

# **CANNULATION FOR THE NOVICE CANNULATOR**

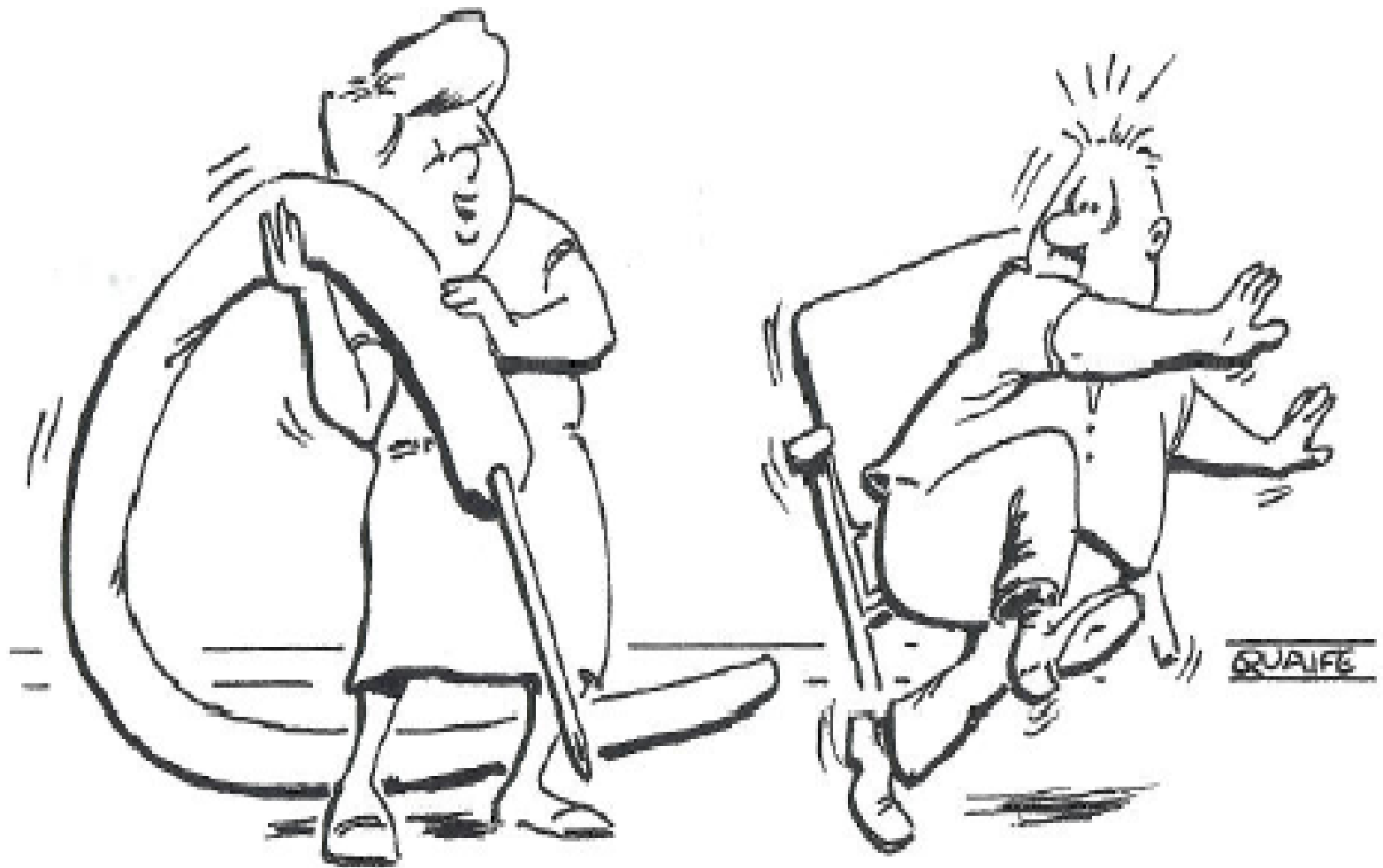
## **Vascular Access Educator Group of BC**

FINAL May 6, 2008



**BC Renal Agency**

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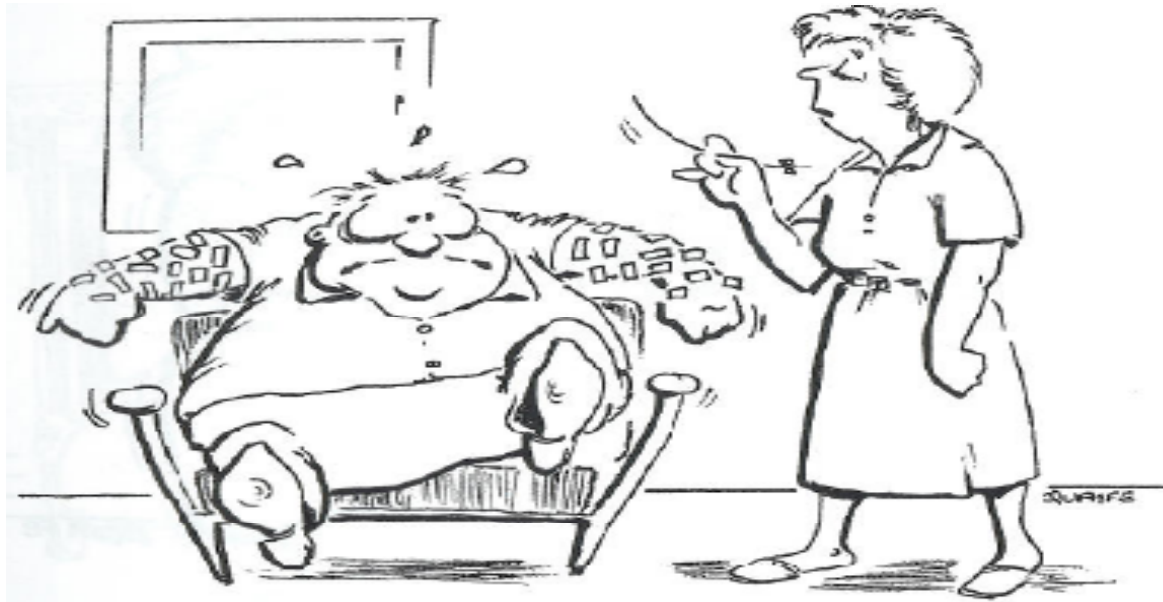
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# Provincial VA Services Team (PVAST)



