Vascular Access – An Introduction

Workbook

Welcome to our vascular access workbook. This has been designed to provide you with ample theoretical knowledge of vascular access as well as a knowledge of polices, practices and procedures that are undertaken in our trust. Throughout the work book, there are questions to help you consolidate your knowledge and understanding of various different topics. There is also space for you to jot down any notes you want to keep for yourself that could help you write a reflective practice for revalidation. This workbook can provide you with study time that you can use as evidence for revalidation.

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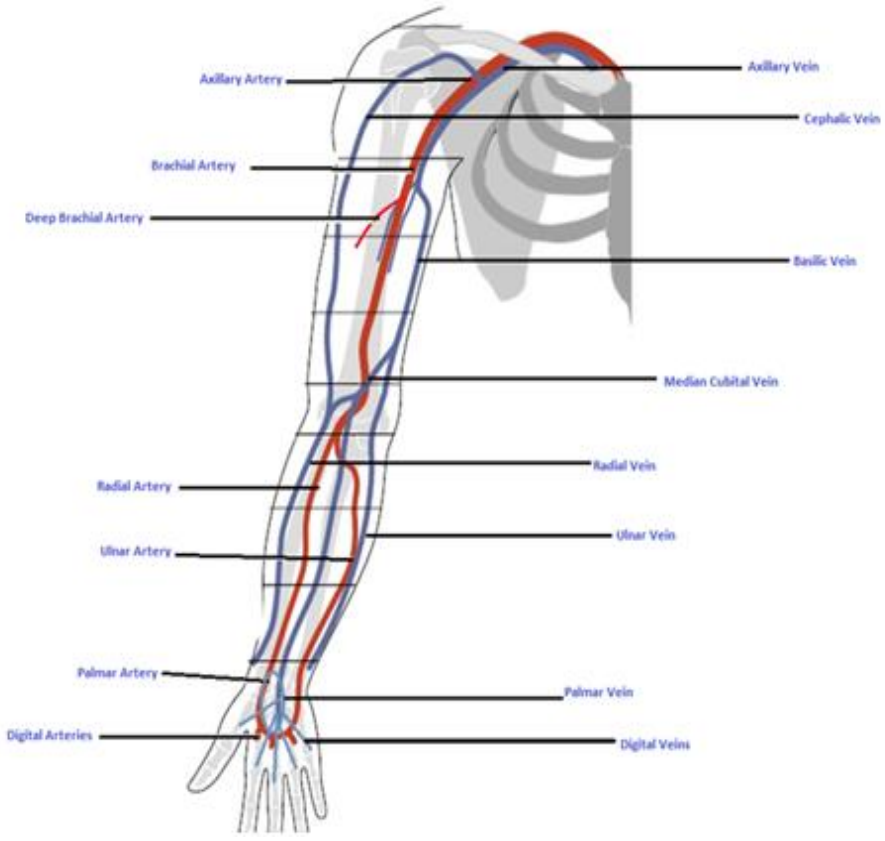
References

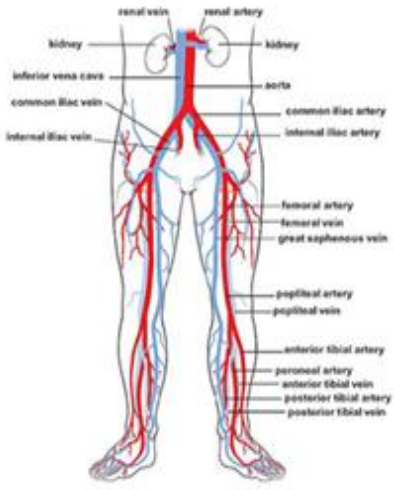
Note: Learning points may involve a small amount of self directed learning and may not always be answered by the text..

Why is vascular access so important?

- Without good Vascular Access, patients are not able to dialyse adequately. Some patients are not suitable for transplant and this access will be their ultimate lifeline. Few patients get to transplantation without needing dialysis. We therefore need good access to keep our patients as healthy as possible so that they are in the best shape for transplantation.
- Nurses are in a unique position to conduct a full comprehensive physical examination of a patients' vascular access.
- Early detection of any changes in performance allows for interventions that prevent the loss of access, reduce CVC placement, decrease sepsis risk and prevent central vein stenosis. (Sousa *et al,* 2014)
- Haemodialysis nurses have been shown to be able to detect 80% of access issues from physical examination alone. (Robbin *et al,* 2002)

Anatomy and Physiology





Anatomy of veins and arteries

- Arteries carry blood away from the heart, diverging into arterioles and capillaries. Capillaries allow nutrients waste and oxygen to be exchanged at a cellular level. Veins then bring blood back to the heart.
- The structure of the different types of blood vessels reflects their function or layers. There are three distinct layers, or tunics, that form the walls of blood vessels. The inner, tunica intima is a smooth, inner lining of endothelial cells that are in contact with the red blood cells. This tunic is continuous with the endocardium of the heart. Unlike veins and arteries, capillaries have only one tunic; this single layer of cells is the location of diffusion of oxygen and carbon dioxide between the endothelial cells and red blood cells. Veins contain valves that help blood flow back to the heart. Veins do not need to keep blood flowing at high pressures so they have much thinner walls than arteries.

Physiology of Circulation

- The systemic circulatory system circulates oxygenated blood from the heart around the body into the tissues before it is returned to the heart.
- The arteries divide into thin vessels called arterioles, which in turn divide into smaller capillaries that form a network between the cells of the body. The capillaries then join up again to make veins that return the blood to the heart.
- The flow of blood along arteries, arterioles and capillaries is not constant but can be controlled depending upon the body's requirements.
- Vascular resistance generated by the blood vessels must be overcome by blood pressure generated in the heart to allow blood to flow through the circulatory system.

"Three key factors influence blood circulation.

Resistance

Resistance to flow must be overcome to push blood through the circulatory system. If resistance increases, either pressure must increase to maintain flow, or flow rate must reduce to maintain pressure. Numerous factors can alter resistance, but the three most important are vessel length, vessel radius, and blood viscosity. With increasing length, increasing viscosity, and decreasing radius, resistance is increased. The arterioles and capillary networks are the main regions of the circulatory system that generate resistance, due the small calibre of their lumen. Arterioles in particular are able to rapidly alter resistance by altering their radius through vasodilation or vasoconstriction.

The resistance offered by peripheral circulation is known as systemic vascular resistance (SVR), while the resistance offered by the vasculature of the lungs is known as pulmonary vascular resistance (PVR).

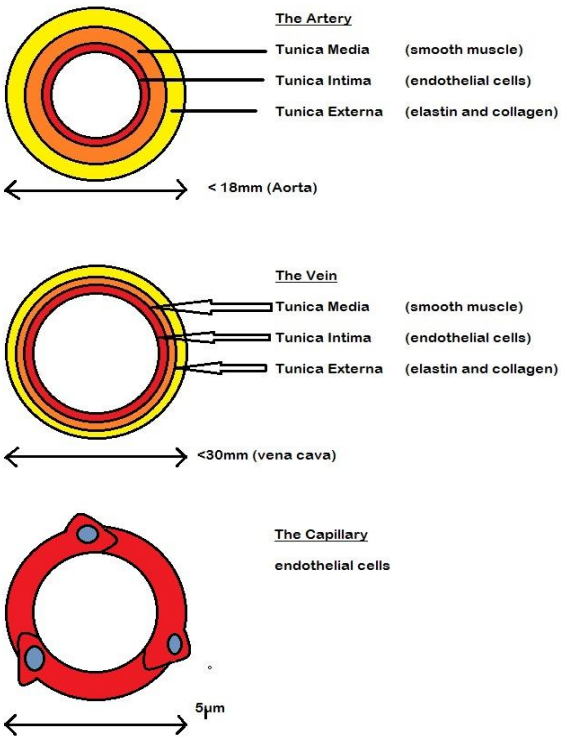
Blood Pressure

Blood pressure is the pressure that blood exerts on the wall of the blood vessels. The pressure originates in the contraction of the heart, which forces blood out of the heart and into the blood vessels. If flow is impaired through increased resistance then blood pressure must increase, so blood pressure is often used as a test for circulatory health. Blood pressure can be modulated through altering cardiac activity, vasoconstriction, or vasodilation.

Blood Flow

Flow is the movement of the blood around the circulatory system. A relatively constant flow is required by the body's tissues, so pressure and resistance are altered to maintain this consistency. A too-high flow can damage blood vessels and tissue, while flow that's too low means tissues served by the blood vessel may not receive sufficient oxygen to function."

https://courses.lumenlearning.com/boundless-ap/chapter/physiology-of-circulation/



Learning Point:

1/. Describe the main differences between veins and arteries.

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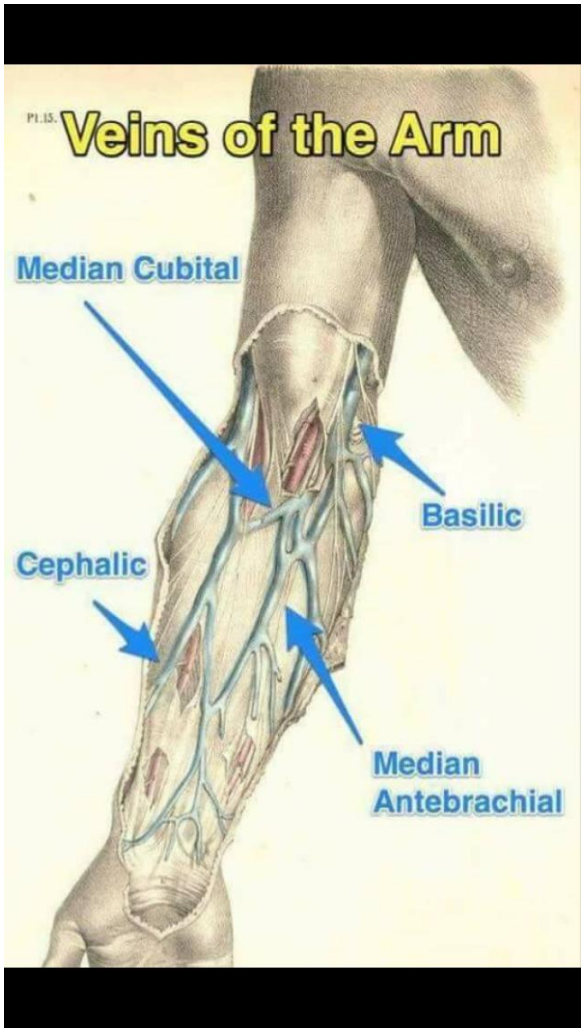
Personal notes for reflective practice:



Vascular Structures Used for Central Venous Access

BASILIC VEIN

The **basilic vein** is larger than the cephalic. It passes upward in a smooth path along the inner side of the biceps muscle and terminates in the axillary vein along with the brachial vein.

