
YNHH Initiative to Reduce Catheter-related Blood Stream Infections (CR-BSI)



Background: Central Venous Catheters

- A CVC or Central Venous Access Device (CVAD) is an intravenous catheter whose tip ends in the central venous system
- Common sites of insertion include internal jugular vein, subclavian vein, femoral vein, and as well as the cephalic & basilic veins (PICC: peripherally inserted central catheter)
- Indications:
 - ✓ Hemodynamic monitoring
 - ✓ IV fluids, medications, vasopressors, blood products, chemotherapy, total parenteral nutrition
 - ✓ Frequent phlebotomy
 - ✓ Hemodialysis

Background: Scope of Problem¹

- 18 million ICU days (11% of total hospital days).
- 9.7 million catheter-days in ICUs (54% of ICU days).
- 48,600 patients in the ICUs have a CR-BSI (catheter-related bloodstream infection (5 BSI/1000 catheter days).
- 17,000 deaths attributable to CR-BSIs in the ICU.
- Although the catheter utilization rate is lower outside of the ICU setting, as many or more CR-BSIs occur outside the ICU setting.²

1. Wenzel RP & Edmond MB: NEJM 355(26):2781-83 (2006)

2. Marschall J et al. Infection Control & Hospital Epidemiology 28(8):905-9 (2007)

CR-BSI Definition: CDC National Healthcare Safety Network (NHSN)

- Presence of a recognized pathogen cultured from one or more blood cultures *and* organism cultured from blood is not related to infection at another site

or

- Presence of a common contaminant bacteria cultured from the blood AND at least one of the following:
 - ✓ *Fever (temperature >38°)*
 - ✓ *Chills*
 - ✓ *Hypotension*

(and signs and symptoms and positive results not related to infection at another site)

Risk Factors for CR-BSI

- Duration of catheterization (CVAD duration > 3 -4 days)
- Increased diameter and number of ports on catheter
- Location (femoral > internal jugular > subclavian)
- Type of catheter:
 - ✓ Tunneled catheters lower risk than non-tunneled
 - ✓ Antimicrobial/Antiseptic coated catheters are lower risk than non-coated
- Thrombosis at the site of the CVAD
- Infusion with TPN or other lipid rich infusate
- Impaired skin integrity (burns, dermatologic disease)

Pathogenesis of Catheter Infection

- Source of organisms causing CVAD infections:
 - ✓ Contamination during insertion or CVAD maintenance
 - ✓ Intraluminal or hub contamination
 - ✓ Skin colonization
- Contributing Factor: Biofilm deposition on external & internal surface of catheter
- Most common etiology is due to skin colonization and resultant microbial migration through catheter entrance site along tract and infection of biofilm surrounding catheter.
- Catheter tract infection can also occur in absence of associated BSI.

Prevention of CR-BSI

- Multicenter trial in 103 Michigan Adult ICUs using a central line bundle*:
 - ✓ Hand washing prior to putting on sterile gloves
 - ✓ Maximum barrier precautions
 - ✓ Chlorhexidine for skin disinfection (allow to dry; *not for children < 1yr old*)
 - ✓ Avoid femoral site for insertion
 - ✓ Removal of catheters as soon as feasible
- Process components included:
 - Education of clinicians
 - Central-line cart with necessary supplies
 - Use of a standardized checklist for insertion to guide adherence
 - Empowerment of nursing staff and observers to halt procedures which do not follow checklist and adherence to guidelines or sterile procedure
 - Daily review of necessity of catheter
 - Feedback to providers regarding infections
- Mean rate of CR-BSI dramatically decreased from 7.7/1000 catheter days to 1.4 BSI/1000 catheter days.*

*Pronovost et al. New England Journal of Medicine 355(26):2725-32 (2006)

