



**ISBMT**

Indian Society for Blood & Marrow Transplantation

# BMT MASTER CLASS

**December 2025**



## ISBMT Masterclass 2025

### Catheters and Catheter Care

Dr Akanksha Chichra  
Pediatric Medical Oncology & BMT  
ACTREC, TMC

# Introduction

- HSCT requires a stable and safe venous access
- A CVC is required for multiple purposes –
  - ✓ Chemotherapy
  - ✓ Parenteral nutrition
  - ✓ Hydration
  - ✓ Supportive medications
  - ✓ Blood sampling

# Outline

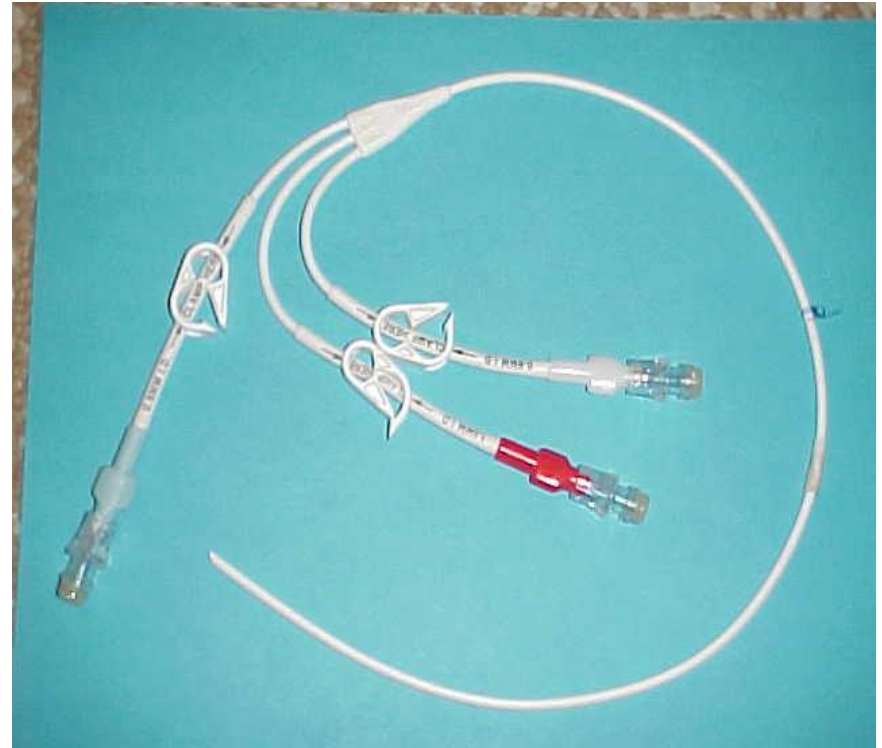
- Types of catheters
- Advantages and Disadvantages
- Catheter care
- Complications

# Catheter types

- Non-tunneled catheters
- Tunneled catheters with anchoring cuff
- Implanted ports
- Apheresis/dialysis catheters
- PICC



