NHS FORTH VALLEY

PARENTERAL NUTRITION POLICY (Adults)

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This document can, on request, be made available in alternative formats

Management of Policies Procedure control sheet

Consultation and Change Record – for ALL documents

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INTRODUCTION

Parenteral nutrition (PN) is the intravenous administration of a solution containing macronutrients, electrolytes, micronutrients and fluid given to support patients with intestinal failure (IF).

Use of PN can be associated with complications, some of which can be life threatening if not managed appropriately. Care of PN patients is best provided by a multidisciplinary team (MDT) with expertise in managing this patient group.

This document has been designed to assist staff in their assessment, selection, implementation and monitoring of patients receiving PN. This document will also identify complications of PN including metabolic and central venous access device (CVAD) problems and subsequent management.

Please note **this policy only applies to adults**.

All acute hospitals should have a nutrition support MDT.[1] Where a fully operational nutrition team is in place, reduced PN related complications, morbidity, improved nutrient intake and clinical outcomes in addition to reduced length of stay has been demonstrated.

This policy is intended to be a working document to help achieve these goals and by standardising practice across Forth Valley and facilitate the audit process.

Acknowledgements
This PN policy is based on similar documents available in Surrey and Sussex NHS Trust but has been modified to suit Forth Valley Royal Hospital patients.

Some information is based on information from the British Dietetic Association Pocket Guide to Clinical Nutrition.[2]

DEFINITIONS

CVAD	Central Venous Access Device
IF	Intestinal failure
MDT	Multidisciplinary Team
PN	Parenteral nutrition

DUTIES & RESPONSIBILITIES

The Referring Clinical Team
The consultant referring the patient retains clinical responsibility of the patient.

Refer to the nutrition team early and provide the rationale for request for PN and clearly document in the clinical notes including type of venous access considered.

For the duration of PN administration, the referring clinicians are responsible for arranging collection of blood samples as advised by the nutrition team and replacement of electrolytes as appropriate. They are also responsible for monitoring fluid balance.

Nutrition Team Clinicians
These are the consultant gastroenterologists with an interest in nutrition. They lead the weekly ward round every Tuesday morning and provide clinical input into the decisions relating to nutrition.

PN Dietitian
The PN Dietitian is responsible for assessing the patient's nutritional status and estimating appropriate nutritional requirements. They will evaluate the risk of refeeding syndrome and examines available access to ensure choice of PN is appropriate e.g. peripheral/central access. They will advise on the appropriateness of PN and any alternative enteral routes. The PN Dietitian works with the PN pharmacist in selecting an appropriate feeding regime including management of electrolytes. They will review the patient daily Monday to Friday, including Public Holidays, to ensure optimal nutrition and fluid balance is maintained throughout their admission.

PN Pharmacist
The PN pharmacist works with the PN Dietitian in selecting an appropriate feeding regime including management of electrolytes. They will help PN dietitians evaluate the risk of refeeding syndrome and examines available access to ensure choice of PN is appropriate (e.g. peripheral/central access). They will review the patient daily Monday to Friday, including Public Holidays, to ensure optimal nutrition and fluid balance is maintained throughout their admission. They will liaise with the aseptic unit regarding the formulation of PN.

Aseptic Unit
The aseptic unit team consists of technicians, support workers and pharmacists. They prepare PN each day Monday-Friday in a sterile environment, ensure formulations are stable and support the nutrition team in meeting complex patient needs.

Ward Nursing Staff
Registered nurses with competencies undertaken for relevant intravenous administration training can be involved in setting up PN using aseptic technique. They are responsible for CVAD (or peripheral Venflon) management and administration of the PN according to the IV fluid charts. They should undertake patient observations, alerting members of the primary medical or surgical team and members of the nutrition team, as appropriate, to a high NEWS.

Contact Details for the Nutrition Team

Dietitian	Page 1692/1960
Pharmacist	Page 9114/1506
Consultant Gastroenterologist	Page 1345

Nutrition MDT

The Nutrition Team MDT meets at 9 am on a Tuesday morning to discuss patients before a ward round. The order cut off time, for same day production of PN, is 11am Monday to Friday. Patients must be referred to the Nutrition Team with enough time to allow a patient to be reviewed and a PN prescription to be generated before this cut off. If you wish to discuss a patient in person, you are welcome and encouraged to attend. Please contact a member of the team to arrange this.

INDICATIONS FOR PARENTERAL NUTRITION

PN is appropriate for patients with IF or non-available gut as identified by the consultant surgeon, physician or anaesthetist**.**

Types of IF requiring PN

- Type 1 acute, short term and usually self-limiting. This is often perioperative in nature such as an ileus following surgery.

- Type 2 prolonged acute IF over a period of weeks or months.

- Type 3 chronic IF in a metabolically stable patient where home PN is required. Indications include short bowel (e.g. resections related to Crohn's disease or ischaemic vascular disease) and radiation enteritis.

The risks/benefits of providing PN should be considered on an individual basis including the expected degree and duration of IF**.**

Referring for PN (New Patients)
If a decision has been made that the patient needs to be referred for PN:

- PN referral sticker to be completed by referring ward team and stuck in that days case notes. See Appendix A for example.
- Page the Dietitian 1692/1960 or pharmacist on page 9114/1506.
- The patient will be seen on the same day if referred before 11 am, otherwise the patient will be seen on the next working day.
- A prescription will be formulated by the Dietitian and Pharmacist. If the prescription is not written by a member of the Nutrition Team who is a prescriber, prescription recommendations will be discussed and a plan agreed with the referring ward team. The prescription must then be signed by a prescriber on the ward.
- The pharmacy will dispense the PN regime to the ward after 5 pm Monday to Friday. On a Friday, the patient's PN for the full weekend will be supplied.
- A yellow sticker (Appendix B) will be completed by the Pharmacist or Dietitian and attached to the fluid prescription chart. This contains details of that day's PN regimen and allows transcription of PN prescription onto fluid chart. This needs to be cross checked against the PN bag and signed before hanging.

If a patient is likely to require PN, it is better to refer early for nutritional assessment.

Ongoing Care

After the initial review, the patient will be added to the Nutrition Team patient list. Initially, they will be reviewed daily Monday- Friday, and prescriptions generated following patient reviews. For longer term patients, frequency of review may be reduced. At each review, one yellow sticker will be written for each day PN is prescribed for.

