Guideline for the Management of Parenteral Nutrition (PN) in Adults

For use in:	Norfolk and Norwich University Hospital (NNUH)
By:	All Registered Nursing Staff and Medical Staff
For:	All adult patients
Division responsible for document:	Clinical Support NNUH
Key words:	Parenteral nutrition (PN), Asepsis, Intravenous Catheter
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Assessed and approved by the:	Nutrition Steering Group. Nutrition Support Team MDT. Clinical Guidelines Assessment Panel Chairs action ✓
Date of approval:	22/01/2018
Ratified by or reported as approved to:	Clinical Standards Group and Clinical Safety and Effectiveness Sub-Board
To be reviewed before:	22/01/2022
To be reviewed by:	Ben Booth
Reference and / or Trust Docs ID No:	1166
Version No:	3
Description of changes:	Clinician names have been added/removed The referral process has been updated to clarify that Consultant to Consultant referrals only, are acceptable on Friday afternoons. The step by step guide on connecting/disconnecting TPN has been updated to reflect that pharmacy is no longer spiking the bags in sterile production. I have therefore had to add a few more steps. The line infection algorithm has been updated introductions the recommendation of using Urokinase when initially treating line infections. More information regarding the use of Taurolock for repeated line infections. References have also been updated
Compliance links:	None
If Yes - does the strategy/policy deviate from the recommendations of NICE? If so why?	N/A

This guideline has been approved by the Trust's Clinical Guidelines Assessment Panel as an aid to the diagnosis and management of relevant patients and clinical circumstances. Not every patient or situation fits neatly into a standard guideline scenario and the guideline must be interpreted and applied in practice in the light of prevailing clinical circumstances, the diagnostic and treatment options available and the professional judgement, knowledge and expertise of relevant clinicians. It is advised that the rationale for any departure from relevant guidance should be documented in the patient's case notes.

The Trust's guidelines are made publicly available as part of the collective endeavour to continuously improve the quality of healthcare through sharing medical experience and knowledge. The Trust accepts no responsibility for any misunderstanding or misapplication of this document.

Quick reference guideline

The Nutrition Support Team (NST) within NNUH aims to provide a service by offering advice on nutritional management of patient care to primary clinicians. In general this will be a patient requiring more complex form of artificial nutritional support.

- **Referral:**
  All adult patients considered for Parental Nutrition (PN) must be referred to the NST. All the referrals should be made on ICE before 09:00 am for the same day review. If a referral is made after 09:00 am but the same day review is required then the Nutrition Nurse Specialist (NNS) on DECT phone 3159 should be notified. Any referral made on ICE should be preceded by a written referral in the patient's medical notes by the referring consultant's team. After patient assessment, the NST may feel PN is not appropriate for that particular patient. In this situation, alternative methods of feeding will be suggested along with appropriate healthcare professional follow-up.

  We discourage starting PN out of normal working hours (after 16:30 and over the weekend) unless this has been agreed earlier with the NST. Moreover, starting PN less than 48hours after surgery can be hazardous due to major metabolic instability and difficulty weaning from artificial ventilation.

- **Intravenous catheter:**
  Ideally PN should be administered via a dedicated single lumen central catheter. If a multi-lumen catheter is used for the delivery of PN one port must be designated for this purpose. All lumens must be handled with the same meticulous attention to aseptic technique. Other drug or fluid therapy must be given via a peripheral cannula whenever possible. Catheter dressing and correct connectors should be reviewed on every possible opportunity.

  Peripherally Inserted Central Catheters (PICC) and Hickman type lines are placed by the Interventional Radiology Unit (IRU) and Vascular Access Team – requests via ICE. Multi-lumen centrally placed lines are inserted via the Anaesthetic Dept. Bedside PICC line insertion does not usually require a chest X-ray if the vascular access team document the line is safe to be used.

- **PN prescription:**
  This will be based upon the patient's presenting clinical condition, weight, gastrointestinal losses and blood results (FBC, U&E's, LFT's, bone group and magnesium). The NST Nurse Specialist and Pharmacist are non-medical prescribers.

