



# Cvc management

**Eugenia Trigoso. Paediatric Committee  
Marrakech, May 2015**

# CVC management

- ▶ Introduction
- ▶ Types of cvc.    - advantages  
                          - disadvantages
- ▶ Risk and complications - infections
- ▶ Skin preparation
- ▶ Hand hygiene
- ▶ Catheter site dressing
- ▶ Replacement sets



# Types of CVC devices



External central  
catheter

Subcutaneous  
porth



# CVC common uses

- ▶ Chemotherapy
- ▶ TPN
- ▶ Antibiotics, anti-fungal, anti-viral medications
- ▶ Blood products (red blood cell transfusion, platelets, fresh frozen plasma, etc.)
- ▶ Other IV medications required for treatment.

# Catheters used for venous access

Cath. type	Entry site	Length	Comments
Nontunneled CVC	Percutaneously inserted into central veins (subclavian, internal jugular, or femoral)	≥ 8 cm depending on patient size	Account for majority of CRBSI
Tunneled central venous catheters	Implanted into subclavian, internal jugular, or femoral veins	≥ 8 cm depending on patient size	Cuff inhibits migration of organisms into catheter tract; lower rate of infection than nontunneled CVC
Totally implantable	Tunneled beneath skin and have subcutaneous port accessed with a needle; implanted in subclavian or internal jugular vein	≥ 8 cm depending on patient size	Lowest risk for CRBSI; improved patient self-image; no need for local catheter-site care; surgery required for catheter removal

# CVC criteria for placement

- ▶ Patients has difficult access
- ▶ Long term chemotherapy
- ▶ More of the chemotherapy agents are vesicant agents.
- ▶ Need for hyper alimentation
- ▶ Test blood.

# Criteria for placement

- ▶ **Diagnosis:** always Sub. Porth at the diagnosis
- ▶ **Age:**
  - less than 3 years old : Jugular vein
  - more than 3 years old: Femoral vein
- ▶ **BMT :** 2 lumen Hickman catheter
- ▶ Localization of solid tumours



# CVC criteria for placement

- ▶ The site at which a catheter is placed influences the subsequent risk for catheter-related infection and phlebitis.
- ▶ Studies in pediatric patients have demonstrated that femoral catheters have a low incidence of mechanical complications and might have an equivalent infection rate to that of non-femoral catheters.



# CVC advantages

- ▶ Easier to access once in place, especially during an emergency
- ▶ Minimizes or eliminates need for repeated venipuncture
- ▶ Increased mobility of patients during infusion
- ▶ Easier to administer treatment as an outpatient

# CVC disadvantages

- Surgical procedures for placement:
- Risk associated with surgery, general anesthesia and complication during insertion
- Requires maintenance
- Higher risk of infection and thrombotic event
- More expensive

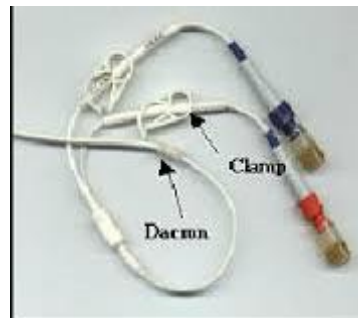
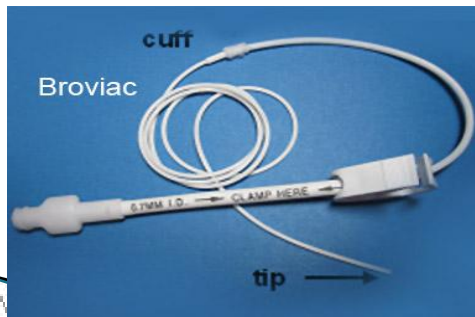
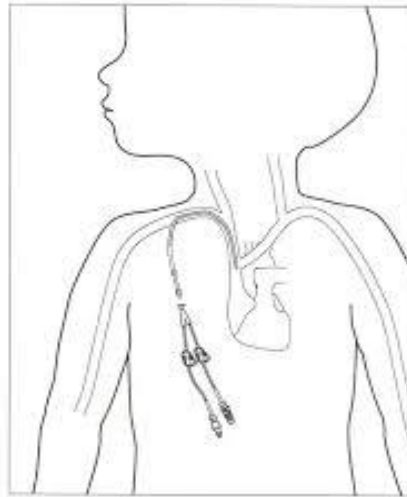
# Selection for catheters and sites

- ▶ No recommendation can be made for a preferred site of insertion to minimize infection risk for a tunneled CVC. **Unresolved issue !! (1A)**
- ▶ Use a CVC with the minimum number of ports or lumens essential for the management of the patient (IB)
- ▶ No recommendation can be made regarding the use of a designated lumen for parenteral nutrition. **Unresolved issue**

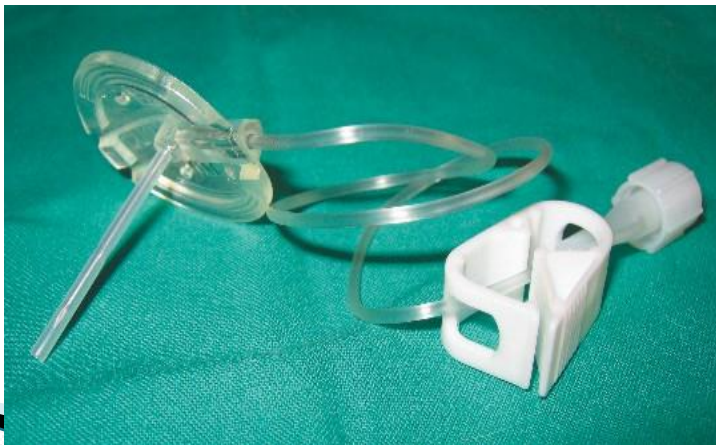
# CVC common areas of placement

- ▶ Internal jugular vein
- ▶ External jugular vein
- ▶ Subclavian vein
- ▶ Location of catheter tip: junction of the superior vena cava and right atrium.

