

LOS ANGELES COUNTY DEPARTMENT OF HEALTH SERVICE  
QUALITY IMPROVEMENT AND PATIENT SAFETY

HEALTHCARE INFECTION PREVENTION BEST PRACTICES

**REVISED VERSION**

# DHS CENTRAL LINE MODULE

## LAC-DHS Mission:

*“To ensure access to high-quality, patient-centered, cost-effective health care to Los Angeles County residents through direct services at DHS facilities and through collaboration with community and university partners.”*

**This program is approved for Continuing Medical Education (CME) Credit and is not commercially supported. See module for additional instructions.**

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Review Date:

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## PROJECT OF:

### HEALTHCARE INFECTION PREVENTION BEST PRACTICES (HIP BP)

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## COURSE DESCRIPTION

This course discusses the basic knowledge that is needed to be a competent care provider when working with Central Line Catheters (CLCs). CLCs are commonly used for vascular access in a variety of care settings. This course will briefly cover the most common types of CLCs--short-term, long-term, peripherally inserted, tunneled, and implanted ports. The emphasis will undertake infection control measures to prevent central line associated bloodstream infection. Staff will understand appropriate infection control procedures to ensure safe and proper care of central lines.

A section on techniques and tips to insert non-tunneled catheter is added specifically for Fellows and Resident physicians. Some questions for Fellow/Resident posttest are covered in this section. Other staff (Attending physicians and nurses) may read this section at leisure (not included in Nurses/Attending Physician posttest).

Facility practices may vary. It is highly recommended that staff consult their facility policies/procedures/protocols as an adjunct to this educational material.

## EDUCATIONAL OBJECTIVES

Upon completion of this presentation, participants will:

1. Describe the appropriate anatomical and physiological factors that relate to the insertion of a CLC.

2. Identify the indications for inserting a CLC.
3. Identify selected distinguishing features of:
  - a. Non-tunneled Central Line Catheters
    - 1) Short-term CLC
    - 2) Umbilical catheter
  - b. Tunneled CLCs
    - 1) Peripheral inserted central catheters (PICC)
    - 2) Hickman catheters
    - 2) Broviac catheters
    - 3) Groshong catheters
    - 4) Implanted ports
  - c. Hemodialysis
    - 1) Non-tunneled hemodialysis catheter
    - 2) Tunneled hemodialysis catheter
4. Discuss the advantages and disadvantages of each type of CLC.
5. Review Central line associated blood stream infection (CLABSI) in terms of:
  - a. Definition
  - b. Potential routes of Infection
  - c. Modifiable Risk Factors
6. Implement the CLABSI bundle.
8. Describe the supplemental interventions to prevent CLABSIs.
9. Discuss the discharge teaching needs of a patient with a CLC.

**ADDITIONAL EDUCATIONAL OBJECTIVES FOR FELLOWS/RESIDENT PHYSICIANS:**

1. State the process of performing the following central line procedures:
  - a. Inserting the line
  - b. Discontinuation of the line
  - c. Managing the guidewire
2. State the precautionary measures to prevent the following complications:
  - a. Pneumothorax during line insertion
  - b. Air embolism
  - c. Inadvertent arterial puncture
3. State the advantage and disadvantages of the femoral site.
4. Explain the procedure at a level the patient can understand.

**CORE COMPETENCIES**

The Institute of Medicine (IOM), the Council of Medical Specialty Societies (CMSS), and Accreditation Council of Graduate Medical Education (ACGME), have set core competencies designed to close the gap between best and actual practice. The HSAQIPS CME Program supports these recommendations, and as a result, identified this course to meet the following checked competencies:

<input type="checkbox"/> Patient and Family Centered Care	<input type="checkbox"/> Communications	<input checked="" type="checkbox"/> Quality Improvement	<input checked="" type="checkbox"/> Culture and Linguistic Competency (AB1195)*
<input checked="" type="checkbox"/> Practice Applications	<input type="checkbox"/> Multi-professionalism	<input type="checkbox"/> Medical Knowledge	

\* Culture and Linguistic Competency (California Assembly Bill 1195). With the passage of AB 1195, CME course with patient care components are required to include curricula in the subject of cultural and linguistic competency. It is the intent of the bill to encourage physicians and surgeons, CME providers in the State of California, And the Accreditation Council for Continuing Medical Education to meet the cultural and linguistic concerns of a diverse patient population through appropriate professional development. The planners, speakers, and authors of this CME activity have been encouraged to address issues relevant in their topic area. In addition, a variety of resources are available to address cultural and linguistic competency, some of which will be included in the syllabus or handout materials. Additional resources and materials can be requested at [HSACME@dhs.lacounty.gov](mailto:HSACME@dhs.lacounty.gov) and will be available at the HSAQIPS CME website in the future.

**TARGET AUDIENCE**

This program is for LACDHS physicians (Faculty, Fellows, and Residents), nurses, and other staff that manage CLCs.

**ACCREDITATION AND CREDIT DESIGNATION STATEMENT**

**ACCREDITATION STATEMENT:** The HSAQIPS CME Program is accredited by the Institute for medical Quality/ California Medical Association (IMQ/CMA) to provide continuing medical education for physicians.

**AMA CREDIT DESIGNATION STATEMENT: Physicians:** The HSAQIPS CME Program designates this enduring material for a maximum of 2.5 AMA PRA Category 1 Credit(s)<sup>™</sup>. Physicians should claim only the credit commensurate with the extent of their participation in the activity.

**Nurses:** The California State Board of Registered Nursing accepts Category 1 hours toward licensure renewal. There is no provider number. On the BRN license renewal form, report the number of hours you attended and fill in "CME Category 1" for the provider number.

**NOTE: Please take note of the number of hours you took to read and complete the exam; and indicate it in the CME application form. That will be the amount of CME unit you will receive. For example, 1 hour=1 CME. However, if you completed it for more than 2 ½ hours, you can only obtain a maximum of 2.5 CME.**

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### DISCLOSURE

In accordance with the ACCME Standards for Commercial Support, the authors for this enduring material have been asked to complete conflict-of-interest forms. See disclosures below:

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### CALIFORNIA ASSEMBLY BILL 1195: CULTURE AND LINGUISTIC COMPETENCY

**Intent:** It is the intent of the legislature to encourage physicians and surgeons, CME providers in the state of California, and the Accreditation Council for Continuing Medical Education to meet the cultural and linguistic concerns of a diverse patient population through appropriate professional development.

**Definitions:** Cultural Competency is defined as a set of integrated attitudes, knowledge, and skills that enables health care professionals to care effectively for patients from diverse cultures, groups, and communities.

Linguistic Competency is defined as the ability of a physician or surgeon to provide patients who do not speak English or who have limited ability to speak English, direct communication in the patient's primary language.

For Culture and Linguistic Resources, you may request a list from HSAQIPS CME at [hsacme@dhs.lacounty.gov](mailto:hsacme@dhs.lacounty.gov)

### INSTRUCTION TO WEB USERS

The **DHS Central Line Module** is available on the HSAQIPS CME website: <http://intranet.ladhs.org> in pdf format.



## DHS Central Line Module

To access or download the enduring material, follow the instructions listed below:

1. Use your Internet browser to visit the DHS Intranet website: <http://www.ladhs.org> and click on “Intranet login”
2. Scroll down and find the location bar on the bottom of the page. Locate “Continuing Medical Education”
3. Click “Continuing Medical Education” to access the CME Homepage.
4. Click on “Educational Activities”
5. Click on “Self-study modules” and then locate **DHS Central Line Module**
6. Read/Print/download module.

### INSTRUCTIONS FOR OBTAINING CME CREDITS

1. Read the module especially the educational objectives.
2. Complete the post test. Use the Post test answer sheet in this module.
3. Complete the CME registration information and evaluation form on the back pages
4. Send completed form via any of the following (include your e-mail address)\*:

**Mail:** HSAQIPS CME Program  
Quality Improvement and Patient Safety Program  
Room 703  
313 North Figueroa Street,  
Los Angeles California 90012

**FAX to:**  
  
(213) 482-3895

**E-mail: (PREFERRED METHOD)**  
  
[HSACME@ dhs.lacounty.gov](mailto:HSACME@dhs.lacounty.gov)

\*E-mail is the preferred method to send certificates (unless otherwise requested). Please give the HSAQIPS CME Program at least a month to generate the certificate.

### CONTACT INFORMATION

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Telephone: Call (213) 240-8283 or e-mail: [HSACME@dhs.lacounty.gov](mailto:HSACME@dhs.lacounty.gov)

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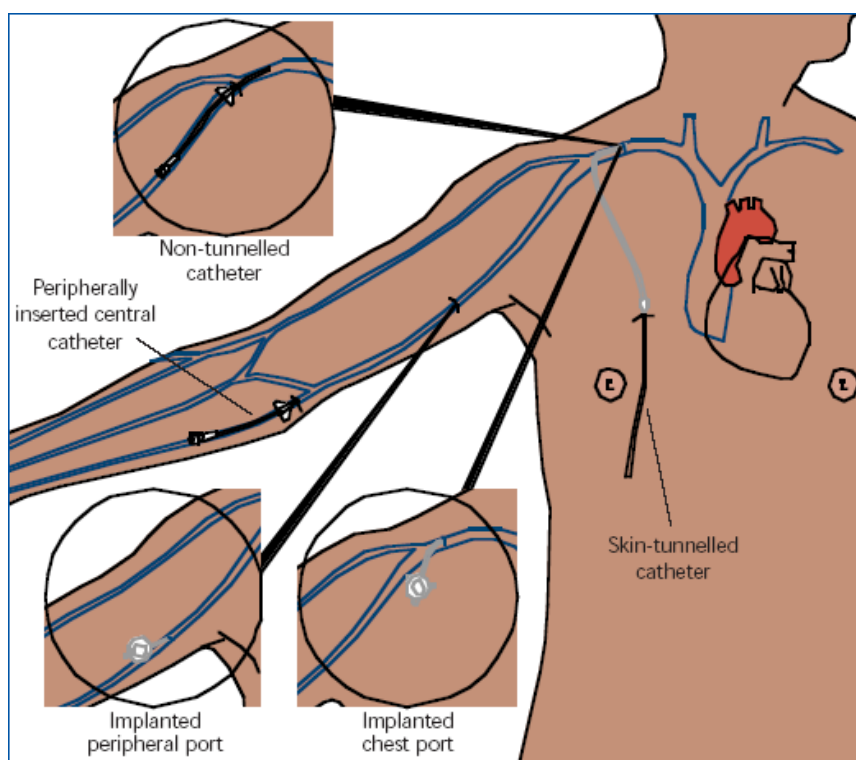
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## PART 1: CENTRAL LINE ASSOCIATED BLOOD STREAM INFECTION (CLABSI)

### I. CENTRAL LINE CATHETERS

Central Line Catheters (CLCs) are venous access devices that are placed into one of the large veins of the venous system and leads directly to the superior vena cava (SVC). CLCs are utilized by patients in the clinical setting for a variety of medical conditions, with the added benefit of avoiding repeated venous punctures. The versatility of available catheters allows patient to receive treatments in a variety of health-care settings, including the home environment.

CLCs are inserted through different sites, all terminating in the lower one-third of the SVC. Catheter tips should not be placed in the right atrium because of the risk of cardiac arrhythmias. Per the Centers for Disease Control and Prevention (CDC), CLCs can be non-tunneled (temporary) and tunneled (permanent). Each will be detailed in the next section.



Sites: Central and Peripheral temporary/permanent CLCs

### II. INDICATIONS

The type of catheter depends upon the length and type of therapy, and on the patient's condition and preference. CLCs may remain in place for a few days (temporary or short-term) or years (permanent or long-term).


Clinical indications for a CLC include:

- Need for prolonged intravenous (IV) therapy (antibiotics, parenteral nutrition and chemotherapy).
- Hyperosmolar, caustic or vesicant medications
- Peripheral veins not accessible
- Frequent blood draws or contrast studies
- Monitoring of central venous pressure (CVP)
- Early discharge of patient to another infusion site (home/institution)

### III. CATEGORIES OF CLCS

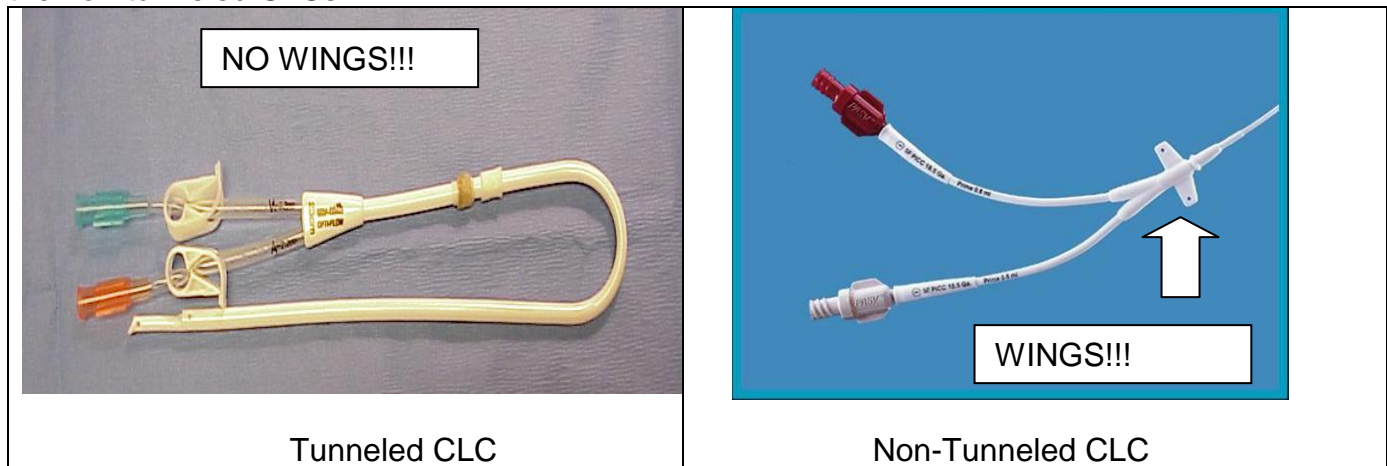
Though there are different CLC types by design but the Centers for Disease Control and Prevention (CDC) identifies two categories: Non-Tunneled and Tunneled. Non-Tunneled CLC is temporary while a tunneled CLC is permanent. This module will use temporary and non-tunneled interchangeably; as with permanent and tunneled.

The risk of infection is higher for temporary (non-tunneled) catheters than for any other central catheter design. This is partly due to the method of insertion and enhanced by the fact that the bacterial count on the skin in these areas is much higher than elsewhere on the body. For tunneled CLCs, it is inserted into a vein at one location (neck, chest or groin), and tunneled under the skin to a separate exit site, where it emerges from underneath the skin.

	<p>Simply, non-tunneled catheters enter the venous system and exits directly at the venipuncture site. For tunneled CLCs, the catheter enters the venous system on the venipuncture site but is then tunneled underneath the skin to come out in another site (usually the chest, arm, or for cosmetic purposes, an area that is not often exposed).</p>
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A bump can be felt an inch or two away from where the tunneled CLC comes out. This is the Dacron cuff, a piece of material around which tissue grows. This helps to stabilize the tunneled CLC and keep microbes out.

In addition, when looking at tunneled CLCs, it does not have the “wings” that are used to suture the non-tunneled CLCs.



#### NON-TUNNELED CLCs

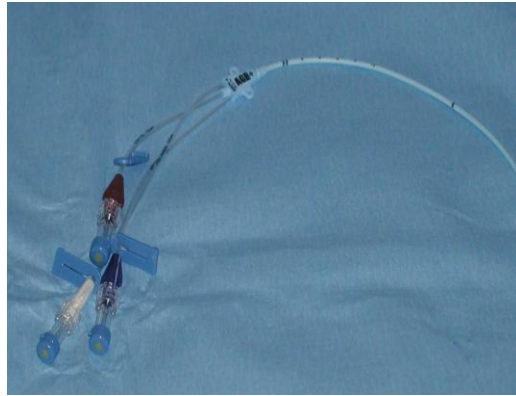
Most of the non-tunneled catheters are made of polyurethane, a stiff material that softens after it is inserted. Because of the material's stiffness, they are easy to insert. A problem with this stiffer material, however, is a higher rate association of thrombogenicity.

#### TEMPORARY SINGLE TO TRIPLE LUMENS

Non-tunneled CLCs are temporary catheters placed percutaneously directly into vessel. They are skin sutured or secured at insertion site.

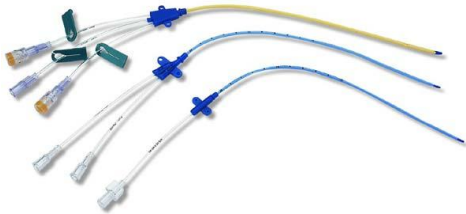
\*Though a triple lumen indicates the number of catheter lumens, it is a commonly understood term for a temporary catheter in the Intensive Care Units (ICU) or Emergency Departments (ED).

😊	Typically, they are short-term, usually in place 7 – 10 days (depending on facility policies).
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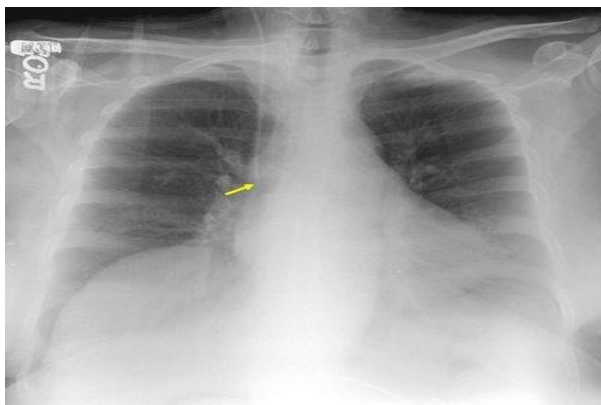
Example of non-tunneled CLC: Arrow™ triple lumen.

Single to multilumen catheter:



A double-lumen/triple lumen CLC two to three separate openings within one catheter. The openings sites are appropriately 2 cm apart from each other, so there is no mixing of solutions or medications that are infused through different ports at the same time. All of the lumens empty into a large vessel which provides enough volume for immediate dilution.

**Insertion:** See last section on Techniques and Tips for Inserting Non-tunneled Central Line Catheter.



After the catheter is inserted, its placement must be verified (blood withdrawal, waveform analysis, etc.). An x-ray is taken to confirm the position of the catheter. All catheters have a radiopaque strip so they can be visualized on chest radiograph or fluoroscopy. When the femoral site is used, the tip of the catheter rest in the inferior vena cava.

💣	Unless emergently needed, it is recommended that fluids and/or medications should not be infused until after placement has been verified by x-ray.  In addition, when not in use, the lumen (s) should be capped and clamped.
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**UMBILICAL VENOUS CATHETER**

According to CDC, an umbilical venous catheter is a central venous catheter device inserted through the umbilical vein in a neonate.

Umbilical vessels are relatively accessible in the newborn infant, particularly the very small and very large infants. The first 7 -10 days of life the umbilical vein is a convenient route for obtaining vascular access during emergencies but as a general rule, infants less than 1000g should have an umbilical venous catheter (UVC) inserted on day 1.

NOTE: Umbilical vein catheters are most the time used as temporary (short-term) catheter though there are studies that indicate it can be used long term. Per literature, both had the same rate of infection.

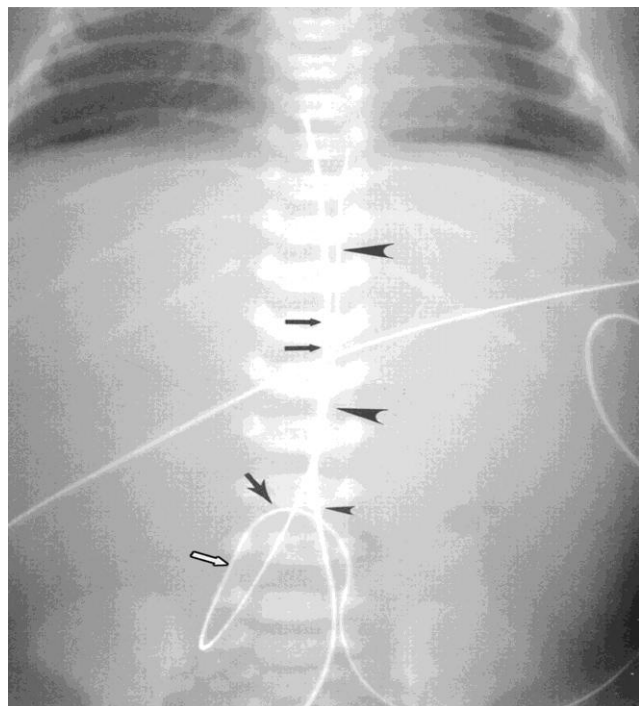


For infants who are term or near-term and sick enough to require central access (for example, sepsis), a 5F double-lumen UVC should be inserted. For infants <1000g, a 3.5F double-lumen catheter should be considered if the infant is likely to need inotropes or multiple infusions. This will be decided on an individual basis.

**Insertion:** Preferred catheter tip placement is in the inferior vena cava above the level of the diaphragm. Placement of the catheter tip in the portal circulation is not acceptable. During an emergency, umbilical venous access is acceptable in the short term as a route for resuscitation drugs and fluids with the catheter tip inserted only 3 - 5cm beyond the muco-cutaneous junction (in this situation the catheter will not have reached as far as the portal circulation). Umbilical venous catheters left in place beyond the resuscitation period should be positioned with the tip at the junction of the inferior vena cava and right atrium.

Throughout insertion, the catheter must be kept filled with fluid and a closed 3-way stopcock attached. If the infant takes a deep inspiration negative pressure may be generated and air drawn into the catheter which could result in air embolism.

The position must be checked by X-ray.



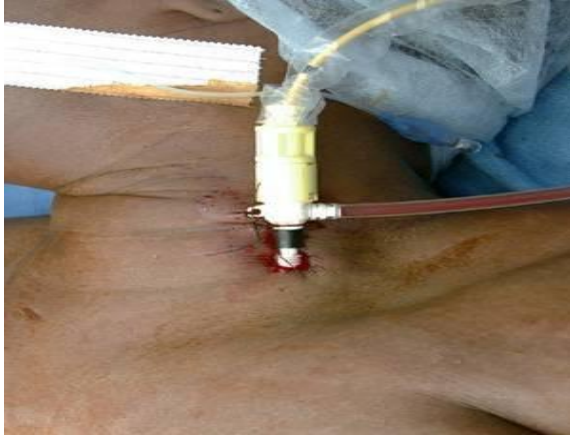
Normal radiographic appearance of umbilical venous catheter and umbilical artery catheter. Frontal radiograph of abdomen shows that the umbilical venous catheter enters the abdomen at the umbilicus (*small arrowhead*), travels in a cephalad direction in umbilical vein (*double black arrows*) (note that catheters cross just above umbilicus), courses through the left portal vein and ductus venosus, enters the inferior vena cava, and terminates in the right atrium. Umbilical artery catheter also enters the abdomen at the umbilicus (*single black arrow*) but extends inferiorly (*white arrow*) and posteriorly into iliac artery before coursing superiorly in aorta (*large arrowheads*).



## SHEATH INTRODUCER

Sheath introducer is considered an intravascular catheter. The line terminates close to the heart or in one of the great vessels. The sheath has 1 wide lumen with 2 ports:


- One port is typically used for aggressive fluid / medication infusion
- One port can be used for pulmonary artery (PA) catheter access (or triple lumen)



Introducer with PA catheter



Introducer without PA catheter or triple lumen

	<p>The following are discouraged for infection prevention purposes:</p> <ul style="list-style-type: none"> <li>• Replacing an old triple lumen or PA catheter with a new triple lumen/PA catheter</li> <li>• Over the wire exchange (i.e., thread a guidewire in the old introducer site and then thread a new triple lumen)</li> </ul>
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## TUNNELED LONG-TERM CLCs

Tunneled catheters are typically placed for long-term treatment (several weeks to months). They are surgically “tunneled” under the skin through tissue then into a vein. They may have a “Dacron” cuff. Long term catheters are made of silicone which is more biocompatible than polyurethane. Silicone is softer, more flexible and durable and decreases the risk of thrombosis.

