

Vascular Access Devices in the NICU 2012

Janet Pettit DNP, NNP-BC, VA-BC, CNS

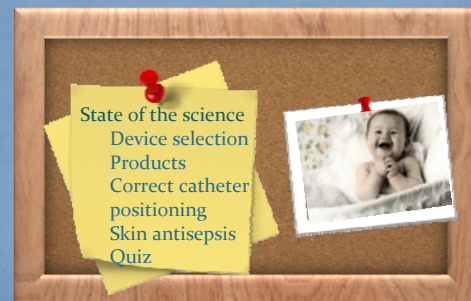
Disclosures

- Argon Medical Products

Objectives

- At the conclusion of the presentation, the participant will:
 - Describe two new products/techniques for determining central line tip position
 - Describe two techniques to reposition PICC
 - List four factors to consider when selecting the appropriate vascular access device for an infant
 - List three complications from peripheral and central catheters, including symptoms and management techniques

Agenda



Matching Vascular Access Needs to Patient & Monitoring Safety



Vascular Access Challenges

Multiple devices placed



Survival of infants with chronic health needs

Long term needs for vascular access

Vascular Access Headlines

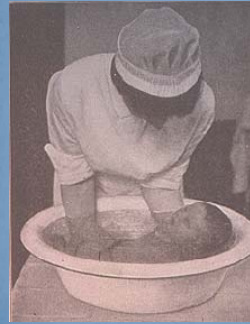
Paraplegia: Complication of Percutaneous Central Venous Line Malposition



Percutaneous Central Catheters and Peripheral Intravenous Catheters Have Similar Infection Rates in Very Low Birth Weight Infants

Pericardial Effusion in a Preterm Infant Resulting from Umbilical Venous Catheter Placement

A New Era of Care



- Growing awareness of medications and solutions and their impact on venous system.
- Recognition of importance of early assessment for the most appropriate vascular device selection
- Recognition of importance of integrated team approach

Evidence Based Resources



Vascular Access Device Choices

Short term

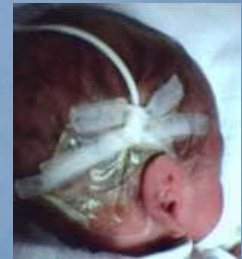
- Peripheral IVs
- PICCs
- Umbilical catheters
- Non-Tunneled CVC

Long-term

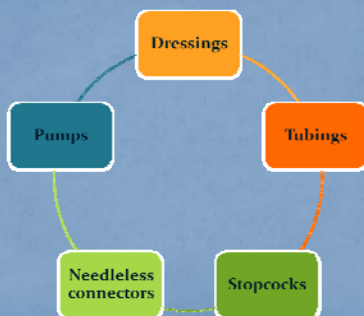
- Tunneled CVC
- Implanted port

Multiple lumen catheter

- Commonly used in intensive care



Accessories Used with Vascular Devices



Choosing the Device

Option 1

Darn if you do

Option 2

Darn if you don't

Is there one best device?

Guess Who Bears Responsibility for Patient Complications



- Device failure
- Patient
- Undetermined
- Healthcare professional
- Pathologic or physiologic factors

Per FDA data

The Reality: Responsibility for Patient Complications



- 55% Healthcare professional
- 28% Undetermined
- 12% Device failure
- 3% Patient
- 3% Pathologic or physiologic aspects

Per FDA data

Choices: Peripheral or Central Line?

MD doesn't want to risk patient developing a central line infection or thrombus and decides to infuse dopamine in the PIV....

And, the end result...



Access Challenge



If you only consider the length of treatment when selecting a vascular device, you are living in the past!



The Golden Rule...



- Insert one catheter
- Early in treatment
- To last throughout entire therapy
- Minimize complications

Considerations for Choice

- Patient condition
 - Disease process
 - Lab data
 - Vein condition & history of other device
 - Inability to maintain peripheral IV
- Vein assessment
- Type of therapy
 - TPN, chemotherapy, antibiotics, transfusions
 - Continuous treatment vs. intermittent treatment
 - Hyperosmolar therapies
 - Solutions with non-physiologic pH
 - Solutions with irritating or necrosing properties
- Length of therapy
 - 3-7 or more days of treatment indication for CVC

PIV & Central Catheter Comparison

PIV

- Lasts 1-3 days
- Requires multiple sticks
- No hyperosmolar solutions, pH extremes, vesicants, or irritants
 - Examples:
 - TPN
 - Vancomycin
 - Acyclovir
- Cost of 2 PIV = 1 PICC
- More frequent complications
- More pain

Central Catheter

- Lasts weeks, months
- Requires few sticks
- All fluids & medications
- More skill to place
- Fewer complications
- Complications more severe
- Increase in cost
- Easier to care for at home

PICCs & Umbilical Lines

- Advantages over other CVCs
 - Low complication profile
 - Lower rates of thrombosis & sepsis
 - Less invasive
 - Placed at bedside
 - Less cost
 - Most removed at end of treatment

Considerations for PICC

Contraindications

- Vein of inadequate size
- Inability to identify an appropriate vein
- Vein needed for other purpose
- Local skin infection, nerve injury, vascular compromise at proposed site

Special Considerations

- Coagulopathies
- Infection
- Insertion site infection/excoriation
- High frequency ventilation
- Decreased venous return
- Fractures

Umbilical Vein Catheter

- Advantages/Benefits
 - Easy to insert in newborn
 - Can remain in place 7-14 days
 - Accepts most medications, fluids & blood
 - Blood sampling
 - CVP monitoring
 - Multiple sizes & lumens
- Catheter sizes
 - 2.8, 3.5, 5, 6.5, 8 Fr
- Number of lumens
 - Single
 - Double
 - Triple



Umbilical Artery Catheter

- Advantages/Benefits
 - Easy to insert in newborn
 - Can remain in place 7-14 days
 - Accepts most medications, fluids & blood
 - Restrictions to use
 - Vasoconstrictive agents
 - Blood sampling
 - CVP monitoring
 - Multiple sizes & lumens
- Catheter sizes
 - 2.8, 3.5, 5, 6.5, 8 Fr
- Number of lumens
 - Single
 - Double
 - Triple



