officers
- Registered Nurses
- Pharmacists
- Clinical Dietitians

Role	Responsibilities
Medical Officers (MO) – Managing Medical Team	• MO are responsible for the overall management of the patient.

	• MO play a crucial role in the identification of patients who require PN, PN prescription and monitoring. • As PN involves intravenous (IV) access and administration of parenteral nutrients, it requires medical authorisation including sign-off on the PN order to ensure it is in keeping with the overall medical management of the patient. • The medical team or anaesthetic registrar (if the patient is an inpatient in the acute care unit) are responsible for optimising fluid and electrolyte status daily.
Registered Nurses	• Safe administration of PN solutions • Care of the CVAD • Observation of patient condition – including vital signs, weight, fluid balance chart • Ensure daily TPN bloods are ordered and taken • See section 3.3.3 below for additional details (Nursing Care of Patients on PN)
Pharmacists	• Order PN for the hospital • Review of PN order prescribed on adult fluid chart • Supply PN bags to the ward • Advise of electrolytes and drug compatibility as necessary
Clinical Dietitians	• Identification of patients (in conjunction with MO) who require PN. • Nutritional assessment (including determination of nutrition requirements and risk of refeeding syndrome), development of nutrition prescription (in conjunction with the medical team) and nutrition monitoring of patients receiving PN. • Advise on alternative feeding routes and manage the transition of patients from parenteral to enteral and oral nutrition.

3. PROCEDURE

3.1 Clinical Practice

3.1.1 Indications and contraindications for PN

The main indication for parenteral nutrition (PN) is when the gastrointestinal tract is not functional or accessible and/ or the patient's nutritional needs cannot be met by either oral or enteral routes.

PN may be indicated, but is not limited to, the following situations:

- Where the gastrointestinal tract cannot be accessed e.g., intractable vomiting with inability to establish jejunal access
- Bowel obstruction or suspected gut ischaemia
- Gastrointestinal fistulae with inability to feed distally
- Malabsorptive states (e.g., short bowel syndrome, radiation enteritis, severe exacerbation of inflammatory bowel disease, persistent severe diarrhoea)
- Enteric anastomosis

PN should be considered when function or accessibility to the intestines is not anticipated to return within the next 5 days. If, however, a patient has poor nutritional status (is malnourished or suspected of malnutrition) and/ or high nutritional risk (e.g. critical illness, malignancy, catabolic) there may be benefit if PN is started promptly while oral/ enteral nutrition is not possible – even if likely duration is less than five days and/or enteral/ oral nutrition is to recommence in the next few days. In general, a course of effective PN is at least 7-10 days.

Where possible, combining PN with low-level enteral feeding maintains gut function and prevents bacterial overgrowth. PN may not be appropriate where the prognosis is inconsistent with aggressive nutritional support.

PN is not without risks (such as catheter insertion complications, infection, sepsis, fluid and electrolyte imbalances and metabolic complications) and financial cost; hence its use should be reserved to where clearly clinically indicated.

3.2 Process/ Procedure for commencing PN

After the decision to commence PN has been made by the multidisciplinary team, there are several steps to organise before PN can be commenced.

3.2.1 IV Access

Due to the multitude of medication incompatibilities and the hypertonic nature of the PN solution, a multi-lumen central IV access is recommended. Thus, parenteral nutrition is to be infused via a dedicated lumen of the CVAD.
For queries regarding drug compatibility please refer to *Micromedex*. If further clarity is needed please refer to Pharmacy.
Refer to RHW Local Operating Procedure – Central Venous Catheter Access Device (CVAD) Management.

3.2.2 Nutrition Assessment

All patients being considered for PN must be referred to the RHW clinical dietitian. Once referred, a nutrition assessment will be performed, estimated nutritional needs determined and a PN plan developed. The Clinical Dietitian will recommend the starting rate and rate of progression. It is usual to commence PN in a graded manner. The recommended PN prescription will be discussed with the managing medical team and documented in the patient's electronic medical record

The dietitian is unavailable after hours and on weekends, therefore, if PN is to be commenced, the managing medical team will initiate an After-Hours Starting Regimen (see Appendix 2) which accounts for the possible risk of refeeding syndrome. Referral to the Dietitian must still be made so that a full nutrition assessment and PN regimen can be completed on the next business day.