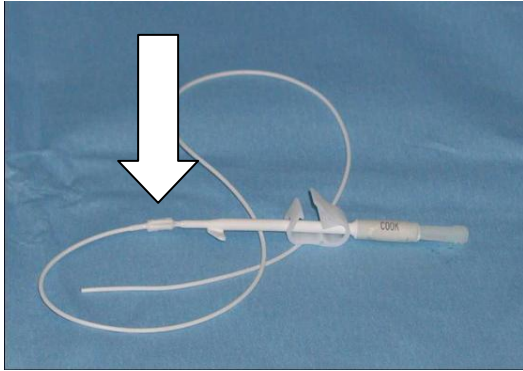
Types of tunneled CLC include: Hickman, Broviac, Groshong, peripherally inserted central catheter (PICC), and implanted port. Similar to the non-tunneled catheters, they may contain a single, double or triple lumen.

## HICKMAN AND BROVIAC CATHETERS

The Hickman and Broviac catheters are typically inserted to deliver long term treatment such as chemotherapy. The care and maintenance is basically the same for both catheters.

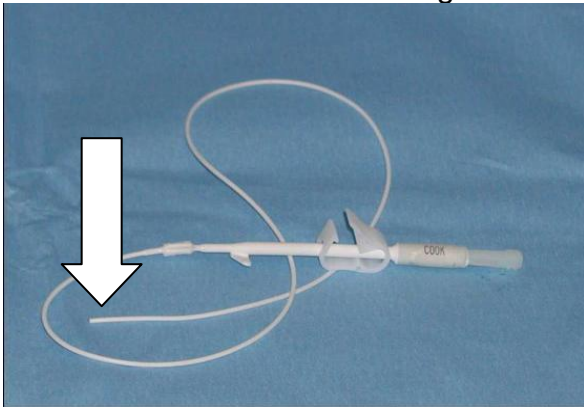
- The Hickman’s internal diameter is 1.6 mm as compared with 1.0 in the Broviac.
- The Broviac’s smaller diameter is more commonly used in children.
- The Broviac catheter has one Dacron cuff and the Hickman has one or two.



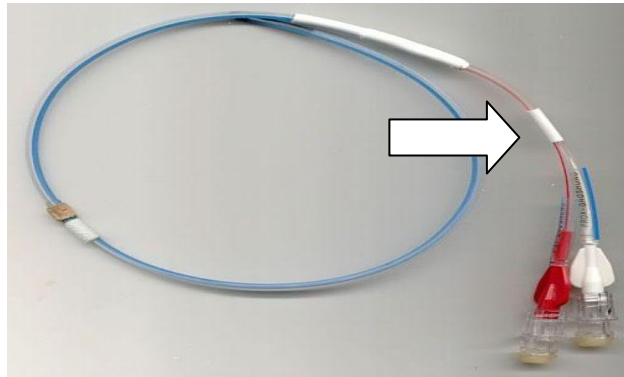


**DACRON CUFF.** The catheter has a Dacron polyester fiber cuff that is positioned approximately 2 mm from the exit site. Fibrous tissue adheres to the Dacron cuff in the subcutaneous tunnel. The cuff's primary purpose is to promote fibrin growth which helps to anchor the catheter in place and it helps to prevent bacteria from migrating up the catheter.

**Insertion:** Tunneled catheters are placed in the operating room or Interventional Radiology suites with the aid of fluoroscopy. It is inserted beneath the skin of the upper chest wall and advanced through a subcutaneous tunnel over the collar bone. The catheter is then positioned through a neck vein into the lower third of the SVC. Once in place, the catheter is secured with stitches until healing occurs.



Because of the open-ended tip, the Hickman/Broviac catheter had to be measured and then cut first at the tip before inserting.



Because of the close-ended tip and the valves, Groshong CLC had to be cut at the distal end. The catheter can be inserted first and then cut later at the distal end. A connector is threaded in before assembling the port.

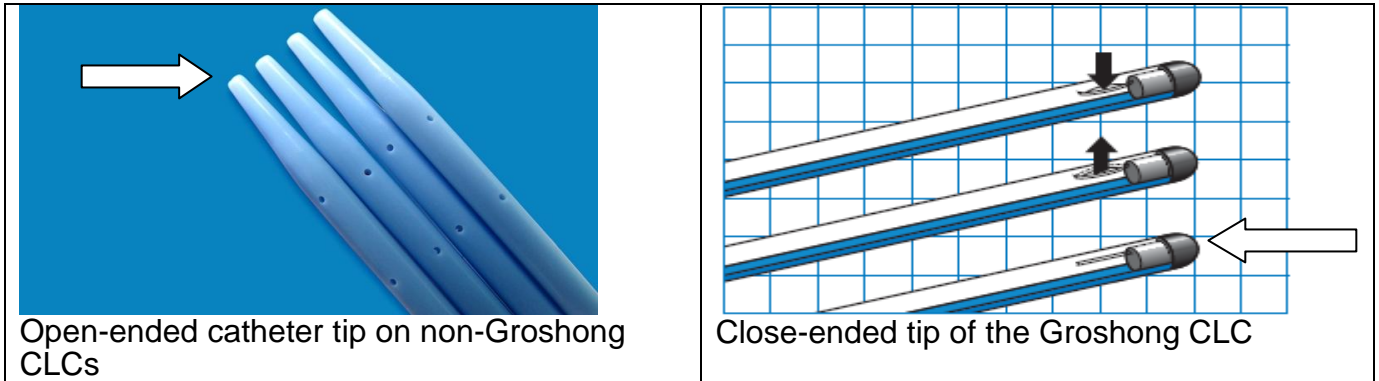
### GROSHONG CATHETER

The Groshong catheter is similar to the other tunneled catheters in how it is secured and placed in the body. One difference of the Groshong catheter is the three way valve at the tip of the catheter. The valve forms a slit in the sidewall of the catheter tip which opens outward during blood aspiration and remains closed when not accessed. The valve feature reduces the risk of clotting, air embolism and blood reflux.



### DIFFERENCES BETWEEN HICKMAN/BROVIAC AND GROSHONG CLC'S

**Catheter Tip:** Most CLC's are open-ended, meaning that the catheter tip is open at the end of the lumen like most other IV catheters. The Groshong CLC contains a valve that is closed when it is not in use.




<p>A photograph of a white Hickman/Broviac catheter with a clamp at the end. A white arrow points to the clamp.</p>	<p>A photograph showing a Groshong catheter inserted into a patient's arm, connected to a drip chamber and tubing. A white arrow points to the catheter.</p>	<p>A diagram of a blue catheter tip. Text labels include: "Silicone material offers superior biocompatibility and thromboresistance to improve indwelling catheter time." and "Rounded, atraumatic radiopaque tip reduces risk of vessel damage and allows clear X-ray visualization."</p>
<p>Because of the open-ended tip, Hickman/Broviac has a clamp to prevent blood backflow. When not in use, Hickman/Broviac catheters should <b>be capped and clamped</b>.</p> <p>Because of the open-ended tip, blood reflux is possible at the tip, thus encouraging formation of blood clots.</p>	<p>Because of the close-ended tip and the valves, Groshong does not have an external clamp. Blood reflux is limited.</p> <p>Heparin isn't needed for flushing. Normal saline is acceptable.</p>	

**PERIPHERALLY INSERTED CENTRAL CATHETER (PICC)**

The PICC line is a variation of CLC. This is a short to long-term catheter that is inserted into one of the major vessels of the upper arm. It is inserted percutaneously into the basili, cephalic or brachial veins. The preferred vessel is the basilica because of its straight pathway to the SVC. The antecubital fossa is to be avoided due to risk of trauma due to arm movement and increased number of microorganisms at the site.



There are two types of PICC lines, one that is considered a Power PICC and another that is a close ended (Groshong type) with a reflux valve. The Power PICC can be used for radiologic studies involving injection of contrast dye under high pressures required for contrast studies. Similar to other CLCs, PICC's are available with a single, double and triple lumen. PICCs are also available in a variety of sizes for neonates and children.

	<p>When accessing the Groshong PICC use a 10ml syringe due to its lower pound/square inch (PSI) force. Use of syringes smaller than 5ml may damage this type of catheter.</p>
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**Insertion:** The PICC is typically inserted at the bedside under sterile technique by specially trained Registered Nurses (RNs) and other similarly trained licensed staff. Unlike the other short-term and long-term CLCs, the PICC is secured with a statlock (a suture-less fastening device).

### IMPLANTED PORTS

An implanted port (Portacath, Infusate Port) is a long-term CLC with no external parts.



The system consists of two components: The subcutaneous injection port and a silastic catheter.

#### Insertion

An implanted port is placed under local anesthesia in an operating room. A silicone catheter is inserted through a large vessel, usually the SVC and terminates in the lower third of the SVC.



The injection port is usually implanted in a subcutaneous pocket (a "bump") of the upper chest; but it may also be placed in the upper arm or abdomen. The injection port is made of a thick rubber septum covers the reservoir of the port, into which medications or fluids may be infused.

#### Accessing the Implanted Port

An implanted port is a closed system without the need for routine site care or dressings after the incision site has healed. The system is accessed with a non-coring needle such as Huber

/Gripper needle. The design of this type of needle bevel is deflected at the tip to prevent coring of the port. The needle makes a straight-line tear that seals itself when the needle is removed. The ports are designated to withstand 500-2000 punctures. The use of standard blunt angle needles can lead to degradation of the port and the potential for embolization of port materials.

The access of an implanted device is similar to preparing for intravenous insertion. The skin must be cleansed with an antiseptic agent such as chlorhexidine and sterile technique maintained. The Huber/Gripper needle is inserted into the center of the rubber septum and advanced into the device until secure.



YES to Huber Needle



NO to standard needles

### Removing Huber/ Gripper needle

Flush port per protocol before removing the Huber/ Gripper needle and adhere to the following steps:

1. Grasp the needle between thumb and index of dominant hand and
2. Using gauze dressing to apply pressure to the injection port with non-dominant hand and cautiously remove needle.
3. Continue to apply slight pressure to site with non-dominant hand until bleeding stops.

### Problems specific to implanted ports

Implanted port erosion through the subcutaneous tissue can be caused by poor wound healing, poor technique when accessing device, inadequate nutritional intake or diminished circulation. Maintaining nutritional intake, avoiding unfavorable sites, use of sterile technique when accessing device and avoiding trauma or pressure to the insertion site, should help minimize the risk of infection. Treatment usually includes antibiotics and close monitoring of the site.

## HEMODIALYSIS CATHETERS

Hemodialysis catheters can be temporary or permanent. Like other CLC's, they carry a high incidence of CLABSI's. Temporary (non-tunneled) dialysis catheters have the highest risk of infection. An increase in use of hemodialysis catheters can be attributed to the growth of patient population with kidney failure.

### NON-TUNNELED DIALYSIS CATHETER

Temporary, non-tunneled dialysis catheters provide a practical and convenient means of achieving immediate vascular access in patients with acute onset of renal failure and patients with symptomatic chronic kidney disease who lack alternate vascular access availability

**Double/Triple-Lumen Hemodialysis Catheter.** Double-lumen hemodialysis catheters are the preferred method for obtaining vascular access for dialysis in the acutely ill. They are



available from many manufacturers and are composed of many different plastics. The current polymers are rigid at room temperature to facilitate insertion but soften at body temperature to minimize vessel trauma and blood vessel laceration. The proximal and distal lumens are separated by at least 2 cm to minimize recirculation. The extra port on the triple lumen dialysis catheter can be used for infusion of other agents or medications.



BARD® Niagra Slim-cath Dialysis Catheter (with straight extensions)



MAHURKAR™ short term high flow triple lumen dialysis catheter (with curved extensions)

The double/triple lumen dialysis catheters can be inserted into the jugular, subclavian, and femoral vein. These non-cuffed catheters are suitable for insertion at the bedside. Obtain chest-x ray after internal jugular or subclavian vein insertion to identify any potential complications prior to either anticoagulation or catheter use.

	<p>In general, subclavian insertion sites should be avoided because of the risk of subclavian vein stenosis and thrombosis.</p>
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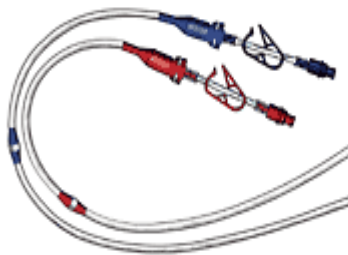
### TUNNELED DIALYSIS CATHETER

Permanent dialysis catheters are tunneled and typically remain in place for six months. Some can last for up to two years but in most cases, the catheter requires removal due to bacterial contamination. The Dacron cuffs of these catheters reduce the incidence of infection. The overall survival of these catheters is highly variable. Some can last up to 2 years but almost all catheter losses were due to bacteremia.

These CLCs can be inserted into the subclavian, internal jugular, or external jugular veins. These catheters are usually inserted surgically or in Interventional Radiology suites under fluoroscopy.



MAHURKAR™ cuffed long term dialysis catheter



TESIO® catheter

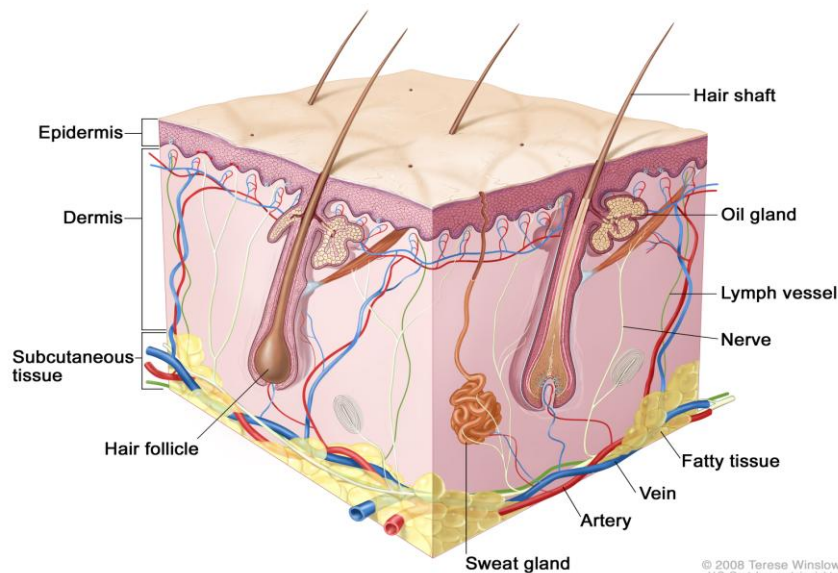


BARD® Hemoglide™ long term dialysis catheter

## IV. CLABSI

According to the CDC, healthcare-associated infections (HAIs) account for a substantial portion of health-care--acquired conditions that harm patients receiving medical care. Nearly one in every 20 hospitalized patients in the United States each year acquires an HAI. Central line-associated blood-stream infections (CLABSIs) are one of the most deadly types of HAIs, with a mortality rate of 12%-25%.

Most cases of CLABSI are caused by organisms that reside on the skin surface. Common skin organisms include: *Staphylococcus aureus*, gram-negative rods, *Candida* species, and *Enterococcus* species.



### SIGNS AND SYMPTOMS


Catheter related infections can be localized or systemic. Local infection symptoms include redness, warmth, tenderness or swelling at the insertion site, exudates of purulent material, local rash or pustules, fever, chills and malaise. Most local infections are related to poor aseptic technique during insertion of care, failure to dress the site adequately, irritation of suture site and patient conditions such as immunosuppression.



Possible causes of local infections include failure to maintain aseptic technique during catheter insertion or care, failure to comply with dressing change protocol, irritated suture line, and the immunosuppression of the patient.

Systemic infection is a more serious complication of CLCs. Symptoms include fever, chills, leukocytosis, nausea and vomiting, malaise, elevated serum or urine glucose levels, and positive blood cultures. Systemic infections are associated with a longer hospital stay, higher

cost of care, and increased morbidity and mortality.

	<p>Possible causes include contaminated catheter or infusate, failure to maintain strict sterile techniques during catheter care and accessing the line, frequent opening of catheter, and the immunosuppression of the individual patient.</p> <p>Though it is advisable to pull an infected CLC, the final decision lies on physician's judgment as to risks/benefits of leaving the CLC.</p>
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### CLABSI DEFINITION (CDC/NHSN\* SURVEILLANCE DEFINITION)

**NOTE:** A surveillance definition can be different from a clinical definition of infection. Surveillance definitions (in this section) are being used for data submission (on CLABSI rate) to the CDC, in which a data subset will be the source of public information.

The CDC defines CLABSI as a primary (i.e. no apparent infection meeting CDC/NHSN criteria at another body site) laboratory confirmed bloodstream infections (BSI) in a patient that had a central line within the 48 hour period before the onset of BSI event. Note that there is no minimum period of time that the central line must be in place in order for the BSI to be considered central line-associated. If the BSI develops within 48 hours of discharge from a location, it is associated with the discharging location.

Central line is defined by CDC as “an intravascular catheter that terminates at or close to the heart or in one of the great vessels which is used for infusion, withdrawal of blood, or hemodynamic monitoring.” The following are considered great vessels for the purpose of reporting central line infections and counting central line days in the NHSN system: aorta, pulmonary artery, superior vena cava, inferior vena cava, brachiocephalic veins, internal jugular veins, subclavian veins, external iliac veins, common iliac veins, common femoral veins, and in neonates, the umbilical artery/vein.

Note: For the purposes of the CDC/NHSN surveillance, an introducer is considered an intravascular catheter. In neonates, the umbilical artery/vein is considered a great vessel. Neither the insertion site nor the type of device may be used to determine if a line qualifies as a central line. Pacemaker wires and other non-lumened devices inserted into the central blood vessels or the heart are not considered central lines, because fluids are not infused, pushed, nor withdrawn through such devices.

**Laboratory Confirmed Bloodstream Infection (LCBI):** Must meet one of the following criteria:

**Criterion 1:** Patient has a recognized pathogen cultured from one or more blood cultures and organism cultured from blood is not related to infection from another site.

**Criterion 2:** Patient has at least one of the following signs and symptoms:

- Fever (>38°C), chills, or hypotension
- Signs/symptoms and positive laboratory results that are not related to infection at another site.
- Common skin contaminant (i.e., diphtheroids [*Corynebacterium* spp.], *Bacillus* [not *B. anthracis*] spp., *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridians group streptococci, *Aerococcus* spp., *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions.
- Two or more blood cultures “drawn on separate occasions”, from multiple lumens of the same central catheter and are positive can be used for a common commensal.

**Criterion 3:** Patient  $\leq$  1 year of age and has at least one of the following signs and symptoms:



- Fever (>38°C core) or hypothermia (<36°C core), apnea or bradycardia
- Signs /symptoms and positive laboratory results are not related to an infection at another site.
- Common skin contaminant (i.e., diphtheroids [*Corynebacterium* spp.], *Bacillus* [not *B. anthracis*] spp., *Propionibacterium* spp., coagulase-negative staphylococci [including *S. epidermidis*], viridians group streptococci, *Aerococcus* spp., *Micrococcus* spp.) is cultured from two or more blood cultures drawn on separate occasions.
- (See notes 3, 4 and 5 below)

## Notes:

1. In criterion 1, the phrase “one or more blood cultures” means that at least one bottle from a blood draw is reported by the laboratory as having grown organisms (i.e. is a positive blood culture).
2. In criterion 1, the term “recognized pathogen” does not include organisms considered common skin contaminants (see criteria 2 and 3 for a list of common skin contaminants). A few of the recognized pathogens are *S. aureus*, *Enterococcus* spp., *E. Coli*, *Pseudomonas* spp., *Klebsiella* spp., *Candida* spp., etc.
3. In criteria 2 and 3, the phrase “two or more blood cultures drawn on separate occasions means 1)that blood from at least two blood draws were collected within two days of each other (e.g. blood draws on Monday and Tuesday or Monday and Wednesday would be acceptable for blood cultures drawn on separate occasions, but blood draws on Monday and Thursday would be too far apart in time to meet this criterion), and 2) that at least one bottle from each blood draw is reported to be a positive blood culture). (see note 4 for determining sameness of organisms).
  - A. For example, an adult patient has blood drawn at 8 a.m. and again at 8:15 a.m. of the same day. Blood from each blood draw is inoculated into two bottles and incubated (four bottles total). If one bottle from each blood draw set is positive for coagulase-negative staphylococci, this part of the criterion is met.
  - B. For example, a neonate has blood drawn for culture on Tuesday and again on Saturday and both grow the same common skin contaminant. Because the time between these blood cultures exceeds the two-day period for blood draws stipulated in criteria 2 and 3, this part of the criteria is not met.
  - C. A blood culture may consist of a single bottle for a pediatric blood draw due to volume constraints. Therefore, to meet this part of the criterion, each bottle from two or more draws would have to be culture-positive for the same skin contaminant.
4. There are several issues to consider when determining sameness of organisms.
  - A. If the common skin contaminant is identified to the species level from one culture, and a companion culture is identified with only a descriptive name (i.e., to the genus level), then it is assumed that the organisms are the same. The speciated organism should be reported as the infecting pathogen.

Table A. Examples of How to Report Speciated and Unspeciated Common Skin Contaminate Organisms

Culture	Companion Culture	Report as....
<i>S. epidermidis</i>	Coagulase-negative staphylococci	<i>S. epidermidis</i>
<i>Bacillus</i> spp. (not anthracis)	<i>B. cereus</i>	<i>B. cereus</i>

S. salivarius	Strep viridans	S. salivarius
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- B. If common skin contaminant organisms from the cultures are speciated but no antibiograms are done or they are done for only one of the isolates, it is assumed that the organisms are the same.
- C. If the common skin contaminants from the cultures have antibiograms that are different for two or more antimicrobial agents, it is assumed that the organisms are not the same.

Table B. Examples of How to Interpret the Sameness of Two Skin Contaminate Isolates by Comparing Antimicrobial Susceptibilities

Organism Name	Isolate A	Isolate B	Interpret as.....
S. epidermidis	All drug S	All drug S	Same
S. epidermidis	OX R GENT R	OX S GENT S	Different
Corynebacterium spp.	PENG R CIPRO S	PENG S CIPRO R	Different
Strep viridans	All drugs S	All drugs S, except ERYTH (R)	Same

- D. For the purpose of the NHSN antibiogram reporting, the category interpretation of intermediate (I) should not be used to distinguish whether two organisms are different.

5. LCBI criteria 1 and 2 may be used for patients at any age, including patients <1 year of age.
6. Specimen Collection Consideration: Ideally, blood specimens for culture should be obtained from two to four blood draws from separate venipuncture sites (e.g. right and left antecubital veins), not through a vascular catheter. These blood draws should be performed simultaneously or over a short period of time (i.e. within few hours). If your facility does not currently obtain specimens using this technique, you may still report BSIs using the criteria and notes above, but you should work with appropriate personnel to facilitate better specimen collection practices for blood cultures.

### **CLINICAL SEPSIS (CSEP)**

CSEP may be used only to report a primary BSI for neonates and infants.

To report a CSEP, the patient has to be <1 year of age and has at least one of the following clinical signs or symptoms with no other recognized cause:

- Fever (>38° C core) or hypothermia (< 36° C core)
- Apnea or bradycardia
- Blood cultures not done or no organisms detected in blood and no apparent infection at another site.

Physician may then institute treatment for sepsis.

Infectious Disease physicians make the final diagnosis of CLABSI. However, other physicians can rule out CLABSI by asking three questions:

1. Is there positive microorganism load of common organism associated with CLABSI identified by laboratory reports? Yes or No. If no, no need to ask the next question.

2. If yes, are there other conditions/diseases that can contribute to the presence of microorganisms? Yes or No. If yes, then that condition may be the source of the organism.
3. If no, is there a central line? If yes, the central line can be the assumed source of the organism.

