

## 4.2.5 Venous Access

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### 1. INTRODUCTION

- Most CF patients need regular venous access for antibiotic treatments, hydration or blood sampling.
- Depending on vein quality and treatment duration, different accesses are possible:
  - Peripheral venous catheter
  - Peripherally Inserted Central Catheter (PICC line)
  - Jugular or subclavian central catheter
  - Totally Implantable Vascular Access Device (TIVAD) such as Port-A-Cath® (PAC)
- Despite the wide use of PAC® and PICC line, no randomized control trials (RCT) are available to evaluate their use in CF patients specifically. In addition, maintenance protocols of TIVAD are derived from those in the oncologic population which are not always adapted to the CF population.
- **Hand washing** is the most important procedure to prevent infection: it has to be done between each patient.

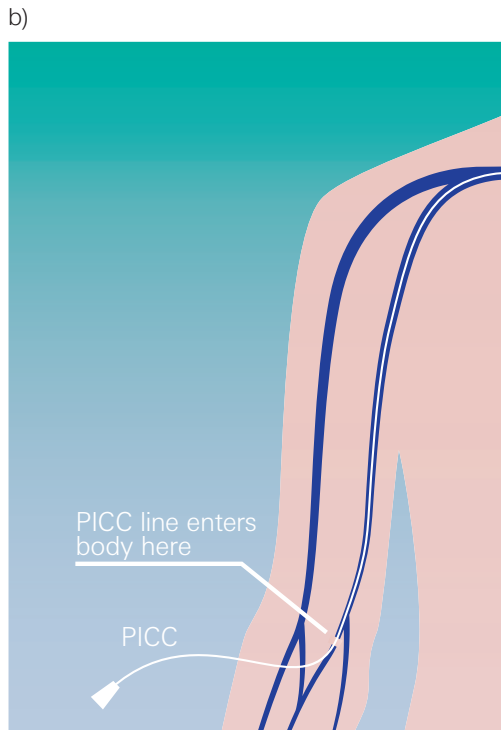
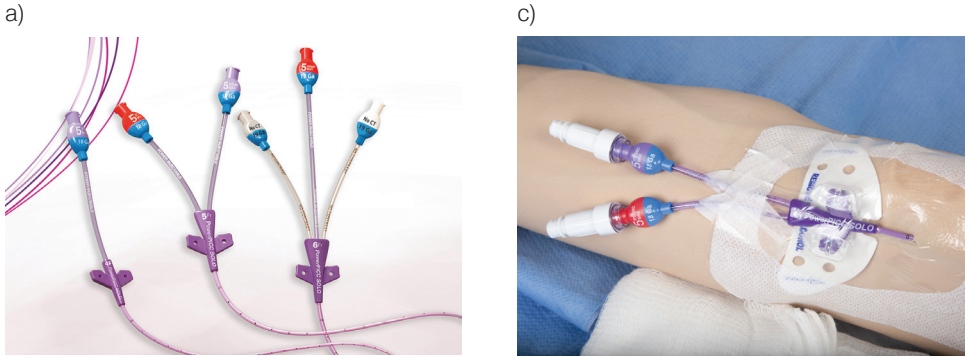
### 2. PERIPHERAL VENOUS CATHETER

- Usually inserted in the forearm or in a small vein of the hand.
- Daily control of puncture site: skin coloration, pain, warmth of the skin and suppuration.
- No systematic replacement of the cannula during a 2-week treatment (only if necessary).
- Change of the infusion system every 72h.
- Dressing change: minimum every 7 days or more often if necessary (e.g. if it becomes damp or loose).

### 3. PERIPHERALLY INSERTED CENTRAL CATHETER (PICC LINE)

- The PICC line (**Figure 1a**) is a central catheter, inserted into the cephalic, the basilic or the brachial vein in the arm, using ultrasound and fluoroscopy (**Figures 1b and c**). The distal end of the catheter has an anti-reflux valve (**Figure 2**).
- The PICC line is also provided with an adhesive securement device (**see section 3.4**). Securing the catheter prevents post-insertion movements of the line which could place the tip in an unsafe position.
- **Table 1** presents the indications, contraindications, adverse events and daily supervision issues for PICC lines.

