Health Leadership & Learning Network

York University Faculty of Health

Advanced Vascular & Infusion Therapy

Session 2: VAD complications: Infection

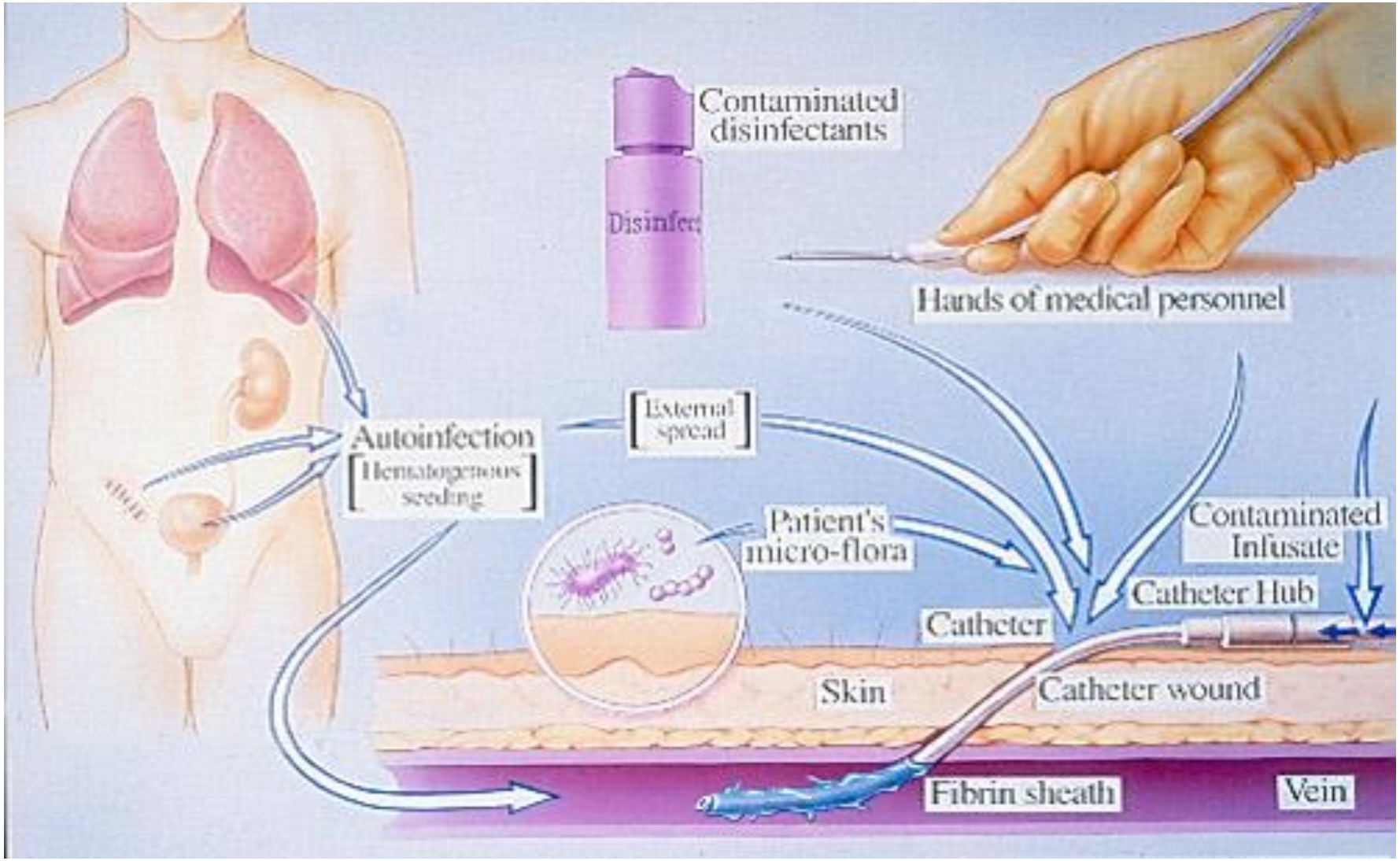
Case Study

- Mary 35 yr old
  - Cystic Fibrosis
  - TPN for 10 years. Managing with support of local hospital PN program.
  - Double lumen Implanted CVAD in place for 4 years. Exits left lateral side.
  - Developed fever & chills while at work
  - Went to ER at request of Home PN program

Objectives

- Identify the HCP role in adhering to principles of asepsis
- Define Aseptic Non Touch Technique (ANTT®)
- Explain the difference between standard and surgical aseptic non- touch technique
- Discuss evidence supporting the key aspects of aseptic technique for initiation and management of VADs, medication & infusion therapy
- Identify early signs and symptoms of blood stream infection
- Explore options for treatment when VAD (PVAD or PICC) is difficult to maintain.

Risks in IV Therapy



Skin is the Source of Infection

"The naturally occurring bacteria that exist on the skin of a patient or on the hands of a healthcare worker are not dangerous on the surface of the skin but can become life-threatening if they enter the body. Intravenous catheter infections happen when microorganisms from the skin attach to the catheter tip during insertion and grow in sufficient numbers to result in infection."