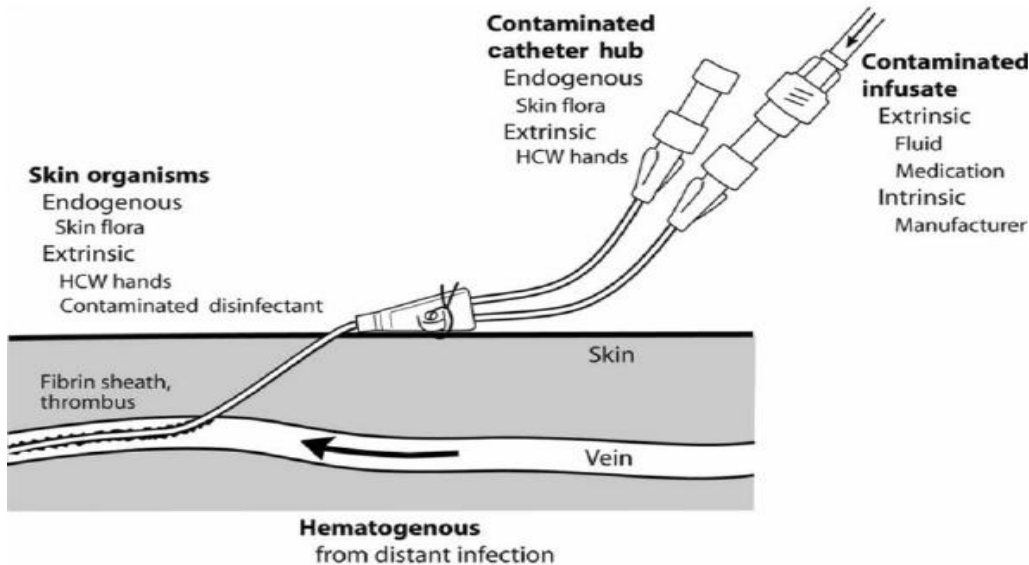
**POTENTIAL ROUTES OF INFECTION**

Disruption of the integrity of the skin creates an avenue for infection. Infection spread to the bloodstream may lead to hemodynamic changes, organ dysfunction and potentially death. However, potential routes of catheter-associated infection include:

**Extraluminal-** Contiguous skin flora ;( either organisms on the patient’s skin or organisms from the healthcare provider placing/caring for the CLC). Note that the patient’s skin is considered the primary source of contamination of the *external* surface of the catheter.


**Intraluminal-** Contamination of catheter hub, connector and lumen or contamination of the infused fluid.

**Hematogenous-** Distant unrelated sites of infection.



**MODIFIABLE RISK FACTORS FOR CLABSI**

Characteristic	Risk Factor Hierarchy
Insertion circumstances	Emergency > elective
Skill of inserter*	General > specialized
Insertion site	Femoral > subclavian
Skin antisepsis	70% alcohol, 10% povidone-iodine > 2% chlorhexidine
Catheter lumens	Multilumen > single lumen
Duration of catheter use	Longer duration of use greater risk
Barrier precautions	Submaximal > maximal

 \* LA County DHS mandate is for a resident physician to have, at a minimum, five (5) central line catheters placements before the resident physician is signed off as competent by the attending physician. NOTE: Some facilities may require more than five CLC placements.

**Other risk factors:**

Excessive manipulation of catheters increases the risk for CLABSI, probably because of the greater

risk for a breach in aseptic technique each time the catheter is accessed. Whenever possible, providers should limit the number of times a line is accessed in order to minimize this risk. Performing non-emergent blood draws at scheduled times (regardless of when they are ordered) is one possible strategy to limit catheter manipulation.

Prior to accessing any line, hands should be washed, gloves should be worn, and the hub should be sterilized with an alcohol swab. Although alcohol possesses antimicrobial properties, the friction from actually wiping a hub is the most important feature of this step. Providers should pay keen attention to the potential for touch contamination when accessing a hub.

Catheters must be properly anchored after insertion. A loosely-anchored catheter slides back and forth, increasing the risk for contamination of the insertion tract. Since skin flora is the most common infecting organisms in CLABSIs, proper anchoring is strongly recommended. Likewise, the contamination shield should always be used on pulmonary artery catheters.

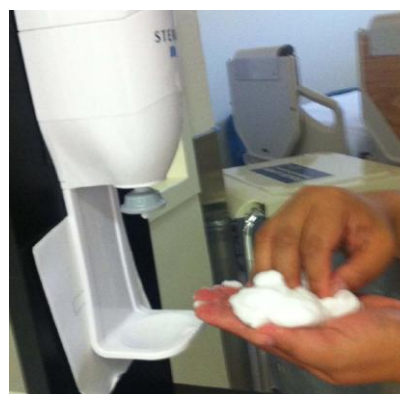
### **CLABSI PREVENTION MEASURES: CLABSI BUNDLES**

CLABSI has been known to be prevented by implementation of care bundles. A care bundle is a grouping of best practices that individually improve care and when applied together results in greater improvement. Every component of the bundle is important and indispensable.

The CLABSI bundle consists of five key elements: 1) Hand hygiene, 2) Maximal sterile barrier precautions including large sterile drape, sterile gown and gloves, mask, and a cap, 3) selection of optimal catheter insertion site with avoidance of the femoral vein for access in adults, 4) Chlorhexidine skin antisepsis, 5) Daily review of the line necessity and prompt removal of unnecessary lines.

#### **HAND HYGIENE**

Good hand hygiene before catheter insertion or maintenance is important for reducing CLC-related infections. Even if providers wear gloves, studies have consistently shown that hand washing immediately prior to the handling of a line reduces the incidence of infections. Use of a waterless, alcohol-based gel is at least as effective as traditional soap and water. All DHS staff is expected to perform hand hygiene practices both **before** and **after** contact with patients and their environment.



Hand washing is an extremely effective way to prevent nosocomial infections, but fingernails often harbor microorganisms after thorough hand cleansing. Lengthy or artificial fingernails increase this tendency for pathogenic organisms to remain on the hands. Health care providers are prohibited from wearing artificial nails and should keep their nails neatly trimmed.

### MAXIMAL STERILE BARRIER (MSB)

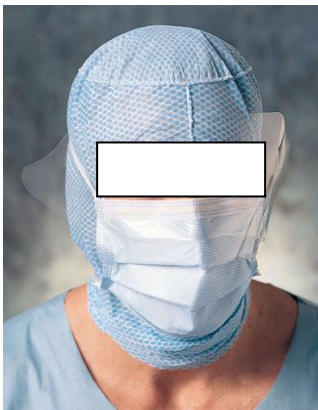
Studies have consistently shown that the use of maximal barrier precautions reduces the incidence of CLABSIs. MSB precautions consist of a cap, mask, sterile gown and gloves, and a large drape. Any deviation to the use of MSB precautions results in risk to the patient and noncompliance.



CLCs should always be placed using MSB precautions.

**Persons placing the CLC (and those assisting)** should wear a cap, mask, sterile gown, and sterile gloves.

The cap should cover all hair and the mask should cover the nose and mouth tightly.

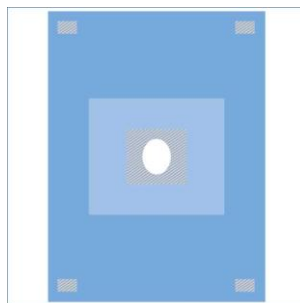


If so desired, surgical hood to cover longer hair styles and side burns.

Face shield also protects the inserter of any blood /biologic splutter.

**For the patient,** a maximal barrier precaution means covering the patient from head to toe with a sterile drape with a small opening for the site of insertion.

A cap may be placed to on the patient's head.



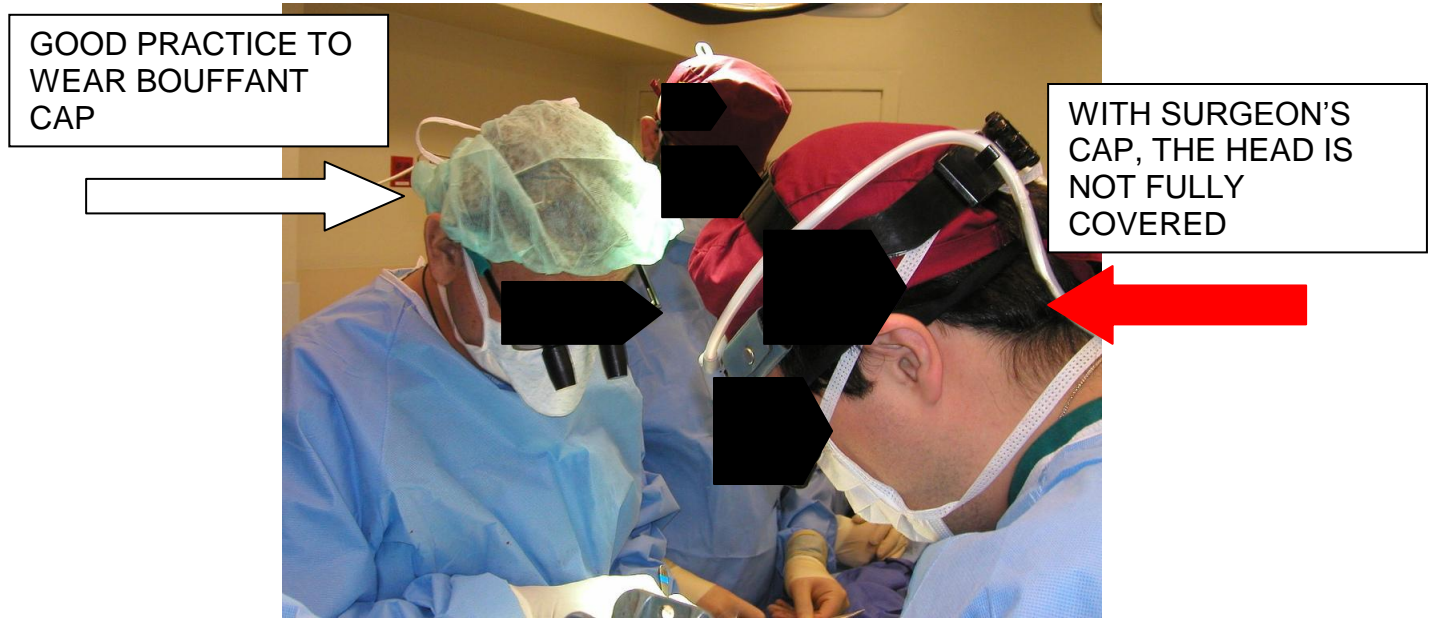
**“ALL OR NOTHING”**

The CDC requires monitoring of compliance to these central line insertion procedures (CLIP). When it comes to MSB, compliance with all barriers (including hand hygiene) is required. Only when all aspects of MSB are implemented is it deemed compliance

For example, you are not considered in compliance to the CLIP requirements if you wear a gown but not a mask or wear a glove but not wash your hand, etc.



### WHAT IS WRONG WITH THESE PICTURES?



*HINT: Loose cap, non-sterile gown, surgeon's cap, no gown*

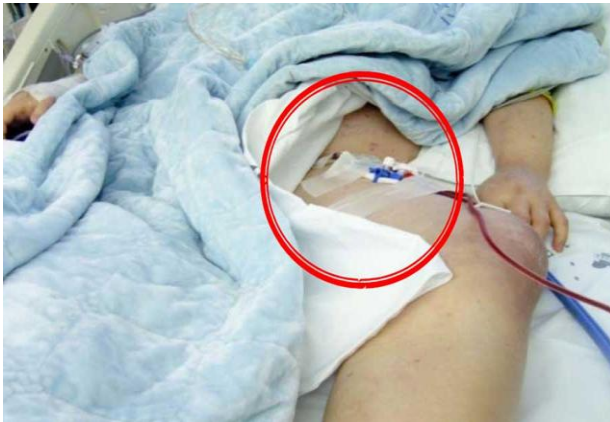
### SELECTION OF INSERTION SITE

A catheter's insertion site directly influences the subsequent risk for catheter-related infection. The amount of skin flora at the insertion site is a major risk factor for CLABSI. Some insertion sites are easier to maintain in a clean and dry manner. Catheters inserted into an internal jugular vein are associated with higher risk for infection than those inserted into a subclavian vein.

Recent studies suggest the femoral site is associated with a higher risk for infection as well as deep venous thrombosis than the other two sites. CDC recommends avoidance of the femoral vein when possible. In adult patients, the subclavian site is recommended; however, this recommendation must be balanced against issues such as patient comfort, anatomic deformity, and risk of mechanical complications (e.g., bleeding and pneumothorax).



In patients with renal failure, use of the subclavian site may result in stenosis limiting future vascular access options.



Femoral



Subclavian

### SKIN ANTISEPSIS

Although povidone-iodine (Betadine) has been the most widely used antiseptic, 2% aqueous chlorhexidine gluconate is actually superior for reducing CLABSIs. Unless contraindicated, use 2% chlorhexidine for skin antiseptics. If the patient is allergic to chlorhexidine, use povidone-iodine.

In general, chlorhexidine is thought to be a superior agent because:

- Stays in the skin longer (as long as 6 hours)
- Acts quicker
- Not easily inactivated by blood/fluids
- CDC recommended (for CL insertion)
- CHG and alcohol is superior than povidone-iodine
- Must be used in patients > 2 months old

Procedure for using Chlorhexidine (in this example, ChlorPrep®)



1. Pinch the wings on the ChlorPrep® to release the liquid into the sponge pad. Do not touch the pad.
2. Gently press the sponge against the skin near the exit site until you can see the liquid on your skin.
3. Use a back-and-forth friction rub for **60 seconds to all skin areas being covered by the dressing.**
4. Let air dry. **Do not blot, wave at, or blow-dry the area.**

CDC has the following recommendations:

- Chlorhexidine is the preferred agent for skin cleansing for both CLC insertion and maintenance.
- Tincture of iodine, an iodophor, or 70% alcohol is alternatives.




- Recommended application methods and contact time should be followed for maximal effect.
- Prior to use, ensure that agent is compatible with catheter. Alcohol may interact with some polyurethane catheters. Some iodine-based compounds may interact with silicone catheters.



If hair must be removed prior to line insertion, clipping is recommended. Shaving is not appropriate because razors cause local skin abrasions that subsequently increase the risk for infection.

### DAILY DOCUMENTATION OF THE REVIEW OF CENTRAL LINE NECESSITY

Daily review of central line necessity will prevent unnecessary delays in removing lines that are no longer clearly necessary in the care of the patient. Many times, central lines remain in place simply because of their reliable access and because personnel have not considered removing the line. However, it is clear that the risk of infection increases over time as the line remains in place and that the risk of infection is decreased if removed.

	To meet Senate Bill 739, CDPH requires that all hospitals develop and implement a process to ensure daily assessment of central line necessity for all patients with central lines on units under surveillance and to be able to present results of that process to CDPH surveyors.
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Example of implemented documentation process in an ICU:

Sputum			
Other			

	Site?	Start Date	Still need?
CVC			<input type="checkbox"/> yes
Aline			<input type="checkbox"/> yes
Foley			<input type="checkbox"/> yes
ETT			<input type="checkbox"/> yes
NET			<input type="checkbox"/> yes
PIV			<input type="checkbox"/> yes

GI prophylaxis	<input type="checkbox"/> Yes	<input type="checkbox"/> Contraindicated
DVT prophylaxis	<input type="checkbox"/> Yes	<input type="checkbox"/> Contraindicated

File in Medical Record

Inpatient Progress Note

### SUPPLEMENTAL INTERVENTIONS

#### ALL-INCLUSIVE CATHETER CART OR KIT

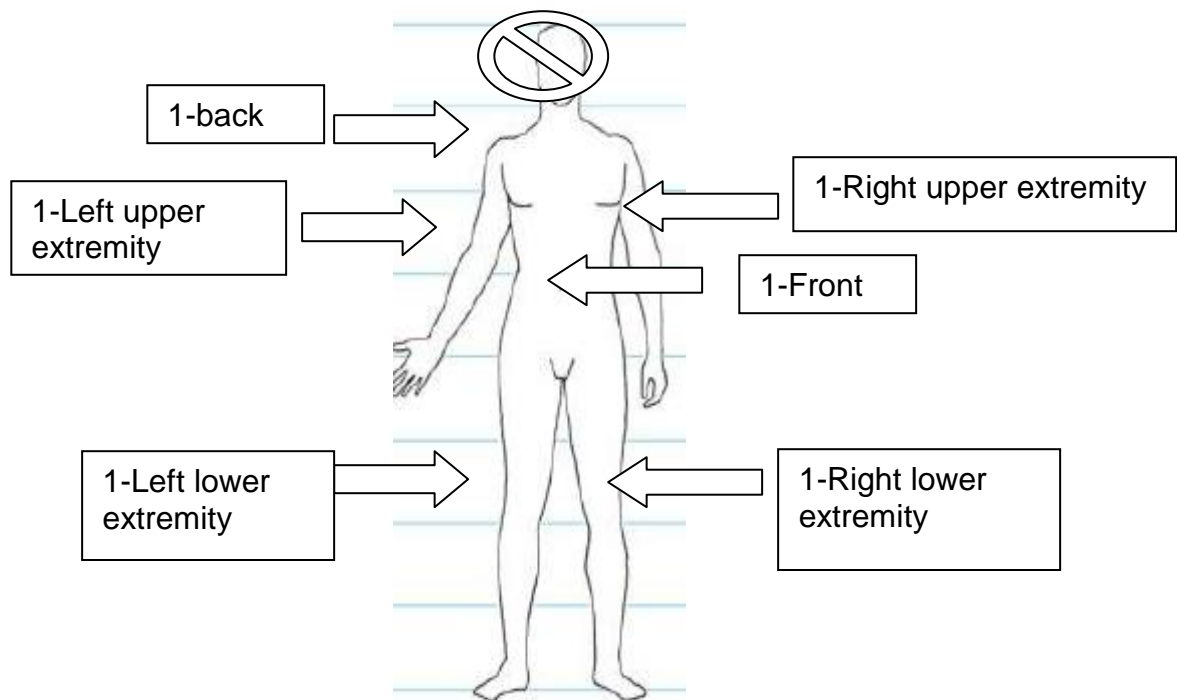
A catheter cart/kit containing all the necessary components for aseptic catheter insertion is to be available and accessible in units where CLCs are inserted. Everything needed should be in one place.




## DAILY CHLORHEXIDINE BATHING

Studies are now starting to show that daily bathing of ICU patients with 2% chlorhexidine-impregnated cloths decreased the rate of BSIs compared to soap and water.

- When performing this, at least 6 cloths are required: 1 for each extremity and 1 in the front, 1 for the back.



 As previously emphasized, use a “scrubbing” motion with the chlorhexidine cloth to clean rather than “wipe” the area. Scrubbing ensures that any bioburden in the skin is reduced.

### Exceptions to the use of 2% Chlorhexidine:

- Patients with a known or developed allergy to chlorhexidine
- Chlorhexidine is **Not** to be used on the face
- Chlorhexidine is **Not** to be used on any area of impaired skin integrity
- Chlorhexidine wipes are **Not** indicated for incontinent care
- Patient refusal of chlorhexidine bath
- Neonates

**CHECKLIST TO ENSURE COMPLIANCE TO ASEPTIC TECHNIQUE**

At the time of placement, CLC insertion should be observed by a nurse, physician, or other healthcare personnel to ensure aseptic technique is maintained.



IHI recommends that the procedure be stopped. This is more critical than simply empowering them to point it out because it implies that the procedure can continue, thus risking infection.

To collect information for the CDC, and to comply with Senate Bill 739, the Central Line Insertion Practices Adherence Monitoring form (CLIP form) must be completed. The staff completing the form is to note whether the CLABSI bundle (i.e., hand hygiene, maximal sterile barrier, etc.) are adhered to. Some facilities may have altered this form to collect additional data.

**Snapshot: Part of the CDC/NHSN CLIP Form**

\*Inserter performed hand hygiene prior to central line insertion:  Y  N (if not observed directly, ask inserter)

\*Maximal sterile barriers used: Mask  Y  N Sterile gown  Y  N  
 Large sterile drape  Y  N Sterile gloves  Y  N Cap  Y  N

\*Skin preparation (check all that apply):  Chlorhexidine gluconate  Povidone iodine  Alcohol  
 Other (specify): \_\_\_\_\_

\*Was skin prep agent completely dry at time of first skin puncture?  Y  N (if not observed directly, ask inserter)

\*Insertion site:  Femoral  Jugular  Lower extremity  Scalp  Subclavian  Umbilical  Upper extremity

Antimicrobial coated catheter used:  Y  N

\*Central line catheter type:

Non-tunneled (other than dialysis)  PICC  
 Tunneled (other than dialysis)  Umbilical  
 Dialysis non-tunneled  Other (specify): \_\_\_\_\_  
 Dialysis tunneled

(\*Other' should not specify brand names or number of lumens; most lines can be categorized accurately by selecting from options provided.)

**DRESSING CHANGES**


Central line dressings should be clean and dry.

Care of the CLC site is accomplished by using > 0.5% chlorhexidine-based preparation during dressing changes. If there is contradiction to chlorhexidine, tincture of iodine, an iodophor, or alcohol swabs may be used.




Do not use antimicrobial ointment, except on dialysis catheters. Studies on the efficacy of the application of antimicrobial ointments to the insertion site at the time of catheter insertion or during routine dressing changes have yielded contradictory findings. Moreover the use of polyantibiotic ointments that are not fungicidal may significantly increase the rate of colonization of the catheter by *Candida* species.

**Procedure:** Before starting, clear off an area that can be used for a sterile field. Place a disposable bag away from the sterile field but within easy reach. Place the patient in a comfortable position. Remove the old dressing with clean gloves. Inspect the insertion site very carefully, looking for any signs of beginning infection such as: redness, heat or discharge. If any of these signs are observed, notify the primary physician for possible culture. Clean the area with selected skin cleaning agent. Let it dry.

	CDC recommends that when chlorhexidine is used to clean the skin, “scrub” the area rather than “wipe” the area.
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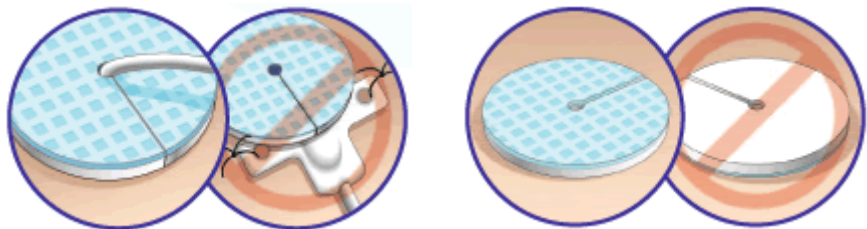
The dressing that is placed over the central line site (gauze or transparent) must be sterile and occlusive.

	CDC recommends that gauze dressings on short term-catheters be changed every two (2) days. For transparent dressings, change every 7 days.  Change more often if soiled.  ALWAYS follow your facility policies/protocols
---	--

Once the dressing is in place, secure the catheter with tape so no pull is exerted on the site. Write the time and date on the catheter dressing so everyone will know when the dressing was last changed.

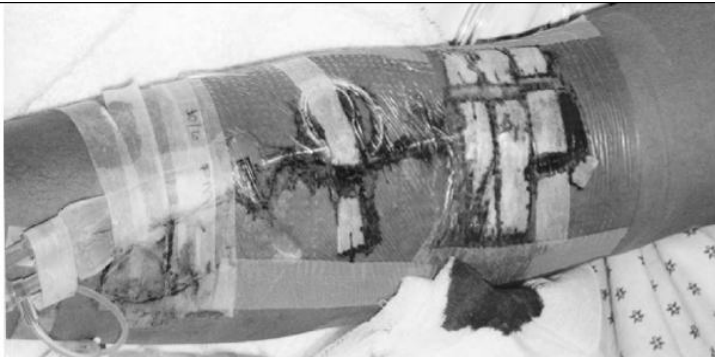


**Chlorhexidine Dressing:** Chlorhexidine-impregnated sponge dressings have been shown to decrease rates of CLABSIs. CDC (2011) recommends the following: Use chlorhexidine impregnated sponge dressing for temporary short term catheters in patients older than 2 months of age if CLABSI rate is not decreasing despite adherence to basic prevention measures.



Once the suture insertion site has healed, no daily site care is required with the implanted port because it does not exit through the skin.