Non-Tunneled Central Venous Catheter

- Catheter inserted from subclavian, internal jugular, or femoral veins into central vein
- Rare use in neonates
- Common in pediatric ICU
- Advantage/Benefits
 - Easy to place
 - Multiple sizes & lumens
 - Allows infusion of all solutions, medications, & blood
 - Allows blood sampling
- Disadvantage
 - Short-term
 - Increase risk of catheter associated bloodstream infection

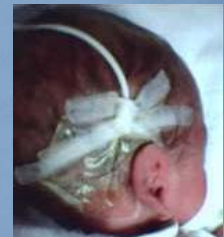


Non-Tunneled Central Venous Catheter

- Account for the majority of central line infections (CDC, 2011)
- Short-term use: < 6 days
- Common sizes:
 - Single Lumen: 3FR
 - Dual Lumen: 4 FR
 - Triple Lumen: 7FR
- Coated catheters that reduce risk of infection:
 - *Minocyclin Rifampin and CHG/silver reduce time to central line infections

Tunneled Catheter

- Placement
- Chest, scalp, abdomen
 - Tunneled into locations where children can't reach
 - Common sizes:
 - Single Lumen: 2.7 FR to 4.2FR
 - Dual Lumen: 7 FR



Tunneled Catheter

- Advantages/Benefits
 - Intermediate to long-term therapies: > 2 months
 - Lower risk of central line associated bloodstream infection
 - Can infuse most solutions, medications & blood
 - Blood sampling
 - Less risk of dislodgement
 - Easy to care for – especially at home
- Disadvantageous
 - Surgical procedure
 - Cost

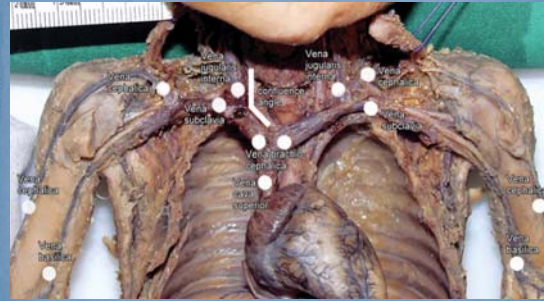


Preventing Adverse Events



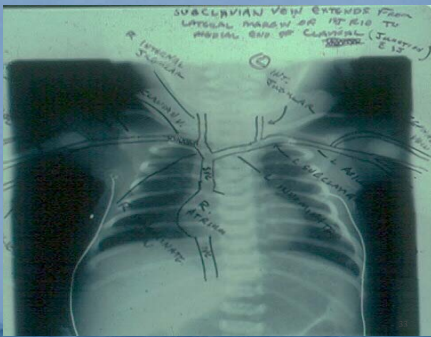
Understanding Anatomy & Impact of Catheter Tip Location

Understanding the Anatomy

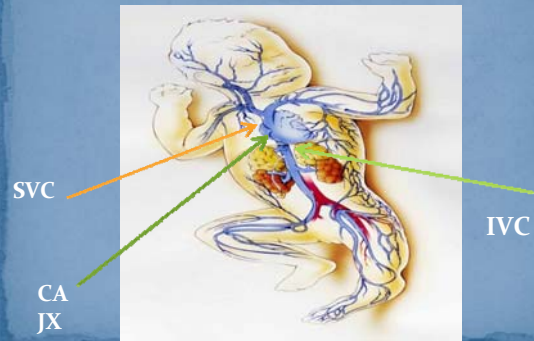


Eifinger et al. Clin Anatomy, 2011

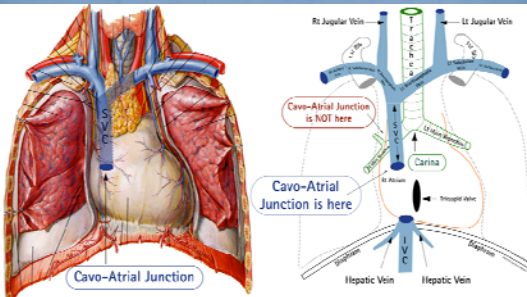
Veins and X-Rays



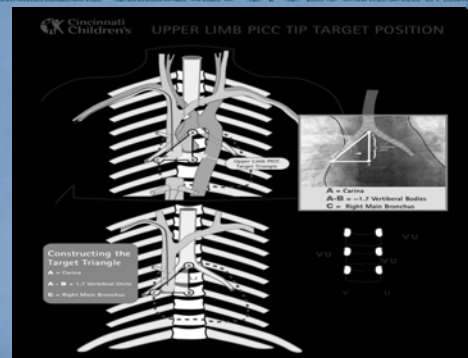
Preferred Central Catheter Tip Locations



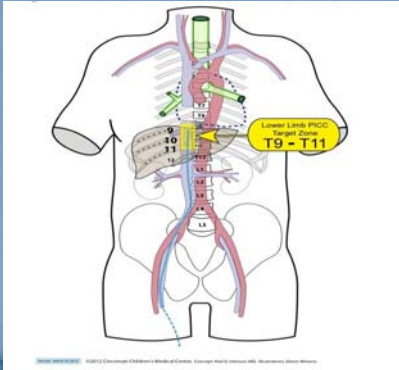
Pediatric Tip Location



Cincinnati Children's CVC Location Map

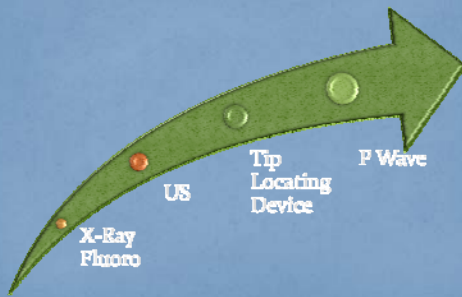


Cincinnati Children's CVC Location Map



How to Know it's Right

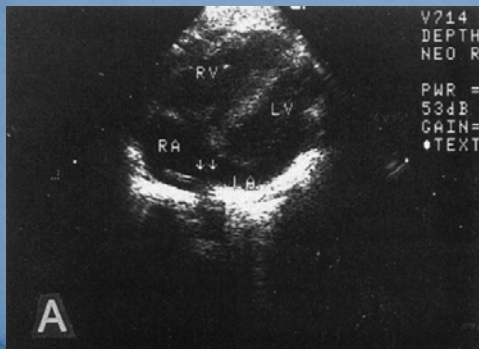
Determining Tip Location: What Does it Take?