- Led by the BC Provincial Renal Agency
- Goal is to facilitate provincial, multidisciplinary improvements in vascular access care – i.e. “Fistula First!”
- One improvement strategy has been the development of provincial guidelines
- Cannulation guideline was approved in May 2007
- Purpose of presentation is to review the *recommendations and step-by-step procedure* in the cannulation guideline

# CANNULATION GUIDELINE: RECOMMENDATIONS



Don't worry, I'll find a good site soon.



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# Recommendation:

## Match Cannulators & Accesses



- Match the skill level of the cannulator to the ease of an access to cannulate
- Rationale:
  - Cannulation is a *learned* skill which improves with practice
  - Without good cannulation skills, an AVF or AVG can be damaged or destroyed. AVFs and AVGs are patient lifelines!
  - Research shows that staff with limited cannulation experience have higher rates of infection, infiltration, and access loss

# Recommendation: Match Cannulators & Accesses



Skill Level of Cannulator	Access Rating Approved to Cannulate
Novice	<ul style="list-style-type: none"> <li>• Easy accesses:                             <ul style="list-style-type: none"> <li>– <u>Established</u> accesses with no complications</li> <li>– AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
Skilled	<ul style="list-style-type: none"> <li>• Moderately complicated accesses:                             <ul style="list-style-type: none"> <li>– <u>New</u> accesses with no complications</li> <li>– <u>Established</u> accesses with up to one complication</li> <li>– AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
Advanced	<ul style="list-style-type: none"> <li>• Complicated accesses:                             <ul style="list-style-type: none"> <li>– <u>All</u> accesses (new &amp; established; with or without complications)</li> <li>– <u>Established</u> and <u>new</u> AVFs in which buttonhole tracks are already established or are being established</li> </ul> </li> </ul>

# Established Fistula



Skill Level of Cannulator	Access Rating Approved to Cannulate
Novice	<ul style="list-style-type: none"> <li>• Easy accesses:                             <ul style="list-style-type: none"> <li>– <u>Established</u> accesses with no complications</li> <li>– AVFs in which buttonhole track are well established</li> </ul> </li> </ul>
Skilled	<ul style="list-style-type: none"> <li>• Moderately complicated accesses:                             <ul style="list-style-type: none"> <li>– <u>New</u> accesses with no complications</li> <li>– <u>Established</u> accesses with up to one complication</li> <li>– AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
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# Established Graft



Skill Level of Cannulator	Access Rating Approved to Cannulate
Novice	<ul style="list-style-type: none"> <li>• Easy accesses:                             <ul style="list-style-type: none"> <li>– <u>Established</u> accesses with no complications</li> <li>– AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
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# New Fistula



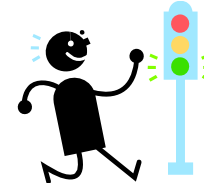
Skill Level of Cannulator	Access Rating Approved to Cannulate
Novice	<ul style="list-style-type: none"> <li>• Easy accesses:                             <ul style="list-style-type: none"> <li>– <u>Established</u> accesses with no complications</li> <li>– AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
Skilled	<ul style="list-style-type: none"> <li>• Moderately complicated accesses:                             <ul style="list-style-type: none"> <li>• <u>New</u> accesses with no complications</li> <li>• <u>Established</u> accesses with one complication</li> <li>• AVFs in which buttonhole tracks are well established</li> </ul> </li> </ul>
Advanced	<ul style="list-style-type: none"> <li>• Complicated accesses:                             <ul style="list-style-type: none"> <li>• <u>All</u> accesses (new &amp; established; with or without complications)</li> <li>• <u>Established</u> and <u>new</u> AVFs in which buttonhole tracks are already established or are being established</li> </ul> </li> </ul>

# Recommendation: When to Cannulate...



- Initial cannulation:
  - AVF: when signs show maturation has occurred (usually 4 wks+)
  - AVG: no swelling in the access limb (usually 2 wks)
  - AVF/AVG: assessed by MD or VA RN as “ready to needle”

# Rationale for When to Cannulate



Cannulation done too early or on a problem access site may damage or result in loss of the access

# Consult MD or VA Coordinator if...



- Absent or poor quality bruit and/or thrill; pulse felt instead of thrill
- Edema
- Signs of infection
- Aneurysm (AVFs) or pseudoaneurysm (AVGs)
- Difficult to cannulate
- Unable to achieve a BPS of  $>300$  mL/min by week 3, or  $\geq 350$  mL/min in established HD in 2 consecutive runs
- Low arterial or high venous pressure on 3 consecutive runs
- Unexplained, prolonged bleeding ( $>10 - 15$  min) from cannulation site on 3 consecutive runs



# Recommendation: Use of Aseptic Technique

- Use aseptic technique for all cannulation procedures - at a minimum:
  - Careful handwashing
  - Clean gloves just prior to disinfecting the access site & needling
- Rationale: Aseptic technique prevents access infections