The most common cause of peripheral line associated blood stream infection (PLABSI) is infection caused when bacteria residing on the skin at the catheter insertion site migrate into the insertion site (Maki,2006, Moreau, 2009)

Patient-related risk factors for infection

- Immunosuppression
- Short bowel syndrome
- Self-care deficit (temporary or other)
- Diabetes or other autoimmune disorders
- Renal failure
- Malnutrition
- Neutropenia
- Long-term CVAD

Organizational risk factors

- Inadequate aseptic technique and/or hand hygiene
- Idle catheters
- CVAD with multiple lumens (each additional lumen ↑ risk)
- Care and maintenance inconsistencies: hub asepsis, flushing techniques, dressings etc.
- Partial or total occluded lumen not treated
- Sludge accumulation (partial occlusion state)

Common breaches in VAD practice[3]

Procedure	Practice breach
PAD insertion	• Work surface not adequately cleaned. • Inadequate hand hygiene. • Touching area of insertion post skin antisepsis • Touching any part of the cannula • Fanning skin to aid drying. • Pressing directly over or on the insertion site entry point. • Contaminating dressing on application. • Reuse of tape roll or tourniquet.
VAD dressing change	• Work surface not adequately cleaned. • Inadequate hand hygiene. • Touching the IV entry site • Inadequate skin antisepsis. • Not allowing skin prep to dry completely. • Improper dressing application.
VAD removal	• Work surface not adequately cleaned. • Inadequate hand hygiene. • Touching IV entry site • Failure to clean site. • Applying a non-sterile dressing post-removal.

Aseptic technique [1-3]

- Set of specific **practices and procedures** performed under controlled conditions, **regardless of setting**, to prevent transfer of microorganisms from the healthcare worker, equipment or immediate working environment **to** the patient
- Pathogens may introduce infection to the patient through contact with the *environment, personnel or equipment*

- GOAL: protect the patient from infection and to prevent the spread of pathogens.

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The aim of *any* aseptic technique is asepsis

Aseptic Non Touch Technique (ANTT®)[7-9]

- Practice framework for all invasive procedures
- Originated by Stephen Rowley & Simon Clare
- ANTT® Collaborative

- Evidence-based, key components to maintain and standardize aseptic practice:
  - Effective hand hygiene–always
  - Never contaminate key-parts
  - Non-touch technique--always
  - Appropriate infection control precautions (PPE)

Key principles

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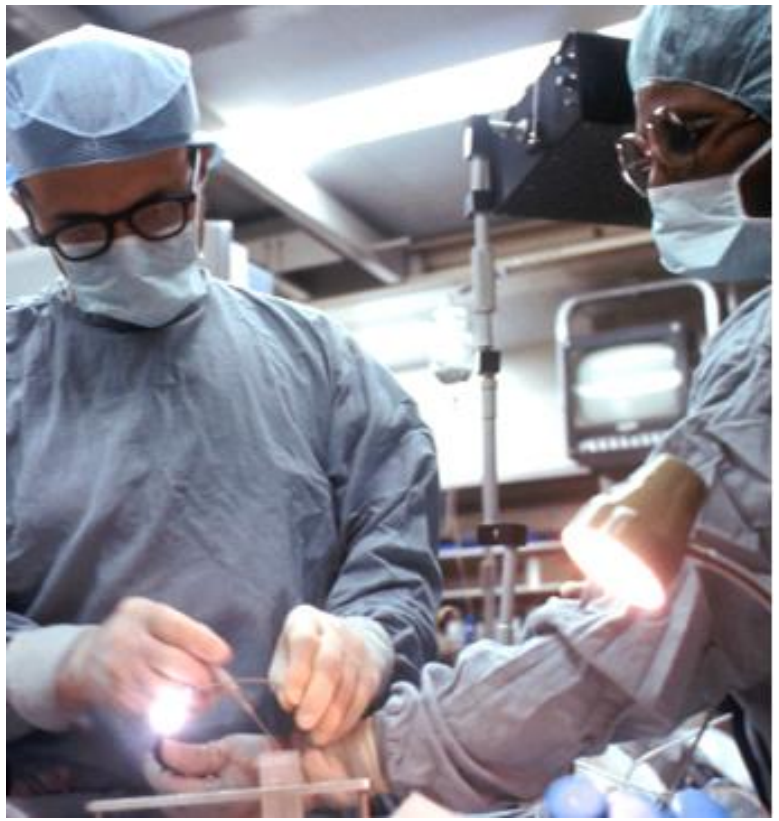
- Prepare all equipment in advance
- Sterile packages are opened as close as possible to the actual use
- Sterile field is prepared as close to actual use as possible
- Only areas seen by the clinician is considered ‘sterile’:
  - Specifically: chest to waist and hands to just above elbows
  - Back and below waist are not sterile
- Sterile field is to be considered a no-talking, laughing, coughing or sneezing zone.
- 2 – 3 cm outer edge of sterile area/fields is not considered sterile



VS

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Clinical Practice Framework [7]

- Aseptic technique defined on concept of Key-Part and Key-Site protection to standardize areas that if touched would likely contaminate the patient

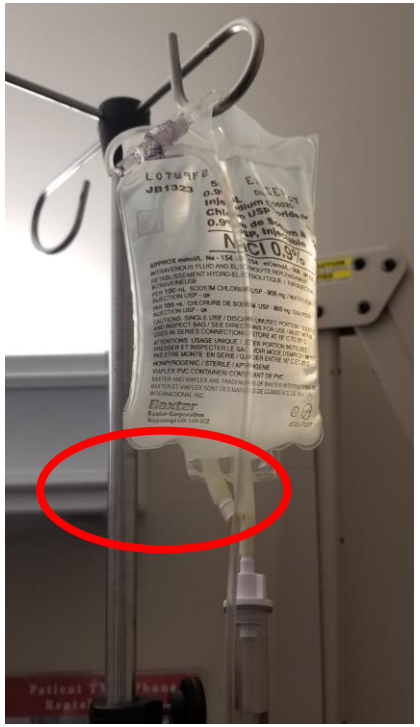
- Key-Part: any part of the procedure equipment: e.g. syringe tip, IV port, cannula, injection needle that is connected to the patient