MEDIAN CUBITAL VEIN

Distally from the basilic vein is the median cubital vein, located at the site of the antecubital space.

BRACHIAL VEIN

The *brachial vein* merges with the basilic vein and becomes the axillary vein.

CEPHALIC VEIN

The **cephalic vein** ascends along the outer border of the biceps muscle to the upper third of the arm. It passes in the space between the pectoralis major and deltoid muscles. It terminates in the axillary vein, with a descending curve, just below the clavicle. The cephalic vein is occasionally connected with the external jugular or subclavian vein by a branch that passes from it upward in front of the clavicle.

AXILLARY VEIN

The *axillary vein* starts upward as a continuation of the basilic vein, increasing in size as it ascends. It receives the cephalic vein and terminates immediately beneath the clavicle, at the outer border of the first rib, at which point it becomes the subclavian vein.

SUBCLAVIAN VEIN

The **subclavian vein**, a continuation of the axillary vein, extends from the outer edge of the first rib to the inner end of the clavicle, where it unites with the internal jugular to form the brachiocephalic vein. Valves are present in the venous system until approximately 1 inch before the formation of the brachiocephalic vein.

EXTERNAL JUGULAR VEIN

The **external jugular vein** is easily recognized on the side of the neck. It follows a descending inward path to join the subclavian vein above the middle of the clavicle.

INTERNAL JUGULAR VEIN

The *internal jugular vein* descends first behind and then to the outer side of the internal and common carotid arteries. The carotid plexus is situated on the outer side of the internal carotid artery. The internal jugular vein joins the subclavian vein at the root of the neck. At the angle of junction, the left subclavian receives the thoracic duct, whereas the right subclavian receives the right lymphatic duct.

Vascular Access in NHS GG&C

- ❖ Arteriovenous Fistula (AVF)
  - Radio-cephalic
  - Brachio-cephalic
  - Brachio-basillic
- ❖ Arteriovenous Graft (AVG)
  - PTFE
  - Acuseal (early cannulation)
  - HeRO
- ❖ Tunnelled Central Venous Catheter
- ❖ Non Tunnelled Central Venous Catheter

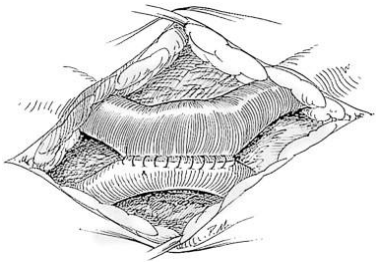
Arteriovenous Fistula (AVF)

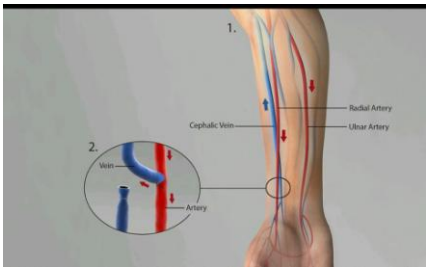
The 'gold standard' access for haemodialysis is an arteriovenous fistula (AVF). They are:

- Most commonly surgically created in the upper limbs but can be created in the legs.
- Last longer than other forms of vascular access.
- Have lower infection rates than other forms of access.
- Have the least morbidity and mortality rates of any form of access.
- Work more reliably than other forms of access.
- Have greater rates of patency.
- Are cost effective over time. (Mahon *et al,* 2013)

So, what is an arteriovenous AVF?

- A connection between a native vein and an artery.
- Usually placed in the non dominant arm.





Learning Point

What type of fistula would you expect to be placed here?

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What type of fistula would you expect to be placed here?

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What type of fistula would you expect to be placed here?

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What type of AVF would you expect to be placed here?

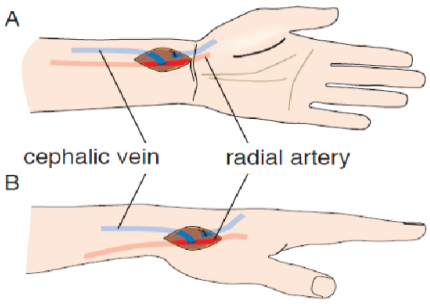
_____

What type of AVF would you expect to be placed here?

_____

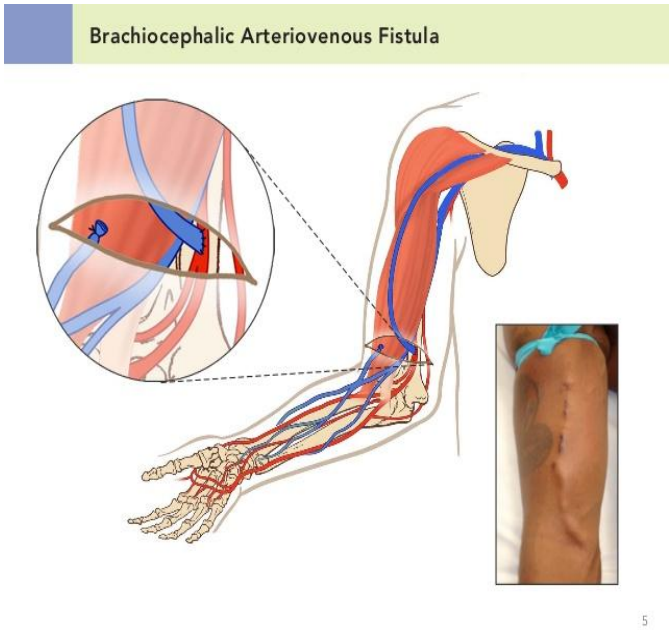
Radio-cephalic AVF

- Most common and straightforward AVF.
- Usually the first choice for AVF creation.
- However, a considerable number fail (approx 40%, Currie and Dunleavy, 2008) particularly in the elderly and those with vascular disease.
- Mid forearm and proximal radio cephalic AVF are often cannulatable in the cephalic vein above the elbow.



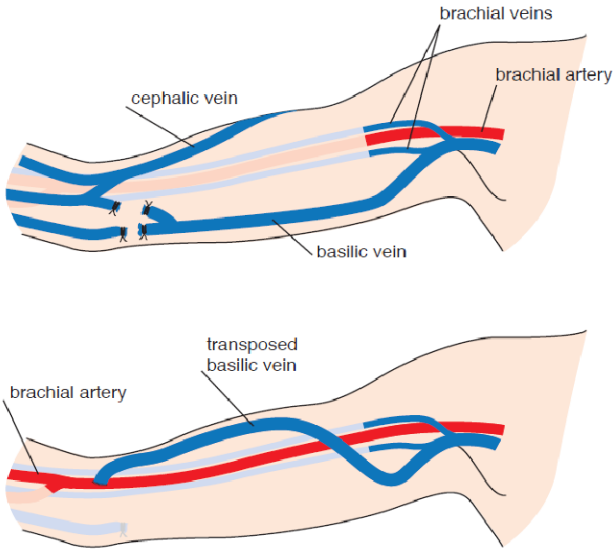
Brachio-cephalic AVF

- Formed at the front of the elbow by connecting the cephalic vein and the brachial artery at the elbow. The cephalic vein is found towards the outside of the upper arm.
- Have around a 90% success rate compared to Radiocephalic AVF (Currie and Dunleavy, 2008)



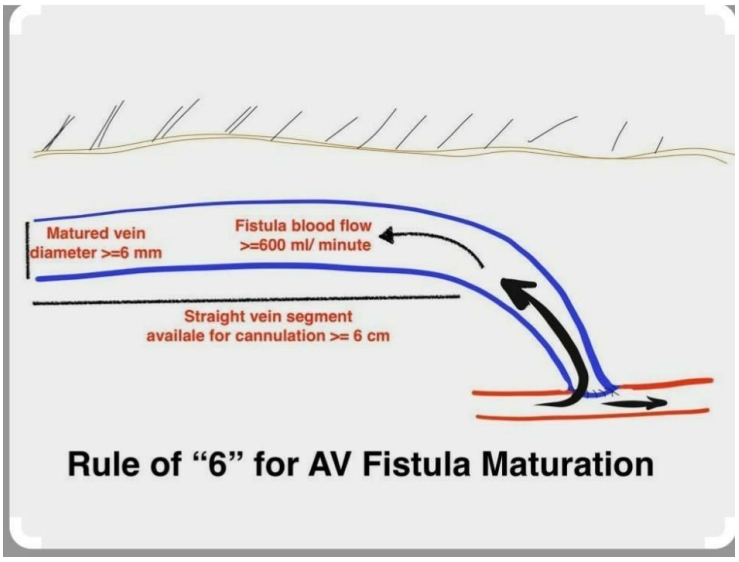
Brachio-basillic AVF

- The basilic vein and the brachial artery are joined at the inside of the elbow. The basilic vein is found on the inside of the upper arm but it is also quite deeply placed and so it needs to be transposed (moved) to a more superficial position. This involves extra incisions along the inside of the upper arm and the vein is then tunnelled in the subcutaneous tissues to enable easier access. The operation is often done in 2 stages and is only transposed after it is clear the basilic vein has matured to a cannulatable diameter.
- Distinguishable by the scar under the arm. The basilic vein does run all the way up the arm but it may be more challenging or uncomfortable in position to cannulate.
- Once a Brachiobasillic fistula has been formed it is more difficult to form a brachiocephalic fistula and so surgeons will usually attempt to create a brachiocephalic fistula first if possible. Fortunately, if the brachiocephalic fistula fails it is still possible to create a Brachiobasillic fistula.