# CVC Hickman or Broviac



# Subcutáneos- Porth

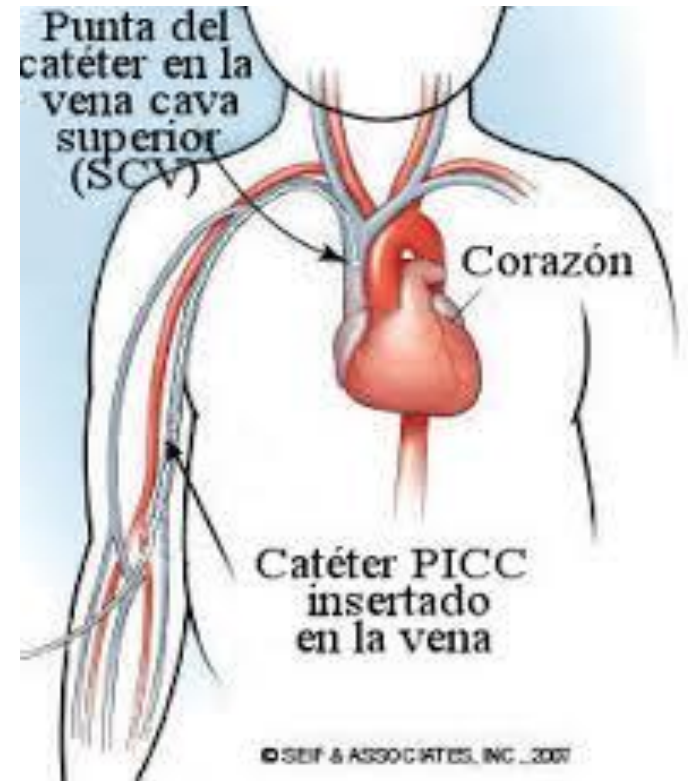


# Huber needle





# PICC





# Criteria for catheter use

- **External catheter:**

- ▶ bone marrow transplant
- ▶ able for care for catheter at home
- ▶ low risk for infection



- **SubQ Port:**

- ▶ high risk for infection
- ▶ young age, baby.
- ▶ patient or family preference



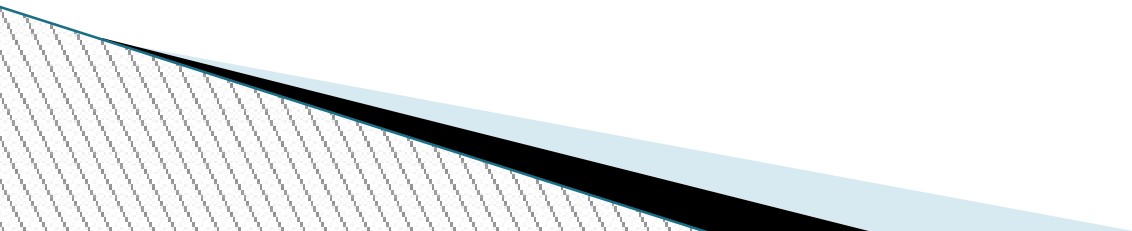
# Type of catheter material

- ▶ Polytetrafluoroethylene (Teflon<sup>®</sup>) or polyurethane catheters have been associated with fewer infectious complications than catheters made of polyvinyl chloride or polyethylene



# Subcutaneous Ports(SubQ Ports)

## Criteria for Port

- ▶ Environment high risk for infection
  - ▶ Unable to care for external catheter
  - ▶ Young age
  - ▶ Higher risk for accidental displacement or removal
  - ▶ Preference of family or patient
  - ▶ Less limitation to activity
  - ▶ Improved cosmetic appearance
- 

# The normal position of the Port-A-Cath in the superior vena cava.



# SubQ Ports : advantages

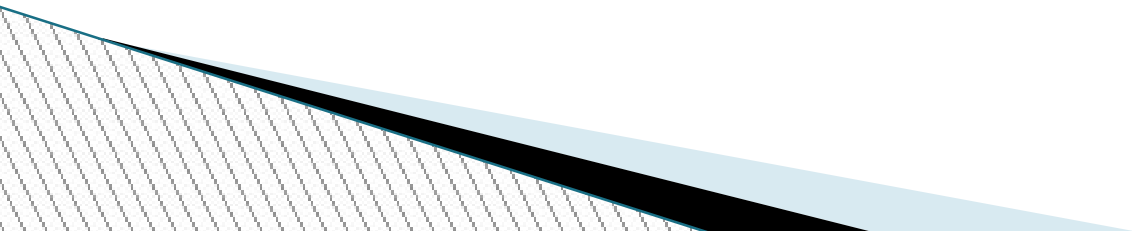
- ▶ Less frequent maintenance and no maintenance required at home.
- ▶ Lower incidence of infection
- ▶ Lower incidence of mechanical problems:
  - catheter kink, break, or accidental removal
- ▶ More cosmetically acceptable
- ▶ Fewer restrictions on activities
- ▶ No dressing required

# SubQ Ports : disadvantages

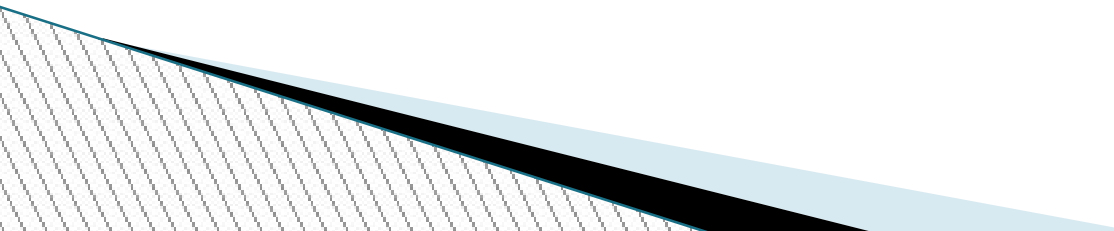
- ▶ More difficult to insert and access
- ▶ Requires a needle –stick to access
- ▶ Higher risk of extravasations
- ▶ More expensive
- ▶ Has limited lifetime :
  - approximately 2000 punctures