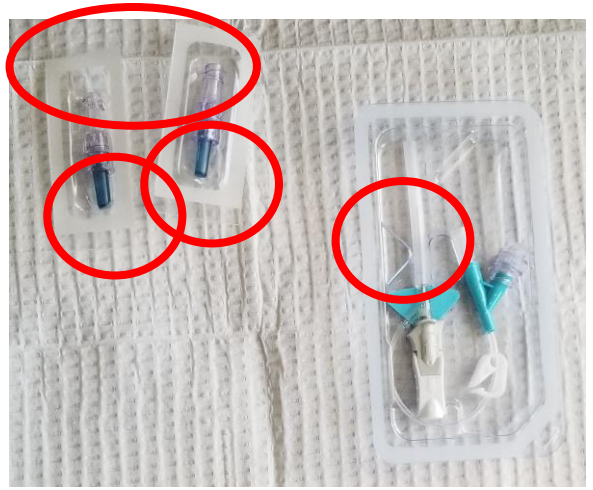
- Key-Site: any portal of entry into the patient: cannula site, injection site, open wound

Key-Parts [7]

Key-parts must only touch other aseptic **key-parts** and **key-sites.**

- Syringe tips, introducer needles
- IV fluids
- Diluents
- Spikes
- Y-connectors
- Catheter hubs
- Ports
- Leur connections





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Key-Sites [7]

Key-parts must only touch other aseptic **key-parts** and **key-sites.**

- **ANY portal of entry**
  - Cannula site
  - Injection site
  - Open wound

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Aseptic Fields[7]

General: disinfected work surface, tray or disposable tray that provides a protected work surface

Critical: sterilized drape where all Key-Parts are placed and managed

Micro-Critical: items used to protect individual Key-Parts: e.g. sterilized caps, connectors, inside of opened sterile package:

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Standard ANTT®

- Simple clinically invasive procedures
- Needs standard precautions, general aseptic field & non-touch technique
- < 20 minutes in length
- Involves small Key-Sites
- Minimal Key-Parts

Surgical ANTT®

- Complex procedures (e.g. surgery, CVAD insertion, NPWT dressing)
- Usually involves combination of standard precautions, full barrier and sterile drape
- > 20 minutes in length
- Involves large open Key-Sites
- Numerous Key-Parts

Key Principles are the same. The complexity of the procedure based on risk assessment, determines how the procedure will be managed.[7]

Sterile vs non-sterile gloves

- ANTT® must be applied fully in order to use non-sterile gloves.
- Consider:
- Storage: outside room and used for everyone? OR, separate on a dressing cart?
- High risk of contamination due to multiple access
- Do not clean gloves with alcohol, CHG, or soap and water as this may compromise material integrity

ANTT® Risk Assessment based on: [7,8]

- Complexity of the procedure
- Challenges in maintaining asepsis of Key-Parts & Key-Sites throughout the procedure
- Key-Part/Site Rule: Key-Parts must only come into contact with other aseptic Key-Parts & Key-Sites
- When to chose what type of ANTT?

"Can I perform this procedure without touching key-parts or key-sites directly?"

- **Yes**-non-sterile gloves may be used
- **No**—Sterile gloves must be used.

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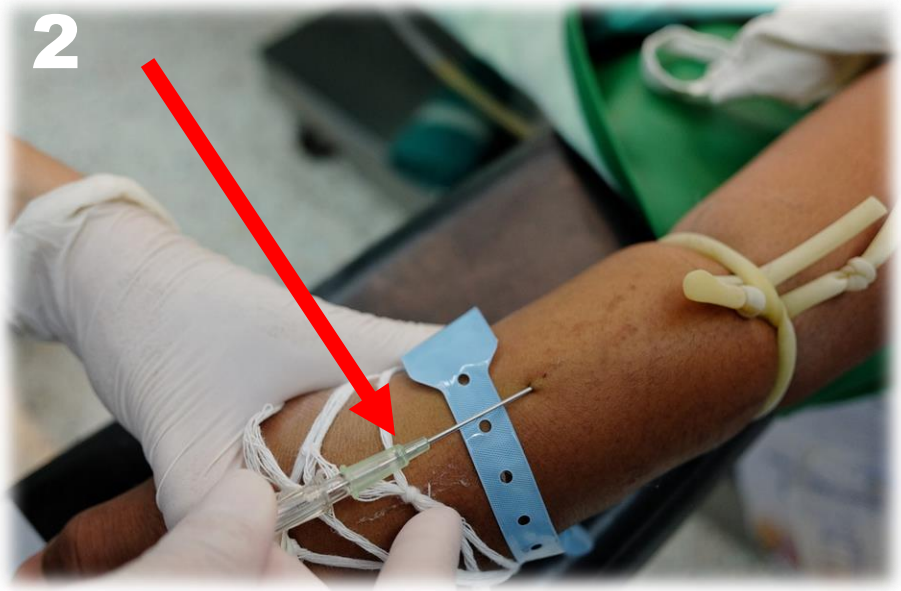
"**Can I perform** this procedure **without touching** Key-Parts or Key-Sites directly?"[6,7]