AVF Maturity

- NKF-KDOQI 6-8 weeks for maturity…however this is too late to assess early failure and we will assess AVF at 4weeks. RDU staff should check the AVF at each session for changes in bruit strength or failure. AVF can be used as early as two weeks if they have been assessed as clinically mature by the vascular access team.
- A fistlua can be classed as mature when it can be repeatedly cannulated without blowing.
- First 2 weeks, oedema and swelling is normal. Bruit should be heard and thrill should be felt.
- The NKF-KDOQI rule of 6s is generaaly applied to ensure a fistula is mature for first use.



Exercise to aid maturation

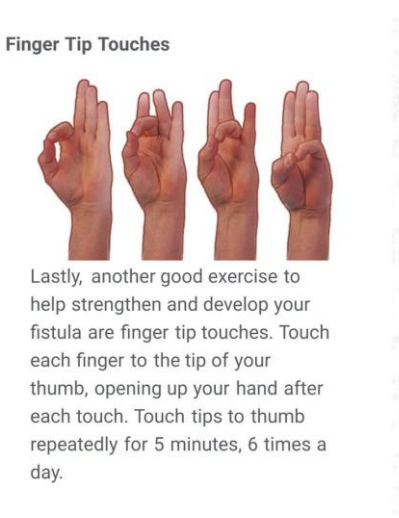
Arm excersies have been shown to have a positive impact on AVF maturation. All patients are given squeezy ball or stress ball at the time of fistula creation that they are taught how to use to help the fistula mature:

These excercises are recommended:

1/. Take the ball in the palm of your hand. Have your arm down at your side.

2/. Squeeze, hold and release.

3/. To be done at least 10-15mins 3X per day. However patients cannot do it too often!



Finger tip touch using a clothes peg can also be done if further input is needed

AVF Assessment

The Look, Listen, Feel, Drain and Pain is an easy, simple and quick assessment of your patients' access that if carried out at each session, we as dialysis nurses will soon know our patients access and will then be able to recognise any changes quickly, allowing us to refer to the appropriate person/department to begin further management needed to maintain access patency.

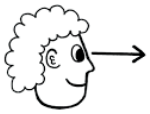
We will have the correct information need to make appropriate referral

If we do this every session it will soon be seen as the normal and we will realise how little time it takes to do, but the benefits it reaps are well worth the effort in the longevity of our patients' access

<u>BE SYSTEMATIC</u>:

To be done before every dialysis session.
Good assessment prevents problems and extends access life.

Look



Look at the access and the arm to assess for aneurysms, bruises, skin problems including compromization, pseudo aneurysms, infection and steal.

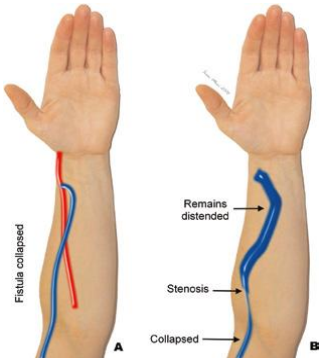
Listen

Listen to the bruit along the full length.
Low pitched with systolic & diastolic components = good.
High pitched with systolic components = stenosis.

Feel

Examine the body of the fistula to determine usability.
Feel for pulse augmentation, thrill, distal oedema and Steal.

Drain



Pain

Patients with good working AVF do not experience pain.

The following pages contain the pre-needling assesment documentation that is recommended for use by the BRS/ VASBI National Clinical Practice for Needling of Arteriovenous Fistula and Grafts.

Signs and symptoms	Score	Actions
○ No scabs larger than the needle sites ○ No pain or new swelling ○ No necrosed areas ○ No aneurysms ○ No erythema ○ Normal bruit / thrill ○ No hardness over AVF/AVG	0	No action required Safe to needle
❖ No pain or new swelling ❖ No necrosed areas ❖ No scabs larger than the needle sites ❖ No erythema ❖ Normal bruit / thrill ❖ No hardness over AVF/AVG ❖ Aneurysms present and stable ○ Not increasing in size ○ Skin not shiny or thin over aneurysms	1	Monitor Consider photograph AVF/AVG for reference Document aneurysm size, by measuring arm diameter at aneurysm and position Safe to cannulate
• No necrosed areas • No scabs larger than needle sites anywhere on fistula Any of the following ○ Pain or discomfort to any area on the AVF/AVG ○ Aneurysms increasing in size or pulsating ○ New aneurysms ○ Thin and shiny skin around AVF ○ Whistling bruit on auscultation ○ Non cannulation segments hard on palpation ○ Bleeding around needle site during dialysis ○ Extended post dialysis bleeding >20minutes ○ Erythema>3mm anywhere on the fistula	2	Refer to Vascular Access Team Previous actions <u>and</u> Patient information given on actions and escalation if fistula bleeds at home Review individual's antiplatelet and anticoagulation prescription Consider swabbing erythema Lift arm above head, to assess whether aneurysms drain
Any of previous signs <u>with</u> any of the following: ❖ Pain/ swelling to AVF/AVG ❖ Necrosed area on AVF/AVG ❖ Patient reports sites bleed at home ❖ Scabs at needle sites or elsewhere >3mm ❖ Absent or changed thrill on palpation ❖ Absent bruit on auscultation ❖ Cannulation segments hard on palpation ❖ Oozing (pus) from red/inflamed areas ❖ Erythema increased in size	3	Do not needle Urgently refer to Renal / Vascular Team Keep patient in department Previous actions <u>and</u> Swab pus / erythema Take blood cultures if erythema or pus present Take U&Es

Please complete before each cannulation.Document any abnormal findings with action taken, in detail in the normal nursing documentation.

Date	**AVF Score** **(0-3)**	**Aneurysm** Present – Y/N	**Bruit** Normal (N) / Abnormal (A) / Absent (NIL)	**Thrill** Normal (N) / Abnormal (A) / Absent (NIL)	**Feel** Soft (S) / Hard (H)	**Safe to Use** Y / N	**Initials**

Post Dialysis Information

Did Venous pressure stay with acceptable limits during treatment (Y/N) comments	Did arterial pressures stay within acceptable limits during treatment (Y/N) Comments

Learning Point:

1/. Haemodialysis nurses are able to detect AVF/AVG issues from a simple physical examination before cannulation.

True / False

2/. New AVF are generally soft as they are still arterializing.

True / False

3/. A Look, listen, feel, drain and fill physical examination should be done:

A) Once a week

B) Only if problems are suspected or anticipated

C) Before every cannulation

D) Done with monthly bloods

4/. If properly assessed, a clotted AVF/AVG should never be cannulated.

True / False

5/. Dialysis access issues should all be recorded in the appropriate place.

True / False

6/. The normal bruit is high pitched and discontinuous.

True / False

7/. The bruit should gradually diminish/fade/become quieter as you move away from anastomosis with no sudden interruption of the sound.

True / False

8/. The normal bruit is a continuous, soft low pitched whooshing sound.

True / False

9/. Oedema, skin discolouration, pulsatile and tense vessel, non draining vessel when arm raised, collateral veins appearing is a sign of possible central or outflow vein stenosis.

True / False

10/. What indicates that a fistula is mature enough for cannulation?

_____
_____
_____

11/. Name 4 qualities of a good cannulation site.

_____
_____
_____

12/. What other structures in the arm could you unintentionally damage during AV cannulation?

_____
_____

13/. Describe what a stenosis would sound like through a stethoscope.

_____
_____

Personal notes for reflective practice:

Preparation and Equipment

As well as preparing the patient for needling, there are aspects of the procedure that require consideration before starting to needle:

Patient personal and hand hygiene is crucial in helping prevent infection.

- Patients should always wash their fistula arm before dialysis at the unit.

Staff hygiene is equally important.

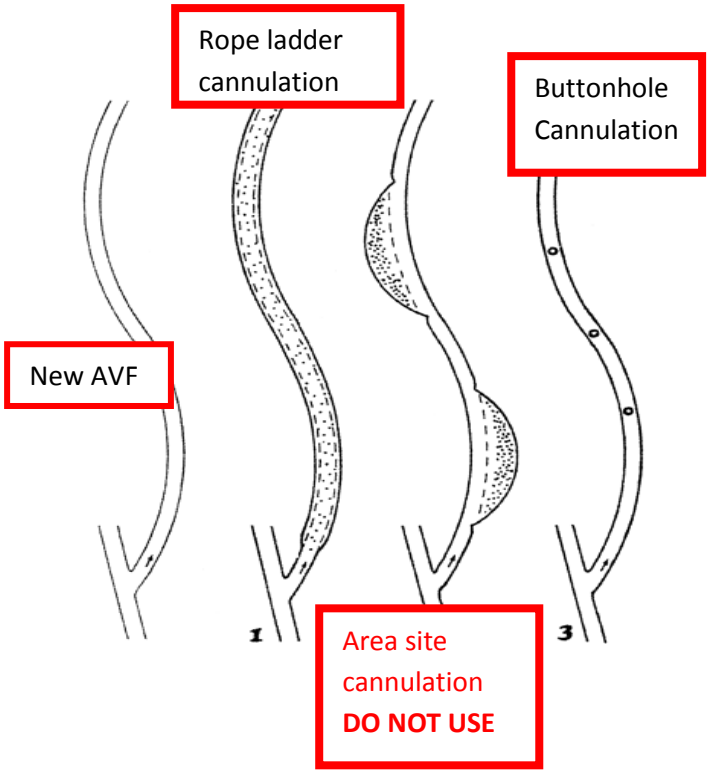
- Always follow your hospital protocol exactly as well and the hand hygiene guidelines produced by your infection control team.

Check that you have all the equipment ready at the bedside before starting cannulation.

