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Peripherally Inserted Central Catheter (PICC) Guidelines - Nursing Perspective

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Abstract

A Peripherally Inserted Central Catheter (PICC) is a form of intravenous line that grants access to the central venous system. It is inserted through a vein in the arm and then carefully advanced until it reaches a large vein close to the heart. The PICC has one, two, or three separate channels, called lumens, that can be used for different purposes, such as blood sampling, medication administration, fluid infusion, and other interventions. Each lumen has a cap and a connector that prevents contamination and allows needle-free access. Venous access is crucial for many patients who need frequent or complex treatments, such as critically ill patients who require blood tests, drugs that affect blood pressure, fluid replacement, long-term antibiotics, and other indications.

Keywords: PICC, Total Parentral Nutrition, Infection, Prevention, Lumen

Introduction

A peripherally inserted central catheter (PICC line) is an elongated, slender tube inserted into a vein in the arm, extending to the large vein near the heart. This facilitates the administration of medicines and fluids by healthcare professionals. A PICC line is required when an extended period of intravenous (IV) therapy is essential or when the treatment cannot be administered through a conventional IV. Normally, a nurse or doctor inserts the PICC line into the arm using a needle and a guide wire. This procedure is commonly performed in a hospital setting or an outpatient clinic.

PICCs, a variant of central venous catheters, are introduced through a vein in the arm, extending to the chest. Featuring one, two, or three tubes known as lumens, these catheters typically measure 50 cm to 60 cm in length. They provide medium-term venous access, allowing them to remain in position for several weeks to up to six months (Figure 1).[1]

Introduced in 1975, this approach serves as a substitute for central venous catheters in significant veins like the subclavian, internal jugular, or femoral veins. Unlike subclavian and jugular line insertions, which may lead to pneumothorax (accumulation of air in the lung's pleural space), PICC lines circumvent such complications due to their distinctive placement method.[2]

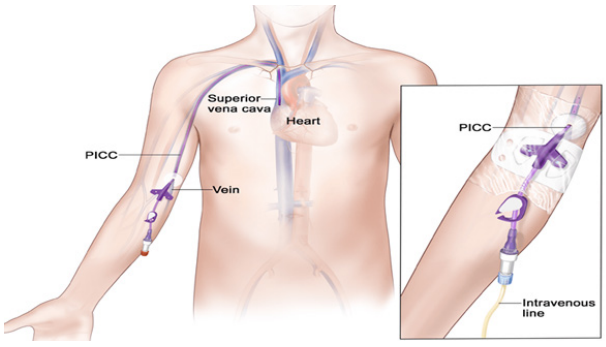

Figure 1: Peripherally Inserted Central Catheter (PICC)

Sites for PICC line insertion

PICCs are placed through:

- Basilic vein
- Brachial vein
- Cephalic or medial cubital vein of the arm.[3]

Indications

The PICC is an effective and secure way to achieve central venous access. It is suitable for patients who need venous access for a long duration because of its performance. Also, it can be handled in both hospital and home settings.

Common indications include:

- Chemotherapy or Oncological disorders
- Prolonged or Long term IV medication administration
- To infuse total parentral nutrition (TPN)
- Blood infusions
- Regular blood investigations
- Unable to access veins due to anatomical or pathological cause
- To infuse large amounts of IV fluids[4]

Advantages of PICC

- Catheter placement can be done for both hospitalized and non-hospitalized patients bedside.
- Patients who opt for infusion therapy can have PICC lines inserted and continue their treatment outside the hospital setting.
- PICCs are highly recommended for patients who have had port infections in the past.
- Catheters can stay in place for long or intermediate duration.
- Unlike port and other types of catheters that need X-rays to verify the tip location, new technologies can confirm the position of the catheter tip as needed even when the PICC is placed bedside.
- The removal of the catheter is uncomplicated and can be conducted as an outpatient procedure.[5]

Contraindications

PICC line insertion plays a very important role in saving life but there are definitely some contraindications. Few contraindications based on the condition of the patient are:

- History of thrombosis in the veins which is needed for PICC line insertion
- Burn injury
- Local infections
- Radiation therapy
- Active septicemia
- Chronic renal failure, end-stage renal disease
- Small veins
- History of mastectomy and lymph node removal
- Persistent cough, vomiting (increased intrathoracic pressure can lead to catheter malposition, catheter erosion or cardiac tamponade)[6]

