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Guide for Power PICC (Peripherally Inserted Central Catheters) Solo using Ultrasound and Sherlock 3CG Guidance	
Introduction and Aim This guide is to be adhered to for staff trained to place Power PICC solo lines within the UHB. This guide acts as a resource for a step-by-step guide for the PICC insertion, using ultrasound guidance and Sherlock 3CG. This guide aims to enhance the patient experience and nursing practice.	
Objectives <ul style="list-style-type: none"> • Provide a standardised approach in PICC placement • Support clinical decisions in PICC placement 	
Scope This guide applies to all of our staff who are trained and competent in PICC placement within Specialist Services, in Cardiff and Vale UHB.	
Equality Impact Assessment	An Equality Impact Assessment has not been completed.
Health Impact Assessment	A Health Impact Assessment (HIA) has not been completed
Documents to read alongside this Procedure	List all documents the reader is advised to read alongside / in support of this document
Approved by	Consultant Haematologist

Accountable Executive or Clinical Board Director	Medical Director
Author(s)	Deborah Powell, IV Access CNS Bethan Ingram, Advanced Nurse Practitioner
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Summary of reviews/amendments

Version Number	<i>Date of Review Approved</i>	<i>Date Published</i>	<i>Summary of Amendments</i>
1	10.06.16	16/12/16	Ratified guide to include Sherlock 3CG, Securacath and updates as per South Wales PICC Guideline

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Executive Summary

This document will comprise of information pertaining to the placement of a PICC using Ultrasound guidance and Sherlock 3CG. This document is required in order to reduce the risks and complications associated with all aspects of PICC insertion by standardising best practice for all practitioners to follow.

This is a Nurse Led Initiative within Cardiff and Vale UHB.

Scope of guideline

The guideline will apply to all healthcare practitioners who place PICCs using Ultrasound guidance (with Sherlock 3CG) in Cardiff and Vale UHB.

Aim

The aim of this guideline is to provide an overview of the concept of ultrasound and to describe the process of placing a PICC using ultrasound guidance and Sherlock 3CG. This document is based on empirical evidence and expert opinion within this field. This will ensure that the standard of practice will be consistent throughout the UHB and that the delivery of care concerning the insertion of PICCs will be of a high standard.

Statement

All the personnel within Cardiff and Vale UHB staff involved in the development and implementation of this guideline document are committed to providing the best possible care for patients who require central venous access. The UHB is also committed to working in collaboration with other Trusts in Wales and throughout the United Kingdom to ensure that the guideline is updated according to recent research and expert opinion.

This guide is inclusive of patients aged 14 years and over who are treated on the Teenage Cancer Trust Unit, and all adult patients within Specialist Services.

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Audit

Audit will be ongoing, highlighting issues such as:

- time frame for placement,
- number of patients who receive placement using ultrasound device
- complications during the procedure
- success of the procedure
- Complication rates post placement

I. Introduction

PICCs can be used for the administration of a variety of intravenous medications within the field Haematology. Only personnel suitably trained and assessed by the intravenous access nurse specialist within the Cardiff and Vale UHB can place PICCs using Ultrasound guidance with Sherlock 3CG to place Power PICC Solo. Ultrasound Locating Devices can be used to improve outcomes when inserting Central Venous Catheters (Stokowski 2009, Simcock 2008, Krestenic et al 2008).

There are many benefits to the use of Ultrasound in relation to the insertion of Peripherally Inserted Central Catheters (PICCs)

- Increases the success rate of first attempt placement by locating the precise location of the vein (Parkinson et al 1998)
- Decreases the incidence of complications such as mechanical phlebitis and thrombosis (Simcock 2008)
- Reduction in the trauma for the patient caused by failed attempts
- Provides assessment of the integrity of the vein – detects thrombosis within the vessel
- Reduction in the overall cost of complication management and multiple attempts

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- Improves the infusion rates of ambulatory chemotherapy pumps – PICCs may be placed away from the inner crook of the elbow

NICE have published guidelines relating to the benefits of using ultrasound guidance to place Central Venous Catheters (NICE 2002). This document advises that 2D Ultrasound guidance 'should be considered in most clinical circumstances where Central Venous Catheter insertion is necessary'.