After assessing your arm, the correct skin preparation is essential. Skin should be cleaned with 2% Chlorhexidine Gluconate with 70% isopropyl alcohol. This can come in the form of Chloraprep Frepp lolipops or Frepp rectangular sponges. It is important to ensure the correct drying time as it is the drying time that steriles the skin. The solution a minimum of 30 seconds to dry on the skin. The area will then be sterile for 48 hours.

The BRS/ VASBI National Clinical Practice Recommendations for Needling of Arterio-venous Fistulae and Grafts for Haemodialysis were published in September 2018. They recommend that Povidone Iodine solutions or Octenidine Dihydrocholride should be used for patients who have allergie to Chlorhexidine. Manufactures guidelines should be followed when using these solutions.

Cannulation



Your rope ladder technique must be clearly documented on the dialysis book so that the next cannulators are aware of what you were doing.

National Clinical Practice Recommendations for Needling of Arterio-venous Fistulae and Grafts for Haemodialysis were published in September 2018. These can be accessed from the following link:

https://britishrenal.org/news/brs-vasbi-needling-recommendations/

Rope Ladder Technique (Preferred Technique)

- Tourniquets should be used.
- Cannulate the full length of the fistula.
- Avoid 2cm from the anastomosis.
- Each cannulation point should be at least 1cm (one fingers width) away from the previous cannulation mark.
- Arterial needle can be ↓or ↑. But evidence shows that ↑ is more fistula protective and associated with better AVF outcomes.
- Venous needle must always be ↑in line with the blood flow.

- Bevel up (black dot up) cannulation is also associated with better patient outcomes.
- DO NOT turn your needles as this reduces the risk of damage to the tunica intima. Subsequently preventing any extravasion into tissue/ pseudoaneurysm formation, immune response or site for clot adhesion.
- Needles must be removed at the same angle as insertion.

Buttonhole Cannulation

- Appropriate for self cannulating patients, home haemodialysis patients or those patients who only have short cannulatable lengths.
- Strict guidelines must be adhered to. New BRS guidelines (2016) are 34 pages long.
- In short:
  - 1 member of staff ONLY to create buttonhole with sharp needles.
  - Sharp needles for 12 cannulations. If blunt cannot be used after 12 cannulations, assess suitability for buttonhole.
  - Avoid dips, curves, skin abnormalities and aneurysms.
  - 3-4 active sites are acceptable.
  - Scabs should be removed with dull blunt tweezers
  - Cannulate by holding the tube rather than the needle wings.
  - On insertion 1-2mm of the needle should be visible to avoid hubbing.
  - If a second blunt needle cannot be inserted, a second needle site can be inserted 2cm below the buttonhole site.
  - DO NOT rotate your needle.

Learning Point:

1/. When using Rope ladder technique the distance between needle sites along the arm should be:

a) 0.15 to 0.3 cm

b) 0.8 to 1 cm

c) Greater than 2cm

2/. In preparing the fistula arm, the drying time is not as important as the cleaning time.

True / False

3/. Buttonhole needles have a sharper point for easier insertion.

True / False

4/. Fistula needles can be turned when inserted.

True / False

5/. 'Zip' Rope ladder involves progressing centrally along the vein rather than side to side.

True / False.

6/. When removing each fistula needle, pressure should be applied for:

A) 5 minutes

B) 10 minutes

C) 15 minutes

D) 3 minutes

7/. Can the direction of your arterial needle be protective towards the fistula.

True / False.

8/. Can you explain why the angle of needling is so important?

_____
_____
_____
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9/. How do you know the needle is in the correct position?

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10/. If you have needled straight through a fistula, what should you do next and what might the impact be to the patient?

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Problematic AVF

- Please refer any concerns you have with an AVF to the Vascular Access Nurses.

Concerns may be

- **Bleeding** – Spontaneous bleeding while not on dialysis or prolonged (greater than 10 minutes) bleeding after needles are removed. Always ensure patients know what to do in the event of a bleed. They CANNOT be told too many times.

The BRS/ VASBI recommendation for Life Threatening Bleeds were published in 2018.

Recommendations for Managing Life-Threatening Bleeds from AV Fistulae / Grafts

Due to several reported incidents of life-threatening bleeds (LTB) from arteriovenous fistulae (AVF) and grafts (AVG), the British Renal Society Vascular Access Special Interest Group (BRS SIG) and the Vascular Access Society of Britain and Ireland (VASBI) have compiled the following recommendations:

This work is related to LTB that do not resolve with 'normal' pressure applied to the bleeding site. These recommendations are not related to minor bleeds from cannulation sites or venous needle dislodgement. LTB can develop from cannulation sites or other areas on the AVF / AVG and can become rapidly life threatening due to the volume of blood lost. It is a traumatic incident for patients, their family, friends and renal unit staff alike.

The main aims are to prevent LTB and manage it effectively when it occurs, so that it does not result in catastrophic harm to patients. It is important that patients, carers and frontline

health care professionals are aware of the appropriate actions in the event of an unexpected bleed. Whilst this is a rare event, instigating the correct action promptly is critical to ensure it does not result in loss of life. Due to the rarity of this event, with the majority of people with an AVF or AVG experiencing a life-threatening bleed, any information and recommended actions should be short, succinct and easy to remember over long periods of time.

Prevention

Prevention of LTB from AVFs / AVGs is of the utmost importance.

- Avoid area puncture cannulation of AVFs / AVGs.
- **Be aware of warning signs of an increased risk of a LTB from an AVF / AVG:**

Any non-healing scab / wound over the AVF / AVG	Prolonged bleeding post haemodialysis or bleeding in between dialysis sessions
Aneurysms that are increasing in size, either at cannulation sites or elsewhere	Shiny, thin skin over the AVF / AVG, particularly over aneurysms
Signs of infection – redness, swelling, pain, discharge or pus	Other skin integrity issues in the vicinity of the AVF / AVG

- Ensure you have clear and rapid referral pathways for patients with any warning signs of a potential LTB from their AVF / AVG.
- Patients, carers and haemodialysis staff should be aware of the warning signs of LTB, so that changes to an AVF or AVG are detected and addressed promptly.
- All haemodialysis staff, patients and carers should be aware of the need to report these warning signs as a matter of urgency.
- Photographs can be used to monitor changes.

Management

- Patients, carers, transport staff and emergency care staff should be educated about the action to take in the event of a LTB from an AVF / AVG.
- **Patients should dial 999 immediately** for any bleeding which soaks through a dressing despite direct pressure.
    - The priority for patients in this situation is to get help
    - This should **not** be delayed whilst trying to stop the bleeding, as loss of consciousness can occur quickly in a LTB
    - The priority is to stop the bleeding, not preserve AVF or AVG function.
- Once help from the emergency services has been initiated, patients should continue to apply direct pressure to the bleed.
- All patients experiencing a spontaneous bleed from their AVF/AVG or felt at immediate risk of a bleed should be seen urgently by a surgeon who specialises in vascular access before they leave hospital

Do's and Don'ts

- If easily available, **a small, flat, rigid object (e.g. large bottle top) can be used to apply pressure** over the bleeding site. This ensures pressure is localised to the area of the bleed.
- Patients should be advised **not to use a large absorbent item**, such as a towel, as this disperses pressure reducing its effectiveness.
- **We do not recommend** the supply of tourniquets to patients to manage LTB but haemorrhage dressings such as Olas dressing can be effective.

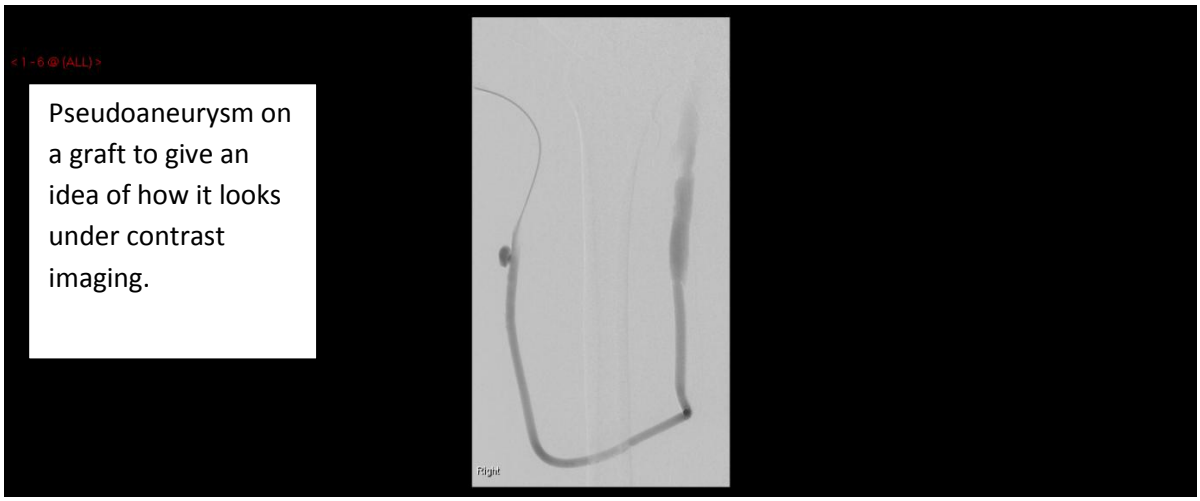
We recommend units locally record / audit the following:

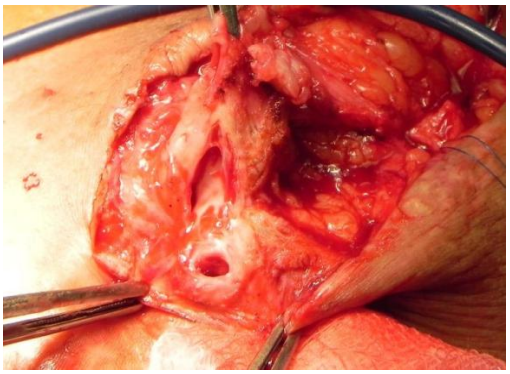
- The number of incidents of mortality related to LTB from AVF / AVG
- The number of LTB from AVF / AVG that do not result in mortality
- The number of AVF / AVG that display warning signs of LTB and are referred due to these signs for further assessment.

