

Patient Safety & Quality of Care: Central Venous Catheter Insertion Practice

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Original June 2008; Updated April 2014

Document prepared by Desmond Chao
UCSFMC Learning Services, date 12/15/14

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Physician Patient Safety & Quality of Care: Central Venous Catheter Insertion Practice

Central venous catheters (CVCs) are used commonly in a variety of inpatient and outpatient healthcare settings. Their use is associated with significant risk of adverse events during insertion, while in place, and upon removal. Procedures involving the insertion, maintenance and removal of central venous catheters that follow best practice guidelines are known to reduce complications and may subsequently affect the morbidity and mortality of patients for whom central lines are necessary.

This course will offer guidelines for central line insertion and removal best practices while consistently maintaining the highest levels of attention to patient safety.

As part of UCSF's medical community, you play a vital role in helping us maintain our commitment to excellent patient care and patient safety. It is your attention to detail and commitment to best practices that makes UCSF Medical Center one of the top hospitals in the nation.

Thank you for your cooperation and participation in completing this course.

What this course covers

This course will cover the following topics:

- Indications and contraindications for CVC insertion
- Preventing infections
- Preparing for the procedure
- Inserting a CVC (internal jugular vein, right side)
- Follow-up care
- Documentation
- Removing a CVC

By the end of the course, you will be able to:

- Identify indications and contraindications for central line insertion
- Demonstrate familiarity with CVC best practice guidelines for pre-procedure infection prevention
- List the steps for safe central line insertion and removal
- Identify the most common complications of central line placement and ways to prevent these complications
- Demonstrate familiarity with most aspects of central line placement, including follow-up care and documentation

Course Terminology



There are many terms used to refer to a central venous catheter, including “central line” and “central venous line.” Throughout this course, we will simply use the acronym **CVC**, which stands for *Central Venous Catheter*.

Please note that this course focuses on temporary internal jugular, subclavian, and femoral central venous catheters. Other types of central lines such as chest ports, tunneled catheters, PICC lines and hemodialysis catheters are also central venous catheters, but will not be specifically covered in this course.

Indications and Contraindications for CVC Insertion

Indications

- Hemodynamic monitoring
- Poor peripheral venous access
- Large bore access
- Infusion of caustic medications
- Hemodialysis/Plasmapheresis

Contraindications

- Infection overlying site
- Abnormal anatomy
- Coagulopathy (moderate/severe)
- Thrombosis at site
- AV fistula/graft on ipsilateral side (subclavian)
- Operator inexperience

Preventing Infections

Statistics

Central Venous Catheters are increasingly being used in both the inpatient and outpatient settings to provide long-term venous access. However, these catheters disrupt the integrity of the skin, making infection possible. Preventing central line associated blood stream infection (CLABSI) is important because if the infection spreads to the bloodstream, complications may result in prolonged hospitalization or even death.

The US statistics indicate:

- 5.3 per 1000 CVC-days, average CLABSI rate
- 15 million CVC- days/yr in ICUs
- 80,000 CLABSIs nationally per year
- 12-25% mortality
- \$35-56K per infection

Centers for Disease Control and Prevention. Guidelines for the Prevention of Intravascular Catheter-Related Infections. MMWR 2002; 51(No. RR-10)

Preventing Infections



The Institute for Healthcare Improvement recommends the use of a group of evidence-based interventions to reduce CLABSIs. This is referred to as the central line bundle and includes:

- Hand hygiene
- Maximal sterile barrier precautions upon insertion
- Chlorhexidine skin antisepsis
- Optimal catheter site selection with avoidance of femoral vein for central venous access in adult patients
- Daily review of necessity with prompt removal of unnecessary lines

Six tips for preventing infection

Tip #1: Maintain proper hand hygiene (use soap/water or alcohol based gel)

- Prior to evaluation of insertion site
- Clean hands with either soap & water or alcohol gel
- If hands are visibly soiled, clean with soap and water
- Prior to donning sterile gloves, clean hands with antimicrobial agent such as Bactistat AE & water, alcohol gel/foam or Surgiccept.



Tip #2: Wear maximal surgical attire including:

- Sterile gown
- Sterile gloves
- Surgical cap
- Mask and Eyewear

Assistants who help to place or are scrubbed in to prep the line tray and hand items to the person inserting the CVC should also wear maximal surgical attire.



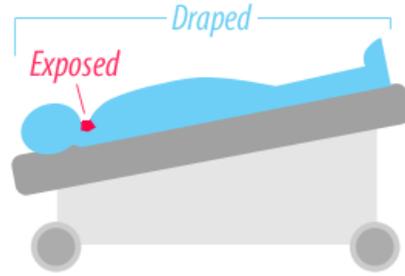
Tip #3: Prepare the skin

- Clip excess hair at the insertion site with single-patient use scissors or disposable-head surgical clippers. Do not shave.
- Prepare skin with Chlorhexidine 2% in 70% isopropyl alcohol using a back-and-forth friction scrub for at least 30 seconds. Do not wipe or blot.
- Allow solution to air dry completely before puncturing the site (minimum of 3 minutes on hairless skin). Do not wipe or blot.



Tip #4: Apply maximal sterile barrier (full-body draping) precautions during patient preparation

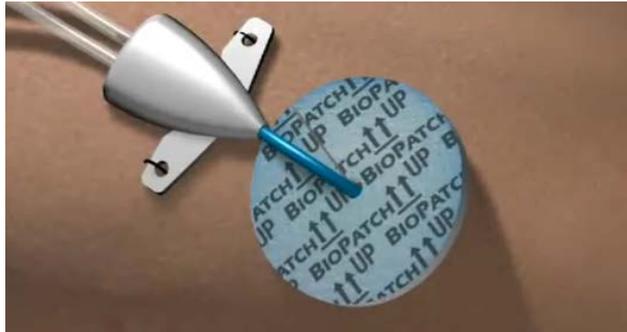
- If using furniture, hamper, or over-bed table as a work surface, clean with Sani-Cloth
- Use a sterile drape to establish the sterile field
 - Drape should be large enough to extend below the surface on which sterile supplies are placed
 - Carefully unfold the drape at table level working to each side, toward the patient's head and the feet until the drape is completely unfolded
 - It should cover the patient from head* to feet and drape down over the surface edge
- Maintain the sterility of the field
 - Do not leave the sterile field unattended
 - Avoid contact with the sterile field during movement
 - The portion of the drape below table level is considered nonsterile
 - A sterile field is contaminated whenever it is permeated
- Place fenestration over the central line insertion site



*For pediatric patients undergoing unit-based insertions the patient may wear cap and mask in lieu of drape covering the face; or cap only if respiratory status is tenuous

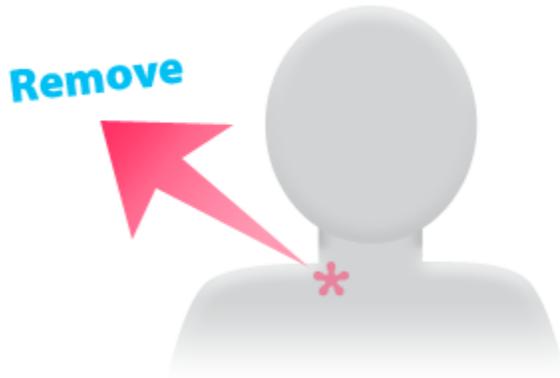
Tip #5: After insertion, dress insertion site

- Apply sterile caps (either injectable or occlusive) to all open catheter lumens.
- Clean blood from insertion site with Chlorhexidine/Isopropyl Alcohol
- Apply Biopatch (Chlorhexidine Gluconate disk) to insertion site except in the following conditions:
 - open skin around insertion site
 - oozing blood or serous fluid
 - noted sensitivity, site infection or irritation
- Apply sterile dressing



Source: BIOPATCH_Inservice_v3.wmv YouTube Video

<http://www.bing.com/videos/search?q=applying+Biopatch+to+central+line+site&FORM=VIRE1#view=detail&mid=E9A4830EC3FC96F3B1D2E9A4830EC3FC96F3B1D2>



Tip #6: Review need for catheter daily, remove when no longer indicated or necessary

Preventing Infections

Additional infection control & prevention reminders

Hand Hygiene

- Hand hygiene is the most effective method of preventing infection transmission
- Alcohol based hand gel/foam and washing with soap and water are both effective methods of hand hygiene
- Perform hand hygiene *immediately* before any patient care activities including CVC care
 - CVC insertion
 - Line access
 - Port access/de-access
 - Dressing change



Sterile/Aseptic/Clean Techniques:

Use sterile technique with:

- Surgical procedures
- CVC insertions
- Tunneled CVC removal
- CVC dressing change

For inserting CVCs wear hat, mask, and sterile gown and gloves

Use aseptic technique with:

- Injection cap change
- Tubing change
- Nontunneled CVC removal

Use clean technique with:

- Routine patient care
- Patient assessment
- Programming pumps

A “closed IV system” reduces nosocomial infection.

