NHS
Blood and Transplant

Therapeutic Apheresis Services

Venous Access Considerations for Apheresis Procedures

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Introduction

This leaflet gives some information on the venous access requirements for therapeutic apheresis to aid decision making when choosing the venous access route and type of devices in order to ensure the requested apheresis procedure can be carried out effectively

All therapeutic apheresis procedures e.g. plasma exchange, stem cell procedures and extracorporeal photopheresis (ECP) require adequate venous access.

- Peripheral veins are the safest option, however central venous catheters (CVCs) are often required for patients undergoing apheresis
- It is the responsibility of the referring clinical team to arrange CVC access if required.

The success of the apheresis procedure is dependent on good venous access providing a good steady flow of blood into the machine.

Interrupted blood flow destabilizes the separation interface in the machine causing disruption to the procedure, increased procedural times and reduced treatment efficacy.

Generally shorter wider needle/catheter/cannula lumens provide better flow, however actual flow rates are also affected by other factors e.g. patient tolerance of fluid shifts, vein size and turgor, catheter position or build up of biofilm and fibrin sheath.

Venous Access Options

Most therapeutic apheresis procedures require two separate points of venous access, one to remove blood and the second to simultaneously return the blood back.

Venous access can be achieved wholly or in combination from peripheral veins, central venous catheters, arteriovenous (AV) fistulas, AV grafts and high flow ports and options chosen will depend on how long the access will be required i.e. short or long term.

Peripherally inserted central catheters (PICC) are unsuitable and contraindicated for apheresis procedures due to the high flows and pressures which can cause rupture of the PICC.

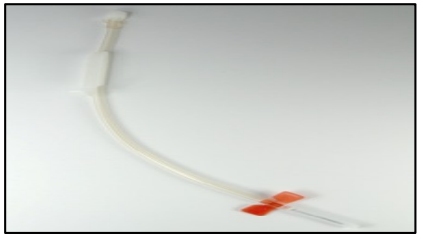
Peripheral Access

- Peripheral venous access is required in both arms as use of one arm can result in recirculation of blood and/or longer procedures.
- Avoid the use of cubital fossa veins for blood sampling and cannula placement in patients who have been referred for apheresis

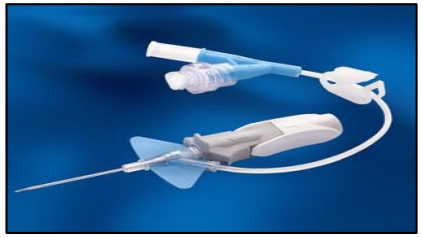
Peripheral venous access devices (PVADs) used in apheresis

- Suitable for short-term or intermittent procedures
- Larger gauge devices needed to for apheresis flow rates.
- Smaller gauge devices achieve slower flow rates and may not be as suitable for apheresis procedures.
- In adults 18 to 20 gauge cannula are required for return flow during apheresis.

Apheresis / Dialysis Needle



Peripheral Cannula



Draw Needle / Cannula

- Peripheral needles/cannulae for drawing blood into the cell separator must be sited in large veins in the cubital fossa or above which can support the negative draw pressure of the machine.
- Should preferably be a fixed metal back eyed 16-17gauge dialysis type needle as the negative pressure of up to approx -250mmHg will often cause plastic cannulae to collapse either preventing flow or requiring low flow rates which lengthen procedure.
- A back-eye needle helps to prevent turbulence around the needle tip irritating the vein and prevents occlusion of flow by the vein wall.
- Fixed needles require the patient to keep their arm straight and maintain it outstretched for the duration of procedure (up to 5 hours).
- The access vein needs to be straight enough to insert the needle and not be sclerosed or thrombosed.
- If there is difficulty in accessing a vein for blood sampling, the vein will be unsuitable for apheresis.

