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Ultrasound-Guided PICC Line Placement

Faculty Information

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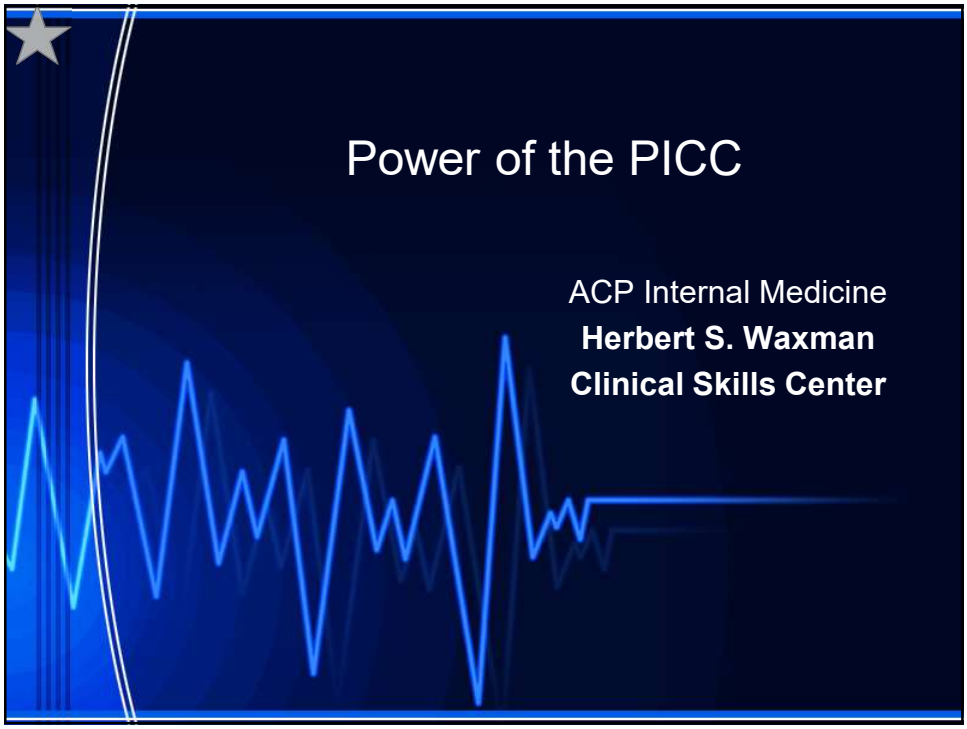

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Disclosure of Financial Relationships

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Objectives of Peripherally Inserted Central Catheters (PICC)

- What is a PICC
- Indications for a PICC
- Complications of PICC placement
- Ultrasound Technology
- Venous Anatomy
- PICC Insertion preparation
- PICC Insertion Techniques

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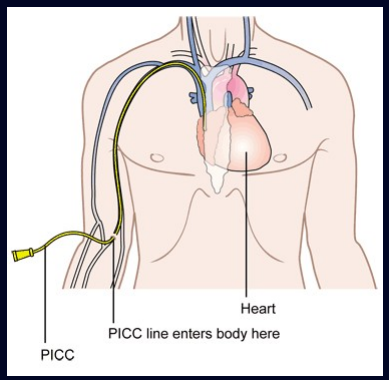
What is a PICC

Peripherally Inserted Central Catheters

- Soft flexible catheter constructed of polyurethane or silicone-based material
- Inserted through the peripheral vein of the arm or leg and advanced into the superior or inferior vena cava.
- They may be single or multi-lumen
- They can be indwelling for up to 12 months



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Indications for a PICC

- Provide stable venous access
  - Patients who require intravenous infusions for > 5 days
  - Patients with multiple complications associated with short peripheral catheters
    - Peripheral catheters do not last 24 hours
    - Few peripheral veins are available
  - Reduced Number of Needle Punctures to Skin
  - Venous Blood Sampling
  - Repeated Administration of Blood or Blood Products
  - Measurement of Central Venous Pressure
- Patients with a need for irritating medications or solutions
  - Long Term Chemotherapy
  - Parenteral Nutrition