# Recommendation:

## Use of Local Anaesthetics

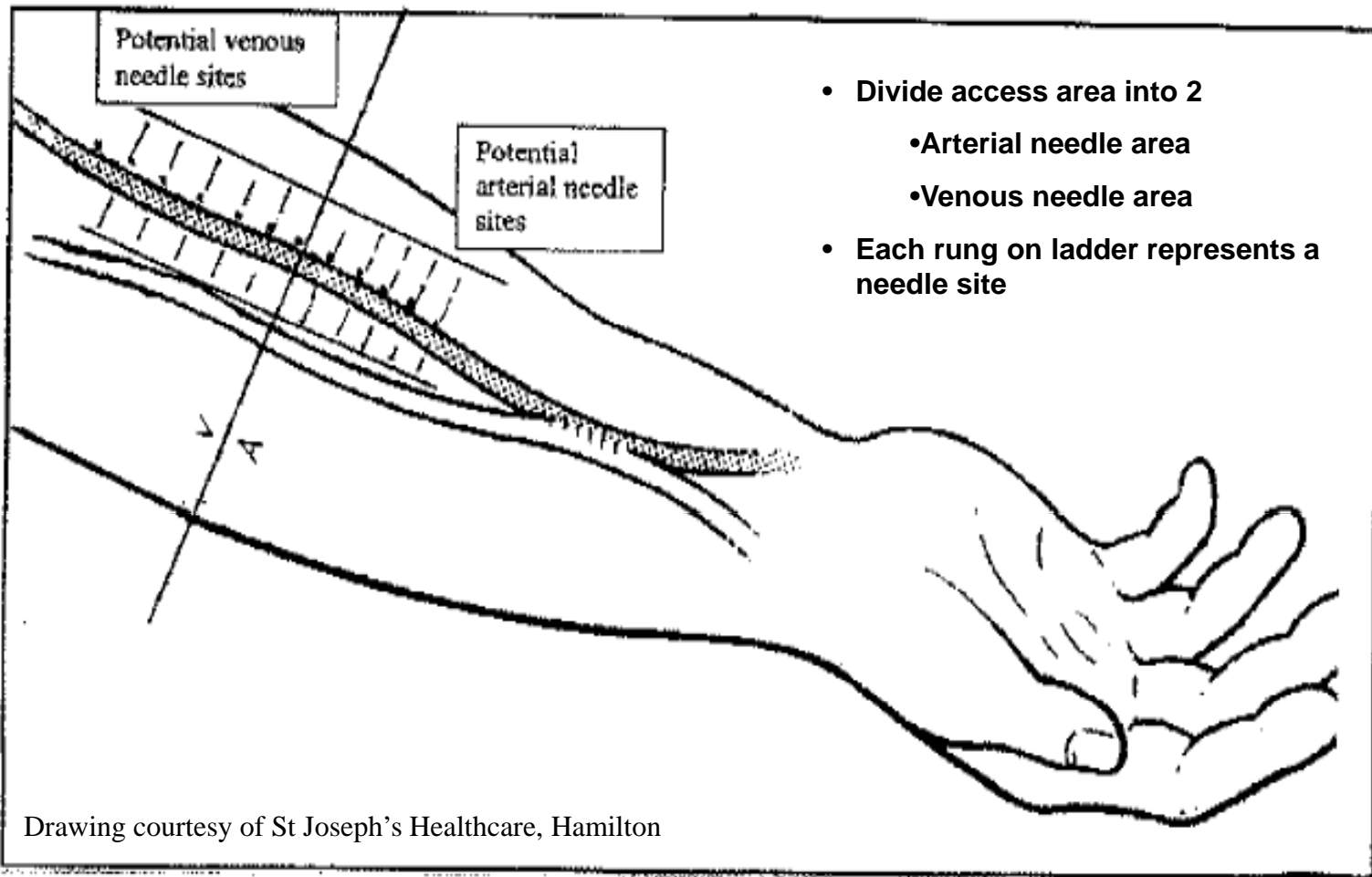
- Use anaesthetics to relieve needle discomfort in *selected* patients
  - Topical anaesthetic (with lidocaine +/- prilocaine such as Emla cream) applied by patient at home (1 – 2 hrs prior to treatment time)
  - Intradermal injection (lidocaine) provided just prior to cannulation. Do not use in poorly developed, edematous, or deep accesses (lidocaine is a vasoconstrictor)
  - If using a local anaesthetic, topical anaesthetic is preferred
- Rationale: Limit use to patients who are highly anxious or complain of pain. Side effects possible

