# Nottingham Renal and Transplant Unit

## GUIDELINES FOR THE INSERTION, EXCHANGE OR REMOVAL OF TUNNELLED CENTRAL VENOUS CATHETERS (Permcaths) IN HAEMODIALYSIS PATIENTS

<table>
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<tr>
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<th>SD Roe, Consultant Nephrologist</th>
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<tr>
<td>Directorate &amp; Speciality</td>
<td>Cancer and Associated Specialities (Renal/Transplant)</td>
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<td>Date of submission</td>
<td>March 2015</td>
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<td>Explicit definition of patient group to which it applies (e.g. inclusion and exclusion criteria, diagnosis)</td>
<td>Applies to: All patients under the care of the Nottingham Renal and Transplant Unit (including patients dialysing at Kings Mill Hospital and Ilkeston Community Hospital and the South Nottingham Dialysis Unit). Excludes: Patients under the care of the Paediatric Renal Unit</td>
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<tr>
<td>If this version supersedes another clinical guideline please be explicit about which guideline it replaces including version number.</td>
<td>Replaces version produced March 2012</td>
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<td>Statement of the evidence base of the guideline – has the guideline been peer reviewed by colleagues?</td>
<td>Evidence level 4 and 5</td>
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<td>Evidence base: (1-6)</td>
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<tr>
<td>1</td>
<td>NICE Guidance, Royal College Guideline, SIGN (please state which source).</td>
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<tr>
<td>2a</td>
<td>meta analysis of randomised controlled trials</td>
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<td>2b</td>
<td>at least one randomised controlled trial</td>
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<td>3a</td>
<td>at least one well-designed controlled study without randomisation</td>
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<td>3b</td>
<td>at least one other type of well-designed quasi-experimental study</td>
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<td>4</td>
<td>well–designed non-experimental descriptive studies (ie comparative / correlation and case studies)</td>
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<td>5</td>
<td>expert committee reports or opinions and / or clinical experiences of respected authorities</td>
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**Evidence base of policy:**

These guidelines have been derived using the following evidence base.


**Audit Plans:**

The following are the subject of prospective audit:

1. Tunnelled line insertions and removals
2. Complications of Central venous catheter insertion
3. Bacteraemic episodes related to line infections

**Training and implementation:**

Management of Dialysis Lines is discussed in the Junior Doctors induction day and these guidelines will be referred to in that programme. Practical procedure training for renal medical staff is co-ordinated by designated consultant trainers (currently Dr McHaffie and Dr Hall).
Dissemination of policy:
The guideline is available on the Trust intranet site and the Clinical Guidelines mobile app.

Other relevant guidelines
This guideline must be read in conjunction with:
- Care bundle for insertion and maintenance of central venous catheters within the Renal and Transplant Unit. This guideline focuses on the elements of care needed to reduce the potential for healthcare associated infections with central venous catheters.
- Intravenous Sedation Policy for Adults. This is the Trust wide policy relating to intravenous sedation for local anaesthetic procedures and is relevant when tunnelled line procedures are carried out under sedation.

Summary
A. Permanent vascular access should be planned and placed in a timely manner before dialysis is needed.
B. Tunnelled cuffed central venous catheters are the method of choice for temporary access of longer than 3 weeks duration (and are acceptable for access of shorter duration). In addition, some patients who have exhausted all other access options require access via tunnelled cuffed catheters.
C. The preferred insertion site is the right internal jugular vein. Other potential insertion sites include: the left internal jugular vein, external jugular veins, subclavian veins, femoral veins or translumbar access to the inferior vena cava. Subclavian vein catheters can jeopardise future vascular access and should only be used when jugular catheters cannot be used or when no further access is possible in the ipsilateral arm. Tunnelled cuffed catheters should not be placed on the same side as a maturing AV fistula, if possible. If the femoral site is chosen then the length of the catheter must be at least 20cm to avoid recirculation.
D. Real time ultrasound-guided insertion is recommended to reduce insertion related complications.
E. Primary right internal jugular tunnelled catheters may be inserted without fluoroscopy. Fluoroscopy is mandatory for the insertion of all other central tunnelled catheters. Chest x-ray post-procedure is necessary if the catheter is not inserted under fluoroscopic control.
F. Placement of tunnelled catheters should take place in sterile conditions. Adequate cardiovascular monitoring should be available including continuous ECG monitoring, non-invasive blood pressure monitoring and pulse oximetry. If conscious sedation is used appropriate monitoring is necessary and supplemental oxygen should be utilised.
Introduction