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Contraindications for PICC

- No trained PICC personnel available
- Cannot obtain patient consent
- No X-ray capability to confirm placement
- Emergency access or high volume requirements
- Upper extremity vasculature problems
  - Thrombosed upper extremity
  - Sclerosed or stenotic
- Suspected sepsis prior to final culture results
- Device related infection
- Chronic renal failure and end-stage renal disease
  - The need to preserve peripheral veins for future dialysis fistulas

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Ultrasound Image Basics

The Ultrasound Appearance of Tissues	
Structure	**Appearance**
Artery	Hypoechoic, pulsatile, non-compressible. Doppler - pulsatile flow
Vein	Hypoechoic, non-pulsatile, compressible. Valsalva effect, doppler - continuous flow
Muscle	Hypoechoic with multiple hyperechoic lines
Tendon	Hyperechoic with anisotropy - bright lines longitudinally or bright dots at right angles fibrillary pattern
Nerve	Variable hypo- or hyperechoic with anisotropy fascicular pattern
Bone	Hyperechoic

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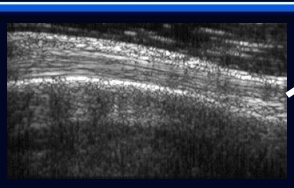
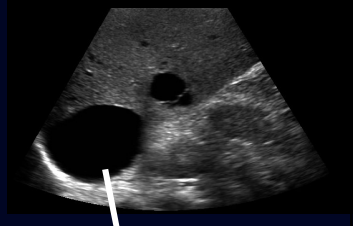
Ultrasound Images



Hyperechoic
Diaphragm
Tendons
Bone

Strong Reflections = White Dots

No Reflections = Black Dots



Isoechoic
Solid organs
Thick fluid

Hypoechoic
Fluid within a cyst
Urine
Blood

Weaker Reflections = Grey Dots

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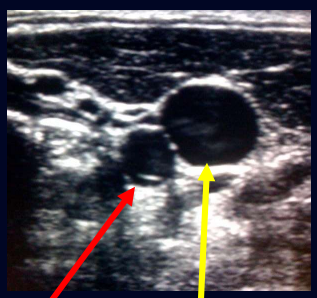
Vascular Ultrasound



Carotid Artery

Internal Jugular Vein

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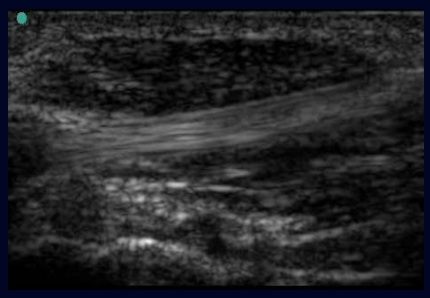
Ultrasound Images

Liver metastases



Flexor Pollicis Longus Tendon

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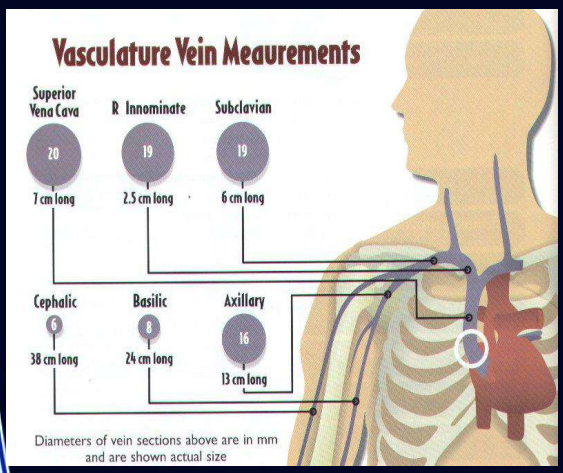
Veins used for procedures