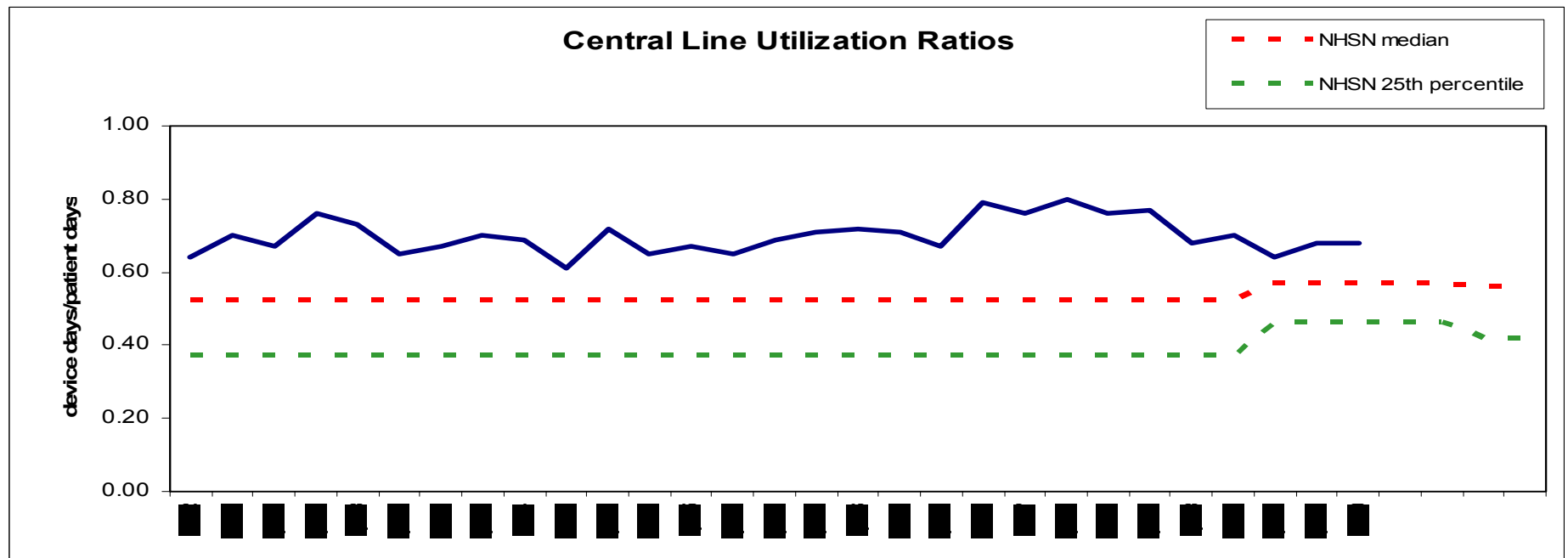
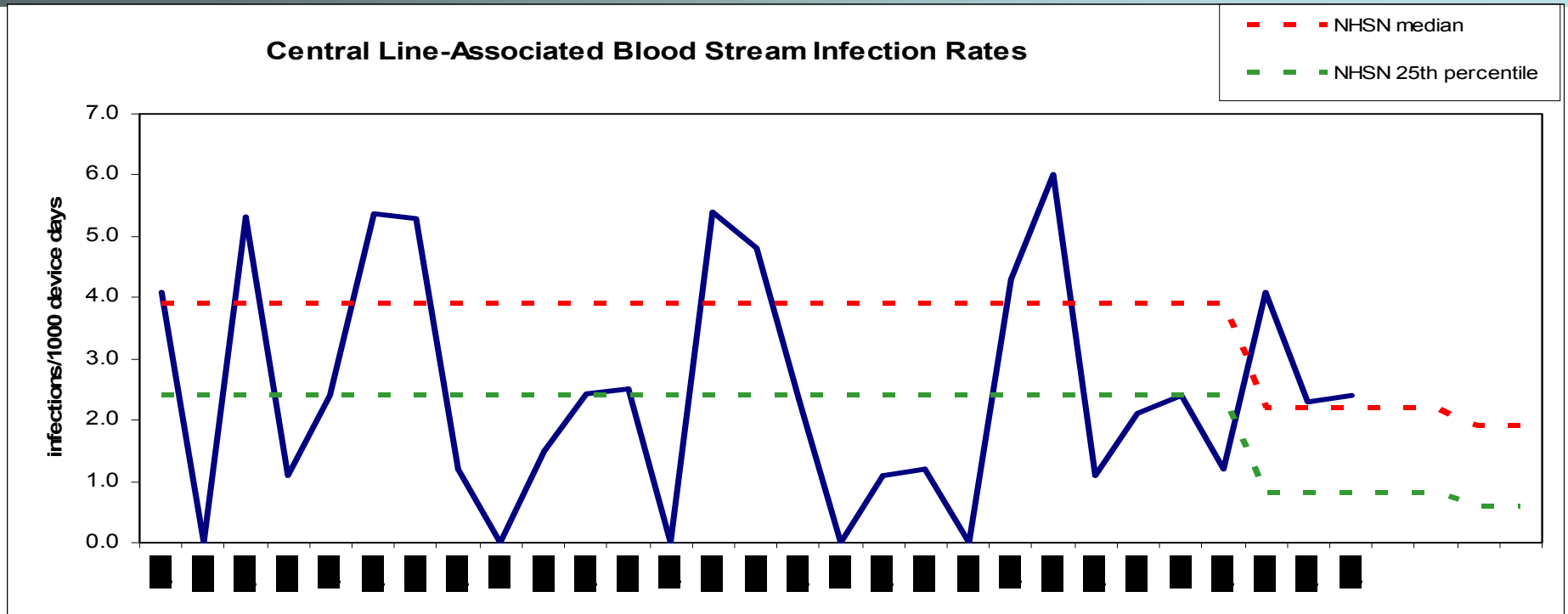
Background: Regulation and Reporting