PN Patient Placement in Hospital

It is advised that patients receiving PN are nursed on wards with experience in the administration of PN (e.g. gastroenterology, upper GI/colorectal surgery, ICU) unless this is not feasible for clinical reasons. Outlier patients must be alerted to the Nutrition Team using the contact details above.

GENERAL GUIDELINES ON ADMINISTRATION OF PN INCLUDING CVAD SELECTION

Contra-indications
Before PN is prescribed ensure there are no contra-indications.
These include:

- Hypersensitivity to egg, soybean or peanut proteins, or to any constituents of the bag
- Congenital abnormalities of amino acid metabolism (e.g. phenylketonuria)
- Severe hyperglycaemia
- Severe hyperlipidaemia or severe disorders of lipid metabolism characterised by hypertriglyceridaemia

Contra-indications may also include:

- Those who follow a vegan diet as PN products may contain animal-derived products.
- Bags containing electrolytes are contra-indicated where patients have pathologically elevated plasma concentrations of the same electrolyte(s).

CVAD Selection and When a Venflon Can Be Used
With regards to PN, IV access is divided into two types - peripheral and central. Peripheral access (using a Venflon) means PN options are limited. This is because PN bags with an osmolality over a certain threshold may cause harm. At the time of writing, only two bags may be given peripherally. The smaller contains 1050kcal and the larger 1400 kcal. As such, it is often not possible to fully meet patient's requirements with peripheral access. This may be appropriate in some cases (e.g. patients with low PN requirements, PN patients on re-feeding regimens or patients expected to be on PN for a short duration).

Selecting a CVAD
In most cases patients will require continuous central venous access to deliver PN. This can be through a PICC or tunnelled central line (Hickman line), both of which are inserted in the Radiology department.

As a general rule, PICC lines are used where central access is needed for a period of weeks to months, whereas Hickman lines are selected where central access is needed for durations of months to years. The NHS Forth Valley Vascular Access Device Decision Matrix is available online at

https://staffnet.fv.scot.nhs.uk/wp-content/uploads/2018/07/VAD-Matrix-2018.pdf

Please consider CVAD type and placement with your patient, the nutrition team and Radiology.

It is crucial that a CVAD with the fewest lumen is selected. If more than one lumen is present then **one will need to be dedicated to PN**. Other lumen (if present) can be dedicated to other medicines or fluids.
A patient should NEVER have more than one CVAD in place as this raises the risk of infection. **If an exception to this is needed then the consultant responsible for the**

request must speak directly to the radiology consultant. Documentation of the rational for two CVAD must be documented in the patient notes with appropriate consent gained from the patient to the increased risk of infection.

All devices used to deliver PN can be a source of life-threatening blood stream infection and must be maintained optimally as per local policy. See the section on infection below for further information.

CVAD & TPN Care
Importance of Care in all PN patients.
The following general points **must** be adhered to:

- When hanging or disconnecting a bag of PN, aseptic technique according to hospital policy must be followed.
- Administration sets and PN bags must be changed every 24 hours. The nutrition team will never prescribe a bag to run longer than this.
- The contents of a bag must not be altered once the bag has left the aseptic unit. Additions must never be made at ward level as this could affect the stability of the bag.
- While a PN infusion is ongoing, the feed should be covered with the bag provided, to protect the contents from light and help maintain stability.
- If PN is disconnected for any reason (e.g. patient going to theatre) the same bag/giving set must never be re-attached. Instead it should be discarded immediately.
- PN infusions must have a dedicated lumen. The dedicated lumen must not be used for other purposes in-between PN infusions.
- Patients should have CVADs inserted with the fewest necessary lumen possible
- PN should never be infused faster than the rate on the bag without nutrition team advice, even if an infusion has started late and will not be finished before the next one is due. The administration rate will be clearly labelled on the side of the bag. Appendix C shows an example of a PN label.

ADMISSION OF PATIENT WITH ESTABLISHED PN

All patients on established PN at home will have an alert on TrakCare and highlighted to dietetics and pharmacy on admission automatically. Patients will be reviewed on the next working day.

Clinical monitoring of PN Patients

Parameter	**Frequency**
FBC/U+Es/LFTs/Mg/Ca/P04	Daily for first two weeks; Twice weekly once stable.
Coagulation/CRP	Twice weekly until stable or as clinically indicated; Weekly thereafter.
Iron	Every 3 to 6 months
Fluid Balance	Daily
Capillary Blood sugar	Four times a day until stable; Twice daily thereafter
Weight (using validated scale)	Weekly

Fluid Balance

Every inpatient must have a detailed daily fluid balance charted, including stoma output if applicable. Ensure PN is included and taken into account if prescribing additional fluids. Extra fluid may be added to the formulation of the bag by the nutrition team to help with hydration.

Biochemical/Haematology Laboratory Tests

These specimens must be taken prior to commencing –

- EDTA (Purple top): Full Blood Count (FBC)
- Clotted blood (Gold top): CRP/U+E/LFTs/Magnesium/bone profile(including phosphate)/serum triglyceride/iron/folate/B12
- Flouride Tube (Grey top): blood glucose
- Sodium citrate (Blue top): Coagulation

- FBC important to assess anaemia
- Mg/Po4 important to monitor for refeeding syndrome
- B12/folate/iron can be low and need replacement
- Calcium may be low secondary to low magnesium, replace magnesium first
- CRP to monitor for infection (note CRP is not specific to infection and in early infection may not yet be elevated; blood cultures and other infection investigations should be considered where infection is a possibility)

Hyperglycaemia

Hyperglycaemia among PN patients is common. This may be due to the carbohydrate volume of the PN or due to stress-induced insulin resistance or pre-existing diabetes. Hyperglycaemia may result in osmotic diuresis and dehydration. Insulin may be necessary.

Potassium
Potassium is primarily found intracellularly. As such, reported plasma levels may not reflect total body levels so care should be taken when interpreting these- it is possible for individuals with considerably depleted stores to have a normal plasma level. For this reason, potassium is often added to bags on a **mmol/kg** basis, even where a plasma level appears normal. A typical daily potassium requirement for a patient would cover a baseline of 1mmol/kg plus losses.