Venous Blood Flow

Cephalic 40 ml/min

Basilic 95 ml/min

Axillary 333 ml/min

Subclavian 800 ml/min

SVC 2-2.5 l/min

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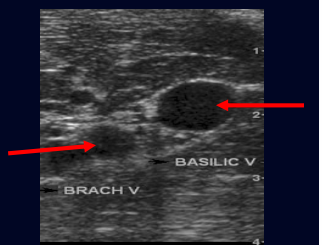
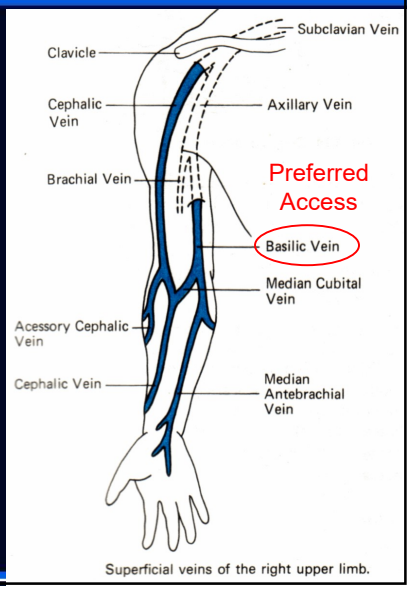
Ultrasound images of the veins

Cephalic Vein



Brachial & Basilic Vein



Superficial veins of the right upper limb.

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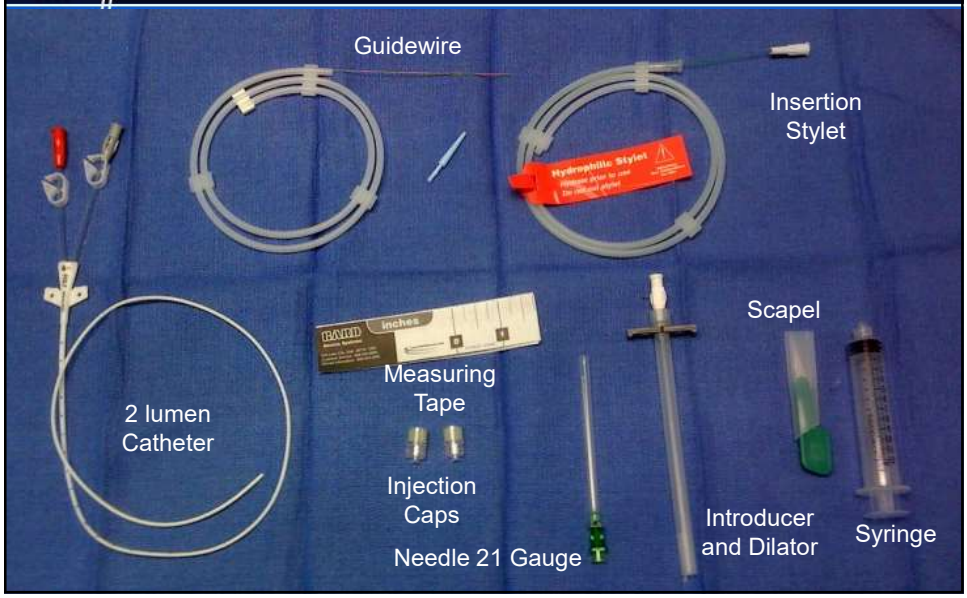
PICC Contents



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Insertion Methods

- **Methods of bedside PICC insertion**
  - Peel-away Cannula technique
    - Access is established by inserting the cannula and stylet into a vein
    - The stylet is removed and the catheter inserted through the cannula
    - The cannula is then pulled back and peeled away from the catheter
    - Higher incidence of thrombophlebitis than the modified-Seldinger technique
  - Modified-Seldinger technique
    - A vein is accessed with a regular hypodermic needle
    - A guide wire is threaded into the needle or cannula several centimeters, then the needle or cannula is removed, leaving the guide wire in place
    - A nick is made in the skin beside the guide wire, and an introducer sheath with dilator is inserted over the guide wire
    - The guide wire and dilator are removed, and the catheter is advanced through the introducer sheath, which is then pulled back and peeled away
- Either insertion method requires maximal sterile barrier precautions to reduce the risk of contamination and subsequent catheter-related bloodstream infections. Maximal sterile barrier precautions include the use of a mask, sterile gown, hair cover, sterile gloves, and large sterile drapes