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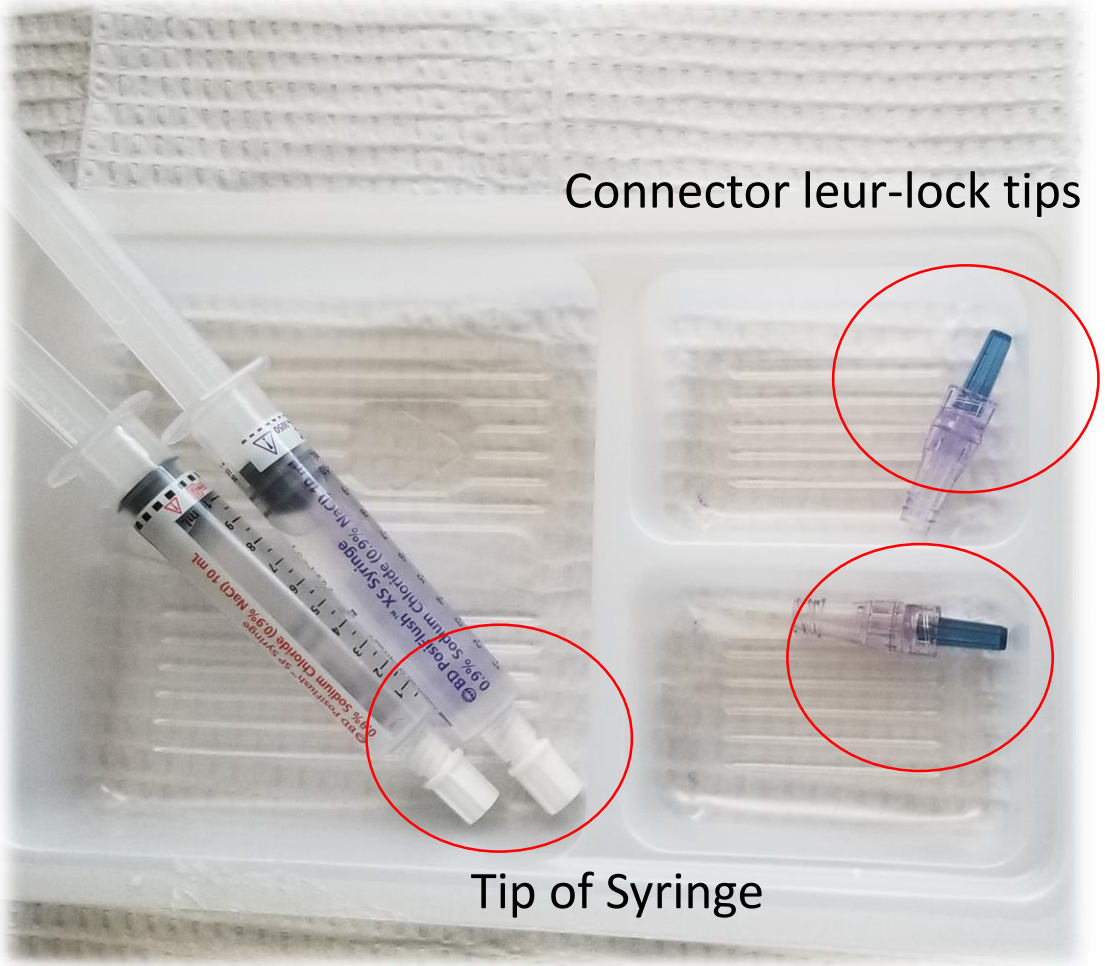
Micro-aseptic field—Key Parts are contained



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Does a PVAD Insertion require Standard, or Surgical ANTT®?

- Depends
- Simple clinically invasive procedures
- Needs standard precautions, general aseptic field & non-touch technique
- < 20 minutes (may take longer)
- Complex (d/t patient's situation)
- Involves small key-sites
- Minimal key-parts

Can I perform this procedure **without touching** key-parts or key-sites directly?"

Does a CVAD dressing change require: Standard or Surgical ANTT®?

- Complex procedure
- Requires standard precautions and sterile drape
- > 20 minutes in length
- Involves open key-site (insertion site)
- Numerous key-parts

Supplies needed

- Non-sterile gloves
- Masks
- Sterile gloves
- Antiseptic solution (2% CHG/70% Alcohol)
- Sterile skin protectant
- Sterile dressing tray or sterile drape
- Securement device or
- Transparent film dressing with securement/borders