- CMS no longer reimburses for vascular catheter associated infections as of October 1, 2008
- Catheter-related blood stream infections are reportable to the state and data is available to the public
- National Patient Safety Goals 2009 (The Joint Commission)
 - ✓ Mandates the use of a central line insertion checklist (with specified elements on checklist) and a standardized protocol for CVC insertion.
 - ✓ Mandates education for nursing and physician providers annually (All licensed independent practitioners who are inserting CVADs)
 - ✓ Mandates patient and family education
 - ✓ Standardization of maintenance protocol with checklist
 - ✓ Full scale implementation: January 1, 2010

Background: Regulation and Reporting

- Reduction of CR-BSI's is one of several components of hospital wide effort to reduce Hospital Acquired Infections (HAIs)
- Data on YNHH CR-BSI's is provided weekly to physicians, nursing staff, and hospital leadership
- Information provided on infections, catheter days, and overall catheter usage for all ICUs (sample on next page)
- Information is provided relative to average data from NHSN data for similar type of ICU or care location
- All elements of the NPSG 2010 recommendations have been incorporated into the new CVAD Insertion Checklist and CVAD Catheter maintenance policies.

Sample of Reporting of CR-BSI Infection Rates at Yale-New Haven Hospital



Components of Effort to Reduce CR-BSI

- **Central line insertion checklist and CVAD policy:**
 - ✓ Elements of the checklist are reviewed in detail in the following slides.
 - ✓ Checklist hard copies available under “C” in the clinical workstation.
 - ✓ Completed copies should be returned to nursing leadership on each unit.
 - ✓ Completion of training required for all who insert CVADs is required upon hire and annually per YNHH policy and the National Patient Safety Goals.
- **Patient and Family Education**
 - ✓ Education should occur at time of consent if possible using educational materials that have been developed for this purpose regarding CVAD devices in general and information related to CR-BSI.
- **Maintenance:**
 - ✓ New maintenance policy developed
 - ✓ Monitoring and prompt removal of unnecessary CVAD is essential component of reduction of CR-BSI

Approach to Procedure & Checklist Elements:

- The following steps **MUST** be completed for **ALL** line insertions on **ALL** patients.
- Pre-Procedure
 - ✓ Communicate plans to nursing and other staff who will assist
 - ✓ Consent
 - ✓ Patient & Family Education
 - ✓ Time-Out (Pre-procedural universal verification)
 - ✓ Hand Washing Directly Observed
 - ✓ **Maximal Barrier Precautions:**
 - Hat & Mask
 - Sterile Gloves
 - Sterile Gown
 - Sterile drape to cover entire patient and adjacent equipment (ventilator arms/tubing, IV pumps, side rails etc)
 - ✓ Disinfect procedure site and allow to dry(chlorhexidine except newborns/infants)
 - ✓ All staff directly assisting in procedure shall wear sterile gown & gloves along with a hat and mask
 - ✓ All staff working within room must wear mask and hat

Checklist Elements

- Intra-procedure
 - ✓ Maintenance of Sterile field
 - ✓ Consider obtaining help after 3 unsuccessful attempts
 - ✓ Use of ultrasound guidance as appropriate
 - ✓ Removal of guide wire
- Post Procedure
 - ✓ Application of a sterile dressing (including “Biopatch” which is a chlorhexidine based dressing)
 - ✓ Imaging (if necessary)
 - ✓ Clean and return equipment (ultrasound, cart etc)
 - ✓ Complete checklist and submit to floor/ICU manager
 - ✓ Complete procedure note
- Nurses (and other observers) are empowered to **stop** the procedure if there has been a breach in sterile technique or any non-adherence to the checklist.

PATIENT LABEL

Yale-New Haven Hospital Central- Line Insertion Checklist

Date: _____

Type of Catheter:	Lumens(#)	Side (L or R)	Location of Insertion
<input type="checkbox"/> Central Line (TLC)	<input type="checkbox"/> 1	<input type="checkbox"/> L	<input type="checkbox"/> Subclavian
<input type="checkbox"/> Dialysis (non-tunneled)	<input type="checkbox"/> 2	<input type="checkbox"/> R	<input type="checkbox"/> Internal Jugular
<input type="checkbox"/> PICC	<input type="checkbox"/> 3		<input type="checkbox"/> Arm
<input type="checkbox"/> Umbilical (Art or Ven)	<input type="checkbox"/> 4		<input type="checkbox"/> Femoral
<input type="checkbox"/> Pulmonary Artery			Must indicate Reason for femoral _____
<input type="checkbox"/> Tunneled Access (Port / Dialysis / Other _____)			

Reason for Insertion: Elective Emergent Code Replace existing catheter over wire
(for use in limited circumstances only)

Procedure Provider: _____ Procedure Assistant(s) _____

		Yes	No	N/A
P r e - P r o c e d u r e	Consent obtained and Time Out performed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Hand washing directly observed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	All performing procedure are using maximal barrier precautions (Wearing sterile gloves, sterile gown, hat, mask and appropriate eye protection)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Disinfect site with chlor-hexidine (adults) or appropriate scrub followed by 30 seconds air dry			
	30 second for non femoral line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	2 minutes for femoral line	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
I n t r a - P r o c e d u r e	Sterile drapes to cover patient including whole bed & nearby equipment.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Mask and hat for all in room.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Maintenance of sterile field	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Ultrasound use if appropriate	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Consider obtaining help after 3 attempts	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Guide wire removed	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
	Cap and flush all ports	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
<i>If sterile technique is broken at any time, procedure should be stopped until sterile technique is restored. This rule does not apply during emergent procedures.</i>				
Sterile technique while securing and dressing the line.	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Verify placement by imaging (if necessary)	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Proper documentation entered in medical record	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	

Print Observer's Name: _____ Successful Unsuccessful

****Please return this form to repository in your ICU/unit.
Contact Attending/Unit Director if list not adhered to after prompting.