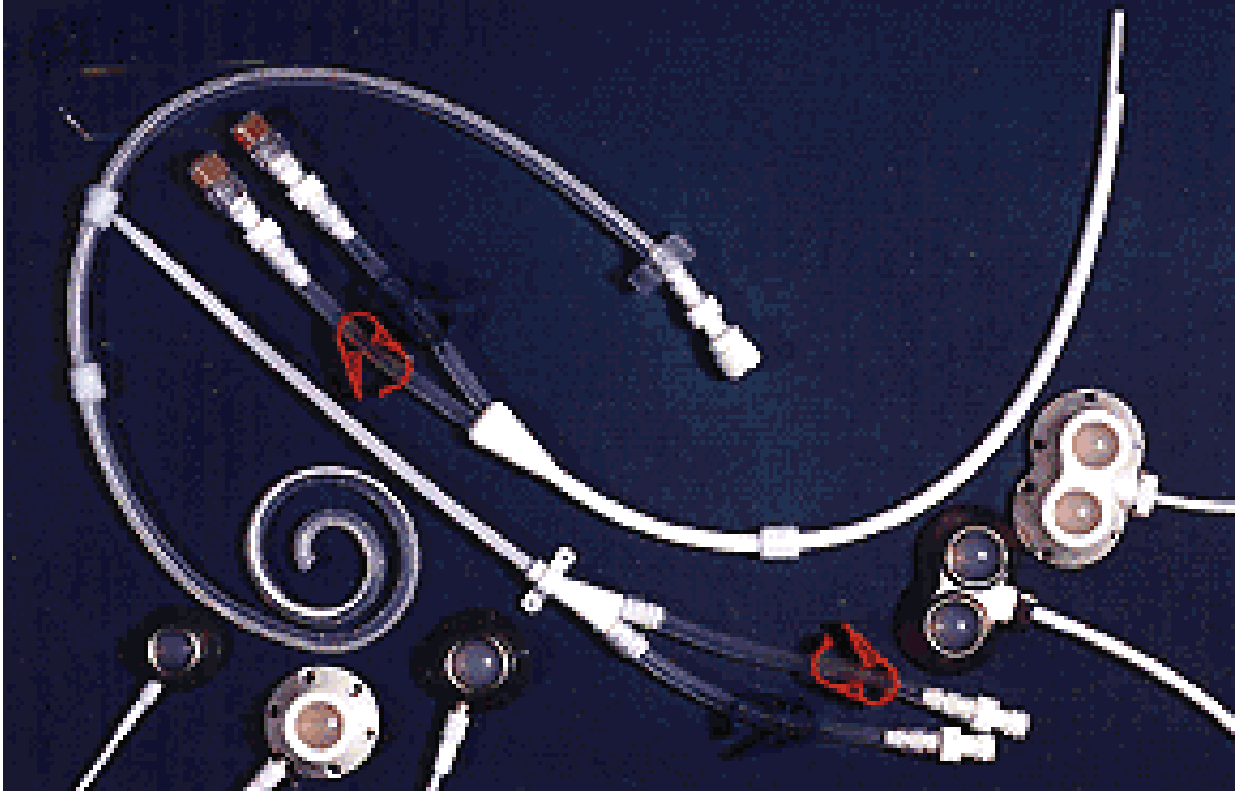
Non-Tunneled Catheter



Hickman catheter



Port



Apheresis catheter

<b>Catheter type</b>	<b>Advantages</b>	<b>Disadvantages</b>
<b>Nontunnelled catheters</b>	Choice of sites Easy to insert /remove Multiple lumina available	Short-term use
<b>Skin-tunnelled catheters</b>	Lower infection rates than nontunnelled Long-term use	More complex insertion and removal
<b>Ports</b>	No external catheter Cosmetically attractive Patient can bathe long-term use Lower infection rates	Surgical insertion and removal Less suitable for frequent repeated access
<b>Apheresis/dialysis catheters</b>	Permit high blood flow rates Good for patients with poor peripheral access who require both PBSC harvest and transplant procedure	Short-term use
<b>PICC</b>	Easy to insert and remove Do not require platelet support or correction of clotting prior to insertion/removal	Higher thrombosis rate Catheter longevity lower than with skin-tunnelled devices Incidence of malposition greater than in other types of CVC

# Choice of CVC

**Table 80.1** Patient and treatment factors that affect catheter selection

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Catheter-related factors:

- Duration of therapy (short or long term)
- Frequency of treatment (intermittent or continuous)
- Number of lumina required

Therapy for which the catheter is intended:

- Transfusions of blood products
- Parenteral nutrition
- Chemotherapy administration (types of chemotherapy agent)
- Hematopoietic cell collection
- Supportive care

Patient-related factors:

- Previous history of chest or neck surgery or radiation (mastectomy, neck biopsy)
- Presence of a chest, neck, or mediastinal tumor
- Pulmonary function (asthma, pleural effusion)
- Cardiac function (arrhythmias, pacemakers)