Risks

PICC line complications can include:

- Bleeding
- Nerve injury
- Irregular heartbeat
- Damage to veins in the arm
- Blood clots
- Infection
- A blocked or broken PICC line[7-9]

Equipment

PICC lines can range in length from 50 to 60 cm, have one to three lumens, and require different cleaning and maintenance procedures. They can also be with or without valves. When the system is open, valved catheters prevent blood from flowing back into the catheter.[10-12]

Catheters may differ slightly between brands in terms of their technology and packaging. The predominant method for inserting a PICC is the modified Seldinger technique, widely employed. This technique necessitates the use of standard equipment, including the following general supplies.

PICC lines are long (about 50 to 60 cm), thin tubes that are inserted through a vein in the arm and advanced until the tip reaches a large vein near the heart. They have one to three openings, called lumens, which allow different fluids or medications to be given through them. PICC lines also have different features, such as valves or no valves that affect how blood flows in and out of them. Valved catheters prevent blood from going back into the tube when it is not in use, while non-valved catheters need to be clamped to avoid this. PICC lines also vary by brand, and each one may have specific instructions on how to use and care for them. The most common method for placing a PICC line is the modified Seldinger technique, which involves using a needle, a wire, and

a dilator to create a pathway for the catheter. The modified Seldinger technique[13] requires some basic supplies, such as:

- Ultrasound machine
- Sterile probe for ultrasound
- Ultrasound gel
- Sterile gloves, mask, face shield, gown
- Sterile hole towel and drape
- Antiseptic solution for skin preparation
- Normal saline sterile for flushing
- Measuring tape[14]

PICC insertion kit (Figure 2)

- Sterile PICC catheter
- Sterile needles of different gauges
- Sterile 10 mL Syringe
- Guide-wire
- Dilator
- Introducer
- Scalpel
- Inj. Lidocaine (for Local Anesthesia)
- Suturing material
- Sterile dressing tray[15]

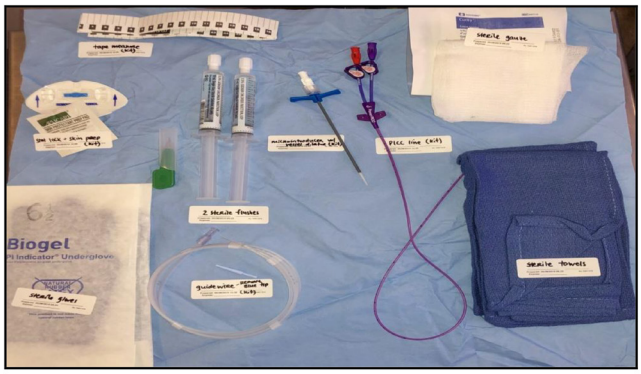

Figure 2: PICC insertion kit

Who can perform PICC insertion

- General surgeon/trained doctors
- Trained PICC line nurse
- Nurse practitioners[16]

Preoperative procedure

The insertion of central venous catheters (CVCs) can be accomplished through surgical or non-surgical means, depending on the catheter type and location. PICCs, typically non-surgically placed at the patient's bedside, utilize ultrasound guidance to ensure accurate positioning. Ultrasound guidance improves the outcomes of catheter insertion by reducing complications and failures.

To prevent catheter-related bloodstream infections (CRBSIs), it is essential to follow sterile technique during the insertion and care of CVCs. Studies have shown that implementing standardized protocols for catheter insertion, care, maintenance, and infection prevention can significantly lower the rate of CRBSIs.

The technique section below provides a detailed description of the procedure for PICC insertion, including the preparation steps, the equipment and supplies needed.[17-18]

Procedure

The most common method for PICC insertion is the Seldinger technique. Other options are peel-away cannulas and brake-away needle techniques. These techniques may increase the bleeding risk for the patient because they require larger veins to accommodate bigger needles and introducers. Peel-away catheters can also cause air emboli, as reported in some cases.