Central venous catheters should be utilised as a method of last resort for longer term vascular access to reduce the overall risk of infectious complications in haemodialysis patients. Tunnelled cuffed catheters are used, generally as a bridging technique while waiting for permanent vascular access to be created or mature. They are also used as the sole form of vascular access for patients who have exhausted other access options.

Tunnelled catheters have a number of advantages for vascular access including:

- Universally applicable
- Ability to insert into multiple sites
- Can be used immediately
- Repeated venepuncture not needed (c.f. AV fistula)
- No adverse haemodynamic consequences
- Relative ease and cost of catheter placement / replacement

Despite the above these catheters have a number of significant disadvantages including:

- High morbidity and mortality due to an increased risk of infection compared to an arteriovenous fistula
- Morbidity associated with catheter dysfunction
- Risk of permanent central venous stenosis or occlusion
- Discomfort and cosmetic disadvantage of an external device
- Shorter duration of life than other access types
- Lower blood flow rates than other access
- Higher erythropoietin requirements than AV fistulae/ grafts

Reducing Tunnelled Line Use

- Ensure early referral of patients for discussion of renal replacement therapy options.
- Ensure AV fistulae are placed pre-emptively with sufficient time for maturation (in general 6 weeks is necessary from creation to first use). The timing of access surgery will be dependent on the rate of decline of patients renal function and their associated co-morbidities. In general patients who have elected to have haemodialysis are referred for vascular access when their GFR is <15 mls/min.
- Ensure peritoneal dialysis is considered as a treatment option for all patients with established renal failure (as per NICE guidance).
- Those who have already decided to have peritoneal dialysis as their future modality should be referred to the home therapy nursing team when their GFR falls to 10 ml/min
- New patients presenting with acute uraemic crisis who do not recover renal function should be referred for permanent access (peritoneal dialysis or haemodialysis) as soon as possible. Forearm and ante-cubital fossa veins in both arms should be preserved for future fistula placement. These patients should be considered for early start peritoneal dialysis as their initial treatment option as this prevents the need for a tunnelled central venous catheter.
Preparation for Line Insertion

- Nephrologists and interventional radiologists insert the majority of tunnelled lines. Surgical (open) placement of tunnelled catheters can also be used.
- Staff inserting tunnelled lines should have been appropriately trained in the procedure (or be training under direct supervision of an individual competent to perform the procedure).
- Dual lumen catheters should be placed wherever possible. The current catheter in use within the unit is the Palindrome catheter. This features a spiral-Z tip design which minimises recirculation with line reversal. The catheter comes in 2 lengths (28cm for right sided insertions and 32cm for left sided insertions). The device can be placed down a conventional 16Fr peel-away sheath system, through a single insertion site for ease and speed of insertion.
- Tunnelled catheters should not be inserted on the same side as a maturing arterio-venous fistula if at all possible.
- Tunnelled catheters should not be inserted in patients with concurrent infection (temperature >38°C within previous 48 hours).

Psychological support

All patients should receive general psychological preparation prior to the procedure. Procedures can provoke feelings of anxiety and distress in patients. Pre-procedure anxiety may result in increased physiological problems, increased pain perception, decreased concordance and engagement in self-care activities which can delay recovery times. Factors which may impact on a patient’s response to a procedure include: previous medical experiences, timing relative to the procedure, temperament, current anxiety levels and coping style. Psychological preparation should include specific interventions to provide information and reduce anxiety. Information should be provided about:

- the procedure itself (that is, steps that person must perform and steps that healthcare professionals will perform);
- the sensations the patient can expect to feel during and after the procedure (for example, sharp scratch, numbness);
- about how to cope with the procedure and post-procedure recovery (e.g. relaxation, breathing rate, distraction, when to mobilise)

Consideration should be given as to whether highly anxious patients may benefit from sedation.