The cause of hypokalaemia should always be considered before any replacement is prescribed. Common causes include high losses (e.g. diarrhoea or NG tube aspirates), inadequate intake, refeeding syndrome, magnesium deficiency and as a side effect to medication. By better matching a patient's potassium requirements with their PN, ward staff should have fewer "top-ups" to prescribe and administer, reducing workload and improving patient care.

Some resources refer to potassium in grams rather than mmol. To convert grams to mmol:

1g potassium chloride = 13.5mmol potassium

Potassium also has a role to play in fluid balance. It is difficult for the body to excrete excess water and sodium in a state of hypokalaemia as potassium is needed for exchange in the kidney. Oedematous patients must therefore be given adequate potassium replacement, aiming for the upper end of normal.

Potassium should be checked daily in patients on PN unless the nutrition team advise otherwise.

Potassium must never be added to PN at ward level. If IV potassium is indicated in addition to what is already in the patient's PN bag (e.g. to correct severe hypokalaemia) please refer to current potassium chloride monograph at the Medusa [1]Injectable Medicines Guide online, available at:

https://medusa.wales.nhs.uk/IVGuideDisplaySelect.asp

Telemetry must always be used when administering a potassium infusion of greater concentration than 40mmol/L. If the enteral route is an option, Sando-K tablets and Kay-Cee-L liquid can also be considered. Each Sando-K tablet contains 12mmol potassium and 8mmol chloride.

Phosphate
Phosphate is found predominantly intracellularly and in the skeleton. Phosphate is not included as part of the standard U+Es bundle, and is measured in labs as part of the bone profile. This needs requested specifically by the ward staff requesting bloods. Low phosphate is particularly common in refeeding syndrome- see chapter 17.
In PN, some phosphate is provided by the lipid component of the bag, as phosphate is integral to phospholipids. This is why even "electrolyte-free" bags appear to contain a small amount of phosphate. It is unknown if this phosphate is readily available for cellular uptake or not.

[1] ***Medusa*** is an online injectable medicines guide. All wards should have access as there is a password for general ward use. Contact the pharmacist if difficulty gaining access.

A typical phosphate requirement is 0.3-0.5mmol/kg/day but can vary. Causes of low phosphate must be investigated. Ventilator assisted patients, post-op patients and patients with high fistula output or sepsis are all known to be at risk of low phosphate. If replacement is needed in addition to PN, IV options include phosphate polyfusors, Addiphos and sodium glycerophosphate. The best option will vary depending on what stock is available and other patient factors, but the first line choice is usually sodium glycerophosphate. For advice on administration, please see the most up to data Medusa monographs (**https://medusa.wales.nhs.uk/IVGuideDisplaySelect.asp**). If the enteral route is available, Phosphate-Sandoz tablets may be used. Each tablet contains 16.1mmol phosphate, 3.1mmol potassium and 20.4mmol sodium.

Phosphate should be checked daily in patients on PN unless the nutrition team advise otherwise.

Magnesium

Magnesium is mostly found intracellularly. It is not included as part of the standard U+Es bundle and must be requested separately from labs by the staff member requesting bloods. It can be difficult to interpret reported magnesium levels as these don't necessarily correlate with body stores, but genuine depletion is often under-recognised and more likely in high output stomas, excessive diarrhoea, high NG losses and refeeding syndrome.

Average magnesium requirements are around 0.13mmol/kg. Due to stability limitations, it is not always possible to replace magnesium exclusively through PN, and additional magnesium may need prescribed eg as a one-off 20mmol infusion. If long term replacement may be necessary, multiple oral formulations are available. The first line choice is magnesium aspartate 10mmol sachets which are licensed in adults at a dose of 1 (one) sachet once or twice daily.

For more information, see NHS Forth Valley Hypomagnesaemia in Adults guideline on the intranet, available at:

https://guidelines.staffnet.fv.scot.nhs.uk/wp-content/uploads/sites/2/2016/11/hypomagnesaemia-guideline-1.pdf

Magnesium should be checked daily in patients on PN unless the nutrition team advise otherwise.

Thiamine (Vitamin B1) & Pabrinex

Carbohydrate metabolism uses thiamine. As such, administering too much glucose to patients with thiamine deficiency when starting PN can precipitate further deficiency-related complications including Wernicke-Korsakoff, cardiac failure and peripheral neuropathy.
If the patient is deemed to be at high risk of refeeding syndrome then the clinical team must prescribe

Pabrinex® IV ampoules 1 and 2 (1 pair) DAILY for 4 to 7 days

The first dose must be administered 30 minutes prior to commencing PN. This is because the malnourished patient is likely to be thiamine deficient at baseline and the re-introduction of glucose causes intracellular uptake of electrolytes which leads to increased utilisation of thiamine. If thiamine is not promptly and sufficiently replaced, deficiency problems may occur.

Pabrinex is continued until the patient is receiving their full nutritional requirements (usually 4 to 7 days) although courses may be extended in severe cases or on specialist advice.

Once Pabrinex is stopped, high risk patients should be prescribed oral thiamine 100mg TDS for 10 days.

If the patient is at moderate risk of refeeding syndrome and is absorbing, Pabrinex is not necessary but they should be prescribed thiamine 100mg TDS by mouth for 10 days.

Note: Thiamine tablets can be crushed and dispersed in water for administration, if necessary.

Supplementation of Micronutrients

Patients requiring PN will often be micronutrient depleted. This may be due to poor long-term diet, insufficient recent intake, inadequate GI absorption, excessive GI losses or the effects of alcohol/drugs. Well before micronutrient depletion reaches levels where clinical deficiency states are seen (e.g. scurvy), metabolic/physiological processes are compromised (e.g. reduced wound healing in vitamin C deficiency). Furthermore, administering a single micronutrient in isolation, or a limited range of micronutrients, can reduce levels of others. For these reasons, all patients should receive full micronutrient provision regardless of stage of PN titration. In most cases, all micronutrients will be added to the formulation in the aseptic unit. However, this will need done at ward level if a patient is getting only part of a bag of PN (to ensure they get the full micronutrient dose) or if an off the shelf bag is to be given. The procedure for giving micronutrients at ward level is detailed in **Appendix D**.