Venous access factors:

- Current venous access
- Previous history of venous access
- Previous history of catheter-related complications
- Previous or current history of veno-occlusive disease or lymphedema

Hematologic and coagulation status:

- Red cell blood count
- Platelet count
- History of bleeding disorders
- Anticoagulation (Coumadin, aspirin, Plavix)

Infection risk:

- White blood cell count
- History of recent infections
- History of catheter-related infections

Allergies:

- Anesthetics
  - Cleansing solutions
  - Dressings
  - Latex
-

# Catheter care – pre & during insertion

- Never place catheters with active infection (except if needed for antibiotic administration)
- Platelet count >50, INR <1.5
- Chlorhexidine has been shown to be superior to either povidone-iodine solution in reducing catheter-related blood stream infections
- Use of lidocaine with adrenaline 1 : 200 000 as local anesthetic will reduce subcutaneous bruising/bleeding

# Post insertion use and care

- Always check tip position post-placement
- The external surfaces of the access port should be disinfected with a chlorhexidine gluconate solution
- A blood sampling protocol should include instruction on the removal of the dead space to avoid erroneous results
- The lumen for taking blood for drug levels should be different from the one used to administer

# Catheter Related Complications

- Catheter- Related Infections
- Catheter –Related Thrombosis
- Catheter malfunction

# Catheter Related Infections

## **Localized Catheter Colonization:**

Significant growth of a microorganism(>15 CFU) from the catheter tip, subcutaneous segment of catheter, or catheter hub.

## **Exit Site Infection**

Erythema or induration within 2 cm of exit site in absence of BSI and purulence

## **Tunnel Infection**

Tenderness ,erythema or site induration > 2cm from catheter site along subcutaneous tract of a tunneled catheter ,in absence of BSI

# Preventive Strategies for CRI

- **Physician / nursing and even patient education**

Randomized Controlled Trial > [J Hosp Infect. 2005 Dec;61\(4\):330-41.](#)

doi: 10.1016/j.jhin.2005.01.031. Epub 2005 Jul 6.

**Patient education--a strategy for prevention of infections caused by permanent central venous catheters in patients with haematological malignancies: a randomized clinical trial**

T Møller <sup>1</sup>, N Borregaard, M Tvede, L Adamsen

> [Clin J Oncol Nurs. 2012 Feb;16\(1\):E12-7. doi: 10.1188/12.CJON.E12-E17.](#)

**Strategic patient education program to prevent catheter-related bloodstream infection**

Rebecca F DeLa Cruz <sup>1</sup>, Brenda Caillouet, Susan S Guerrero

# Preventive Strategies for CRI

- **Cutaneous Antisepsis**

Studies evaluating 2% chlorhexidine vs either povidone-iodine or alcohol for the care of an intravascular catheter insertion site have shown lower rates of CRBSI associated with the chlorhexidine preparation

Randomized Controlled Trial > Arch Intern Med. 2007 Oct 22;167(19):2066-72.

doi: 10.1001/archinte.167.19.2066.

## Chlorhexidine-based antiseptic solution vs alcohol-based povidone-iodine for central venous catheter care

Olivier Mimoz<sup>1</sup>, Stéphanie Villeminey, Stéphanie Ragot, Claire Dahyot-Fizelier, Leila Laksiri, Franck Petitpas, Bertrand Debaene

Affiliations + expand

PMID: 17954800 DOI: 10.1001/archinte.167.19.2066



► Cochrane Database Syst Rev. 2016 Jul 13;2016(7):CD010140. doi: [10.1002/14651858.CD010140.pub2](https://doi.org/10.1002/14651858.CD010140.pub2)

## Skin antisepsis for reducing central venous catheter-related infections

[Nai Ming Lai](#)<sup>1,2,✉</sup>, [Nai An Lai](#)<sup>3</sup>, [Elizabeth O'Riordan](#)<sup>4</sup>, [Nathorn Chaiyakunapruk](#)<sup>2,5,6</sup>, [Jacqueline E Taylor](#)<sup>7</sup>, [Kenneth Tan](#)<sup>8</sup>