II. Ultrasound

Ultrasound is a series of high frequency sound waves that are sent into the body and then reflected back to create an image. On the ultrasound screen, fluid filled structures appear black and surrounding tissues appear as various shades of grey. Vessels such as veins and arteries appear well defined. Ultrasound cannot penetrate air or bone; this is why ultrasound gel is always required between the probe and the skin to conduct the ultrasound beam.

The ultrasound screen will vary in its magnification of the image and can be adjusted. Depth markings will be clearly identified on the screen. It is recommended that scanning should start with the 4cm setting, and then if the vessel is superficial, increase the magnification to 2cm. This setting will magnify the vessel to twice its normal size.

The Ultrasound Device

Probe (Linear Transducer)

The probe of choice should be between 5 and 10 MHz. For example:

- 9.0 MHz probe can be used to locate a vessel that lies up to 1.5 cm below the surface of the skin.
- A 7.5 MHz probe can be used to locate a vessel that lies between 1.6 and 4 cm below the surface of the skin i.e. when there is more subcutaneous fat.

Acoustic gel is used in order for the probe to transmit the high frequency sound wave and to convert into an image on the screen.

The probe should be held at a 90 degree angle on contact with the skin, and perpendicular to the vessel (across). A light and steady touch should be maintained in order to view the images.

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III. Micro-Introducer Technique

The use of a micro-introducer technique will be required when using the ultrasound equipment to cannulate a vein that is not palpable. The procedure is a modified Seldinger technique which involves the insertion of a small gauge needle into the vein followed by the introduction of a wire. A sheath and dilator then pave the way to accommodate the PICC.

- **A wire should never be forced.**
- **The wire should never be removed through the needle, due to the risk of severing the wire on the tip of the needle.**
- **If the introducer is damaged prior or during placement - replace**

IV. Vessel identification and selection

Identification

- A vein is a non-pulsatile vessel and easily compresses with the ultrasound probe; i.e. the vein will collapse easily when pressure is applied by the probe.
- An artery is a pulsatile structure that is difficult to compress with the ultrasound probe

Once the vessel has been accessed, the practitioner must observe the flow of blood from the needle to ascertain if the vessel is a vein or an artery. Blood flow from an artery will pulsate and be excessive.

Vein Selection

The veins of choice for the placement of a PICC when using ultrasound guidance are the basilic and the brachial veins in the upper arm. The cephalic vein should only be used if the

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aforementioned veins are unsuitable and provided the cephalic vein is above 0.5mm in diameter. PICCs should not be placed in a small cephalic vein.

The selected vein should be of adequate size for catheterisation. A small catheter gauge may be required for smaller vessels.

Care must be taken accessing the brachial vein due to its proximity to the brachial artery and the median nerve.

V. Patient preparation and consent

1. Preparation

Patients should be given a PICC information leaflet preferably prior to the placement or prior to insertion. An explanation of the following must be provided prior to obtaining consent:

- reason for PICC
- assessment of physical and psychosocial maturity of the younger patients (i.e. those aged 14-17 years)
- placement
- time frame of the procedure
- after care
- potential complications
- contact numbers for patient concerns and reporting complications. All patients to be given a PICC alert card.
- appropriate venous assessment prior to insertion

Prior to consent, all patients should receive a copy of the Patient Information on PICCs Leaflet to read. Following this, consent should be taken by the PICC placer where possible and patients or any person accompanying the patient should have the opportunity to ask questions. All patients must verbally consent and sign the written consent form.

Due to the nature of the insertion procedure, younger patients (those under 16 years) should be assessed to establish Gillick competence (or not). Those without Gillick competence should be discussed with and referred back to the Paediatric Oncology Team for line placement.