**Figure 1:** a) Single, double and triple lumen PICC line systems, b) position of the PICC line system in regard to the venous system and c) insertion site of a double lumen PICC line system. Image source of figures a and c: *C.R. Bard GmbH*



**Table 1:** Indications, contraindications, adverse events and daily supervision concerning PICC lines

### Indications

- Usually for patients requiring  $\leq 2$  IV treatments/year (for  $\geq 3$  treatments/year, PAC should be considered)
- IV treatment longer than 6 days, IV therapy at home
- Veins that are difficult to access with a peripheral venous catheter

### Contraindications

- Insertion at a site of infection
- Sepsis
- Irradiation of the insertion site
- Anticipation of artificial arterio-venous fistula in case of renal failure
- History of thrombosis following PICC line insertion (relative contraindication)\*<sup>1</sup>

### Adverse events

- Arrhythmia during PICC line insertion
- Infection (blood stream and/or at the puncture site)
- Fibrin sheath formation, occlusion
- Superficial or deep thrombosis\*<sup>2</sup>
- Pulmonary embolism
- Break of the catheter
- Catheter migration
- Difficult ablation

### Daily supervision

- Patient's complaints
- Swelling and/or pain of vein pathway
- Skin condition: redness, pain, swelling, warmth
- Catheter fixation
- Aspect of the dressing: it should be dry, clean and sealed

\*<sup>1</sup> Consider administration of prophylactic anticoagulation

\*<sup>2</sup> In the very rare case where 2 PICC lines need to be used simultaneously, if possible, introduce the 2 PICC lines **on the same side in 2 different veins** in order to reduce the risk of thrombosis in both arms.

## 3.1. Types of valves and their specific characteristics

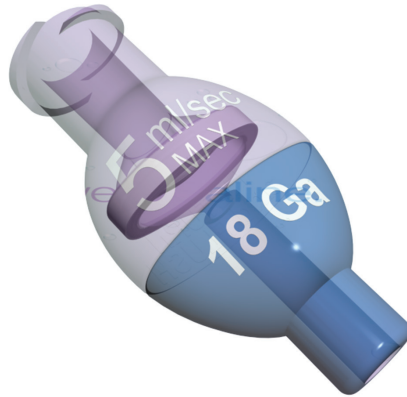
### ▪ Neutral-pressure integrated valve (Figure 2)

- Carefully disinfect the valve with alcoholic antiseptic containing Chlorhexidine® 2% before every syringe or line connection.
- This valve is integrated in the catheter. It produces a constant pressure and can not be removed.
- No need to clamp the catheter.
- Use a stopper on the valve if no infusion or syringe connected.

- **Removable positive pressure valve**

- This type of valve is no longer commercially available.
- It is forbidden to clamp the catheter except to change the valve.
- It is forbidden to fix a stopper on the valve.
- Carefully disinfect the valve with alcoholic antiseptic containing Chlorhexidine® 2% before every syringe or line connection.
- This valve has to be replaced every 8 days in case of hospitalisation, but can stay up to 2 weeks if home care.
- *Valve replacement procedure:* clamp the catheter → remove the old valve → adapt the new valve (previously purged with NaCl 0,9%) → unclamp the catheter.

**Figure 2:** Pressure activated valve (image source: C.R. Bard GmbH)



### 3.2. Flushing process

- **General considerations:**

- Use only a 10 ml syringe to minimize the risk of excess pressure.
- Disinfect both types of valves with an alcoholic antiseptic containing Chlorhexidine® 2%.