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Modified-Seldinger Technique

- Obtain access with the aid of ultrasound
- Apply tourniquet to arm upper arm
- Sterile technique

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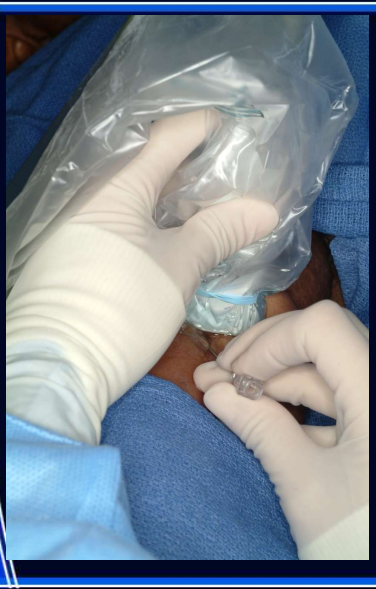
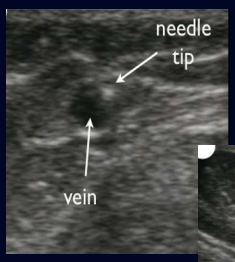
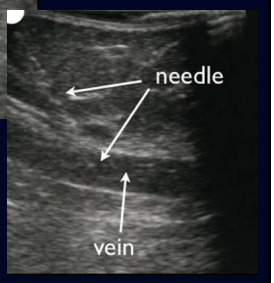
Modified-Seldinger Technique



- Using the 21 gauge needle
- Sliding needle technique with US





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Modified-Seldinger Technique

- Introduce the guidewire
- Advance guidewire 15-20cm

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Modified-Seldinger Technique

- Release the tourniquet
- Enlarge puncture site with scalpel
- Leaving the guidewire in place remove needle
- Introduce the microintroducer through the puncture site

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Modified-Seldinger Technique

- Introduce the microintroducer through the puncture site
- Make sure constant monitoring of guidewire to ensure embolization of the wire does not occur

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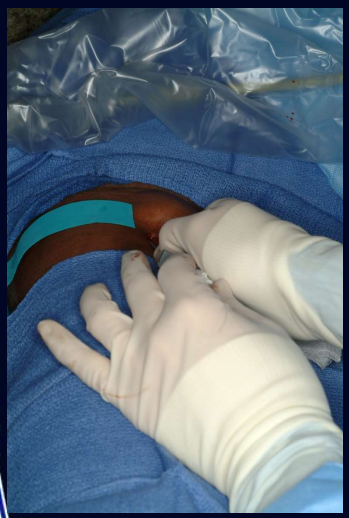
Modified-Seldinger Technique



- Once the microintroducer has been placed remove the guidewire

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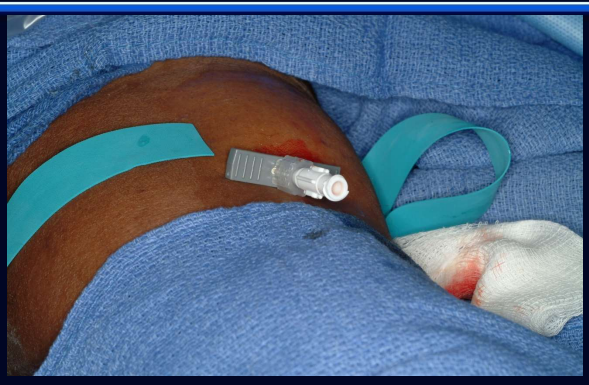
Modified-Seldinger Technique



- Rotate the locking collar of dilator and remove dilator from sheath

WARNING : Place finger over sheath to minimize blood loss and risk of air aspiration until cap is placed onto dilator sheath.

