LEARNING MODULE
FOR
CARE OF VASCULAR ACCESS FOR HEMODIALYSIS
- ARTERIOVENOUS FISTULAS - ARTERIOVENOUS
GRAFT

CC 50-004

DEVELOPED BY: Nephrology Program
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PURPOSE

The RN and LPN working within the Dialysis Program will demonstrate knowledge of the theory and skill related to the care of the arteriovenous fistula (AVF) and the arteriovenous graft (AVG).

LEARNING OBJECTIVES

Following the completion of the independent learning activities and skill practice, the RN and LPN within the Dialysis Program will be able to:

1. Discuss the use and purpose of an AVF and AVG.
2. Describe the assessment components of an AVF and AVG.
3. Discuss the complications of infection, thrombosis (clotting), hematoma formations, bruising, pseudo aneurysm formation, arterial steal syndrome, and venous hypertension.
4. Describe the care for an AVF and AVG. Determine the most suitable cannulation technique for the patient.
5. Perform safe cannulation.
6. Familiarize themselves with Buttonhole technique.
7. Describe the initial patient teaching necessary for the care of the AVF and AVG

**Proficiency Standards**

The RN and LPN within the Dialysis Program will:

1. Perform the following learning activities via independent study.
   1.1. Review the Learning Module on Care of Vascular Access for Hemodialysis:
      1.1.1. Native AVF
      1.1.2. AVG
   1.2. Read the policy and procedure on Care of Vascular Access for Hemodialysis:
      1.2.1. AVF
      1.2.2. AVG
   1.3. Read the policy and procedure for Buttonhole (Same Site) Cannulation
   1.4. View videos:
      1.4.1. Medisystems™- Your complete guide to assess preservation and needle stick prevention:
         - The Native AV Fistula (the keys to optimal vascular access)
         - The AV Graft (maintaining a healthy vascular access)
         - Introduction to Cannulation (Steps to optimal Cannulation)
         - Constant Site Cannulation Using buttonhole Technique (Medisystems)
      1.4.2. Learning About Your Vascular Access (Amgen)
      1.4.3. Module3- Vascular Access in Dialysis-
               http://www.rocheresourcecentre.ca

2. Successfully complete the Self Test on Care of Vascular Access for Hemodialysis (found at the end of the learning module):
   2.1. AVF
   2.2. AVG

3. Observe an RN and LPN within the Dialysis Program deemed competent in this care:
   3.1. Assess an AVF and AVG prior to cannulation.
   3.2. Demonstrate proper cannulation technique.
   3.3. Obtain a blood sample from the fistula needle (if applicable).
   3.4. Remove fistula needles post dialysis.
   3.5. Perform post dialysis fistula care (apply pressure, dress cannulation sites, document appropriately).
   3.6. Demonstrate proper cannulation technique in a skills lab setting.

4. Complete successfully the proficiency standard skills checklist Cannulating
an AVF/ AVG and Removal of Fistula Needles (found at the end of the learning module).

**METHOD**

Self study, skills lab.
THEORY

ARTERIOVENOUS FISTULAS

The AVF is the preferred mode of access for chronic hemodialysis because of the low incidence of complications and longevity.

AVFs are created surgically by anastomosing an artery and a vein that allows the arterial blood to flow through the vein. Over time, this causes venous enlargement and thickening of the vein wall. This process is known as arterialization (maturation of the vein). The most common and preferred site is a radial artery to cephalic vein in the forearm. Other common vessels may be used such as the brachial artery and cephalic or basilic vein in the upper arm. Less common combinations may also be created such as ulnar-basilic fistula. When less common vascular access is created, an operative report or picture of the access should be made available on the chart.

The vein must mature and be suitable to cannulate when the vein’s diameter is sufficient to allow successful cannulation. After a fistula is created it takes approximately 6-8 weeks before it is ready to be used. The fistula should not be used sooner than 1 month and preferably 3-4 months after creation. During this healing and maturation time the fistula must be assessed for infection, flow (bruits), vessel development and thrombosis. Risk factors for early failure include low blood pressure, diabetes, small caliber veins and arterial atherosclerosis.