# Subcutaneous Ports. Restrictions

- ▶ Contact sports are prohibited
- ▶ Swimming is allowed after the suture line is  
well healed

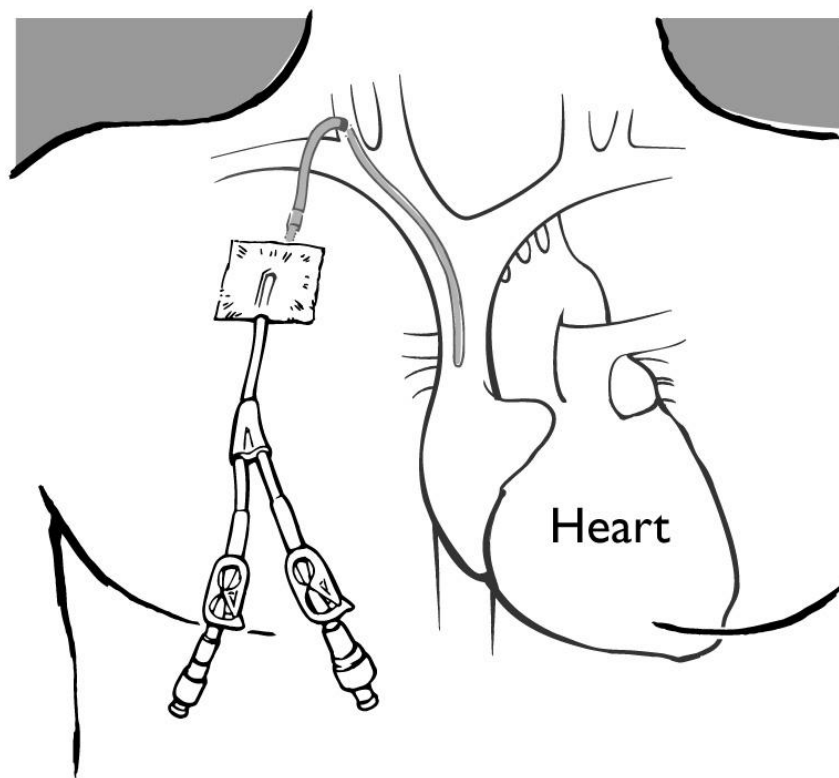


## Ex. CVC: advantages

- ▶ Easy to insert and access
  - ▶ Lower incidence of extravasations
  - ▶ More often multi-lumen: simultaneous infusions
  - ▶ Some mechanical problems can be repaired without replacing catheter
  - ▶ Required for BMT
  - ▶ Theoretically unlimited lifetime of use.
- 

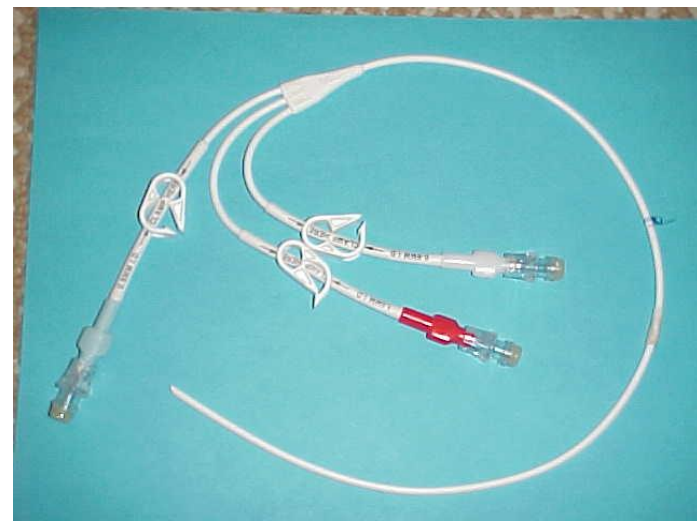


# External central venous catheter

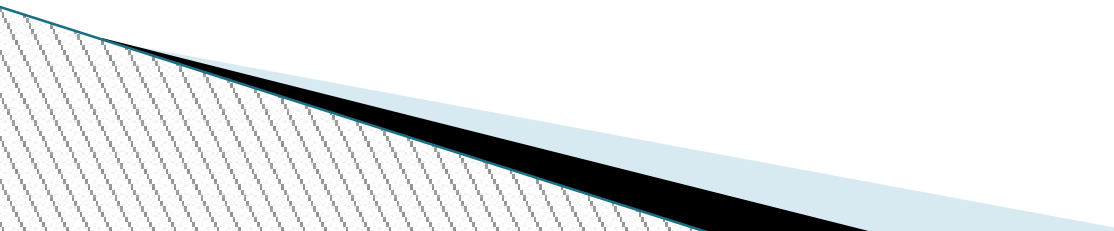


## Ex. CVC: disadvantages

- ▶ Requires more frequent maintenance
- ▶ Higher incidence of infection
- ▶ Higher incidence of mechanical problems:
  - kink, break or accidental displacement/removal
- ▶ Less cosmetically acceptable
- ▶ More restrictions on activities (external)
- ▶ Family must learn catheter care.



