Patency management algorithm for central venous access devices (CVADs)

STANDARD CARE

- **Educated and competent** clinicians, patients, family/carers involved with CVAD management
- **Catheter selection:** insert CVAD with the minimum number of lumens for the prescribed therapy
- **CVAD catheter tip:** located at cavoatrial junction, lower third of the superior vena cava or upper right atrium for upper body insertions or inferior vena cava above the level of diaphragm for femoral vein insertions
- **Syringes:** with 10 mL or 20 mL
- **Flushing:**
  - Using 0.9% sodium chloride
  - Using a pulsatile/start-stop flush technique and complete with the appropriate clamping-disconnection sequence to maintain positive pressure at the catheter tip according to the type of needleless connector
  - Regularly to remove intraluminal drug residue, blood components and in between incompatible solutions
  - Adults: 10 mL increasing to 20 mL post blood sampling or infusions, viscous or sticky solutions e.g. CT contrast, medications, dextrose, TPN
  - Paediatrics: at least double the volume of the CVAD system
- **Locking:**
  - Using 0.9% sodium chloride
  - Using a pulsatile/start-stop flush technique and complete with the appropriate clamping-disconnection sequence to maintain positive pressure at the catheter tip according to the type of needleless connector
  - For every lumen
  - Frequency: according to type of CVAD, intermittent use or in between prescribed therapy episodes

Every patient: implement strategies for every patient, every time, for every CVAD by all clinical staff managing CVADs.

ASSESSMENT

Easy injection / easy aspiration? IN1/AS1

PATENCY ASSESSMENT
CINAS Catheter Injection Aspiration Classification

Assess *aspiration* and *injection* ability of the CVAD

CINAS Classification	Injection ability (IN): Easy ≥ 1 mL IN1	Difficult ≥ 1 mL IN2	Impossible < 1 mL IN3	Unknown INx
Aspiration ability (AS): Easy ≥ 3 mL AS1	IN1AS1	IN2AS1	IN3AS1	INxAS1
Difficult ≥ 3 mL AS2	IN1AS2	IN2AS2	IN3AS2	INxAS2
Impossible < 3 mL AS3	IN1AS3	IN2AS3	IN3AS3	INxAS3
Unknown ASx	IN1ASx	IN2ASx	IN3ASx	INxASx

Unknown or no assessed aspiration or injection? Inx/ASx

DOCUMENT

Difficult aspiration / difficult injection? IN2/AS2

SIGNS & SYMPTOMS: partial occlusion

- No blood return but flushes easily
- Flash back only and no frank blood return
- Slow blood return
- Increased resistance on flushing
- Catheter tip not at cavoatrial junction on CXR
- Sudden onset of resistance after medication administration
- Drug precipitation in the catheter lumen
- Prolonged creasing in catheter lumen
- Blood remnants in catheter lumen
- Closed clamp on catheter or IV tubing

Impossible aspiration / injection? IN3/AS3

SIGNS & SYMPTOMS: complete occlusion

- No blood return and
- Inability to inject fluids

Is there evidence of a mechanical occlusion

- **CVAD factors:** closed clamps on catheter lumen or non coring TIVAD needle; kinked catheter under dressing; malpositioned, angled or inappropriate length non coring TIVAD needle, change in catheter length, blood in catheter lumen
- ***IV administration lines*** – kinks, twists or closed clamps in IV lines including additive lines or in-line filters, blood in needleless connector
- ***Patient factors*** - patient position, catheter tip malposition or adjacent to vein wall

MECHANICAL occlusion

INTERVENTIONS OR INVESTIGATIONS:

- ***Actions***: change patient position, ask patient to cough or deep breathe, open clamps, change dressing, replace blocked needleless connectors or filters, re-access TIVAD, replace IV administration line/s
- ***Investigations***: e.g. flow studies for kink, occlusion, fibrin sheath/sleeve, catheter fracture; CXR for suspected catheter tip malposition, pinch-off syndrome

YES

Easy injection / easy aspiration? IN1/AS1

YES

Resume use of CVAD

CLINICAL PRACTICE POINT
Act promptly and avoid delay in interventions

NO

Is there evidence of DVT?