This data should be reviewed locally and can help units identify trends in occurrence, aiding detection of potential LTB of AVF / AVG earlier.

- **Aneurysms** – tight, pulsatile, compromised skin, high pressures on haemodialysis. Aneurysms are not normal and should not be considered as a normal AVF. Nurses need to stop viewing an aneurysmal fistula as a normal fistula. Once an AVF has an aneurysm, surgical removal is the only way to get rid of it. Dialysis nurses must change their practice to damage limitation to keep an aneurysmal AVF running as long as possible. Area cannulation is not acceptable practice.

- **Pseudo- aneurysms** – need urgent attention.

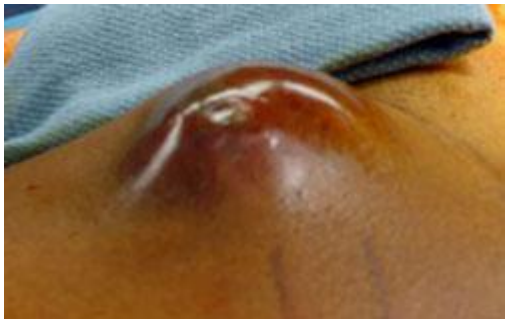




This photograph shows a pseudo-aneurysm on a fistula. This is its surgical repair, you can clearly see the hole it has left is the vein.

- **Haematoma** – most clots in needles come from cannulating through a bruise aka haematoma. Haematoma can become hard in the surrounding tissues and can take weeks to fully disperse.

- **Infection**



Swab, check bloods (U&Es FBC CRP) and refer to medics.

- **Scabs**

Please notice the cannulation mark on the right hand side and then compare its size to the scab. Can anyone guess how big the hole under the scab is? Encourage patients not to pick at scabs and not to scratch fistula or surrounding skin as this can result in a life threatening bleed.

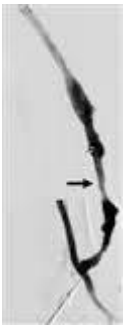
- **Steal**

Cold, blue hands with pins and needles that don't resolve. Can be worse on haemodialysis. Observe for ischaemic changes at finger tips. True Steal syndrome is rare.

Steal occurs when too much arterial blood is diverted into the venous system. It is more prone to happen in upper arm fistulas than in RCF. PVD and diabetic neuropathic changes can often be mistaken for Steal syndrome so both hands need to be examined together. You can test for steal by momentarily occluding the fistula thus allowing more arterial blood to flow to the extremities. Does the hand pink up and capillary refill times improve? Ultimately a USS is needed to confirm steal syndrome prior to surgical intervention.

- **Stenosis**

A narrow area on AVF can be the cause of aneurysms. This can cause other issues including high recirculation of blood and sub optimal clearances.



Recirculation can be investigated using the function on the Fresenius 5008 dialysis machines. This gives a rough estimate. True values can be achieved by following the protocol that is found on SERPR:

Perform test after approximately 30 minutes of treatment and after turning off ultra filtration.

1. Draw arterial (A) and venous (V) line samples.
2. Immediately reduce blood flow rate (BFR) to 120 mL/min.
3. Turn blood pump off exactly 10 seconds after reducing BFR.
4. Clamp arterial line immediately above sampling port.
5. Draw systemic arterial sample (S) from arterial line port.
6. Unclamp line and resume dialysis.
7. Measure BUN in A, V, and S samples and calculate percent recirculation (R).
8. Labelling

In TRAKCARE
In processing note section for each blood bottle type in-
Recirculation Bloods and put whether sample is A, V or S on bottle

Recirculation Formula:
$R = ((S-A)/(S-V)) \times 100$

Learning Point:

1/. List 3 common problems that can occur with AVF:

_____
_____
_____

2/. A high pitched bruit in a normal bruit.

True / False

3/. A stenosis can be a cause of an aneurysm.

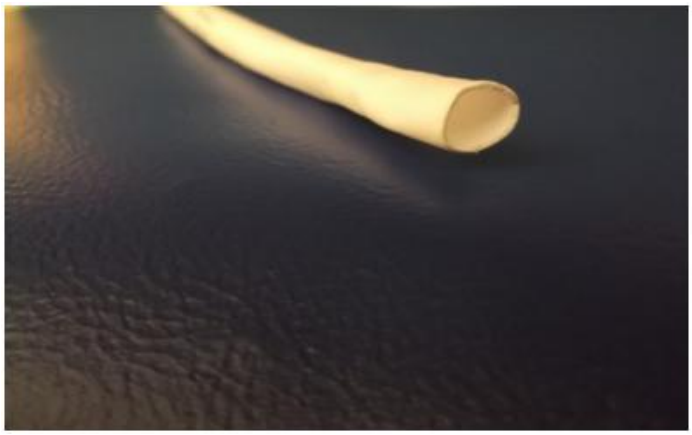
True / False

Personal notes for reflective practice

Arterio-venous grafts

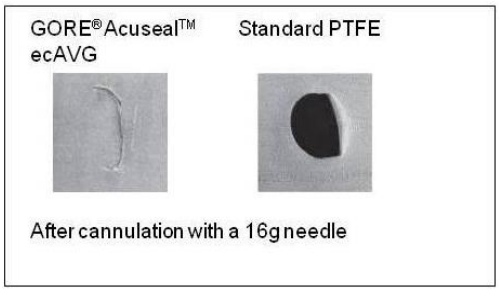
PTFE

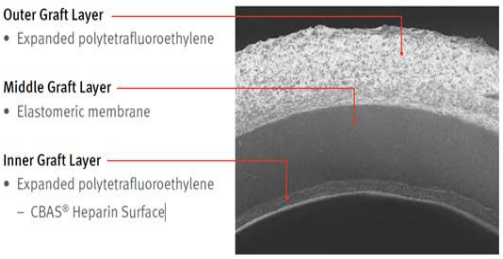
- Single layer
- Basic graft that has been used for many years
- Cannot be cannulated for 2-3 weeks after creation.



Early Cannulation Acuseal AVG

- The GORE® AcusealTM ecAVG. A tri-layer graft with unique sealing properties that allows for **cannulation with 24hrs of implantation**.
- Reduced infection risk - around 7x less likely when compared with a TCVC
- ecAVG may reduce the risk of developing central vein stenosis as TCVC are not being placed into central veins
- Reduces thrombosis
- Increases solute clearance (UKRA, 2011)
- May reduce pseudo-aneurysm risk
- TCVC avoidance





HeRO/ SuperHeRO

- These are used when people have developed central vein stenosis and can bypass the narrowed area. The majority of central vein stenosis is caused by TCVC use.
- A normal graft, either ecAVG or PTFE, is attached to the artery. The graft is then attached to the venous outflow component at the delta-pectoral groove via a titanium connector which is fed through the central vein system to sit in the mid to upper right atrium of the heart.
- It is the graft that is cannulated and the material determines when it can be cannulated.
- The titanium connector and venous component are placed in a position that you CANNOT cannulate.
- HeRO grafts may be formed from an Acuseal portion and a PTFE portion. Be aware of the diagram so that you cannulate the correct part of the graft at the correct time.

AVG Assessment and Cleaning Protocol

1/. Patient enters dialysis room and washes arm at sink before sitting down.

2/. Nurse hand hygiene protocols should be followed.

- **Look** entire length of limb including the nail bed. Where were the last cannulation points? Look at documentation – have there been any issues.
- **Listen** to the entire length of the graft noting changes in strength and pitch.
- **Feel** the entire length of the graft and note the blood flow direction. (Pulsates at the arterial end when momentarily occluded).

3/. Check you have all equipment ready at the patients side before commencing procedure

4/. Undertake a second hand wash.

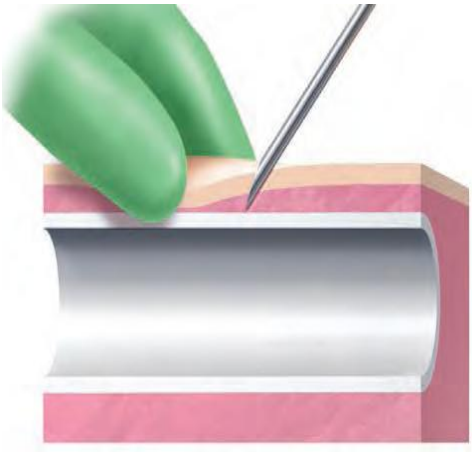
5/. Clean site using a 'lattice' pattern with 2% Chlorhexidine in 70% isopropyl alcohol for 30 seconds and allow drying. 1.5ml Frepp applicators or lollipops should be used. Allow to dry for the correct amount of time.

6/. Cannulate and secure with H tape technique. Assess need for VND monitor.

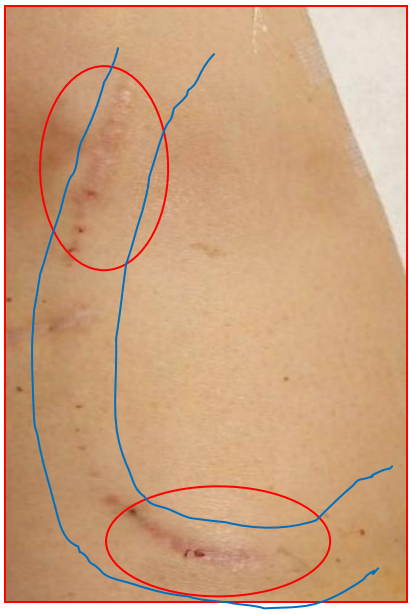
AVG Cannulation

- 312 cannulation minimum each year.
- No tourniquet. 45 degree (creates a flap), bevel up, don't turn.
- At least 2.5cm apart.
- Avoid 3cm from the anastomosis and avoid previous needle sites.
- Use the full length of the graft with Rope ladder technique. Graft should not be area site cannulated not buttonhole cannulated.
- Remove the same way as insertion.
- 17g needles for the first two weeks.