- Place a cap onto the microintroducer
- Measure the distance for the PICC catheter

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Modified-Seldinger Technique

- Measurement of PICC line
  - Numerous techniques
    - Overall you measure from the insertion site to 2nd ICS below the sternal notch.
    - Measure before placement
      - Unsure if insertion site will be the correct site during actual placement
    - Measure during placement
      - After sterile technique the measurement can be done anytime
      - Recommend to measure after vein access has been obtained therefore one knows the actual insertion site

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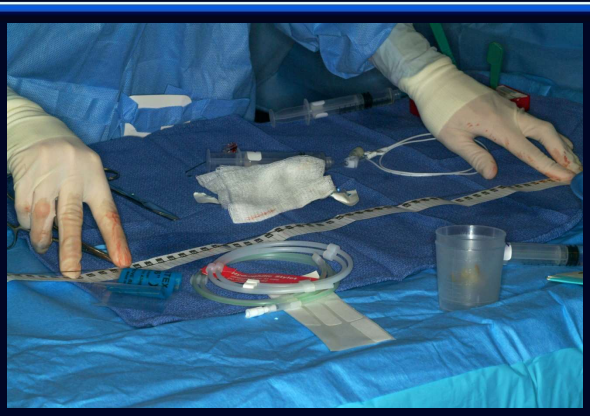
Modified-Seldinger Technique



- Cut the length of the catheter per measurement obtained

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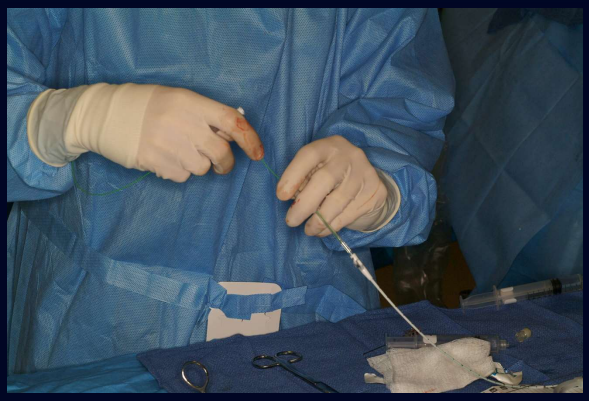
Modified-Seldinger Technique



- Place the stylet into the PICC line for stability
- Ensure the stylet doesn't extend beyond the PICC catheter

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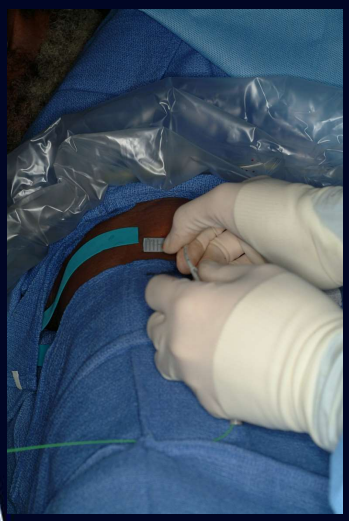
Modified-Seldinger Technique



- Insert the catheter and stylet as a unit
- Advance catheter slowly

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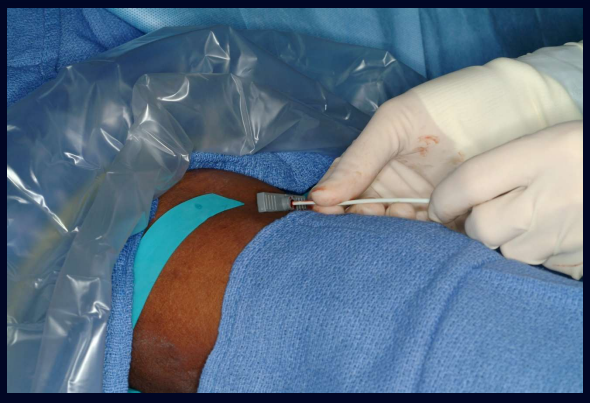
Modified-Seldinger Technique