3.2.3 Baseline Investigations and Monitoring

Prior to initiating PN, the managing medical team is responsible for arranging the following baseline biochemistry investigations, reviewing fluid and electrolyte abnormalities, and managing them appropriately. A patient's weight and other vital signs must also be taken as recommended in the table below.

In those at risk of developing Refeeding Syndrome, particular care should be taken in managing suboptimal electrolyte levels (in particular, phosphate, potassium, and magnesium).
Refer to RHW Local Operating Procedure – Potassium – Administration of Oral and Intravenous Infusion
Refer to RHW Local Operating Procedure - Phosphate Intravenous (IV) Replacement
Table 1 (below) – from POWH Parenteral Nutrition Management policy outlines the recommendations for routine monitoring of biochemistry, weight, fluid balance and vital signs.

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Table 1. Baseline Investigations and Monitoring Guidelines

Parameter	Initial	Ongoing, Stable Acute Care Patient
EUC, CMP	Baseline Daily for 7 days or until stable	2-3 x weekly or as clinically indicated
Liver Function Tests	Baseline 3 x weekly until stable	Weekly or as clinically indicated
FBC	Baseline 3 x weekly until stable	Weekly or as clinically indicated
Triglycerides	Baseline in those with known history of, or risk factors for, hypertriglyceridaemia As clinically indicated	As clinically indicated
INR, PT, aPTT	Baseline Weekly	Weekly or as clinically indicated
25'OH Vitamin D	Baseline	3 monthly or as clinically indicated
Iron studies	Baseline	3 monthly or as clinically indicated
Selenium, Zinc	Baseline only in at-risk populations	As clinically indicated
Manganese, Copper	Baseline only in at-risk populations	As clinically indicated
Vitamin A, E	Baseline only in at-risk populations	As clinically indicated
Vitamin B12, Folate	Baseline only in at-risk populations	As clinically indicated
C-reactive protein (to assess presence of acute phase response)		Concurrent with any vitamin or trace element testing - assists interpretation of results
Nursing Observations		
Vital signs (including temperature, pulse, blood pressure)	QID at 6-hourly intervals	QID at 6-hourly intervals
Capillary Blood Glucose Level	QID (unless on insulin - then every 4 hours)	May be reduced to daily in long-term patients, as per team (unless on insulin - then every 4 hours)
Fluid Balance	Baseline and daily	Daily
Weight	Baseline 2 x weekly	Weekly
CVAD access site	Daily	Daily

PARENTERAL NUTRITION – ADULT cont'd

3.2.4 Prescribing and ordering PN

Prescription and Ordering of PN from Pharmacy

A member of the managing medical team or anaesthetic fellow must write the PN order on the Adult Fluid Order Form. The order must be sighted by pharmacy, who will supply the PN formulation to the ward. The PN bags must be stored in the fridge. Due to the short expiry of the PN bags, they will not be stored on imprest. After hours and on weekends, please contact the afterhours nursing manager who will obtain TPN from POW ICU.

Bags that have been refrigerated should be removed from the fridge approximately 3 hours prior to infusion, to allow the solution to reach room temperature.

What should be prescribed before PN commences?

Many patients requiring PN will have fluid and electrolyte imbalances, as well as a degree of protein/energy malnutrition. The managing medical team is responsible for optimising fluid and electrolyte status, and prescribing the following:

- Thiamine – 100mg IV, to be given 30 minutes prior to commencement of PN, then daily for 5 days. In cases of severe malnutrition/extreme risk of refeeding syndrome give 300mg prior to PN commencement and then 100mg tds for 7-10days.
- Additional Cernevit (IV multivitamin) and/or trace elements may be recommended by the Clinical Dietitian in severely malnourished patients receiving low-volumes of PN and/ or at risk of refeeding syndrome until target rate is achieved.
- Vitamin K – 10mg IV weekly on Tuesdays (excluding patients on warfarin)

Any critical biochemical abnormalities, particularly low levels of potassium, magnesium, and phosphate, should be corrected in a planned manner either prior to commencement or simultaneously with the commencement of PN. Note that commencement of nutrition support should not be delayed. Ongoing prophylactic supplementation of potassium, phosphate and/or magnesium should be considered in patients at high risk of refeeding syndrome until stable at target rates (See Appendix 1: Refeeding Syndrome).

3.2.5 Composition of Parenteral Nutrition Solution

The standard PN solution at RHW is an 'all-in-one' solution containing a mixture of glucose, amino acids, lipids, electrolytes, vitamins, and trace elements (Baxter Olimel N9E: See appendix 4). At RHW, this formulation is only available in a 2000mL bag.