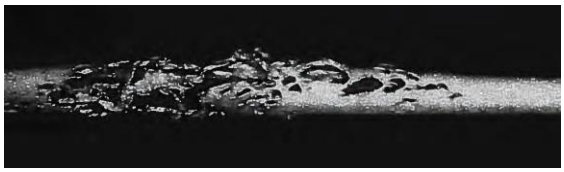
Thereafter the lowest needle size and BF the gives the best URR. 15g needles must only be used if prescribed by Nephrologist and this must be documented on SERPR.



AVG Cannulation – Rope Ladder ONLY



This photograph shows area of over cannulation on a graft. You can clearly see the over cannulated area with a large section in between that is barely touched with just a few cannulation marks. The black and white image shows a shredded graft that has been over cannulated



- Rope ladder technique must be used to prevent shredding; document the way in which you Rope ladder.
- Use a fistula map to identify previous puncture sites.
- Let 2-3 weeks pass before cannulating within 1 cm of puncture site.
- Secure with H tape as per protocol.

AVG Bloods flows during HDx

Cannulations within the first two weeks post insertion:

- ❖ 200ml/min - 250ml/min Blood flow
- ❖ 17g needle
- ❖ Minimal Heparin

After the first fortnight, blood flows can be gradually increased but remember to keep the lowest possible blood flow and needle size for the best URR to reduce turbulence from the graft back into the vein.

Learning Point:

1/. All grafts are the same.

True / False

2/. Over cannulation of the same area will cause the graft to “shred”.

True / False

3/. High pump speeds are needed are needed to get adequate dialysis via an AVG.

True / False

4/. AVG is a ANTT for cannulation.

True / False

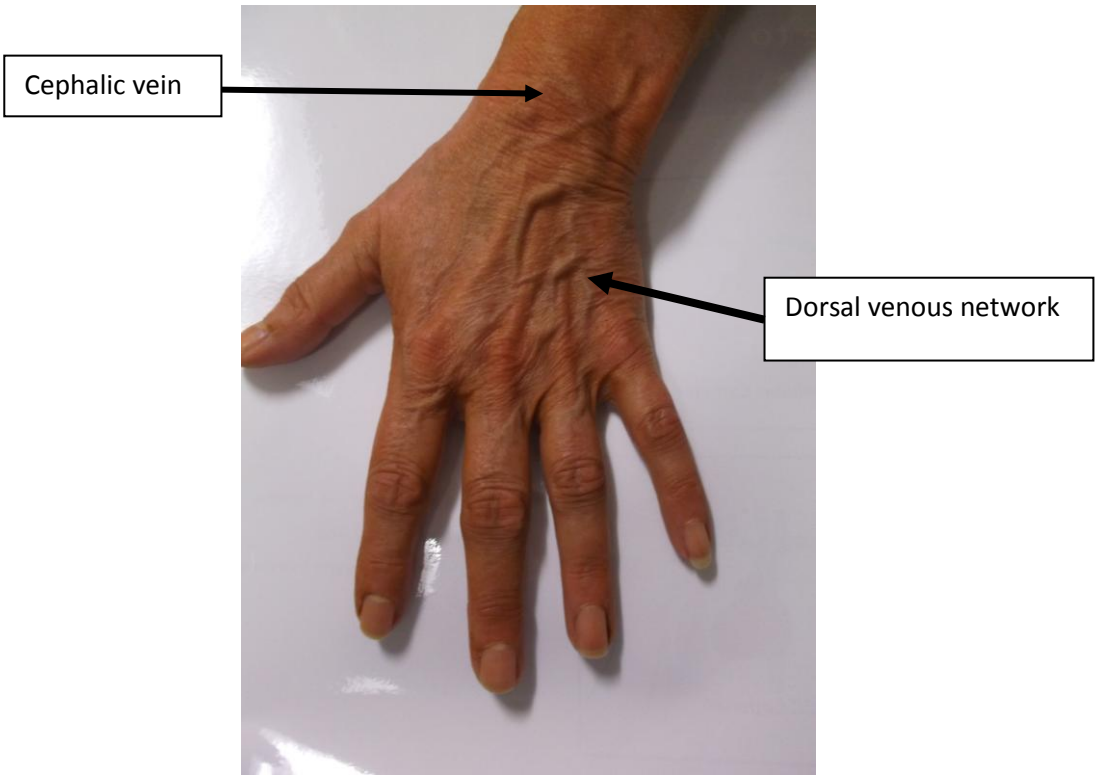
5/. Nurses do not need to listen to AVG priori to cannulation as this is d9one by the patient.

True/ False

Personal notes for reflective practice

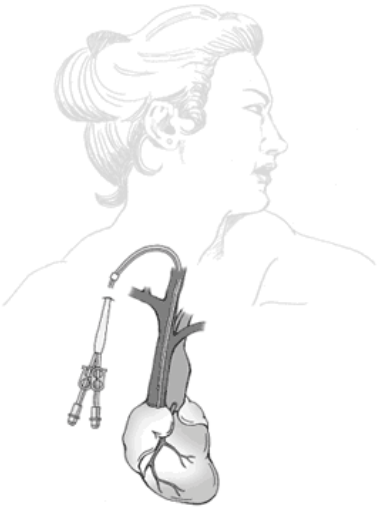
Preserving veins for the future

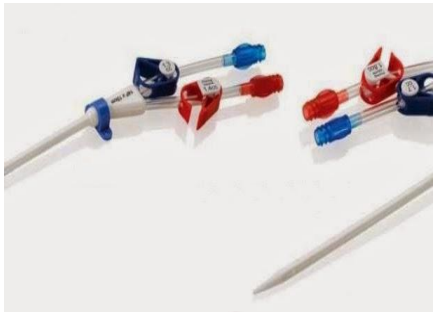
The majority of AVF will not see a patient through their time on dialysis – nor will a transplant see the majority of patients through their lives. It is therefore important from the pre-dialysis stage onwards that blood is taken only taken from the hand. This allows veins to be preserved for future AVF creation. It you have tried heating the hand without a good result, the next place to try should be the feet. Patients awaiting AVF creation should have one arm protected from taking bloods at any point and should have a red band that acts as an alert or reminder for staff.



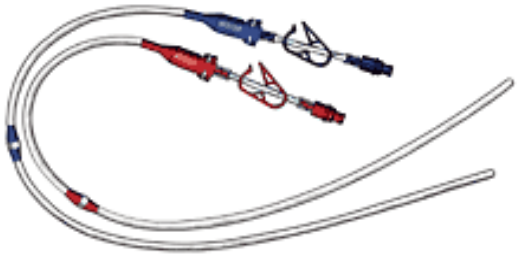
Tunnelled Central Venous Catheters

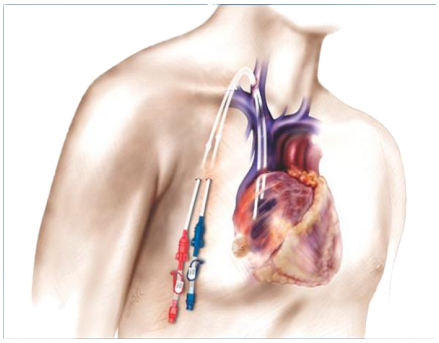
Ash Split – MedComp Catheter (Interventonal Radiology)





Tessio Lines (Nurse Led Service)





TCVC Insertion

TCVC insertions placed by both IR and NLS can be traumatic and does requires lines to be tunnelled under the skin.

IR TCVC – Ashsplit TCVC

IR do not routinely place new TCVC if they are suitable for NLS. They replace lines for poor flows, complex issues or if a femoral or trans lumbar TCVC insertion is requested.

Renal do not have a set IR list, appointments are set by the IR department after vetting by a consultant Interventional Radiologist.

Bloods required: U&E, FBC, Glucose, CO-AG

Patients must fast.

NLS Insertion (Tuesday QEUH) Tessio Lines

New TCVC insertions, Cuff exposures and removals. They do not exchange TCVC for poor flows. Tessio lines can sometimes take a couple of weeks to bed in as they are softer material and affected by swelling and trauma. This means that the initial flows may be reduced with higher venous pressures. This should settle. The NLS will also remove TCVC when they are no longer required. It is the same bloods and fasting procedure for both their insertions and their removals.

Bloods: U&E, FBC, Glucose, CO-AG

Do not fast for NLS procedures.

Platelets must be above 40. Platelets ↑40. PT, 16 or less, APPT 1.6 or less.

Exclusion Criteria:

Known venous stenosis, SVC obstruction or central venous stent in situ

Significant mediastinal disease

Recent myocardial infarction (within 2 days)

Pacemaker in situ

Current pneumothorax

Prophylactic Antibiotics for Tunnelled Central Venous Catheters (TCVC) Insertion

1. Insertion of a de-novo (i.e new puncture site) TCVC:

- No antibiotic prophylaxis is required.

2. Replacement of a TCVC over a guidewire:

- 400mg Teicoplainin IV to be given prior to insertion in the interventional radiology suite.

- (or 1g Vancomycin IV if Teicoplainin allergic).

The prophylactic antibiotic regime above will be prescribed and

administered in the interventional radiology suite.

Prophylactic antibiotic prescriptions outwith these criteria are at the discretion of the nephrology team, who are responsible for arranging its subsequent prescription and administration.

Post Insertion Care

First 24 - 48hrs

- Observe exit site and insertion site. Renew exit site dressing and place CHG IV dressing. Cleaning as per protocol on SERPR

First Week

- Leave dressing/ skin closure strips at insertion intact for 7 days. Then if wound has healed, it can be left exposed.
- Contact VAN for advice if this area has not closed and the skin edges have granulated.

First 6 Weeks

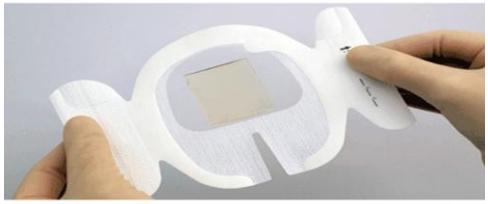
- Remove wing stitches on IR lines at 21 days. Remove suture at exit site at 6 weeks.