- **Frequency of flushing:**

- If the minimum infusion rate is  $\geq 3\text{ml/h}$ , no need to flush.
- If parenteral nutrition, flush with NaCl 0,9% 10 ml 1x/day.
- Before and after each utilisation, flush the line with NaCl 0,9% 10 ml (to prevent problems related to drug incompatibility).
- If no use of the PICC line, flush the line with 10 ml of NaCl 0,9%
  - 1x/day if removable positive pressure valve.
  - 1x/week if neutral-pressure integrated valve.

- **Procedure:**
  - Adapt the syringe on the valve.
  - With the “push and stop” technique, rinse the line with 10 ml NaCl 0,9%.
    - *Note:* “push and stop” technique refers to the quick injection of small amounts of flush solution followed by a pause of 1-2 seconds. The procedure is repeated until all the solution is injected. This type of ‘turbulent’ flushing allows to remove residues and medication from the inside of the central catheter.
  - Remove the syringe.
  - Adapt a stopper only if a neutral-pressure integrated valve is used.

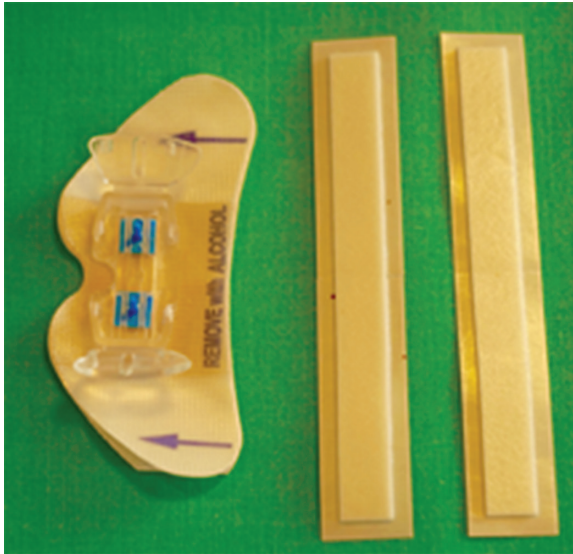
### 3.3. Blood drawing

- **Procedure:**
  - Hand disinfection with a hydro-alcoholic solution or gel.
  - Put on protection gloves.
  - Disinfect the valve with an alcoholic antiseptic containing Chlorhexidine® 2%.
  - Flush the line with 10 ml NaCl 0,9% according to the “push and stop” technique.
  - Take 10 ml blood and discard them.
    - *Note:* If a neutral-pressure integrated valve is used, blood must be drawn very gently to open the valve.
  - Take blood samples according to medical prescription.
  - Flush the line with 20 ml NaCl 0,9% according to the “push and stop” technique.
  - If necessary restart the perfusion or adapt a stopper (only if a neutral-pressure integrated valve is used).
- **Troubleshooting:** PICC line occluded, what to do? (see section 6)

### 3.4. Dressings

- Change the dressing
  - immediately if soiled, wet or loose.
  - every 7 to 8 days if the puncture point can be seen.
  - every 2 to 3 days if the puncture point is covered by a gauze.
- Change the adhesive securement device (such as StatLock® PICC Plus) (**Figure 3**) every 7 to 8 days and replace it by a new one, covering it with a transparent film dressing.
- If not available, use Steri-Strip® around the line and cover with a gauze and Mefix®.
- **Table 2** presents the supplies and the procedure of dressing change.

**Figure 3:** StatLock<sup>®</sup> set



**Table 2: Supplies and procedure of dressing change**

### Supplies

- Bed protection
- Hydro alcoholic hand solution
- Alcoholic antiseptic with Chlohexidine<sup>®</sup> 2% (iodine solution if allergy)
- Mask
- Non sterile gloves + sterile gloves
- Disinfection set with a sterile surgical clamp
- Statlock<sup>®</sup> set, steri-strip<sup>®</sup> and transparent adhesive film (Opsite IV 3000<sup>®</sup>, Tegaderm<sup>®</sup>) or Steri-Strip<sup>®</sup>, gauze and Mefix<sup>®</sup>