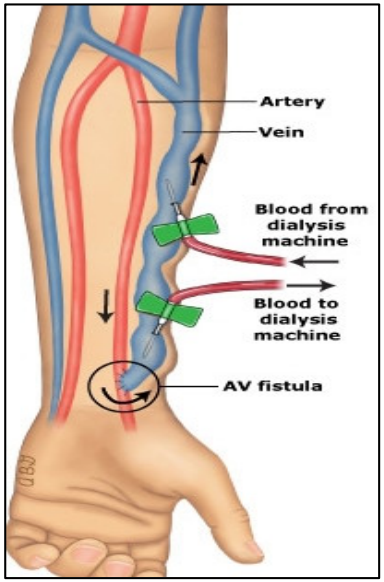
Return Needle / Cannulae

- Peripheral Needles/cannulae for returning blood may be sited in any part of the lower arm or hand as return flow can be accommodated by smaller veins, however use of peripheral leg veins is contraindicated in apheresis.
- Return needles/cannulae are best placed away from joints where bending of the arm or wrist cause increased pressure and can occlude the return flow back to the patient. They will need to be at least 20 gauge in adults to accommodate return flow rates. The patient will be able to use the arm more readily during the procedure if the needle/cannula will not be affected by bending.

AV Fistulas

- A Mature AV fistula can support both the access and return needles for apheresis procedures however positioning of needles is important to reduce recirculation.

- Because the high arterialised flow minimises recirculation a single arm procedures can be carried out using an AV fistula which allows the patient greater freedom of movement during treatment
- Apheresis procedures are routinely carried out using AV fistulas and are an alternative option for some patients. There use in photopheresis for GvHD may be dependant on the extent of skin involvement.

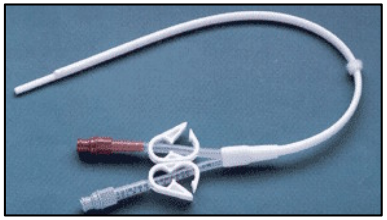


Central Venous Access

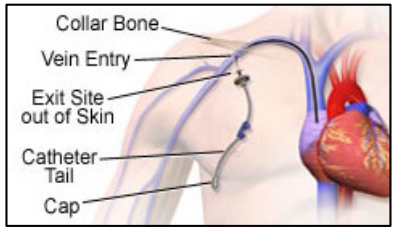
Central venous access devices (CVADs) used in apheresis:

Non – tunnelled central venous catheters (CVC)

- Temporary short term use or one off Central Venous Catheters (CVC) placement sited in the internal jugular (IJ), subclavian (SC) or femoral veins can be used for apheresis.



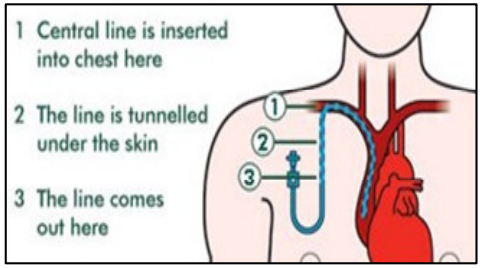
- Stiff bodied, large bore, dual lumen catheters (sometimes generically referred to as VASCATHS) with staggered ends are required to accommodate high flow rates, withstand draw and return pressures and allow simultaneous draw and return flow without recirculation.
- Other types of CVC e.g. triple lumen are generally unsuitable for apheresis and although return flow may be possible through some access/draw flow is not.

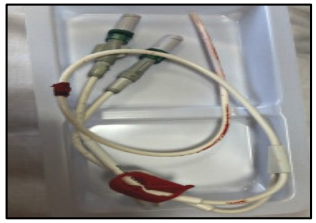


Skin Tunnelled Catheters (HICKMAN LINES)

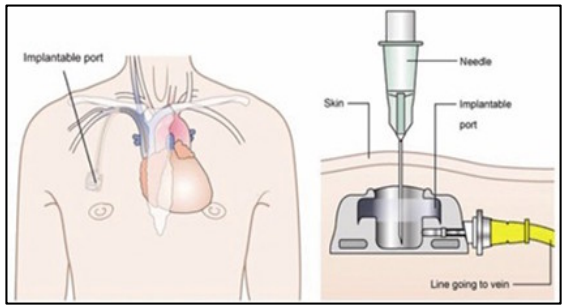
Caution should be taken with the term “Hickman line” as it is often used for any tunnelled CVC Inc large bore apheresis catheters.

- Inserted through SC or Jugular veins into the central circulation and used for long term venous access (>30 days)
- Not suitable for draw flow as small lumen diameter does not withstand high pressure and flow rates generated.
- Can be used for low return flow ratetes.