Ultrasound / Fluoroscopy

- Localisation and puncture of the internal jugular vein should be carried out under real time ultrasound guidance. This has been shown to reduce insertion related complications.
- Fluoroscopy allows ideal catheter tip placement to maximise blood flow, and minimises the chances of malposition. Tunnelled catheters can be inserted without fluoroscopy in any of the following circumstances:
  - Where ultrasound demonstrates a patent right internal jugular vein of adequate size and the patient has not had previous tunnelled central venous catheters
  - Conversion of a suitably sited (usually low jugular puncture) non-infected right internal jugular (RIJ) temporary catheter to a RIJ tunnelled catheter,
  - Catheter exchange of an existing tunnelled catheter over a guidewire

  All other tunnelled lines should be inserted in radiology with fluoroscopy.

- Complication rates should be <0.1% for pneumothorax, <1% for carotid artery puncture and <10% for early catheter malfunction.
Pre-procedure

1. Determine if radiology / nephrology insertion (see above). If there is doubt as to whether a radiology or nephrology insertion is necessary take advice from SpR / Consultant.
   - Primary RIJ tunnelled lines are inserted in the treatment room on Bramley ward.
   - The interventional radiologists insert all other tunnelled lines in the interventional radiology theatre. Interventional lists take place throughout the working week. Requests should be made on NOTIS and discussed with interventional bookings (extension 56703). Urgent requests should be discussed directly with one of the interventional radiologists (contacted via the consultant of the day Cisco phone 70816).
   - NOTIS requests should contain all relevant clinical information. Details of known occluded / obstructed veins should be included so that attempts are not made to insert lines into inappropriate vessels.

2. **Communication is vital.** Ensure the patient, the Dialysis Unit (who may need to arrange transport / alter dialysis times etc.) and Bramley ward are aware of the date and time of the procedure. Patients should arrive by 07.30 for morning procedures and 11.30 for afternoon procedures.

3. If the patient is anticoagulated either stop warfarin 3 days before procedure and re-start post-procedure or arrange early admission and convert to intra-venous unfractionated heparin.

4. Antiplatelet agents: Clopidogrel should be stopped 10 days prior to an elective permcath procedure. Aspirin therapy can usually be continued.

5. Blood should be taken for FBC, PT, APTT and Group & Save as soon as the patient arrives or, if appropriate, on the last dialysis session before the procedure. If samples are taken on the day of the procedure the laboratory should be telephoned to request urgent FBC and clotting. The non-availability of clotting results is one of the major disruptions to permcath lists.

6. Ensure FBC and clotting are within acceptable limits (Hb >8 g/dl, Platelets >50x10⁹/l, PT <15 seconds, INR <1.3, APTT <35 seconds). If coagulation parameters are outside these ranges discuss with radiology / renal consultant.

7. Prior to line insertion all patients should ideally use Octenisan skin wash at least once (see care bundle).

8. Prescribe pre-procedure antibiotics - IV flucloxacillin 1g or IV vancomycin 500mg if history of MRSA infection or penicillin allergic. **For radiology permcaths antibiotics should be administered before the patient leaves the ward to go to x-ray.**

9. Written informed consent should be obtained for all Permcath insertions. The appropriate consent form should be used (usually Form 3, but Form 1 should be used if the use of sedation is being considered). The SpR/ Consultant should obtain consent for nephrology insertions. For insertions in radiology, the first part of the consent form can be completed by the nephrology SpR/ Consultant and the interventional radiologists will confirm consent. Ideally patients should have received written information about the procedure (Information for patients – Preparation for haemodialysis. Having your Permcath inserted). The consent process should involve a discussion of the insertion related complications (bleeding, haematoma formation, pneumothorax/ haemothorax) and of the longer-term complications (infection, catheter dysfunction and vessel stenosis). Procedure specific consent forms which are pre-printed with the name of the procedure and common/ significant complications are available for tunnelled line insertions.