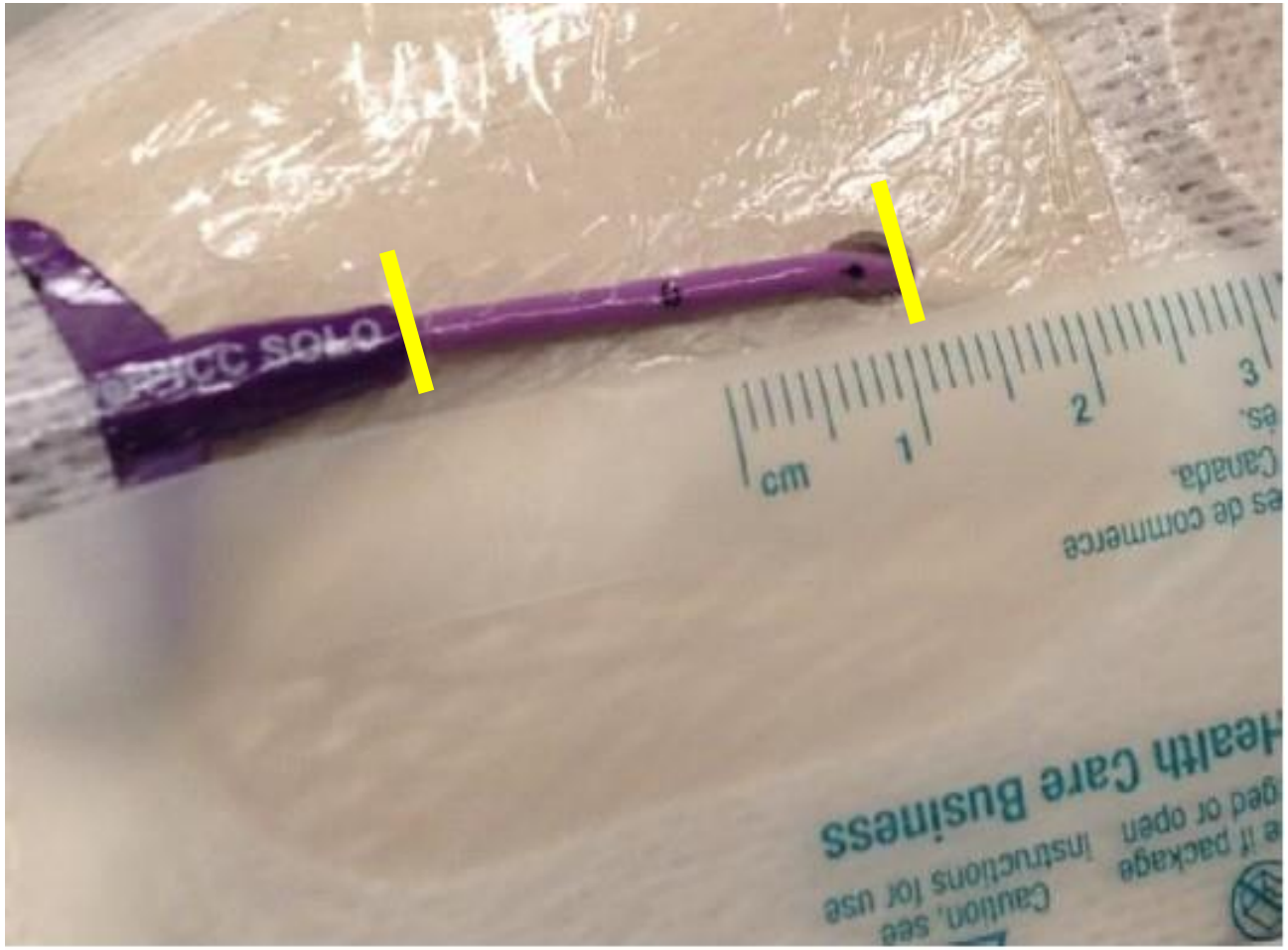
CVAD Dressing procedure

- Gather all supplies needed. Ensure catheter clamps are engaged (if present)
- Clean surface to be used with antiseptic wipe
- Hand hygiene. Remove all jewelry from your fingers and wrist before washing.
- Apply mask to self and patient.
- Don clean gloves
- Before removing dressing assess site: look, palpate and ask patient re: tenderness, pain, redness, etc. Measure external length of catheter from insertion site to hub. (PiCC, tunneled and non-tunneled) . Document.
- Measure arm circumference at established length and document.
- Remove dressing atraumatically (low and slow). Use adhesive remover or alcohol to loosen adhesive. Gently peel off the old dressing moving vertically from distal to proximal. Remove adhesive securement device if present. Secure catheter before final removal of device as shown
- Clean skin using antiseptic swab. Scrub for 30 seconds area larger than selected dressing.
- Allow skin to dry a minimum of 1 min. If using 2% CHG w/o alcohol drying time will take a minimum of 2 minutes.
- Remove gloves, hand hygiene

CVAD dressing change part deux

- While the antiseptic is drying, prepare aseptic field, dressing and supplies.
- Once antiseptic is completely dry, apply sterile skin barrier (if using). Allow to dry for a minimum of 60 seconds.
- Don sterile gloves
- Apply adhesive securement device as per manufacturer's IFU; apply cover dressing according to manufacturer's IFU.
- Remove masks
- Measure catheter external length.
- Replace needless connectors.
- Flush catheter to confirm patency. Use 10mL syringe for flushing.
- Document on dressing strip and in patient chart.
- Remove the gloves, hand hygiene

Measuring external length



Standardized processes

- Hand Hygiene
- Environmental controls
- Patient preparation
- Equipment preparation and devices as close as possible before the start of the procedure

Protect patients every time with…

6 Actions for Safe Aseptic Technique

The ANTT-Approach

Risk Assessment

Select Standard or Surgical-ANTT according to the technical difficulty of achieving asepsis

Manage the Environment

Avoid or remove contamination risks

Decontaminate & Protect

Hand cleaning, personal protective equipment (PPE), disinfecting equipment, surfaces and Key-Parts

Use Aseptic Fields

General, Critical and Micro Critical Aseptic Fields protect Key-Parts & Key-Sites