- Continue to advance catheter slowly until resistance

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Modified-Seldinger Technique

- Stabilize the catheter position by applying pressure to the vein distal to the microintroducer sheath
- Withdraw the microintroducer from insertion site (only .5cm)
- Split the microintroducer sheath and peel it away from the catheter (don't peel into incision site)

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Modified-Seldinger Technique

- Advance catheter with the microintroducer removed until the zero mark is at the skin

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Modified-Seldinger Technique

- Remove the stylet from the catheter

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Modified-Seldinger Technique

- Aspirate for adequate blood return from each port

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Modified-Seldinger Technique

- Flush saline into each of the ports

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Modified-Seldinger Technique

- Stabilize catheter into position
  - Statlock device
  - Suture

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Modified-Seldinger Technique

- Place sterile dressing onto catheter

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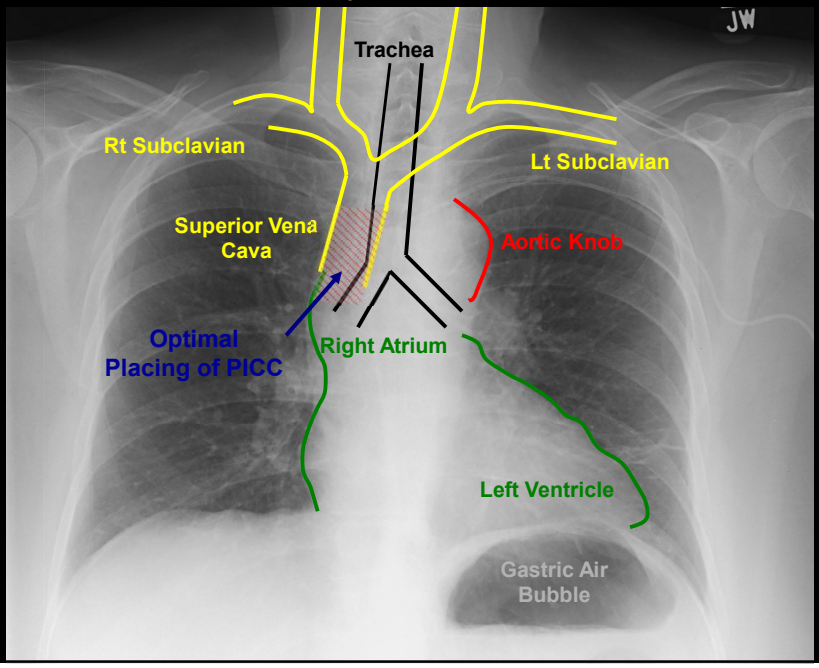
Chest X-Ray for Conformation



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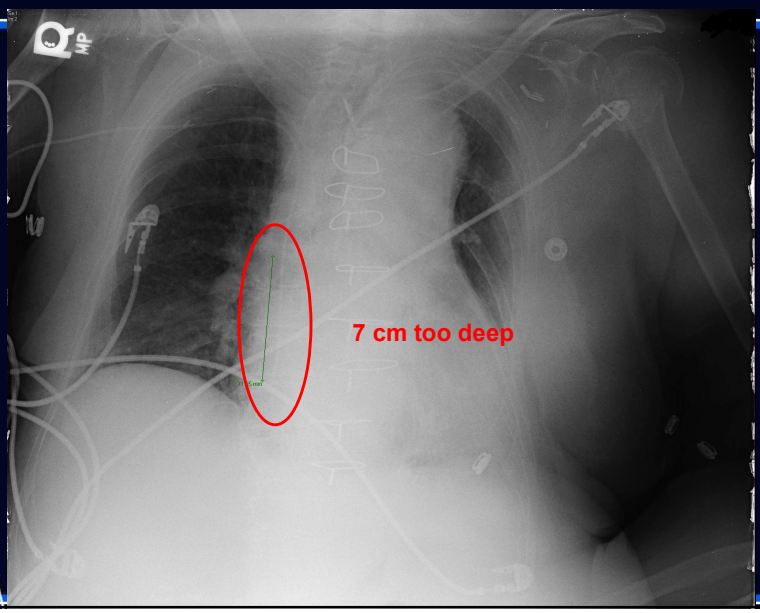
Chest X-Ray for PICC Placement