10. These procedures are often performed with local anaesthetic only. If intra-venous sedation is used then the patient will require a longer period of recovery following the procedure. The guidelines on IV sedation should be followed (see below).

11. Nasal mupirocin 2% tds for 5 days should be prescribed as a TTO for all new catheter insertions and catheter exchanges, and the patient instructed how to administer this.
Procedure

1. Prior to the procedure starting it is important that a formal pre-procedure pause takes place. This universal procedure is vital to ensure that the correct procedure is performed on the correct patient. The “Time Out” should be conducted audibly between the practitioner undertaking the procedure and another member of staff. It should cover:
   - Correct patient (using 2 identifiers)
   - Agreement of correct procedure
   - Confirmation that consent form has been completed and signed by the patient
   - Rechecking of blood test results to ensure that they are satisfactory
   - Agreement of intended site and side (accepting that this may change during the procedure due to anatomical issues)
   - Correct patient position for the procedure

2. Tunnelled lines should be inserted under full aseptic conditions. Further information regarding this is detailed in the Care bundle for the Insertion and Maintenance of Central Venous Catheters. The main elements include:
   - Appropriate hand hygiene
   - Maximal barrier precautions
   - Chorhexidine skin cleaning (using Chloraprep® 2% chlorhexidine in 70% alcohol)

3. Device details should be fully recorded in the patient notes. This should include: Product Make/Model, Product No., Expiry Date. Lot/Batch No. If the line pack contains a pre-printed label with this information recorded on it this should be placed into the medical notes.

4. Tip position. Optimal tip position is poorly studied. The tip of the catheter is generally placed distally in the right atrium whilst the patient is lying in a supine position as it will retract proximally by several centimetres when the patient returns to an upright position. However the mid right atrium is ideally sited for the catheter tip due to its large calibre space, reducing inadvertent mural wall trauma. However having the catheter too far in can cause the catheter to lie across the tricuspid valve potentially allowing the catheter to become fibrosed to the valve or put the patient at increased risk of endocarditis.

Post-procedure

1. Catheter locks. The catheter lumens should be aspirated to ensure good blood flow and then flushed with 10mls of 0.9% sodium chloride solution. Subsequently the catheter lumens should be locked with a citrate locking solution (citrate 46.7%). The arterial and venous lumens of the catheter should be locked to the exact volume specified on the catheter lumen. The citrate locking solution must be injected slowly to avoid reflux into the vein.

2. Post-procedure bed rest and observations.
   - Bed rest for 2 hours post procedure
   - Monitor level of consciousness for patients who have received sedation
   - All patients require monitoring of BP, respiratory rate, pulse and observation of exit site and incision site
   - Observations should be recorded every 15 minutes for 1 hour and every 30 minutes for 1 hour. Observations can be discontinued/ revert to standard frequency if observations are stable at 2 hours.

3. A Chest X-ray (to check the tip position and exclude complications) is mandatory before the catheter is used if the catheter was not inserted under fluoroscopy.

4. Record details of procedure in medical notes.
5. Until fibrosis has occurred into the Dacron cuff, there is a risk of catheter displacement if external traction is accidentally applied. Particularly during the first 2–4 weeks the catheter must be handled with care. The sutures around the catheter hub should be removed after 21 days. The skin sutures from the supra-clavicular insertion site can be removed after 7-10 days. Some operators will also use a tunnel suture which will be absorbable and will not require removal and is usually placed around the the tunneled portion of catheter close to the skin entry site.