- CVC lumen or stopcock are capped or connected to IV tubing

Preventing Infections

Additional infection control & prevention reminders

For Pediatric Patients:

“Scrub the Hub”

Alcohol scrubbing

- With every catheter and tubing port entry
- Dedicated drying time is not necessary



Technique

Using friction, “Scrub the hub” or injection cap/port for a count of ten (“1, and 2, and 3...”) around the sides of cap and over the diaphragm. With each count, scrub alcohol to:

For Adult Patients:

- Utilize Curox port protectors on all CVC IV needleless ports and caps (i.e. Alaris tubing ports, Microclave caps) that do not have IV tubing already attached and infusing. If patient has both a central line and a peripheral line, Curox port protectors must be used on both lines.
- If Curox port protector has been attached for ≥ 3 minutes, then you do not need to scrub with an alcohol wipe before accessing.
- If Curox port protectors are not in place or asepsis is not maintained, the injection port or cap must be scrubbed with isopropyl alcohol for a count of 10 before accessing.
- Replace with new Curox port protector after each access and with each tubing or cap change.
- Note: Curox port protectors are not occlusive. Do not use as a cap directly on CVC hubs, stopcocks or open lumens of manifolds.

Curos Caps: Instructions for use

1. Peel foil tab or strip from the Curos cap.
2. Once foil is removed, push and twist the Curos onto the end of the luer-activated needleless valve.
3. The Curos must remain on the luer-activated valve for a minimum of three (3) minutes and may remain on for seven (7) days (168 hours) or the duration of the intended use.
4. A new Curos should be placed on the luer-activated valve after each use.
5. Discard the Curos after use.



Preparing for the Procedure

Site Selection Overview

Internal Jugular (IJ) is generally the preferred site for catheterization due to its:

- Compressibility
- Ease of visualization with ultrasound
- Generally lower risk of infection than the femoral site

Subclavian as an alternate site is preferred in the CDC's Guideline for Prevention of Intravascular Catheter-Related Infections, 2002, but is limited by its lack of compressibility in the event of an arterial puncture and a higher risk of pneumothorax.

Femoral lines should be avoided in adult patients due to higher risk of infection and thrombosis. They are a preferred, however, in the setting of emergent need for venous access such as cardiopulmonary arrest.

Preferred order of sites:

- 1 Internal Jugular (right side)**
- 2 Subclavian**
- 3 Femoral**



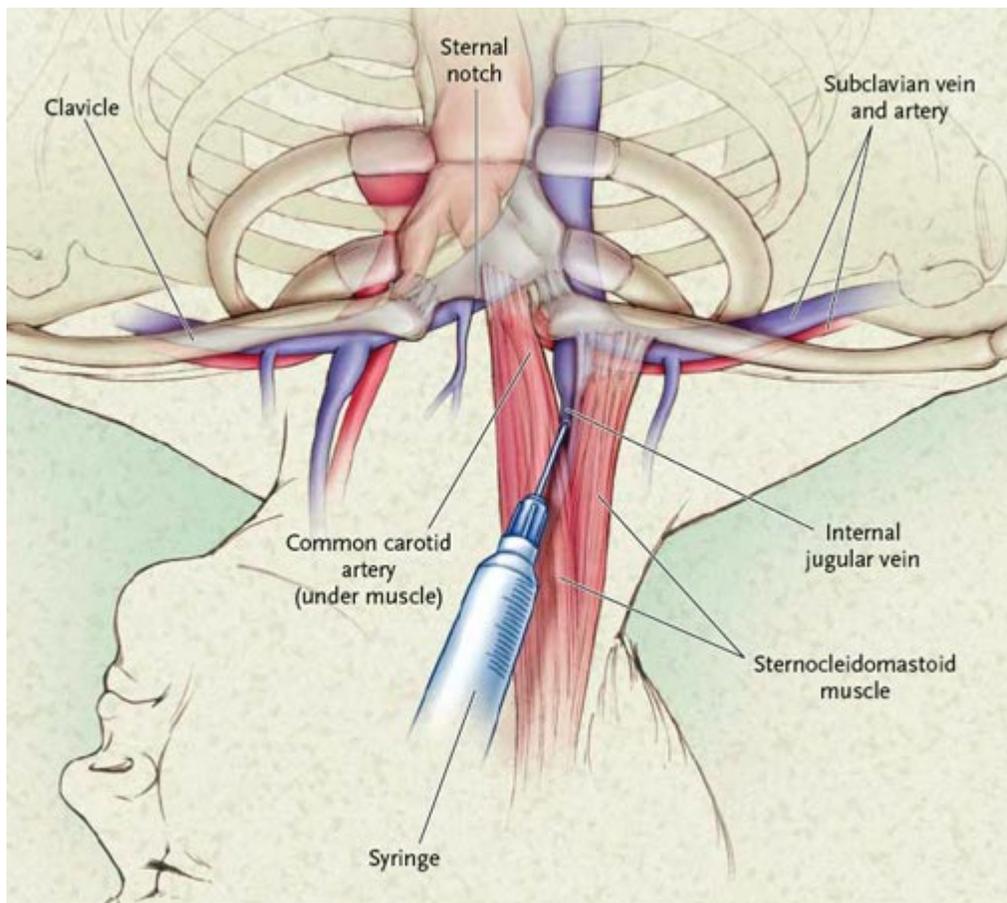
Internal Jugular Vein

✓ Pros

- Compressible
- Easily identified with ultrasound
- Lower rate of infection when compared to femoral

✗ Cons

- Risk of carotid puncture
- Risk of pneumothorax



McGee, et al. Preventing Complications of Central Venous Catheterization. N Engl J Med 2003;348:1123-33.