PN is generally infused as a continuous infusion over 24 hours. Infusion times may be reduced for patients requiring PN longer term. For patients at risk of refeeding syndrome a slower commencement regimen may be required. The medical team or dietitian will advise if this is the case and recommend an appropriate starting rate. PN solution should be commenced at a maximum of 20mls/hr and maintained at that rate until medical team or dietitian r/v.

Fluids

PN fluid volume contributes to daily fluid balance. In some cases, additional fluid will be required to meet a patient's hydration needs. If required, this should be prescribed/ordered by the medical team and administered separately. The dietitian must be notified of any fluid restrictions.

Electrolytes

We do not have a sterile unit at RHW therefore TPN cannot be modified. The standard PN solution at RHW (Baxter Olimel N9E) is an 'all-in-one' solution and contains electrolytes (see Appendix 4 for constituents of TPN).
Electrolytes are to be reviewed daily until stabilised on target rate of PN. It is the responsibility of the medical team to check the electrolyte content of the PN prior to prescribing additional electrolytes (see Appendix 4 for constituents of TPN). Refer to RHW Local Operating Procedure – Potassium – Administration of Oral and Intravenous Infusion
Refer to RHW Local Operating Procedure – Phosphate Intravenous Replacement

Vitamins, Minerals and Trace Elements

The standard PN formulation includes vitamins and trace elements in amounts equal to the recommended daily requirement for stable patients on parenteral nutrition, except for Vitamin K, which is to be charted separately. This does not account for increased requirements related to baseline deficiency, illness, or losses. Additional Zinc or Selenium, for example, may be required in patients with large gastrointestinal losses. Replacement will be determined by consideration of clinical condition and biochemistry screening results. Additional Cernevit (IV multivitamin) and/or trace elements may be recommended by the Clinical Dietitian in severely malnourished patients receiving low-volumes of PN and/ or at risk of refeeding syndrome until target rate is achieved.

Micronutrient levels must be monitored in long-term PN patients to prevent overload or deficiencies (see Table 1 -Baseline Investigations and Monitoring Guidelines)

3.3 Monitoring

3.3.1 Clinical Dietitian

All patients receiving PN will be reviewed daily (Monday – Friday), or as required/able, by the clinical dietitian for the RHW, until the patient is stable on the target rate of PN. The Dietitian is responsible for monitoring adequacy of nutrition input (from all sources) to meet nutrition requirements and avoid overfeeding. Nutrition requirements will be reassessed as needed when changes in clinical condition and/or activity level occur. The Dietitian will also manage the transition of patients from parenteral to enteral and oral nutrition as required. Issues will be brought to the attention of the medical team and documented in the patient's health care record.

3.3.2 Medical Monitoring

The managing medical team retains overall responsibility for the patient. They are responsible for ensuring that PN monitoring requirements are ordered and reviewed in accordance with Table 1, Baseline Investigations and Monitoring Guidelines, or more frequently if clinically indicated and managed appropriately where indicated.

3.3.3 Nursing Care

The ward Nursing Staff will perform the following tasks for patients on PN:

Observations

- Weight at baseline and twice weekly thereafter
- Vital signs in accordance with frequency on SAGO chart.
- Accurate fluid balance chart and summary (to maintain accurate fluid balance and homeostasis).
- Capillary blood glucose monitoring:
    - every six (6) hours (every 4 hours in patients on insulin)
    - blood glucose monitoring may be reduced to daily once stable on target rate of PN (i.e. glucose between 4 – 8 mmol/L without requirement of insulin, See Appendix 3.) following consultation with Dietitian and managing medical team.
- Bag change will be at 15:00 hrs each day unless otherwise required (should a bag change be required at an alternate time, the reason should be clearly documented and handed over). Bags must not hang for longer than 24 hours.

PN solutions must only be hung for a maximum of 24hours. The PN bag is to be changed every 24 hours at 1500hrs each day regardless of the amount remaining in the previous bag, except where otherwise indicated (exception: patient with increased requirements infusing more than one PN bag/day). Infusion sets are to be

changed each day at the same time as the bag change. For patients on rates greater than 84ml/hr (greater than 2000ml/day), bags and infusion sets are to be changed at the completion of each bag.