Comments (must comment on all items indicated by no or n/a): _____

YNHH Central Venous Access Device Insertion Checklist

Additional Key Points

- Practice does vary – infants and newborns should not have skin antisepsis with chlorhexidine (iodine antisepsis alternative for rare cases of chlorhexidine allergy)
- Many catheter infections are related to maintenance rather than insertion therefore daily surveillance with early removal of lines is essential.
- Blood cultures should *always* be drawn peripherally – contamination rate (false positives) if drawn through CVAD is substantial.
- Change of CVAD over a wire is not recommended and should be reserved for specialized situations (Due to inability to obtain other access (e.g. stenotic vessels) or emergencies).
- Consider antibiotic/antiseptic coated catheters and early transition to tunneled devices (e.g. transition quinton to permacath in 3-4 days) for immunocompromised hosts and those at high risk (skin breakdown).
- Chlorhexidine dressing (“Biopatch”) should be applied to newly inserted lines while site still sterile and is included in all dressing kits.

YNHH Initiative to Reduce Catheter-related Blood Stream Infections

(CR-BSI):

Review Questions: Answers &
Explanations



Question #1

All of the following are elements are now required for insertion of a central venous access device *except*:

- A)Betadine preparation of the site for adults
- B)Maximum barrier precautions
- C)Wash hands prior to procedure
- D)Use of a checklist



Question #1

All of the following are elements are now required for insertion of a central venous access device *except*:

- A)Betadine preparation of the site for adults
- B)Maximum barrier precautions
- C)Wash hands prior to procedure
- D)Use of a checklist

Explanation:

- (A) is incorrect. Chlorhexidine is a superior antiseptic and Betadine (iodine based antiseptic) is only for use in infants and babies less than 1 year of age.



Question #2

All of the following are true *except*:

- A) Hospital policy requires use of a checklist for insertion of a CVAD
- B) Practitioners privileged to insert CVAD devices must receive annual education regarding prevention of blood stream infections
- C) Rates of BSI at YNHH are reported to hospital staff as well as the state authorities
- D) Blood cultures should be sent from a CVAD to determine if there is an infection in the device



Question #2

All of the following are true *except*:

- A) Hospital policy requires use of a checklist for insertion of a CVAD
- B) Practitioners privileged to insert CVAD devices must receive annual education regarding prevention of blood stream infections
- C) Rates of BSI at YNH are reported to hospital staff as well as the state authorities
- D) Blood cultures should be sent from a CVAD to determine if there is an infection in the device

Explanation:

- (D) Blood cultures should be obtained peripherally under nearly all circumstances. Contamination rate when drawn from CVAD is significant leading to difficulty interpreting data and possible removal of a useful CVAD.



Question #3

All of the following are true *except*:

- A) CR-BSI are uncommon in non-ICU patients
- B) Femoral vein catheters are more prone to developing CR-BSI
- C) Tunneled access devices decrease the risk of CR-BSI
- D) Blood cultures should not be sent from a CVAD to determine if there is an infection in the device



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- C) Tunneled access devices decrease the risk of CR-BSI
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Explanation:

- (A) Although proportionally fewer patients have CVADs outside the ICU setting the total number is substantial and they are often in place for an extended duration. At YNHH, and nationally, historically more than half of CR-BSI's occur outside the ICU setting.



Question #4

All of the following are elements of the Insertion Checklist *except*:

- A) Consent obtained
- B) Maximum barrier precautions
- C) Use of chlorhexidine skin anti-sepsis routinely in adults
- D) Hand washing prior to putting on gloves
- E) Procedure should continue even if sterile field is disrupted



Question #4

All of the following are elements of the Insertion Checklist *except*:

- A) Consent obtained
- B) Maximum barrier precautions
- C) Use of chlorhexidine skin anti-sepsis routinely in adults
- D) Hand washing prior to putting on gloves
- E) Procedure should continue even if sterile field is disrupted

Explanation:

- (E) If the sterile field is disrupted the procedure must be began again from the start. Supervisors and observers (MD & RN) have been instructed to terminate the procedure if the sterile field is breached.



Question #5

Maximal barrier precautions include using a sterile drape to cover the entire patient and adjacent equipment (e.g., ventilator arms/tubing, IV pumps, side rails, etc.).