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2. Oral Anticoagulation (the advice below are all locally set guidelines)

- Warfarin does NOT need to be stopped prior to PICC insertion. An INR should be measured 24-72 hours prior to PICC insertion. The INR should be stable and < 3.5 prior to placement.
- Direct Oral Anticoagulant (DOAC) e.g. Rivaroxaban, Dabigatran, Apixaban, Edoxaban
 - Continue to take usual dose of medication. No interruption required.
- Parental anticoagulation
- Subcutaneous Low Molecular Weight Heparin
 - Thromboprophylactic dose – wait at least 12 hours since last dose prior to insertion of PICC.
 - Therapeutic dose – wait at least 18-24 hours since last dose prior to insertion of PICC
 - Intravenous Unfractionated Heparin
 - Discuss with coagulation team

3. Blood Monitoring

Prior to placement patients should have the following blood tests performed:

- FBC
- U&E
- CRP (if neutropenic or previous infection)
- Clotting (if on anticoagulation, new diagnosis or known clotting abnormalities)

NICE (2015) recommend that platelet counts of $>10 \times 10^9/L$ are sufficient for PICC or midline catheters. Patients may require platelet transfusion to achieve this. This number should also be viewed in the clinical context of the patient; for example, patients with veins in close proximity to the artery or who are bleeding may require platelet transfusion prior to insertion despite an adequate platelet count. Discussion with Haematology SpR should take place if concerns over thrombocytopenia.

VI. Infection control

All PICCs must be placed using strict maximal barrier precautions following Epic 3 guidelines 2013

This includes:

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- Cleansing the site with chlorhexidine 2% in 70% alcohol single use applicator 3mls in an area of approx 6cm squared around the proposed exit site and allowed to dry for 2 minutes
- Top to toe draping
- Thorough hand-washing and drying with sterile towels
- Wearing hat and mask
- The use of sterile equipment placed onto a sterile field

Observe for any pooling of the chlorhexidine. Spread out any pooling of the fluid to avoid ignition where electrical equipment is used. If any electrical equipment is used during placement or PICC cleansing, the chlorhexidine must be left to dry for 3 minutes.

VII. Lidocaine Injection

Lidocaine 1% (lignocaine) (20mg in 2mls solution) is a local anaesthetic solution that is used prior to placement. The maximum dose of lidocaine, alone as a single agent is 3mg per kg, i.e. 21mls of 1% solution for an adult of 70kgs. This dose must not be exceeded. Children and elderly or debilitated patients require smaller doses, commensurate with age and physical status.

The administration of lidocaine must be preceded by a withdrawal technique to verify that a vessel had not been inadvertently punctured.

Adverse symptoms relating to the use of lidocaine may be delayed post administration, so each patient must be observed for 20 minutes post injection.

The lidocaine will be prescribed prior to the procedure or issued as part of a Patient Group Directive (appendix 1).

Administration:

Lidocaine anaesthetic injection should be administered sub-dermally prior to venepuncture.

- Place the orange needle into the subcutaneous tissue and withdraw on the plunger to verify that the needle is not in a vein
- First raise a fine shallow bleb and inject slowly into the subcutaneous space. If lidocaine anaesthetic is given prior to needle insertion, another injection may be required in order to anaesthetise deeper within the subcutaneous tissue using ultrasound guidance to identify the location of the needle tip in relation to the vein.

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Care must be taken not to inject the lidocaine too close to the surface of the vein as this will cause the vein to collapse.

- Leave the lidocaine to become effective.
- Test the effectiveness with the tip of the needle prior to needle insertion.

When preparing the equipment on the sterile field, the lidocaine injection must be drawn into a smaller syringe than the saline in order to clearly distinguish between the two.

VIII. Venepuncture

When inserting the needle into the vein, the probe can be held perpendicular (across) or longitudinal (along) the vein. The needle should be placed slowly into the skin. When the needle approaches the vessel target, the anterior wall will indent. A swift insertion into the vein at this time will prevent excessive collapse of the vein wall. Once venepuncture has taken place, the vessel returns to normal shape. Always observe for a blood return from the needle or cannula.