Bags connected to the patient should be protected from light (which breaks down some components of PN) using the coloured protective cover provided with each bag in accordance with manufacturer's instructions.

The setup of TPN and accessing the CVAD is a strict aseptic non touch technique procedure to prevent line infections and must be administered via a giving set with a 170-200 micron filter. TPN must only be disconnected for line and bag changes or when cessation is documented by the medical officer.

3.4 Cessation of PN

Cessation of PN is a multi-disciplinary decision.

Generally, PN can be ceased when 75% of nutritional requirements can be achieved orally/enterally unless impaired gastrointestinal function precludes 100% absorption of nutrient needs. In response to improvements in oral intake, TPN rate will be weaned accordingly

At this point, nursing staff or the patient should maintain accurate Food Record Charts, in addition to the existing fluid balance charts. Blood glucose level checks may be ceased with cessation of PN, unless the patient is on insulin.

3.4.1 Advising Dietitian

Dietitian should be consulted prior to cessation of TPN to discuss weaning procedures, and nutritional requirements considering cessation.

3.4.2 Ceasing PN Suddenly or Unexpectedly, prior to establishing oral/enteral nutrition

Occasionally PN may need to be stopped for other reasons (e.g., line infections, acute operations, major metabolic disorders) despite the patient remaining NBM/nil enteral feeds.

For patients not on insulin:

- With PN infusion rates up to approximately 84mL/hr there is no need to taper the infusion rate prior to cessation.
- With PN infusion rates greater than 84mL/hr, or at the end of a cyclic infusion (eg those on overnight PN), the PN infusion should be tapered to avoid rebound hypoglycaemia by halving the PN infusion rate for 30mins prior to cessation).
- A single BGL 1 hour post PN cessation is sufficient.

If short-acting insulin has been administered within 4 hours of PN cessation:

- Patients should be monitored closely for risk of hypoglycaemia with hourly BGLs for up to 4 hours. If Actrapid or Humulin R: hourly BGLs for up to 6 hours.

For patients on long-acting insulin:

- High risk of hypoglycaemia, especially those on Levemir. Contact RHW Physician on call and commence IV Glucose 10% (via CVAD) at the same rate as PN infusion or Glucose 5% (via peripheral line) at twice the PN infusion rate if clinically appropriate for up to 12 hours (or up to 24 hours for Optisulin). Lower IV glucose rates could be considered if BGLs between 6-10 mmol/L.
- Contact RHW Physician on call and continue 4-hourly BGLs. If BGLs less than 6mmol/L, monitor 2nd-hourly.
- If Managing Medical Team unable to commence IV glucose, then 2nd-hourly BGLs up to 12 hours for Levemir or up to 24 hours for Optisulin. If all BGLs have been above 8 mmol/L for preceding 6 hours then decrease frequency to every 4 hours. If BGLs less than 6mmol/L – consider starting IV glucose.
- The above may not take into account patients on very long agents such as Toujeo. Please consider this when managing patients on TPN.

- Refer to POWH Clinical Business Rule POWH/SSEH CLIN002 Hypoglycaemia Management for Patients with Diabetes.

3.4.3 Line Removal

Refer to RHW Local Operating Procedure - Central Venous Catheter Access Device (CVAD) Management.

3.5 Documentation

- Adult Fluid Order Chart
- eFluids
- Patient Health Care Record

3.6 CBR communication

The new CBR has been reviewed and endorsed by all relevant hospital staff. The revised CBR will be distributed to all medical, nursing and midwifery staff. The CBR will be discussed at ward meetings, education and patient quality and safety meetings. Education will occur through in-services, open forum and local ward implementation strategies to address changes to practice. The CBR will be uploaded to the CBR tab on the intranet and staff are informed how to access.

3.7 Appendices

APPENDIX 1: Refeeding Syndrome

What is Refeeding Syndrome?

Refeeding syndrome is the term used to describe the adverse metabolic effects and clinical complications that may arise when a starved or seriously malnourished individual commences refeeding by any route. When the malnourished patient is fed carbohydrate, anabolism leads to intracellular influx of anabolic ions in response to insulin

(notably phosphate, potassium, magnesium) and a simultaneous shift of sodium and water out of cells. The resulting electrolyte shifts can lead to dangerously low plasma levels of these ions.

Signs of refeeding syndrome include:

- Severe hypophosphataemia, hypokalaemia or hypomagnesaemia;
- Vitamin deficiencies (most notably, thiamine depletion);
- Glucose intolerance;
- Fluid balance disturbances.