X-Ray/fluoroscopy



Ultrasound

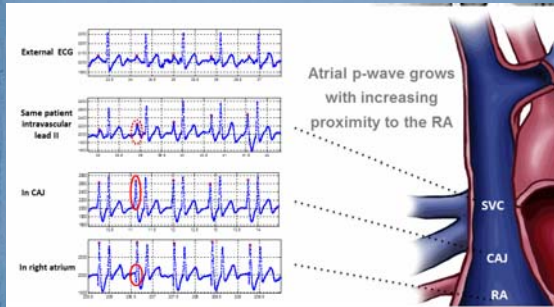


Catheter Tip Locating Devices



- Uses magnetic stylet within PICC
- Advantages:
 - Accurate to within 1 cm
 - Fewer x-rays
 - Decrease time for insertion
- Disadvantages
 - Costs ±
 - Limits in pediatrics
 - Evidence
 - Sizes

P-Wave Morphology



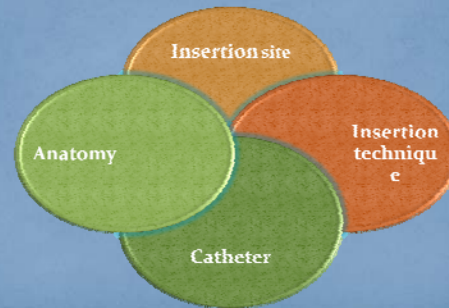
EKG Guided PICC Placement

- Allows confirmation of tip location by evaluating height of P wave
- Methods
 - Guidewire
 - Saline
- Advantages
 - Rapid identification of tip
- Disadvantages
 - Availability
 - Competency
 - Costs ±

Non-Radiographic Assessment Findings of Malposition

- May be asymptomatic
- Symptoms related to position
 - Cardiovascular
 - Pulmonary
 - GI
 - Neurologic
 - *Soft tissue swelling
 - *Pain
 - Other
- Change in catheter function
- Infusion pump occlusion alarm
- Change in external length of catheter

Risk Factors: Insertion Related Catheter Malposition



Malposition

“To conclude, CVC using single orifice catheter through arm veins in pediatric patients is easy to perform, but the proper catheter tip placement is highly unreliable, particularly in younger children 1 to 5 years of age.”

Chaturvedi, et al. (2003). J Neurosurg Anesthesiol, 15(3):170-5.

Malposition: Post-insertion Factors

- Patient position/Movement
- Catheter dislodgment
- Dressing security
- Change in intrathoracic pressure
 - Coughing
 - Vomiting
 - High frequency ventilation
- Other forces

Complications Associated with Malpositioned Catheters

- NONE
- UNKNOWN
- Respiratory
 - Effusions
 - Paralysis
 - Hiccoughs
- Cardiac
 - Dysrhythmias
 - Effusion/tamponade
- Vascular
- Tissue
- Neurologic
 - Seizures
 - Altered exam
- Renal
- Other

When it Isn't Right

Correction of Malpositioned PICCs

- Timing
 - Insertion
 - During dwell
- What's correctable?
 - Vein
 - Type & size of catheter
 - Patient specifics
 - Time in location
- Techniques
 - Assisted
 - Spontaneous
- Outcomes

Passive Techniques: Repositioning Catheters

- Wandering catheter: It it changed once, it can change again
- Gravity
- Venous return
- Time
- Luck

Effect of Body Movement on Peripherally Inserted CVC Tip Location

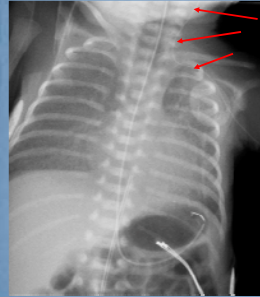
Site	Abduction	Adduction	Flexion	Extension	Head Rotation
Arm - Basilic	↑	↓	↓	↑	-
Arm - Axillary	↑	↓	-	-	-
Arm - Cephalic	↓	↑	↓	↑	-
Scalp/ Jugular	-	-	↓	↑	↓
Leg	--	-	↑	↓	-

Active Techniques: Repositioning Catheters

Bedside Techniques

- Reposition patient to utilize gravity
- Arm & leg - extremity manipulation
- Flushing - gentle vs power
- Infusion of fluids
- Venous return
- Time
- Imaging to confirm correction
- Other - IR approaches

Repositioning Left Arm to Jugular



If catheter in basilic vein travels to jugular:

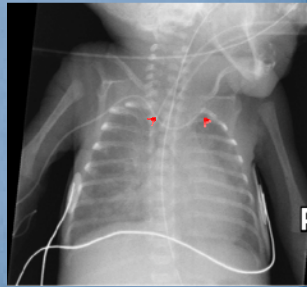
1. Abduct arm at shoulder
2. Extend elbow to retract catheter
3. Adduct arm
4. Flex elbow to advance catheter

If catheter in cephalic vein travels to jugular or axilla:

- Adduct the arm
- Extend the elbow to withdraw catheter
- Abduct the arm
- Flex the elbow to re-advance catheter

Tip in Contralateral Brachiocephalic Vein Repositioning

- Reposition patient to utilize gravity
 - Sit upright - jugular tip location
 - Place on ipsilateral side if catheter has crossed midline to contralateral side
- Dynamic forces:
 - Gentle flushing
 - Infusion of fluids
 - Venous return to heart
- Reconfirm catheter position radiographically
- Length of efforts



When Unable to Achieve Vena Cava Tip Position

- Assess risk vs. benefit of location, consider infusates & length of treatment
 - Brachiocephalic & subclavian tips
 - ??Lower IVC tips
 - Midline tips

Is It ok to leave in this position

Thrombosis Resulting From Incorrect Tip Position



Real Time Safety Dilemmas



Case

History

A PIV was used to infuse epinephrine & during my beginning of shift assessment I discovered...

Prevention: Peripheral IV Complications



Peripheral Venous Infusion Risk

This is an estimate of risk for phlebitis or local tissue injury due to extravasation. Risk derived from available evidence, CCHMC data and CCHMC expert opinion, subject to review and change as further evidence becomes available.

This does not apply in situations of emergency medical treatment. If a medication is not on this list, please refer to the CCHMC formulary or contact pharmacy (6-699) for information.