IX. Inadvertent arterial puncture

The inadvertent puncture of an artery can be avoided by:

- Recognising the position and location of all main and aberrant arteries
- If the vein accessed is close to an artery, this will be highlighted on the X-ray form
- Arterial placements will bleed excessively and this must also be documented on the X-ray form
- Any patient who's PICC has been placed in a vein close to an artery or where excessive bleeding is noted must be assessed further by identifying the placement of the PICC in the vein using Doppler ultrasound – for further confirmation a colour Doppler ultrasound procedure can be requested by the radiographer.

X. The procedure

The PICC placement procedure is usually a two person procedure but placement can be achieved using strict asepsis and maximal barrier precautions with one practitioner.

1. Collect the equipment required:

- Portable Ultrasound machine
- Sherlock 3CG for ECG guided placements
- Ultrasound conduction gel
- Sterile conducting gel
- Probe – 9.0 MHz for vessels less than 1.5 cm in depth

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- Probe – 7.5 MHz for vessels greater than 1.5 cm in depth

Power PICC pack includes all the equipment mention below except Sterile gloves x 3 and Chloraprep 3ml x 3

- Sterile Ultrasound probe cover
- Needle guide (optional)
- Microintroducer kit
- PICC pack
- Gown pack
- Sterile gloves x 3
- Syringe 5mls
- Blue needle x 1
- SecuraCath
- Steri-strips if using a Statlock
- Chloraprep 3ml x3
- Lidocaine injection 1 %
- Disposable or new tourniquet
- Face mask

2. Non-sterile vessel assessment with ultrasound.

- Instruct the patient on the purpose of the ultrasound procedure and explain the ECG process for placing a PICC using Sherlock 3CG
- Position the patient with the arm supported
- Ensure that the Ultrasound machine is in a suitable location for optimum visualisation by the placer
- Activate depth markings
- Apply tourniquet
- Scan the patient with a non-sterile technique to determine the location, depth and patency of the vein and arteries
- Select the appropriate needle guide that corresponds to the appropriate vessel depth (optional).
- Identify the area where placement will take place
- Prepare Sherlock 3CG for PICC tip tracking and confirmation

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- j) Place sensor in cover remove adhesive backing from sensor cover, place the covered sensor directly on the patient's skin, and place the sensor as flat as possible and high on the patient's chest.
- k) Attach electrodes to lead wires, remove backing
- l) Check that the patient has an identifiable P wave, if the patient does not have an identifiable P wave, then the Sherlock 3CG can be used to navigate the PICC into the SVC but confirmation of the PICC tip will require a Chest X-ray.
- m) Ensure no metal, or mobile phones are in the area where the sensor is be placed
- n) Move active motor driven equipment at least 5 feet away from the patient if possible
- o) Lower bed rails (when appropriate)

3. Preparation

Determine the length to be inserted

- Place the arm at a 90 degree angle to the body. Mark AC fossa with a pen.
- Measure from AC fossa to axillary crease.
- Axillary crease to the right clavicular head.
- Right clavicular head to the sterna border of the third intercostals space. Record this pre measurement.

Prepare the sterile field:

- a) Put on hat and mask
- b) Wash hands and arms using a surgical scrub technique
- c) Assistant to open PICC pack and place on two pairs of sterile gloves and Chloraprep, blue needle, syringe 5ml, chlorhexidine single use applicator on to the sterile field
- d) Dry hands with sterile towels within the pack
- e) Put on gown
- f) Put on sterile gloves
- g) Draw up the normal saline
- h) Draw up lidocaine injection (5ml syringe) and label if using Power PICC Pack. Place an orange needle onto the filled syringe – **only a 5ml syringe and a 10ml syringes are permitted onto the sterile field in order to clearly distinguish between the lidocaine and the saline.**
- i) Prime the PICC with saline without touching the PICC with your gloves, leave saline filled syringe attached to PICC, close