COMPLICATIONS OF PN

This section is divided into two subsections:

1. Metabolic complications
2. CVAD related complications

Metabolic Complications

Refeeding syndrome: Identification & Management

Refeeding syndrome is not a singular condition but a group of biochemical and clinical symptoms. It is a set of adverse effects occurring in malnourished patients if nutrition is given too quickly or in amounts exceeding their metabolic capacity. This includes fluid and electrolyte shifts, related metabolic implications and severe fluid shifts. This can affect patients on oral, enteral or parenteral nutrition

Duties and Responsibilities

The Clinical Team

- Identify patients who may be at risk of refeeding syndrome – See **Determine Level of Refeeding Risk** section
- Refer to the Dietitian for advice.
- Daily refeeding bloods and correct as required (see **Clinical monitoring of PN Patients**)
- Restore circulatory volume and monitor fluid balance and overall clinical status closely.
- Refer to Nutrition Team if patient is on parenteral nutrition – **see Contact Details above.**

Ward Nursing Staff

- Complete MUST and refer to ward Dietitian as appropriate.
- Implement MUST nutritional care plan.
- Maintain food record charts until assessed by Dietitian.
- Maintain fluid balance charts.
- Blood glucose monitoring (see **Clinical monitoring of PN Patients**)

Dietitian

- Nutritional assessment.
- Calculate nutritional requirements.
- Recommend nutritional plan (oral, enteral, parenteral).
- Monitor and adjust nutritional plan as required.

Signs and Symptoms

- Hypophosphataemia
- Hypokalaemia
- Hypomagnesaemia
- Altered glucose and lipid metabolism

- Fluid balance abnormalities
- Vitamin deficiency

Altered levels may lead to cardiac, respiratory, renal, neuromuscular, metabolic, haematological, hepatic and gastrointestinal complications or death.

It is essential that patients who are at risk of re-feeding are identified and appropriate action taken.

Pathogenesis of Refeeding Syndrome

See Figure 1 & 2 (below) for visual representation

Starvation

Insulin concentrations decrease and glucagon levels rise. As a consequence, glycogen stores are rapidly converted to glucose and gluconeogenesis is activated resulting in glucose synthesis from protein and lipid breakdown products.

The adipose tissue lipase is activated releasing large amounts of fatty acids and glycerol. Free fatty acids and ketone bodies replace glucose as the major source of energy in starvation. In the starved state the catabolism of fat and muscle leads to loss of lean body mass, water and minerals.

> **NOTE:** Serum concentration of electrolytes may be normal due to adjustments in renal rate of excretion.

Refeeding

When carbohydrates are reintroduced after a period of starvation there is a switch in the metabolism from fat stores to carbohydrate use. This switch leads to a rapid cascade of metabolic events.

This reintroduction of sugars initiates insulin release. With carbohydrate repletion and increased insulin production there is an increased uptake of glucose, phosphorous, potassium and water cells and a stimulation of anabolic protein synthesis.

Depleted total body phosphorus during catabolic starvation and the movement of phosphorus into cells during refeeding leads to severe extracellular hypophosphataemia in association with hypokalaemia and hypomagnesaemia.

Insulin secretion increases acutely and this compounds hypokalaemia and hypomagnesaemia as well as having the effect of rapid movement of sodium and water within the cells into the circulation.

Thiamine is also required for carbohydrate metabolism but is not stored in appreciable amounts in the body. Heart failure, confusion and encephalopathy, secondary to thiamine deficiency may be precipitated by refeeding.

Hypophosphataemia causes reduction in sodium and water excretion, resulting in congestive heart failure. Low levels of potassium and magnesium predispose to arrhythmias, constipation, ileus, confusion and neurological and renal deficits.