# Not been conclusively shown to prevent BSI

- Catheter dressing type
- Antimicrobial catheter locks
- Routine replacement of CVC (important for non-tunneled catheters)

# Preventive Measures of Catheter related infections

## **Panel: Preventive measures of catheter-related infections**

### **Education**

- Appropriate education of all health-care providers caring for a patient with a central venous catheter on the importance of catheter-related infection prevention
- Specialised teams: infusion therapy teams
- Simulation training

### **Bundles**

- Hand hygiene
- Maximal barrier precautions: large sterile drape, gown, cap, mask, and gloves during insertion of central venous catheter
- Chlorhexidine skin antisepsis during insertion
- Optimal catheter site selection: subclavian preferred
- Routine assessment of central venous catheter necessity and prompt removal when not indicated
- Post-insertion care

### **Antimicrobial catheters**

### **Lock therapy**

# Management of CRI

- Is Catheter removal necessary in all cases

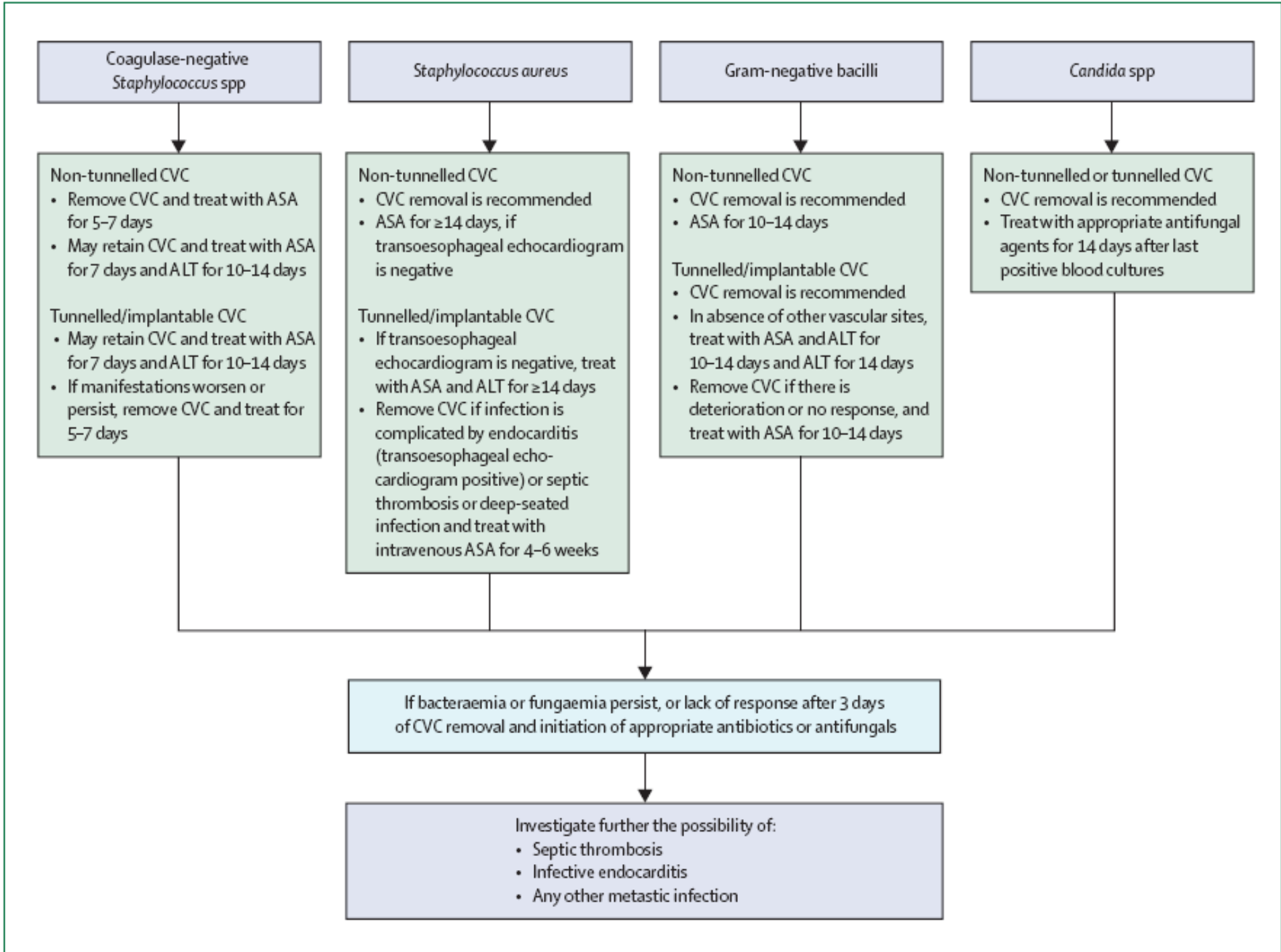
Salvage approach possible if all criteria present	Catheter removal necessary in case of:
Absence of local infection signs	Local complications, e.g. tunnel or port infection
Absence of metastatic complications	Metastatic complications
Sterile blood cultures	Relapse of infection during/ after antibiotic treatment
Clinically stable patient	Unstable patient
	Persistent sepsis/bacteraemia
	Certain microorganisms: <i>S. aureus</i> , <i>Candida</i> species