# Recommendation:

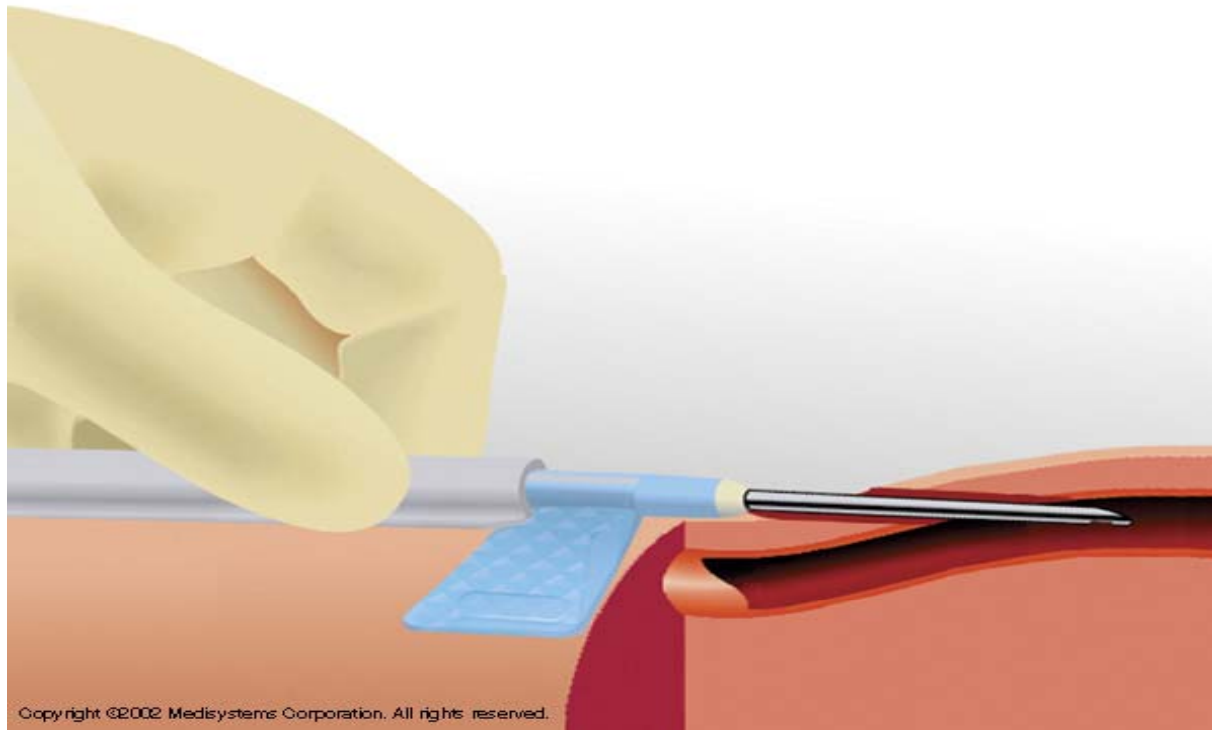
## Cannulation Techniques

- AVFs: Use rope ladder (rotating sites) or buttonhole (same needle site, depth, and angle each time) technique
- AVGs: Use rope ladder technique
- Rationale:
  - Rope ladder technique prevents the formation of aneurysms (AVFs) & pseudoaneurysms (AVGs)
  - Buttonhole technique (AVFs only)
    - Benefits: Fewer infections, infiltrations, hematomas and missed sticks. Once established, can use blunt needles to access the fistula. Recommended for self-cannulation
    - Drawbacks: Requires a consistent cannulator(s) until the track has been formed (usually 8 – 12 cannulations)

# “Rope Ladder” Technique



# Buttonhole Technique



# Recommendation: Needle Size

- Use small gauge needle (17 or 16 g):
  - Early cannulation attempts
  - For 2 weeks after a major cannulation complication
- Once cannulation has been established:
  - Correlate needle gauge, vein size, blood pump speed, and clinical condition (Kt/V or PRU)
  - Increase needle size gradually
  - Use the smallest gauge needle that achieves the desired blood pump speed (helps prevent infiltrations, hematomas, & compression of the vessel causing clotting)

# Needle Size

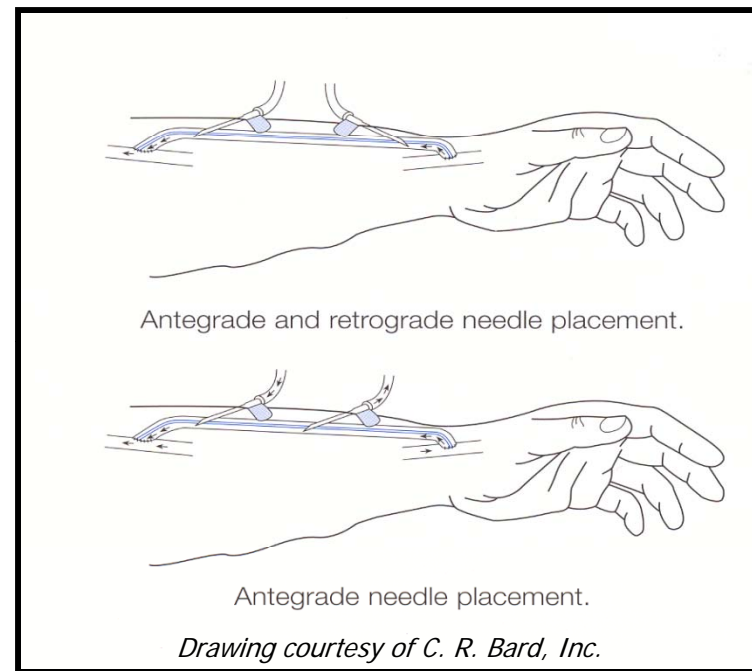
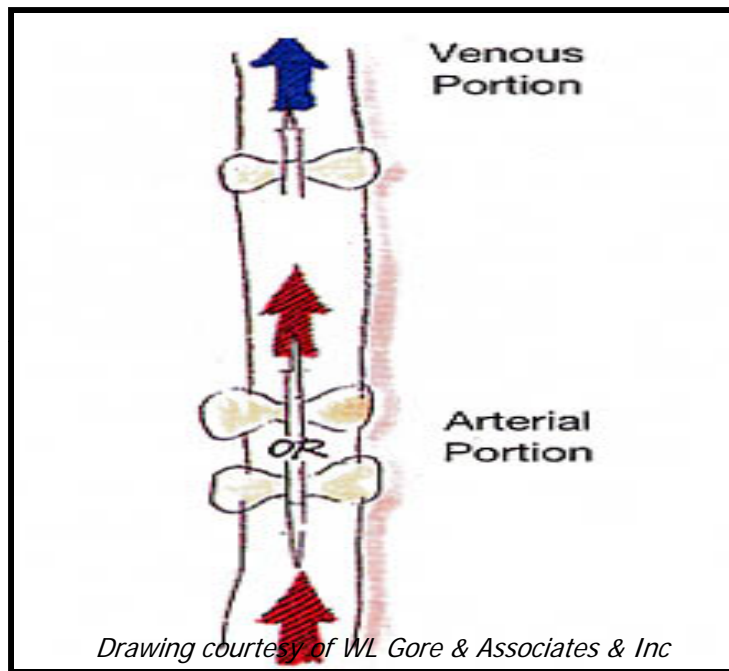
Once cannulation has been established, correlate needle gauge, vein size, blood pump speed, and clinical condition (Kt/V or PRU)