Common Sites for AVF Placement:

http://www.bing.com/images/search?q=avfistula&FORM=BIFD  cjasn.asnjournals.org

Complications
Complications related to AVF include:

Thrombosis (Clotting)
May occur as a result of hypotension, distal peripheral vascular disease, excessive access compression or occlusion of blood flow. Premature cannulation may result in higher incidence of infiltration with associated compression of the vessel by hematoma resulting in thrombosis.

**Arterial Steal Syndrome**

Ischemia of the hand associated with shunting of blood from the artery to the vein particularly in a brachial fistula. Shunting may also be accompanied by retrograde (backward) flow in the distal artery. Signs and symptoms may include pallor, cyanosis, mild to severe numbness, tingling, coolness and pain of hands and/or digits. Difficulty performing venipunctures and poor arterial flows during dialysis may also occur.

**Venous Hypertension**

Caused by stenosis of the cephalic vein proximal to the site of an AV fistula resulting in venous hypertension. Signs and symptoms include swelling of the fistula arm/hand, cyanosis of the thumb and index finger. Skin involvement such as ulceration and eczematoid changes may be noted. Venous hypertension is also referred to as a sore thumb syndrome.

**Aneurysm and Pseudo Aneurysm Formation**

A consequence of an AV fistula creation is thickening and enlargement of the vein walls due to arterialization. Over time, flow in the fistula increases and the vein enlarges and may become tortuous. An aneurysm is a weak spot in the wall of the fistula which causes ballooning of the vessel wall. Pseudo aneurysm formation resembles an aneurysm but the outpouching is not all the vessel wall. **Weakened vessel walls related to repeated needle puncture in the same area (same ‘siteitis’) predisposes it to aneurysm formation. Inadequate holding of puncture sites post dialysis contributes to pseudo aneurysm formation.** Aneurysm and/or pseudo aneurysm may also be caused by a proximal stenosis.

Aneurysms can cause recirculation, poor dialysis clearances, prolonged bleeding time and risk of rupture. Monitor changes in the aneurysm such as size, overlying skin, redness, warmth or pain. Thrombus can form within the aneurysm leading to thrombosis of the fistula.

**Infection**

Infection rates are lower with AV fistula than other forms of dialysis access. Infections can be localized to the site or systemic. Aseptic technique must be implemented during venipuncture.

**Hematoma**

A collection of blood in the soft tissue resulting from an arterial or venous interstitial needle or from inadequate hemostasis post needle removal.

**Assessments**

Assessments prior to cannulation include:

1. Review of the previous dialysis flowsheets, kardex, progress notes, and
Same Site Cannulation (Buttonhole Technique) Tracking sheet to identify needling problems and/or plan of care

2. Review diagram if one available
3. Visual inspection for signs and symptoms of infection (redness, tenderness, swelling, drainage, hematomas)
4. Determination of patency through palpation and auscultation
5. Determination if other complications; such as arterial steal syndrome, aneurysms, or presence of collateral veins, have developed and/or may be impacting on the ability to access the AVG or AVF successfully.

Surveillance of AV fistula / grafts is monitored using an Ultrasound Dilution Technique. Monitoring a patient’s vascular access flow over time and its trends can lead to early intervention reducing access failures and increasing patient outcomes. Please refer to Transonic Monitoring – Appendix A.

Fistula complications need to be reported to the nephrologists, NP or Home Dialysis Unit staff (as applicable) for further assessment and possible intervention prior to cannulation.

**ARTERIOVENOUS GRAFTS**

**Description:**
Used in patients who have poor vasculature. The graft may be made of biological, semi-biological or prosthetic material. The graft is surgically placed between an artery and a vein.

**Indications:**
As an alternative for patients with poor veins.

**Advantages:**
1. Can be used earlier than an AVF (Ideally 3-6 weeks & no earlier than 14 days).
2. Larger surface area, needle puncture usually easier to accomplish.
3. Size and blood flow are not dependent on vein maturation
4. Forearm grafts may help to develop upper arm vessels.