### Procedure

- Put a mask
- Put the bed protection
- Hand disinfection with a hydro-alcoholic gel or solution
- Open the disinfection set and put on the sterile field the Steri-Strip<sup>®</sup>, Statlock<sup>®</sup>, clamp and alcoholic antiseptic
- Hand disinfection with hydro-alcoholic gel or solution
- Put non sterile gloves, remove the transparent adhesive film
- Put off the gloves then hand disinfection with the hydro-alcoholic gel or solution
- Disinfect the puncture site with Chlorhexidine<sup>®</sup> solution 2%
- Secure the PICC line with Steri-strip<sup>®</sup> near to the puncture point
- Remove the old Statlock<sup>®</sup> and disinfect the skin outwards from the puncture site

- Hand disinfection with hydro-alcoholic gel or solution
- Put on the sterile gloves
- Apply skin preparation Aplicare® on the area of application of the Statlock™ (skin protection and better grip)
- Connect Statlock® to the catheter before adhesion on the skin
- Statlock® application
- Remove the Steri-Strip®
- Apply the transparent adhesive film
- Note the nursing care in the patient file

### 3.5. PICC line removal

- PICC line can be removed by physicians and nurses.
- This procedure must not be painful. If pain and/or resistance, don't force and contact the radiologist.
- **Table 3** presents the supplies and the procedure of PICC line removal.

**Table 3:** Supplies and procedure of PICC line removal

#### Supplies

- Bed protection
- Hydro-alcoholic hand solution
- Alcoholic antiseptic with Chlohexidine® 2% (iodine solution if allergy)
- Mask
- Non sterile gloves
- Disinfection set
- Sterile recipient if bacteriological culture is needed + sterile scissors
- Opsite®

#### Procedure

- Put a mask
- Hand disinfection with hydro-alcoholic gel or solution
- Open the disinfection set, add on it Chlorhexidine® 2% +/- sterile scissors if bacteriological culture is needed
- Put on the non sterile gloves, remove the transparent adhesive film
- Clamp the PICCline if possible
- If no bacteriological culture is requested, disinfect the puncture site and the catheter
- Remove Statlock®
- Apply a dry sterile gauze on the puncture site during removal of the catheter. If pain or resistance during removal, stop the procedure and contact the radiologist
- If bacteriological culture is requested, put the catheter on a sterile sheet, cut the tip with sterile scissors and put it in a sterile recipient before sending it to the laboratory.
- Compress the puncture point

*(continued)*

- Widely disinfect the site with Chlohexidine® and fix with an occlusive dressing
  - Check the size and integrity of the catheter after removal
  - Note the nursing care in the patient file
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#### 4. JUGULAR OR SUBCLAVIAN CENTRAL CATHETER

- Rarely used in outpatients, it is mostly used during hospitalization.
  - Its placement may be associated with adverse events, it is not comfortable during physiotherapy → **PICC line is preferable, if available in the hospital.**
- **Table 4** presents the indications, contraindications, adverse events and nursing care of jugular or subclavian central catheters.

**Table 4:** Indications, contraindications, adverse events and nursing care of jugular or subclavian central catheters

##### Indications

- Veins that are difficult to access with a peripheral venous catheter
  - Hemodynamic monitoring
  - Usually for patients requiring  $\leq 2$  IV treatments/year (for  $\geq 3$  treatments/year, PAC should be considered)
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##### Contraindications (relative)

- Bad hygiene
  - Skin damage: such as burns, psoriasis etc
  - Patient behavior: great agitation, disorientation
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##### Adverse events

- Pneumothorax
  - Haematoma
  - Infection, bacteremia
  - Air embolism
  - Heart rhythm disorder
  - Thromboembolic complications
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##### Nursing care

- Follow the institutional guidelines for dressing and renewal of the infusion tubing
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#### 5. TOTALLY IMPLANTABLE VASCULAR ACCESS DEVICE (TIVAD)