# Common complications

- ▶ Mechanical dysfunction
  - ▶ Infectious Complications
    - ➔ Local
    - ➔ Systemic
  - ▶ Occlusions
    - ➔ Mechanical
    - ➔ Medication or TPN related
    - ➔ Thrombotic
  - ▶ Catheter Related Thrombosis
- 

# Exit site infection: local

- Infection of the area around catheter exit site
- Treat with oral antibiotics



Erythema, swelling, and pain in this area, where the catheter exits the skin

**Chemical cellulitis. Anthracycline extravasation caused intense erythema that resulted in tissue necrosis and forced the removal of the catheter.**



## Catheter extrusion



Fraquelli, Lidia. Complications of Totally Implantable Catheters. Findings at Physical Examination,

**Pocket infection. This complication occurred soon after subcutaneous catheter placement at the site of the port.**

**Complications of Totally Implantable Catheters.  
Findings at Physical Examination.  
Oncopedia #164**

Lidia Fraquelli, MD  
Hospital JP Garrahan  
Buenos Aires, Argentina  
Added to Oncopedia: 08/27/2008

***Discussion***

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Catheter-related infections may compromise the skin and subcutaneous tissue, resulting in cellulitis. At the exit site cellulitis can be severe and may be caused by a variety of microorganisms, including gram-positive cocci, gram-negative bacilli, fungus, and acid-fast bacilli. The treatment for this condition includes antimicrobials; however, removal of the catheter may be necessary in most cases. In children receiving chemotherapeutic agents, cellulitis may be caused by the extravasation of fluids (Figure 1). Here, using images as examples, we review the most frequent complications associated with the use of vascular catheters.

## **Mechanical dysfunction. Migration of the catheter.**

The whole length of the Port-A-Cath had become disconnected from its septum and migrated into the heart, making a large curve in the right ventricle.





3  
3  
**Tunnel infection of the catheter: treat with IV antibiotics, often requires catheter removal.**



Fraquelli, Lidia. Complications of Totally Implantable Catheters. Findings at Physical Examination,

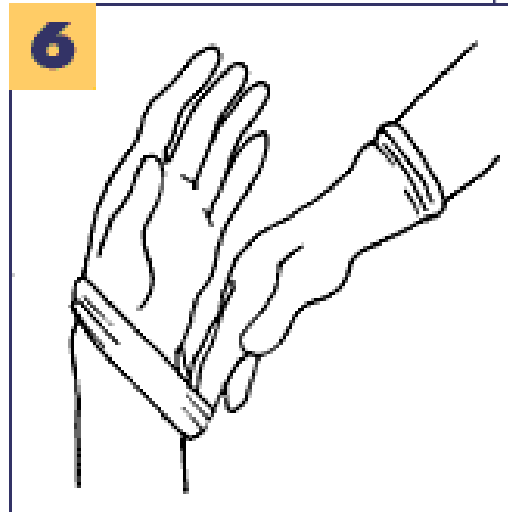
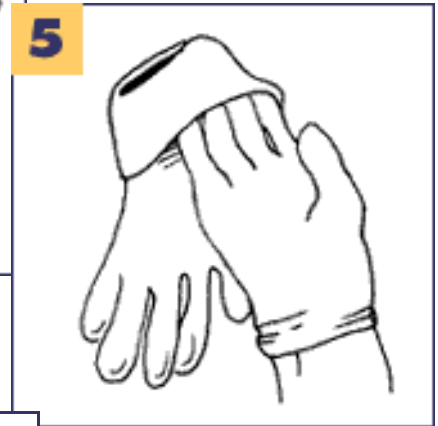
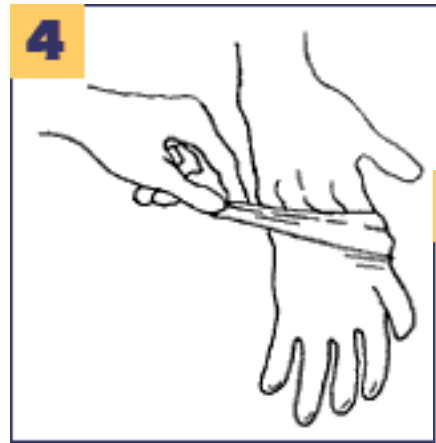
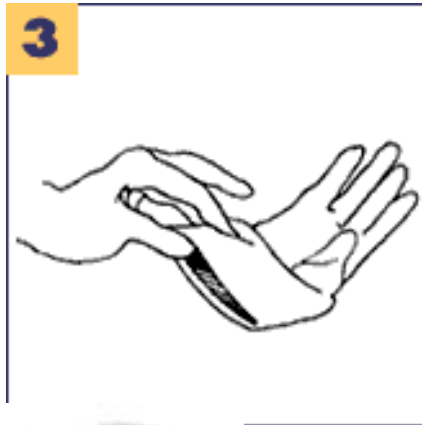
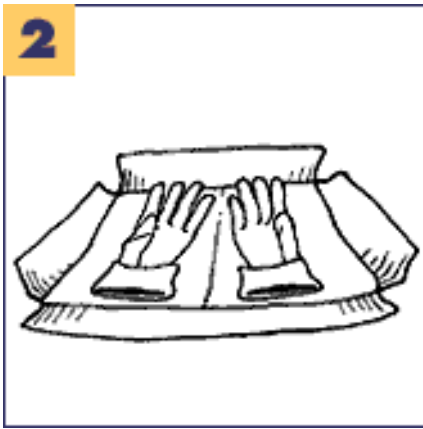
# Skin preparation

- ▶ 1. Prepare clean skin with an antiseptic (70% alcohol, tincture of iodine, an iodophor or chlorhexidine gluconate) before peripheral venous catheter insertion (IB )
- ▶ 2. Prepare clean skin with a >0.5% chlorhexidine preparation with alcohol before central venous catheter and peripheral arterial catheter insertion and during dressing changes. If there is a contraindication to chlorhexidine, tincture of iodine, an iodophor, or 70% alcohol can be used as alternatives (IA)
- ▶
- ▶ 3. No comparison has been made between using chlorhexidine preparations with alcohol and povidone-iodine in alcohol to prepare clean skin. **Unresolved issue.**