Who is at risk?

"Some" risk of refeeding syndrome	Any patient who has had very little nutrition intake for >5 days is at some risk of re-feeding problems.

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High risk of refeeding syndrome	**Patient has one or more of the following:** • BMI <16kg/m^2 • Unintentional weight loss of >15% within the previous 3-6 months • Very little or no nutrient intake for >10 days • Low levels of potassium, phosphate or magnesium prior to any feeding **Or patient has two or more of the following lesser criteria:** • BMI <18.5kg/m^2 • Unintentional weight loss >10% within the previous 3-6 months • Very little or no nutrient intake for >5 days • A history of alcohol abuse or some drugs including insulin, chemotherapy, antacids or diuretics.
Extreme risk of refeeding syndrome	**Use extra caution in patients with:** • BMI <14kg/m^2 **Or** • Negligible intake for more than 15 days

Precautions to be taken

1. Identify at-risk patients.

All patients should be assessed for risk of refeeding syndrome by a Dietitian. If a dietitian assessment is not possible (for example, on weekends), then a risk of refeeding syndrome should be assumed and the following precautions taken.

2. Treat electrolyte abnormalities.

Electrolyte levels (in particular phosphate, potassium and magnesium) must be assessed at baseline and any abnormalities corrected prior to or simultaneously with the commencement of PN.

3. Provide vitamin supplementation.

Thiamine 300mg IV must be given 30 minutes prior to PN commencement and then 100mg tds for 7-10days. An IV multivitamin (Cernevit, 1x5mL ampoule) and trace elements (1x10mL syringe) must also be provided daily for 5 days or until the target-rate of PN is achieved.

4. Deliver energy and fluids slowly.

PN should be commenced at no more than half the goal rate and increased gradually. The dietitian will provide recommendations on starting rates and progression for patients at risk of refeeding syndrome. *After hours* (dietitian unavailable) PNS9 2000ml solution should be commenced at a maximum of 20mL/hr and maintained at that rate until a dietitian assessment can be conducted.

5. Monitor the patient.

Fluid balance should be carefully documented so as to avoid fluid overload. Biochemistry should be monitored at least daily during the first week of refeeding and any abnormalities corrected (specifically phosphate, potassium and magnesium). Refer to Table 1. Baseline Investigations and Monitoring Guidelines.

APPENDIX 2: After Hours PN Starting Regimen

After hours and weekends (when Dietitian unavailable):

1. Contact the afterhours nurse manager (AHNM). TPN is kept at POW AHDR.
2. On call pharmacist should only be organising supply if the AHDR supply has been exhausted.
3. PN must be ordered via fluid chart (see section 3.3.3 for details).
4. Baxter Olimel N9E 2000ml solution should be commenced at a maximum rate of 20mL/hr and maintained at that rate until a Dietitian assessment can be conducted.
5. Prescription: Thiamine (300mg IV 30mins prior to commencing PN and then 100mg tds), Cernevit (1 ampoule IV daily) and trace elements (1 syringe IV daily).
6. Prescribe sliding scale insulin regimen (see Appendix 3).
7. Monitor potassium, phosphate, and magnesium levels daily for refeeding syndrome (supplement if low). Refer to Table 1. Baseline Investigations and Monitoring Guidelines.
8. Medical team to review need for supplemental IVF while TPN is running at low rate.

APPENDIX 3: Blood Glucose Monitoring and Management in Patients Receiving Parenteral Nutrition

3.1 Blood Glucose Monitoring during PN

- All patients starting PN: BGL check prior to commencement of PN and every 6 hours (QID) until goal rate of PN achieved, then daily if BGL<8mmol/L.
- Patients on insulin: BGL monitoring every 6 hours.
- Patients where there is an abrupt interruption to PN:
    - Patients not on insulin: a single BGL 1hr post PN cessation is sufficient
    - NBM on insulin: every 2 hours for up to 12 hours (or 24 hours for Optisulin) if not commencing IV glucose.
- For most patients the target BGL range is 5-10mmol/L. Pregnancy target is 4-8mmol/L.