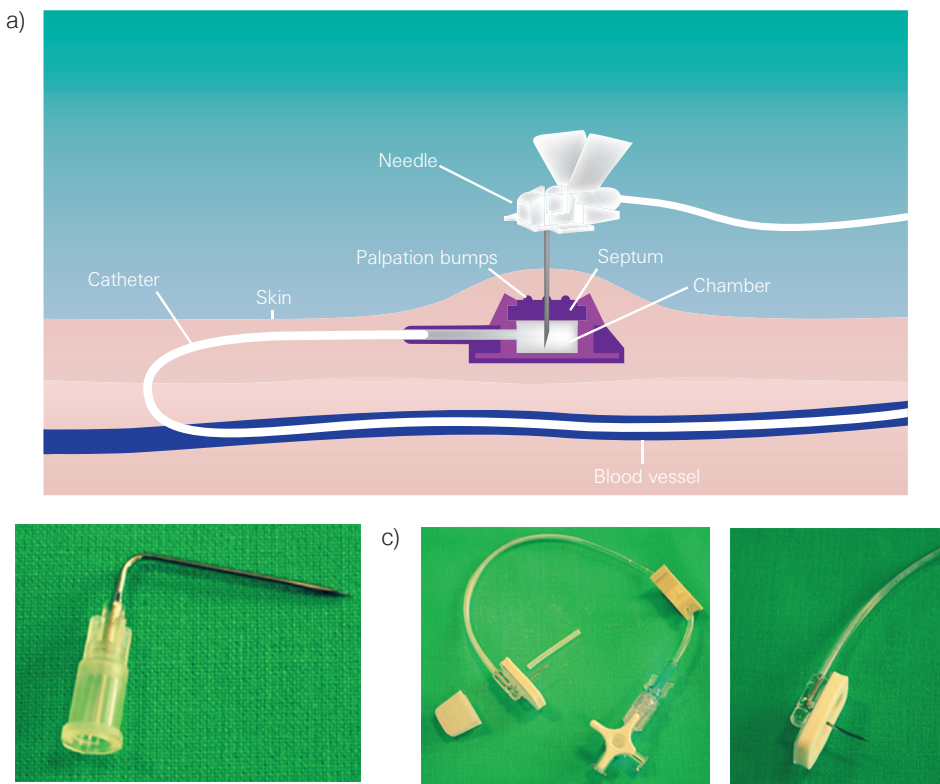
- Commonly used for CF patients: Port-A-Cath® (PAC) (**Figure 4a**)
- It consists of a silicone or polyurethane catheter attached to a stainless steel portal (titanium and plastic) with a self-sealing silicon septum. The chamber is accessed with a Huber



needle or a Gripper® which has a specially designed tip to avoid damaging the silicon septum (**Figures 4b and c**).

- Single chamber PAC devices are typically used, but for patients who require treatment with simultaneously administered IV drugs, double chamber PAC devices may be considered.
- **Table 5** presents the indications, contraindications, adverse effects and nursing care of TIVAD.
- **Table 6** presents the material and the procedure for needle insertion in a PAC.
- **Table 7** presents the procedure for blood drawing using a PAC.
- **Table 8** presents the indications, the supplies and the technique for changing the dressing of a PAC.
- **Table 9** presents the indications, supplies and technique for needle removal from a PAC.