- **PN procedures:**
  Procedures for PN monitoring (p4), catheter management (p5-6) and suspected catheter sepsis algorithm (p7-8) are detailed within this guideline.

Objective

To promote safe, effective delivery and management of PN, minimising the risks associated with this therapy.

Rationale

As well as being a potentially life-saving treatment PN is an expensive and potentially dangerous therapy. Bloodstream infections associated with the insertion and maintenance of central venous catheters (CVCs) are among the most dangerous complications of healthcare, prolonging hospitalisation and increasing the cost of care (3).

These guidelines have been formulated on existing evidence (see reference section) for the safe delivery of PN and to minimise the risk of line sepsis, subsequent septicaemia and metabolic complications. Reductions in catheter-related sepsis rates from 18-35% to 0-4% respectively were reported after introduction of a NST (5). This reduction can be seen within the NNUHT in consecutive annual audits since 1995.

Broad recommendations

All staff who undertake care of patients receiving PN must adhere to Trust policies and guidelines and comply with their own professional body.
These guidelines are to be used in conjunction with other existing NNUHT guidelines:

- Management of Aseptic Non-Touch Technique (ANTT) for Intravenous Therapy (B42 version 1).
- Management of Central Venous Catheters in Adults (B28 version 3).
- Trust Policy for Hand Hygiene (B10).

Patient Monitoring During PN

Glucose:

- Check finger prick glucose before initially commencing PN and 1 hour after commencement.
- Monitor finger prick glucose 6 hourly in the first 24 hours of PN. If normal, thereafter, use daily urinalysis.
- Daily finger prick glucose if sugar detected in urine.
- If blood glucose >11mmol/L then the use of an intravenous insulin infusion to maintain euglycaemia may be required.
- If glycaemic control is a problem or the patient is on steroid or needing insulin infusion then early diabetologists review is recommended.
- In surgical ITU patients, tight euglycaemic control is recommended (7).

Weight:

- Commencement of PN, then twice a week for duration of PN.
- Consider daily weights if unable to accurately measure fluid balance..

Temperature:

- 6 hourly.

Fluid balance:

- Accurate daily measurement of any gastrointestinal output is essential (nasogastric drainage, fistula output, vomit, diarrhoea) and inputs (such as medications, iv fluid and oral intake if any).

Blood Tests:

- FBC, U&E's, LFT's, bone group, magnesium, bicarbonate and chloride – initially daily, when stable three times per week. These tests are available to request as 'TPN bloods' on ICE, under profiles.
- Urinary electrolytes- at discretion of NST.
- Trace elements – at discretion of NST.

Changing PN Infusion

Equipment list:

- PN prescription.
- PN bag
- Administration Set, with filter and compatible with IV pump.
- Dressing pack with sterile gloves.
- Two Sani-cloth CHG 2% wipe (2% chlorhexidine and 70% isopropyl alcohol).
- 10mLs sodium chloride 0.9% pre-filled syringe.

Procedure:

- Check PN against prescription in accordance with the Trust's Medicines Policy. Hang PN.
- Wash hands, complying to Trust policy for hand hygiene. Apply non-sterile gloves.
- Open dressing pack onto clean trolley top and prepare sterile field.
- Open Sani-cloths, 0.9% sodium chloride flush and administration set onto sterile field.
- Stop infusion pump and disconnect administration set from closed hub system of the intravenous catheter.
- Open Sani-cloth and holding end portion of intravenous catheter clean the intravenous catheter thoroughly with the wipe, starting at the Bionector™ and working up. Still holding catheter discard wipe and place sterile towel under the catheter.
- Allow catheter to drop onto the towel and allow to dry for 30 seconds before accessing.
- Remove non-sterile gloves and put on sterile gloves. Flush line with 10mLs 0.9% sodium chloride using push pause technique.
- With the second Sani-Cloth, clean the infusion port on the PN bag and insert IV administration set into the infusion port on the PN bag.