Use Non-Touch Technique

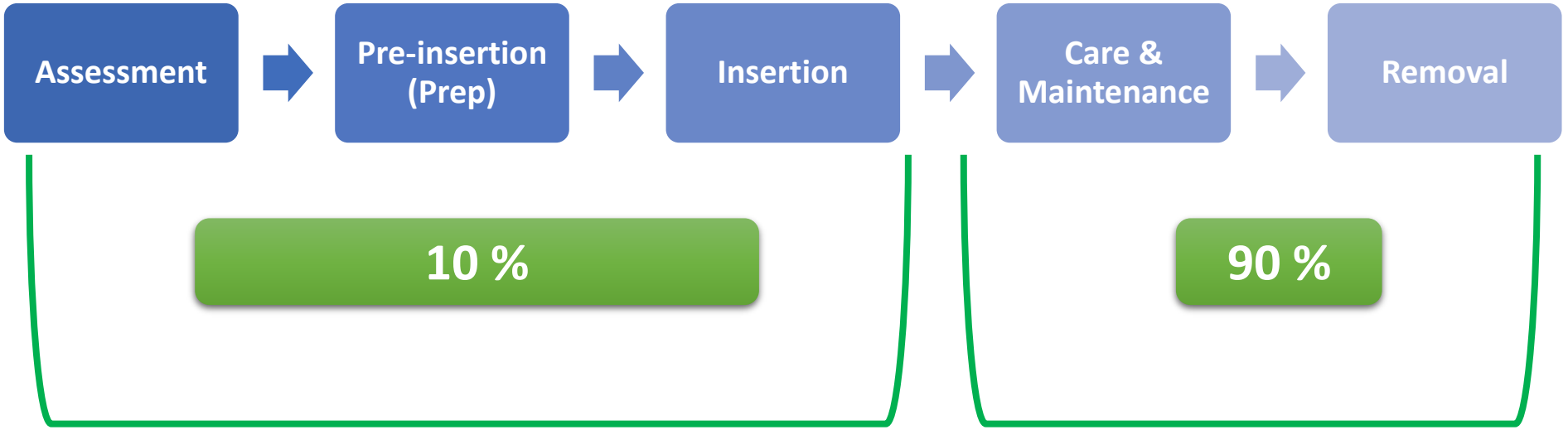
Key-Parts must only come into contact with other Key-Parts & Key-Sites

Prevent Cross Infection

Safe equipment disposal, decontamination & hand cleaning

ANTT®

Life Cycle of a Vascular Access Device (VAD)



J. LeDonne, 2018

PICC Advantages

- Long term venous access with ability to accommodate any medication or infusion reducing risk of phlebitis
- Decreased complications associated with other CVADs: e.g. pneumothorax, venous perforation, cardiac perforation and air embolus
- Lower risk or infections
- Preservation of peripheral vascular system, decreased stress and anxiety, related to multiple IV insertions and blood draws
- Reliable access for length of treatment, reduces risk of treatment delays
- Less invasive then implanted and tunneled central vascular access
- Care and maintenance bundle = consistency of practice.
- Location in upper arm may be easier to keep in for those with confusion/dementia.

PICC Disadvantages

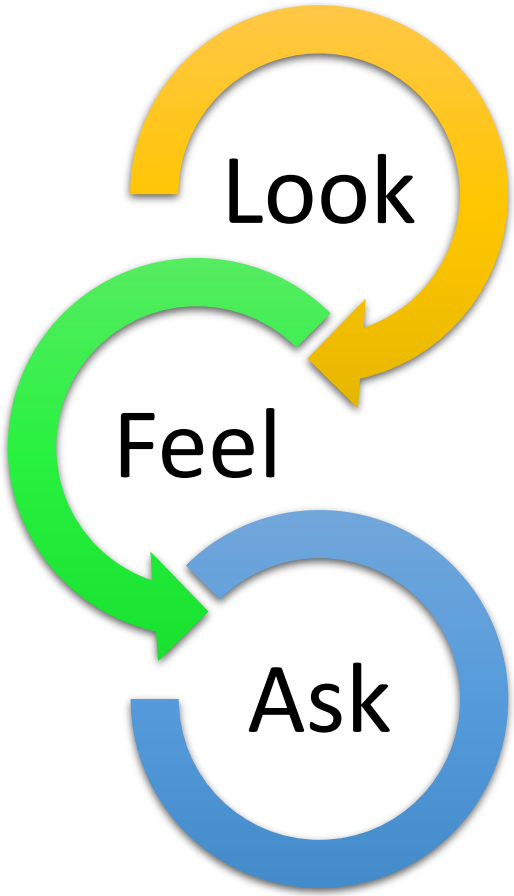
- May have some activity restrictions (limits in repetitive arm movement, no swimming, weight lifting etc).
- Mechanical phlebitis possible due to the insertion site, the catheters passage along a smaller peripheral vein and movement of the upper arm.
- Increase risk of thrombus in small vessels
- Increased risk of occlusion if not properly flushed and maintained due to above and smaller size gauge
- Potential for migration of catheter, with increased activity, vomiting, coughing etc.
- Risk of infection if aseptic technique not followed

Care & Maintenance

- Daily assessment–monitoring for complications
- Flushing
- Dressings
- Blood sampling
- Monitoring for complications