Implanted Intravascular Access Devices (PORT)

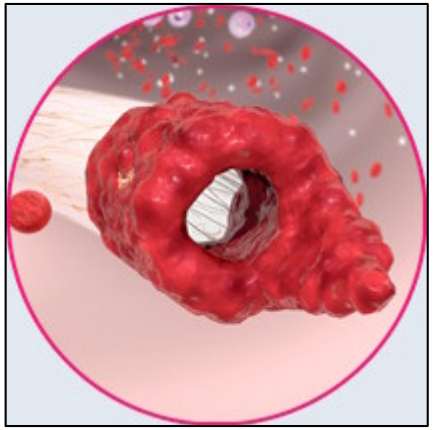


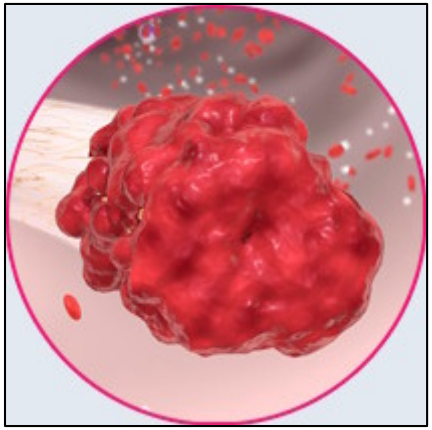
- Placed subcutaneously on the chest with the catheter further tunnelled into the distal superior vena cava or right atrium.
- For long term use (Often referred to as Portacath)
- Only high flow dual (VORTEX) ports used with large bore non coring needles are suitable for apheresis.
- Standard Portacaths are not suitable for apheresis

- Although IJ and SC CVCs carry risks of pneumo/haemothorax and mechanical complications related to placement they are preferred over femoral CVCs which have higher risks of infection, thrombosis and kinking however for urgent or short-duration procedures femoral lines may be chosen.
- Paediatric CVC length and Fr diameter should be based on body size and weight with Minimum CVC size 7Fr and Maximum CVC length 36cm
- CVC patency is of the upmost importance for apheresis procedures. Narrowing of the lumen of the catheter will affect the flow rates and increase pressure in the lumens.
- Presence and formation of fibrin sheath, biofilm build up and thrombosis can occlude the lumens. Adequate care and anticoagulation of CVCs is vital to ensure patency is maintained as resistance to flow in either direction limits adequate blood flow.

Fibrin Sheath and Thrombosis Occlusion

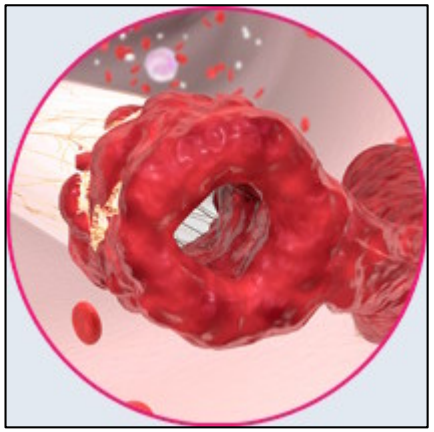
- Fibrin sheath is the most common cause of flow occlusion and a fibrin tail may develop which can prevent aspiration as the 'tail' is pulled back against the CVAD tip when draw is attempted.
- The fibrin sheath can however envelope the CVAD completely preventing return flow.

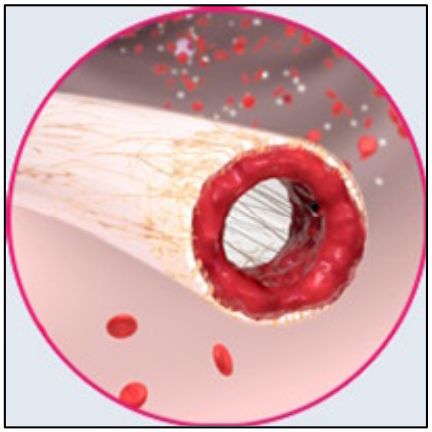




Intraluminal Thrombosis

- Account for 5-25% of all catheter occlusions causing complete catheter obstruction in some cases
- A mural thrombosis adheres to the vessel wall and may partially occlude the vein as well as the catheter tip.





Mural Thrombus

Guide to Central Venous Catheter Sizing

The french size corresponds to the outside diameter of the catheter - to covert this size into millimetres, divide it by 3 (Fr size / 3= mm)