**Figure 4:** a) Structure of a Port-A-Cath, b) Huber needle, c) Gripper®



**Table 5:** Indications, contraindications, adverse effects and nursing care of TIVAD

### Indications

- Veins that are difficult to access with a peripheral venous catheter
- When PICC line is not recommended
- Repeated IV treatments

### Contraindications

- Sepsis
- History of thrombosis

### Adverse events

- Arrhythmia during insertion of the catheter
- Fibrin sheath formation, occlusion
- Superficial or deep vein thrombosis (risk increases when infection with *B. cepacia* complex)
- Infection (blood stream and/or at the puncture site)
- Needle blocked by a clot or displaced within the silicon membrane
- Break of the catheter, catheter migration

### Nursing care

- Assess patient's complaints
- Skin condition (redness, pain, swelling, warmth)
- Needle or Gripper® fixation
- Dressing aspect (must be dry, clean and sealed)
- Check for blood return before any administration of IV medication

**Table 6:** Material and procedure of needle insertion in a PAC

### Supplies

- Bed protection
- Hydro-alcoholic hand solution
- Alcoholic antiseptic with Chlorhexidine® 2% (iodine solution if allergy)
- Mask for the nurse and for the patient
- Sterile gloves
- Disinfection set
- Huber needle or Gripper® system
- NaCl 0,9% 10 ml x 2, sterile syringe 10ml x 2
- Transparent adhesive film (Opsite IV 3000®, Tegaderm®) if gripper. Compress and Mefix® if Huber needle.

### Procedure

- Put a mask and give one to the patient
- Hand disinfection with hydro-alcoholic gel or solution
- Open the disinfection set, add on it Chlorhexidine® 2%
- Put on sterile gloves

- Widely disinfect the site with Chlohexidine® and let the skin dry
- Insert the Huber needle or the Gripper®, check for blood return and rinse the PAC with a minimum of 20 ml NaCl 0,9%
- **NEVER** use a syringe smaller than 10 ml → risk of overpressure and catheter disconnection
- Note the nursing care in the patient file

**Table 7:** Procedure of blood drawing using a PAC

- Hand disinfection with hydro-alcoholic solution or gel
- Put on protection gloves
- Flush the catheter with 10 ml NaCl 0,9% according to the “push and stop” technique
- Take 10 ml of blood and discard them
- Take the blood samples according to the medical prescription
- Flush the line with 20 ml NaCl 0,9% according to the “push and stop” technique
- If necessary restart the perfusion or adapt a stopper until the next infusion
- If no more use of the PAC, make a heparin lock with 5ml Heparin® 100UI/ml and remove the needle

**Table 8:** Indications, supplies and technique for changing the dressing of a PAC

#### Indications

- Immediately if it is soiled, wet or loosed
- Every 7 to 8 days if you can see the puncture point
- Every 2 to 3 days if the puncture point is covered by a gauze

#### Supplies

- Bed protection
- Hydro-alcoholic hand solution
- Alcoholic antiseptic with Chlohexidine® 2% ( iodine solution if allergy)
- Mask
- Non sterile gloves + sterile gloves
- Disinfection set
- Transparent adhesive film (Opsite IV 3000®, Tegaderm®) if Gripper®. Compress and Mefix® if Huber needle.

#### Procedure

- Put on a mask
- Put the bed protection
- Hand disinfection with a hydro-alcoholic gel or solution
- Open the disinfection set, add on it Chlorhexidine® 2%
- Hand disinfection with hydro-alcoholic gel or solution
- Put non sterile gloves, remove the transparent adhesive film
- Put off the gloves, then hand disinfection with a hydro-alcoholic gel or solution

*(continued)*

- Put on the sterile gloves or use a sterile surgical clamp
  - Disinfect the puncture site with Chlorhexidine® solution 2%
  - Wait to allow skin to dry
  - Apply the transparent adhesive film if Gripper®. Apply compress and Mefix® if Huber needle
  - Note the nursing care in the patient file
- 

**Table 9:** Removal of a Huber needle or a Gripper® from a PAC

### General considerations

If there is no complain and the skin is normal, proceed as follows:

- Huber needle has to be changed every 7 days
  - Gripper® system has to be changed every 14 days
  - When the treatment is finished, the TIVAD has to be flushed and locked with 5ml Heparin® 100 UI/ml.
  - **During the following period, if the TIVAD is not used, rinse the line with NaCl 0,9% and lock it with 5ml Heparin® 100 UI/ml every 8 to 12 weeks**
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### Supplies