Daily Assessment

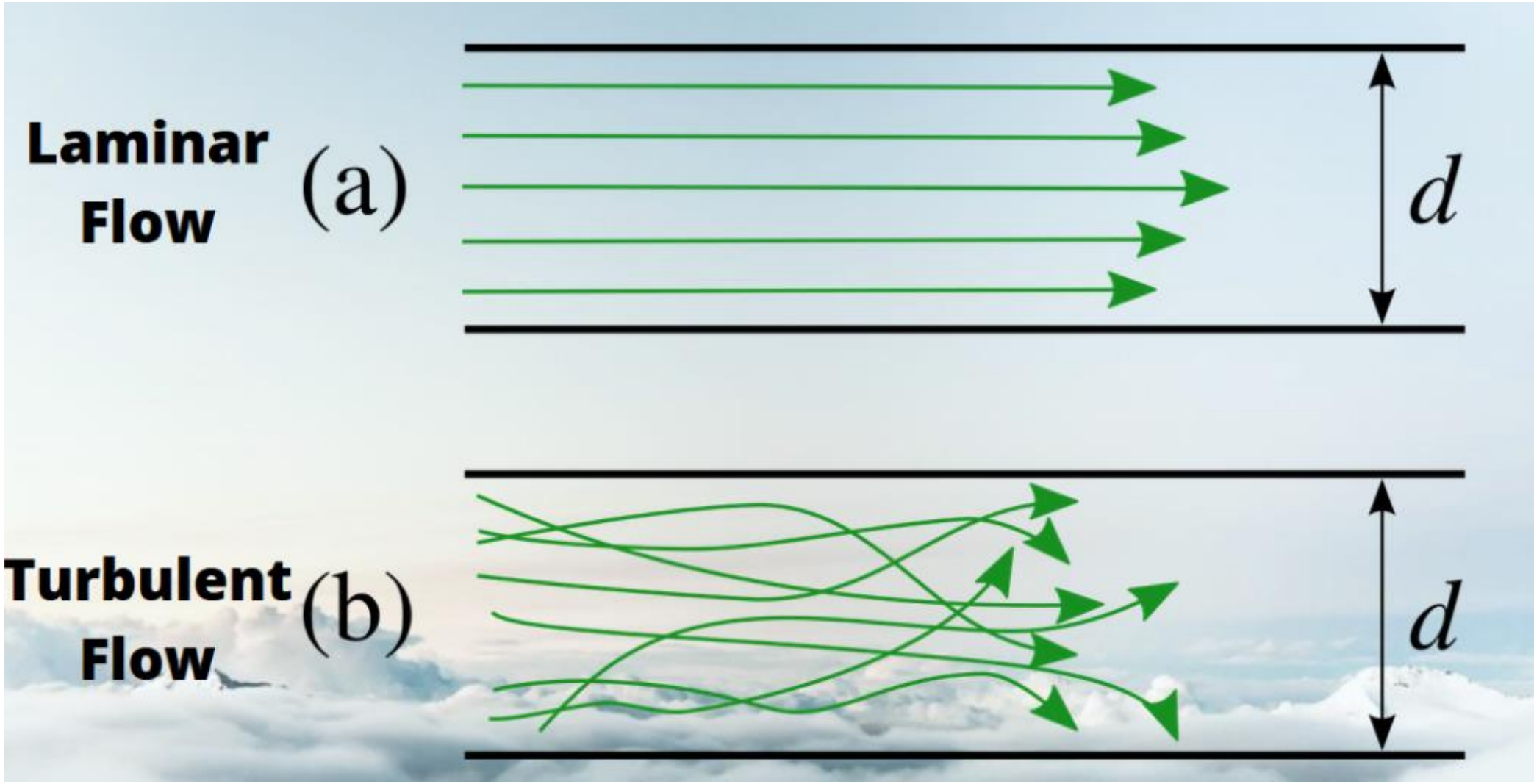
- Assess need for device–is it still medically necessary?
- Check External length. Measure at dressing change and prn
- If catheter has migrated ≥ 2 cm, Xray to verify tip is needed before the VAD can be used for treatment
- If a catheter has migrated in from the original external measurement, the catheter can be pulled back out to its original external measurement during dressing change. The PICC can never be reinserted into the vein; this is a risk of infection.



Flushing

- SAS! Saline, Administer, Saline
- BEFORE and AFTER each use: 10-20 mLs 0.9% NaCl (non-bacteriostatic)
- Multi lumen catheters must have all lumens flushed post, even if only one lumen is accessed
- Non-valved catheters need to keep clamps closed when not in use to help prevent reflux of blood into the catheter that could cause occlusion.
  - Change location of clamps daily to avoid damage of the lumens.
- Always use a push pause technique when flushing to insure catheter is cleared of any residual medication or blood using a 10mL size (or larger syringe) to reduce risk of catheter damage.
  - 10mL syringe = 8 PSI–NEVER use any size smaller for flushing.

Laminar vs Turbulent Flow



Sciencetrends.com Apr 2 2018

Dressing Recommendations

- Select a sterile transparent film dressing as the preferred dressing (to allow for continuous observation and assessment
- Use a sterile gauze or absorbent dressing if the patient is diaphoretic or if the site is bleeding or draining until appropriate for a sterile transparent film dressing.
- Consider use of hemostatic agents (to control bleeding & reduce need for additional dressing changes)
- Consider the use of alternate dressings or products for site condition.
- Avoid placement of products that are not designated for vascular access over the insertion/exit site, unless clinically required.

Securement options

- Adhesive stabilization/securement device (e.g. Statlock)
- Adhesive securement dressings
- Subcutaneous securement device
- Tissue adhesive

- Discuss pros and cons of each

Blood sampling from CVAD

- If possible do a peripheral draw.

- If drawing blood cultures draw sample directly from the hub, removing the needless connector and do not do a discard, the blood in the catheter is what you want for the sample
- For blood culture: do not flush catheter prior to draw and do not discard. The blood in the catheter is what you want for the culture sample. If unable to aspirate flush with 1 – 2 mLs and draw back. You need to culture all lumens at the same time. Using different collection bottles and labeling each appropriately.