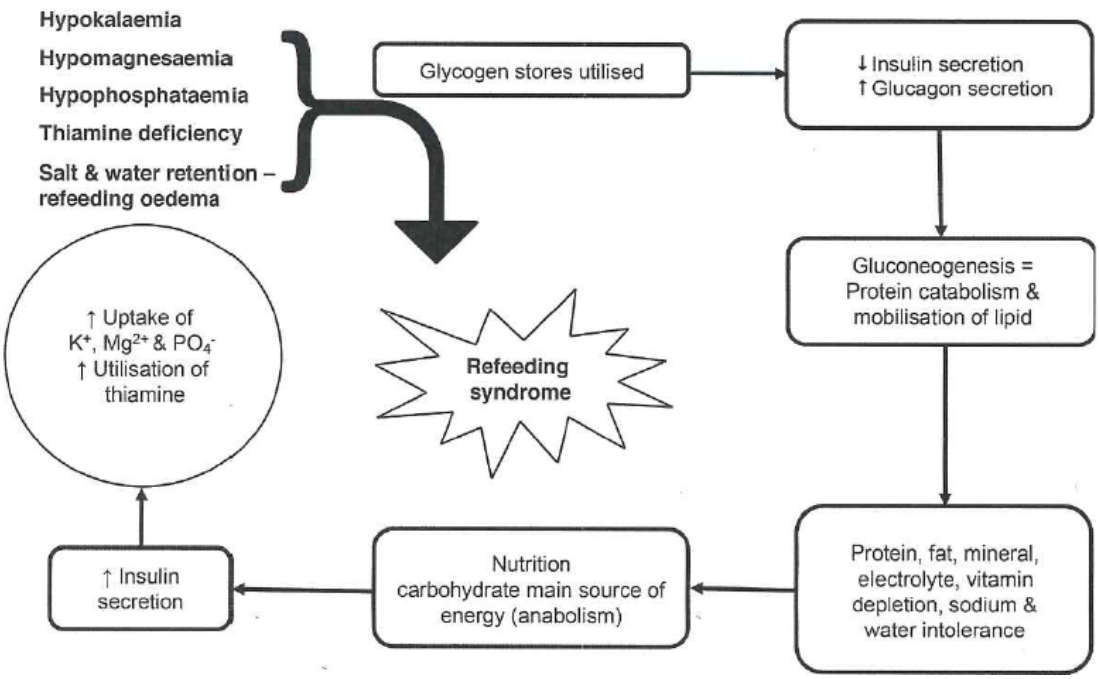


Figure 1 Starvation and Refeeding Syndrome

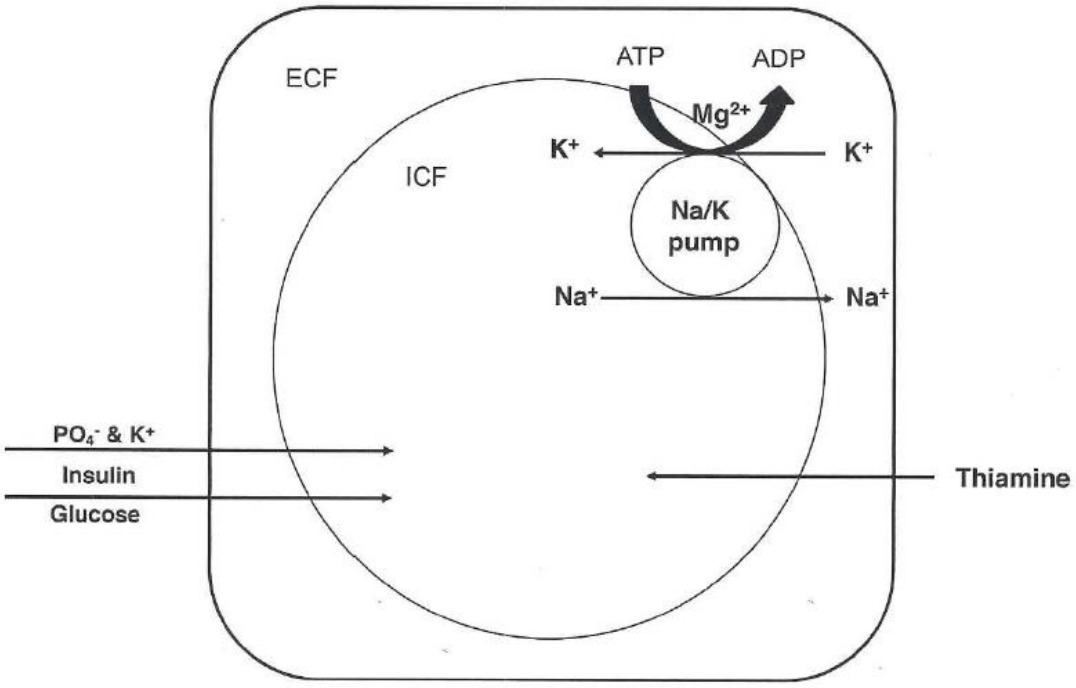


Figure 2 The effect of refeeding syndrome on cell metabolism
ECF – extracellular fluid ICF – intracellular fluid
ATP – adenosine triphosphate ADP – adenosine diphosphate

Determine level of refeeding risk

HIGH RISK: Patients with <u>any</u> of the following are at high risk of Refeeding Syndrome:
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, as per Forth Valley reference ranges, of potassium, phosphate or magnesium prior to any feeding

Patients with two or more of the following are also at high refeeding risk:
BMI < 18.5kg/m^2
Unintentional weight loss of ≥ 10% within the previous 3-6 months
Very little or no intake for > 5 days
A history of alcohol abuse or some drugs including insulin, chemotherapy, antacids or diuretics

Management (Checklist)

Vitamin, mineral and fluid requirements should be met from initiation of PN.

Checklist	
Check baseline Potassium, Calcium, Phosphate and Magnesium levels	
Replete electrolytes as indicated. This may need to be replaced intravenously. **See section on PN monitoring.**	
IV Pabrinex for 4-7 days or Thiamine 100 mg TDS by mouth for 10 days	
Daily refeeding bloods until PN is established or until electrolytes normalised.	
Blood glucose monitoring 4 times a day until established on PN and twice daily thereafter, unless diabetic.	

Moderate risk – start feeding at 20 kcal/kg.
High risk – start feeding at 10 kcal/kg.
In rare cases feeding may need to be started at 5kcal/kg.

Do not wait for electrolyte bloods to be within normal ranges before starting feeding slowly.

The Dietitian plan will aim to meet full nutritional needs in 4 to 7 days.

CVAD RELATED COMPLICATIONS

Central venous access devices can lead to a variety of complications. Infection related complications are dealt with separately below. All complications should be documented as an IR1 as per Forth Valley Royal Hospital Guidance.

To reduce these complications it is crucial that only trained staff interact with CVADs. Early identification and management of complications may save a person's life.

Catheter occlusion

Whenever the catheter is disconnected, it is vital that the catheter is adequately flushed to reduce the risk of clot formation and subsequent infection and/or occlusion.

Haemorrhage

There is the risk of bleeding from the catheter, should the catheter cap become dislodged or if the lumen is not clamped and left open to the air. The nurse must check all connections and security of the catheter on a regular basis.

Air embolism

Air embolism occurs when air enters a systemic vein and travels to the right ventricle, causing a reduction in systemic blood circulation. It can lead to acute cardiac arrest and be fatal. Should the catheter cap become dislodged, or if the lumen is not clamped and left open to the air, then air can be sucked through the catheter into the venous circulation. The nurse must check all connections and security of the catheter on a regular basis.

Pneumothorax

Often associated with insertion of a central line, but other CVADs may cause this complication. A pneumothorax is when air enters the pleural space between the pleural membranes that surround the lungs. It may require aspiration, or insertion of a chest drain. It may be necessary to remove the central line.

Severance of the catheter

In the case of any damage to or breakage of the catheter the following action will be taken: Any rupture, damage or leakage from the catheter must be acted upon immediately to prevent blood loss, or formation of an air embolus.

The catheter should be clamped, proximal to the damaged area, or close to the exit site, and a sterile dressing should be applied to the affected area under strict aseptic conditions.

Inform the clinical team immediately that a severance has occurred. The device will need to be removed as soon as possible.