Red Higher Risk	Yellow Intermediate Risk	Green Lower Risk
<p>Acyclovir Caffeine Citrate Calcium (all salt forms) Dextrose > 12.5% Doxycycline Mannitol 20% & 25% Promethazine Potassium >60 mEq/L Sodium bicarbonate Sodium chloride ≥ 3% TPN > 950 mOsm/L Vasopressors such as Dopamine Chemotherapy Drugs</p>	<p>Acetazolamide Allopurinol Amikacin Amphotericin B (conventional) Arginine Ciprofloxacin Dextrose 10% to ≥12.5% Erythromycin Ganciclovir Lorazepam Midazolam Morphine Ondansetron Nafgillin Non-Ionic Radiology Contrast Phenobarbital Phenytoin Potassium ≤ 60 mEq/L TPN ≤ 950 mOsm/L Vancomycin</p>	<p>Amphotericin B Liposomal Aspirin Aztreonam Cefazolin Cefazoxime Ceftriaxone Cefuroxime Chlorthalidone DRL Dextrose < 10% Diuretics Fentanyl Fluoxetine Gentamicin Heparin Insulin IVIG Lactated Ringers Lipids Magnesium sulfate (bolus) Maroprost Methylprednisolone Normal saline Pantoprazole Piperacillin Piperacillin/tazobactam Triclabazone Tobramycin</p> <p>* NOTE: No peripheral intravenous infusate is "safe". Gross extravasation, even of normal saline, may result in serious tissue injury including compartment syndrome, resulting in ischemia and loss of tissue or permanent loss of limb function.</p>

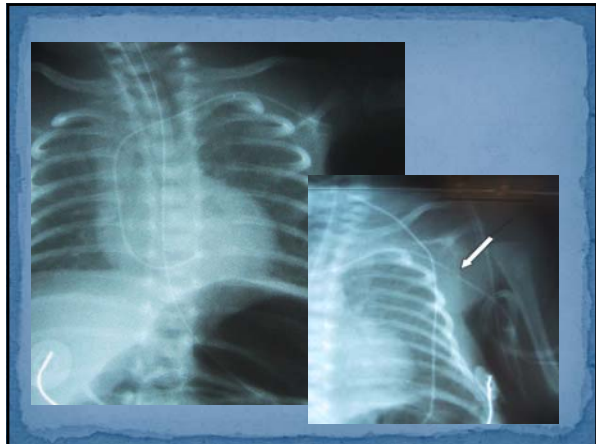
Real Time Safety Dilemmas



Case

History

The infusion pump had an occlusion alarm. The fellow flushed the PICC and it worked fine. Several days later we discovered...



Real Time Safety Dilemma

Case



History

When we removed the PAL after not being able to get blood return, we noticed this at the insertion site...

Arterial Catheter Complications



Real Time Safety Dilemmas

Case

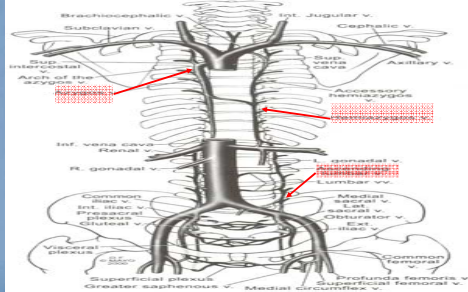


History

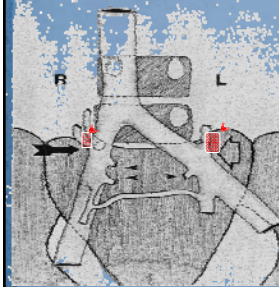
My baby had a seizure!!

We did a LP to rule out sepsis and drained TPN!!

Azygous & Hemizygous Systems

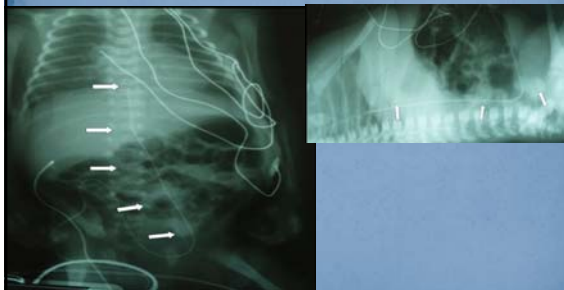


Route to Ascending Lumbar Vein

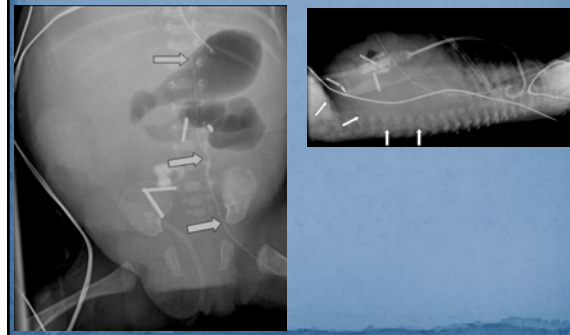


- Left sided insertion most common
 - fails to cross midline
 - appears to overlay spine
- Subtle, lateral deviation (hump) of catheter at L4-5 for left sided insertions
- Curl in catheter in inguinal region
- Investigation
 - Skill in interpretation
 - Lateral radiograph
 - X-ray with contrast

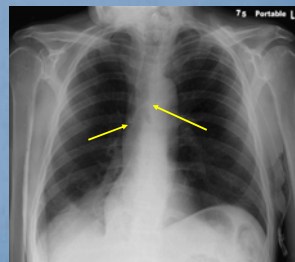
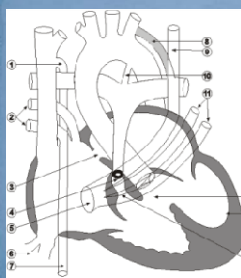
Normal Inferior Vena Cava (IVC) Tip Placement