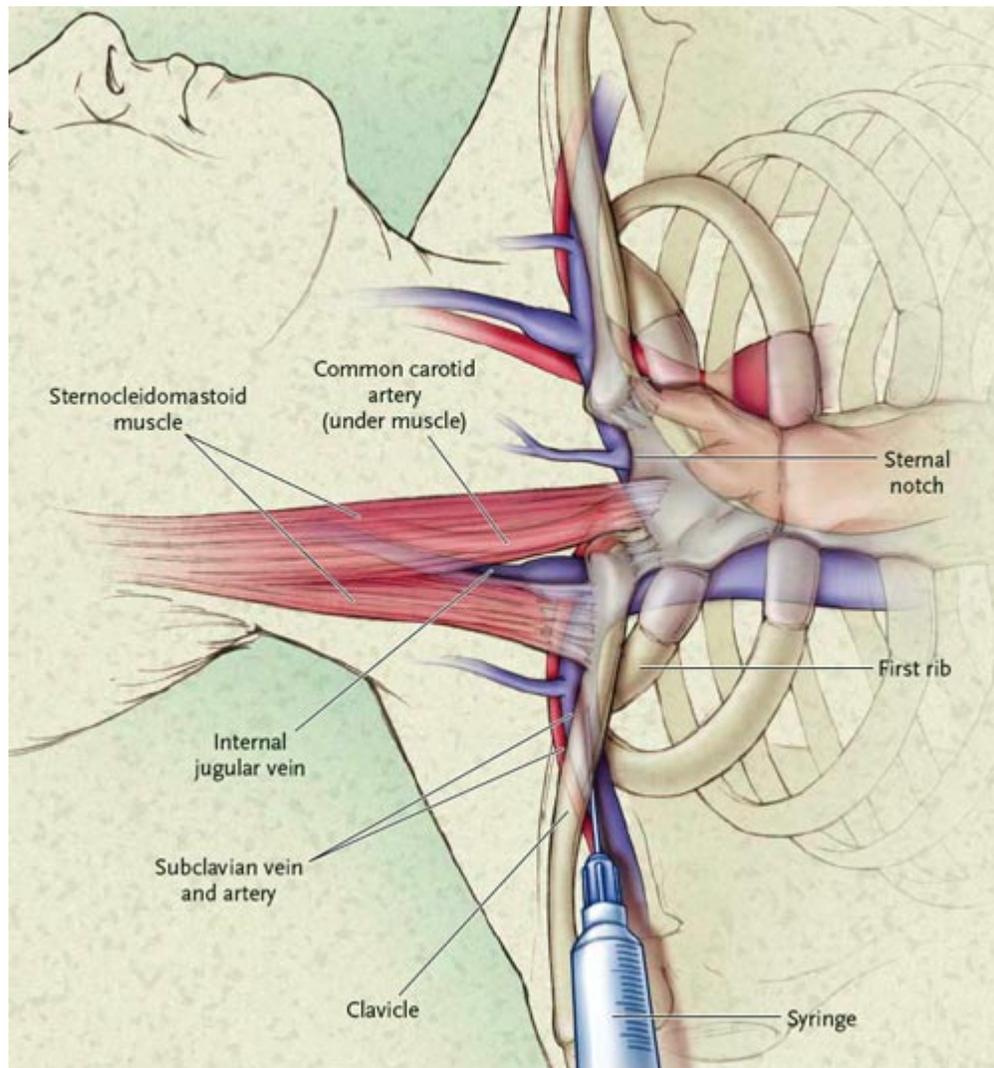
Subclavian Vein

✓ Pros

- Comfortable for patient
- Lowest risk of infection

✗ Cons

- Not compressible in the event of arterial puncture/bleed
- Highest risk of pneumothorax
- Risk of subclavian stenosis can complicate care of patients requiring dialysis in the future



McGee, et al. Preventing Complications of Central Venous Catheterization. N Engl J Med 2003;348:1123-33.

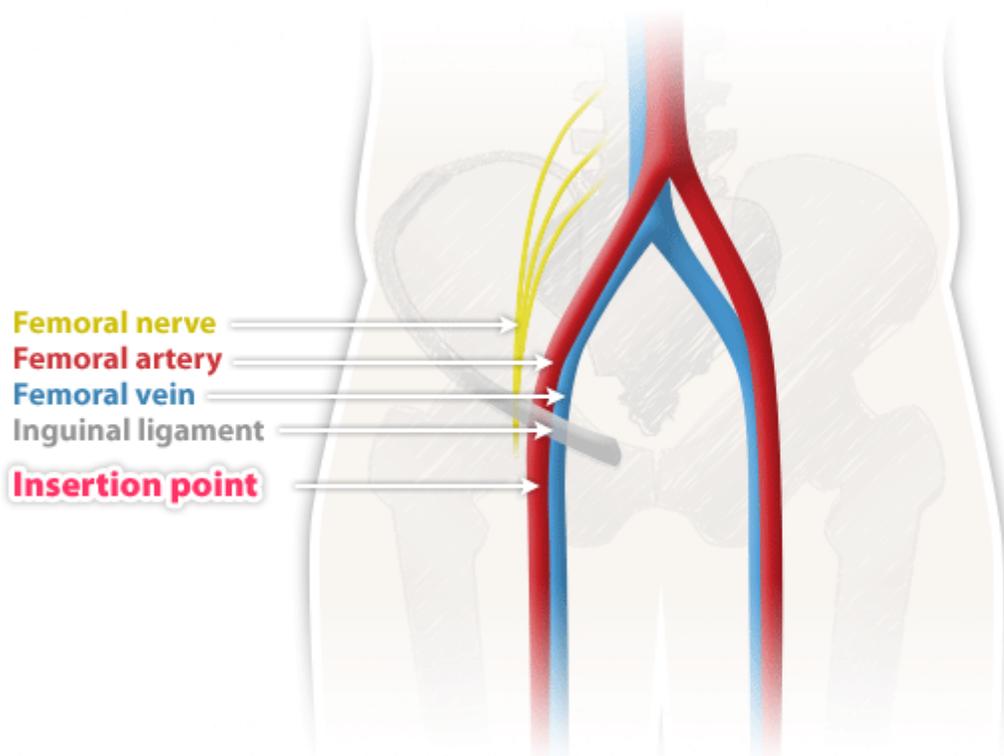
Femoral Vein

✔ Pros

- Compressible
- Easily accessible
- Easily visualized with ultrasound

✖ Cons

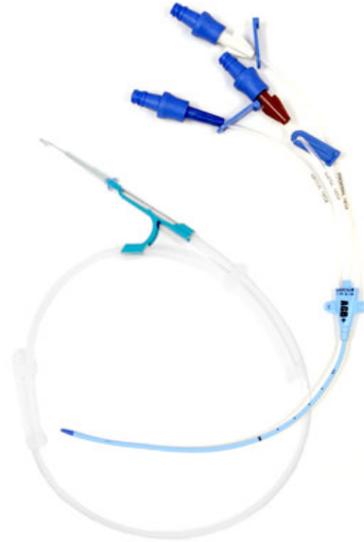
- Highest risk of infection
- Predisposes to venous thrombosis
- Risk of arterial puncture



Catheter Selection (for adult patients)

Many catheters are available but some general principles should guide catheter selection.

- The catheter with the minimum number of lumens needed should be selected.
 - Generally, a 7 French triple-lumen catheter is used.
 - For patients requiring aggressive volume resuscitation due to hypovolemic shock or hemorrhage, an 8.5 French introducer sheath will provide optimal access. This catheter also allows for placement of either a pulmonary artery catheter or transvenous pacing catheter, if needed.
- Antimicrobial impregnated catheters should be considered in all patients in whom catheterization is expected to exceed 5 days.

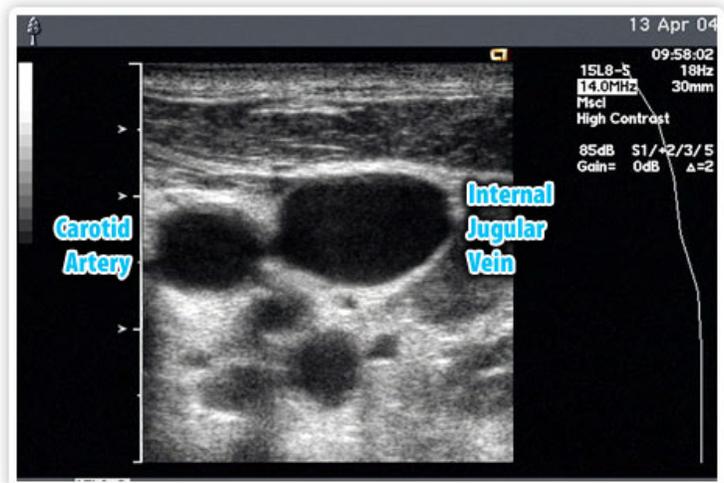


Ultrasound

Use of real-time ultrasound guidance can facilitate:

- Evaluation of individual patient anatomy,
- Confirm venous flow using color-flow Doppler, and
- Increase first-pass success rate.

Ultrasound is recommended for all IJ and Femoral central lines, and should be employed when placing catheters in all high-risk patients (those with any coagulopathy, on positive pressure ventilation, etc.).

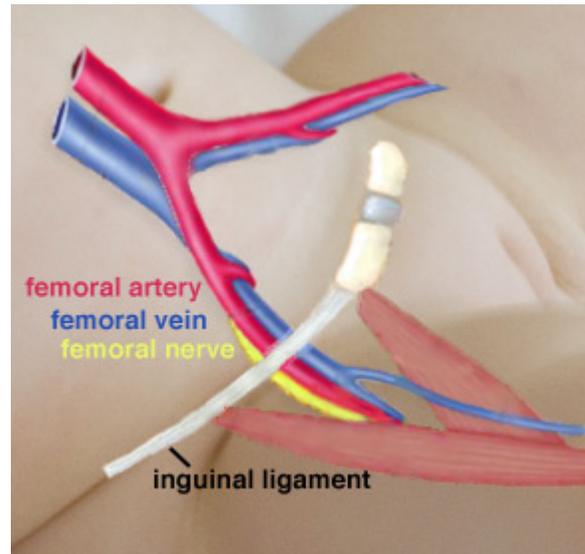


Considerations for Placement in Pediatrics

Choice of Insertion Site

The femoral vein or the right internal jugular vein is the preferred sites for CVC placement in children.