› [Transpl Infect Dis.](#) 2019 Feb;21(1):e13017. doi: 10.1111/tid.13017. Epub 2018 Nov 19.

## **Antibiotic lock therapy for salvage of tunneled central venous catheters with catheter colonization and catheter-related bloodstream infection**

Saurabh Zanwar<sup>1</sup>, Punit Jain<sup>2</sup>, Anant Gokarn<sup>1</sup>, Santhosh Kumar Devadas<sup>1</sup>, Sachin Punatar<sup>1</sup>, Sachin Khurana<sup>1</sup>, Avinash Bonda<sup>1</sup>, Ritesh Pruthy<sup>3</sup>, Vivek Bhat<sup>4</sup>, Sajid Qureshi<sup>3</sup>, Navin Khattry<sup>1</sup>

9.8% and CRBSI in 10.7% patients. Gram-negative bacilli (GNB) accounted for 45% and 83% of isolates in CC and CRBSI, respectively. In patients with CRBSI, the rate of catheter salvage with the use of ALT in addition to systemic antibiotics was 86% compared to 55% in patients with systemic antibiotics use only ( $P = 0.06$ ). There was no CRBSI related mortality, and no increase in resistant strains was noted at



Coagulase-negative  
*Staphylococcus* spp

*Staphylococcus aureus*

Gram-negative bacilli

*Candida* spp

Non-tunneled CVC

- Remove CVC and treat with ASA for 5-7 days
- May retain CVC and treat with ASA for 7 days and ALT for 10-14 days

Tunneled/implantable CVC

- May retain CVC and treat with ASA for 7 days and ALT for 10-14 days
- If manifestations worsen or persist, remove CVC and treat for 5-7 days

Non-tunneled CVC

- CVC removal is recommended
- ASA for  $\geq 14$  days, if transoesophageal echocardiogram is negative

Tunneled/implantable CVC

- If transoesophageal echocardiogram is negative, treat with ASA and ALT for  $\geq 14$  days
- Remove CVC if infection is complicated by endocarditis (transoesophageal echocardiogram positive) or septic thrombosis or deep-seated infection and treat with intravenous ASA for 4-6 weeks

Non-tunneled CVC

- CVC removal is recommended
- ASA for 10-14 days

Tunneled/implantable CVC

- CVC removal is recommended
- In absence of other vascular sites, treat with ASA and ALT for 10-14 days and ALT for 14 days
- Remove CVC if there is deterioration or no response, and treat with ASA for 10-14 days