**Disadvantages**
1. Long term survival rate is less than AVF and may require more interventions
2. Higher rate of infection and thrombosis than AVF.
3. Increase risk of “steal syndrome”
4. Increased risk of pseudo aneurysm
5. Potential for an allergic response to nonautogenous material, especially Polytetrafluorethylene (PTFE).

**Types:**
1. Autogenous (originating within the body) or saphenous vein graft (are to be cannulated as per fistula procedure).
2. Modified human umbilical vein graft: human umbilical vein graft that has been treated to destroy collagen cells and then covered with a Dacron mesh.
3. Bovine heterograft: bovine carotid artery material that has been treated to remove protein material.
4. Polytetrafluorethylene (PTFE) graft (preferred type)

**Placement**

1. Interposed between any suitable artery and vein and placed in a subcutaneous location.
2. Ideal placement site is the upper extremity, preferably the looped brachial-cephalic.
3. Grafts implanted in the thigh are at greater risk for ischemia and infection.
4. A straight graft vs. a loop graft depends on the availability of vessels.

Types of Grafts:
Complications:

Infection
1. More serious in grafts than in an AVF due to the risk of disintegration and subsequent hemorrhage.
2. Early postoperative infection usually extends the entire length of the graft through the open space around the graft and frequently involves the suture line.

Thrombosis
Causes:
1. Venous outflow stenosis
2. Inadequate arterial flow
3. Extrinsic compression

Treatment:
1. Venous outflow stenosis is corrected by angioplasty or bypass grafts
2. Avoid excessive pressure after needle removal
3. Do not use clamps
4. Maintain adequate blood volume

Ischemia
1. Usually greater problem with an AV graft, as larger vessels are generally used in making the anastomosis.
2. Symptoms are the same as with native AVF.
3. Prevention depends on limiting the size of the opening between the arterial vessel and the graft.

Pseudoaneurysms and Aneurysms
1. Pseudoaneurysms can be prevented by achieving hemostasis post needle removal, thus avoiding formation of a hematoma.
2. Rotation of puncture sites prevents weakening of any one area along the graft, which will contribute to formation of pseudoaneurysms and aneurysms.
3. Usually require surgical repair.

General Care and Patient Education
1. Same as for AV fistulas except for vein maturation techniques.
2. Place added emphasis on observing for infection and seeking prompt treatment.
3. Practice techniques to achieve hemostasis without occlusive pressure.

CANNULATION
Cannulation is a learned, specialized skill set which improves with practice. Without good cannulation skills, an AVF or AVG can be damaged or destroyed.
Research suggests that inexperienced dialysis staff have higher rates of access infection, infiltration, and loss.

Cannulation involves inserting two, occasionally one; large bore needles into the fistula vessels. To ensure proper needle cannulation, the flow direction of the fistula must be correctly identified. Most fistulas flow from the distal end of the limb toward the venous return. The direction of flow can be identified by locating the arterial anastomosis engorgement prior to placement of a tourniquet or listening for the bruit and feeling for the thrill, which should be noticeably stronger at the arterial end of the fistula.

Placement of the venous needle is dependent on the direction of the blood flow. The venous needle returns the blood from the extracorporeal circuit to the vasculature and must always point toward the venous return. The arterial needle is used to withdraw blood from the vasculature to the extracorporeal circuit and may point in either direction. The terms antegrade and retrograde are used to describe the direction of the arterial needle. Antegrade cannulation has the needle pointing in the direction of the blood flow (toward the venous limb). Retrograde cannulation has the arterial needle pointing toward the arterial anastomosis.

When needles are placed with one pointing in opposite direction (see Fig. 1) they must be placed at least 1” apart, as measured from hub to hub. This is to avoid recirculation.

![Fig. 1](image)

When needles are placed in the same direction in the same vessel (see Fig. 2), they should be no less then 3” apart, as measured from hub to hub. This is to avoid recirculation and the risk of the bevels touching.