- Prime administration set with PN solution keeping the tip of the set on the sterile field.
- When administration set is primed, connect to designated Bionector™ on central line.
- Set pump for new infusion, open administration set clamp, set pump to run, open catheter clamp.
- Complete appropriate documentation to comply with professional/legal requirements.
- Dispose of equipment as per hospital policy.

Note:
The needle free device e.g. Bionector™, should be changed weekly or after the manufacturer recommended number of accesses if sooner.
At no point should the PN infusion be disconnected and reconnected once the infusion has commenced.
If for any reason the PN is disconnected, the bag and giving set must be discarded. Please contact the Nutrition Support Team if, for any reason, you have had to stop and
discard the PN infusion. If PN is discontinued due to potential defective product then this should be retained for the NST pharmacist. Use IV crystalloids to maintain fluid balance until new PN can be arranged.

Catheter patency:

- It is **ONLY** necessary to flush the PN catheter between routine bag changes for **peripherally inserted central catheters** (PICCs) **OR** if there is a delay before changing PN **OR** the patient is receiving cyclical PN (over less than 24 hours).

Flush with 10mL 0.9% sodium chloride, using the push-pause and positive pressure technique (see below). Sterile 0.9% sodium chloride for injection should be used to flush and lock catheter lumens. It is not necessary to use heparin to lock the line if the catheter is not in use for 24 hours or more (6). **Any** access to PN catheters must be aseptic and using sterile gloves.

The Push-Pause and Positive Pressure Flushing Technique

Action:	Rationale:
Flush using pulsating push-pause motion	**Allows turbulent flow to remove any medication or blood residue from inside catheter**
Keep pressure on the plunger of syringe until the catheter is clamped	**Maintains positive pressure within the catheter preventing back flow of blood into the catheter tip (4)**
Do not use smaller than a 10mL syringe (check with individual manufacturers)	**Smaller syringes can exceed 25 psi pressure which can cause venous damage and catheter rupture (1)**

Peripherally Inserted Central Catheters:

The management of these catheters is the same as for a centrally placed line, plus the

following specific points:

- If the line of choice is only a 3F gauge DO NOT LEAVE PUMP SWITCHED OFF FOR LONGER THAN 30 MINUTES.
- If a PN infusion is to be stopped for any reason, clamp the catheter first and then switch volumetric pump off to provide positive pressure within the catheter.
- Flush catheter with 10mL 0.9% sodium chloride between PN changes using the push-pause method.
- Occasionally these catheters occlude due to the external part kinking. Look for this if the pump keeps reading ‘occlusion’. Redress.
- Observe patient for signs of peripheral vein thrombosis (pain, redness, swelling, and induration). If this occurs it is usually due to mechanical phlebitis. This can be treated by application of local heat over the affected area three times a day (to dilate the affected vein). If it worsens or does not resolve, remove the catheter.

Entry Site Care:

Any dressing that is transparent, adherent, flexible and easy to apply is suitable. Transparent dressings should be changed every 7 days or sooner if no longer intact or moisture collects under the dressing. If the insertion site is bleeding/oozing a sterile gauze dressing is preferable. Use an aseptic dressing technique.
2% chlorhexidine and 70% isopropyl alcohol (Chloraprep 3mL single patient use applicator) to be used for skin asepsis at dressing changes (EPIC 3).

Contact the Nutrition Nurse Specialist for advice with regard to any sutures or advice on swimming and showering.

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Catheter Related Sepsis Protocol (suspected & documented infection)

Symptoms: chills, flu-like symptoms (especially with the IV nutrition)

Signs: fever >38°C, rigors

1. Stop PN
2. Central and peripheral blood cultures
3. Blood tests (incl. FBC, CRP)
4. Screen for other causes of infection (incl. CXR, MSU)
5. Establish peripheral access

No shock
(Await culture results)

Mild shock
Relative hypotension and tachycardia

Septic shock (Fever, hypotension, tachycardia requiring inotropes or ITU)

Empirical antibiotic lock in catheter (discuss with microbiology)