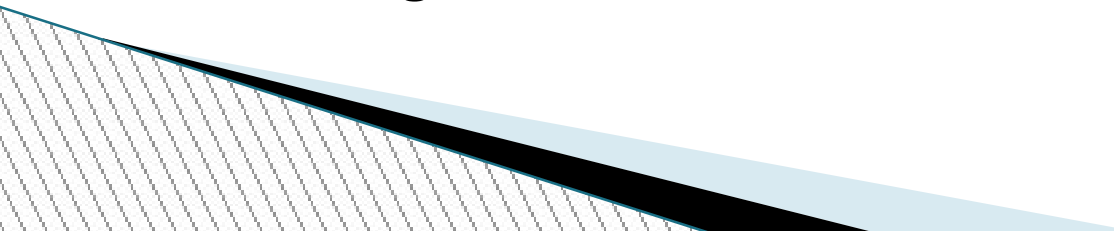
# Hand hygiene and aseptic technique-1

- ▶ Perform hand hygiene procedures, either by washing hands with conventional soap and water or with alcohol-based hand rubs (ABHR). Hand hygiene should be performed before and after palpating catheter insertion sites as well as before and after inserting, replacing, accessing, repairing, or dressing an intravascular catheter. Palpation of the insertion site should not be performed after the application of antiseptic, unless aseptic technique is maintained.(IB )
- ▶ Maintain aseptic technique for the insertion and care of intravascular catheters (IB)

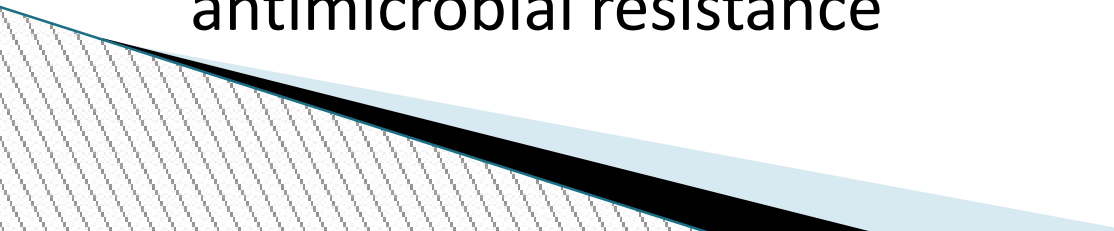
# Put on gloves



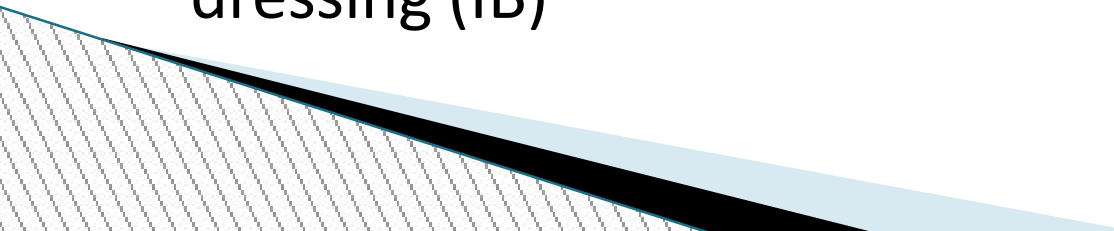
## Hand hygiene and aseptic technique-2

- ▶ Wear **clean** gloves, rather than **sterile** gloves, for the insertion of peripheral intravascular catheters, if the access site is not touched after the application of skin antiseptics. (IC )
  - ▶ **Sterile gloves should be worn for the insertion of arterial, central, and midline catheters [IA]**
  - ▶ Use new sterile gloves before handling the new catheter when guidewire exchanges are performed. (II)
  - ▶ Wear either clean or sterile gloves when changing the dressing on intravascular catheters. ( IC )
- 

# Catheter site dressing regimens-1

- ▶ Use either sterile gauze or sterile, transparent, semi permeable dressing to cover the catheter site (IA )
  - ▶ Replace catheter site dressing if the dressing becomes damp, loosened, or visibly soiled.
  - ▶ Do not use topical antibiotic ointment or creams on insertion sites, except for dialysis catheters, because of their potential to promote fungal infections and antimicrobial resistance
- 

## Catheter site dressing regimens-2

- ▶ Do not submerge the catheter or catheter site in water. Showering should be permitted if precautions can be taken to reduce the likelihood of introducing organisms into the catheter (IB )
  - ▶ Replace dressings used on short-term CVC sites every 2 days for gauze dressings. (II)
  - ▶ Replace dressings used on short-term CVC sites at least every 7 days for transparent dressings, except in those pediatric patients in which the risk for dislodging the catheter may outweigh the benefit of changing the dressing (IB)
- 







Abstract ▾

Send to: ▾

Am J Med. 2015 Feb 16. pii: S0002-9343(15)00102-3. doi: 10.1016/j.amjmed.2015.01.027. [Epub ahead of print]

## Peripherally Inserted Central Catheter-Associated Deep Vein Thrombosis: A Narrative Review.

Fallouh N<sup>1</sup>, McGuirk HM<sup>2</sup>, Flanders SA<sup>1</sup>, Chopra V<sup>3</sup>.

### + Author information

#### Abstract

**BACKGROUND:** Although common, little is known about factors associated with peripherally inserted central catheter-related deep vein thrombosis (PICC-DVT). To better guide clinicians, we performed a comprehensive literature review to summarize best practices in this condition.

**METHODS:** A systematic search of the literature for studies reporting epidemiology, diagnosis, treatment and prevention of PICC-DVT was conducted. Algorithms for diagnosis and management were compiled using available evidence.

**RESULTS:** The incidence of PICC-DVT varied between 2-75% according to study population, testing modality and threshold for diagnosis. Studies evaluating the role of clinical symptoms suggested that these were neither sensitive nor specific for PICC-DVT; conversely, ultrasonography had excellent sensitivity and specificity and is recommended as the initial diagnostic test. Although more specific, contrast-venography should be reserved for cases with high clinical probability and negative ultrasound findings. Centrally positioned, otherwise functional and clinically necessary PICCs need not be removed despite concomitant deep venous thrombosis. Anticoagulation with low-molecular weight heparin or warfarin for at least three months represents mainstay of treatment. The role of pharmacologic prophylaxis and screening in PICC-DVT is unclear at this time.