The steps for the sterile, modified Seldinger technique are as follows:

- Explain the procedure to the patient and legal guardians.
- Obtain written consent from patient or legal guardians.
- Arrange the articles required for the procedure.
- Patient's arm circumference to be measured for avoiding future complications.
- Find the suitable vein by using ultrasound equipment.
- Maintain hydration levels before opting for the procedure.
- Insertion site can be marked for easy access.
- Determine the required length of catheter advancement to reach the junction of the superior vena cava (SVC) and right atrium.
- This is typically done by taking measurements from the insertion point to the middle of the right clavicle and then downward to the third intercostal gap.
- Wash hands thoroughly.

- Cleanse the upper arm area with alcohol and chlorhexidine.
- Put on a mask, face shield, and hair cover before changing into a sterile gown and gloves.
- Create a sterile environment by draping sterile towels over the area, anesthetizing the skin if necessary, and utilizing ultrasound to re-identify the vein.
- Use a needle and syringe to access the vein until blood is aspirated.
- To advance the guide wire through the needle, remove the syringe.
- Take out the needle and then use ultrasound to make sure the wire is in the vein.
- Make a small incision using the scalpel at the insertion site to accommodate the dilator.
- Insert the dilator and introducer over the guide wire.
- Remove the guide wire and dilator, leaving the introducer alone.
- Insert the catheter through the introducer and advance it to the desired length.
- Remove the introducer.
- Before using PICC, confirm that the catheter is properly positioned in the atriocaval junction with a chest x-ray.

To prevent complications after confirming the correct position and function of the device, several measures should be taken. These include using stabilizing devices to secure the catheter, flushing the line regularly with saline and heparin solutions to prevent clotting, and changing the dressings with sterile technique to reduce infection risk.[19-21-22]

Complications

- Catheter (PICC) displacement
- Infection (Local or systemic)
- Blockage or functioning irregularities
- Air embolism
- Phlebitis
- Cardiac arrhythmias
- Occlusion of catheter[22]

Nursing intervention

- PICC line care is an important aspect of nursing practice that requires attention to detail and adherence to infection control measures.
- The patients who have a PICC line inserted should be encouraged to shower daily with a transparent dressing over the insertion site to prevent infection.
- The PICC line should be secured with a device that prevents movement and dislodgement of the catheter.
- The clients should report any signs of catheter movement to the hospital immediately.
- To maintain the patency of the PICC line, each lumen should be flushed with 10 mL of 0.9% sodium chloride once a week, even if one lumen is not used.
- The PICC line has a valve that does not need a clamp.
- To prevent infection, the dressing should be changed weekly using aseptic technique following universal precautions.
- The catheter hub, the insertion site, the SecurAcath device and the needle free cap should be cleaned with antiseptic agent and allowed to air dry.
- The transparent dressing should cover both the SecurAcath and the insertion site and have a date label (Figure 3).
- No large pieces of gauze should be placed under or over the SecurAcath as they hinder inspection and removal of the dressing.
- A small piece of gauze can be used under the SecurAcath if needed.
- Each nursing staff who is handling the PICC line to be provided proper training to maintain PICC line to prevent damage of the catheter.[23]

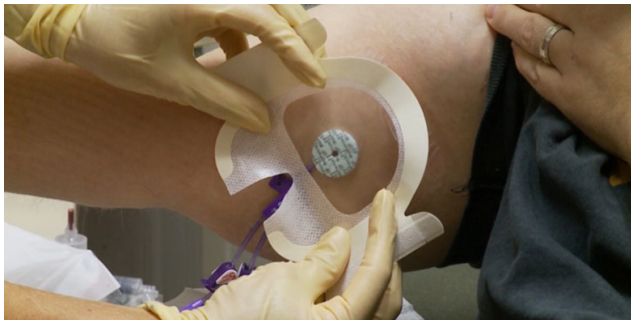

Figure 3: PICC line dressing

Conclusion

A PICC line is a form of central venous catheter designed for the direct delivery of medications and therapies to the large veins near the heart. These lines offer a convenient and safe option for long-term use, given their ease of insertion and removal. Particularly beneficial for patients with chronic conditions and cancer, PICC lines facilitate medical management and diagnostic procedures. Despite having a lower risk of infection compared to other central venous catheters, proper infection control practices are essential when handling PICC lines. They also enable routine blood tests, regular medication administration, and can serve as a conduit for nutritional support. Providing training for nursing staff on PICC line care is crucial to preventing potential complications.

Conflict of Interest

Nil

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