3.2 Insulin Regimens

- Ward Dietitian is to be consulted regarding rates of glucose administered in PN.
- Supplemental/correction scale of subcutaneous rapid acting insulin should not be used alone to optimize glucose control in patients receiving PN.
- IV insulin may be preferred with haemodynamically unstable or critically ill patients with hyperglycaemia on PN. Discuss with RHW Physician on call if patients are outside critical care areas (ICU, HDU or CTICU). Refer to POWH Clinical Business Rule POWH CLIN006 Insulin Infusion (Continuous Intravenous) and treatment of Diabetic Ketoacidosis (DKA), Hyperglycaemia Hyperosmolar State (HSS) and Non DKA/HSS.

3.2.1 Patients with known Diabetes Mellitus on PN

- For patients with Type 1 Diabetes Mellitus, on a basal bolus insulin regimen or subcutaneous insulin pump, or where there is concern for insulin secretory deficit (eg diabetes secondary to pancreatic disease), seek immediate consultation from RHW Physician on call.
- For patients with Type 2 Diabetes Mellitus and hyperglycaemia, adding Levemir (1 unit per 10g glucose, administered as two (2) divided doses but modified if patient's body weight is under 45kg or eGFR less than 30mL/min/1.73m2) along with supplemental NovoRapid or Humalog or Apidra should be considered. The doses and frequency of supplemental insulin should be reviewed at time of charting as to whether to administer every 4 or 6 hours, according to degree of blood glucose elevation and whether the patient is eating or receiving concurrent enteral nutrition. RHW Physician on call can be consulted for guidance. Insulin doses will require adjustment if PN regimen is altered or if BGLs outside of target range.

- Prescribe as Levemir (Determir) subcutaneous every 12 hours at 1800 and 0600 hours plus supplemental/correction scale of subcutaneous rapid acting insulin every four (4) or six (6) hours, doses as per eMEDs.

- Using Optisulin as basal insulin may be associated with a risk for hypoglycaemia.

3.2.2 Patients with no known Diabetes Mellitus on PN with one or more BGL ≥10mmol/L

- Adding Levemir (1 unit per 20g glucose, administered as two (2) divided doses but modified if patient's body weight is under 45kg or eGFR less than 30mL/min/1.73m2) along with supplemental NovoRapid or Humalog or Apidra should be considered. The doses and frequency of supplemental insulin should be reviewed at time of charting as to whether to administer every 4 or 6 hours, according to degree of blood glucose elevation and whether the patient is eating or receiving concurrent enteral nutrition. RHW Physician on call can be consulted for guidance. Insulin doses will require adjustment if PN regimen is altered or if BGLs outside of target range.
- Prescribe as Levemir (Determir) subcutaneous every 12 hours at 1800 and 0600 hours plus supplemental/correction scale of subcutaneous rapid acting insulin every four (4) or six (6) hours, doses as per eMEDs.
- Using Optisulin as basal insulin may be associated with a risk for hypoglycaemia.

3.2.3 Adjustment to insulin

- Change in rate of PN, BGL results and need for supplemental/correction scale of subcutaneous rapid acting insulin should guide daily adjustment of Levemir. Increase total Levemir dose by 2/3 of the units of NovoRapid given on the correction scale in the last 24 hours.
- If BGL < 5mmol/L, reduce Levemir dose, e.g. by 20% before next dose is due.

3.2.4 Ongoing insulin requirement after PN is ceased

- For patients transitioning to oral intake who are still requiring Levemir, seek RHW Physician on call consult regarding transition to home diabetes regimen.
- Patients who are usually on insulin or insulin-deficient, require RHW Physician on call input to transition to an ongoing insulin regimen.

APPENDIX 4: Formulation of Baxter Olimel N9-840E (with electrolytes) (2000ml bag)

Prescription Details	**Baxter OliMel N9-840E**
Amino Acid (g)	113.9
Glucose (g)	220
Lipid (as ClinOleic) (g)	80
Nitrogen (g)	18
Sodium (mmol)	71.5
Potassium (mmol)	60
Magnesium (mmol)	8
Calcium (mmol)	7
Chloride (mmol)	90
Phosphate (mmol) (including phosphate from lipid)	30
Acetate (mmol)	107
Adult trace elements(ml)	10
Cernevit (ml)	5
Total Volume (mL)	2016
Osmolarity (mOsmol/L)	1310
Osmolality (mOsmol/kg water)	1580