Prep the patient:

- a) Place sterile towel underneath the arm using a non-touch technique

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- b) Cleanse the skin thoroughly with the chlorhexidine applicator from the inside out
- c) Drape the surrounding area with sterile drapes to create a small exposed area of skin
- d) Cleanse the skin thoroughly for a second time with the chlorhexidine applicator from the inside out

Drape the probe for sterile use:

- a) Allow the assistant to place the probe in the side arm holder on the stand
- b) Apply a layer of non-sterile ultrasonic gel on the acoustic window of the probe
- c) Place the sheath over the probe head, being careful not to wipe off the gel
- d) Cover the probe and cable with the sheath
- e) Smooth the sheath over the acoustic window of the probe head and remove any air bubbles
- f) Use a sterile elastic band to hold the sheath in place.
- g) Place the probe safely onto the sterile drapes

4. Insertion of the PICC

- a) Apply sterile gel onto the skin at the intended site of cannulation
- b) Apply the tourniquet – not too tightly
- c) Locate the site of a suitable vein for venepuncture using the ultrasound machine
- d) Optional = Place the needle guide onto the probe
- e) Administer intradermal lidocaine at the proposed venepuncture site using the guide described above in section V.
- f) Place the probe on the skin at the intended access site and hold the probe perpendicular to the vein. Realign the vein on the centre dot marker (on the ultrasound screen).
- g) If the vein is superficial, a longitudinal method can be used to place the needle into the vein
- h) When the vein is successfully accessed blood return will be observed in the needle. The needle guide can be removed from the probe.
- i) Introduce the wire into the needle or cannula and once the wire is in situ in the vein, remove the needle.

Take extreme care not to lose the wire into the bloodstream, allow at least 15cm of wire outside the sheath and dilator.

- j) Perform a dermacotomy at the entry site with the blade from the PICC pack (aprox 2mm in diameter)
- k) Advanced the sheath and dilator over the wire
- l) Check measurement from ac fossa to insertion site deduct this from your first measurement, and add up to 6cm.

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Power PICC Solo:

- m) Prepare PICC line retract the entire T-lock connect/stylet assemble as one unit until the stylet is well behind the catheter cut location. Do not entirely remove the stylet from the catheter. Using sterile scissors cut the catheter. Re-advance the T-lock connector/stylet assemble locking the connector to the catheter hub, gently retract the through the locked T-lock connector until the stylet is contained within the catheter.
- n) Uncoil catheter stylet lead, attach to fin on sensor, select calibrate immediately prior to catheter insertion, remove
- o) Once the sheath and dilator are in the vein, the wire is removed with the dilator, retaining the sheath (cannula) in the vein
- p) Insert PICC until the magnetic navigation shows stylet icon moving consistently downward. Continue to SLOWLY advance catheter until the catheter is inserted to the external measurement.
- q) The dilator is peeled away and discarded
- r) At this point the catheter may need to be flushed to stabilize the waveform
- s) Flush catheter with saline and wait for intravascular ECG waveform to stabilize.
- t) Verify that the P-wave on the intravascular ECG waveform is present. Select 'Freeze' to save the current ECG wave forms on the reference screen. Slowly adjust the catheter 1 cm at a time to maximum P-wave amplitude. Freeze and then print.
- u) Remove the stylet and T-lock assembly, withdraw blood and flush catheter.
- v) Secure with SecuraCath or Statlock Secure the entire PICC under a dressing of sterile gauze and occlusive dressing.

5. X-ray requesting, interpreting and tip location patient without an identifiable P wave

All PICC placers will be able to interpret PICC X-rays and successfully demonstrate this skill during the competency assessment.

All X-rays at time of placement will either be reported by a radiologist. If an immediate report is not available, the chest x-ray should be reviewed by SpR to review the whole film and review any incidental findings.