Desired BPS	Recommended Needle Gauge	
	AVF	AVG
<300 mL/min	17 g	17 g
300 – 350 mL/min	16 g	16 g
350 – 450 mL/min	15 g	15 g
>450 mL/min	14 g	15 g

# Recommendation: Needle Placement

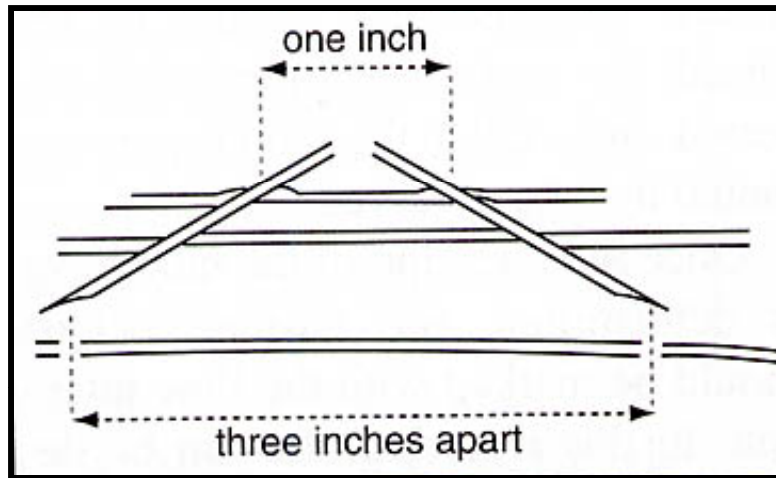
- Place venous needle antegrade (i.e. with the blood flow – facing venous end). Arterial needle may be placed antegrade or retrograde (against the blood flow – facing arterial end)
- Place needles so tips are  $\geq 7.5$  cm (3 in) apart and 4-5 cm (1.5-2 in) away from the arterial or venous anastomosis. Avoid aneurysms, curves, & flat spots
- If using rope ladder technique, cannulate  $\geq .6$  cm (1/4 in) from previous site

# Needle Placement

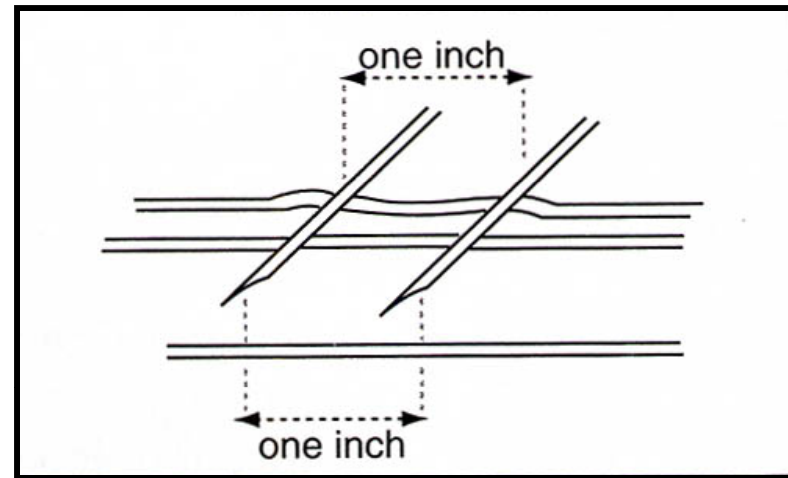


- Venous needle: antegrade (i.e. with the blood flow – facing venous end)
- Arterial needle: antegrade or retrograde (against the blood flow – facing arterial end)

# Needle Placement



Correct



Incorrect: Needles too close

*Drawings courtesy of WL Gore & Associates & Inc*

- Needle tips  $\geq 7.5$  cm (3 in) apart and 4–5 cm (1.5-2 in) from anastomosis (to avoid recirculation)
- Bevel may be up or down (no research to support one over the other)
- Cannulate  $\geq .6$  cm (1/4 in) from previous site

# Recommendation: Cannulation Attempts



- Max # of cannulation attempts at any one session = 4 (total for arterial and venous sites)
- If on 2<sup>nd</sup> attempt you don't succeed.....**don't** try again. Consult an(other) advanced cannulator
- Notify MD after 4 unsuccessful attempts
- Rationale: Repetitive attempts to cannulate an infiltrated AVF or AVG  $\Rightarrow$  swelling  $\Rightarrow$  permanent loss of access

# Recommendation: Infiltration

- Stop pump (if on) and seek assistance from a skilled cannulator
- If patient *has not* received heparin, remove needle, & apply digital pressure to the site
- If patient *has* received heparin, assess site to see if needle should be pulled out:
  - If size of hematoma is stable, leave needle in, apply ice over the site, and resume hemodialysis
  - If hematoma is increasing in size, remove needle, and apply digital pressure. Never apply pressure until the needle is completely out
  - Situation will define whether dialysis should be resumed
- Apply ice to access (on 10 min, off 10 min) and instruct patient to continue x 24 hours at home. After 24 hours, may alternate cold and warmth
- If feasible, rest the AVF or AVG until resolution of bruising and/or swelling (1 – 2 weeks) (may require a temporary access)
- Re-initiate treatments with smaller gauge needles

# Recommendation: Hemostasis

- Apply mild, digital, localized, direct pressure, using 2 fingers over the needle sites. Remember to apply pressure over both the outside and inside holes (hole in skin and hole in vein where needle poked through)
- Do not use clamps or tourniquets (aka straps or site minders) on new AVFs or AVGs or on accesses that show signs of infiltration, infection, or edema
- May use clamps or tourniquets on mature/established AVFs/AVGs with no signs of complications. Use one at a time and never for more than 20 min. Check that a thrill &/or bruit present above & below the compression site. If not, reduce the pressure