Be aware of the Dacron cuff position when removing dressing. **Pull the dressing upwards when removing** (as per VAD guidelines). The skin is slowly knitting into the cuff to provide stability and a barrier for infections of the TCVC.

Ongoing care needs – Dressing

First 6 weeks – CHG Dressing

- CHG dressing to be applied with TCVC exit site in the middle of the gel area in the clear window.
- Lines must hang through the slit area.
- Remove the section on the Left hand side and place under lines.
- Remove the strip on the Right hand side, write on the date of placement and place on the white area directly under the clear window.



Post 6 weeks until removal

Apply a sterile dressing, ensuring adherence to skin.

Document procedure in care plan/dialysis book.

Move clamps at each dialysis session to ensure on area on the tubing does not become nipped.

TCVC and exit site cleaning

Skin and TCVC tubes and hubs should be cleaned when dressings are changed using 2% Chlorhexidine Gluconate with 70% isopropyl alcohol – Chloraprep lollipops. This should be allowed to dry for the correct time before dressings are applied. Even TCVCs not in use should be cleaned and flushed. This should be documented in dialysis books. Clinell wipes should be used at the commencement and discontinuation of dialysis to sterilies hubs. Clinell wipes should also be used if the patient requires off the machine during dialysis. Catheter hubs should always be treated asceptically. Once disinfected, the cather hubs should not be allowed to touch non sterile surface. This is best performed by holding them holding them until the antiseptic dries. During this time the catheter must remian clamped

TCVC Care Bundles

The Institute for Healthcare Improvement (IHI) state "A bundle is a structured way of improving processes of care and patient outcomes. It is a small straightforward set of practices - generally three to five - that, when performed collectively, reliably and continuously, have been proven to improve patient outcomes."

TCVC care bundles have been incorporated into the dialysis books and should be accurately completed at every dialysis sessions. What you complete forms part of a legally binding document of care.

This is an image of the TCVC care bundle that is used in NHS GG&C. All trusts have a care bundle but they may be presented in a different form.

Learning Point:

1/. Ashsplit Med comp catheters have two separate exit points on the skin.

True / False.

2/. The Vascular Access Nurses Led service are able to exchange all lines that have poor flows.

True / False.

3/. To remove a dressing, it should be pulled downwards.

True / False

4/. How often are TCVC dressing changed.

a) 3 times a week.

b) Once a month.

c) Weekly

d) When they are dirty.

5/. List the dates when sutures have been removed:

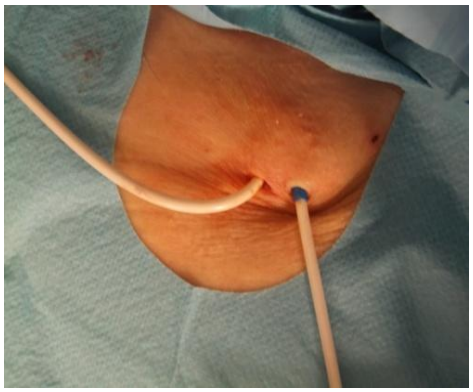
_____

_____

<u>TCVC Problems</u>

Cuff exposure/ dislodgement

A – Dacron cuff secure – no action required.



B - Cuff exposed. Action required. Contact VAN. Take a full set of bloods including a co-ag.

C- Cuff exposed. Immediate action required. Take bloods. Secure line for transfer/ or remove line in unit as per medics advice.

D- TCVC out. Remove as per medical advice..

Infection

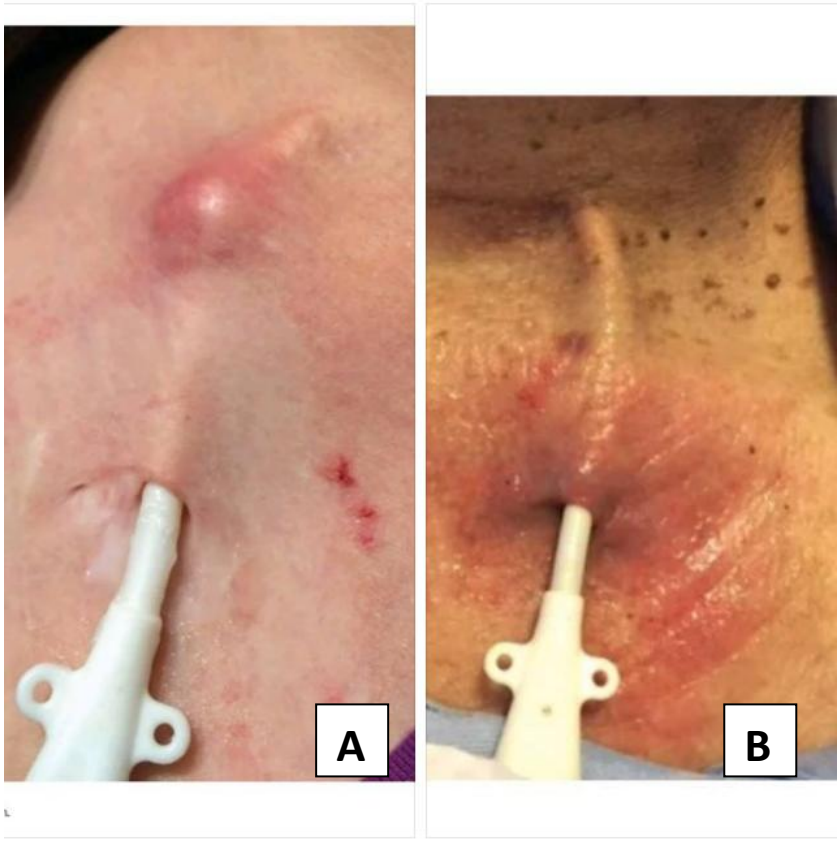
- Swab exit site (before cleaning)
- Check bloods
  - U&Es
  - FBC
  - CRP
  - Blood Cultures(both lumens. Protocol on SERPR)

Check observations.

Refer to on call medic.

Discontinue dialysis if rigoring.

Tunnel infection VS Exit-site infection



Learning Point:

Looking at the above image, which one would you be happy to dialyse and mange in an outpatient dialysis setting?

_____

- Swab exit site (before cleaning)
- Check bloods
  - U&Es
  - FBC
  - CRP
  - Blood Cultures(both lumens. Protocol on SERPR)

Check observations.

Refer to on call medic.

Discontinue dialysis if rigoring.

Poor Flows

Start with the simple checks:

- Check for clamps and kinks.
- Check hydration of patient.
- Check tinzaparin/ anti co-agulation needs.
- Cough
- Positional changes
- Reverse lines
- NaCl flush – push pause technique

If not improvement, follow the urokinase protocol. This protocol must be followewd before a TCVC exchange will be considered.

(Urokinase Protocol)

If the blood flow is less than 250ml/min within 2 weeks of catheter insertion or manipulation a CXR should be performed.

- Blood flow rate ↓150ml/min → Urokinase lock
- 25,000units urokinase in 5ml 0.9% sodium chloride (5,000u/ml). Slowly inject the stated volume down each lumen and leave in-situ for 20-30min. Aspirate the urokinase from each lumen and then commence dialysis.
- **Inadequate flow continue?**
- Mini Urokinase Infusion
- 25,000 units urokinase with 0.9% sodium chloride and add to 50ml 0.9% sodium chloride and infuse down each lumen over 30mins. Thereafter commence dialysis . If blood flow is 150-250ml/min for 15-20 mins after commencing HD, inter-dialytic infusion should be administered.
- Maxi Interdialytic Urokinase Infusion

- 125,000u in 0.9% sodium chloride and add to 0.9% sodium chloride to give a final volume of 24ml. Infuse 125,000 units into each lumen over 4-12hours via an infusion device. The summary of product characteristics states that this can be given over 90-180mins if appropriate. In HD units 125,000 units can be added to a 50ml bag of 0.9% sodium chloride and infused over a minimum of 90mins. On completion HD should be attempted immediately.

Poor flows persist ?

If deemed undialysable/safety concerns, check potassium and liaise with the renal physician on call. Tel:- 0141 452 (8)2417

Otherwise liaise with the Vascular Access Nurses for review +/- consideration of new access. Tel:- 0141 452 (8)3695/2981 / Email:- Vascular.access@ggc.scot.nhs.uk

Clotted TCVC

- Ashsplit or Tessio?
  - Do you have the option for single lumen?
  - Check Bloods & fast – Do they urgently need HDx?
  - Liaise with on call medics/ VAN team.
  - Do not transfer to QEUH until bloods have been checked, results are back and you have been advised to do so.

Exposure of TCVC after the Dacron cuff

- Occasionally the TCVC becomes exposed after the dacron cuff. This is rare.
- Due to:
  - the insertion site not healing and the skin edges becoming granulated.
  - Thin, tissue paper skin with the line eroding through due to friction.
- This is an infection risk and will require a new line to be retunnelled.
- Cover the eroded area with an occlusive dressing such as duoderm and contact the VAN.

To prevent this happening, nurses need to educate out patients about caring for the lines that are under the skin to prevent erosion. This includes education about necklace chains that can rub and handbags that are worn over this shoulder. We also need to be aware of patients becoming frailer and changes to skin intergrity with time, medications and other co-morbidities.

Skin Irritation

Learning Point:

Why is an understanding of skin irritation important?

_____
_____
_____
_____

- Identify cause

  ? Tape

  ? cleaning agents and/ or not allowing them to dry for the correct amount of time.

  ? Phosphates

  ? Ethylchloride spray

  ? washing powder

  ? Have you left the correct amount of time for the Chloraprep to dry

  ? need dermatology referral.

What can we do?