![Fig. 2](image)
**Note:** Pointing the arterial needle toward the anastomosis may provide higher blood flow and less blood line collapse/line sucking and better pre-pump arterial pressure in new AV fistulas that are not fully developed.

To minimize discomfort topical lidocaine 2.5% with prilocaine 2.5% (Emla Cream) may be prescribed. Emla cream should be applied, a minimum of 30 minutes prior to cannulation at a thickness of 1/4 inch.

Prior to cannulation the patient is to clean the fistula arm with bacteriostatic soap. In addition, each needle placement site must be individually cleansed in a six-inch radius with a 2% chlorhexadine/70% alcohol swab (SOLU-IV), in a back and forth motion for 30 seconds from the centre to the outer aspect of the arm. Allow this to air dry completely (approximately 2 minutes).

To cannulate, the needle should be held by the wings, with the bevel facing upward. The needle should be held at a 20 - 35 degree angle. The use of a “wet needle” is recommended; (prime the fistula needle with normal saline solution and leave a 10ml syringe attached). Clamp should remain open on the saline filled fistula needle when cannulating. Once the needle has been advanced through the skin, subcutaneous tissue and fistula wall with visible blood flashback, the angle should be decreased/leveled out and the needle advanced slowly up to the hub. If resistance is felt at any time during the needle advancement or needle position change, the needle should be pulled back and the angle redirected. Aspirate for blood return and flush carefully with normal saline to check for any evidence of infiltration. **Rationale:** since blood alone is not enough to show good needle placement, flushing with normal saline will be less traumatic than flushing with blood, should an infiltration occur.

Needles must be taped securely to prevent accidental dislodgement or movement of the needles within the access. Movement of needles within the fistula can result from the patient rotating or bending the access limb, which may lead to poor blood flow and/or needle infiltration. If an infiltration does occur prior to the patient receiving heparin, the needle should be pulled out and digital pressure applied until the bleeding has stopped. If the patient has already received heparin, the infiltration site must be carefully assessed to see if the needle should be pulled out or left in place with ice applied over the site until the dialysis treatment is finished. If the infiltration site remains stable with no increase in the size of the hematoma, the needle can be safely left in place and pulled at the end of treatment. If however the hematoma increases in size, the needle should be removed and digital pressure applied. Never apply pressure to an infiltration site while the needle is still in the vessel, as this could further damage the vessel wall. Should an infiltration occur, cannulation with another needle should be performed as far away as possible from the infiltration site. If the venous needle has caused the infiltration, the second needle should be placed above the infiltration site. If the venous needle must be placed below the infiltration site, it should be placed 1.5 - 2 inches away from the site to prevent
the needle tip from dislodging the clot formation at the site of the infiltration. Following the second cannulation, careful flushing of the venous needle, along with a slow restart of the dialysis pump, should be performed in order to monitor the infiltration site for an increase in hematoma size. It is important to provide patient teaching regarding the infiltration including instruction the application of ice and/or heat and the need for elevation of the infiltrate site. Document on the progress note the patient teaching that has occurred.

*It is important to rotate cannulation sites to avoid one site “itis”.* Cannulating the same area in a vessel can lead to pseudo aneurysm formation. Cannulation throughout the entire fistula helps it mature more evenly. Rotation of cannulation site may be limited by factors such as the size of the fistula and characteristics of the blood vessels. Major reasons cited for failure to rotate sites are patient reluctance and nurse’s preference for convenient cannulation sites. **Neither are acceptable reasons.**

“New” access is defined as:
(1) AVF that has been successfully cannulated for less than 6 weeks.
(2) AVG that has been successfully cannulated for less than 2 weeks.

“Established” access is defined as:
(1) AVF that has been successfully cannulated for 6 weeks or more.
(2) AVG that has been successfully cannulated for 2 weeks or more.