# Recommendation: Hemostasis

## Rationale

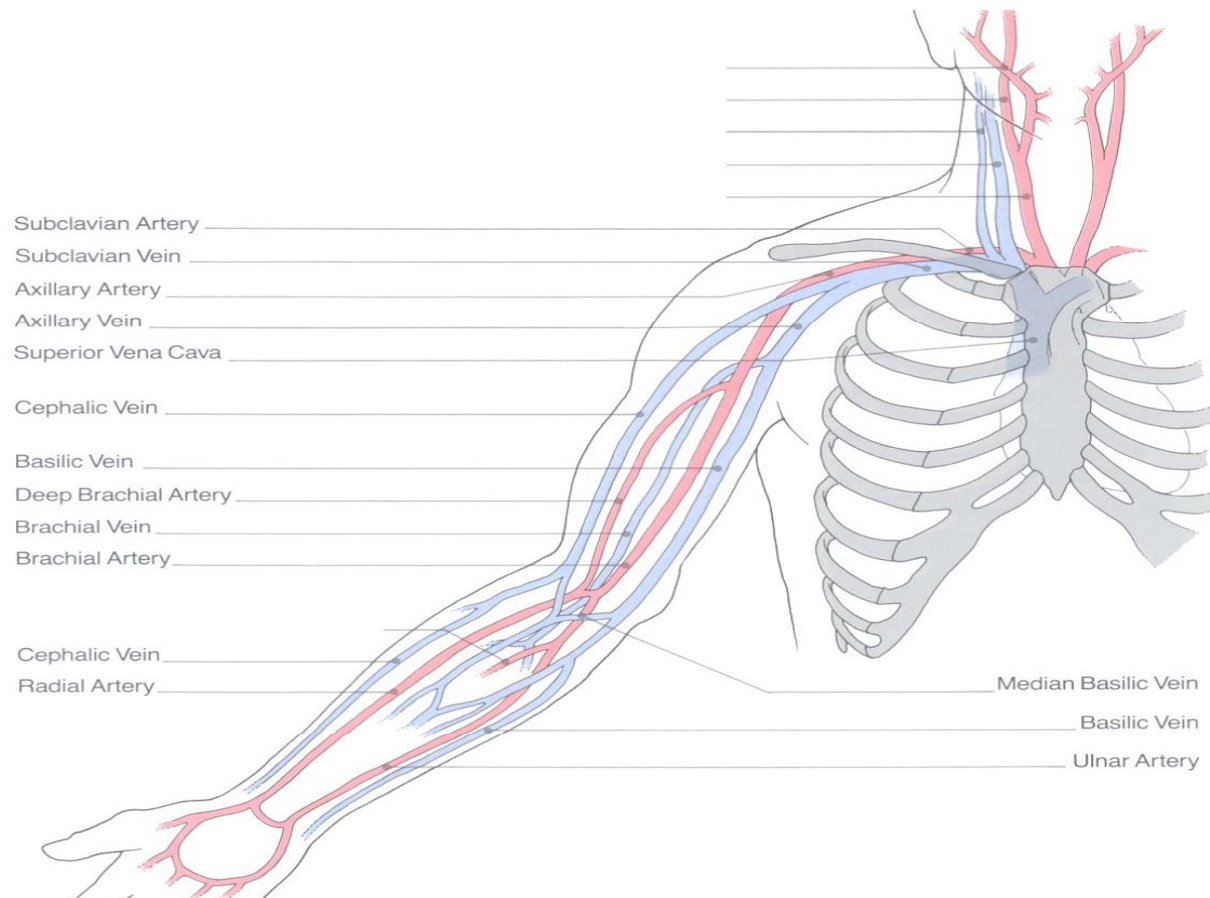
- Hemostasis is best achieved by applying digital pressure using 2 fingers over the needle sites
- Clamps or tourniquets  $\Rightarrow$  damage and/or thrombosis (by applying too much pressure)  $\Rightarrow$  loss of access

# CANNULATION GUIDELINE: STEP-BY-STEP PROCEDURE



No, Kelly. You're supposed  
to leave the vein inside!

# Access Anatomy



*Drawing courtesy of C. R. Bard, Inc.*

# Fistulae: Surgical Procedures

- Radial-cephalic (RCF) – 1<sup>st</sup> choice
  - Wrist & forearm
- Brachial-cephalic – 2<sup>nd</sup> choice
  - Elbow
- Other options – 3<sup>rd</sup> choice
  - Radio-basilic with vein transposition
  - Brachio-basilic with vein transposition
  - Brachio-cephalic with vein transposition
  - Transposition elevates vein superficially and laterally to enable access for cannulation

# Grafts: Surgical Procedures

- Forearm graft
  - Usually looped
- Upper arm graft
  - Usually straight
- Leg/inguinal graft
  - Usually looped
- Variations are possible; consult VA Nurse if questions

# Cannulation Steps

- Physical assessment
  - Inspection (LOOK!)
  - Auscultation (LISTEN!)
  - Palpate (FEEL!)
- Cannulation
  - Planning the needle sites
  - Preparing the needle sites
  - Inserting the needles
  - Removing the needles

# Physical Assessment



**Inspection  
(LOOK!)**



**Palpation  
(FEEL!)**



**Auscultate  
(LISTEN!)**

# Inspection (LOOK!)



- Examine entire access limb & compare to other limb
  - Length of access? Depth? Diameter?
  - Absence of infection, swelling, cyanosis, aneurysms/pseudoaneurysms, & haematomas?
- AVF:
  - Well developed venous outflow vein?
  - Areas of straight vein available to cannulate?
- AVG:
  - Loop or straight configuration?
  - Graft uniform in size?