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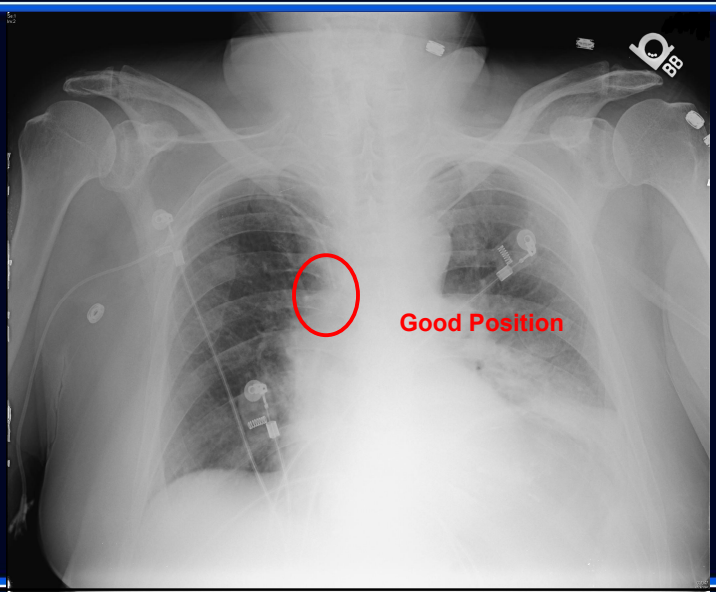
Chest X-Ray for PICC Placement



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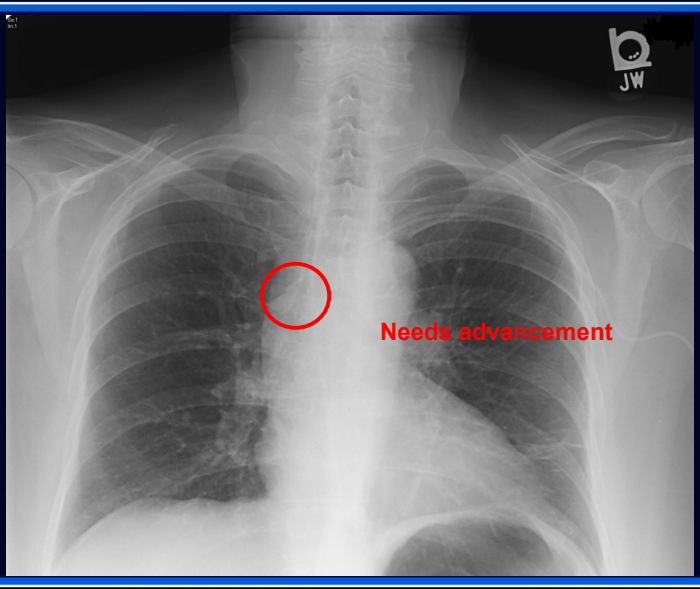
Chest X-Ray for PICC Placement