**Matching Skills of Cannulators to the Ease of Cannulating Accesses for Individual Patients** (Refer to Appendix B for description of Access rating). It is recommended that hemodialysis programs match skill level of cannulators to the degree of difficulty of an access to cannulate. Skill level of cannulator is to be determined by vascular access nurse and/or delegate.

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<tr>
<th>Skill Level of Cannulator</th>
<th>Access Rating Approved to Cannulate</th>
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<tr>
<td>Novice</td>
<td>Easy</td>
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<tr>
<td>RNLPN</td>
<td>Easy &amp; moderately complicated</td>
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Advanced
RN/LPN who assesses, cannulates, and troubleshoots needles of AVFs and AVGs designated as “easy,”
“moderately complicated,” or “complicated.”
Cannulates all new accesses.
Forms initial buttonhole tracks.
Uses steel and teflon needles.
Observes cannulation skills of colleagues & offers feedback.

Easy, moderately complicated, & complicated

Same Site Cannulation (Buttonhole Technique)
Same Site Cannulation (Buttonhole Technique) is a needling technique that has been used for over thirty years. First developed in a European country for a patient with a limited access site, it was described in the literature in 1979 by Dr.Z. Twardowski. It is increasingly being used across North America.

The Buttonhole Technique requires putting the needles in the same site, same angle, and same depth to develop a same tissue tunnel track. A track is a tunnel that is created by formation of scar tissue. The track goes from the surface of the skin to the outside wall of the fistula (blood vessel wall). Once the track is healed there are no nerves or tissue in the path of the needle to cause pain.

The candidates who benefit from the Buttonhole Technique are patients with low pain tolerance, with limited cannulation sites, and patients who want to self cannulate. The benefits are: less pain when needled, fewer missed “sticks”, fewer infiltrations, shorter bleeding time post treatment, and patients feel they are more in control of their own care. While the traditional needling “Rope- Ladder Technique” is not always the best option, the alternative Buttonhole Technique may help avoid one “site itis” and decrease aneurysm formation.

Perform physical assessment of the AVF prior to initiating Buttonhole Technique (Same site cannulation) to assess for suitable location of vessels, avoid aneurysmal sites and determine if the patient will self cannulate.

Establishing the track usually takes eight to ten cannulations with a sharp needle by one primary cannulator. If not possible to have one primary cannulator then a maximum of two is recommended with similar needling styles. Thorough scab removal and aseptic technique prior to all cannulations must be maintained.

Once the tunnel is established, use the dull Buttonhole dialysis needle to cannulate. An established track can be needled by persons competent to perform Same Site Cannulation (Buttonhole Technique).

Removing Fistula Needles
Each needle should be withdrawn slowly in the direction and angle they were inserted. Digital pressure should not be applied during needle removal as this may cause damage to the vessel wall. Once the needle has been removed, mild digital pressure using two fingers or fistula clamps should be applied to needle exit sites for 15 minutes. The bruit and thrill should still be detectable above and
below the compression sites. The needle exit sites should be dressed with an adhesive bandage or gauze dressing. Tape may be used to secure the dressing, but must not be so tight as to compress the fistula and restrict the blood flow.

Patient Teaching
Patient teaching is an important component in the care of patients with arteriovenous fistulas. Patients must be taught to:
1. Avoid having blood pressures, blood samples or IVs in the fistula arm.
2. Avoid wearing tight clothing or jewelry that could reduce blood flow to the fistula.
3. Avoid sleeping on the fistula arm or keeping it bent more than 90 degrees for long periods of time.
4. Check the fistula a few times each day for a thrill or bruit (especially after an episode of hypotension, dizziness).
5. Check the fistula for signs of infection (i.e., redness, warmth, drainage).
6. Discuss any concerns with the nurse, nurse practitioner or nephrologists.
7. With Buttonhole Technique- Do not remove the scab with fingernails.

Document all patient teaching that has occurred in the patient health record.

Provide the patient with the CDHA Patient Care Guide for Care of Your Arteriovenous Fistula (WQ85-0651) (View Pamphlet).

Provide the patient with the pocket card Care of the Hemodialysis Arteriovenous (AV) Fistula or AV Graft (PRINA1155 Revised 6/2011).