PICC in Ascending Lumbar Vein



Azygous Catheter Location



Courtesy of Tim Royer

Scalp insertion



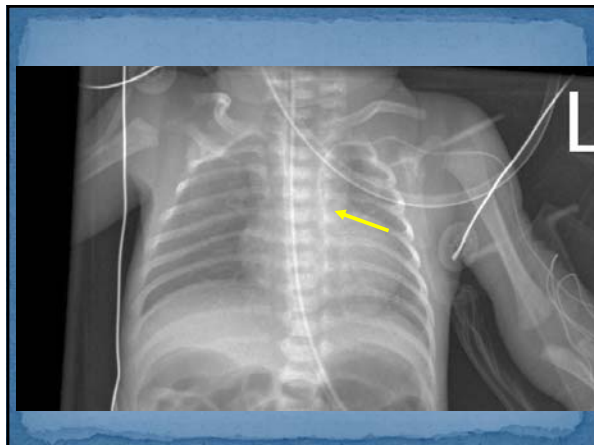
Real Time Safety Dilemmas

Case

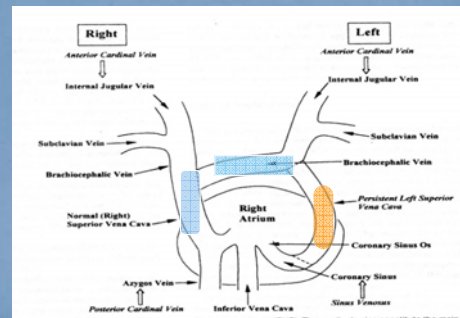


History

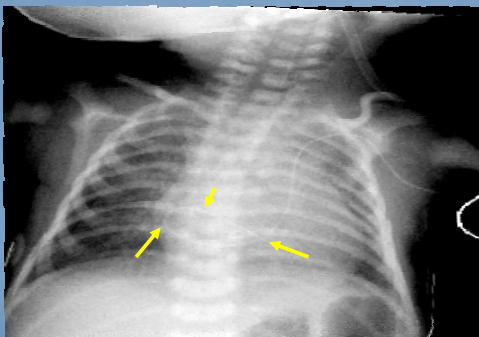
The PICC looked different on the chest x-ray...



Redundant/Persistent Left Superior Vena Cava



Left Sided Vena Cava



Real Time Safety Dilemma

Case



History

While doing my beginning of shift assessment, I noticed the fingers on the right left hand were dusky and cool...

or

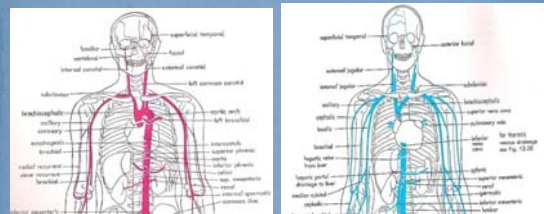
Post PICC insertion, The arm turned blue!



Can you always identify when an insertion is arterial?

True or false

Arterial vs Venous Anatomy



- Distinction clearer in adults
 - *Artery crosses over clavicle vs under
 - Left sided insertion does not cross midline
 - Right sided insertion crosses over sternum & to left
 - Leg insertion - joins aorta to left of midline

Arterial Cannulation

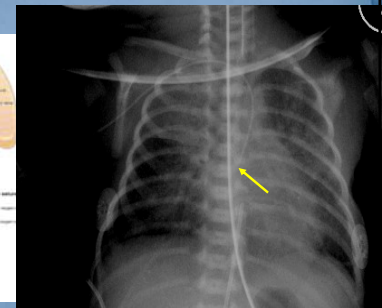
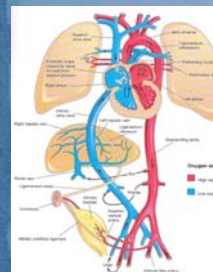
Arteries

- Arm
 - Brachial
 - Axillary
- Scalp
 - Temporal
- Leg
 - Popliteal
 - Dorsalis Pedis

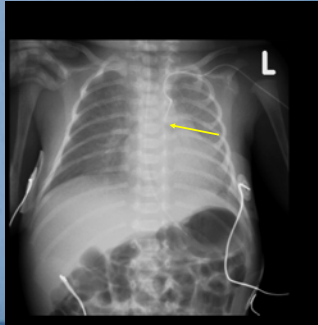
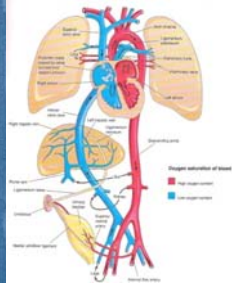
Evaluation

- Radiographic
- Physical features
- Laboratory studies
- Transduce
- Visual evaluation
 - Blood flow
 - Color
- ? Aberrant anatomy

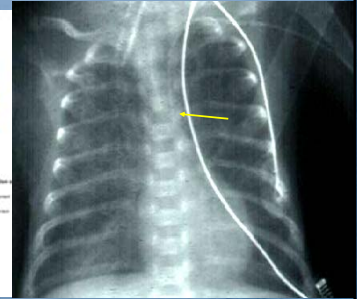
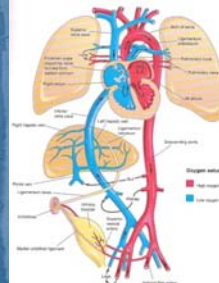
Arterial Insertion



Arterial Insertion



Arterial Insertion



Real Time Safety Dilemma

Case



I think my patient has NEC...

Superficial Abdominal Vein



Baker, J et al. Arch. Dis. Child. Fetal Neonatal Ed. 2002;86:61-F62

Real Time Safety Dilemmas

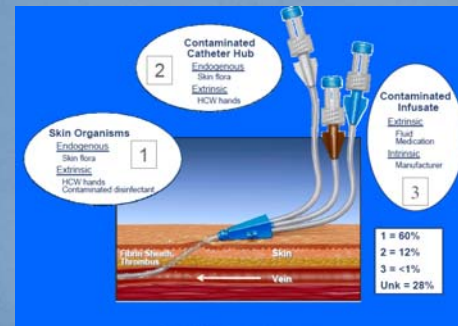
Case



History

Our rate of CLABSI is too high. What can we do?