CVAD SEPSIS IDENTIFICATION & MANAGEMENT

Clinical features of a CVAD infection

- Pyrexia or rigors when line is flushed
- Discharge from or spreading erythema around the exit site
- Inflammation around the exit site or tunnel.
- Note the exit site may not appear inflamed in a CVAD infection. The infection may be inside the line itself or at the line tip.
- Sepsis in patient with a line and no other obvious source

Initial management

1) Airway, Breathing, Circulation assessment – ring 2222 if needed

2) Take paired blood culture samples from the CVAD & a peripheral site
    a. In multi-lumen devices take samples from **each** lumen before starting antibiotics (**NOTE:** Only staff that have been trained & deemed competent in care and maintenance of CVADs should take blood cultures)

3) Label each sample appropriately so it is clear to the lab which is from the CVAD and which has been taken peripherally.

Infection management is laid out in the **Suspected/Confirmed Central Venous Access Device Infection Protocol - Adults** [https://guidelines.staffnet.fv.scot.nhs.uk/]. Follow the antimicrobial advice in this document as well.

CVAD device salvage may be possible depending on the organism isolated. A list is available in the CVAD infection policy. Please note that some organisms (e.g. Staphylococcus aureus, Pseudomonas aeruginosa, Candida species and many others) will require the CVAD to be removed when it is safe to do so for the ongoing safety of the patient.

PN PROVISION OUT OF HOURS

PN is never an emergency and is most appropriately initiated by a competent member of a nutrition team during normal hours. It is not generally necessary to start PN overnight or at weekends. Careful consideration should be given to waiting to the next working day to allow for input from an appropriate member of the nutrition team and preparation of an aseptically prepared PN bag.

The Nutrition Team may occasionally recommend 'off the shelf' prepared PN bags (eg if a patient is referred on a Friday afternoon and it is not appropriate to wait until Monday). Off the shelf bags are also stored in ICU, and may be given on ICU consultant advice.

If parenteral nutrition is requested as an 'off the shelf 'bag (i.e. not a bag made with additions by the pharmacy aseptic suite), only Triomel N4E 1500ml bags or equivalent should be used. **Vitamins and trace elements must be given in a separate infusion**. **Vitamins and trace elements must be given for every 24 hour period an 'off the shelf' bag is used. The decision to use PN out of hours is made by the consultant and this must be documented in the patient notes.**

DISCONTINUING PN

PN may be discontinued when enteral nutrition has been re-established either orally or via other enteral routes such as an enteral feeding tube or enterostomy. In general, when greater than 50-70% of nutritional requirements can be met by oral or enteral means, PN may be ceased completely. If the patient is taking food and fluids, accurate food charts should be maintained to establish actual oral intake.

Withdrawal of PN should be planned and stepwise with a daily review of patient's progress. Prematurely stopping PN may lead to further nutritional depletion in patients with pre-existing malnutrition. Establishing another route of feeding is important prior to discontinuing PN.

In other instances e.g. the decision for palliative care, it may be appropriate to withdraw PN. This decision must be made in association with the clinical team and patient/relatives. PN should not be stopped abruptly due to the risks of rebound hypoglycaemia. Rates of PN should be reduced to at least 50% for a short period of time before stopping and blood glucose levels monitored after cessation.

Unplanned stops in PN

There are some occasions when reducing the rate of administration is not possible. The most common reasons include:

- Suspected CVAD sepsis
- Failed IV access e.g. CVAD/venflon has become blocked, fallen out or been pulled out
- IV access required for other therapy (e.g. antibiotics; blood transfusion)
- Peripheral vein thrombophlebitis
- Significant intervention (e.g. surgery)
- Significant change in the patients fluid balance or electrolytes (e.g. acute fluid overload or acute renal failure)

In any case where PN is disconnected for any length of time, the PN should be disconnected and discarded. Blood glucose levels should be monitored for rebound hypoglycaemia and any drugs to control blood glucose, especially insulin, will need urgent review.

Recommencing PN after an unplanned break

In the event of any interruptions of PN, previous bags must never be reconnected once it has been disconnected due to increased microbial risks.

If the break is less than 4 days and the patient was already receiving PN at the full rate for several days before the interruption occurred and was clinically stable on the regimen, then the patient can go straight back on their previous regimen.

If the interruption is longer than 4 days, the PN was never fully established at full rate, or the patient was clinically unstable on the regimen given, recommencement may need to be at 25-50% and gradually increased.

WITHDRAWING PN

Parenteral nutrition should be considered as an active medical treatment. If it is providing no benefit (e.g. if the patient is dying) then it should be discontinued. Where the patient lacks the capacity to consent to such a decision, the safeguards provided by the Adults with Incapacity (Scotland) Act 2000 [https://www.legislation.gov.uk/asp/2000/4/contents] must be followed as part of the consideration of withdrawal of feeding. In ethical terms there is no legal difference between starting and withdrawing treatment. In emotional terms it is much more difficult to withdraw a treatment once begun than not to start it at all. For this reason there can sometimes be a reluctance to commence PN for fear it will be difficult to stop. In such circumstances it may be appropriate to start treatment for a specific time period, with the provision that the outcome will be reviewed at the end of this specific time period or earlier if needed, to be stopped, changed or continued as appropriate.

REFERENCES

1 Healthcare Improvement Scotland. 2015. *Complex nutritional care standards.* Healthcare Improvement Scotland.

2 British Dietetic Association. 2018. *A Pocket Guide To Clinical Nutrition: 5th Edition updated 2018.* Parenteral & Enteral Nutrition Group. Editors V.E. Todorovic and B. Mafrici.

3 NICE. National Institute for Health and Clinical Excellence. *Nutritional Support in Adults*. Clinical Guideline 32 (2006).