Non-tunneled or tunneled CVC

- CVC removal is recommended
- Treat with appropriate antifungal agents for 14 days after last positive blood cultures

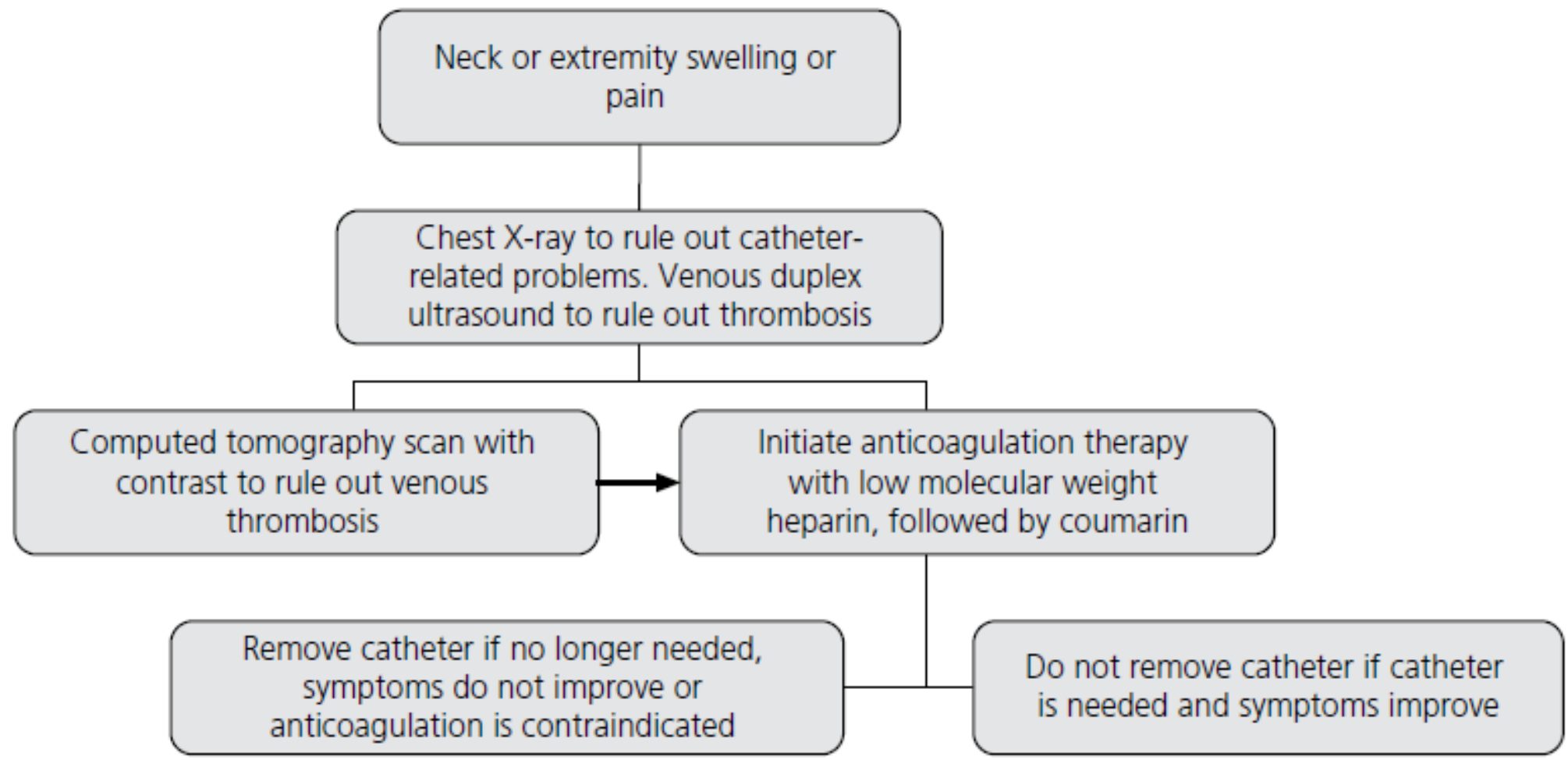
If bacteraemia or fungaemia persist, or lack of response after 3 days of CVC removal and initiation of appropriate antibiotics or antifungals