**WHAT IS WRONG WITH THESE PICTURES?**



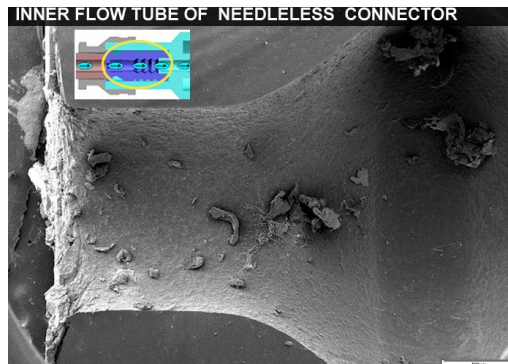
**CLEANING/CHANGING THE INJECTION CAP/HUB**



CLCs used for intermittent infusions have needleless injection caps /valves.

BSI “outbreaks” have been associated with failure to adequately decontaminate catheter hubs or failure to change them at appropriate intervals.

Studies have shown that biofilms develop intraluminally, and can carry at least 5 or more organisms.



Permission to use image obtained from Marcia Ryder, PhD

The frequency of cap changes and the number of times the cap is used varies with each facility. For successful cleaning, connection disinfections should occur prior to each time any syringe, IV tubing or blood drawing device is attached to the connector and prior to changing the cap/hub.

The catheter cap/valve is to be cleaned/disinfected by following three steps:

1. With the appropriate antiseptic wipe (e.g. chlorhexidine, povidone-iodine, an iodophor or 70% alcohol), press down with your thumb on the top access area of the IV or central line port. Rotate 3-5 times clockwise and counter clockwise.



Regardless of agent, **use vigorous rubbing action** (critical action) to decrease the bioburden.

2. Repeat the process (with a new wipe) around threads of IV access connector.
3. Disinfect for each IV access and port.



Biocide activity occurs when wet with alcohol and dry with chlorhexidine (CHG) therefore when using a CHG disinfectant a 30 second drying time is recommended. “Quick swipes of the surface DOES NOT meet the standard for either friction or time.”



Essential principles in central line hub care:

- Use strict aseptic technique and establish a sterile field near the patient.
- Follow manufacturer recommendations regarding cleansing and changing connectors.

### **ANTIBIOTIC IMPREGNATED CATHETERS**

Several studies have demonstrated that using antiseptic/antibiotic impregnated CLCs can significantly reduce BSIs in short-term catheters.

At this time, experts recommend using antibiotic impregnated catheters if the infection rate is high **despite** adherence to other proven strategies.

Per CDC, all of the studies involving these types of catheters have been conducted using triple lumen, non-cuffed catheters in adults whose catheters remained in place for more than 30 days. Based on these studies certain catheters and cuffs that are coated or impregnated with antimicrobial or antiseptic agents decrease the risk of CLABSI and potentially decrease hospital costs associated with treating CLABSI, despite the addition acquisition of the cost of these catheters.

FDA has approved the use of these catheters for use in patients weighing >3kg. No antiseptic or antimicrobial impregnated catheters currently are available for use in patients weighing < 3kg.

### **DISCHARGE TEACHING**

Long-term CLCs allow patients to receive caustic fluids at home rather than just in the hospital. These catheters have a much longer life because they are less thrombogenic and less prone to infection than the short-term catheters.

The patient must have a family member or significant other who can safely and competently administer the ordered therapy and perform the needed catheter related care. Supplemental educational materials that are simple and understandable may be given to the patient/family (if available).

The care procedures used in the home are the same as those used in health care facilities, except clean technique is used instead of sterile. Home environments do not carry the same risk for microorganisms as the hospital.

The overall goal of home therapy is patient safety, so your teaching must begin well before discharge.

A list of what must be taught to the patient includes:

- When and how to perform dressing changes, change the injection cap or reflux valve
- When and how to clamp the catheter
- Teach the Valsalva's maneuver and when to use
- The type of I.V. therapy ordered and rationale
- When and how to administer I.V. therapy
- Signs and symptoms of major complications
- Signs and symptoms of common problems encountered
- Any restrictions that must be observed
- Whom to contact with minor problems and in an emergency
- Return demonstrations by the patient or care giver

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## DHS Central Line Module

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CDC National Safety Healthcare Network. [http://www.cdc.gov/nhsn/TOC\\_PSCManual.html](http://www.cdc.gov/nhsn/TOC_PSCManual.html)

ANSWERS FOR POSTTESTS: NURSES: 1.a 2.d 3.d 4.d 5.c 6.a 7.d 8.b 9.d 10.b ATTENDING PHYSICIAN: 1.b 2.b 3.a 4.a 5.b 6.d 7.b 8.c 9.d 10.b  
FELLOWS/RESIDENTS: 1.d 2.c 3.d 4.c 5.d 6.b 7.d 8.b 9.d 10.d



## ADDITIONAL INSTRUCTIONS

The next section (PART 2) is on “Techniques And Tips For Inserting Non-Tunneled Catheters.” Fellows/Residents are required to read this section. Attending staff may review it.

1. **FOR NURSES**, proceed to the following:  
 Complete self-assessment post test for NURSES: Page **35 - 36**  
 Use answer sheet found on Page **40**. You can check your answers found in page 33.
2. **FOR ATTENDING PHYSICIANS, FIRST-** perform a self-assessment where your competency/performance gap would be. Is it in diagnosing CLABSI or is in the technical aspect of central line insertion/care?
  - If it is in diagnosing CLABSI, complete self-assessment post test for **ATTENDING PHYSICIANS: Page 37 – 39**
  - If it is in the technical aspect of central line insertion/care, review Part 2 and complete the posttest exam for Fellows/Residents found on page **108 – 109**.

You can only take one test and whichever it is, use answer sheet that will be found on Page **40**. You can check your answers found in page 33.

### Nurses and Attendings:

- A. Please complete the registration and evaluation form found on page **41**
- B. Indicate your score in the registration/evaluation form. A passing score must be obtained to get CME units (a CME unit is acceptable for nurses for license renewal).

The post tests are composed of 10-item questions. EXPECTED PASSING GRADE: 80% (8/10).  
 FIRST TAKE FAILURE: If a score of  $\leq 70\%$  is obtained for the first attempt, review the module and retake the exam.

- C. Please indicate the number of CME hours requested in the registration/evaluation form.  
**The maximum number of CME to be obtained is 2.5 hours.**
- D. Submit completed paperwork to a facility designee or send it to [HSACME@dhs.lacounty.gov](mailto:HSACME@dhs.lacounty.gov). The following are not reliable methods to receive your CME documents but if need be, mail or fax to:

Mailing address: DHS QIPS, Room 703, 313 N Figueroa St, Los Angeles, CA 90012	Fax Number: (213) 482-3895	(Please always keep a duplicate copy of your application for future reference if need be. HSACME will provide you the certificate as soon as able).
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3. **FOR FELLOWS AND RESIDENTS**, read Part 2 of this module: “Techniques And Tips For Inserting Non-Tunneled Catheters” (starting on page 42). **Some of the test questions for the Fellows/Residents will be derived from the content of this section.**

After reading Part 2, complete the Self-assessment posttest exam for Fellows/Residents found on page **108 – 109**.  
 Use the answer sheet found on page **110**.

**SELF-ASSESSMENT POSTTEST FOR NURSES**

1. The Dacron polyester fiber cuff on most permanent catheters is useful in what way?
  - a. Prevent infections
  - b. Prevent air embolisms
  - c. Prevent pneumothorax
  - d. Locate the catheter by manual palpation
2. What size syringe should be used to flush a PICC?
  - a. 1 ml.
  - b. 3 ml.
  - c. 5 ml.
  - d. 10 ml.
3. Redness, warmth over an area, tenderness and swelling from a central line insertion site are symptoms of:
  - a. Thrombosis
  - b. Air embolism
  - c. Pneumothorax
  - d. Local infection
4. Which of the following catheter sites are associated with the highest incidence of CLABSI in adults?
  - a. Brachial peripherally inserted central line catheter
  - b. Internal Jugular
  - c. Subclavian
  - d. Femoral
5. CLABSI is **LEAST** likely to be a risk in the following situation:
  - a. Emergency insertion of central line
  - b. Insertion of a central line by an Intern as supervised by a Senior Resident
  - c. Utilization of a central line for a short period of time
  - d. Cleaning the insertion site with povidone-iodine
6. Which of the following interventions is **MOST** effective in preventing CLABSI?
  - a. Washing hands before handling a central line
  - b. Changing the CLC dressing every 24 hours
  - c. Wiping injection swabs with povidine-iodine swabs
  - d. Using a mask when changing the dressing

7. Which of the following describes maximal sterile barrier?
  - a. Wearing a mask and sterile drape
  - b. Wearing a sterile gown, sterile cap and sterile drape
  - c. Wearing sterile gloves and large drape
  - d. Wearing a mask, cap, sterile gown, sterile gloves, draping the patient
  
8. When using chlorhexidine (CHG) skin preparation, the **MOST** important step to undertake is:
  - a. Wiping off the CHG after application
  - b. Scrubbing the skin with CHG wipes/swab
  - c. Waiting 5 minutes for the CHG to dry
  - d. Washing off the CHG with soap and water after application
  
9. Which of the following is **NOT** a part of the central line bundle?
  - a. Hand hygiene and maximal sterile barrier
  - b. Avoidance of the femoral area as a catheter insertion site
  - c. Daily documentation of the central line necessity
  - d. Administration of prophylactic antibiotic prior to central line insertion
  
10. When accessing a CLC hub/port, it is important to perform the following:
  - a. Clean the port with povidone-iodine scrub
  - b. Vigorously rub the port with alcohol swab
  - c. Gently wipe the port with chlorhexidine
  - d. Change the injection cap every 24 hours

<b>SELF-ASSESSMENT POSTTEST FOR ATTENDING PHYSICIANS</b>
--

**REMINDER:** Attending physicians may take this test or that on page 108-109 depending on self-assessed learning need. The test below emphasizes on diagnosing CLABSI and the post test on page 108 emphasizes on the technical aspect of central line insertion/care (review of Part 2 may be required)

**NOTE:** The questions below focus on surveillance definition of CLABSI. It will be evident when answering the questions that surveillance definitions may differ from clinical definitions of infection. In real practice, clinicians, given more information than this test, can conclude that a patient has infection (even if it does not meet surveillance definitions) and are not being barred from instituting interventions that will be appropriate in treating the patient deemed with infection. Though the role of identification of CLABSI falls on Infection Control (in some facilities), often times, Infection Control collaborates with Attending physicians to determine CLABSI. It is hoped that knowledge of the surveillance definitions will promote communication of the same criteria for data submission to CDC and/or public reporting.

1. A patient was admitted on **January 2<sup>nd</sup>** for abdominal pain. A central line was inserted in the Emergency Department (ED) on the same day. The patient was then transferred to the Intensive Care Unit (ICU). On **January 5<sup>th</sup>**, the patient had a fever so laboratory samples were sent for cultures, one blood specimen from the right arm, and another from the left arm. A urine culture was also sent. On **January 9<sup>th</sup>**, the blood specimens and urine culture came back positive (+) of Coagulase-negative staphylococcus (CNS). The patient still has the central line inserted on the 2nd of January.

Based on the information above, did the patient have a primary Central Line Associated Blood Stream Infection (CLABSI)?

- a. Yes
- b. No

2. A patient was admitted on **March 9<sup>th</sup>** and was sent to the Operating Room for abdominal surgery and to fix an aortic dissection. After surgery, the patient was admitted in the ICU. A central line was inserted on **March 10<sup>th</sup>** but was discontinued on **March 15<sup>th</sup>**. The patient had fever and increased white blood count and received antibiotics. On **March 18<sup>th</sup>**, the patient's blood culture came back positive (+) of Vancomycin resistant organism (VRE), and Coagulase-negative staphylococcus (CNS).

Based on the information above, did the patient have a Central Line Associated Blood Stream Infection (CLABSI)?

- a. Yes
- b. No

3. A patient was admitted on **July 30<sup>th</sup>** in the ICU from the ED due to diabetic ketoacidosis. A central line was inserted in the ICU on **August 1<sup>st</sup>**. On **August 16<sup>th</sup>**, the patient was having fever and an increased white blood count. Blood cultures were sent from four (4) different peripheral sites and an antibiotic was started. The central line was discontinued. On **August 20<sup>th</sup>**, blood cultures from 2 different peripheral sites came back positive (+) of *Corynebacterium* spp.

Based on the information above, did the patient have a Central Line Associated Blood



Stream Infection (CLABSI)?

- a. Yes
- b. No

4. On **May 1<sup>st</sup>**, a medical patient is admitted in the Surgical ICU due to lack of beds in the Medical ICU. In the Surgical ICU, the primary Medical team inserted a central line on **May 2<sup>nd</sup>**. The patient was being managed in the Surgical ICU until the patient was stable and transferred to the Medical Stepdown unit on **May 16<sup>th</sup>**. On **May 20<sup>th</sup>**, the patient developed a fever. The central line was discontinued and blood culture specimens were drawn on the left and right arm. A peripherally inserted central catheter (PICC) was inserted on the left brachial vein. An antibiotic was started.

Based on the information above, did the patient have a Central Line Associated Blood Stream Infection (CLABSI)?

- a. Yes
- b. No

Questions 5 and 6 will pertain to this case:

A 15 year old female patient was admitted in the ICU with a Hickman catheter (tunneled, long term catheter). She claimed that the Hickman was inserted a week before. She came in because of redness in the Hickman's exit site. The exit site is notably red (around 2cm x2 cm) with minimal purulent discharge in site. No blood culture was sent. She did not complain of fever/chills, and no pain on the exit site.

5. Based on the information above, did the patient have a Central Line Associated Blood Stream Infection (CLABSI) according to the NHSN\* definition?
- a. Yes
  - b. No

\*NHSN- National Healthcare Safety Network

6. What additional interventions shall the physician consider?
- a. Start the patient on an antibiotic
  - b. Clean the site aseptically and remove the Hickman catheter
  - c. Send 2 bottles of blood cultures
  - d. All (or any) of the above

Question 7 and 8 pertains to this case:

A patient was admitted directly to the Operating Room for management of multiple trauma and Anesthesia inserted a non-tunneled central line (#1). The patient was immediately transferred to the Surgical ICU for higher level of care. On POD#1, the central line (#1) was used to infuse multiple vasopressors to achieve hemodynamic stabilization. The patient was in the Surgical ICU for 10 days in which the original central line was replaced (#2) by the surgical team. However, he developed acute renal failure so a non-tunneled (temporary/short-term) hemodialysis catheter was inserted by the Renal team. When the patient became surgically stable, the central line was removed and the nurse started a peripheral IV. The patient was then transferred to a Stepdown unit with the hemodialysis catheter and a peripheral IV.

7. To promote best practices by complying with the CLABSI bundle, which of the following would be the **MOST** important information for physician hand-off in this case?
- Write an order to wear mask and gown when changing the hemodialysis dressing
  - Continue to evaluate and document line (hemodialysis) necessity
  - Call the Surgical ICU team for discontinuation of hemodialysis catheter
  - Promote daily chlorhexidine bath in the Stepdown unit
8. Two days in the Stepdown unit, the patient developed CLABSI. When the case will be reported to NHSN (CDC), which of the following units would the CLABSI be attributed to?
- The Operating Room
  - The Surgical ICU
  - The Stepdown unit
  - It will be unknown
9. A patient is admitted in the ED on **December 1<sup>st</sup>** and was taken to the ICU on **December 2<sup>nd</sup>**. A central line was inserted on **December 2<sup>nd</sup>**. It was a difficult procedure (the inserter was successful only after the third attempt). On **December 4<sup>th</sup>**, the patient met the criteria of a CLABSI. Should the physicians decide not to remove the central line, what additional steps should BEST be undertaken?
- Include an alternate central line site for discussion during patient rounds
  - Evaluate and document the central line necessity everyday
  - Consider another intravenous infusion site like a PICC
  - All of the above
10. A unit/department's CLABSI rate remains high despite promotion of the CLABSI bundle, what can be an additional intervention for the unit/department to undertake?
- Form a CLABSI team that will manage the central line 24/7
  - Institute additional interventions such as chlorhexidine baths every day
  - Change the central line catheters to antibiotic-impregnated catheters
  - Implement a weekly educational activity for physicians on CLABSI for 6 months

**ANSWER SHEET**

Name: \_\_\_\_\_ Facility: \_\_\_\_\_

Question #	ANSWERS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Correct your answers. You may find the correct answers on the bottom of page **33**

Please write your score (above your signature) on the registration form found on page 41.  
You are required to pass the post test to obtain CME credit (or equivalent CEU-for Nurses).



LOS ANGELES COUNTY -DEPARTMENT OF HEALTH SERVICES  
HEALTH SERVICES ADMINISTRATION QUALITY IMPROVEMENT AND PATIENT SAFETY (HSA QIPS)PROGRAM  
**CONTINUING MEDICAL EDUCATION PROGRAM**  
**CONFIDENTIAL ACTIVITY EVALUATION**

Sponsoring Program:	HSAQIPS
CME Activity/Topic:	DHS CENTRAL LINE MODULE

The HSAQIPS Continuing Medical Education program will appreciate your thoughtful appraisal of this activity to help in planning future CME activities. After the activity, please complete and return this evaluation to any program staff. Thank you.

Your profession ( **MANDATORY** - Please shade):  Physician (MD/DO);  Nurse (RN/LVN/NP);  Other

Please shade bubbles. Rating Legend: **5 – Excellent 4 - Very Good 3 – Good 2 – Fair 1 – Poor**

OVERALL ACTIVITY EVALUATION:	Excellent	Very Good	Satisfactory	Fair	Poor	NA
Module provided a balanced view of therapies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
OVERALL evaluation of the activity (content, clarity, organization, free of commercial bias, etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Educational objectives were met: Yes  No

Any potential conflicts of interest had been declared (see page iv for disclosure): Yes  No

**RELEVANCE TO PRACTICE/ CHANGING OUTCOMES:**

<i>Please shade (all that apply):</i> After reading the module	YES	NO
I can identify central lines and their differences in the clinical area	<input type="radio"/>	<input type="radio"/>
I can perform hand hygiene prior to caring for the patient with (or inserting a) central line to prevent CLABSI	<input type="radio"/>	<input type="radio"/>
I can identify the component of and implement maximal sterile barrier	<input type="radio"/>	<input type="radio"/>
Whether inserting or managing a central line, I can clean the skin with chlorhexidine solution to decrease CLABSI	<input type="radio"/>	<input type="radio"/>
I will monitor and document my assessment of the central line daily	<input type="radio"/>	<input type="radio"/>
I can identify factors that cause CLABSI and proactively resolve them	<input type="radio"/>	<input type="radio"/>
What other measures have you learned and want to implement to decrease CLABSI in your patient population?		

**REGISTRATION (This form may be photocopied)**

COMPLETE AND PRINT ALL INFORMATION REQUIRED BELOW (to help expedite generation of certificate)

Last Name																										
First Name																										
Degree	M D	R N	Other (specify)										License #													
Facility																										
Department																										
E-mail																										

E-mail is the primary method to distribute certificate(s)

**Time Attestation:** I certify that I have participated in the CME activity entitled *DHS CENTRAL LINE MODULE* for a total of \_\_\_\_\_ hour(s) [determines number of CME units to be awarded to the participant= **Maximum 2.5**].

**POST TEST SCORE:** \_\_\_\_\_/10

Signature: \_\_\_\_\_ Date of Submission: \_\_\_\_\_

Send completed answer sheet, registration and evaluation electronically to [hsacme@dhs.lacounty.gov](mailto:hsacme@dhs.lacounty.gov) or to your facility designee for submission to DHS QIPS (DHS QIPS, ROOM 703, 313 N. Figueroa St, LA, CA 90012)

# **PART 2: TECHNIQUES AND TIPS FOR INSERTING A NON-TUNNELED CENTRAL LINE CATHETER INSTRUCTIONS**

- 1. Review the educational objectives.**
- 2. Fellow/Resident Posttest will be found at the end of this section.**
- 3. Check the answer. Answers can be found on page 33**

## **DISCLAIMER**

**The attached is an overview of inserting non-tunneled central lines. It will not replace additional training requirement established by the DHS facilities or affiliated academic institutions.**

**Simulation Training course is the best adjunct to reading this module.**



# OBJECTIVES

After treading this review course, the reader will:

1. State the process of performing the following central line procedures:
  - a. Inserting the line
  - b. Discontinuation of the line
  - c. Managing the guidewire
2. State the precautionary measures to prevent the following complications:
  - a. pneumothorax during line insertion
  - b. Air embolism
3. State the advantage and disadvantages of the femoral site

# ACKNOWLEDGMENT

DHS would like to thank:

- the USC Keck School of Medicine for granting permission for DHS to adopt their GME Procedural Skills Workshop curriculum
- OVMC ICU (Susan Stein, MD, Dennis Yick, MD) for granting permission for DHS to adopt their presentation on guidewires

# PREPARE PATIENT

- Explain procedure to patient in a language and manner that they can understand.
- **OBTAIN INFORMED CONSENT** in non-emergent cases
- **TIPS:**
  - Use interpreters as appropriate
  - Provide educational materials as appropriate



## SELECT APPROPRIATE CATHETER FOR CONDITION

- **NON-TUNNELED CATHETERS:**
  - Triple Lumen
  - Sheath Introducer
  - Short term hemodialysis catheter

# **SELECT APPROPRIATE CATHETER FOR CONDITION**

- **NON-TUNNELED CATHETERS INDICATIONS**

- Rapid resuscitation- fluid or blood
- Hemodynamic monitoring- CVP or pulmonary artery catheterization
- Long-term administration of meds (chemotherapy)
- Inability to access peripheral veins
- Hemodialysis/ plasmapheresis/ transvenous pacemaker placement
- **NOTE: PICC may be selected instead of non-tunneled catheter when long term use is expected.**
- **Intraosseous (IO) line may also be a better choice in emergent situations**

# SELECT APPROPRIATE CATHETER FOR CONDITION

**NOTE: 98% of the time , the tip of the catheter is found in the right atrium. It should be in the cavo-atrial junction.**

**NOTE: LA County central line standard length is 16 cm**

Table 1. Recommended Length of Central Venous Catheter (CVC) Insertion in Pediatric Patients Based on Weight

Patient weight (kg)	Length of CVC insertion (cm)
2-2.9	4
3-4.9	5
5-6.9	6
7-9.9	7
10-12.9	8
13-19.9	9
20-29.9	10
30-39.9	11
40-49.9	12
50-59.9	13
60-69.9	14
70-79.9	15
≥80	16

# SELECT APPROPRIATE SITE FOR INSERTION: SUBCLAVIAN

- Preferred site for patient with tracheostomy
- Convenient for patient / nursing care
- Highest rate of complications- *injuries to apex of the lung*
- Ideal when chest tube in place
- Probably lowest infectious complications
- Should not be used coagulopathic pts





# SELECT APPROPRIATE SITE FOR INSERTION: INTERNAL JUGULAR (IJ)

- Uncomfortable for the pt
- Nursing care is difficult
- Complicated by C-spine precautions / tracheostomy
- Rate of insertion complication is low
- Lung puncture is unusual
- Injury to carotid
  - a. can be managed with direct pressure



# SELECT APPROPRIATE SITE FOR INSERTION: FEMORAL

- Cannot be used long term
- Easy- great for acute resuscitation
- *High incidence of infection in adults*
- Difficult to maintain asepsis of groin
- Should not be used when trauma to IVC / iliac veins suspected



# INSERTION SITE PEDIATRIC DATA

- **Femoral**
  - **Lower incidence of mechanical complication**
  - **Possible equivalent infection with other sites**
  - **Possible venous congestion**
    - a. Elevate extremity**
    - b. Usually improves with hydration**