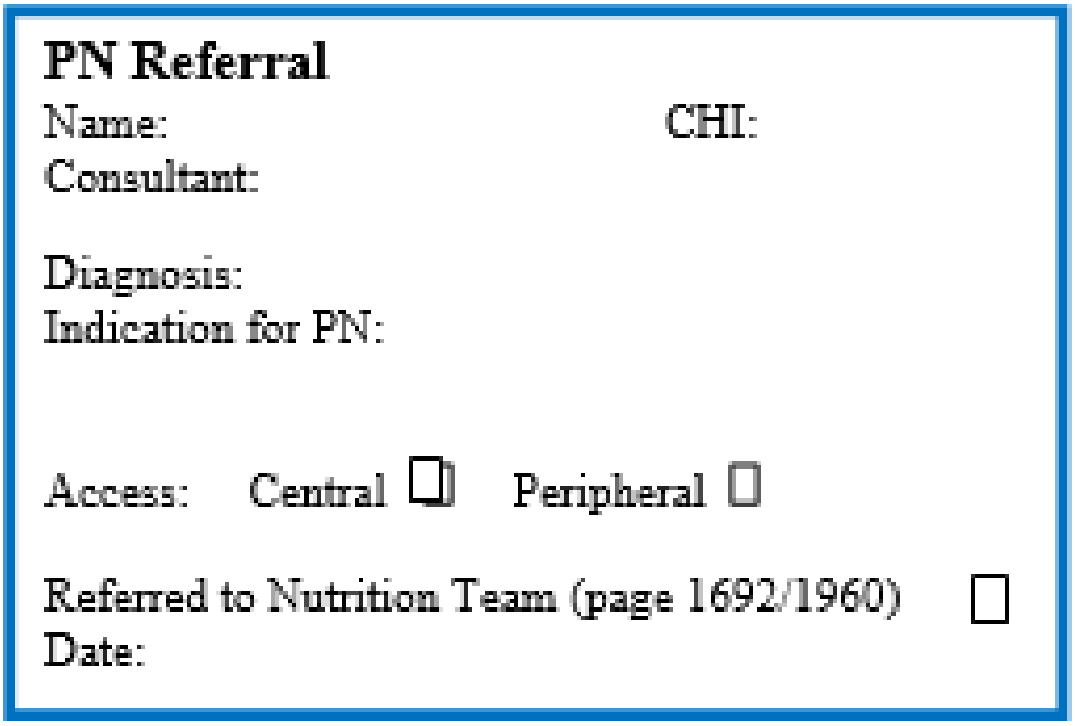
APPENDICES

Appendix A

Referral

Below is an example of the sticker that must be completed and placed in a person's notes for referral to the Nutrition Team. Contact the Nutrition team pager as well to notify of PN referral.

Stickers are available on every ward. If more referral stickers are required please contact the Nutrition Team on the pager.



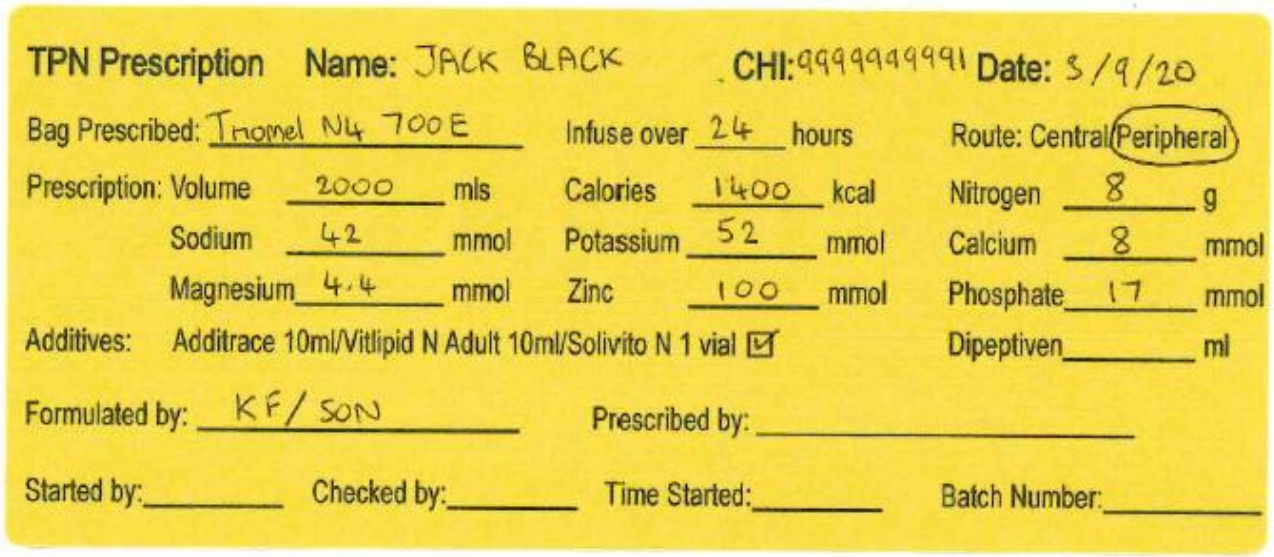
Appendix B

Example of yellow sticker

This is an example of the yellow sticker that should be completed and stuck onto the patient's fluid chart when the PN bag is due to be hung. It will be filled out by the nutrition team as shown below, and left with the patient's charts or in their notes.

If the "Prescribed by" field is blank when the bag is due to hang, this should be signed by a prescriber on the ward. The other blank fields should be completed by nursing staff.

Before hanging, nursing staff should check the details on this sticker against the label on the PN bag.


TPN Prescription Name: JACK BLACK CHI: 9999999991 Date: 3/9/20

Bag Prescribed: Trumel N4 700E Infuse over 24 hours Route: Central (Peripheral)

Prescription: Volume 2000 mls Calories 1400 kcal Nitrogen 8 g

Sodium 42 mmol Potassium 52 mmol Calcium 8 mmol

Magnesium 4.4 mmol Zinc 100 mmol Phosphate 17 mmol

Additives: Additrace 10ml/Vitlipid N Adult 10ml/Solivito N 1 vial ☑ Dipeptiven _____ ml