Investigate further the possibility of:

- Septic thrombosis
- Infective endocarditis
- Any other metastatic infection

# Thrombosis

Author	Year	Study design	No. CVCs	CVC-related thrombosis, <i>n</i> (%)	(A)Symptomatic	CVC care
Boraks <i>et al.</i>	1998	Retrospective	115	15 (13.0)	Symptomatic	Heparin flush twice weekly
		Prospective	108	5 (4.6)	Symptomatic	Heparin flush and warfarin 1 mg/day
Ratcliffe <i>et al.</i>	1999	Prospective	23	2 (8.7)	Symptomatic	Daily heparin-saline flushes
Nouwen <i>et al.</i>	1999	Prospective	48	7 (14.6)	(A)Symptomatic	Not mentioned
Lagro <i>et al.</i>	2000	Retrospective	163	10 (6.1)	Symptomatic	Daily heparin-saline flushes/no prophylaxis
			125	10 (8.0)	Symptomatic	7 days nadroparin s.c.
			102	7 (6.9)	Symptomatic	10 days nadroparin s.c.
Fijnheer <i>et al.</i>	2002	Prospective	94	9 (9.6)	Symptomatic	Daily heparin-saline flushes
			183	23 (12.6)	Symptomatic	10 days of LMWH s.c./4 weeks of heparin
Harter <i>et al.</i>	2002	Prospective	233	4 (1.5)	(A)Symptomatic	10,000 IE heparin i.v./day
Male <i>et al.</i>	2003	Prospective	85 children	29 (34.1)	(A)Symptomatic	Continuous UFH or flushes
Lordick <i>et al.</i>	2003	Prospective	43	13 (30.2)	(A)Symptomatic	Continuous UFH/LMWH s.c/low-dose heparin
Cortelezzi <i>et al.</i>	2003	Retrospective	137	14 (10.2)	Symptomatic	Weekly heparin flush and LMWH or UFH or none
Van Rooden <i>et al.</i>	2005	Prospective	105	13 (12.4)	Symptomatic	Daily urokinase in lumina of the CVC
Abdelkefi <i>et al.</i>	2005	Prospective	102	10 (9.8)	(A)Symptomatic	Saline infusion
			102	2 (2.0)	(A)Symptomatic	Continuous infusion of UFH
Cortelezzi <i>et al.</i>	2005	Prospective	458	35 (7.6)	Symptomatic	Not mentioned 14.2% antithrombotic prophylaxis
Magagnoli <i>et al.</i>	2006	Retrospective	254	3 (1.2)	Symptomatic	1 mg of warfarin daily