CLABSI Pathogenesis



Safdar & Maki, 2004

Infection Related to Length of Dwell

- Greater rate if PICC in > 21 days Chathas et al 1990
- Greater risk if CVC in >22 days Stoll et al 2003
- Greater risk if PICC in >35 days Sengupta et al 2010
- Greater risk if CVC in >11 days (median) Sammoh, et al 2010
- Umbilical lines left in for 28 days have the same infection rate compared with the practice of removal at 7 days followed by placement of a PICC line for 21 days Butler-O'Hara et al 2006
- Repeat study 2006-09
 - Long term UVC & PICC 4.16/1000 CD
 - Short term UVC & PICC 3/1000 CD
 - PICC related CLABSI rate stable after 7 days while UVC CLABSI rate increased (p<0.001)

Butler-O'Hara et al. P&S Poster Presentation 2010 Vancouver

CCS CLABSI Prevention Bundle Elements

- Insertion
- Maintenance
- Leadership
- Diagnosis



- Go to website for information about bundle
<http://www.dhcs.ca.gov/ProvGovPart/initiatives/nqi/Pages/default.aspx>

Central Line Bundles: Advances

- Hub antiseptics
- Skin antiseptics
- Ensuring consistent practices
- Monitoring care processes



Marschall, Mermel, Classen, Arias, Podgorny & Yokoe, 2008

Agents & Methods for Disinfection of Needless Connectors



Line Insertion Checklist

CCHA/CCS Central Line Insertion Practices (CLIP) Adherence Monitoring Form

*Patient ID: _____ Patient Name: _____ *Gender: F M
 *Date of Birth: ____/____/____ (mm/dd/yyyy) *Consent Verified: Y N *Time out: Y N

*Event Type: CLIP *Location: ____/____/____ (mm/dd/yyyy)
 *Person recording insertion practice data: Inserter Procedure Observer: Y N
 Central line inserter ID: _____ Observer ID: _____

*Occupation of inserter:
 Fellow IV Team NP Medical student Other medical staff
 Physician Assistant Attending MD Inserter/Resident Other student
 Other (specify): _____

*Reason for insertion:
 New indication for central line Replace malfunctioning central line
 Suspected central line-associated infection Other (specify): _____

*Inserter performed hand hygiene prior to central line insertion: Y N
 *Maximal sterile barrier precautions used: Mask/Eye shield: Y N Sterile gown: Y N
 *Aseptic technique used: Large sterile drape: Y N Sterile gloves: Y N Cap: Y N
 *Face masks worn by those within 3 feet of sterile field: Y N
 *Problems encountered maintaining sterile field: Y N If Yes, specify: _____

*Skin preparation (check all that apply): Chlorhexidine gluconate Povidone iodine Alcohol
 *Was skin preparation agent completely dry at time of first skin puncture? Y N

*Insertion site:
 Femoral Jugular Upper extremity (PICC) Scalp (PICC) Lower extremity (PICC)
 Subclavian Umbilical Other: _____

Antimicrobial coated catheter used: Y N
 All supplies required for procedure available at bedside prior to insertion: Y N
 *Central line type:
 Dialysis non-tunneled PICC
 Dialysis tunneled Umbilical
 Non-tunneled (other than dialysis) Other (specify): _____
 *Tunneled, i.e. Broviac: Yes No Exit site: Scalp Chest Groin
 *Number of lumens (circle one): 1 2 3
 *Central line exchanged over a guidewire: Y N
 *Antibiotic ointment applied to site? Y N

Tubing Change Checklist

STERILE TUBING CHANGE CHECKLIST

- Hand hygiene.
- Don exam gloves and prime new fluid through new tubing.
- Discard exam gloves and wash hands.
- Open sterile gloves (find appropriate area that will decrease risk of contamination). Place the sterile side of the outer sterile glove wrapper underneath the connection of patient's central line and tubing.
- Use packaging from sterile gloves as a sterile field. Carefully open (2) packages of sterile 2 x 2 gauze, (4) alcohol wipes and drop onto sterile field.
- Don mask, hat, and sterile gloves.
- With one hand, pick up (1) sterile 2 x 2 gauze and place around old tubing that is attached to patient's central line.
- With your other hand, scrub JUNCTION of the catheter and old tubing with (2) alcohol wipes: 1 for 15 seconds, then a 2nd alcohol wipe for an additional 15 seconds, for a total of 30 seconds.
- Allow alcohol to dry (approximately 30 seconds).
- Pick up (1) sterile 2 x 2 gauze to hold patient's catheter, disconnect old tubing with other hand and set aside.
- Use (1) sterile 2 x 2 gauze to pick up new tubing and connect to patient.
- Repeat steps for additional lumens if necessary.

Courtesy of Rady Children's

Needless Connector Checklist

Post-Flow & SmartSite Sterile Changes for PICC/CVP/UA/C Checklist:

- Hand hygiene
- Set up sterile field using outer wrapper of sterile gloves
- Carefully open (2) packages of sterile 2 x 2 gauze, (4) alcohol wipes and a 10x1 inch valve(s) or SmartSite(s) and drop onto sterile field
- Clamp catheter tubing (CVP only, do not clamp PICC)
- Don sterile gloves, hat, and mask
- Use (1) sterile 7 x 7 gauze to hold catheter
- Scrub junction of the catheter and the Post-Flow valve or SmartSite with alcohol wipes x 2 for 30 seconds (remembering to use (2) alcohol wipes, 15 seconds each)
- Allow alcohol to dry for approximately 30 seconds
- Use (1) sterile 2 x 2 gauze to remove Post-Flow valve or SmartSite
- Discard
- Firmly attach the new positive pressure valve or new SmartSite
- Draw back to remove any air bubbles and flush with 1 ml NS to clear the catheter
- Then attach a 3 ml syringe containing 1 ml of 1% (w/v) heparin lock solution. Draw back to remove any air bubbles and flush.
- Remove syringe from the 10x1 inch Access Device. Do not place any caps or SmartSite valves to the end of the Post-Flow Device.
- It is not necessary to change reference set when using Post-Flow
- Label 10x1 inch with date of placement 10x1 inch and SmartSite are changed every 72 hours

(Remember to document heparin lock flushes on the MAR)

Courtesy of Rady Children's



Line Set-Up Auditing

Date: _____ Shift: _____ Observer: _____

Observation #	Perform hand hygiene adequately	Gather supplies	Use disinfectant wipe to clean surface of counter	Clean or sterile barrier used for tubing	Place new tubing & supplies on barrier without contamination	Perform hand hygiene adequately	Wear sterile/don gloves during tubing assembly	Wipe items required for procedure, per assembly	Use aseptic technique to connect components & without contamination without contamination	Connect IV solution to tubing & prime without contamination	Place tubing in bed without contaminating seal	Place XXX under CVC connection site	Scrub connections (to 1.5 sec with alcohol/CHG before disconnecting)	Perform hand hygiene & don	Connect tubing to VAD without contamination	Perform hand hygiene after glove	Label tubing w/ date, site, & time	Provide feedback
1	Y	Y	Y	Y	Y	Y	Y	H	F	C	NA	Y	Y	Y	Y	Y	Y	Y
2	Y	Y	Y	Y	Y	Y	Y	H	F	C	NA	Y	Y	Y	Y	Y	Y	Y