- **For short-term use:** the femoral vein may be preferred because of the ease of insertion.
- **For long-term use:** the internal jugular vein may be the preferred site if it is easily visualized with ultrasound.
 - Insertion of internal jugular catheters may require deep sedation or general anesthesia in small children.



Sandrijn van Schaik, MD, PhD, UCSF Pediatric Critical Care Specialist, September 2008

Complications

There are no differences in infection rates between femoral venous and non-femoral venous catheters in children,¹ although, after puberty, the infection rate in adults likely applies to teenagers.

- While **femoral venous catheters** have the lowest complication rate around insertion, they have the highest rates of thrombotic complications.^{2,3} This is likely due to the relative large size of the catheters used in comparison to the caliber of the femoral vein. The incidence of thrombotic complications is clearly related to duration of indwelling catheter use.
 - Remove catheters as soon as they are not necessary.
- **Subclavian venous catheters** have the lowest success rate and the highest complication rate around insertion in children. The risk of insertion complications for subclavian catheters is especially high in pediatric patients with lung disease and/or coagulopathy and may only outweigh the benefits if other sites are unavailable.

Ultrasound

Use of ultrasound and Doppler ultrasound-guided needles: The risk of accidental puncture of the artery may be increased in children due to small caliber of the vessels and close proximity of arteries to veins selected for cannulation. Ultrasound visualization and/or a doppler ultrasound-guided needle (PD Access device) should be used in all children to localize the vein of interest during insertion.

Catheter Size

Size of catheters is dependent on size of child. Rough guidelines:

Patient Weight	Size of Catheter
< 3kg	3 Fr
3-10 kg	4 Fr
10-20 kg	5 Fr
> 20 kg	6 Fr

One should also take into account the length of the catheter.

Other considerations

Special considerations in pediatric patients with congenital heart disease:

- Right-to-left shunting may give arterial blood the color of venous blood, and significant left to right shunting may result in redder appearance of venous blood.
- Catheters in the SVC should be avoided in patients who have undergone or will need to undergo bidirectional cavopulmonary shunt placement.
- Patients with previous heart surgery and/or cardiac catheterizations may have venous thrombosis. Check the chart and verify blood flow by ultrasound or Doppler.

PICC lines: Despite the widespread use of PICC lines these days, there is no clear data that they are superior and/or associated with fewer complications.

1. Femoral vascular catheterization in critically ill infants and children. Venkataraman ST, Thompson AE, Orr RA. Clin Pediatr (Phila). 1997 Jun;36(6):311-9
2. Complications of central venous catheterization in critically ill children. Casado-Flores J, Barja J, Martino R, Serrano A, Valdivielso A. Pediatr Crit Care Med. 2001 Jan;2(1):57-62
3. Complications of central venous catheterization in critically ill children. Karapinar B, Cura A. Pediatr Int. 2007 Oct;49(5):593-9

Inserting a CVC

Steps For CVC Insertion Procedure

1. Obtain informed consent (unless emergent) and complete the “Pre-procedure checklist” in APeX.

The image shows a form from UCSF Medical Center titled "AUTHORIZATION FOR SURGERY OR SPECIAL DIAGNOSTIC OR THERAPEUTIC PROCEDURE". The form includes fields for UNIT NUMBER, PT NAME, BIRTHDATE, LOCATION, and DATE. The main text reads: "1. I authorize _____, M.D., and associates to perform the following operation(s) or procedure(s):". Below this are three horizontal lines for text entry. Further down, there are four numbered points: "2. I authorize the administration of anesthesia and/or sedation.", "3. I authorize the use of pathology and radiology services if necessary. I understand that any tissue removed will be disposed of at the discretion of the hospital Pathologist or designee.", and "4. The nature and purpose of the operation, possible alternative methods of treatment, benefits, risks, and possible complications..."

2. Complete Time-Out

A Time Out (final verification) must be conducted

- immediately before starting the procedure
- by the people involved in the procedure
- in the location where the procedure will take place

Time Out elements:

- Correct patient identity
- Correct procedure to be done verified with consent
- Correct patient site and side (verified with site marking)
- Correct patient position
- Review of pertinent diagnostic results
- Availability of correct equipment

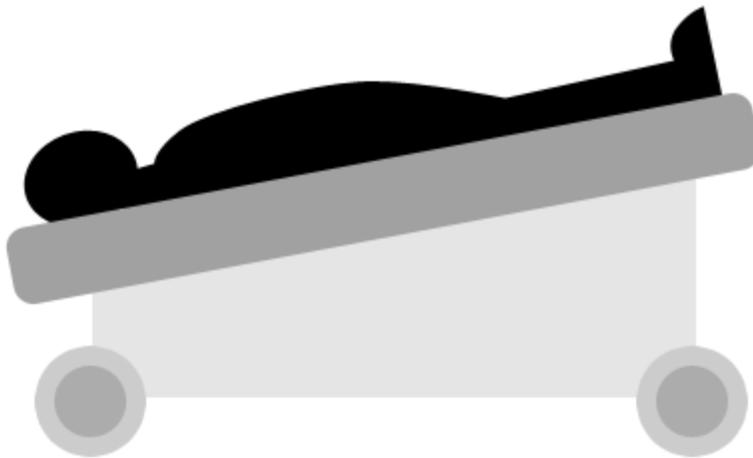


Be sure to document the Time Out in the patient’s medical record.