**CONCLUSIONS:** PICC-DVT is common, costly and morbid. Available evidence provides guidance for diagnosis, treatment and prevention of this condition.

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**KEYWORDS:** DVT; Deep Vein Thrombosis; PICC; Peripherally Inserted Central Catheter; diagnosis; prevention; thrombosis; treatment

PMID: 25697969 [PubMed - as supplied by publisher]

## Catheter site dressing regimens-3

- ▶ Replace transparent dressings used on tunneled or implanted CVC sites no more than once per week (unless the dressing is soiled or loose), until the insertion site has healed. (II )
- ▶ Ensure that catheter site care is compatible with the catheter material (IB)

## Catheter site dressing regimens-4

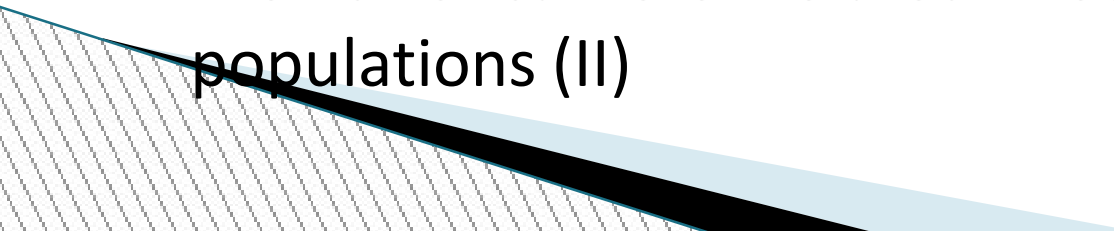
- ▶ Monitor the catheter sites visually when changing the dressing or by palpation through an intact dressing on a regular basis, depending on the clinical situation of the individual patient. If patients have tenderness at the insertion site, fever without obvious source, or other manifestations suggesting local or bloodstream infection, the dressing should be removed to allow thorough examination of the site (IB )
- ▶ Encourage patients to report any changes in their catheter site or any new discomfort to their provider.

(II)

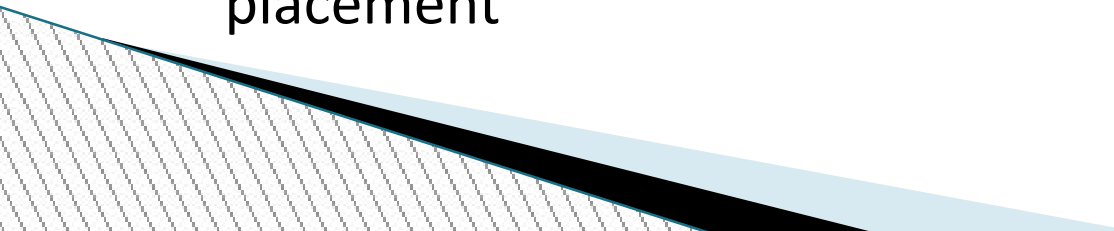
# Systemic antibiotic prophylaxis

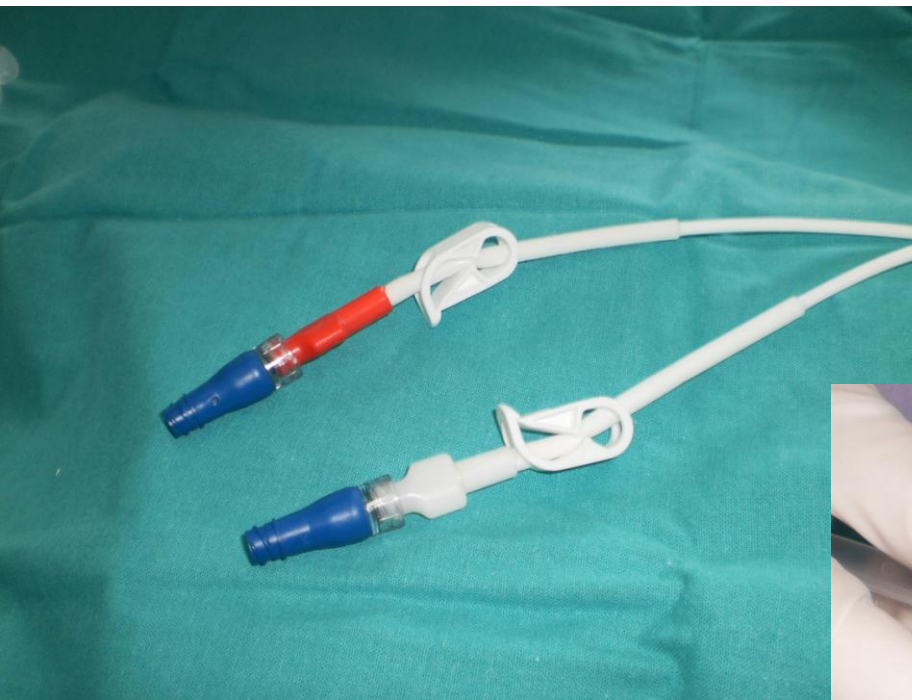
- ▶ **Recommendation**
- ▶ Do not administer systemic antimicrobial prophylaxis routinely before insertion or during use of an intravascular catheter to prevent catheter colonization or CRBSI