The location of the tip of the PICC should be ideally in the junction between the Superior Vena Cava and the Right Atrium at the Cava atrial Junction. The PICC should not be placed above the mid SVC at placement.

If there is no identifiable P wave then the Sherlock3CG can be used to navigate the PICC into the SVC, and Chest X-Ray must be performed to check PICC tip location

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A Clinifast sleeve will be placed over the PICC to protect and must not be tight.

Documentation in the medical notes will include:

- Date
- Written consent gained
- Name of placer
- Vein used
- Side used
- Account of any complications i.e. malposition, difficult placement, nerve injury
- Measurement of PICC advanced
- Personnel interpreting the X-ray
- Location and date of first dressing

XII. Patient discharge

All patients will be:

- Given an appointment for a first dressing in the Haematology Day Unit or if in patient on the ward 24-48hrs of placement. In circumstances where patients have difficulty attending hospital – the community nurse can perform the first dressing.
- Referred to the community nurse and provided with equipment for one dressing, instructions for dressing and flushing, community nurse letter, saline and a signed prescription for saline.
- Given an alert card outlining the reasons to call and the numbers to call if they experience problems
- Advised to move the arm and to inform the Haematology Day Unit or ward if they are admitted into another hospital with a PICC in situ.

XII. Care of the ultrasound equipment

Cleaning

Cleaning the Ultrasound machine (IV Scanner): Dampen a non abrasive cloth in warm water or rubbing alcohol and wipe the surfaces gently.

The probe should be cleaned after each use with water or rubbing alcohol using a non abrasive cloth. **DO NOT USE HOT WATER ON THE PROBE.**

Testing

Probe testing: Each probe should be tested for proper alignment on a monthly basis or when the probe has been dropped or mistreated.

If a probe is damaged in any way, discontinue use immediately.

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Checking the probe for proper alignment:

- Connect the probe to the Site-Rite scanner
- Press the power button
- Press Dot Marker button to display the centre dot markers on the screen
- Clip 1.5 cm disposable needle guide onto the probe and insert the appropriate needle into the guide, bevel away from the probe(Optional)
- Immerse the tip of the probe in a container of clear water
- Advance the needle until tip displays as a bright dot on the screen

Charging the battery:

For instructions on charging the battery see operator's manual.

XIII. Training

Prior to embarking on placing PICCs using Ultrasound guidance, the practitioner must:

- Familiarise themselves with the Ultrasound machine and attempt to identify vessels on a healthy volunteer
- Be able to identify the location of the structures in the upper arm and distinguish between a vein and an artery using ultrasound guidance
- Perform the procedure under the guidance of an experienced practitioner until deemed competent
- Read the guidelines document and relevant articles.
- Pass a competency assessment which includes a theoretical and practical evaluation performed by the intravenous access nurse specialist.
- Within Cardiff & Vale UHB all theoretical and final competency assessment is provided by BARD, however training is supported by the UHB PICC team
- Competency will be reviewed annually by peer assessment
- Individual practitioners are responsible for maintaining competence by inserting at least 20 PICCs per annum

XIV. Audit

Regular audits pertaining to the procedure and the effects of the ultrasound will be completed. Data will be collated on a daily basis identifying difficulties with the equipment or the procedure, duration of the procedure and the number of attempts.

XV. References

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XVI. Appendix 1

Patient Group Direction

Description	
Name of Medicine:	Lidocaine Hydrochloride injection
Status of medicine:	POM (Prescription Only Medicine)
Form:	Fluid for Injection
Strength:	1% (10mg per 1ml)
Appropriate dosage:	0.4- 2ml per placement
Maximum total dosage:	20mg (2ml)
Route of Administration:	Intracutaneous/subcutaneous
Rate of Administration:	N/A
Frequency of Administration:	One dose prior to each placement which can be up to four attempts per patient
Minimum period over which medicine should be administered:	N/A
Maximum period over which medicine should be administered:	N/A