3. Obtain adequate supervision and assistance

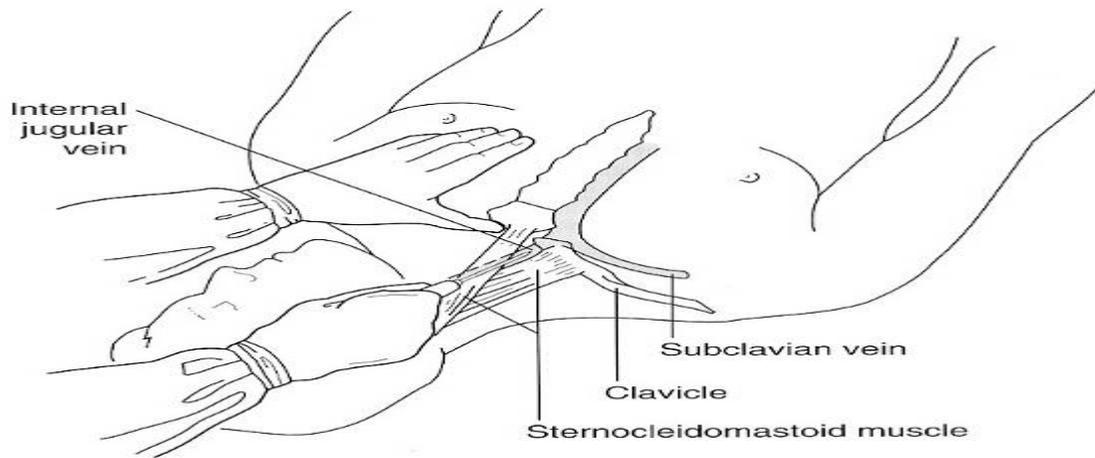


4. Position the patient appropriately
 - Trendelenburg position
 - Head rotated ~30° to the left



Trendelenburg position

5. Identify surface landmarks



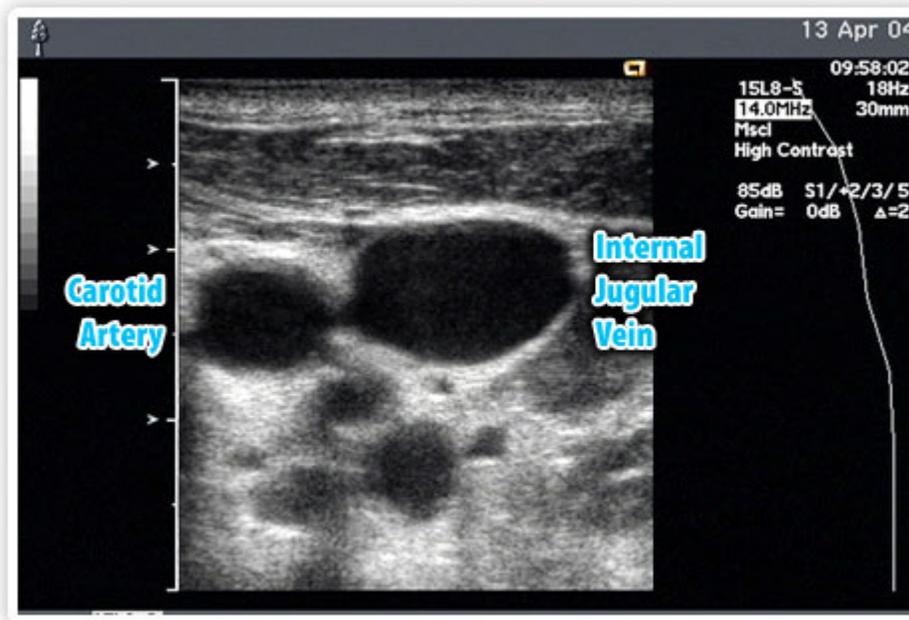
Source: www.med.unc.edu/emergmed/.../Central_Venous_Catheterization.ppt

Accessed: 4/8/14

6. Use optimal sterile technique (Chlorhexidine/alcohol)



7. Use real-time ultrasound guidance



8. Administer local anesthetic to conscious patients. Always draw back on the syringe prior to injection to be sure the needle tip is not within a blood vessel.

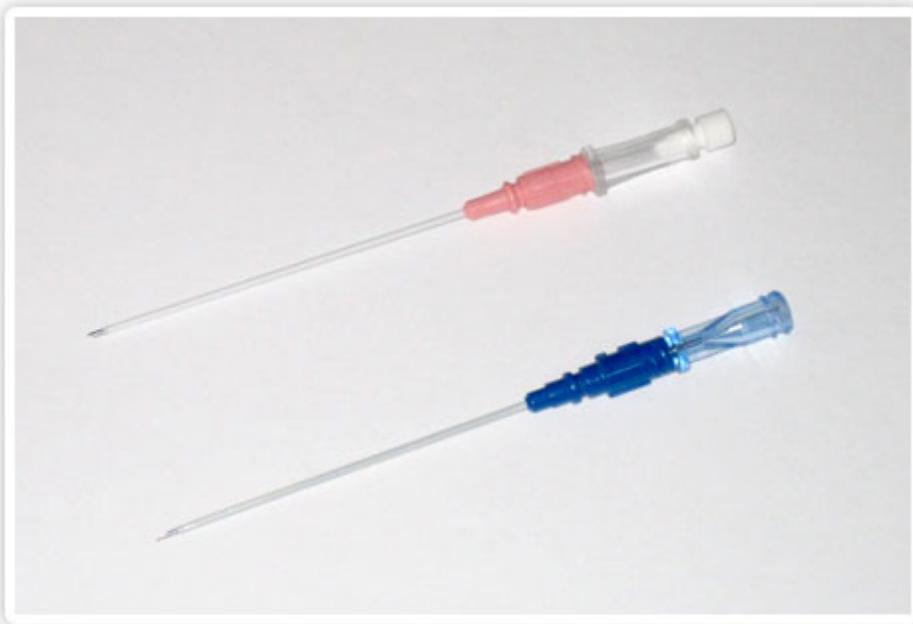


Source: <http://photos1.blogger.com/img/24/4558/1024/DSC01606.jpg>
Accessed: 4/21/14

9. Puncture at least 2 cm above the clavicle.
It should not be necessary to hub the needle



10. Use of angiocath is encouraged as the thin-walled needles can migrate after confirmation of venous cannulation and result in accidental carotid puncture.



11. Confirm venous puncture with saline-filled column of IV tubing



12. Advance guidewire gently while watching for cardiac ectopy on ECG (always maintain control of the guidewire to ensure that it is not inadvertently advanced entirely into the patient or that venous access with the guidewire is lost).



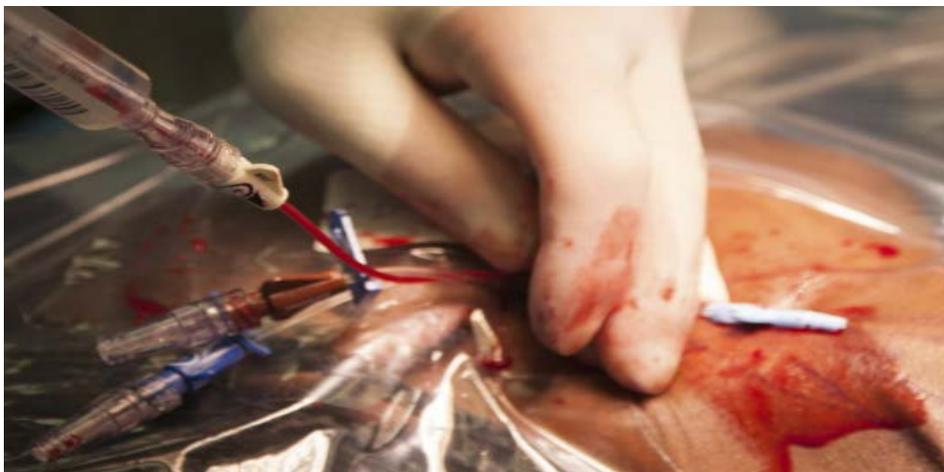
13. Make small skin nick using scalpel



14. Dilate and advance catheter over the guidewire while ALWAYS maintaining control of the guidewire.



15. Remove guidewire and check for blood return in all ports.



16. Flush all ports with sterile normal saline. Assure all catheter hubs are capped.

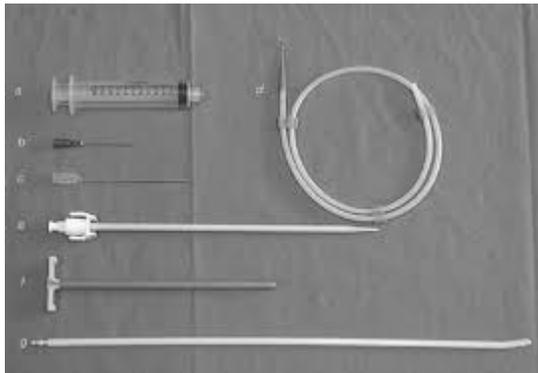


17. Suture and dress

Secure line (the use of a StatLock® or other sutureless device is recommended by the CDC. If secured using suture, ensure that enough space for placement of Biopatch), place Biopatch and dress.



18. Perform a wire and dilator count prior to end of procedure.



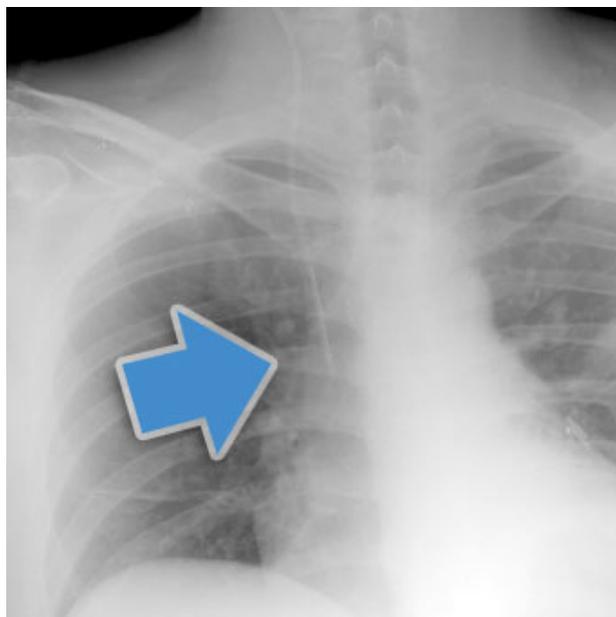
Source: [http://www.uptomed.ir/Digimed.ir/ACS-Surgery 2008/ACS Surgery_2008/06.22.htm](http://www.uptomed.ir/Digimed.ir/ACS-Surgery_2008/ACS_Surgery_2008/06.22.htm).
Accessed: 12/23/13

19. Obtain chest x-ray to confirm appropriate placement and to rule out complications.

- The catheter should be visualized along the path of cannulated vessel.
- The tip should ideally be positioned at the junction between the right atrium (RA) and the superior vena cava (SVC).