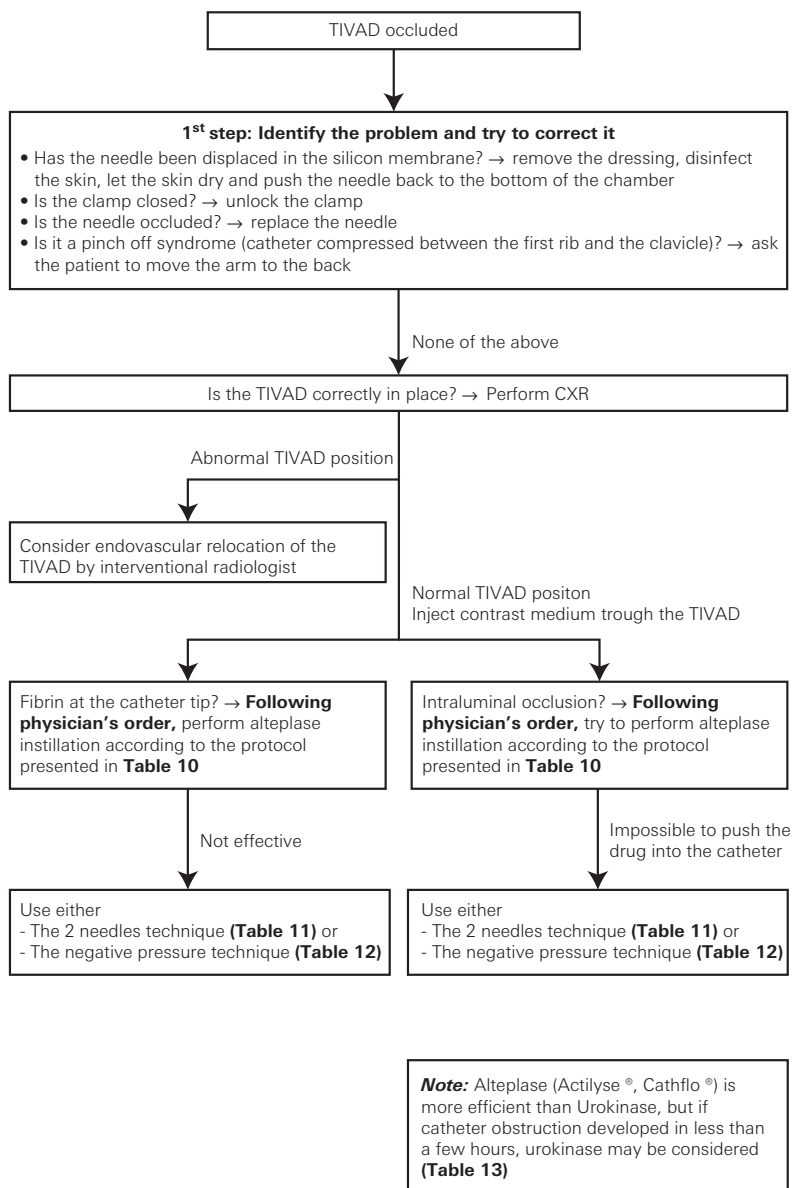
- Bed protection
  - Hydro-alcoholic hand solution
  - Alcoholic antiseptic with Chlohexidine® 2% (iodine solution if allergy)
  - Mask
  - Non sterile gloves
  - Disinfection set
  - NaCl 0,9% 20 ml
  - Heparin® 500UI/5ml
  - Opsite®
- 