Developed by CCS CLABSI Prevention Collaborative

Catheter Entry Auditing

Observation #	Reason for entry: T-tubing change M-need administration P-PRN U-urinary C=Chlorhexidine O=Other	UVC: U=UVC C=Chlorhexidine O=Other	Perform hand hygiene	Apply clean gloves	Place clean/sterile barrier under port for 10-15 sec using friction	Port scrubbed using: A=Alcohol C=Chlorhexidine O=Other	Wipe port without contamination	Flush antibiotic from port without contamination	Single use pre-filled flush syringe used only 1 time	All blood/residue flushed clear from injection port	Wipe injection port surface to flow into blood draw	Remove gloves	Perform hand hygiene	Provides feedback
1	BTM	PUA	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
	UV	PI												
	O													

Developed by CCS CLABSI Prevention Collaborative

Investigating Failure



Positive Blood Culture Review

Version 15
3-8-2012

DOB: ___/___/___ Birth WT: ___(gm) GA: ___/___wk & days/7 Date 1st + blood culture drawn: ___/___/___

Record below: Risk factors present at time blood culture drawn & data about the positive blood culture	
<input type="checkbox"/> [Y/N] Immunocompromised other than being premature	<input type="checkbox"/> [Y/N] Endotracheal tube present
<input type="checkbox"/> [Y/N] Compromised skin integrity	<input type="checkbox"/> [Y/N] Intubated within 72 hrs.
<input type="checkbox"/> [Y/N] Open body cavity	<input type="checkbox"/> [Y/N] NCPAP/Nasal cannula present
<input type="checkbox"/> [Y/N] Ostomy present	<input type="checkbox"/> [Y/N] Feeding tube present
<input type="checkbox"/> [Y/N] Surgical site infection receiving Rx	<input type="checkbox"/> [Y/N] Continuously indwelling: if so date last changed: ___/___/___
<input type="checkbox"/> [Y/N] Major surgery within past week	Enteral fluids: ___ ml/kg/d, Parenteral nutrition: ___ ml/kg/d
Specify most recent major surgery: _____	during last full day prior to sepsis workup
	<input type="checkbox"/> [Y/N] Other risk factors: (see)
Catheter Information: Only relevant if line(s) present (or discontinued) within 48 hours prior to first blood culture	
<input type="checkbox"/> [] No deep line present	<input type="checkbox"/> [Y/N/NA] Port protector on needleless connectors in place if used in your NICU
<input type="checkbox"/> [] PV ___# days (if multiple sites, note only longest)	<input type="checkbox"/> [Y/N] Antibacterial patch in use: Type: _____
Estimate # IV start attempts in last 72 hrs: ___	<input type="checkbox"/> [Y/N] Abnormal CL site appearance on day culture drawn
<input type="checkbox"/> [] UAC ___# days present prior to 1 st blood culture	<input type="checkbox"/> [Y/N] Line-related phlebitis
<input type="checkbox"/> [] UVC ___# days present prior to 1 st blood culture	<input type="checkbox"/> [Y/N] Compromised dressing
<input type="checkbox"/> [] PICC ___# days present prior to 1 st blood culture	<input type="checkbox"/> [Y/N] Vomiting onto line dressing
Site: _____	<input type="checkbox"/> [Y/N] Spool/line onto line dressing
<input type="checkbox"/> [] Other CENTRAL line ___# days present prior to 1 st blood culture. Site: _____	<input type="checkbox"/> [Y/N] Line repaired/exchanged in past 48 hours
Estimate total # times all lines accessed during the last 72 hours (including all meds/blood draws/ tubing changes, etc)	<input type="checkbox"/> [Y/N] Line leaking events in past 48 hours
Last date tubing changed: ___/___/___	<input type="checkbox"/> [Y/N] Care by temporary staff in past 48 hours
Last date dressing changed: ___/___/___ (applies only to umbilical & central lines)	<input type="checkbox"/> [Y/N] Care by non-NICU staff in past 48 hours
	<input type="checkbox"/> [Y/N] Stalling difficulties for the NICU over past 48 hours
	<input type="checkbox"/> [Y/N] Improper line set-up
	<input type="checkbox"/> [Y/N] Tubing/infusate NOT changed appropriately (mech/odtime)
	<input type="checkbox"/> [Y/N] Any other unusual event (specify): _____
	<input type="checkbox"/> [Y/N] Line discontinued < 48 hrs prior to drawing blood culture

Developed by CCS CLABSI Prevention Collaborative

Skin Antisepsis: Is There a Best Product

Choosing the Best Skin Antiseptic

- Factors to consider
 - Efficacy – microorganism coverage: gram + & -, viruses, pathogenic fungi
 - Broad spectrum
 - Active despite presence of organic matter
 - Length of action
 - Patient factors
 - Non irritating
 - Toxicity

Properties of Skin Antiseptic Agents

Antiseptic	Mode of Action & Dry Time	Spectrum of Action	Application
Alcohol	Denatures cell proteins Less than 1-2 minutes.	Gm+, Gm-, bacteria, fungi, viruses	Apply with friction away from site
Povidone-iodine	Destroys bacterial protein, DNA. At least 2 minutes.	Gm+, Gm-, bacteria, fungi, viruses	Circular outgoing motion for 30 sec
Chlorhexidine/Alcohol 2% & 3,15%	Disrupts bacterial cell membranes Less than 2 minutes	Gm+, Gm-, bacteria, fungi, viruses	Central lines – 30 sec – 2 min (product dependent)
Chlorhexidine/Aqueous 2% & 4%	Disrupts cell membranes. ? Dry time	Gm+, <Gm-, bacteria, <fungi, viruses	Circular outgoing motion for 30 sec

Denton, 2001; Linder, Davidovitch, Reichman, Kuint, Lubin, Meyerovitch ... & Sack, 1997

Properties of Skin Antiseptic Agents

Antiseptic	Kill Time	Residual Activity	Removal Recommended	Inactivated by Blood or Body Fluids
Alcohol	Rapid	None		No data
Povidone-iodine	Intermediate	Minimal ~2 hours	Yes	Moderate to inactive
Chlorhexidine/Alcohol 2% & 3,15%	Rapid	High As long as 2-7 days in single application	No	No
Chlorhexidine/Aqueous 2% & 4%	Intermediate	High, but requires cumulative effect in multiple applications	Yes	No