Blood culture negative

Blood Culture Positive

Any other organism from CVC cultures

If recurrent/ portacath infection see notes below

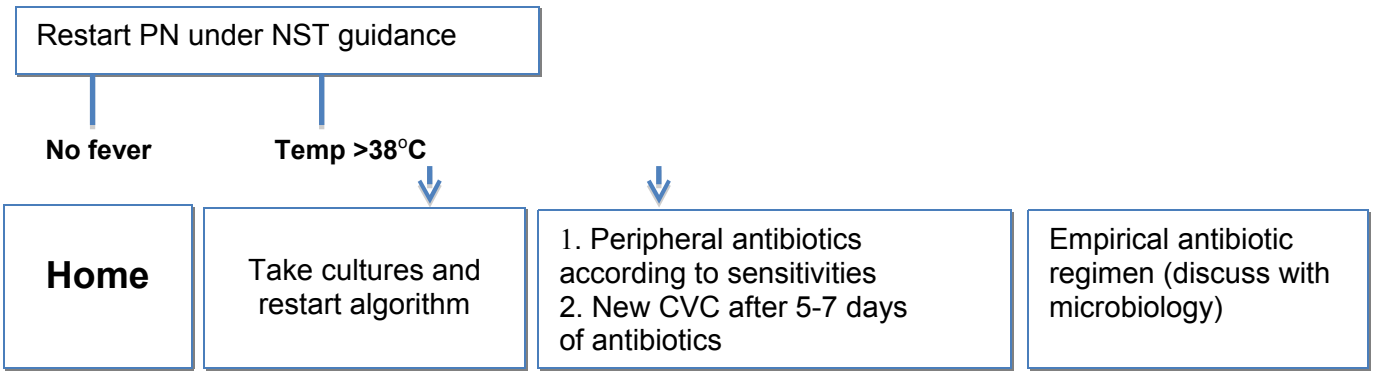
Candida/Staph Aureus Pseudomonas or repeated

similar organism from CVC

TARGETED ANTIBIOTIC REGIMEN (7 DAYS)
According to antibiotic sensitivities.Via CVC, leaving the antibiotic in catheter (no flush between doses and stop PN)Duration 7 days.
Give peripheral fluids/electrolytes according to PN requirements (Volume, Na, K and Mg).

Remove CVC line and send tip for culture

If very limited venous access see the notes


Restart PN under NST guidance
No fever
Temp >38°C
Home
Take cultures and restart algorithm
1. Peripheral antibiotics according to sensitivities
2. New CVC after 5-7 days of antibiotics
Empirical antibiotic regimen (discuss with microbiology)

Notes:

1. **If recurrent infection (another infection within 3 months with any organism):**
   - 1st recurrent infection: urokinase, with a targeted antibiotic course to prevent catheter removal (Refer to the table below for dosing).
   - 2nd recurrent infection: remove CVC, send tip for culture and give peripheral antibiotics according to sensitivities. Consider TauroLock™ via new central venous catheter for maintenance after treatment for this infection has finished.

2. **Sending a CVC tip for culture:**
   Please make it clear on the request form that a CVC infection is suspected or known.

3. **Candidal infections:**
   Remove the CVC. Contact microbiology for advice on antifungal treatment then change antifungal treatment based on species and antifungal sensitivity results. Give 2 weeks of IV antifungal treatment before CVC replacement. Consider ECHO, urgent ophthalmology review and CT head if any neurological signs.

4. **Patients with very limited venous access (patients with a CVC in their only remaining central vein, direct IVC or atrial CVC):**
   Salvage treatment for a CVC infection may be considered. Please discuss with the Nutrition Team.

5. **Consider re-culturing the CVC tunnelled line prior to restarting PN after appropriate course of antibiotics.**

Drug (Reference)	Indication	Dose	Mode of instillation
Urokinase	**Suspected fibrin deposits**	10,000 IU in 6mLs 0.9% sodium chloride	1. Use 10mL luer-lock syringe and inject 3mL into each lumen via hub of catheter using a push-pause motion 2. Monitor catheter closely for signs of "ballooning" or traumatic fracture. 3. Dwell time 4-12 hours. 4. Attempt aspiration, then flush catheter with 10mLs 0.9% sodium chloride. 5. Repeat once if initial dose not successful.