### Complications

<table>
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<tr>
<th>Complication</th>
<th>Management</th>
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<tbody>
<tr>
<td>Inadvertent arterial puncture</td>
<td>Less likely with ultrasound guidance. Exert direct pressure over the puncture site for at least 5 minutes.</td>
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<tr>
<td>Pain</td>
<td>Pain resulting from insufficient or mis-placed local anaesthetic is easily rectified. Mild discomfort as the dilator is passed is relatively common. More severe pain should alert the operator to the possibility of vessel rupture and pneumothorax. If there is any doubt the procedure should be stopped.</td>
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<tr>
<td>Pneumothorax</td>
<td>Small pneumothoraces may be managed by observation or aspiration alone. More sizeable pneumothoraces require formal drainage with an intercostal drain. Management should follow British Thoracic Society guidelines.</td>
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<tr>
<td>Haemothorax</td>
<td>This may occur alone or in association with a pneumothorax. Intercostal drainage will be required in most cases and severe cases require thoracotomy. Seek cardiothoracic assistance at an early stage.</td>
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<tr>
<td>Air Embolism to pulmonary circulation</td>
<td>Rare complication – prevent by placing patient in a head down position. If suspected place patient in left lateral position, head-down position and administer supplemental oxygen. Intensive care and even hyperbaric oxygen may be required in severe cases.</td>
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<td>Cardiac arrhythmias</td>
<td>These can occur if the guide-wire is advanced too far and usually respond to withdrawal of the guide-wire. They are generally transient, although more serious arrhythmias such as ventricular tachycardia can occur.</td>
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<td>Bleeding</td>
<td>Most commonly this occurs from the subcutaneous tunnel. It usually responds to direct pressure applied over the subcutaneous tunnel / root of neck. Occasionally a desmopressin (DDAVP) infusion may be needed (20 micrograms diluted in 50mls 0.9% saline administered over 30 mins). Desmopressin is contra-indicated in patients with ischaemic heart disease and heart failure. Cryoprecipitate or fresh frozen plasma are alternatives in patients who cannot be given desmopressin – advice from haematology should be sought. Alternatively protamine soaked gauze can be used to promote local haemostasis.</td>
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<tr>
<td>Cardiac tamponade</td>
<td>Withdraw blood from line. Pericardiocentesis.</td>
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Catheter Exchange
Tunnelled catheter exchange is usually undertaken for persistent catheter dysfunction (following failure of intra-luminal thrombolytics) or as part of a management strategy for catheter related infections. The procedures are carried out under fluoroscopy in interventional radiology. The old catheter is dissected out and exchanged over a guidewire. The pre-procedure work up and post procedure care is the same as for a catheter insertion.

Catheter Removal
1. Indications for catheter removal include:
   - Catheter related infection
   - Persistent catheter occlusion
   - Damaged catheter
   - Catheter no longer required (alternative access available or patient recovers renal function)
2. Removal shall be undertaken by experienced personnel.
3. Removal of a skin tunnelled catheter requires local anaesthetic and minor surgical cut down to remove the cuff if the catheter has been in situ for more than approximately 3 weeks.
4. Prior to the procedure the operator should ensure that the patient does not have a history of bleeding disorders, is not taking oral anticoagulants and has a satisfactory platelet count (>50 x10^9/l). Line removal should be scheduled to take place either pre-dialysis or on a non-dialysis day. Clopidogrel should ideally be stopped 7 days prior to the procedure (if clinically possible) but generally line removal can proceed without interruption to other anti-platelet therapy.
5. The procedure should be undertaken with full aseptic technique (appropriate hand hygiene, maximal barrier precautions and chlorhexidine skin preparation). Simple traction by the clinician can remove the catheter and cuff in catheters that have been in situ <3 weeks. Otherwise a small incision is made to release the cuff from the subcutaneous tissues prior to removal. If the line needs to be cut to aid removal a clamp should be used to clamp the distal portion of the catheter prior to cutting the line. This reduces the risk of air embolism and inadvertent loss of the distal portion of the catheter leading to catheter embolism.
6. On removal of the catheter the clinician should visually check the integrity of the line to ensure that the tip is present, the complete line has been removed and no breakage has occurred. The incision is sutured and the sutures removed after 7 days.