If the catheter is not in expected location, it can be repositioned using sterile Seldinger technique. Consultation with a more experienced provider is recommended.

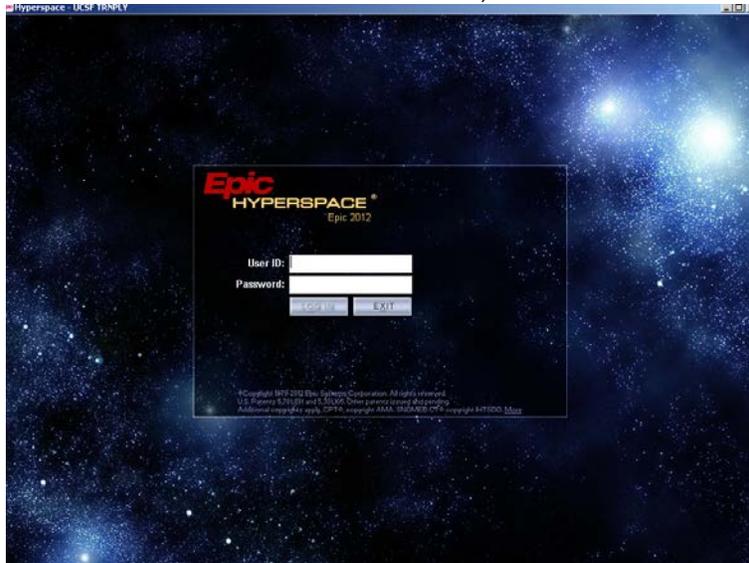
Note: In the case where guidewire catheter exchange is necessary, the catheter should never be cut or modified.



Patient Safety & Quality of Care: Central Venous Catheter Insertion Practice

20. **Complete documentation:** document the adult or pediatric procedure using the Central Line Insertion Procedure (CLIP) note in the medical record. Complete all portions of the note to maintain compliance with state reporting requirements.

Instructions for documentation follow, slides 21-24



21. Select New Procedures tab.

Patient Safety & Quality of Care: Central Venous Catheter Insertion Practice

22. Select Central Line tab.

The screenshot shows a medical software interface with a 'Central Line' tab selected. A pink arrow points to the 'Central Line' tab. The interface includes sections for 'Indications', 'Anesthesia', and 'Sedation'.

Indications

- Indications: New indication for central line (specify), Replace malfunctioning central line, Replacement due to suspected central line-associated infection, Other (specify)

Anesthesia

- Anesthesia: local infiltration, see MAR for details
- Local anesthetic:
 - lidocaine 1% with epinephrine, lidocaine 1% without epinephrine, lidocaine 2% with epinephrine
 - lidocaine 2% without epinephrine, bupivacaine 0.25% with epinephrine, bupivacaine 0.25% without epinephrine
 - bupivacaine 0.5% with epinephrine, bupivacaine 0.5% without epinephrine, NaHCO3 (sodium bicarbonate)
 - topical anesthetic, LET (lido,pi,tetracaine), lidocaine/prilocaine emulsion
 - co-phenylcaine spray, lidocaine spray
- Anesthetic total (ml)

Sedation

Other (specify)

23. Complete each element. This note comprises the central line insertion checklist.

The screenshot shows a medical software interface with a checklist for central line insertion. The checklist includes sections for 'Anesthesia', 'Sedation', 'Procedure details', 'Location', 'Site selection rationale', 'Patient position', 'Catheter Type', 'Number of lumens', 'Catheter size', 'Implants/Size Inserted/Total PCC Length/External PCC Length', and 'Pre-procedure'.

Anesthesia

- Anesthesia: local infiltration, see MAR for details
- Local anesthetic:
 - lidocaine 1% with epinephrine, lidocaine 1% without epinephrine, lidocaine 2% with epinephrine
 - lidocaine 2% without epinephrine, bupivacaine 0.25% with epinephrine, bupivacaine 0.25% without epinephrine
 - bupivacaine 0.5% with epinephrine, bupivacaine 0.5% without epinephrine, NaHCO3 (sodium bicarbonate)
 - topical anesthetic, LET (lido,pi,tetracaine), lidocaine/prilocaine emulsion
 - co-phenylcaine spray, lidocaine spray
- Anesthetic total (ml)

Sedation

- Patient sedated? Yes No

Procedure details

- Preparation:
 - skin prepped with 2% chlorhexidine, skin prepped with alcohol, skin prepped with Betadine
 - skin prepped with Chloraprep, skin prepped with Hibiclens, skin prepped with povidone-iodine
- Skin prep agent dried: Skin prep agent completely dried prior to procedure
- Sterile barriers and hand hygiene: All five maximal sterile barriers used - gloves, gown, cap, mask, and large sterile drape - and hand hygiene performed prior to central venous catheter insertion
- Choose either "all 5 sterile barriers and hand hygiene used" OR indicate which of the 5 barriers and/or hand hygiene were used if not all were employed:
 - Gloves, Gown
 - Cap, Mask
 - Large Sterile Drape, Hand hygiene

Location

- left subclavian, right subclavian, left internal jugular, right internal jugular
- left femoral, right femoral, umbilical, scap (PCC)
- right upper arm (PCC), left upper arm (PCC), right lower extremity (PCC), left lower extremity (PCC)

Site selection rationale

Patient position

- Trendelenburg, reverse Trendelenburg, flat

Lot #

Brand

Catheter Type

- Non-tunneled (other than dialysis), Tunneled (other than dialysis), Dialysis non-tunneled, Dialysis tunneled
- Umbilical, PCC

Number of lumens

- 1, 2, 3, >=4

Catheter size

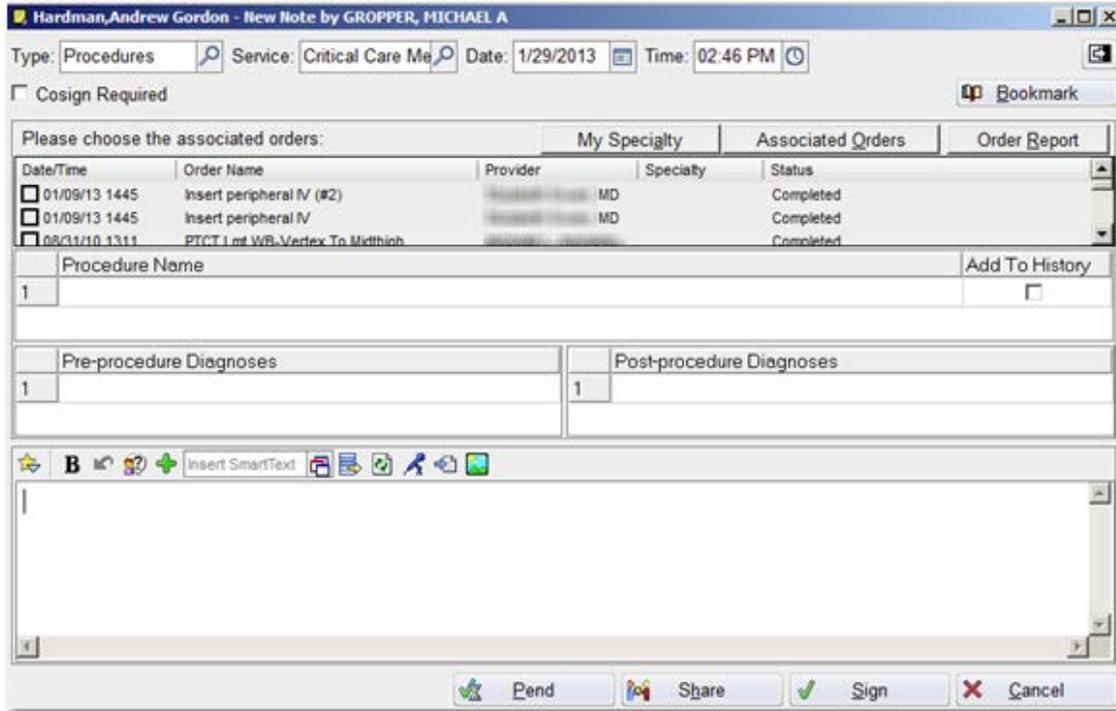
- 1.1 Fr, 1.9 Fr, 2.8 Fr, 3 Fr, 3.5 Fr, 4 Fr, 4.5 Fr, 5 Fr, 5.5 Fr, 6 Fr, 6.5 Fr, 7 Fr, 7.5 Fr, 8 Fr, 8.5 Fr, 9 Fr, 9.5 Fr, 10 Fr, 12 Fr, 13 Fr, 14 Fr

Implants/Size Inserted/Total PCC Length/External PCC Length

Pre-procedure

- Landmark identified

24. Sign Note.



Inserting a CVC



Click the play button to start the video.