# Antibiotic lock prophylaxis

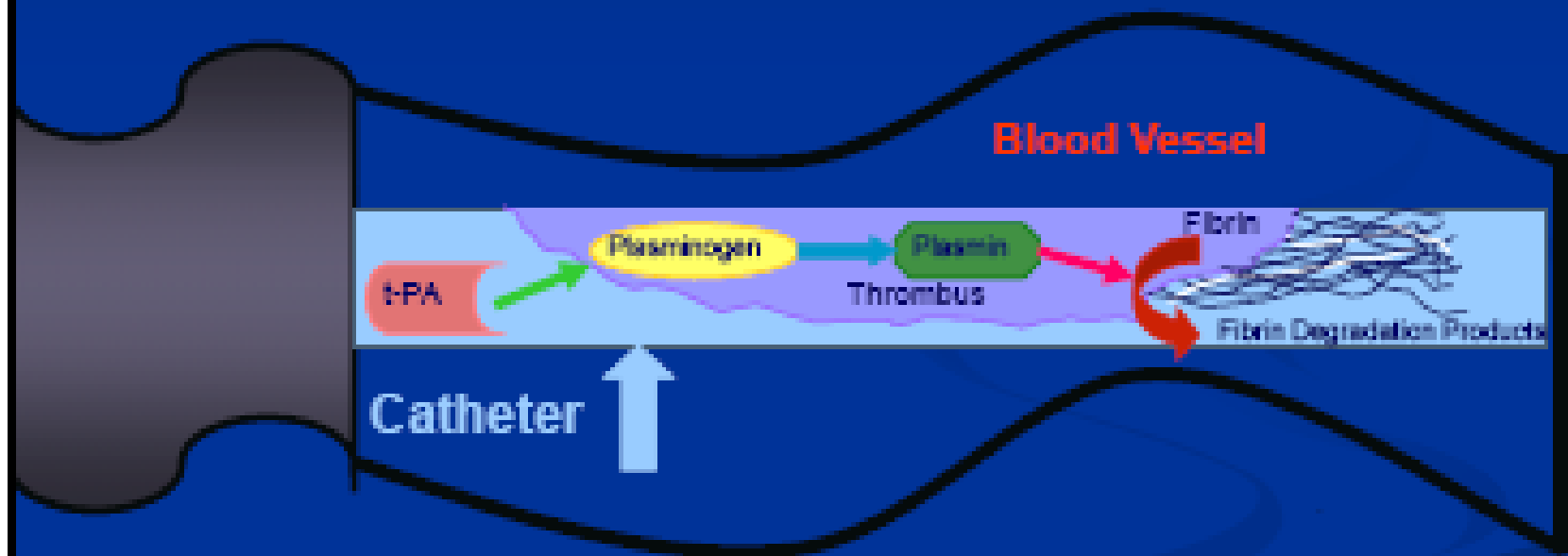
- ▶ **Antimicrobial Catheter Flush and Catheter Lock Prophylaxis**
  - ▶ **Recommendation**
  - ▶ Use prophylactic antimicrobial lock solution in patients with long term catheters who have a history of multiple CRBSI despite optimal maximal adherence to aseptic technique
  - ▶ **Anticoagulants**
  - ▶ Do not routinely use anticoagulant therapy to reduce the risk of catheter-related infection in general patient populations (II)
- 

# Antibiotic lock therapy

- ▶ **Definition:**
    - ▶ High concentrations of antibiotics locked in lumen of catheter
  
  - ▶ **Effective:**
    - ▶ Coagulase Negative Staphylococcus infection
  
  - ▶ **Not effective:**
    - ▶ Local infection
    - ▶ Infection that occurs less than 2 weeks after catheter placement
- 

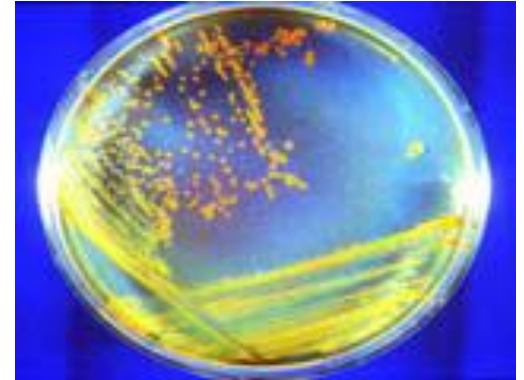


# Action of t-PA





# When to remove the catheter



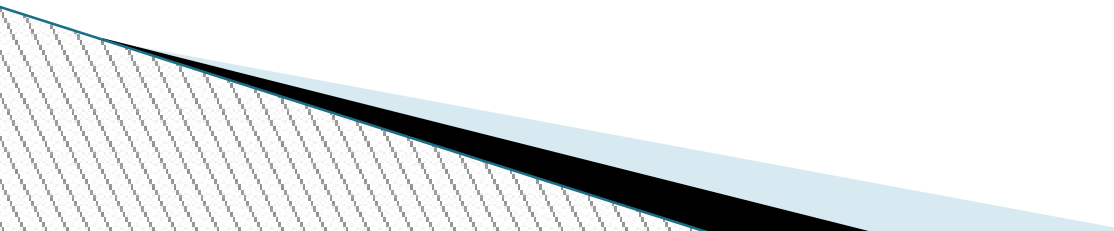
## ➤ **Local infection:**

- ▶ Patient deteriorates
- ▶ Infection extends despite IV antibiotics
- ▶ Infection with rapid growing Acid Fast Bacillus

## ➤ **Catheter Related Bloodstream Infection**

- ▶ Persistent fever or persistent (+) Blood cultures
- ▶ Signs of sepsis not responding to therapy
- ▶ Blood cultures positive for resistant organism
- ▶ Recurrent Catheter related blood stream infection

# Replacement of administration sets -1

- ▶ In patients not receiving blood, blood products or fat emulsions, replace administration sets that are continuously used, including secondary sets and add-on devices, no more frequently than at 96-hour intervals, but at least every 7 days (IA)
  - ▶ No recommendation can be made regarding the frequency for replacing intermittently used administration sets. **Unresolved issue**
- 

## Replacement of administration sets -2

- ▶ No recommendation can be made regarding the frequency for replacing needles to access implantable ports. **Unresolved issue**
- ▶ Replace tubing used to administer blood, blood products, or fat emulsions (those combined with amino acids and glucose in a 3-in-1 admixture or infused separately) within 24 hours of initiating the infusion (IB)

Category /grade		Definition
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## Strength of Recommendation and Quality of evidence.