3.8 References

- Policies/ Business Rules
  - Prince of Wales Hospital Parenteral Nutrition Management Business Rule -POWH CLIN 048 (2021)
  - Local Operating Procedure – Central Venous Catheter Access Device (CVAD) Management
  - RHW Local Operating Procedure – Potassium – Administration of Oral and Intravenous Infusion
  - RHW Local Operating Procedure - Phosphate Intravenous (IV) Replacement
  - POWH Clinical Business Rule. 2021. Electrolyte Replacement Guidelines for General Wards. POWH CLIN104
  - NSW Ministry of Health. 2020. Recognition and management of patients who are deteriorating. PD2020_018
  - POWH Clinical Business Rule. 2020. Hypoglycaemia Management for Patients with Diabetes. POWH/SSEH CLIN002

- POWH Clinical Business Rule. 2020. Insulin Infusion (Continuous Intravenous) and treatment of Diabetic Ketoacidosis (DKA), Hyperglycaemia Hyperosmolar State (HHS) and Non DKA/HSS. POWH CLIN006
- NSW Ministry of Health. 2017. Infection Prevention and Control Policy. PD2017_013

External References:

- Worthington P, Balint J, Bechtold M, Bingham A, Chan L-N, Durfee S, Jevenn AK, Malone A, Mascarenhas M, Robinson DT, Holcombe B. 2017. When is parenteral nutrition appropriate? Journal of Parenteral and Enteral Nutrition, 41:324-377. https://doi.org/10.1177/0148607117695251
- Independent Hospital Pricing Authority. 2018. Pricing and funding for safety and quality–Risk adjustment model for hospital acquired complications, version 3. IHPA, Sydney. Accessed 29/6/21: https://www.ihpa.gov.au/sites/default/files/publications/pricing_and_funding_for_safety_and_quality_- _risk_adjustment_model_for_hospital_acquired_complications_2018-19.pdf
- Singer P, Blaser AR, Berger MM, Alhazzani W, Calder PC, Casaer MP, Hiesmayr M, Mayer K, Montejo JC, Pichard C, Preiser JC, van Zanten ARH, Oczkowski S, Szczeklik W, Bischoff SC. 2019. ESPEN guideline on clinical nutrition in the intensive care unit. Clinical Nutrition, 38:48-79. https://doi.org/10.1016/j.clnu.2018.08.037
- McClave SA, Taylor BE, Martindale RG, Warren MM, Johnson DR, Braunschweig C, McCarthy MS, Davanos E, Rice TW, Cresci GA, Gervasio JM, Sacks GS, Roberts PR, Compher C; Society of Critical Care Medicine; American Society for Parenteral and Enteral Nutrition. 2016. Guidelines for the Provision and Assessment of Nutrition Support Therapy in the Adult Critically Ill Patient: Society of Critical Care Medicine (SCCM) and American Society for Parenteral and Enteral Nutrition (A.S.P.E.N.). Journal of Parenteral and Enteral Nutrition, 40:159-211. https://doi.org/10.1177/0148607115621863
- Barash M, Patel JJ. Gut Luminal and Clinical Benefits of Early Enteral Nutrition in Shock. *Current Surgery Reports* **7,** 21 (2019). https://doi.org/10.1007/s40137-019-0243-z
- Osland EJ, Ali A, Nguyen T, Davis M, Gillanders L. 2016. Australasian society for parenteral and enteral nutrition (AuSPEN) adult vitamin guidelines for parenteral nutrition. Asia Pacific Journal of Clinical Nutrition 25: 636-650. https://doi.org/10.6133/apjcn.022016.05
- Osland EJ, Ali A, Isenring E, Ball P, Davis M, Gillanders L. 2014. Australasian Society for parenteral and enteral nutrition guidelines for supplementation of trace elements during parenteral nutrition. Asia Pacific Journal of Clinical Nutrition, 23:545-554. https://doi.org/10.6133/apjcn.2014.23.4.21
- Blaauw R, Osland E, Sriram K, Ali A, Allard JP, Ball P, Chan L-N, Jurewitsch B, Logan Coughlin K, Manzanares W, Menedez AM, Sioson M, Visser J, Berger MM. 2019. Parenteral provision of micronutrients to adult patients: An expert consensus paper. Journal of Parenteral and Enteral Nutrition, 43:S5-S23. https://doi.org/10.1002/jpen.1525
- da Silva, J.S.V., Seres, D.S., Sabino, K., Adams, S.C., Berdahl, G.J., Citty, S.W., Cober, M.P., Evans, D.C., Greaves, J.R., Gura, K.M., Michalski, A., Plogsted, S., Sacks, G.S., Tucker, A.M., Worthington, P., Walker, R.N., Ayers, P. and (2020), ASPEN Consensus Recommendations for Refeeding Syndrome. Nutrition in Clinical Practice, 35: 178- 195. https://doi.org/10.1002/ncp.10474