This video contains audio. If you can't hear the audio, please adjust your speaker volume. If your computer is not equipped for audio, you can still follow along by reading the captions displayed underneath the video.

When you are finished watching the video, click the "Next" button at the bottom of the page to continue the course.

Note: This video demonstrates a CVC internal jugular insertion from the left side, Internal jugular insertions should normally be performed on the right side.

Video source: Adam Collins MD, Associate Clinical Professor of Anesthesia, UCSF Dept. of Anesthesia and Perioperative Care, CollinsA@anesthesia.ucsf.edu

Handling Complications

Pneumothorax (incidence 1-3%)

- Inquire if the patient has developed new chest pain
- Listen for decreased breath sounds on the ipsilateral side
- Rule out with CXR (upright/expiratory film is best)
- Needle decompression for hemodynamic compromise
- Surgery or IR consultation for chest tube

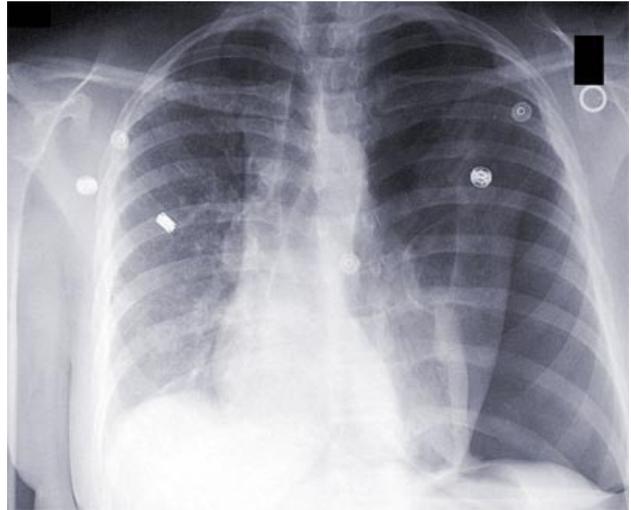


Image: Left tension pneumothorax.
Credit: Wikipedia.org
(http://en.wikipedia.org/wiki/Image:Pneumothorax_CXR.jpg),
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Arterial puncture

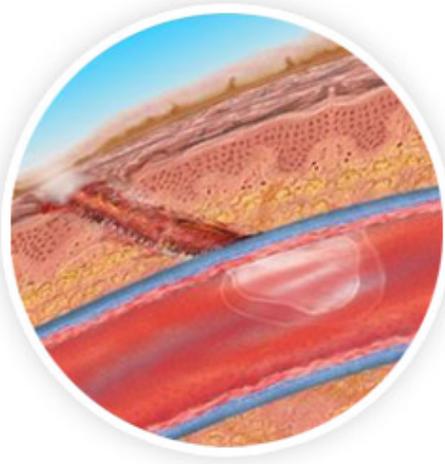
- If with small needle, withdraw and hold pressure
- If with larger catheter, consider vascular surgery consultation



Venous air embolism

Prevention is key.

- Ensure that puncture sight is below level of right atrium (Trendelenburg position for IJ and SC lines)
- Ensure that all ports of catheter are securely sealed
- Appropriately position patient for CVC removal



If a venous air embolism occurs, be sure to:

- Administer 100% oxygen
- Place patient in trendelenburg, left lateral decubitus position

Hematoma

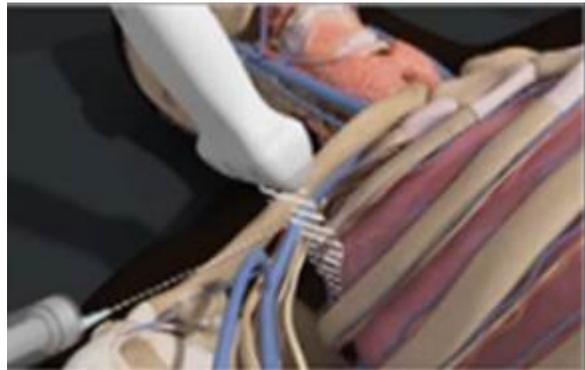
- Manual compression, correct any coagulopathy

Source: <http://clinicalcases.org/2004/02/complications-of-central-line.html>
Accessed: 11/25/13



Unable to pass wire or cannulate vessel

- Consider ultrasound guided insertion
- Consider a smaller catheter
- Consider another site
- Consult a more experienced provider



Source: SonoSite video: Ultrasound guided central venous catheterization. Subclavian/axillary vein transverse approach.

<http://www.bing.com/videos/search?q=video+of+central+line+placement+with+ultrasound&FORM=VIRE10#view=detail&mid=3EEB7D9D46D31514E8953EEB7D9D46D31514E895> Accessed 11.22.13

Post-procedure

Daily assessment of line necessity by a licensed provider (defined as a person with the authority to order insertion or discontinuation of a central line) is strongly associated with reduction of infection risk because it prompts the removal of lines sooner rather than later. State law also requires daily assessment for and attestation of central line necessity.

California Code of Regulations, Title 22 §70739



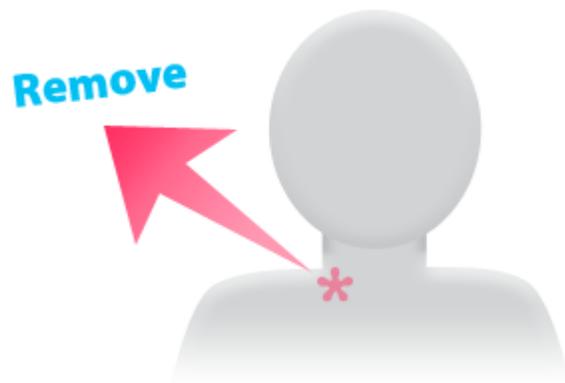
Follow-Up Care

- Examine site daily for signs of local infection
- Ensure dressing is sterile and transparent
- Change dressing only when dislodged, or every 7 days
- Remove line as soon as it is no longer needed (MD order required)



Removing a CVC

- Use Standard Precautions and clean technique for removal
- Assess patient's coagulation studies prior to removal
- Prevent venous air embolism
 - Position patient in trendelenberg position for IJ or SC access.
 - Ensure the entry site is below level of right atrium
 - Perform removal under positive pressure:
 - Ask spontaneously breathing patients to hum or exhale during CVC removal
 - For patients unable to follow instructions or receiving mechanical ventilation, remove catheter in a steady motion during patient's exhalation phase
- At the time of removal, simultaneously place sterile occlusive dressing and hold pressure for 2-5 minutes or until bleeding stops
- Patient should remain on bedrest for 1 hour post CVC removal
- Monitor for bleeding or hematoma development
- Document removal in progress note.
- Patients must be monitored at least 1 hour after CVC removal prior to discharge