The following chart outlines desired pump speed for appropriate needle gauge:

<table>
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<tr>
<th>Desired Blood Pump Speed</th>
<th>Recommended Needle Gauge for AVF and AFG</th>
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<tbody>
<tr>
<td>Less than 300mls/min</td>
<td>17 gauge</td>
</tr>
<tr>
<td>300-350 ml/min</td>
<td>16 gauge</td>
</tr>
<tr>
<td>350-450 ml/min</td>
<td>15 gauge</td>
</tr>
</tbody>
</table>

***Arterial pressure must be less than -250mmHg for all needle gauge and pump speeds

Cannulation of a “New” AV Fistula Procedure

Cannulation of a “New” Fistula with a Central Venous Catheter in place
A thorough physical assessment (visual, palpation and auscultation) is required
to determine the maturity of the fistula vessels. A physicians /NP order is required. Cannulation of the fistula should be performed by a skilled/advanced cannulator to minimize the risk of infiltration. If cannulation is not successful, recannulation should only be attempted when the vessel is healed or reassessed to be appropriate for cannulation. If cannulation is unsuccessful and dialysis is required an alternate access (central venous catheter or single needle) may be required and will be under the direction of the nephrologist.

1. 1\textsuperscript{st} cannulation - insert one 17g needle for \textit{arterial supply}; use the CVC for venous return. This allows for assessment of maturity AV fistula and the arterial supply; also there is decreased risk of infiltration. Blood flow through a 17g needle is limited and pre pump arterial pressure should not exceed – 250 mm hg. Slowly increase the pump speed to 200 mls/min. If unable to cannulate successfully use alternative access, one attempt only.

2. 2\textsuperscript{nd} cannulation – repeat step 1

3. 3\textsuperscript{rd} and 4\textsuperscript{th} cannulation – insert one 17g needle for \textit{venous return}, use the CVC for arterial supply. Slowly increase the pump speed to 200mls/min, suggested venous resistance less than 150mmhg. If unable to cannulate successfully use alternative access, one attempt only.

4. 5\textsuperscript{th} cannulation – If steps 1-4 have been successful insert 17g needles for both arterial and venous flow. Slowly increase blood flow to 200mls/min, increasing the blood flow by 50mls/min to maximum flow using nursing assessment of arterial and venous pressure. The venous pressure (resistance) should never exceed the pump speed.

5. There must be three successful cannulations using both arterial and venous needles prior to removal of central venous catheter. A physicians order is required.

6. Gradually increase the needle gauge to (15g) depending on the vessel size, ease of cannulation and acceptable arterial and venous pressures. Recommended arterial pressure should not exceed – 250mmhg and venous pressure should not be greater than 250mmhg.


Cannulation of a “New” Fistula without a Central Venous Catheter in place

A thorough physical assessment (visual, palpation and auscultation) is required to determine the maturity of the fistula vessels. A physicians /NP order is required. Cannulation of the fistula should be performed by a skilled/advanced cannulator to minimize the risk of infiltration. If cannulation is not successful, recannulation should only be attempted when the vessel is healed or reassessed to be appropriate for cannulation. If unsuccessful cannulation and dialysis is required, an alternative access (central venous catheter) may be required or the decision may be made by the nephrologist to use single needle.
1. 1\textsuperscript{st} cannulation - insert 17g needles for both arterial and venous flow. Slowly increase blood flow to 200mL/min. Blood flow through a 17g needle is limited and pre pump arterial pressure should not exceed – 250mmhg, suggested venous resistance less than 150mmhg.

2. 2\textsuperscript{nd} and 3\textsuperscript{rd} cannulation – Repeat step 1, slowly increase blood flow to 200mL/min, increasing the blood flow by 50mL/min to maximum flow using nursing assessment of arterial and venous pressure. The venous pressure (resistance) should never exceed the pump speed.