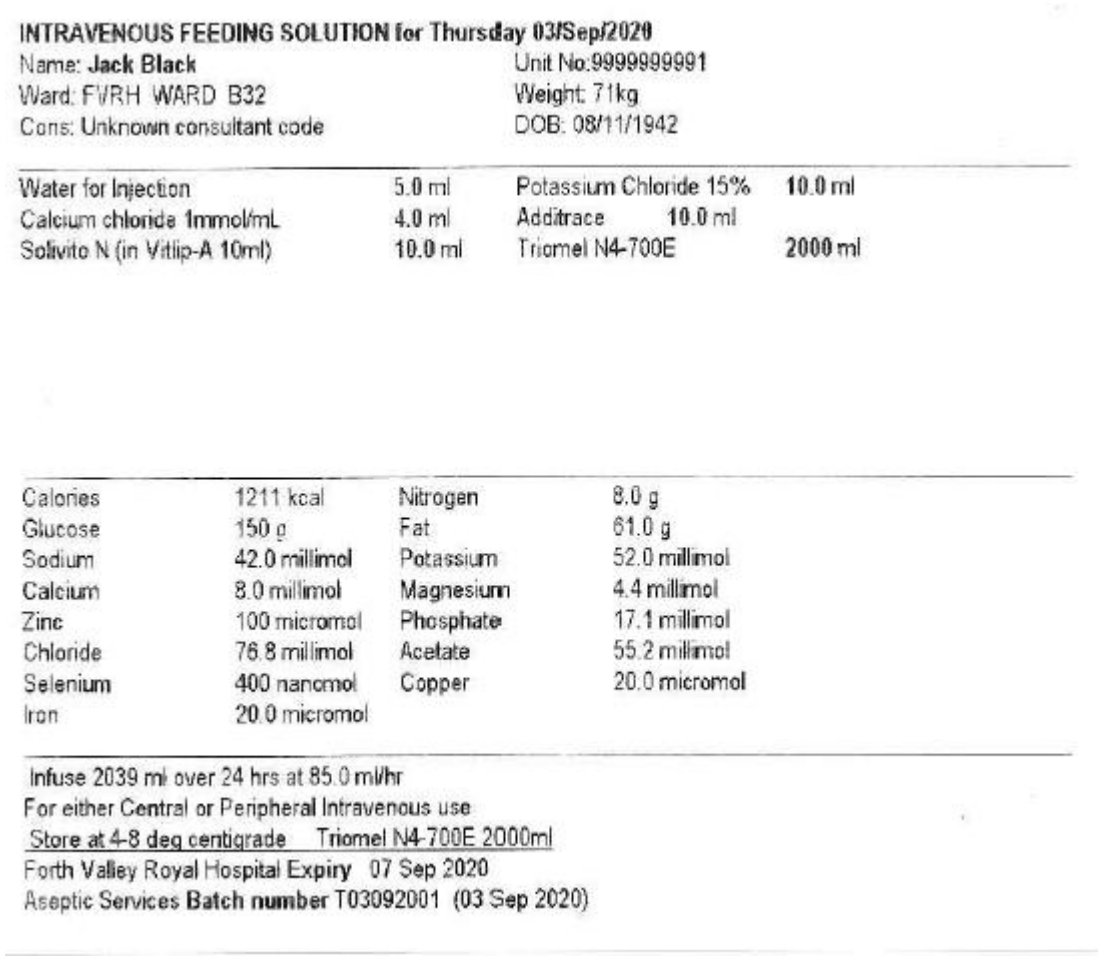
Formulated by: KF/SON Prescribed by: _____

Started by: _____ Checked by: _____ Time Started: _____ Batch Number: _____

Appendix C

Example of PN Label

This is an example of the labels that are attached to PN bags by the aseptic unit.



INTRAVENOUS FEEDING SOLUTION for Thursday 03/Sep/2020

Name: **Jack Black** Unit No:9999999991
Ward: FVRH WARD B32 Weight: 71kg
Cons: Unknown consultant code DOB: 08/11/1942

Water for Injection	5.0 ml	Potassium Chloride 15%	10.0 ml
Calcium chloride 1mmol/mL	4.0 ml	Additrace 10.0 ml	
Solivito N (in Vitlip-A 10ml)	10.0 ml	Triomel N4-700E	2000 ml

Calories	1211 kcal	Nitrogen	8.0 g
Glucose	150 g	Fat	61.0 g
Sodium	42.0 millimol	Potassium	52.0 millimol
Calcium	8.0 millimol	Magnesium	4.4 millimol
Zinc	100 micromol	Phosphate	17.1 millimol
Chloride	76.8 millimol	Acetate	55.2 millimol
Selenium	400 nanomol	Copper	20.0 micromol
Iron	20.0 micromol		

Infuse 2039 ml over 24 hrs at 85.0 ml/hr
For either Central or Peripheral Intravenous use
Store at 4-8 deg centigrade Triomel N4-700E 2000ml
Forth Valley Royal Hospital Expiry 07 Sep 2020
Aseptic Services **Batch number** T03092001 (03 Sep 2020)

Appendix D

Procedure for Preparing Infusion of Vitamins, Minerals and Trace Elements

To meet a patient's micronutrient requirements, they should be given one full vial of Solivito N, Vitlipid N and Additrace every 24 hours.

1. Draw up vial of Vitlipid N into a syringe
2. Add to vial of Solivito N
3. Draw the resulting mixture back into the syringe
4. Add to a 100 ml - 500mls* bag of sodium chloride 0.9% or dextrose 5%
5. Add the vial of Additrace to this mixture, and agitate to disperse the solution.
6. Infuse this mixture peripherally or centrally over a minimum of 2-3 hours to minimise renal losses of water soluble vitamins. Please note the mixture is not aesthetically pleasing but is clinically acceptable and pharmacologically stable if used immediately.

* Please consider the patient's full fluid requirements when choosing what volume to use. Solivito N, Vitlipid N and Additrace should be ordered from the pharmacy department with 'off the shelf' PN. If pharmacy is closed, contact on-call pharmacist via switchboard for advice.

References
Direct communication with Fresenius Kabi Medicines Information 08/10/2015
Customer letter from Fresenius Kabi- "Administration of micronutrients separately from parenteral nutrition", supplied by FK October 2015

Document Development and Approval Checklist

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Specify the rationale for the development of the policy, procedure or guideline

Forth Valley Royal Hospital does not currently have a TPN document in force and one is required.

Document developed in the NHS Forth Valley document template (Appendix 2) and developed in accordance with the Document Development and Approval Process (Appendix 3). The cover pages include the following:-

Document title Lead author Issue and review dates Version number Equality impact assessment date Authorising approval group/ committee and approval date Consultation and change information including the contributing authors, consultation process, distribution and change record	☐

Approval

Specify areas of document applicability

NHS Board Wide ☐
Acute only ☐
Community Services Directorate only ☐
Mental Health only ☐
Multiple directorate/ department/ practice ☐
Individual directorate/ department/ practice ☐
Other, please specify_____

Name of Approval Group_____ Date Approved: DD / MM / YYYY

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