Central Venipuncture (CVP)

To be reviewed by:
   NP, PA, Attending, Resident, Fellows
   (Anyone placing Non-PICC central lines)

Developed by: Upstate University Hospital CVP Task Force and Organizational Training & Development   11/ 2009   Last edited 5/ 2015, 6/ 15
Module 1

Ultrasound-Guided Central Venipuncture

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Fundamental Principles of Ultrasound (U/S) Guidance

- CVC complications are a “big deal”
- Identify and locate your target
  - Don’t guess at your target
- Identify and differentiate non-targets
Presumptions:

- Familiarity with aseptic technique
- Familiarity with...

Sven-Ivar Seldinger
(1921-1998)
Target Vein Identification “Rules”

- **In the Pre - U/S Age**
  - “Nipples, Notches, & N-A-V-E-L” s

- **In the Post - U/S Age**
  - Appearance, Size, Compressibility, Phasicity, Doppler flow
Appearance/Orientation “Rules”

- Image orientation: “CT Convention” (except for proceduralists at HOB for IJ)

- Homogenous fluids: BLACK on U/S
  - Blood, urine, bile

- Distinct interfaces: WHITE on U/S
  - Tissue 1 <-- Tissue 2
  - Steel <-- Blood
Blood (in a vessel)
Machine - Technical Issues
## Transducer ("Probe")

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Probe Characteristics</th>
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</table>
| Linear     | Elements are arranged in a line  
             | Higher frequency than Convex  
             | Higher resolution than Convex  
             | Poorer penetration than Convex  
             | Superficial small parts applications |
| Convex     | Elements are arranged along a curve  
             | Deeper (viscera) applications |
For the preceding reasons, 95+% of vascular access will be done using the LINEAR probe.

If a pt is soooo large/obese that you must reach for the convex probe, you’ve got TROUBLE.
Linear Probe

- The elements are arranged along a line
- The image shape is rectangular
- Usually Higher Freq (7.5 - 10 MHz)
Probology: The Grasp
The 3 finger grip enables:

- Remaining fingers or wrist to rest on the pt, anchor, and thereby stabilize
- Finer probe manipulations
- The sonographer to watch the screen and NOT his/her hand, while preventing the “wandering probe.”
- Reduction of pt discomfort and injury risk
Probology: The Grasp

- As with suture instruments, LP needles, etc, there is a *right* and a *wrong* way.

- Orthopods, OTs, and anthropologists can discourse on “power grip vs fine grip”

- Bottom line: Don’t be an ape
  - Use a fine grip
Patient and Operator ID Entry

1. Press On/Off

2. If two probes on unit select probe.

3. Press Patient – Press New/End (bottom left of screen) and enter patient name/medical record # etc. You must enter this information to take an image for documentation.

4. Select Exam Type (make sure the probe is clean)

5. Image Optimization Keys
   - Depth
   - Pen/Gen/Res (penetration/general/resolution)
   - Press Auto gain or manually adjust image with knobs on left side machine.

6. To end exam Press Patient key again and then New/End.

7. Leave unit on for 3 minutes to send images over wireless network.
Sonosite Pre-Sets

- Reasons:
  - Allocation of processor brainpower
    - 2D image function vs Doppler function
  - Adherence to conventions
Probe/Screen Orientation

Probe notch = Screen green dot

Therapeutic/procedural imaging: Notch goes to operator’s left and green dot to screen’s left.
- IJ CVC operator is at head of bed
- Is looking inferiorly at both pt and screen
- Screen’s left = reality’s left --> a “natural”
- Resultant “anti-CT” image orientation
- Femoral CVC operator is at feet looking superiorly
- Resultant image is consonant with CT orientation
Probe Frequency:

“Res, Gen, Pen”

(high) Resolution
General use
(high) Penetration
Screen Depth
Screensmanship: Geography

- Allocate screen to the AOI (Area Of Interest)
- Generally locate the AOI at mid depth and devote substantial screen
Screensmanship: Geography

(cont’d)

- Do include identifying “context” anatomy
- Avoid the “quest for the perfect still image”
  - But, do consider the Monday AM QB
Incorrect AOI Screen Allocation

AOI

(Largely Wasted)
Cleaning the Probe

- Regard the transducer as you would a stethoscope head
- “Clean,” not sterile
- Can’t heat sterilize
- (Long) list of approved/prohibited cleansing agents
Cleaning the Probe After Use

Wipes ought never be absent from the U/S cart
Anatomic Issues:

Locate and positively identify the vein

1) Anatomic Location
IJ Anatomy about the sternomastoid triangle: IJ usually superficial and lateral to the carotid
(Some patients fail to read the anatomy textbook)
In the euvolemic supine pt, the CFV and the IJ are each normally larger than their adjacent arteries.
2) Phasicity/Competency
3) Compressibility: Veins have it. Arteries don’t. Easiest and primary differentiating factor.
4) Doppler flow characterization
This is a vein
This is an artery (don’t stick it!)
The optimal target is...