### Procedure

- Put a mask
  - Put the bed protection
  - Hand disinfection with a hydro-alcoholic gel or solution
  - Open the disinfection set, add on it Chlorhexidine® 2%
  - Put on non sterile gloves, remove the transparent adhesive film
  - Rinse the PAC with 20 ml NaCl 0,9%
  - Adapt a syringe with 5ml Heparin (Heparin® 100 UI/ml) → while injecting the last ml of heparin, remove the needle. You may ask help from the patient or a colleague.
  - Apply a sterile gauze with Chlorhexidine® 2% on the puncture site during removal of the needle or the Gripper®.
  - Widely disinfect the site with Chlohexidine® 2% and fix an occlusive dressing
  - Note the nursing care in the patient file
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## 6. TIVAD OCCLUDED, WHAT TO DO? (FIGURE 5)

**Figure 5:** Proposed approach in case of occluded TIVAD



### Table 10: Procedure for the instillation of Alteplase

Actilyse® Cathflo® 1mg/ml

- If patient is < 30kg, maximum dose 1mg per injection
- If patient is > 30kg, maximum dose 2mg per injection
- Inject the maximum dose in the chamber and wait 30 to 120 min (test the permeability after 30min)
  - If permeability is restored, take 3ml of blood away (to remove actilyse) and then rinse with NaCl 0,9% solution
  - If after 120 minutes the obstruction is still present, inject again the same dose in the chamber and wait 30 min to 120 min
  - If the catheter permeability is not restored after the 2<sup>nd</sup> injection, discuss stripping procedure with the interventional radiologist.

### Table 11: Two needles technique

- Implementation of the first Huber needle (following Table 6) but let space to insert a second Huber needle in the chamber. If a Gripper® is used, take 2 different lengths (the good size for this patient and a longer one)
- At the end of needle 1, insert an empty syringe 10 ml
- At the end of needle 2, insert a syringe filled with 10 ml NaCl 0,9%
- Gently draw the NaCl 0.9% through the chamber with the syringe no1
- Repeat the procedure 3 to 4 times (or more if necessary) to remove some particles out of the chamber.
- Connect alteplase or urokinase syringe at the needle no 2
- Draw alteplase or urokinase into the chamber with syringe no1
- Remove needle 2 (the longest one)
- Wait 120 minutes to check the permeability

### Table 12: Negative pressure technique

- Using a syringe, draw out the saline from the catheter lumen
- Clamp the Gripper® tubing (negative pressure in the chamber)
- Adapt the alteplase containing syringe
- Open the clamp
- Allow the alteplase containing syringe to return to the neutral position so that the medication is injected into the chamber

**Table 13:** Procedure for the instillation of Urokinase

*Urokinase HS medac*® 10'000 UI

- Use 2 ml sterile H<sub>2</sub>O to prepare the solution (5'000 UI/ml)
- Add 6 ml NaCl 0,9% to this first solution: you obtain a **final solution of 10'000 UI of Urokinase / 8ml**
- Inject 4ml of the final solution in the catheter
- Wait 45 min to check the permeability
  - If no success, repeat once the injection of 4 ml of the final solution
  - If success, draw out 4 ml blood to remove Urokinase and rinse the catheter with NaCl 0,9%

## 7. CONTAMINATION OF CENTRAL LINES (TIVAD AND PICC LINE)

- Proceed to blood cultures 1<sup>st</sup> from a peripheral vein and 2<sup>nd</sup> from the central line.
- PICC line: Remove the PICC line and send the tip of the catheter to the bacteriology laboratory.
- TIVAD
  - Depending on the pathogen (e.g. *St. aureus*) an antibiotic lock may be considered and should always be discussed with the infectiologist. When this approach is not possible, the TIVAD needs to be removed.
  - Do not use the TIVAD during the lock and, after 2 weeks, perform a blood culture through the TIVAD to confirm the decontamination success.

## 8. HEPARIN LOCK OR NOT DURING ANTIBIOTIC COURSE?

- During a 2-week antibiotic course, the flow through the central line (PICC line or TIVAD) may become slower if infusions are intermittent.
- In that case, flush the central line once a day with 3-5ml Heparin 100 UI/ml → this is preferably done during the night, because notably in homecare the interval between 2 infusions (last nocturnal and first morning infusion) is usually longer to allow patients to sleep.

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