- Pain +/- swelling e.g. arm, chest wall, neck, face, jaw
- Discoloration of the extremity
- Altered sensation of the extremity
- Reduced function in the extremity
- Engorged peripheral veins on the extremity or chest wall on the side of catheter insertion

NO

YES

Consult with medical staff

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ASSESSMENT

INTERVENTION & OUTCOME

THROMBOTIC or CHEMICAL occlusion

CLINICAL PRACTICE POINT
Technique for partial occlusion: inject solution into CVAD via syringe
Complete occlusion: use three-way tap technique (installation facilitated by creating negative pressure)

ABBREVIATIONS

CT	Computerised tomography
CVAD	Central Venous Access Device
CXR	Chest x-ray
IV	Intravenous
TIVAD	Totally Implanted Venous Access Device

CLINICAL PRACTICE POINT
If occlusion is not mechanical and no evidence of chemical occlusion - treat as thrombotic occlusion

THROMBOTIC occlusions: 58%
CHEMICAL & MECHANICAL occlusions: 42%

Is there evidence of THROMBOTIC OCCLUSION
- Visible blood in catheter, needleless connector or IV line
- Frequent, reoccurring administration pump alarm
- Resistance or inability to inject fluids
- Sluggish flow of intravenous fluids
- Inability to withdraw blood
- Flash back but no frank blood return

YES

NO

Is there evidence of CHEMICAL OCCLUSION
- Visible medication precipitation in catheter
- Recent administration of medication, lipid, viscous solutions
- Sudden onset of resistance after medication administration

What is the cause?

Seek advice from pharmacist for management of chemical occlusions

1st round: as prescribed

Easy injection / easy aspiration? IN1/AS1

NO

Instil #1 dose of thrombolytic medication as per prescribed order.
e.g alteplase: Adults: 2mg in 2mls or 110% of catheter volume for paediatric patients <30kg
Dwell for 30-120mins
Label lumen appropriately

Suspected fibrin tail or sheath: stop all infusions during thrombolytic dwell time If clinically appropriate

YES

Resume use of CVAD

DOCUMENT
Initial findings, assessment, interventions, evaluation and final actions

Acid solution (pH<6)
e.g. parenteral nutrition, amino acids, vancomycin
Dwell for 20-60 minutes
Label lumen

Alkaline solution (pH>7)
e.g. heparin ampicillin, acyclovir imipenem
Dwell for 20-60 minutes
Label lumen

Lipid
70% sterile Ethanol
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

CLINICAL PRACTICE POINT
Check compatibility of solutions with catheter material e.g. ethanol and polyurethane

As prescribed order:
Hydrochloric acid
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

Sodium bicarbonate
Sodium hydroxide
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

70% sterile Ethanol
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

AIM: dissolve the precipitation.
Precipitation occurs with exposure of a solution to another with an opposing pH

Easy injection / easy aspiration? IN1/AS1

YES

Is patency restored?

NO

2nd round: as prescribed

Instil #2 dose of thrombolytic medication as per prescribed order.
e.g. alteplase
Dwell for 30-120mins
Label lumen appropriately

YES

Resume use of CVAD

Is patency restored?

NO

Potentially allow to dwell overnight or up to 72 hrs

Consult expert CVAD nurse and medical staff,
consider:
- Radiological assessment e.g. CXR or flow studies
- Low dose thrombolytic infusion (e.g. 30 mins – 4 hrs) for unresolved partial occlusion
- Assess for chemical occlusion
- Interventional radiology procedures e.g. for fibrin sheath management
- Potential CVAD removal or replacement

Instil #2 dose as per prescribed order

Hydrochloric acid
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

Sodium bicarbonate
Sodium hydroxide
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

70% sterile Ethanol
Fill volume of CVAD only
Dwell for 20-60 minutes
Label lumen

YES

Resume use of CVAD

Is patency restored?

NO

Consult expert CVAD nurse and medical staff,
consider:
- Radiological assessment e.g. CXR or flow studies
- Assess for thrombolytic occlusion
- Interventional radiology procedures e.g. for fibrin sheath management
- Potential CVAD removal or replacement

DOCUMENT
Initial findings, assessment, interventions, evaluation and final actions

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