- Large
- Superficial
- Distant from non-target vital structures

The usual venipuncture target point will be a compromise between these; no target is perfect.
Technique for IJ

- Surface landmarks are same as before
- Pt neck positioning MIGHT NOT be

Neutral position: Neutral neck positioning
Standard rotated position: Rotated neck positioning
Technique

- Traditional rotation of neck away from procedure side brings IJ over the CA, potentially increasing risk of CA puncture
- Reasonable compromise: rotate head/chin out of operators’ way, but avoid extreme rotation
- Real-time ongoing U/S visualization will mitigate risk in either case
Perform a pre-prep venous survey (unless CODE situation)

- Identify anatomical variants
- Identify optimal (L vs R) sidedness
- SAVE AN IMAGE
Technique

- Real-time vs skin mark option
- One vs two operators real-time option
- Transverse (aka short axis) favored over long axis
  - A “can’t miss” scenario
Know: 1) Size of target  
2) When to expect to hit pay dirt
The distance (b) from the transducer to the needle insertion site is shown. The depth (a) of the vein is also indicated. The needle path (c) is calculated using the Pythagorean theorem: 

\[ c = \sqrt{a^2 + b^2} \]
Technique (real time)

- Center the target vessel (L <---> R)
- Skin puncture near transducer at midpoint thereof; 45 +/- degrees
- Wiggle needle
- Look for
  - Wiggling tissue
  - White dot of needle in cross-section
  - Shadow and/or comet tail distal to dot
- Advance and locate needle tip
Needle viewed in cross-section [arrow], with deep shadowing/comet tailing [between hash marks]
Right CFV
Technique (real time)

- Achieve blood flash-back
- Set aside the probe
  - Cease U/S visualization
- Complete procedure remainder
- (With 2 operator technique, further imaging is optional)
(Seldinger wire entry)

- Wire
- CFV (long axis view)

2005 May 16 18:01
(Terminal wire “J”)
(Cannula introduced)

- Cannula
- CFV (long axis view)

Date: 2004 Mar 04
Time: 16:20
(Doppler flush of intraluminal cannula...)

SUNY UH 2007 May 07 08:38

- Vas
  L38

- CF
  .76

- TIS
  0.4

- 219

3.9
Block Phantom Stations...
Central Line IHI Bundle Implementation

Central Line Catheter Removal

- Patient should be in supine position.
- Catheter should be removed and site compressed for 10 minutes with no evidence of bleeding.
- Sterile, dry gauze dressing should be secured over the site.
- Dressing may be removed after 24 hours.
Maximum Barrier Precautions for Asepsis
# Central Line IHI Bundle Implementation

## University Hospital Central Line Infections

<table>
<thead>
<tr>
<th>Year</th>
<th>Totals</th>
<th>PICCs</th>
<th>Percutaneous CVCs</th>
<th>Ports</th>
<th>Vath Caths</th>
<th>Perma Caths</th>
<th>Multiple Lines</th>
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<td>55</td>
<td>29</td>
<td>11</td>
<td>12</td>
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<td>27</td>
<td>14</td>
<td>2</td>
<td>8</td>
<td>---</td>
<td>3</td>
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<td>3</td>
<td>3</td>
<td>5</td>
<td>---</td>
<td>2</td>
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</tbody>
</table>
Central Line IHI Bundle Implementation

Evidence based standardized practice was derived from: Michigan Keystone Study Group of 125 Hospitals (Community and Academic Centers) reducing their line infections to rate of 0% by implementing a “Bundle Approach”

Central Line IHI Bundle Implementation

- ✓ NY State Department of Health Regulation
- ✓ Standard of Care/Practice

- Professional misconduct includes violation of the scientifically accepted standards for hand hygiene, aseptic technique, barrier use, and cleaning/disinfection of items used in patient care.