Blood sample procedure (example)

1. Use aseptic technique
2. Explain procedure to patient
3. Wash your hands and apply non-sterile gloves
4. Stop all infusions for 5 minutes prior to drawing samples, unless contraindicated
5. Scrub the hub with alcohol swab , 15 sec let air dry
6. Attach 10ml prefilled N/S syringe and flush catheter using a push pause technique
7. Withdraw 5 mLs of blood into the syringe and discard
8. Scrub the hub or needless connector attach a 10 mL sterile syringe and withdraw blood for samples, remove syringe and attach transfer device to fill blood tubes
9. Scrub hub attach a 10mL N/S syringe and flush catheter using push pause technique, repeat with a second 10 mL flush or until catheter is cleared
10. If lab is present give them the sample so they can fill the tubes, if not, be sure to fill in correct order of draw using the appropriate transfer device. Label specimens as required.

CVAD Removal

- Removal performed on MD order
  - As per CNO, organizational policies, procedures, practice guidelines or immediately upon suspected contamination or complication
- Shall be removed on unresolved complication, therapy completion or if deemed unnecessary
- PICCs (and non-tunneled CVADs) may be removed at the bedside following organization policy, procedure and qualification requirements
- Tunneled and implanted devices are removed in the OR or in surgical clinic setting.

Infection prevention bundles

PVAD

- Hand hygiene
- Use minimum 0.5% CHG & 70% Alcohol unless contraindicated
- Use ANTT®
- Use 22 ga catheter unless otherwise indicated
- Avoid hand & ACF
- Use securement transparent dressing
- Assess site at clinically required intervals
- Change dressing when soiled, loose or damp
- Use ANTT®
- Use disinfection caps on all connectors and hubs

CVAD

- Hand hygiene
- Sterile maximum barrier precautions for insertion
- Skin antisepsis 2% CHG w/w-o 70% Alcohol
- Catheter selection: Catheter: vein ratio; right device, right time
- Secure and stabilize device
- Daily review of VAD necessity
- Change dressing when soiled, loose or damp
- Disinfection caps
- Use ANTT®
- Routine site assessment clinically required

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Case Study discussion

1. What were early signs/symptoms of Mary's Catheter Line Associated Blood stream infection (CLABSI)?
   a) How do these signs and symptoms differ or are similar to the classic signs of CLABSI?
2. Explain the rationale for the diagnostic tests performed?
3. What are the risk factors for someone like Mary who has a long-term VAD in situ?
4. The blood cultures show +ve and –ve gram bacteria. What do these organisms have in common?
   a) Would you question these results? Why? Why not?
5. The MD recommends the CVAD be removed. Do you agree with this order? Why? Why not?
   a) Are there risks to Mary if the CVAD is removed?
6. What would be the patient/care giver strategies Mary and her family need to know

What were early signs/symptoms of Mary's Catheter Line Associated Blood stream infection (CLABSI)?

Mary's symptoms

- Nausea/vomiting
- Sluggish catheter
- Residual volume
- Dizziness
- Chills
- Muscle aches

Classic CLABSI

- Fever
- Chills
- Hypotension
- Headache
- Malaise
- Nausea, vomiting
- Exit site tenderness, erythema, purulent discharge (may show up as a crust)

Local infection IVAD

- Port pocket
  - Culture site
  - Local Woundcare
  - Systemic antibiotics
  - Do not use until signs and symptoms of infection resolved and culture –ve
  - Device may need to be removed (Pseudomonas or atypical mycobacteria)

Diagnostic tests

- Blood cultures; exit site C&S; urine culture; sputum culture; chest, abdomen and kidney X-rays, EKG.
- Rule out other possible source of infection

What are the risk factors for someone like Mary?

- Disease state (cystic fibrosis & short bowel syndrome); lowered immune system
- Dehydration
- TPN (serves as a growth medium)
- Malnutrition
- Frequent use of antibiotics
- Co-existing infections
- Long term CVAD (entry point and site for microbial development)
- Flushing procedure not followed (dormant lumen not flushed regularly)
- Blood draw by lab: aseptic breach or possible fibrin micro-emboli into bld stream
- Sluggish line (partial occlusion)
- Aseptic breach

The blood cultures show +ve and –ve gram bacteria. What do these organisms have in common?

- Need to know how blood cultures were done: Query contamination during procedure.
- Staph are skin microflora (possible contaminate during blood draws and/or with patient
- Klebsiella and E coli are gut bacteria (query contamination)

Treatment options

- Depending on clinical picture may be admitted to hospital
- IV antibiotics needed to cover both gram +ve and gram -ve bacteria while waiting for complete C&S results.
- General course is 14 days.
- Vancomycin antibiotic of choice.
- If exit site infection is confirmed and not blood stream infection use antibiotics identified in sensitivity report.

Should the CVAD be removed?

- Recommendations include removing CVAD if:
  - the patient presents with severe sepsis and no other obvious source is present;
  - If there is a tunnel infection;
  - the patient is a pregnant woman;
  - the infecting bacterium is *S. aureus* or fungus.
- Rest CVAD until completion of appropriate antibiotic therapy and repeat blood C&S (5 – 10 days post ABX) is negative.
- PICC is a reasonable substitute
- Infusions including PN is withheld until patient is cleared of sepsis.

Patient/caregiver strategies

- Review ANTT techniques including hand hygiene, CVAD site monitoring, flushing all lumens each access
- Infection prevention checklist
- Review, reinforce list of potential complications, signs and symptoms to monitor (N/V sign of sepsis) and what to do “if”