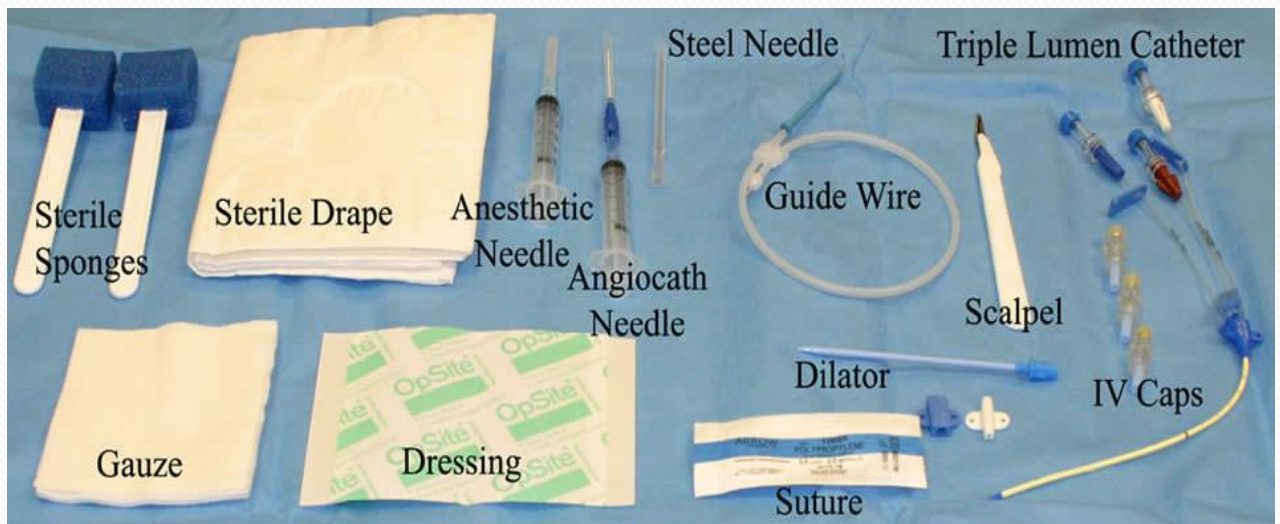
# PERFORM PRELIMINARY SITE CLEANING

- **Position the patient (depending on the choice of site)**
- **Assess the site**
- **Clean the site prior to performing skin prep. Use chlorhexidine wipes/Hibiclens/bed bath to decrease the patient's endogenous skin flora/ dirt in the skin (especially on patients with hygiene problems)**

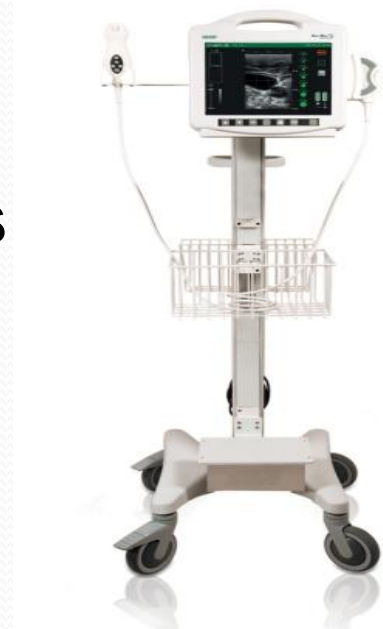


# OBTAIN ALL EQUIPMENT REQUIRED

- Utilize central line carts as available
- Bring all equipment at the bedside



- **DO NOT FORGET** the central venous access **Ultrasound machine** if available





# USE THE CENTRAL LINE CART



# STERILIZE THE SITE USING APPROPRIATE TECHNIQUE

- ***USE CHLORHEXIDINE  
(CHG) SOLUTION***

## •PROCEDURE



- Pinch the wings to “pop” the ampule
- Press the applicator to the skin and use a back and forth motion for **30 seconds**

**ALLOW TO DRY**

# IMPLEMENT MAXIMAL STERILE BARRIER

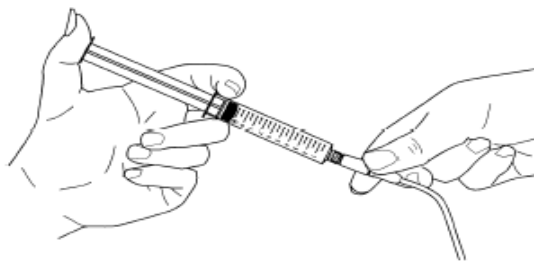
- Hand hygiene! Wash hands or use antiseptic gel/foam



- Put mask, cap, sterile gown, sterile gloves
- Sterile drape for patients

# PREPARE CATHETER

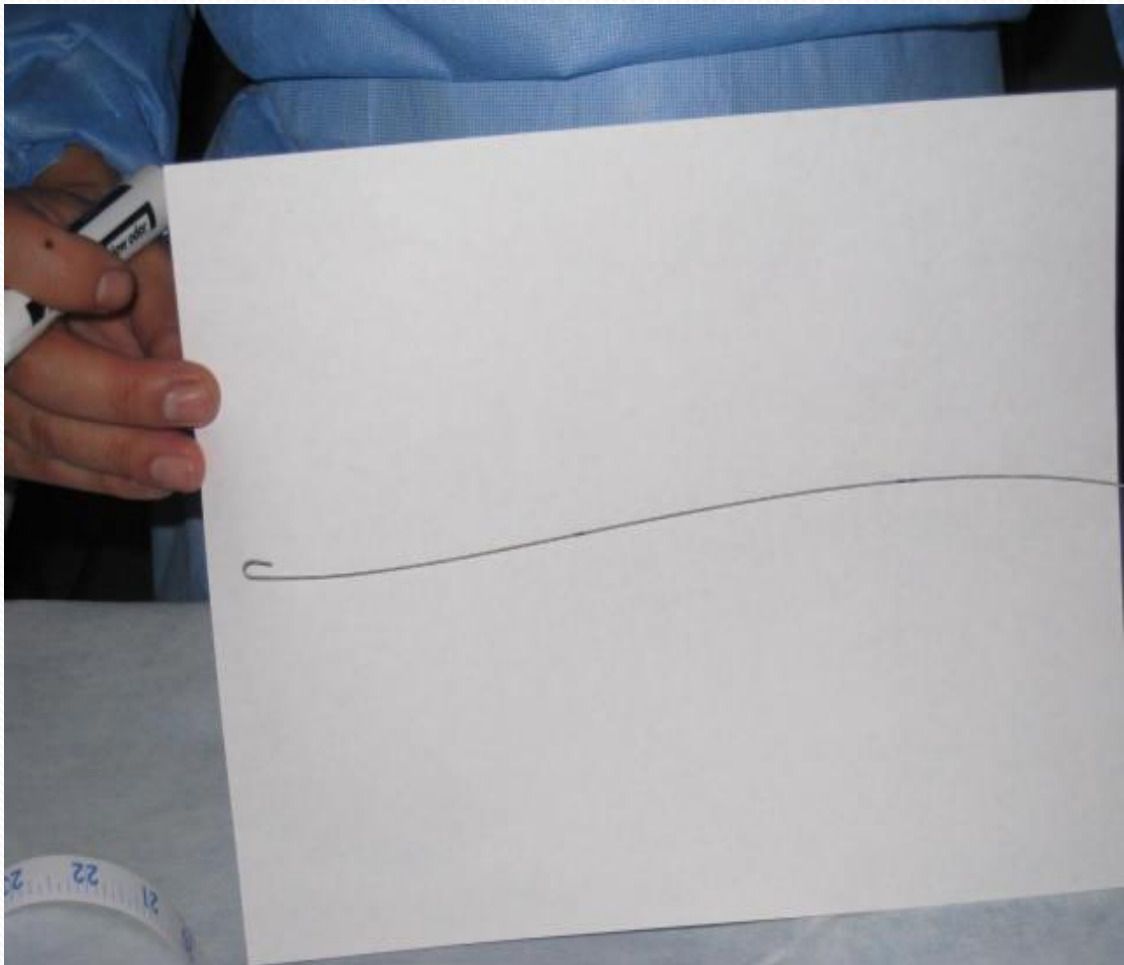
- Flush catheter ports with normal saline.
  - TIPS:
  - Some attach the catheter ports/hub/caps at this time. **NOTE:** Do not cap the port where the guidewire is going to exit [it is usually the distal port]



- Prefill 10 ml syringes with normal saline (for future line infusion or line flushing)

# ORIENT SELF WITH THE CONTENTS OF THE CATHETER KIT ESPECIALLY THE GUIDEWIRE!

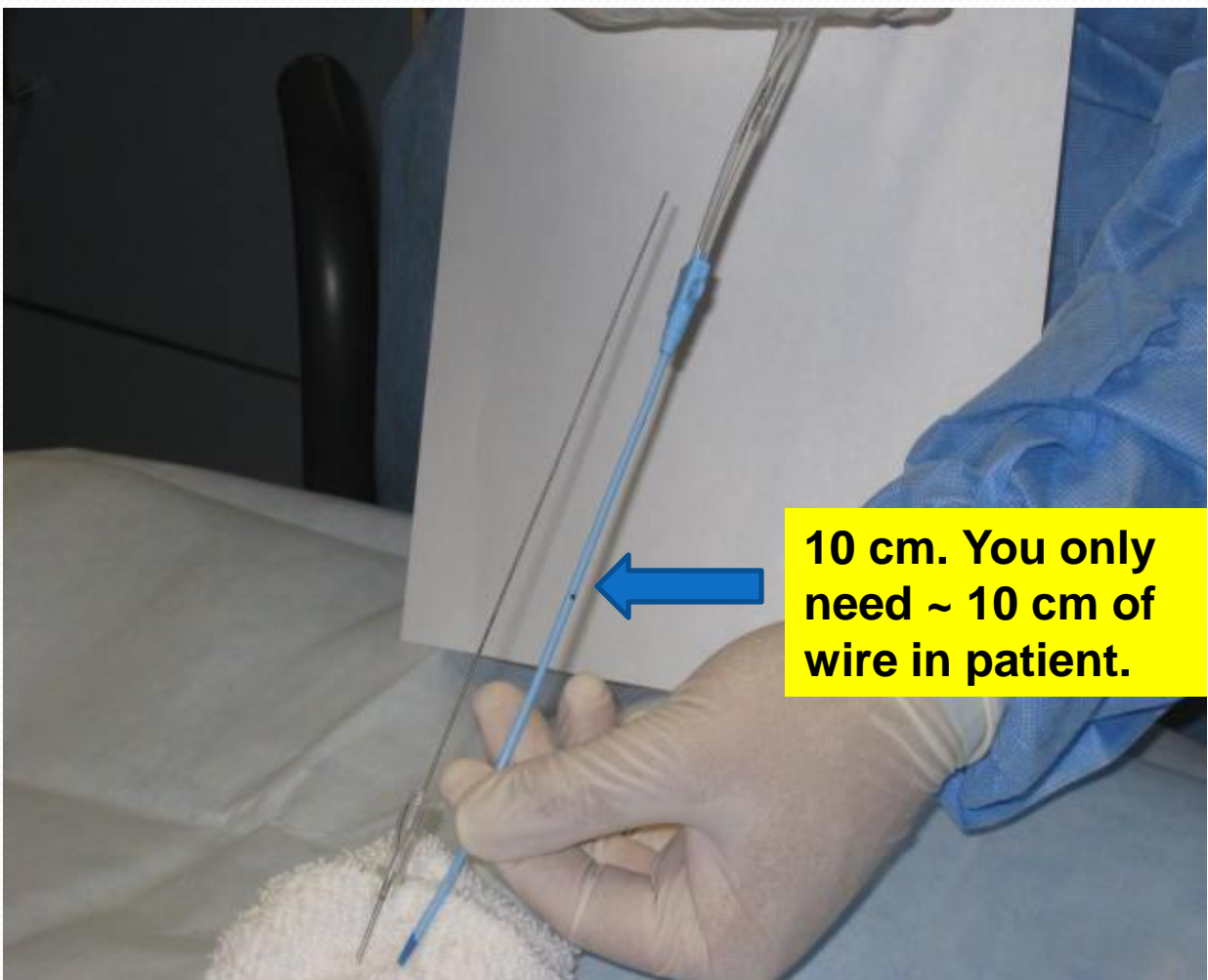
- **NOTE: Incidences of misplaced guidewire had been reported in DHS, thus, familiarizing self with guidewire is important!**





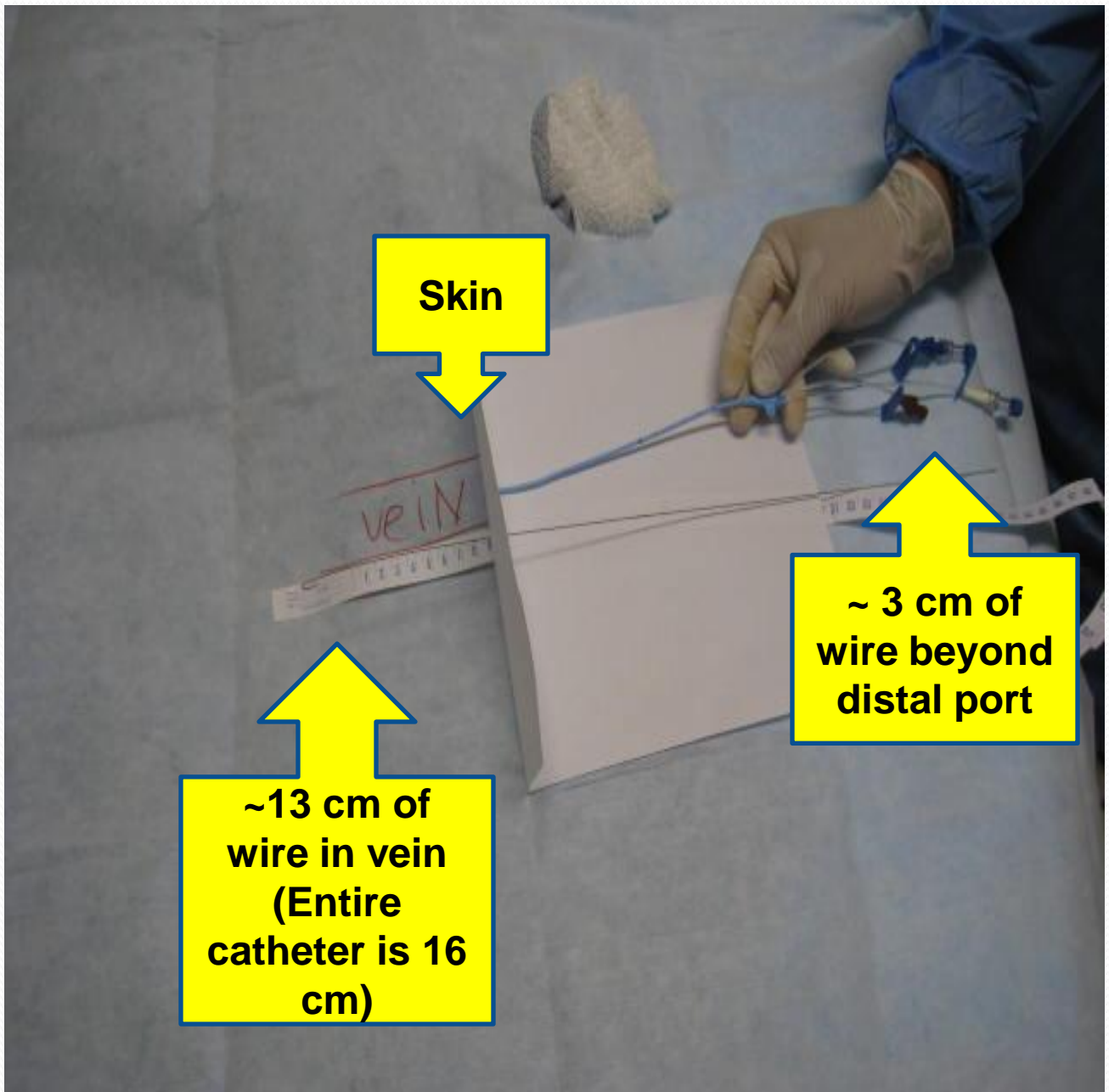
# ORIENT SELF WITH THE GUIDEWIRE!

- The guidewire is a 45 cm wire.
- It is marked at 10cm, 20cm, 30cm. Use the marks to guide you
- It is hard to see 10 and 20 cm mark on wire.



# ORIENT SELF WITH THE THE GUIDEWIRE!

## Illustration of guidewire in vein



# PREPARE LOCAL ANESTHETIC

- **Inject 1% LIDOCAINE (typical agent) on the intended site**

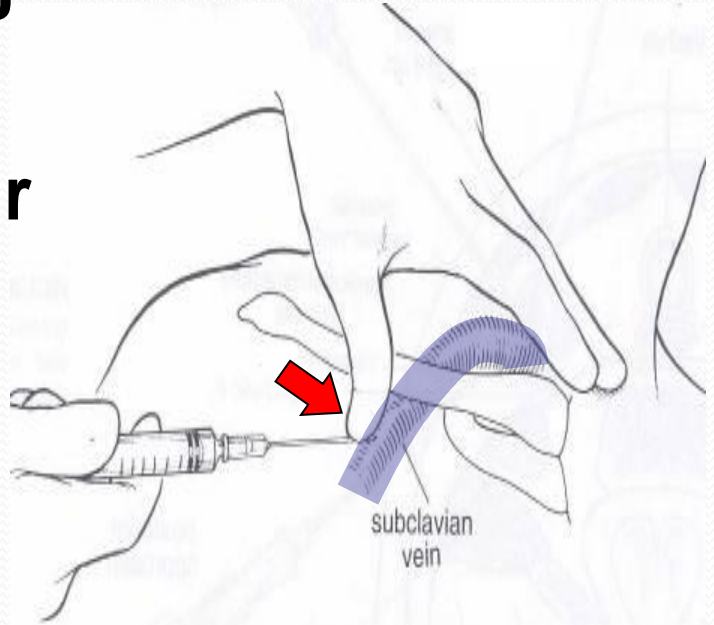


## INSERT THIN-WALLED NEEDLE (ANGIOCATH IS ALSO AVAILABLE IF PREFERRED)

- **Start insertion with non-dominant hand holding the needle as dominant hand holds the syringe**

# USE LANDMARKS FOR ACCESS - SUBCLAVIAN

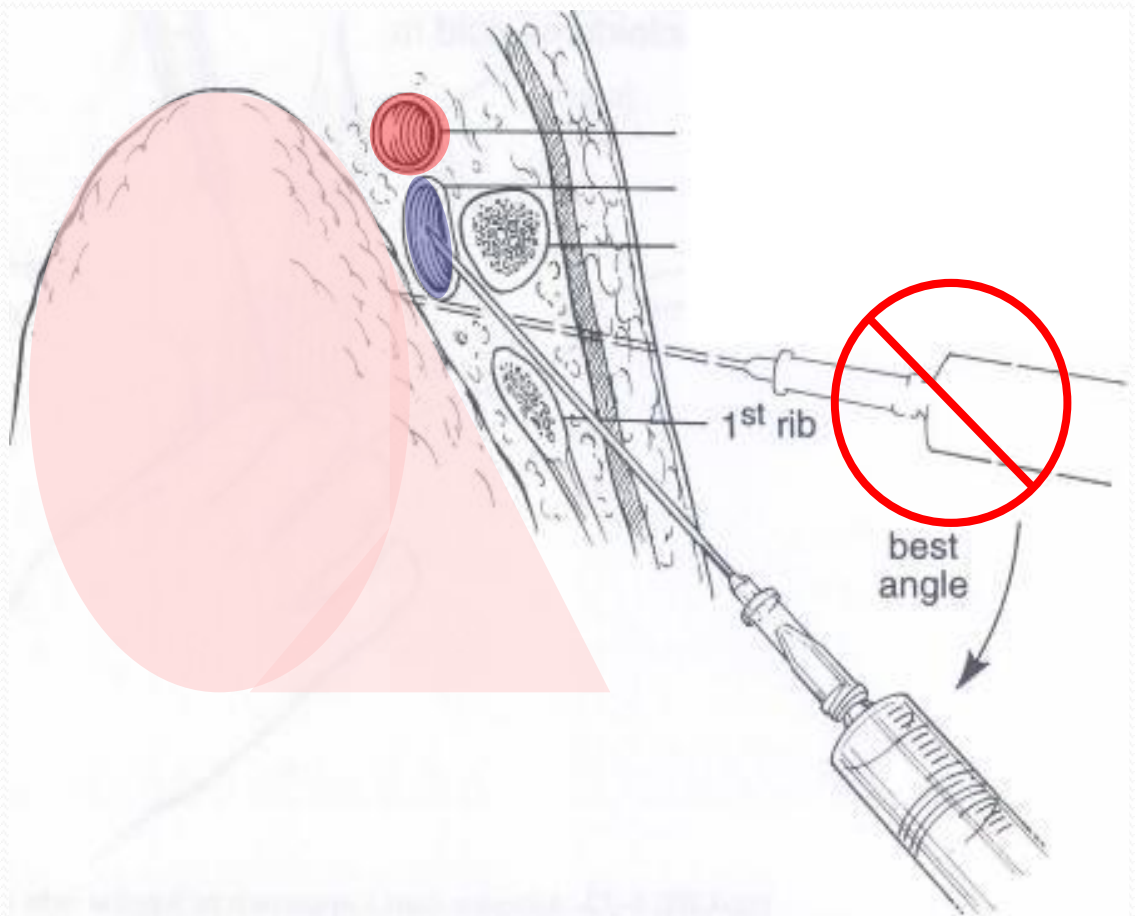
- Trendelenburg position to distend vein and prevent air embolism



- Needle is inserted into skin 2 cm under middle of the clavicle
- Needle is directed toward sternal notch

# USE LANDMARKS FOR ACCESS - SUBCLAVIAN

- Needle abuts clavicle and passes immediately underneath to avoid entrance into pleural cavity