- In addition to established competency, “Mandatory Infection Control Training” is required every four years to assure Physicians, Physician Assistants, Specialist Assistants, and Nurses maintain their knowledge of the required standards of care/practice.

- All licensed personnel are responsible for monitoring each other’s performance during procedure.

SUBPART 92-1
Statutory Authority: Public Health Law, Sections 230-a, 238
Central Line IHI Bundle Implementation

**Bundle Includes:**

1. Handwashing  
2. Maximum Barrier Precautions  
3. Chlorohexadine Prep  
4. Right Site Selection  
5. Daily Review of Line Necessity

“IHI 5 Million Lives From Harm. Prevent Central Line Infections: How-to Guide Toolkit”
Central Line IHI Bundle Implementation

1. **Hand Hygiene:**
   Performed by all staff just prior to starting the procedure.

   Consists of:
   
   15 sec hand wash with soap and water or application of waterless (alcohol based product) product which is rubbed in until dry.

Boyce, J. Pittet, D. “Guideline for Hand Hygiene in Health Care Settings”. MMWR October 25, 2002(51RR16); PP. 1-44.

“Hand Hygiene: Tool Kit for Implementing the National Safety Goal 2008”. The Joint Commission

New York State Law and Regulations. New York State Health Code Title 10: 92-2
2. **Maximum Barrier Precautions**

Consists of:

Cap, Mask, Sterile Gown and gloves.

Also includes “Head to Toe” Sterile Drape

Addition of large mayo stand cover to allow bedside table to move over and in-out of field
Central Line IHI Bundle Implementation

2. **Maximum Barrier Precautions**

   **Additional Success Factors:**
   
   Procedure Cart with all supplies present.
   
   Nurse is to remain in room at all times.
   
   Order and administer sedation/analgesia early.
   
   Must give one hour notification for **non-emergent procedures**.
2. Maximum Barrier Precautions

Cart contains a bundle that supplies gowning, draping and common equipment used in maximum barrier procedures.

Carts are located in all ICUs and may be secured from distribution if needed on floors.
2. **Maximum Barrier Precautions**

**Hat**

Hat must cover scalp/all hair to prevent shedding (epithelial cells and hair strands).

Beards must be contained with hooded hats.
Central Line IHI Bundle Implementation

2. Maximum Barrier Precautions

Eye Protection and Mask

Must be splash proof
Central Line IHI Bundle Implementation

2. Maximum Barrier Precautions

**Gowns:**
- Must have clean, dry Hands
- Folded so you are unable to contaminate them prior to opening
- Open gloves prior to gowning
- Only “above the waist and in the front” is considered sterile

**Gloving:**
- Glove your non-dominant hand first
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2. **Maximum Barrier Precautions**

**Draping:** Dressing the ultrasound probe

**Full Body Drape** with the following features:
- Hole with adhesive
- Clear window for visualizing anatomical landmarks and assessing patient condition
- Soft surface to prevent the catheter and insertion items from sliding off sterile surface
- Breakaway section for tearing away the drape but keeping the site sterile at the end of the procedure
- Attach corner to pole so patient may breath and be assessed

**Mayo stand cover** for bedside table allowing you to move over the field without contaminating the sterile field
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3. Chlorhexidine 2% in 70% isopropyl alcohol

Consists of:
Back and forth for at least 30 sec.
Do not blot or wipe.
Allow to dry completely before puncturing site (~ 2 min)

“IHI 5 Million Lives From Harm.
Prevent Central Line Infections: How-to Guide Toolkit”
4. Right Site Selection

- Avoid the Femoral
- Subclavian has lower infection rates but has serious complications of hemo-pneumothoraces
- IJ slightly higher infection rate but less serious complications when placed with ultrasound
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5. Daily Review of Line Necessity

✓ Completed daily and documented in Electronic Medical Record
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Cleaning the ultrasound

**Instructions Found on Ultrasound**

**Transducer Cleaning**
- ✓ Wipe all obvious gel and debris with towel and/or wash with enzymatic soap to remove protein deposits
- ✓ Wipe probe with disinfecting wipes- extend down length of cord
- ✓ Wipe again with second wipe leaving probe wet and let air dry
- ✓ If you are going to use the transducer in a non-sterile field that will contaminate it with blood or body fluids- cover the probe with sheath to facilitate easier cleaning.

**Machine Cleaning**
- ✓ Use disinfecting wipes- to clean off all surfaces of keyboard and cart.
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Thank You!
Please print this page and sign the bottom, attesting to your review of this education.