Recurrent CVC infections (recurrent CRS)

Prophylaxis of recurrent central venous catheter infection

There are reports of the use of antibiotics and TauroLock™ (taurolidine and citrate) in the successful prevention of CVC infections in HPN patients:

1. **<u>Antibiotic prophylaxis</u>**: A number of different approaches have been employed, including systemic antibiotics, topical antibiotics to the skin insertion site, catheter flushing with an antibiotic lock and antimicrobial impregnated catheters. There is conflicting evidence of efficacy of antibiotic locks in the prevention of central venous catheter infection as well as potential for the development of antibiotic resistance.

2. **Taurolidine lock**: Only TauroLock™ (taurolidine and citrate) is available at NNUH. In addition to having a broad-spectrum bactericidal activity, it prevents or reduces the adherence of bacterial cells to the epithelium by altering the bacterial cell wall structures and by destroying the fimbriae and flagellae. Anti-adherence is achieved when either the bacterial or epithelial cell is exposed to taurolidine (chemically derived from the aminosulphonic acid taurine, the drug is metabolised to water and carbon dioxide). Its bactericidal mechanism of action is attributed to reactive methylene iminium ions, the conversion to which occurs in an aqueous medium. Bacteria and fungi cell wall constituents are then methylolated and killing is affected. Resistance for a vast array of microbes as well as superinfection with the use of taurolidine have never been reported.

   There have been two studies assessing the use of taurolidine in HPN patients.

   - Jurewitsch from Toronto report a case series of 7 HPN patients with recurrent central venous catheter infections and demonstrated that the introduction of 2% taurolidine (Taurolin®) used as a daily flush solution decreased the infection rate from 10.8 to 0.8 infections/1000 catheter days (13).
   - Bisseling et al, undertook a randomised controlled trial comparing taurolidine with heparin lock in 30 home parenteral nutrition patients following a catheter-related bloodstream infection. The mean infection-free survival was 175 days in the control group (heparin lock) and 641 days in the taurolidine group ($p < 0.0001$). In addition 10 patients with infections on heparin crossed over to taurolidine and only 1 new infection occurred.

TauroLock™

TauroLock™ contains anticoagulant and antimicrobial substances. It is to be used with a catheter-based vascular access device. It is to be instilled in the device lumens between treatments in order to make the internal flow passages resistant to clot formation and hostile to bacterial and fungal growth. **The solution must be withdrawn prior to initiating the next treatment**. The active ingredients in TauroLock™ are taurolidine and citrate. Other components include water for injection. The pH is adjusted with citric acid and/or sodium hydroxide. The product is sterile filter processed and supplied as a clear, sterile, non- pyrogenic solution. Each single-use ampoule contains 5ml.

Indications for Taurolock:

TauroLock™ can be used in patients who have had:

- ≥4 infections over a 2 year period.
- ≥2 fungal central venous catheter infections.
- 1 fungal infection on a background of repeated bacterial infections.
- 1 bacterial infection that has caused endocarditis, osteomyelitis or discitis.
- Recurrent CVC infections with problematic venous access (for inpatients this may include short term parenteral nutrition).

Clinical audit standards:

- Annual audit to be undertaken by the NST to incorporate:
- All PN patients to be referred to NST.
- PN patients to remain free from catheter-related sepsis.
- Designated PN catheter.
- All intravenous catheter tips to be sent to microbiology.

Summary of development and consultation process undertaken before registration and dissemination:

The author listed above updated this guideline on behalf of the Nutrition Support Team who has agreed the final content. During the development of the previous version was has been circulated for comment to those listed in the 'supported by' section and to Dr Ngozi Elumogo, Director of Infection Prevention and Control. This previous version has been endorsed by the Clinical Guidelines Assessment Panel.

Distribution list/ dissemination method

Trust Intranet

References/ source documents

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