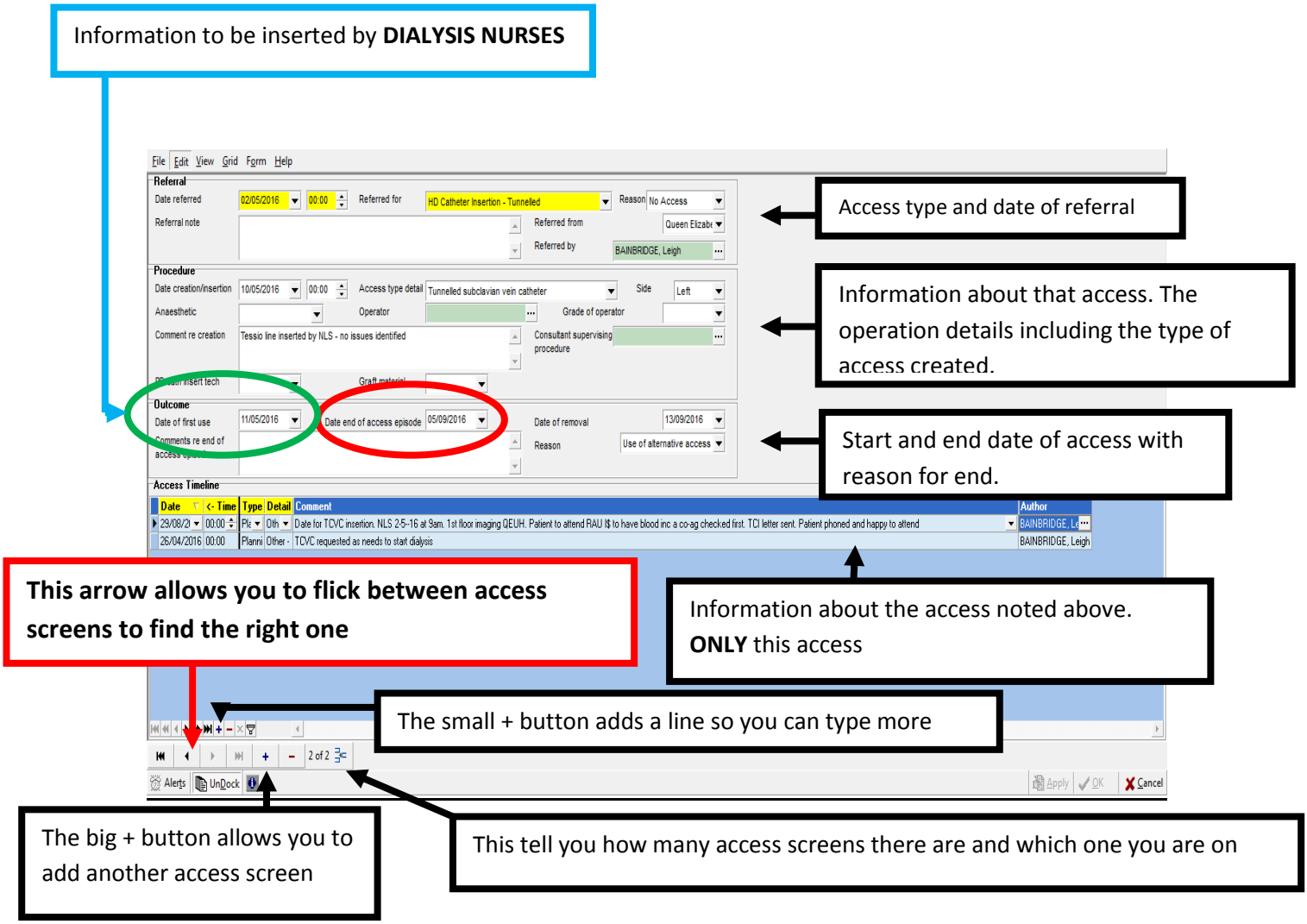
Eurax cream, use of aqueous creams rather than soap. Don't scratch

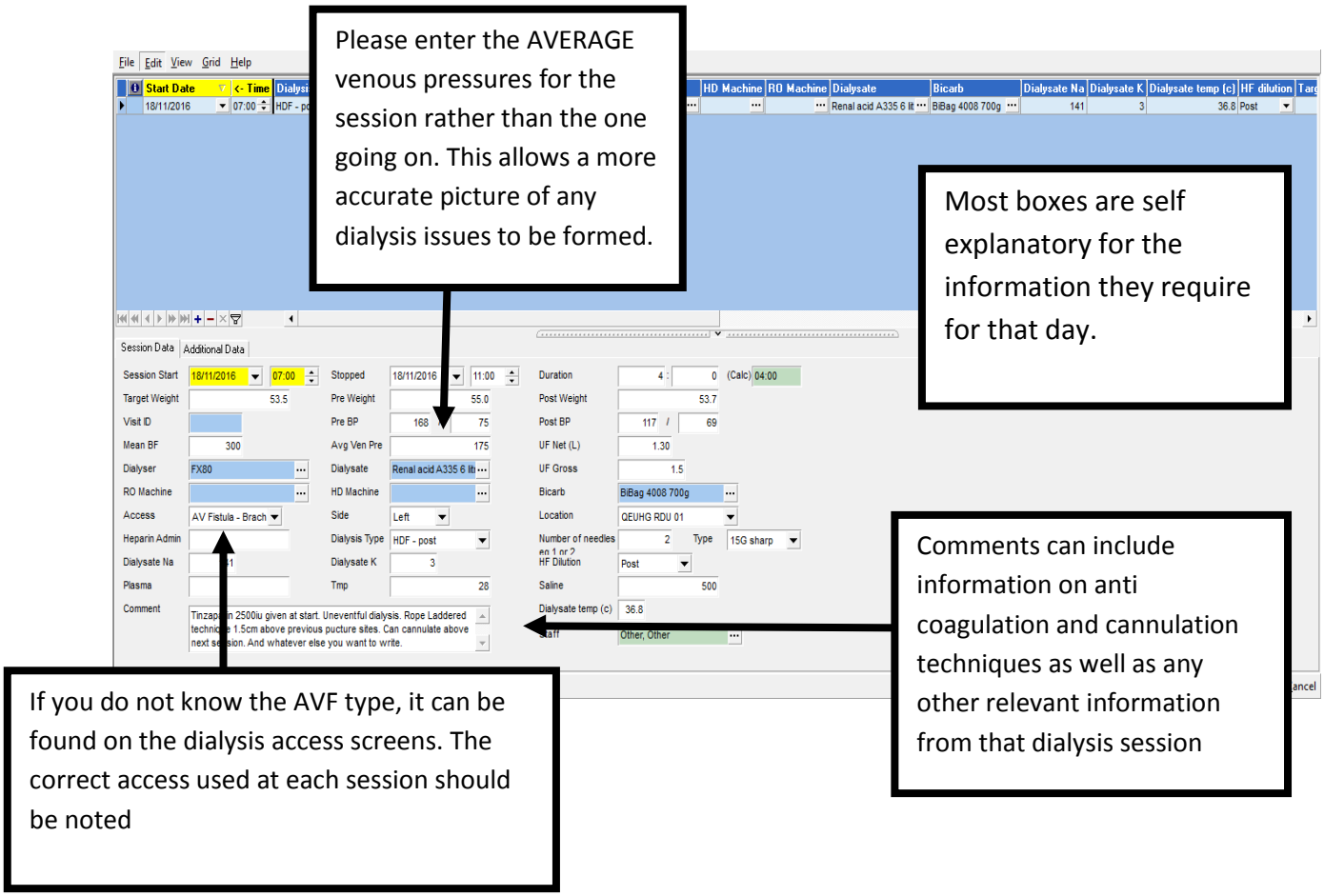
Document any changes to protocol

Personal notes for reflective practice:

Dialysis Access Screens – SERPR

- Everything about a patient's dialysis access should be recorded on the dialysis access screens on SERPR – not the Clinical History screens.
- Every access should have its own screen with a creation date, first use date and end of access date. All information about that particular form of access is recorded on the screen that relates to that access. Please ensure theses are filled in appropriately so that everyone can find the correct information when they need to. This information is used to plan clinical and managerial care as well for research. Accuracy and full completion is extremely important.
- Haemodialysis access screens should be accurately completed. They are used by other clinicians across the trust to plan care and make decisions based on the information that is written. Some information may transfer across from the machines; however, the nurse is responsible for ensuring the full screen is completed. Accurate documentation can prevent errors.





Vascular Access Nurses

Aneurysmal Fistula Surveillance Programme:

This programme involves the Vascular Access Nurses (VAN) visiting each dialysis unit on a four monthly basis, assessing each patient for issues with aneurysms. They photograph and document aneurismal fistula, taking the necessary actions to try and preserve access. Aneurysm are classified using the system designed by Mr D Valenti and his colleagues at Imperial College, London.

Vascular Access work up:

Following the dialysis access referral pathway, the VANs ensure that vein mapping is undertaken and that appropriate decisions are made prior to listing for access creation. This may involve attendance at the 'one stop' clinic on a Wednesday morning. Patients undergoing this process may be on dialysis or may be pre-dialysis. The one-stop clinic involves an appointment with a sonographer in Ultrasound to have mapping done. This mapping is then reviewed by the surgeon along with a clinical examination of the patient. Access options are then discussed with patient and a plan is formed. Surgeons prioritise

surgical listing needs for these patients. Education and advice is given by VANs. Patients are also given 'care of your access packs' at this point. These packs contain written advice, contact numbers, stress balls, stethoscopes and life threatening bleed cards for their wallets.

VAN Clinics:

Fortnightly on a Monday and Tuesday morning. This is for post-op follow up and fistula assessment.

Patient care leaflets:

The following leaflets are available. These are written and updated as required by the VANs. They can be ordered from medical illustrations using the following codes:

Care of your PTFE Graft	MI 284297
Care of your early cannulation graft	MI278765
Care of your Fistula	MI298841
Care of your Tunnelled Central Venous Catheter	MI302250

Education:

VANs have produced e-Learning module, this workbook and regularly formal and informal teaching sessions. They are involved in research at both regional and national levels. Moreover they involved in clinically auditing procedures and practices as well as clinical governance.

Education is also given to patients on the ward in order to empower them to become more actively involved in their own care.

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