Denton, 2001; Linder, Davidovitch, Reichman, Kuint, Lubin, Meyerovitch ... & Sack, 1997

Concerns Associated with Skin Antiseptic Agents

Agent	Effect	Alleviation
Alcohol	Chemical burns	Unknown
Povidone Iodine	Absorption with iodine causing thyroid suppression Skin reactions	Remove from skin
CHG/Alcohol	Minimal absorption Toxicity not reported Skin reactions	No recommendation to remove
CHG/Aqueous	Minimal absorption Toxicity not reported Skin reactions	Remove with sterile water following the procedure (aqueous CHG will not dry due to its soapy consistency)

Pettit & Wyckoff, 2007; Lund, Kuller, Raines, Ecklund, Archambault, & O'Flaherty, 2007

History of CHG Use in Neonates

- More than 40 years¹
 - Use in bathing the newborn, umbilical cord cleansing, and wiping the skin to reduce infection
 - Few reports of significant adverse effects
 - Trace blood levels of CHG identified esp. premature newborns subjected to a variety of concentrations and repeated use.
 - ? Blood levels due to skin contamination rather than percutaneous absorption.
- Skin irritation in infants <1000 grams, *regardless of alcohol or aqueous base*
 - 2% CHG/aqueous²
 - 2% CHG/alcohol³
 - PI irritation double that of CHG/Alcohol

¹Mullany, Darmstadt & Tielsch, 2006

²Andersen, Hart, Vemgal & Harrison, 2005

³Garland, Buck, Maloney, Durkin, Toth-Lloyd, Duffy, . . . Goldmann, 1995

Adopting Evidence-Based Use of CHG/Alcohol in the NICU

- Barriers
 - Previous product labeling restricted use if < 2 months of age.
 - Updated product labeling January 2012: **Use with care in premature infants or infants under 2 months of age. These products may cause irritation or chemical burns.**
 - Skin reactions
 - Absorption
 - Fear of the unknown
- Facilitators
 - Emerging evidence
 - Improved CLABSI reduction
 - Minimal reactions
 - Adjusting use based on gestation & chronologic age
 - No toxicity associated with the minimal absorption
 - Realization that all skin antiseptics problematic
 - More than half of NICUs in US are using

Survey of Neonatal CHG Use

- Survey of Neonatology Fellowship Directors in the United States¹
 - CHG use 61%
 - 51% of users limited use on basis of birth weight, gestational age or chronological age.
 - Skin reactions (erythema, erosions, burns) occurring primarily in those weighing <1500 grams were reported by 51%.
 - **No difference in adverse events between the alcoholic or aqueous CHG preparations**
- Survey of nurses inserting PICC in U.S.²
 - CHG use 54%

¹Tamma, Aucott, & Milstone, 2010

²Sharpe & Pettit 2009

Can & Should CHG/Alcohol Be Removed From the Skin?

- Can it be removed?
 - Unknown
- Should it be removed?
 - Reduces persistent effect of antiseptic
 - Not linked to prevention of skin reactions
 - No studies on transcutaneous absorption following attempts to remove

There is no evidence to support removal & it may defeat the proven benefits of CHG with an **↑** in CLABSI

Summarizing the Debate About Chlorhexidine/Alcohol

Pros

- Residual antimicrobial effects of both CHG/alcohol discourages colonization for up to 7 days
- Not inactivated by blood or body fluids as is povidone iodine
- Increasing body of evidence to support safe, effective use
- Updated product labeling for those < 2 months of age

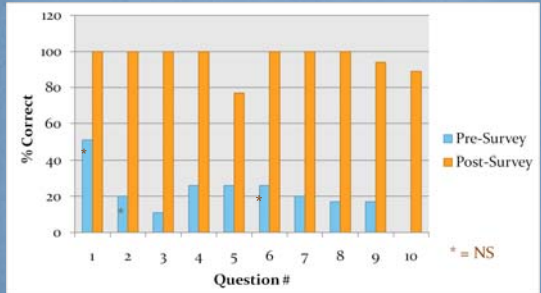
Cons

- Potential skin irritant
 - Probably population based
- Low proven risk of topical absorption
 - No toxic effects identified
- Attempts at CHG/alcohol removal may be detrimental

Survey of CHG/alcohol Use & Removal During PICC Insertion

- **Pre-Survey – 21 questions**
- 7 questions – Demographics
- 3 questions – Qualifying questions
- 7 questions – Knowledge of CHG/alcohol use
- 2 questions – Reasoning for method of use of CHG/alcohol, including source of knowledge about product use
- 2 questions – Assessment of attitude regarding CHG/alcohol use
- **Post-Survey – 22 questions**
- 1 question – Program evaluation

Responses to Knowledge Questions



Clinical Significance of Findings



- Significant lack of information or misinformation
- Risk to patients
- Knowledge can be changed through use of a targeted education program

CHG Question 1

How does the manufacturer recommend applying chlorhexidine/alcohol?

- A Using a circular motion
- B Back and forth, side to side motion
- C I do not know the manufacturer's recommendation

CHG Question 2

The manufacturer does not recommend removal of chlorhexidine/alcohol from the skin following a procedure.

- A True
- B False
- C I do not know the manufacturer's recommendation

CHG Question 3

When applying chlorhexidine /alcohol, if erythema results it is a normal response to the alcohol.

- A True
- B False
- C I do not know

CHG Question 4

Both chlorhexidine in a water or an alcohol-base have been linked to skin irritation in neonates.

- A True
- B False
- C I do not know

CHG Question 5

Chlorhexidine can be easily removed from the skin using water or saline.

- A True
- B False
- C I do not know

CHG Question 6

Chlorhexidine is inactivated in the presence of blood and other body fluids.

- A True
- B False
- C I do not know

CHG Question 7

When left on the skin, chlorhexidine imparts persistent antiseptic action for at least two days.

- A True
- B False
- C I do not know

CHG Question 8

Do you feel that leaving chlorhexidine on the skin protects the neonate from infection?

- A Yes
- B No
- C I am unsure

Summary



The End



Questions: jspettit@sbcglobal.net

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