# Inspection (LOOK!): Signs of Trouble



- Stenosis or poor maturation:
  - Dilated neck veins or small surface collateral veins in arm or neck
  - AVFs: Multiple outflow veins, narrowing of main outflow vein, or poorly defined cannulation areas
- Infection: redness, discharge, broken skin, swelling of access limb
- Steal syndrome: poor colouration of access limb

# Auscultate LISTEN!)



- With a stethoscope, start at the anastomosis and listen to the bruit
  - Low pitched, continuous “whooshing” sound is normal
- Listen to the entire access noting changes in the sound of the bruit

# Auscultate (LISTEN!): Signs of Trouble



- Stenosis or poor maturation:
  - Bruit high pitched, present on systole only, and/or makes “whistling” sound
- Steal syndrome:
  - Bruit may be strong
- Clotted access:
  - No bruit present

# Palpation (FEEL!)



- Use your finger tips
- Start at the anastomosis and palpate the entire length of the access
  - Strong thrill (“buzz”) felt only at or near the arterial anastomosis is normal
  - Pulse may be felt throughout the length of the outflow vein but strength should decrease along the vein pathway
  - For a fistula, repeat with a tourniquet
- Note abnormal skin temperature (too warm or too cold), grip strength, range of motion and/or complaints of pain

# Palpation (FEEL!): Signs of Trouble



- Stenosis or poor maturation:
  - Strong thrill and/or pulse at site of stenotic lesion
  - Pulse has water-hammer feel (strong bounding pulsation)
  - AVG: graft may feel “mushy” (low intra-access blood flow)
- Infection: warm to touch, swelling in access site/limb
- Steal syndrome: cool to touch, decreased grip strength &/or range of motion, &/or pain

# Planning the Cannulation Site

- Identify direction of blood flow at access site
  - AVFs:
    - Locate arterial anastomosis
    - Blood usually flows from distal end of the limb toward the heart
  - AVGs:
    - Review operative note
    - Listen to bruit & palpate for thrill at both ends of graft – the end with the stronger bruit & thrill is usually the arterial end

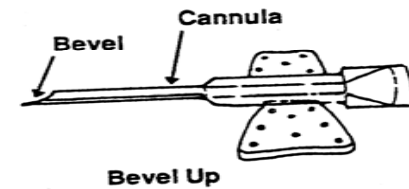
# Planning the Cannulation Site

- Visualize the site and plan for placement of BOTH needles
  - Take your time
  - Listen to your patient
- Put on clean gloves prior to cleansing and cannulating the site.
- Change gloves if contaminated during cannulation procedure

# Preparing the Cannulation Site

- Confirm that patient has washed access site.
- Cleanse site with antiseptic solution using a circular motion inside to outside. Allow skin to air dry.
  - If using buttonhole technique, soak scab with a 2x2 gauze & sterile saline or alcohol-based gel or an alcohol wipe
- AVFs:
  - Apply tourniquet to access arm just below the axilla (if access is in upper arm) or midpoint of the upper arm (if access is in lower arm)
  - Tourniquet should be tight enough to dilate the veins but not occlude the flow
- If desired by the patient, apply/inject the local anaesthetic (if using topical anaesthetic, will have likely been applied by patient at home)

# Inserting the Needle



- Take needle in one hand and place thumb and forefinger of the other hand on either side of the access
- Using either the pinky or ring finger of the needle holding hand, pull skin taut in the opposite direction of the needle insertion
- Assess the depth of the access and adjust the cannulation angle.
  - Less steep angles ↑ risk of dragging cutting edge of needle along surface of vessel
  - Steeper angles ↑ risk of perforating underside of vessel
- AVFs: If using buttonhole technique, use the same site, angle, and depth of needle insertion every cannulation

# Inserting the Needle

- Once the needle is through the skin, tissue, & wall of access, check for blood flashback
  - If blood flashback not visible, confirm needle placement & assess blood flow by aspirating blood into the fistula needle using a syringe. If no blood returns, adjust the needle until blood is visible
  - When blood flashback is visible, level the needle to the level of the skin and slowly insert to the hub. Do not flip the needle
- Advance needle slowly to allow enough time for patient to let you know of pain. Listen to the patient
- Secure wings of the needle at the angle of advancement. If required, place a 2x2 gauze pad under the needle wings to correct the angle
- Repeat all steps for the second needle