A	Good evidence to support a recommendation for or against use.
B	Moderate evidence to support a recommendation for or against use.
C	Poor evidence to support a recommendation.

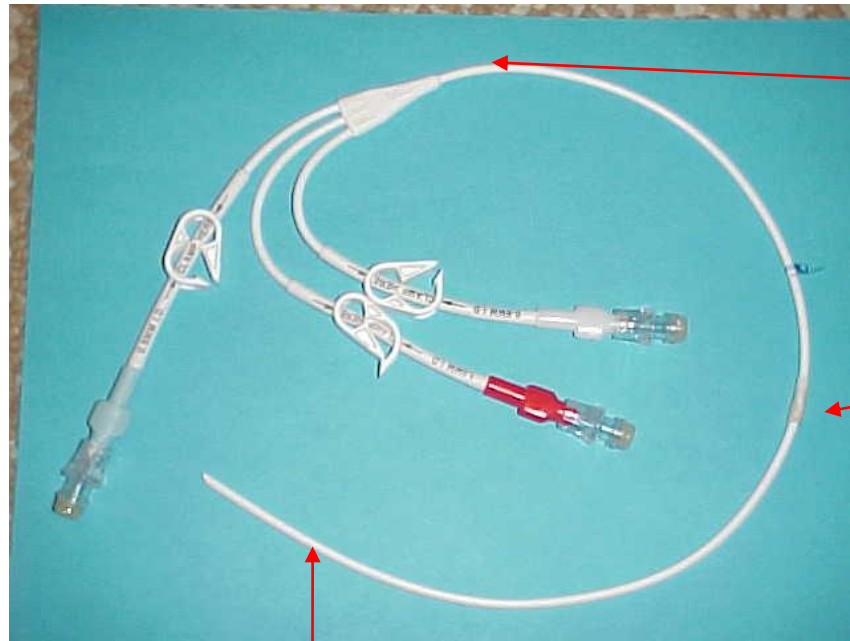
## Quality of Evidence

I	Evidence from >1 properly randomized, controlled trial.
II	Evidence from >1 well-designed clinical trial, without randomization; from cohort or case controlled analytic studies (preferably from .1 center); from multiple time-series; or from dramatic results from uncontrolled experiments.
III	Evidence from opinions of respected authorities, based on clinical experience, descriptive studies, or reports of expert committees.

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**Healthcare Infection Control Practices Advisory Committee (HICPAC)**

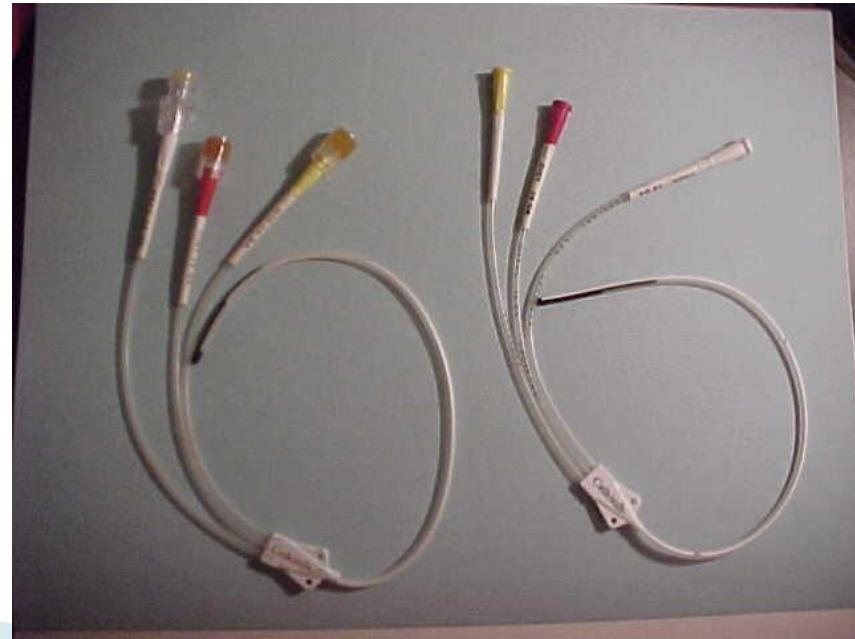
# External central venous catheter



external

cuff

internal





**Mechanical Dysfunction.**

**Repair of Broken CVC**

# To take home

- ▶ **Education, Training and Staffing**
- ▶ 1.- Educate healthcare personnel regarding the indications, proper procedures and appropriate infection control measures
- ▶ 2.-Periodically assess knowledge of and adherence to guidelines for all personnel involved in the insertion and maintenance of intravascular catheters

# To take home

## ▶ **Education, Training and Staffing**

- ▶ 3.- Designate only trained personnel who demonstrate competence for the insertion and maintenance of peripheral and central intravascular catheters.
- ▶ 4.- Ensure appropriate nursing staff levels in ICUs. Observational studies suggest that a higher proportion of "pool nurses" or an elevated patient-to-nurse ratio is associated with CRBSI in ICUs where nurses are managing patients with CVCs



## To take home

- ▶ the nurse providing infusion therapy shall be proficient in its' clinical aspects, **shall have validated competency**
- ▶ “development of clinical competencies **should be the responsibility of the nurse** and should be included in the organization’s policies and procedures”



Thanks you  
Merci  
Gracias

# Bibliography

- ▶ **Management and Complications of Central Venous Catheters**  
Cure4Kids #1516. Released on Cure4Kids: 25 nov 2008.  
URL: <https://www.cure4kids.org/seminar/1516/>
- ▶ **Guidelines for the Prevention of Intravascular Catheter–Related Infections, 2011**
- ▶ **Survey of guidelines and practices used for prevention of central venous catheter associated infection (CLABSI) in hematopoietic stem cell transplantation recipients**