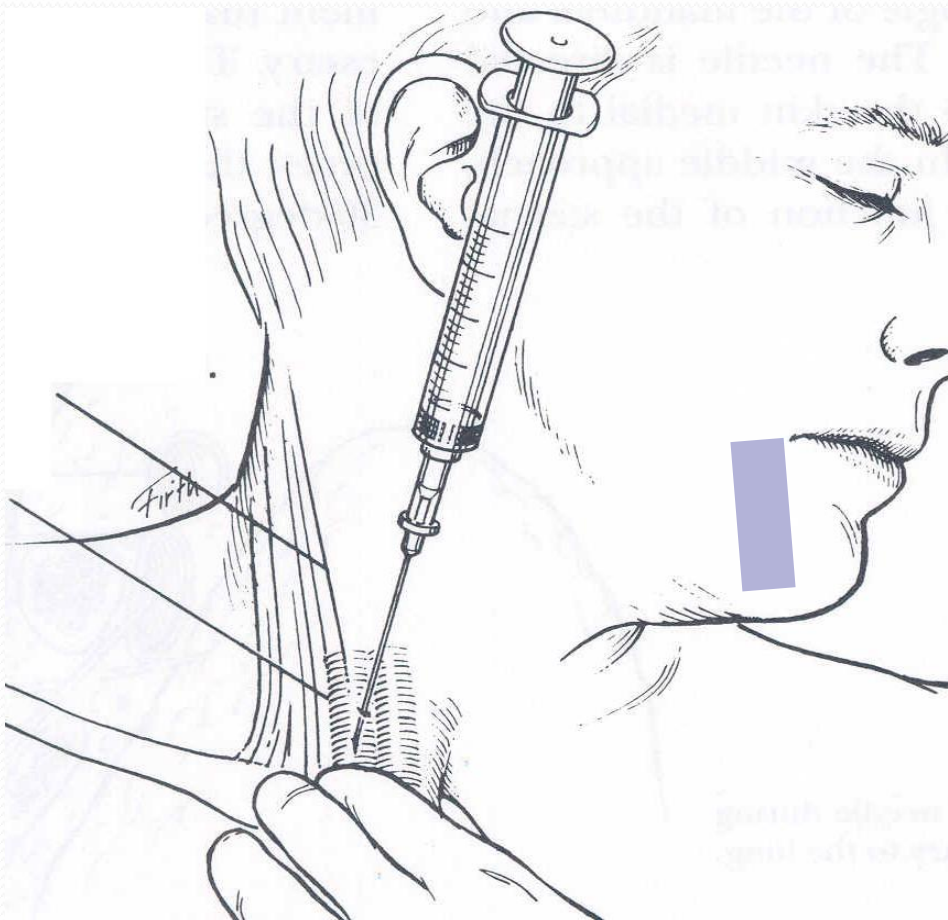




# USE LANDMARKS FOR ACCESS

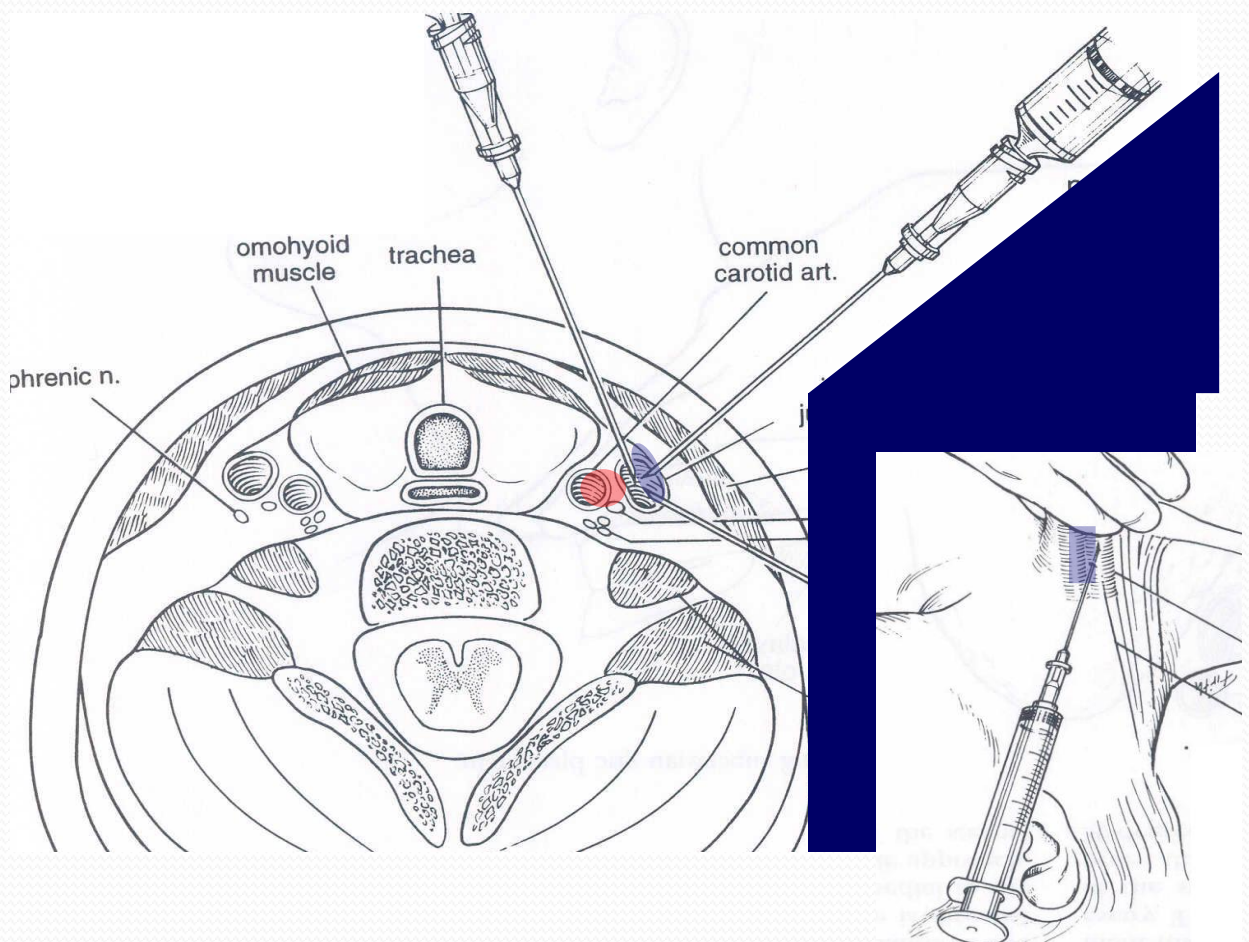
## - INTERNAL JUGULAR (IJ)

- Pt must be in Trendelenburg and head turned opposite of the intended site
- Consider a roll under the shoulders to hyperextend neck (if no spinal precautions)



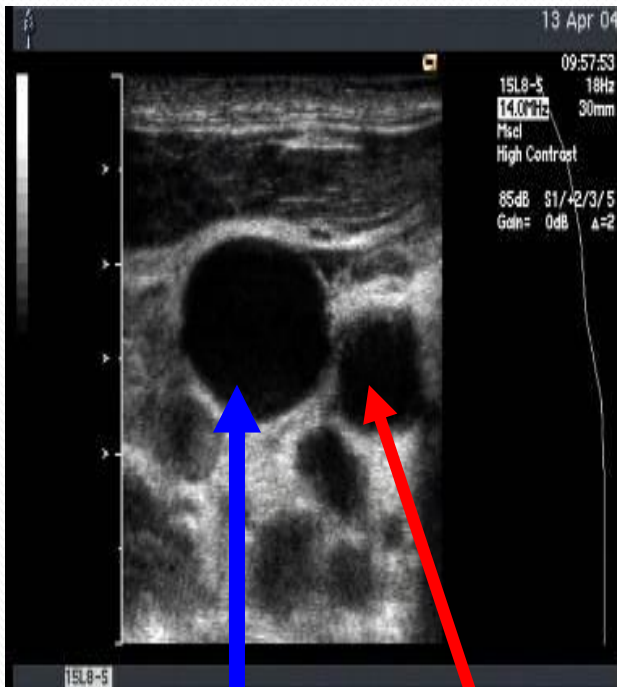
# USE LANDMARKS FOR ACCESS - INTERNAL JUGULAR (IJ)

- Needle inserted at junction of sternal and clavicular heads of sternocleidomastoid (SCM)
- 30- to 45-degree angle to skin
- Direct to ipsilateral nipple



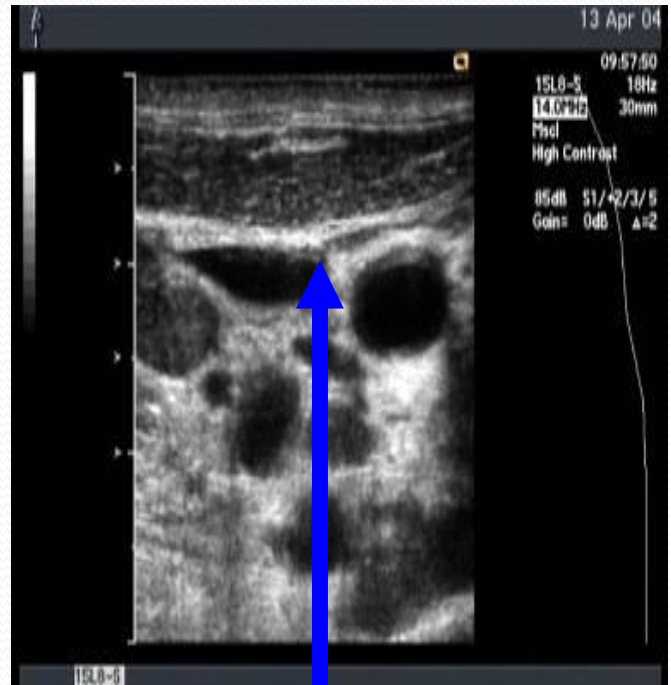
# USE ULTRASOUND GUIDANCE FOR IJs

- Improves reliability and decreases complications
- *Standard of care*
- TIPS:
  - When the vessels are visualized, the artery will be pulsating and the vein will not. When pressing the site with the probe, the vein will be compressed and the artery will not (typically).



Carotid Artery

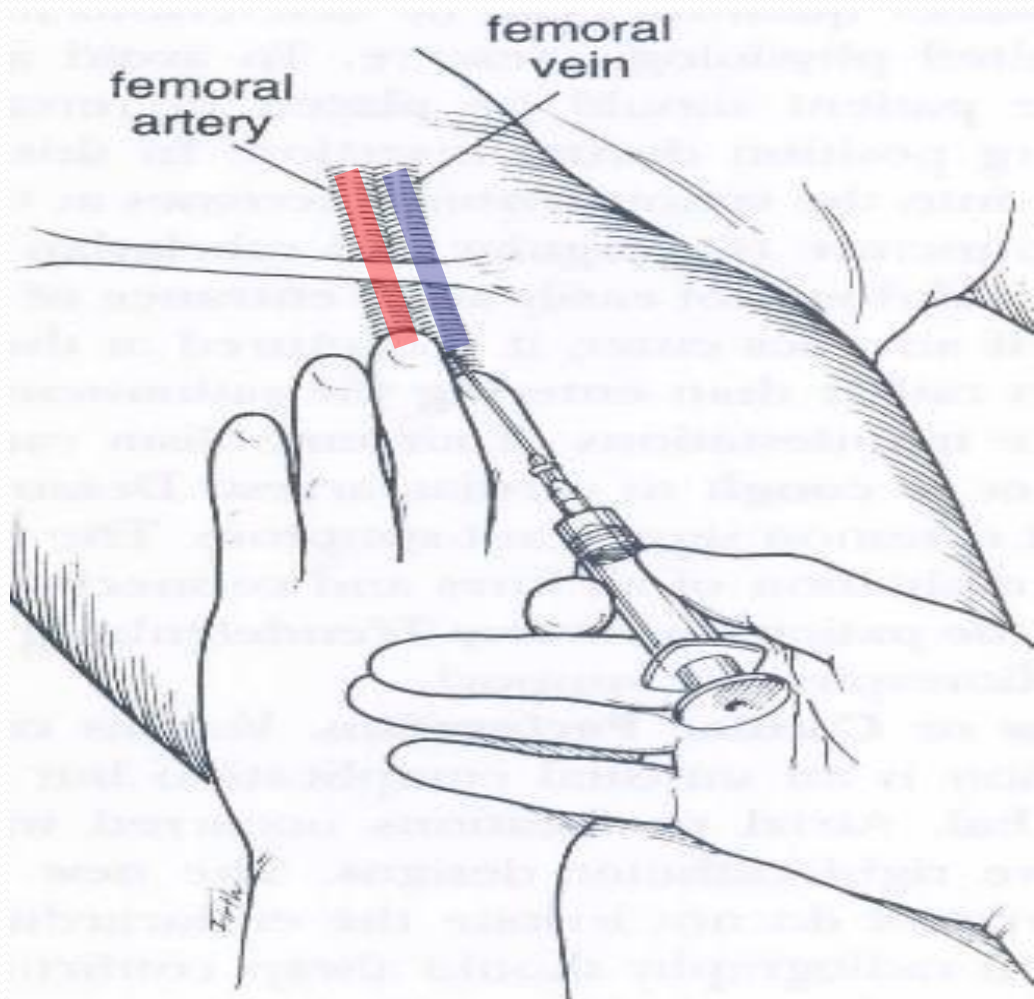
Internal Jugular Vein



Vein compressed by probe

# USE LANDMARKS FOR ACCESS: FEMORAL

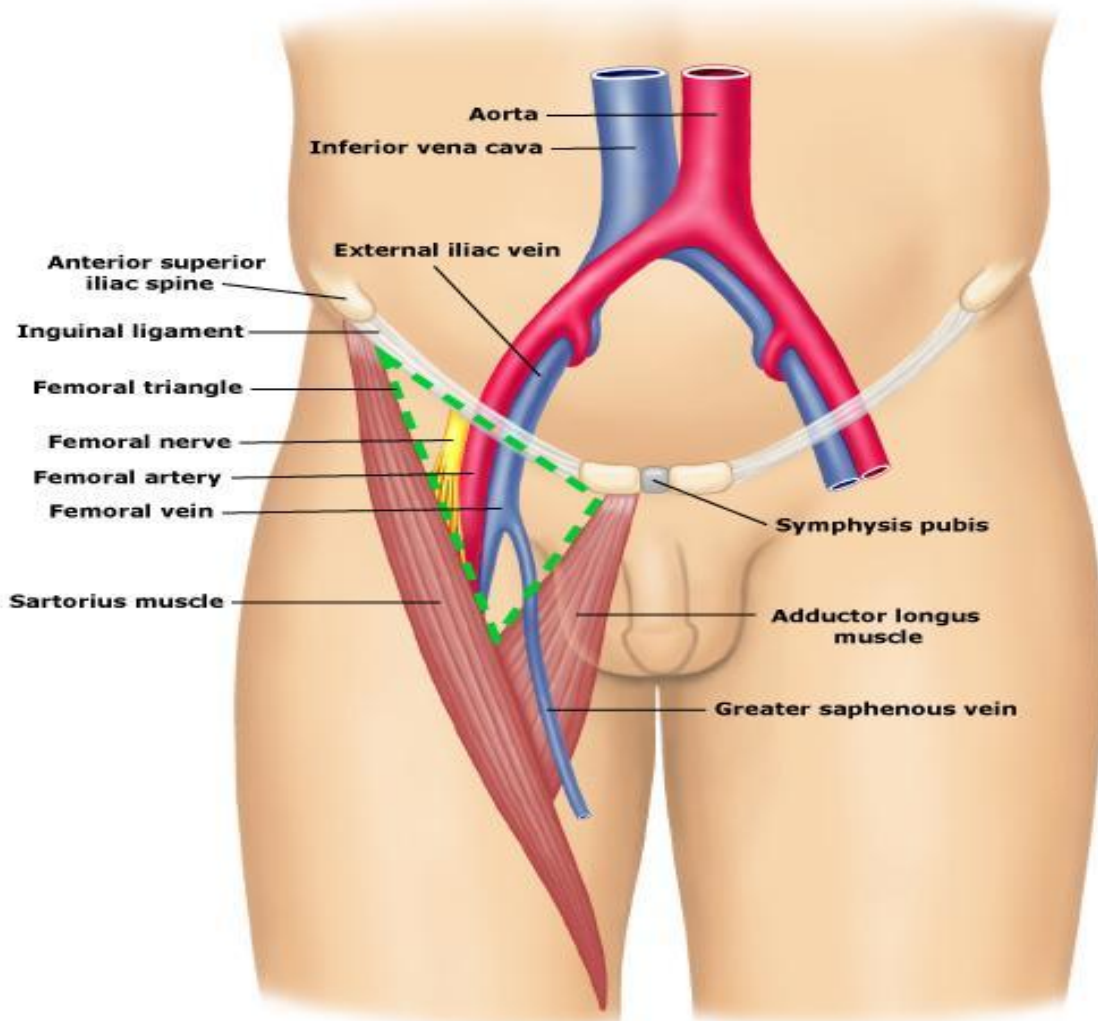
- Supine, thigh abducted
- Palpate pulse of artery
- Needle inserted medial to pulsation
- Direct toward umbilicus at 30-45 degree angle to skin





# USE LANDMARKS FOR ACCESS: FEMORAL

- Mark anterior superior iliac spine (ASIS) and pubic tubercle
- Halfway between are vessels





# CHECK BLOOD RETURN

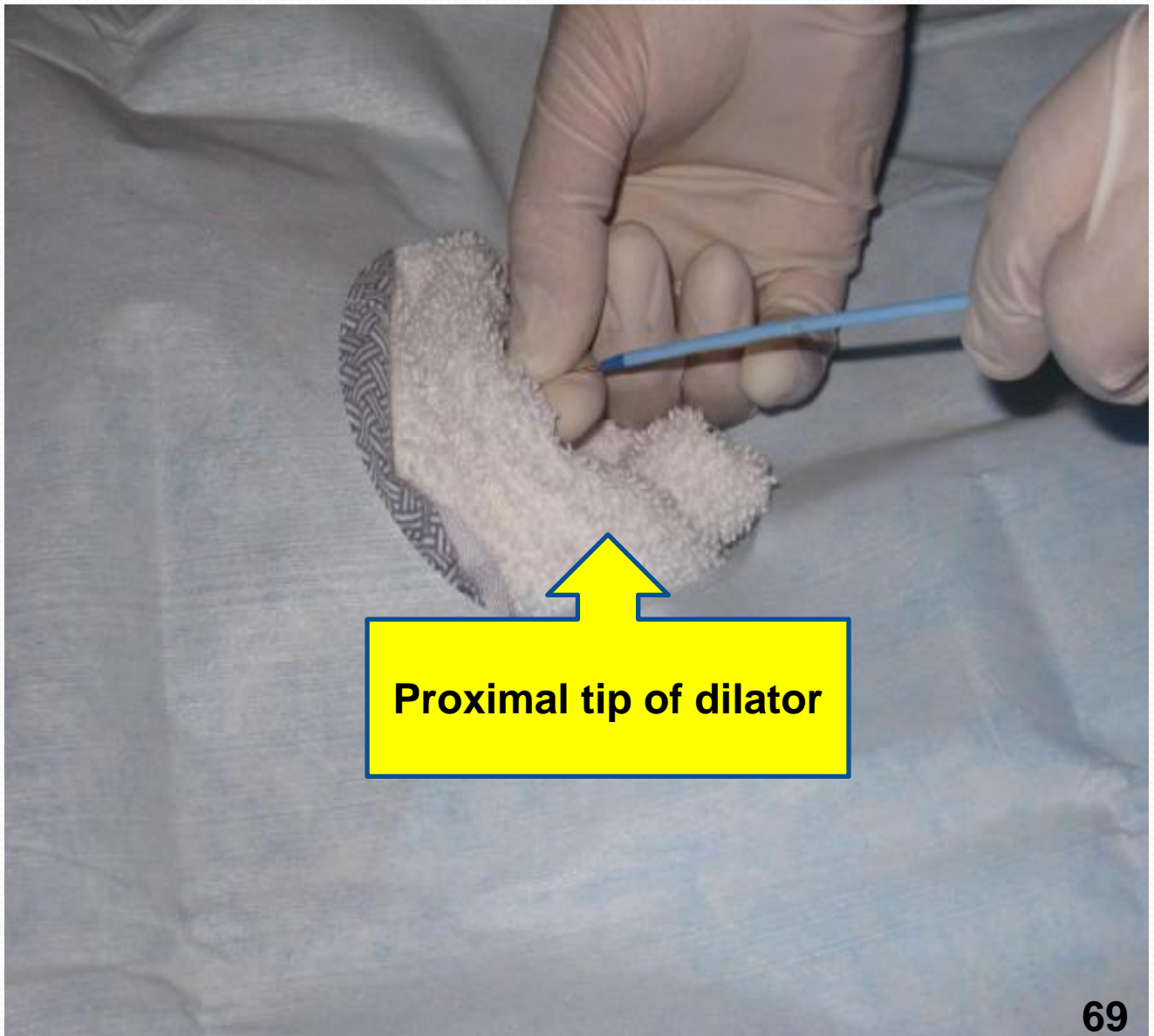
- With good blood return achieved, thread 10 cm of guidewire through the needle and remove needle



- “Stab” skin with scalpel  
TIP: rest the dull side of the scalpel against the wire and the sharp point to the skin. Slightly stab an opening just enough for the dilator.

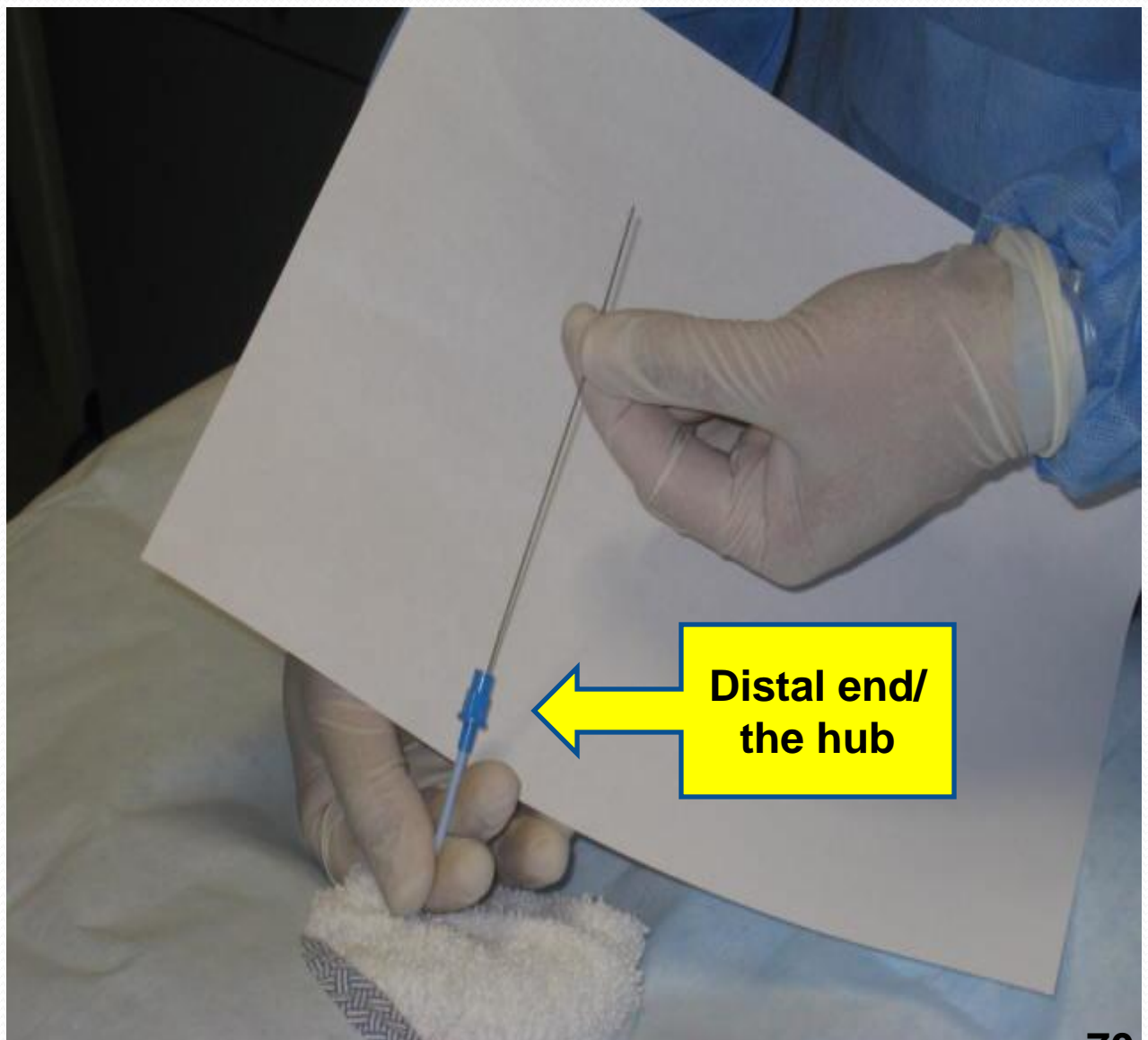
# HOLD GUIDEWIRE WHILE INSERTING DILATOR

- May need to retract guidewire until visible at distal end of dilator



# HOLD THE GUIDEWIRE WHILE INSERTING THE DILATOR

- No need to advance to hub
- **NOTE:** the dilator dilates the skin not the vein!