# Inserting the 1<sup>st</sup> Needle



# Inserting the 2<sup>nd</sup> Needle

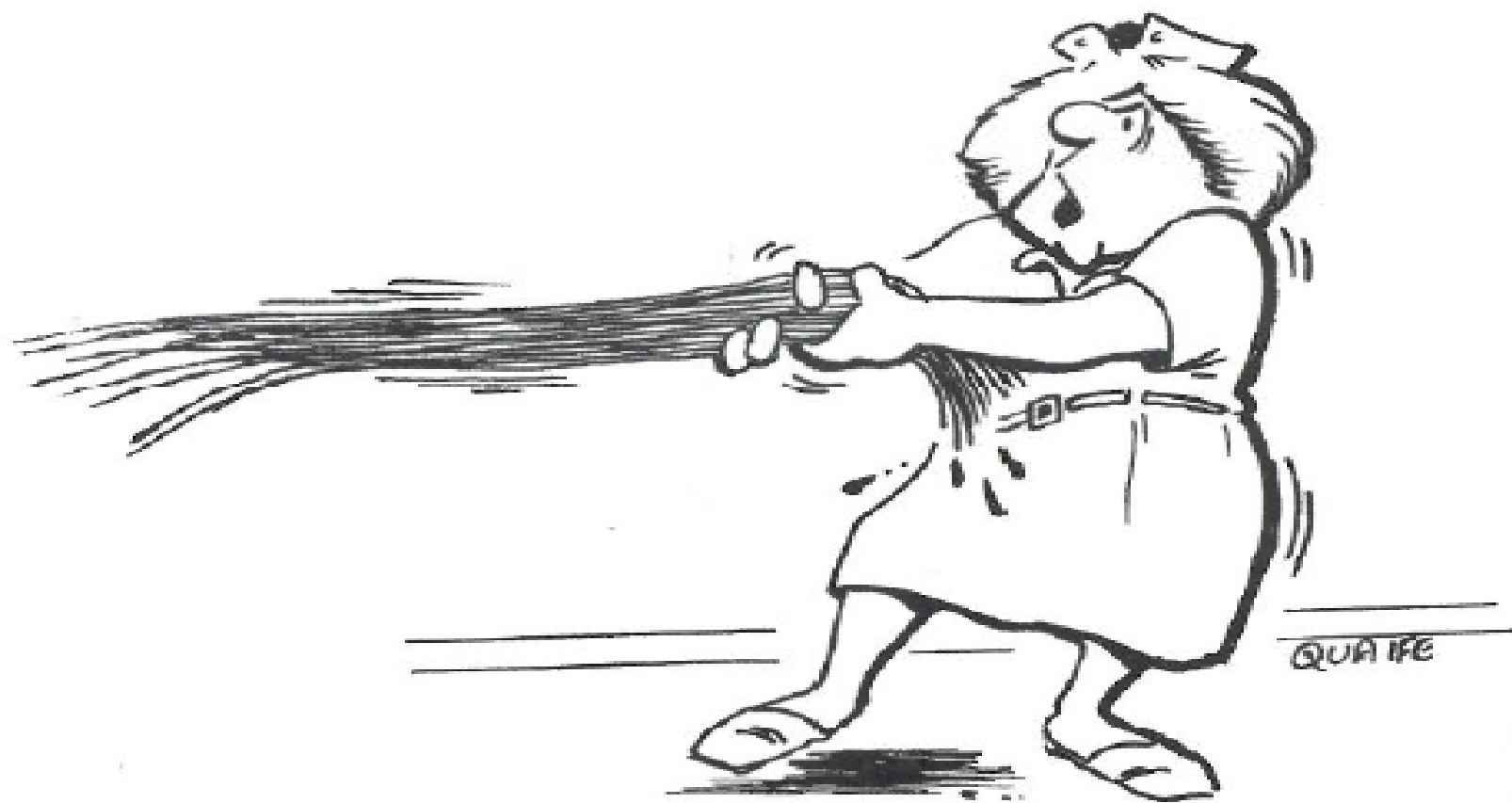


# Success!



# Removing the Needles

- Have your supplies at hand!
- Remove the adhesive device
- Remove the needle slowly at the same angle as used for insertion
- Using 2 fingers, apply pressure to the exit site:
  - Apply pressure over both the outside and inside holes (hole in skin and hole in vein where needle poked through)
  - DO NOT apply pressure until AFTER the needle is ALL the way out
  - To ensure the pressure is not too much, palpate for a pulse above and below the compression site. If not palpable, reduce the pressure
- Hold the pressure WITHOUT PEEKING for 10-15 min.
- Place an adhesive or gauze pad on the exit site or ensure dressing used is secure



Okay! On the count of three,  
it's out with all the needles.



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# Summary of Steps

- Physical assessment
  - Inspection (LOOK!)
  - Auscultation (LISTEN!)
  - Palpate (FEEL!)
- Cannulation
  - Planning the needle sites
  - Preparing the needle sites
  - Inserting the needles
  - Removing the needles

# Words from the Wise

## *Planning & Preparing the Needle Sites:*

- Raise bed to comfortable position or sit at same height as access (less back strain)
- Try access limb in different positions to get good visibility and access to vessel. Dependent position allows vessels to fill. May need to stand behind the patient if access is retrograde
- For fistulas, use a tourniquet even if fistula looks “good.” When applying, keep pressure light (80-100 mmHg) and do not leave on too long (tourniquet helps to stabilize the fistula & dilate the vein resulting in a smaller hole and less likelihood of back wall infiltration)

# Words from the Wise

## *Planning & Preparing the Needle Sites:*

- Visualize a roadmap of the access. Some may find the use of a pen helpful to mark the outside edges and direction of access on the access limb (caution: some accesses will move)
- Do not follow past needle marks as they may be off to one side or another depending upon how you anchor the vein. Avoid tortuous areas, stenosis, dips, previous blows, etc
- Push with your middle finger to dilate vein. Keep 2<sup>nd</sup> finger next to middle finger. Insert needle next to 2<sup>nd</sup> finger

# Words from the Wise

## *Inserting & Removing the Needles:*

- Stabilize the vein before inserting the needle. Can be done by placing your fingers on either side of the vessel or by placing your fingers above and below where the needle is going to be placed. Pull skin taught over the access
- Insert needle bevel up or down. Once see blood flash, level off the needle. Do not flip the needle
- If the pulsation of the blood stops as you insert the needle, the needle is not aligned correctly. Gently pull back until a flash reoccurs

# Words from the Wise

## *Inserting & Removing the Needles:*

- Once inserted, test for patency. Put syringe on tubing and pull back 1” of blood. Place your finger over the vein and beyond the end of the needle. Push blood back in and if no bubbles or resistance felt, ok. If bubble or lump felt, reposition your needle
- Secure needles using bridge tape. Tape should support angle of entry, not alter it
- Turn machine on and observe pressures. Venous pressure should go up slowly. If it doesn't, there is a problem

# Words from the Wise

- An average HD patient receives 312 needle-pokes annually, just from dialysis needles
- Patient know best - actively listen to your patient – remember their access is their LIFELINE!
- Be humble! Don't be embarrassed to ask for assistance
- Stick unto others as you would have them stick you

(Reference: Sticking Tips by Lesley Dinwiddie)