- A) True
- B) False



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- A) True
- B) False

Explanation:

- (A=True) Maximum barrier precautions means using sterile drapes, gowns, etc to cover a wide area around the patient and adjacent areas. Simply draping the patient to their knees or other predetermined point is not sufficient. There should be a clearly defined sterile field a minimum of 4-5 feet from the intended point of insertion for the CVAD.



Question #6

Only the person(s) inserting a CVAD, or those directly assisting with the procedure, need to wear a mask and hat. It is not necessary for other persons in the room to wear a mask and hat while a CVAD is being inserted.

- A) True
- B) False



Question #6

Only the person(s) inserting a CVAD, or those directly assisting with the procedure, need to wear a mask and hat. It is not necessary for other persons in the room to wear a mask and hat while a CVAD is being inserted.

- A) True
- B) False

Explanation:

- (B = False) Personnel in the room should wear a mask and hat to avoid contamination of the sterile field.



Question #7

Chlorhexidine is the preferred skin disinfectant (exceptions: newborns/infants, persons allergic to chlorhexidine) for CVAD insertion. It is important to let the disinfectant dry before starting the CVAD insertion procedure.

- A) True
- B) False



Question #7

Chlorhexidine is the preferred skin disinfectant (exceptions: newborns/infants, persons allergic to chlorhexidine) for CVAD insertion. It is important to let the disinfectant dry before starting the CVAD insertion procedure.

- A) True
- B) False

Explanation:

- (A = True) Chlorhexidine is a superior skin disinfectant when compared to iodine based preparations. Both products require time to dry to be effective.



Question #8

Which of the following is true?

- A) It is acceptable to leave a central line in when it is no longer needed but it might be needed in the future. Daily assessment of CVADs is not necessary.
- B) The patient's skin and contamination at the hub site are 2 sources of organisms that can cause a CVAD infection.
- C) Biofilm deposition along the external and internal catheter surface plays no role in CVAD infections.
- D) The only person authorized to halt a CVAD insertion when guidelines for insertion or sterile procedure is not followed is the person inserting the CVAD.



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- D) The only person authorized to halt a CVAD insertion when guidelines for insertion or sterile procedure is not followed is the person inserting the CVAD.

Explanation:

- (B) CR-BSI's are most commonly caused by bacteria from the patient's skin (migrating along catheter) or contamination of the hubs.



Question #9

Which of the following is true?

- A) Patients and their families are to be educated regarding CVADs and preventing infections. This should occur at the time of consent.
- B) Nursing and licensed independent practitioners (e.g., physicians, PAs, APRNs) are required to undergo annual training and education on techniques for preventing CVAD infections.
- C) The CVAD Insertion Checklist must be used for all CVAD insertions.
- D) Routine changes of CVAD and/or guide wire exchanges are not recommended.
- E) All of the above.

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- D) Routine changes of CVAD and/or guide wire exchanges are not recommended.
- E) All of the above.

Explanation:

- (E) Education of patients and families as well as healthcare workers is a important component of the National Patient Safety Goals from The Joint Commission. The checklist is required for all insertions unless truly emergent and guide wires exchanges are only for use in rare occasions.



Question #10

Which of the following is false regarding preventing CVAD infections?

- A) Avoid using the femoral vein for central venous access in adult patients.
- B) Remove non-essential catheters as soon as possible.
- C) Routinely replace central venous catheters.
- D) Scrupulous attention to aseptic technique during insertion and/or maintenance of CVADs is important in preventing CVAD infections.



Question #10

Which of the following is false regarding preventing CVAD infections?

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- C) Routinely replace central venous catheters.
- D) Scrupulous attention to aseptic technique during insertion and/or maintenance of CVADs is important in preventing CVAD infections.

Explanation:

- (C) Replacement of CVADs routinely is discouraged because it does not clearly reduce the risk of CR-BSI and does have risk related to insertion. Early removal of the CVAD or use of a tunneled catheter are recommended.