Procedures carried out with IV sedation on the Renal Unit
All procedures carried out with sedation should follow the NUH trust wide policy for Intravenous sedation in adults. Practitioners should ensure that they have completed all necessary training to allow them to undertake procedures with IV sedation. Additional points of particular relevance to patients with renal failure include:

- Patients over the age of 70 are at high risk of aspiration.
- Patients should be advised that they should not have any solid food for 6 hours prior to the procedure and no fluids for 2 hours prior to the procedure.
- The additional risks of sedation should be explained to the patient by medical staff prior to the procedure.
- Pre-oxygenation and supplementary oxygenation should be administered to all sedated patients during the procedure and recovery period.
- 10mg of midazolam should be drawn up in a syringe and made up to a volume of 10mls water for injections (1mg midazolam / ml).
• Lower doses of midazolam are recommended in patients with a GFR <10mls/minute due to reduced protein binding, increased levels of free drug and increased CNS sensitivity. Intravenous midazolam should be administered with an initial dose of 1mg and then further increments of 0.5-1mg given as necessary until adequate sedation is achieved. Remember to allow sufficient time to observe the effect. The dosage should be kept to a minimum. **The aim is to ensure that verbal contact is maintained at all times.** If verbal responsiveness is lost the patient requires a similar standard of care to that needed for general anaesthesia.

• Local anaesthetic is then administered in the normal way and the procedure is undertaken.

• Further 0.5-1ml increments of midazolam can be given during the procedure if necessary. In general it would be unusual to administer more than 5mg of midazolam.

• If there is any respiratory embarrassment the sedation should be reversed using Flumazenil (Anexate). Administer 200 micrograms IV over 15 seconds, then 100 mcg at 60-second intervals up to a maximum dose of 1mg.

• Minimum standards for record keeping are provided in the intravenous sedation policy. These should be recorded on an anaesthetic chart.
Appendix – Permcath Insertion on Bramley

Permcath insertions are now generally performed on in-patients. Timing of the procedure will be agreed between the ward StR’s and the nursing staff. If patients are admitted for tunnelled line insertions they should be asked to attend the ward at 0800, to allow blood results to be obtained as early as possible. An auxiliary nurse will be required to assist medical staff when permcaths are inserted.

Responsibilities:

Nursing staff: -

- Take pre-procedure bloods (FBC, clotting (PT, APTT), U+Es and Group and Save)
- Routine observations prior to procedure, and inform SHO if any abnormality.
- Administer prescribed pre-procedure antibiotics
- Patient in treatment room and dressed in theatre gown prior to procedure
- Assist with procedure
- Observations (pulse, BP, $O_2$ saturations if sedation given) as per guideline
- Ensure wound stopped bleeding, Chest X-ray checked by doctor and observations satisfactory prior to patient leaving ward.
- Ensure nasal mupirocin given as TTO and patient knows how to administer this

SHOs: -

- Complete care pathway documentation pre-procedure (blood results from previous day acceptable if patient not already on haemodialysis)
- Inform Specialist Registrar if any missing/abnormal results
- Insert venflon (avoiding potential fistula veins)
- Prescribe pre-procedure antibiotics
- Request Chest X-ray (usually Dept. film by wheelchair)
- Inform X-ray when procedure finished and check film when available
- Completion of TTOs

Specialist Registrars: -

- Check pre-procedure results acceptable
- Consent patient
- Undertake procedure
- Document procedure
- Review of post procedure chest X-ray
Perm cath Insertion – Equipment Required

Care pathway document for central venous catheters

Clean procedure trolley

Sterile gown & towel, Face mask, Theatre Cap

Sterile gloves (selection of sizes)

Intravenous cut down pack

Palindrome catheter kit (28cm for right sided insertions, 32 cm for left sided)

Suture – 45cm Ethilon non absorbable monofilament blue 3/0 26mm 3/8 circle reverse cutting prime needle

Chloraprep 3ml applicator

2 Sterile towels

2x 5 ml lignocaine hydrochloride 2%

I-Look ultrasound scanner

Ultrasound gel and sterile sheath to cover probe

Selection of syringes (4x10ml, 4x5ml, 2x2.5ml)

Gauze swabs (2 packs)

Guide wire (spare)

Introducer needle (spare)

Selection of hypodermic needles (21g & 25g)

100ml bag sodium chloride 0.9%

Citrate locking solution (citrate 46.7%)

Biofilm dressing (Opsite IV 6000)

2 Luerlock injection caps

Sharps