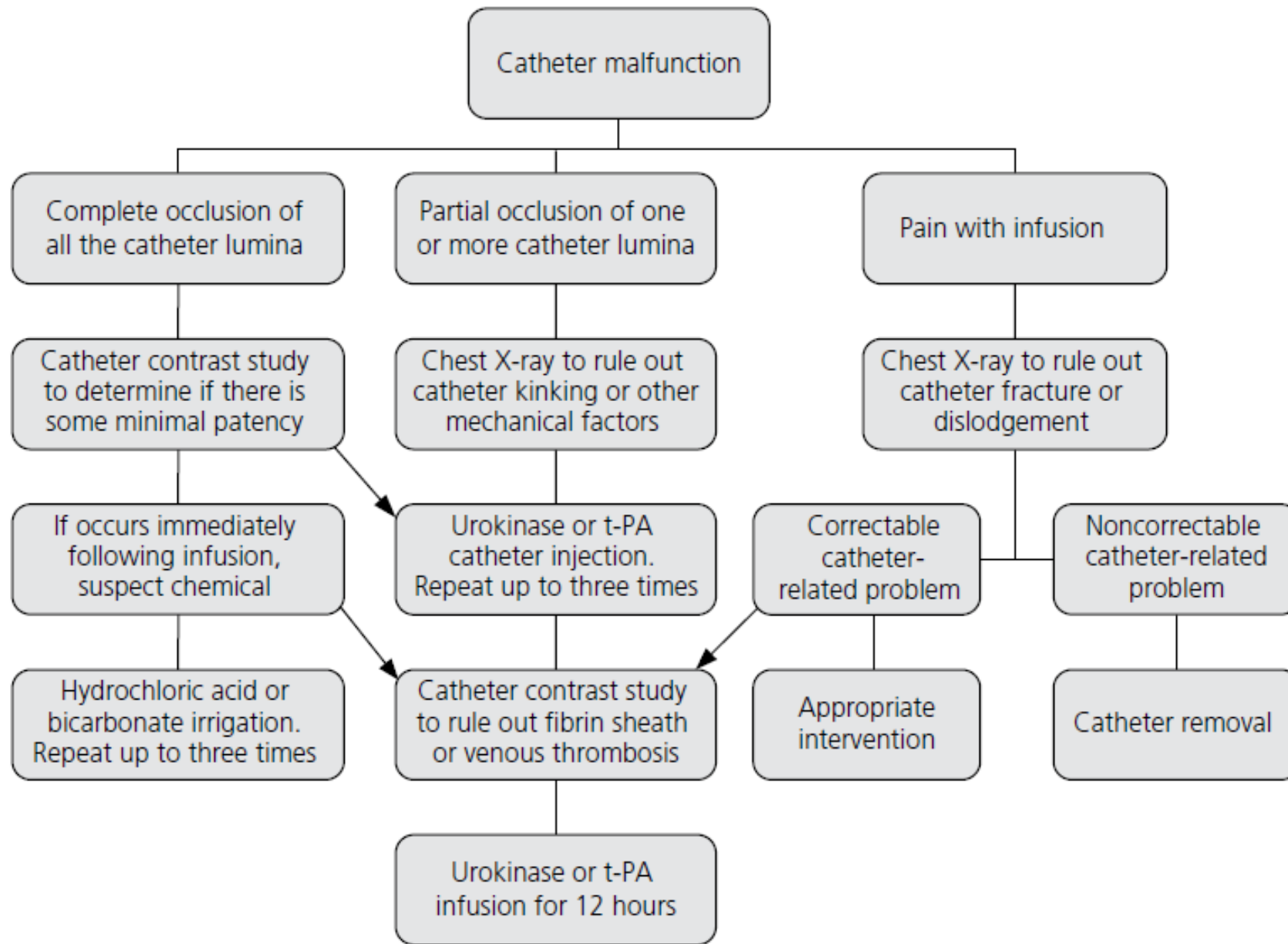
# Catheter Malfunction

## **Catheter occlusion includes**

- Blockage resulting from kinking of the catheter
- Occlusion of the catheter tip on the vessel wall
- Fibrin sheath or fibrin flap or luminal thrombus
- Migration of the tip into a smaller vessel

Plain X-ray or a catheter contrast study

may be helpful in confirming the diagnosis



# Take home messages

- Catheter are lifelines for transplant patients
- Several options – multitude of factors based on what to choose
- Important complications – infections, thrombosis, malfunction
- Several low-cost interventions to prevent CRBSI
- Taking good care of catheters needs a bit of effort (by physicians, nurses and patients) – but important to reduce complications

THANK YOU

# Questions

- The main reason tunneled catheters are preferred in HSCT is
  1. Lower risk of arterial puncture
  2. Reduced risk of long-term infection
  3. Ability to tolerate high osmolarity infusions
  4. Suitable for short procedures only

# Questions

- Which is the most appropriate action for a catheter that becomes occluded during stem cell infusion
  1. Stop infusion permanently
  2. Attempt thrombolytic therapy immediately
  3. Establish alternate venous access urgently
  4. Continue infusion under pressure