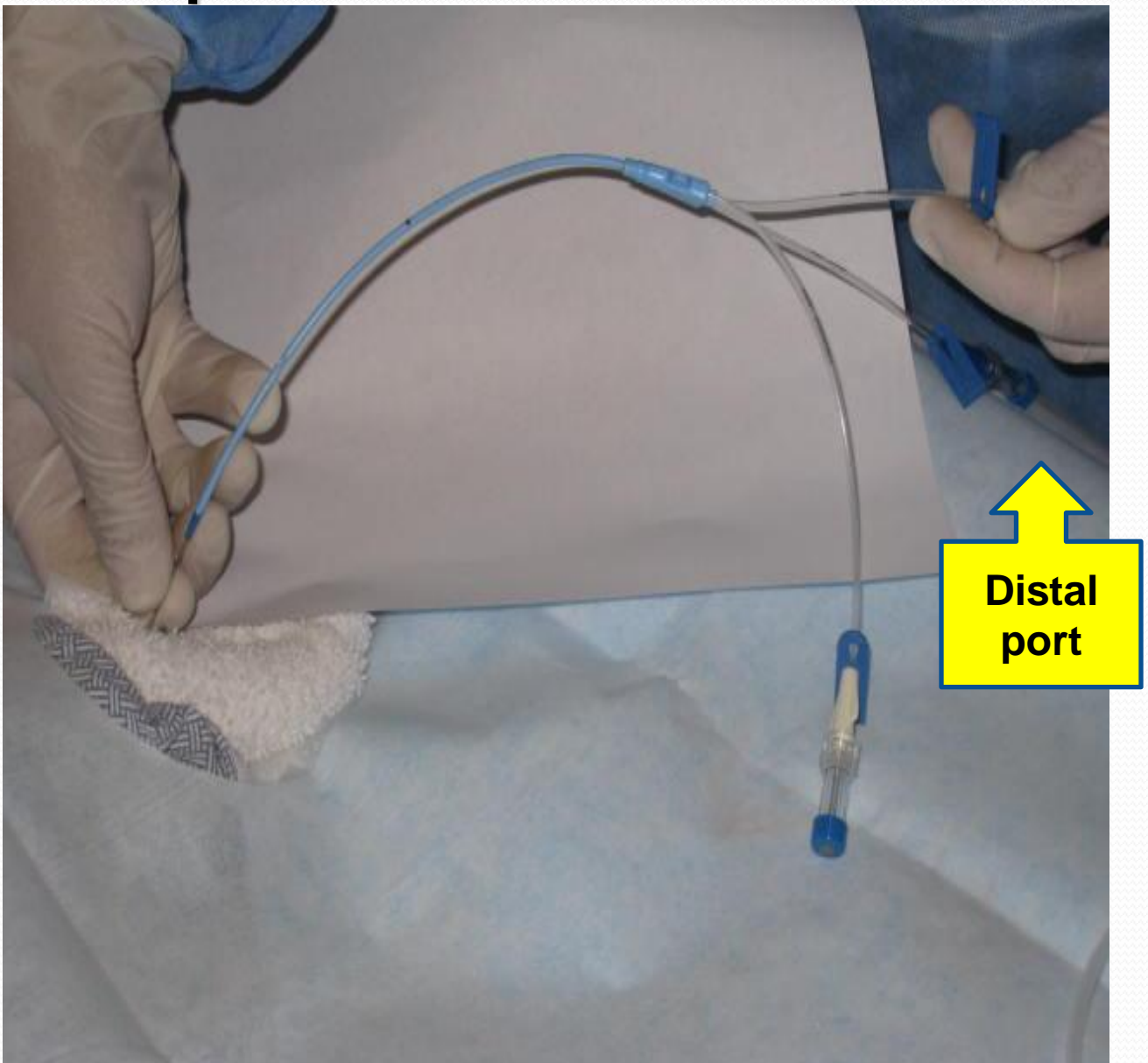
# MAINTAIN HOLD OF THE GUIDEWIRE WHILE REMOVING THE DILATOR





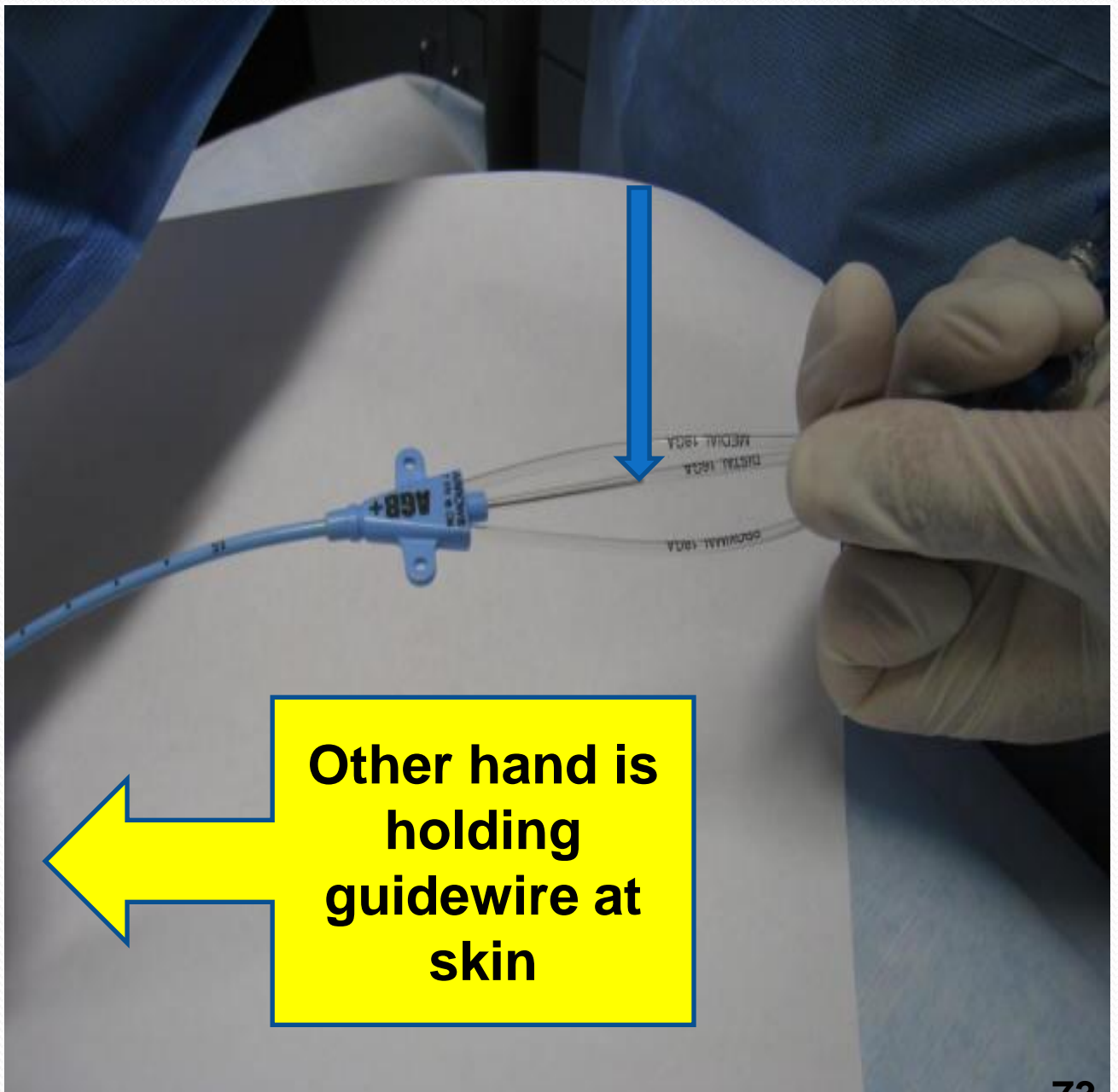
# THREAD CATHETER INTO THE GUIDEWIRE

**ATTENTION:** Hold the guidewire while retracting the wire from the patient. Wait for the wire to exit from the distal port.





# TIP: Guidewire about to exit- Do NOT advance catheter yet!



# What is wrong with this picture?

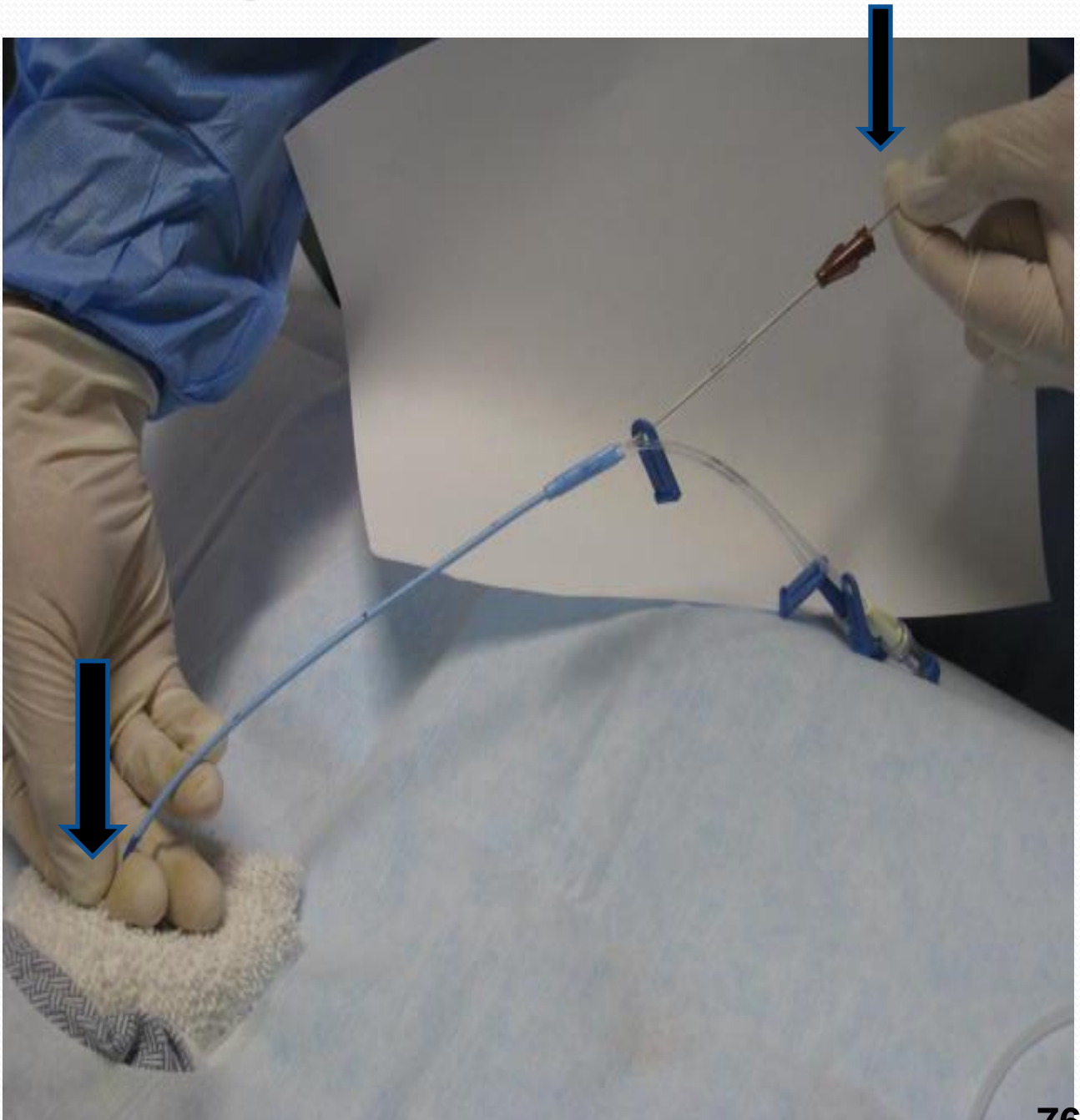


**The inserter lost control of the guidewire!**

# CHANGE HOLD TO WIRE AT DISTAL PORT

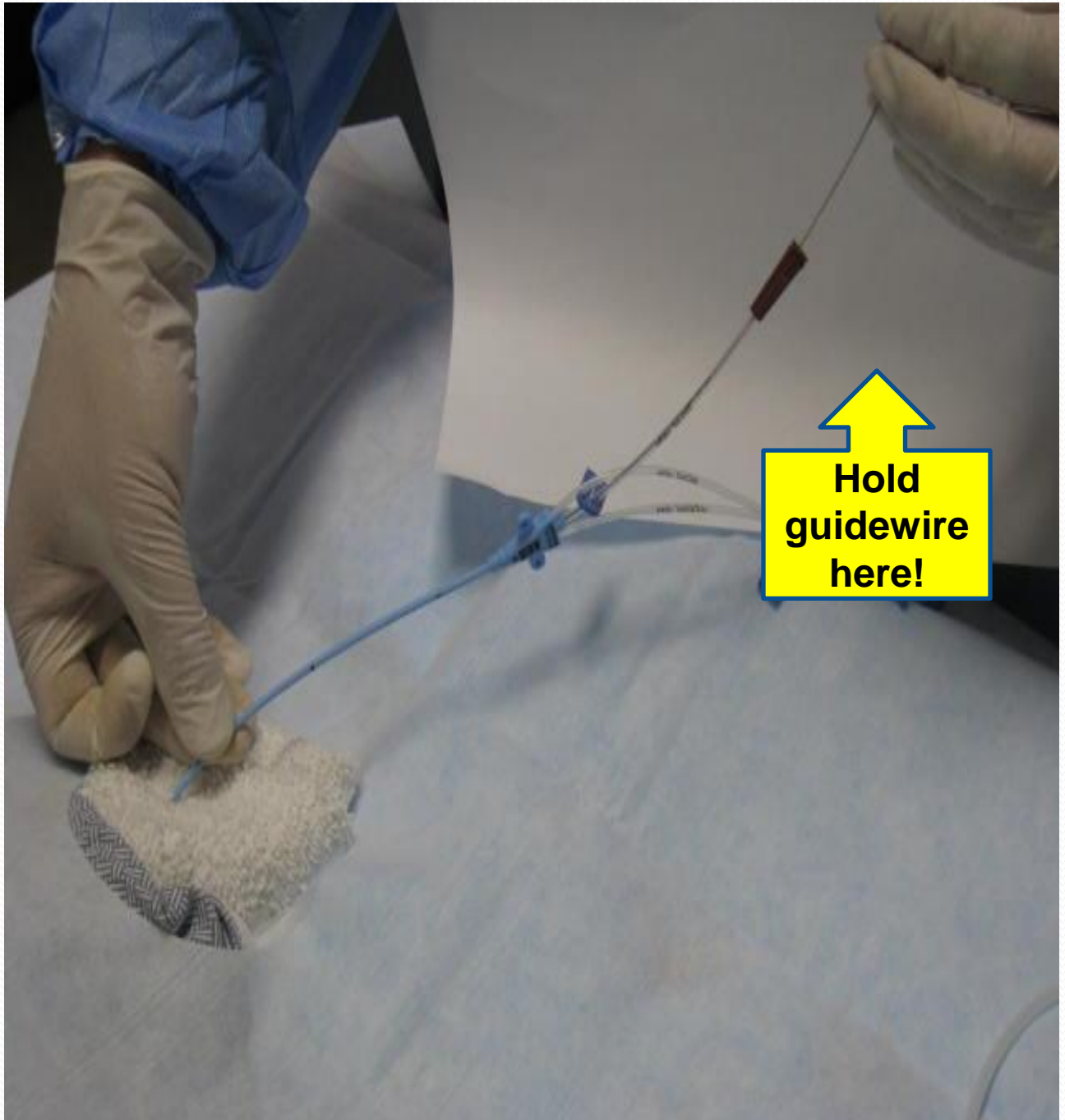


**Now can let go of guidewire at skin and advance catheter while holding guidewire at distal port.**





# GUIDE CATHETER IN AT SKIN WHILE HOLDING GUIDEWIRE AS IT EXITS





# Key point: Guidewire should move freely



**DO NOT LET GO OF THE WIRE!**  
**Remove wire when catheter is fully**  
**inserted, THEN cap port**



**Documentation of procedure should note that the guidewire was removed.**



# CHECK FOR BLOOD RETURN

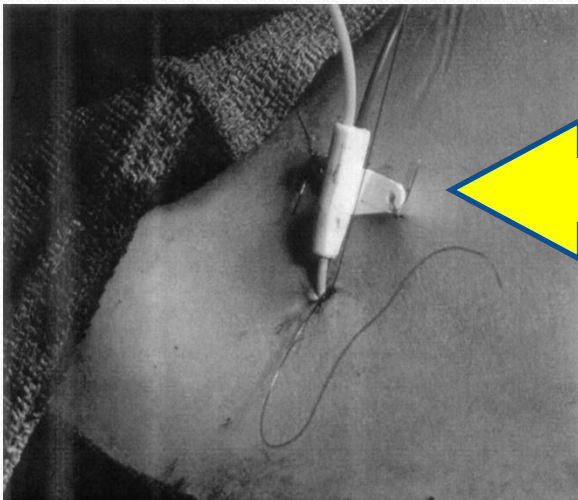
- Aspirate each lumen – Evaluate flow (should be non-pulsatile) and flush with saline





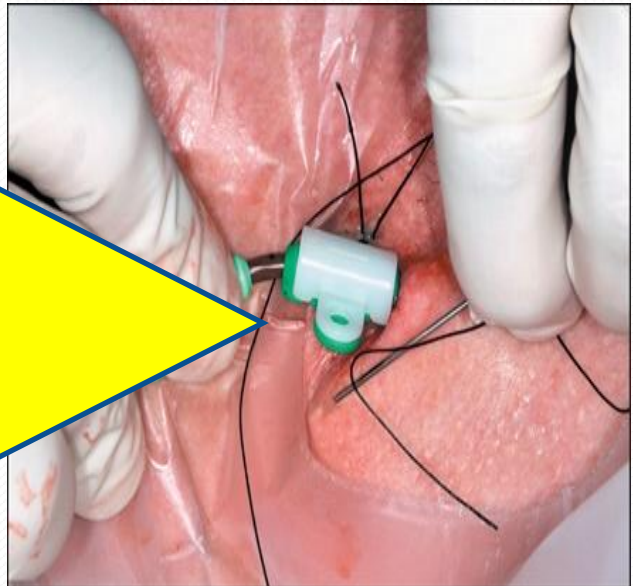
# SECURE THE CATHETER IN PLACE

- USE NON-ABSORBABLE SUTURE



**ALWAYS  
Suture the  
wings**

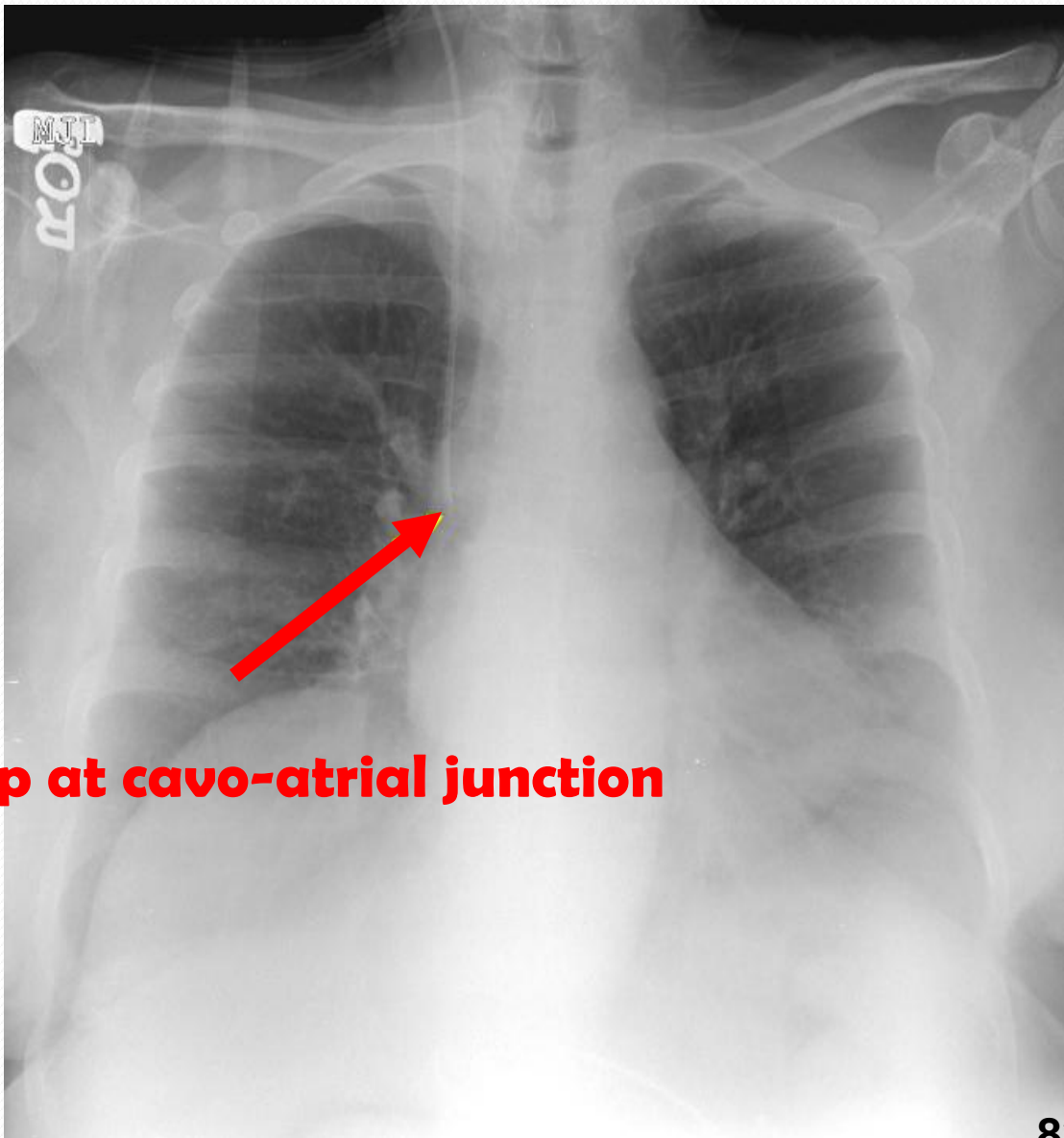
Even if using a  
Spacer (catheter  
clamp)  
The wings must  
be sutured **First**.  
**TIP: suturing  
ONLY the spacer  
is not advisable  
as the catheter  
can slip out.**





# OBTAIN RADIOLOGIC CONFIRMATION

- Check apices and sulci for pneumothorax
- Recommendation: unless emergent, wait x-ray before infusing fluids in central line. Pressure monitoring may be safely obtained.