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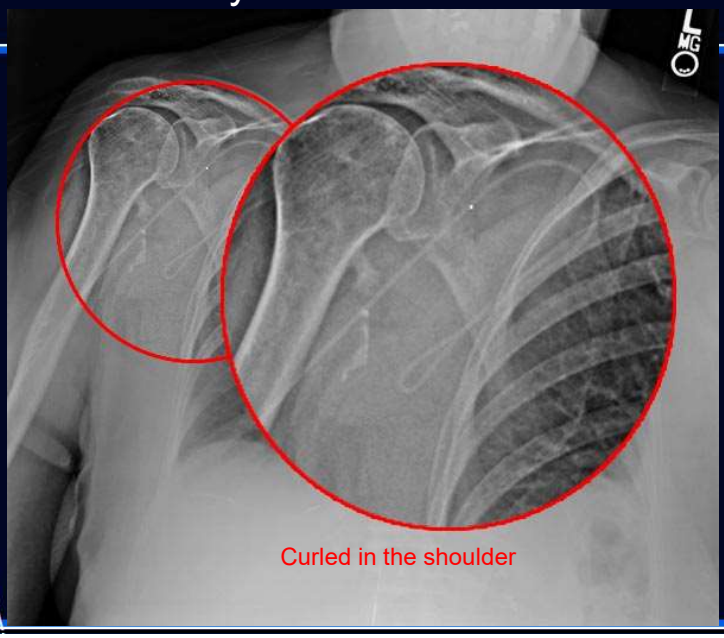
Chest X-Ray for PICC Placement



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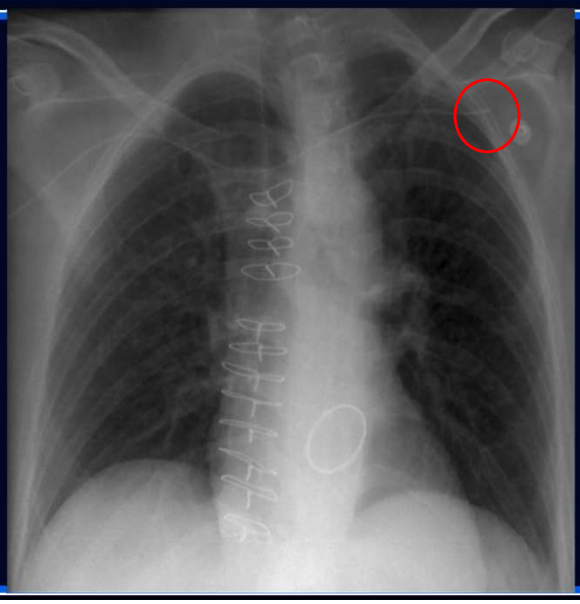
Chest X-Ray for PICC Placement



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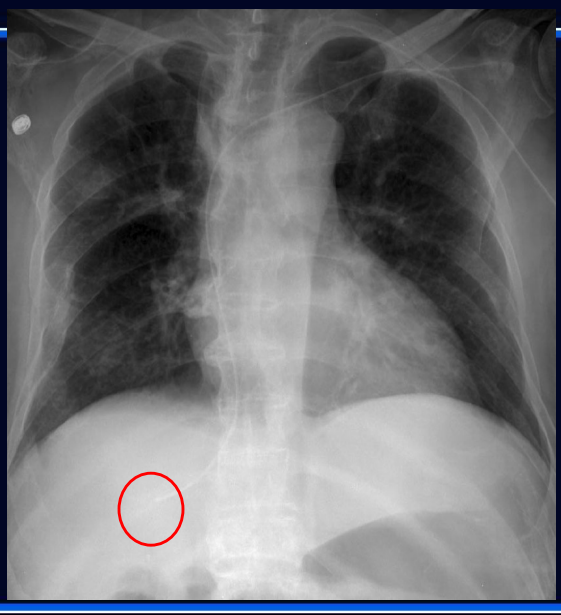
Chest X-Ray for PICC Placement



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Tricks to help with PICC Placement

- External Measurements / Formulas
- Positioning of the patient's head
  - Having patient turn head toward shoulder which PICC is being placed
- Threading the catheter with deep inspiration
- US scanning of neck during placement to monitor for catheter malposition in the Internal Jugular Vein

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Products available for PICC

- Bard
  - http://www.bardaccess.com/products/nursing
- Arrow / Teleflex
  - http://www.arrowintl.com/products/pa/
- Cook
  - http://www.cookmedical.com/ir/familyListingAction.do?family=Venous+Access&subFamily=PICC+Lines

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