- National Institute for Health and Clinical Excellence. 2017. Clinical Guideline 32 Nutrition Support in Adults: oral nutrition support, enteral tube feeding and parenteral nutrition. National Collaborating Centre for Acute Care, London. Accessed 29/6/21: https://www.nice.org.uk/guidance/cg32
- Consensus statement POWH Parenteral Nutrition Forum. 2016
- Braga M, Ljungqvist O, Soeters P, Fearon K, Weimann A, Bozetti F. 2009. ESPEN guidelines on parenteral nutrition: Surgery. Clinical Nutrition, 28:378- 386. https://doi.org/10.1016/j.clnu.2009.04.002
- Pironi L, Boeykens K, Bozzetti F, Joly F, Klek S, Lal S, Lichota M, Mühlebach S, Van Gossum A, Wanten G, Wheatley C, Bischoff SC. 2020. ESPEN Guideline on home parenteral nutrition. Clinical Nutrition, 39:1645-1666. https://doi.org/10.1016/j.clnu.2020.03.005
- Wagman LD, Miller KB, Thomas RB, Newsome HH, Weir GC. 1986. The effect of acute discontinuation of total parenteral nutrition. Annals of Surgery 1986; 204:524-529. https://doi.org/10.1097/00000658-198611000-00003
- Australian Diabetes Society Guidelines for Routine Glucose Control in Hospital; 2012. Accessed 29/6/21: https://diabetessociety.com.au/documents/ADSGuidelinesforRoutineGlucoseControlinHospitalFinal2012.pdf
- Dietitians Association of Australia Nutrition Support Interest Group (2015). *Parenteral Nutrition Manual for Adults in Healthcare Facilities*. DAA, Canberra.
- Gosmanov AR, Umpierrez GE. 2013. Management of hyperglycemia during enteral and parenteral therapy. Current Diabetes Reports, 13:155-166. https://doi.org/10.1007/s11892-012-0335-y
- Ramos A, Rabasa F, Mendoza L, Cardenete J, Gill P, Morilla A, Cardona D, Pérez A. 2018. Differences in Glycemic Control in Diabetic and Nondiabetic Patients with Parenteral Nutrition Using a Basal plus Correction Insulin regimen: An Observational, Retrospective Study. Diabetes Therapy, 9:1359- 1367. https://doi.org/10.1007/s13300-018-0433-1
- Agency for Clinical Innovation (2011). Parenteral Nutrition Pocketbook. ACI, Chatswood.
- Baxter Factsheet – Storage of Compounded Parenteral Nutrition (2019)

4. ABORIGINAL HEALTH IMPACT STATEMENT DOCUMENTATION

Aboriginal people have been considered and engagement with the Aboriginal Health Unit has occurred in the development of this policy. Aboriginal Hospital Liaison Officers and /or Aboriginal Health Workers can be contacted as required.

5. CULTURAL SUPPORT

- When clinical risks are identified for an Aboriginal woman, she may require additional supports. This may include Aboriginal health professionals such as Aboriginal liaison officers, health workers or other culturally specific services.
- For a Culturally and Linguistically Diverse CALD woman, notify the nominated cross-cultural health worker during Monday to Friday business hours

- If the woman is from a non-English speaking background, call the interpreter service: NSW Ministry of Health Policy Directive PD2017_044-Interpreters Standard Procedures for Working with Health Care Interpreters.

6. REVISION AND APPROVAL HISTORY

Date	Revision No.	Author and Approval
15/06/2023		Endorsed by Safety and Quality Committee
15/12/03		Approved Quality Council
16/8/11		Reviewed Therapeutic & Drug Utilisation Committee
18/8/11		Approved Quality & Patient Safety Committee
10/6/14		Reviewed and endorsed Therapeutic & Drug Utilisation Committee
17/7/14		Approved Quality & Patient Safety Committee
23/8/18		Reviewed and endorsed Gynaecology Services Division Management Committee
15/11/2018		Approved Quality & Patient Safety Committee
		Reviewed and endorsed by RHW Nutrition Committee
		Reviewed and endorsed by RHW Comprehensive care committee