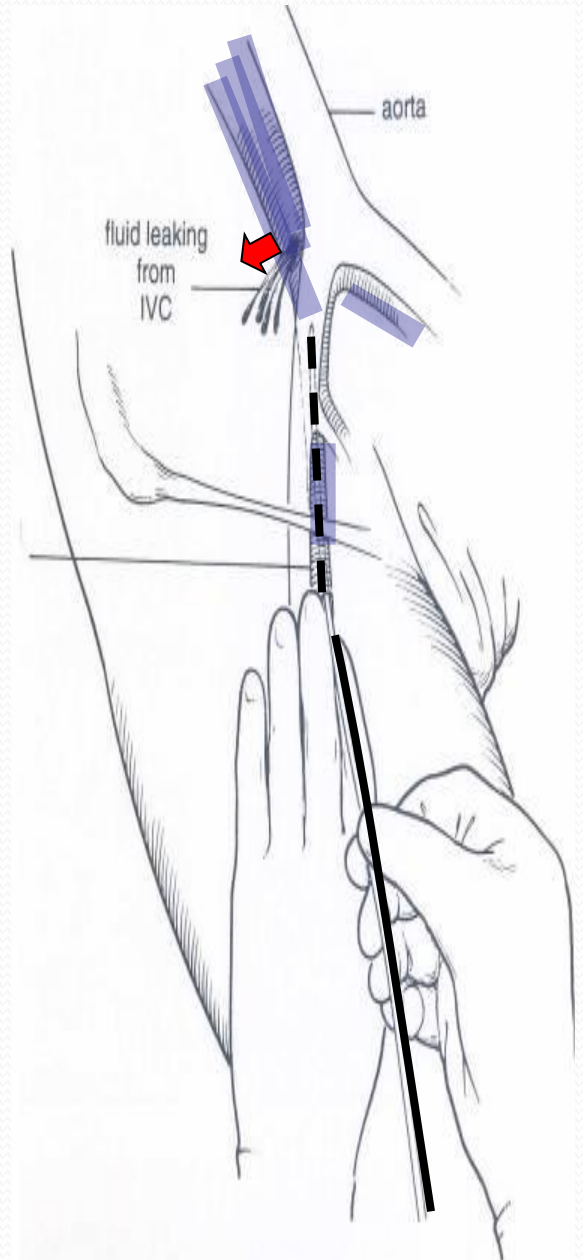
**Tip at cavo-atrial junction**

# **COMMON MISTAKES**

- **Multiple Attempts at Same Site**
  - **Site should be changed / more senior help sought**
  - **Risk of injury increases with multiple attempts**
  - **Resultant hematoma compresses vein & makes insertion more difficult**
- **Reluctance to Use Upper Veins Because of C-Collar**
  - **Sand-bags, pharmaceutical paralysis, forehead taping, and manual stabilization free upper torso neck area**

# COMMON MISTAKES-

- Use of a site distal to an injury
- Fluid may extravasate through injury proximal to site
- Subclavian- upper presternal penetrating injury
- Femoral- severe pelvic fractures / suspected IVC injury



# COMMON MISTAKES

- **Pushing Guidewire / Dilator against Resistance**
  - Insertion should be *smooth!*
  - Resistance = false passage
  - Withdraw and repeat
- **Pulling Guidewire / Catheter against Resistance**
  - Entangled by another IV device or knotted
  - Do not withdraw forcefully
  - Stop and obtain CXR
  - Surgery may be necessary

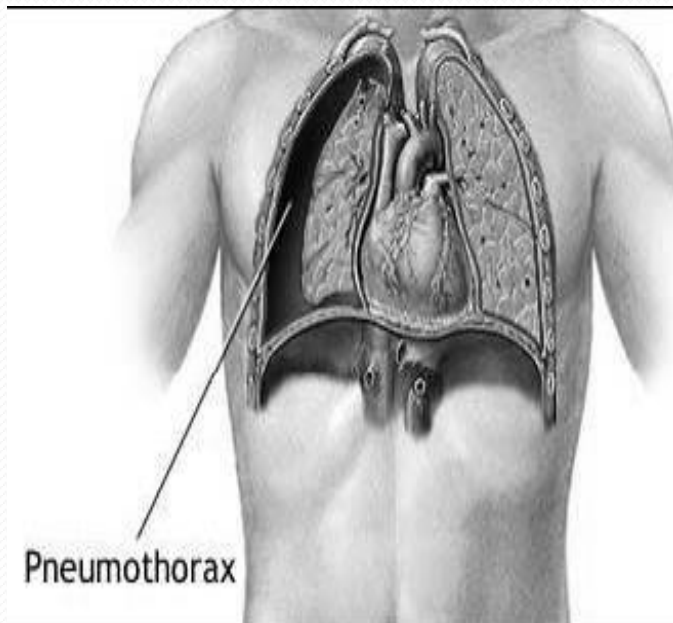
# COMPLICATIONS- PNEUMOTHORAX AND HEMOTHORAX

2% - 10% (subclavian vein)

1 % - 2% (internal jugular vein)

Associated with:

- Multiple attempts
- Overdistended lungs
- Anatomic variants
- Inexperience





# **COMPLICATIONS- PNEUMOTHORAX AND HEMOTHORAX**

- **Keep needle in immediate contact with lower border of clavicle**
- **US guidance**
- **Auscultation & CXR p placement**
- **Chest tube for PTX >20% or any size in pts on positive pressure ventilation**
- **<20% can be managed without a chest tube with close surveillance**

# COMPLICATIONS- INADVERTENT ARTERIAL PUNCTURE

- **Pulsatile bright red blood may be an indicator but is not reliable**
  - Volume overloaded patients on 100% oxygen may have pulsatile venous blood
- **May happen during emergency insertions.**
  - Hypotensive/hypoxemic patients may have minimally pulsatile, dark arterial blood
  - Recommendation: Start intraosseous (IO) line for emergencies instead.
  - Arterial puncture may be realized after fluid resuscitation or patient stabilizes. **ALWAYS** follow-up on emergently inserted central lines.

# **COMPLICATIONS- INADVERTENT ARTERIAL PUNCTURE**

- **Withdraw needle, digitally compress for 5 - 10 min**
  - **Not adequate for subclavian artery- bleeding usually contained by surrounding tissues**
- **Injury worsened if catheter advanced into artery**
- **Arterial dissection, intimal flap creation, or pseudoaneurysm should be excluded by duplex scanning**

# COMPLICATIONS

- **Tracheal Puncture**
  - **Characterized by aspiration of air**
  - **Withdrawal of needle- invariably of no further concern**
- **Lymphatic Drainage**
  - **Injury to the major thoracic duct during left SC or IJ catheterization**
  - **Chyle fistula, chyloma, or chylothorax**
  - **Conservative treatment with drainage, low-fat diet, or TPN**

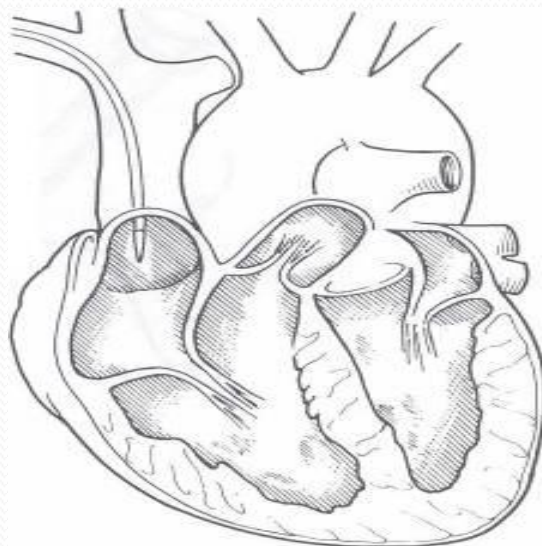
# **COMPLICATIONS— AIR EMBOLISM**

- **Potentially lethal**
- **Air aspirated into venous system**
- **Disconnected line / unsealed ports**
- **Hypotensive patients at risk**
- **Caused by approx 100 mL of air**
- **Reverse Trendelenburg- increases venous pressure at site, decreases entrance of air, captures air at apex of heart**
- **Quick eval of lines / connections, reverse Trendelenburg, cardiorespiratory support**



# **COMPLICATIONS- CARDIAC PERFORATION**

- **Can be common during over-the-wire line insertions**
- **Atrial perforations- older / rigid catheter designs**
- **New catheters are softer- do not irritate endocardium**
- **CXR- tip of catheter should be at / above SVC-atrial junction**
- **Signs of tamponade**
- **Emergent surgical intervention**

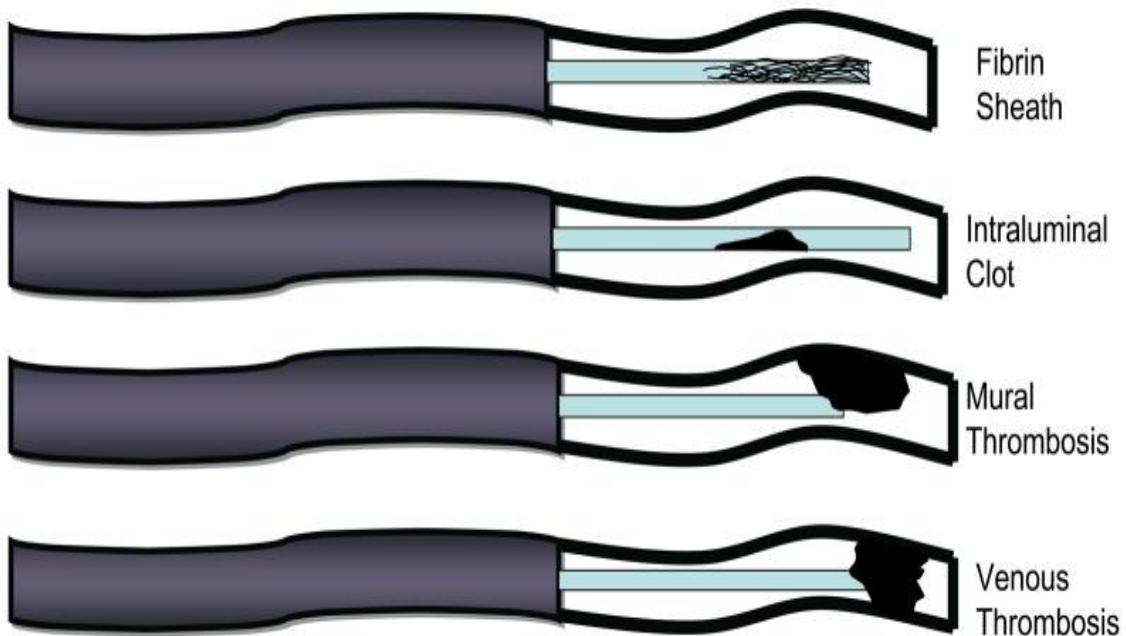


# COMPLICATIONS

- **Cardiac Arrhythmias**
  - **Guidewire / catheter irritates endocardium**
  - **Usually self-limited on withdrawal**
  - **Infrequently requires anti-arrhythmic meds**
  - **Guidewire should not be inserted >20 cm**

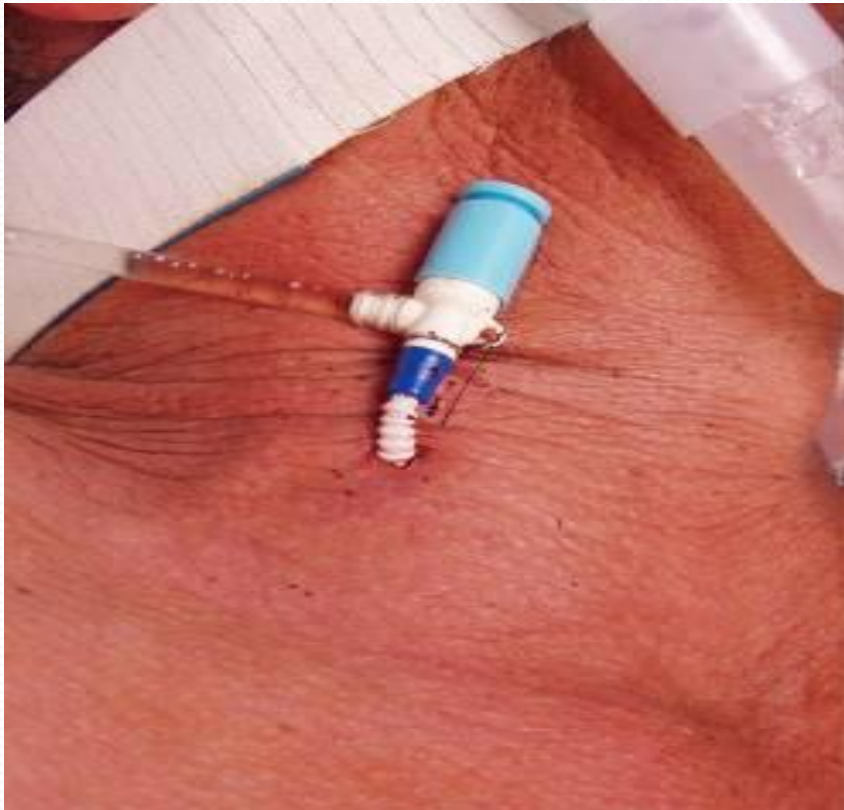
# COMPLICATIONS

- **Catheter-Related Venous Thrombosis**
  - Incidence unknown- up to 40% depending on site, duration, technique, infusate, condition of pt
  - % progressing to complete venous obstruction or PE is unknown
  - Duplex screening for subpopulations at risk
  - Catheter-related VTE common in femoral site



# CATHETER-RELATED BLOODSTREAM INFECTIONS

- See previous section of the module



# DOCUMENT PROCEDURE!

COUNTY OF LOS ANGELES

HARBOR - UCLA MEDICAL CENTER

DEPARTMENT OF HEALTH SERVICES

## CENTRAL LINE CHECKLIST

(to be verified and completed by bedside RN during the procedure; RN may stop the procedure to correct missing elements below)

- Time out Performed:  Correct  Patient  Site  Procedure
- Education provided for:  Patient  Family  N/A
- Chlorhexidine prep (not Betadine)  Femoral line placed only if subclavian
- Hand hygiene performed by all providers  Mask  Sterile Gloves
- Sterile Gown  Trendelenburg Position for IJ/Subclavian (unless medically contraindicated)
- Some or all of above procedures not followed due to true emergency (e.g.: cardiac arrest)
- Explain any missing elements above / Actions taken \_\_\_\_\_

RN Printed Last Name: \_\_\_\_\_

RN Signature: \_\_\_\_\_ ID#: \_\_\_\_\_

Date: \_\_\_\_ - \_\_\_\_ - \_\_\_\_ Time: \_\_\_\_ : \_\_\_\_

## PROCEDURE NOTE (Provider to complete)

- Procedure:**  Central Venous/Hemodialysis Catheter  PA Catheter
- Indication:**  Venous/Dialysis Access  Hemodynamic Monitoring
- TPN  Other: \_\_\_\_\_

## PRE-PROCEDURE

- Informed Consent:**  Patient/Representative signature  Provider signature
- Emergency Consent Exception (explain below)
- Skin Condition:**  Clean/Uninfected/New  Site Clean/Uninfected
- Emergency Placement/Suboptimal Antisepsis
- Skin Prep & Patient Draped:**  Chlorhexidine (preferred)
- Skin preparation dry prior to puncture  Antibiotic Ointment
- Topical/Local Anesthetic:**  1% Lidocaine  Other: \_\_\_\_\_

## DESCRIPTION

Date of Insertion: \_\_\_\_\_ Time: \_\_\_\_\_ Lo \_\_\_\_\_

**Technique:**  Seldinger  Over-guidewire Excise

**Patient Position:**  Supine  Trendelenburg

**Insertion Site:**  Left  Right Vein:  Internal jugular

**Equipment:**  Ultrasound used:  Yes  No

**Catheter:**  Central

**# of Lumen:**  Triple

Name= \_\_\_\_\_ DOB= \_\_\_\_\_ Age= \_\_\_\_\_ MRUN= \_\_\_\_\_ Sex=M Acct #= \_\_\_\_\_

**FINAL REPORT**

**CENTRAL LINE PROC NOTE**

Procedure: Central Line (Note: Evaluate catheter daily and remove all non-essential lines)

Procedure Date: 06/26/11 23:15

Procedure Time: [ ] AM [ ] PM

Attending/Senior physician: \_\_\_\_\_

[x] Reviewed relevant labs and anticoagulation medications and status

[ ] Informed consent obtained

[x] Time Out conducted prior to procedure. Verified patient, procedure, site and equipment/supplies needed.

[x] Hand hygiene performed

[x] Procedure site marked (or alternative method used to identify site if patient refused marking, or for cases in which it is technically or anatomically impossible or impractical to mark the site, or for pre-mature infants)

[ ] Procedure sedation used

Procedure or sedation complications/issues:

[x] No

[ ] Yes (specify below)

[ ] Transfer to higher level of care

[ ] Unexpected or prolonged increase in O2 requirement

[ ] Reversal agent used

[ ] Significant alteration in hemodynamic stability and/or parameters

[ ] Unable to complete procedure as planned due to:

[ ] Procedure-specific complication, Describe:

[ ] Other: \_\_\_\_\_

**OVMC**

Demand Copy



# MEDICO-LEGAL ISSUES

- **Consider:**
  - use antibiotic / antiseptic-coated catheter when long-term central line anticipated
  - ALWAYS use chlorhexidine skin prep
  - apply full-barrier precautions
  - use a PICC line for anticipated long-term need
  - *Staph epi* in the presence of a central line may be a pathogen
  - echocardiogram when pt fails to improve with Abx
- **DHS CASES!**
  - Failure to remove guidewire
  - Pneumothorax (during insertion)
  - Broken PICC
  - Failure to document aspiration of blood in ALL lumens
  - Others



# **DISCONTINUATION OF A CENTRAL LINE: A REVIEW**

# PREPARE!

- **Check for patients lab to determine patient's clotting or bleeding times.**
  - If anticipate bleeding, may bring a stool to sit on while applying pressure
- **Explain procedure to patient in a language and manner that they can understand.**
- **TIPS:**
  - Use interpreters as appropriate
  - Provide educational materials as appropriate
- **Position the patient in trendelenburg**
- **Prepare supplies**
  - **NON STERILE:** Clean gloves for old dressing removal and another clean gloves for catheter removal
  - **STERILE:** Sterile dressings, Chlorhexidine antiseptic, Scissors

# REMOVE OLD DRESSING

- **WEAR CLEAN GLOVES**
- **Remove old dressing, discard dressing and gloves.**

# CLEAN SITE

- **Open sterile supplies. Wear gloves.**
- **Cleanse site with 2% chlorhexidine**
- **Remove any sutures. Use scissors (carefully) as appropriate**

# FOR IJ OR SUBCLAVIAN VENOUS CATHETERS:

- **Ask patient to take a deep breath and hold it.**
  - **Patient can also hum, exhale or do valsalva at the time of line removal.**
- **Gently withdraw catheter while applying direct pressure with the sterile gauze.**
- **Tell the patient to breathe normally after the catheter is removed.**

# FOR MECHANICALLY VENTILATED PATIENTS:

- **Pull the catheter at end-inspiration.**



# APPLY PRESSURE

- **Apply direct, manual pressure for a minimum of 5 minutes.**
- **If oozing continues, compress for 5 more minutes before checking again. Hold direct pressure for a minimum of 5 minutes after evidence of bleeding has stopped.**
- **For femorals, a C-clamp may be used**
- **If the patient is not on heparin and noted continued oozing in the site, consider quick clot/surgicel/thrombin if available**

# APPLY OCCLUSIVE DRESSING

- **DO NOT** apply a bulky pressure dressing as it provides inadequate pressure. Cessation of bleeding requires direct pressure.
- **AN OCCLUSIVE DRESSING MUST BE USED TO MINIMIZE THE RISK OF AIR EMBOLISM (“AIR OCCLUSIVE”).**

## INSPECT CATHETER

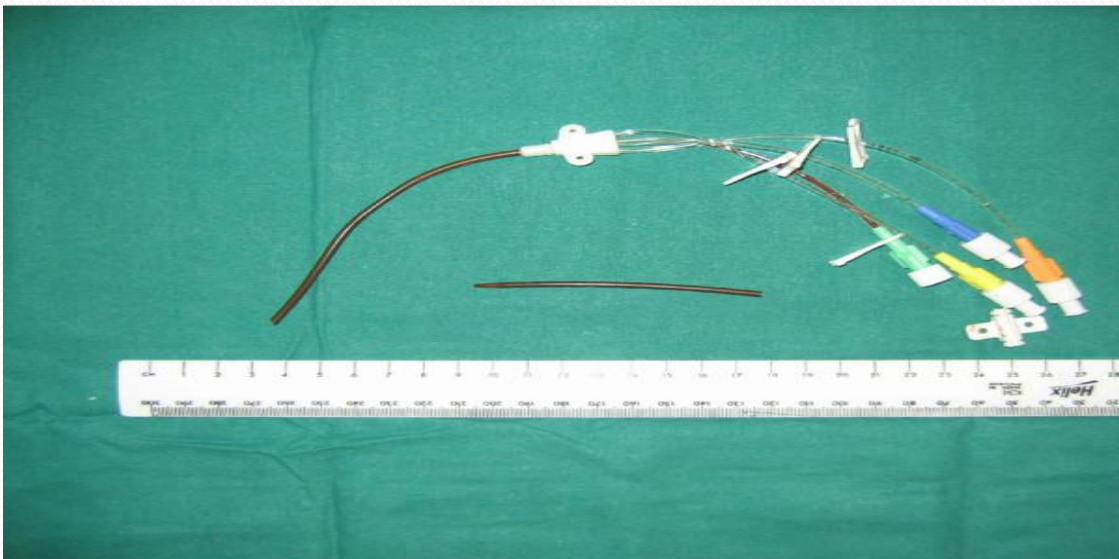
- **Inspect catheter for clots.**



- **Inspect the integrity of the catheter**

# IN THE EVENT OF CATHETER FRACTURE:

- Apply direct pressure over the site
- Position patient in trendelenberg position left side down. Might trap the embolus in the right ventricle and prevent migration to the lung.
- If the catheter fragment is palpable, apply additional pressure distal to the catheter to prevent migration.



# SUSPECTED AIR EMBOLISM

- **Turn patient left side down, trendelenberg position (head down)**
- **If possible, ask patient to perform valsalva maneuver**
- **Administer 100% oxygen**
- **If the patient has a right atrial or pulmonary artery catheter, attempt to aspirate air**
  
- **THE END**

**SELF-ASSESSMENT POSTTEST FOR FELLOWS/RESIDENT PHYSICIANS**

1. A decision was made to insert a subclavian central line on a 45 year old male patient with diabetic ketoacidosis (DKA) and cellulitis of the leg. After obtaining informed consent , which of the following steps would **NOT** be helpful:
  - a. Review platelets, PT, PTT and INR, and medications to better determine coagulation status of the patient.
  - b. Clean the area where the line will be placed prior to skin preparation with antiseptic
  - c. Bring the central line cart to the bedside
  - d. Ensure a urinary catheter is present
  
2. During the insertion of a central line, the Attending/supervising physician comes to the bedside, unmasked, leans over the sterile field, and offers some tips as to how best to insert a subclavian catheter. The appropriate next step is to:
  - a. Not worry about the sterile field as sub-clavian lines are less likely to get infected.
  - b. Be glad that an antiseptic coated central line is being utilized.
  - c. Request a new set up from nursing, and remind the Attending/supervising physician to don a mask and cap.
  - d. Say or do nothing!
  
3. An internal jugular central line is being placed on an 84 year old patient with poor peripheral access. After guiding the catheter over the wire, the guidewire was removed. In normal circumstance, the next **BEST** step would be:
  - a. Temporarily tape the catheter until placement is confirmed radiologically
  - b. Arrange assessment by interventional radiology
  - c. Check for the jugular pulse to see if it is still present
  - d. Aspirate blood from all lumens, evaluate the flow and then flush the ports with sterile saline filled syringe
  
4. In addition to ruling out a pneumothorax on a post-procedure chest x-ray, proper insertion must be checked by:
  - a. Ensuring the distal tip is in the right atrium to allow for good mixing and dilution of medications
  - b. Ensuring the distal tip is in the right atrium to allow for better venous return when obtaining blood samples
  - c. Ensure the distal tip is above the right atrium to avoid a cardiac perforation.
  - d. The proximal tip is in the right atrium



5. A patient had a central line placed in the right internal jugular vein three (3) days ago. To be compliant with State Legislative requirement, which of the following must be documented DAILY in the physicians note? (Hint: all documentation options below are recommended.)
- Central line in RIJ(right internal jugular) day 3
  - RIJ in good position on today's chest x-ray
  - Central line site and dressing clean dry and intact
  - Central line is still necessary
6. After a central line is placed, security of the line can **BEST** be achieved by:
- Suturing the "spacer" comes in the kit
  - Suturing the catheter "wings" or stat lock provided
  - Taping the line in place
  - Suturing the catheter itself
7. A patient is ready to be transferred to the ward. The nurse has placed peripheral IV's and a decision is made to discontinue right internal jugular line. In order to safely remove the line, the following must be undertaken **EXCEPT**:
- Wear non-sterile gloves
  - Carefully cut the suture
  - Place the patient in slight trendelenberg, and ask patient to exhale or hum during the pull
  - Immediately place a non-occlusive dressing
8. After insertion of a central line, the following must be performed to decrease the risk of CLABSI (central line associated blood stream infection):
- Place antibiotic gel on the entry site.
  - Place a biopatch™ (chlorhexidine impregnated patch) around the catheter entry site, prior to dressing it
  - Use non sterile gloves and a mask for dressing changes
  - Leave the central line a maximum of 7 days
9. A patient with a central line for 4 days has a fever and white count elevation. A fever work up is done. The urine contains gram negative rods and the blood cultures grow *staph epidermidis* in 4/4 bottles. The conclusion/decision would be:
- The fever is from the gram negative rods, as *staph epidermidis* is a contaminant
  - The central line is not infected as it was only in 4 days when the patient showed signs of infection.
  - The line can be exchanged over a wire
  - The line is infected and should be removed
10. Which of the following describes maximal sterile barrier?
- Wearing a mask and sterile drape
  - Wearing a sterile gown, sterile cap and sterile drape
  - Wearing sterile gloves and large drape
  - Wearing a mask, cap, sterile gown, sterile gloves, draping the patient

**ANSWER SHEET**

Name: \_\_\_\_\_ Facility: \_\_\_\_\_

Question #	ANSWERS
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Correct your answers. You may find the correct answers on page 33