Removing a PICC

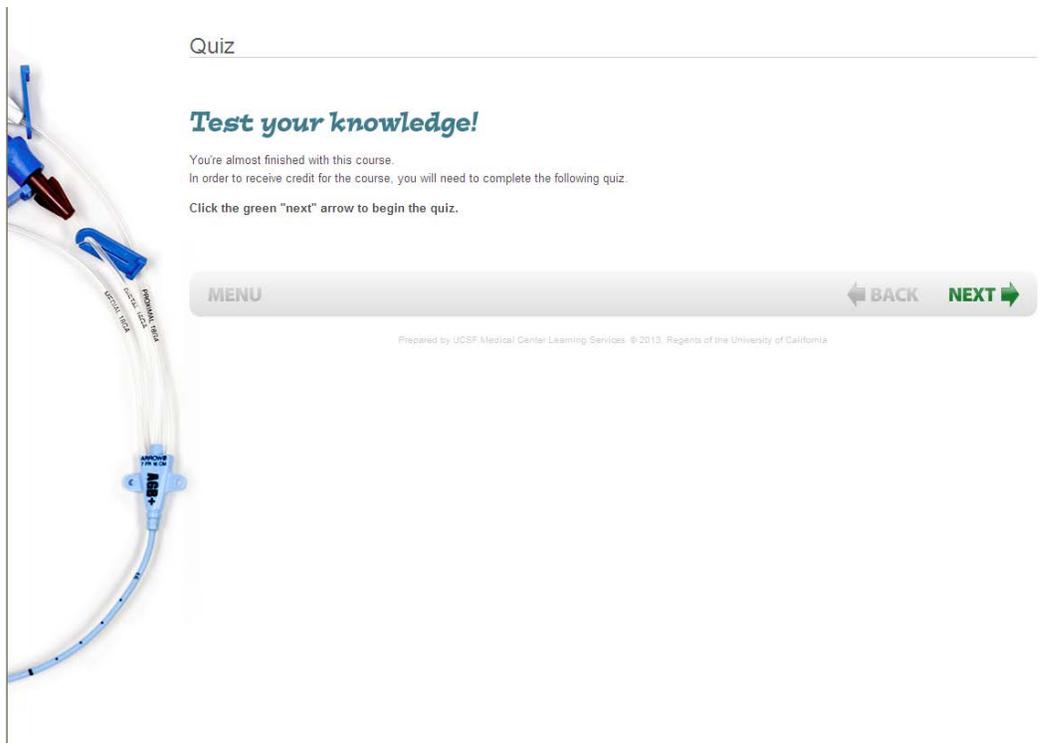
- Don sterile gloves and establish sterile field
- Position the patient supine with HOB flat. Do not raise the arm above the heart.
- Ask spontaneously breathing patients to hum or exhale during PICC removal. For patients unable to follow instructions or receiving mechanical ventilation, remove catheter in a steady motion during patient's exhalation phase.
 - If there is resistance to removal, cover site and any exposed line with sterile occlusive dressing and refer patient to IR immediately.
- Apply pressure for 2-5 minutes or until bleeding has stopped.
- Secure site with sterile occlusive dressing before raising HOB. Occlusive dressing is to remain in place for 24 hours.
- Monitor for at least one hour after PICC removal prior to discharge.
- Document removal including comparison of PICC length on removal vs. on insertion.

Quiz

Test your knowledge!

You are almost finished with this course.

In order to receive credit for the course, you will need to complete the following quiz.



Quiz

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Infection Prevention

1. In preparing to place a central line, all of the following are recommended steps to reduce the incidence of infection except:
 - a. hand hygiene (either alcohol gel/foam or antimicrobial soap)
 - b. wearing hat, mask, and sterile gown and gloves
 - c. skin antisepsis with betadine solution**
 - d. full-body draping
 - e. having all assistants wear hats and masks

Feedback:

Chlorhexidine is recommended for skin anti-sepsis prior to placement of a CVC for its superior efficacy compared with iodine-based preparations.

Site selection - Coagulopathy

2. A 32 year-old male is admitted to the ICU with fulminant hepatic failure. A central line is needed for infusion of vasoactive medications. Which of the following would be an inappropriate site in the setting of significant coagulopathy?
 - a. femoral vein
 - b. internal jugular vein
 - c. subclavian vein**

Feedback:

The subclavian vein and artery are not compressible due to their anatomic location, and placement of a CVC in the subclavian vein is contraindicated in the setting of significant coagulopathy.

Ultrasound anatomy of IJ

3. On ultrasound examination of the IJ, the carotid artery is seen lateral to the vein in most patients.
 - a. true
 - b. false**

Feedback:

In most patients, the internal jugular vein is located lateral to the carotid artery; however, it should be noted that anatomy can be variable in individual patients. Other characteristics that can help differentiate vein from artery include: compressibility (veins tend to be more compressible), vessel caliber (the IJ tends to be larger than the carotid in normovolemic patients), pulsatility (arterial pulsations can sometimes be visualized), and direction of blood flow detected using color-flow Doppler.

Procedure Safety

4. When placing an IJ catheter all of the following helps to improve the safety of the procedure **except**:
- a. Use real time ultrasound
 - b. Use ultrasound to prescreen the anatomy of the patient, but not during the procedure.**
 - c. Confirm venous placement using saline filled tubing
 - d. Trendelenburg position
 - e. Use of cardiac monitoring for ectopy

Feedback:

Several measures are recommended to reduce complications when placing a CVC. Use of real-time ultrasound allows assessment of anatomy during needle advancement and puncture. Confirmation of venous pressure using saline-filled IV tubing can help detect arterial puncture before dilation and cannulation with a larger catheter. Trendelenburg position during placement of IJ and subclavian CVCs can reduce the risk of venous air embolism. ECG monitoring allows early detection of cardiac arrhythmias.

Complications

5. Which of the following are complications associated with central line insertion?
- a. pneumothorax
 - b. hemothorax
 - c. carotid artery puncture/dissection
 - d. venous air embolism
 - e. local hematoma
 - f. infection
 - g. all of the above**

Feedback:

The risks associated with CVC placement are numerous and potentially serious. Care should always be made to reduce risk by utilizing optimal technique and obtaining appropriate supervision or assistance when needed.

Complications

6. If you are concerned for venous air embolism, how should you manage the patient?
- a. **Place the patient in left lateral decubitus, trendelenburg position and start 100% oxygen.**
 - b. Place the patient in right lateral decubitus, trendelenburg position and start 100% oxygen.
 - c. Place the patient in right lateral decubitus, upright position and start 100% oxygen.
 - d. Place the patient in left lateral decubitus, upright position and start 100% oxygen.

Feedback:

In the event of venous air embolism, placing the patient in left lateral decubitus and trendelenburg positions serves to sequester any air in the apex of the right ventricle thereby preventing “air-lock” and hemodynamic compromise. Some early signs of venous air embolism include bronchoconstriction, coughing, and a sense of anxiety or agitation in conscious patients.

Removal

7. When removing a central line, it is important for the site to be above the level of the right atrium to prevent venous air embolism.
- a. true
 - b. false**

Feedback:

Prevention of venous air embolism depends upon maintaining positive venous pressure at the puncture site and ensuring that all catheter ports are clamped when not in use. This is best accomplished by positioning the puncture site several centimeters below the right atrium and asking the conscious patient to hum or perform the valsalva maneuver during removal of the catheter.

Follow-Up Care

8. In order to prevent infection and catheter related thrombosis, it is important to evaluate the need for each central venous catheter daily and remove catheters which are not necessary.
- a. true**
 - b. false

Feedback:

The rate of complications (especially infectious and thrombotic) increases with the duration of catheterization. Therefore, CVCs should be removed as soon as they are no longer needed.

Summary

CVC insertion is required in many critically ill patients. The following points highlight best practice guidelines noted within this educational module:

- Use of impeccable sterile technique including maximum sterile barriers while placing central intravenous catheters to prevent infections
- Use of real-time ultrasound guidance during central line insertion to prevent complications
- Site Selection: IJ>SC>Femoral (adult); femoral vein or right IJ (pediatric)
- Chest x-ray should be ordered to evaluate appropriate placement of all central lines placed in the IJ or subclavian position
- Proper documentation via APeX CLIP (Central Line Insertion Procedure) Note
- Daily assessment of insertion site
- Remove line as soon as it is no longer needed (MD order required)

Congratulations, you've completed this course!

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For any questions regarding course content: Kevin Thornton, MD, UCSF Anesthesia, Jenifer Twiford, RN, UCSF Quality Improvement, or Jim Stotts, RN, MS, Patient Safety Manager