3. Gradually increase the needle gauge to (15g) depending on the vessel size, ease of cannulation and acceptable arterial and venous pressures. Gradually increase the blood flow; recommended arterial pressure should not exceed – 250mmhg and venous pressure should not be greater than 250mmhg.

4. Document on the Cannulation Protocol sheet CD2530MR ), hemodialysis record sheet (CD1175MR ) and the progress note for any additional comments

5. If cannulation is unsuccessful, may attempt to cannulate a second time. If second cannulation is unsuccessful, consult another skilled cannulator. After proper assessment and only if appropriate, another skilled cannulator may then attempt to cannulate one time. Total maximum of three attempts per cannulation site. It is preferable to insert the needle above the area of infiltration. If unable to cannulate after a total of three attempts per site, consult with physician or nurse practitioner (NP) for assessment.

REFERENCES


http://www.bcrenalagency.ca/professionals/VascularAccess/default.htm


Contemporary Nephrology Nursing, ANNA, 2006, Pitman, New Jersey 08071-0056


Thomsom, Lisa, Petershofer, Elizabeth, Successful hemodialysis with a dual lumen needle, CANNT, Summer 1994.

Twardowski, Zbylut, Constant Site (Buttonhole) Method of Needle Insertion for Hemodialysis, Dialysis & Transplantation, October 1995, Volume 24, Number
SELF TEST

1. Major complications of an AV fistula are:
   1. ________________________
   2. ________________________
   3. ________________________

2. Fistula needles pointing in the same direction should:
   a. Be a minimum of 1" apart hub to hub
   b. Be a minimum of 2" apart bevel to bevel
   c. Be a minimum of 3" apart hub to hub
   d. Be a minimum of 0.5 inches bevel to bevel

3. Fistula needles pointing in the opposite direction should:
   a. Be a minimum of 1" apart hub to hub
   b. Be a minimum of 2" apart bevel to bevel
   c. Be a minimum of 3" apart hub to hub
   d. Be a minimum of 0.5 inches bevel to bevel

4. List 3 nursing assessments performed prior to cannulating a fistula.
   1. ___________________________
   2. ___________________________
   3. ___________________________

5. It is important to rotate cannulation sites because:
   a. It is less painful
   b. It reduces the risk of recirculation
   c. It reduces the risk of infection
   d. It reduces the risk of pseudo aneurysm formation
6. When teaching your patient about the care of his new AV fistula what information would you give them
   a. Palpate the fistula for a thrill several times per day
   b. Avoid sleeping on or wearing anything tight on the extremity with the fistula
   c. How to recognize signs of infection
   d. How to stop bleeding from the fistula
   e. All of the above

7. An advantage of an AV fistula is:
   a. It has longevity
   b. It can be used immediately for dialysis
   c. It can be easily declotted
   d. There is no risk of infection

8. If a needle infiltration occurs prior to heparinization you should:
   a. Leave the needle in until the end of dialysis
   b. Rotate the needle 180 degrees and tape it securely
   c. Apply ice to the site for five minutes, and then slowly remove the needle
   d. Remove the needle and apply digital pressure

9. If a needle infiltration occurs after initiation of dialysis treatment you should:
   a. Leave the needle in until the end of dialysis but reduce the pump speed.
   b. Rotate the needle 180 degrees and tape it securely and reduce the pump speed.
   c. Apply ice to the site for five minutes, the slowly remove the needle
   d. Leave the needle in and apply ice to the site, and continue to assess the size of the hematoma, until the dialysis treatment is finished.

10. When removing the fistula needles, you must apply pressure during needle removal.
    True ___       False _____
11. Advantages of AV grafts over native fistula’s are:
   a. Can be used sooner
   b. Easier to needle
   c. Size and blood flow are not dependent on vein maturation
   d. All of the above

12. The preferred type of graft is:
   a. Saphenous vein graft
   b. Umbilical vein graft
   c. PTFE graft
   d. None of the above

13. The preferred placement site of AV grafts is:
   a. In the right thigh
   b. Straight radial cephalic
   c. Straight upper arm graft
   d. Looped brachial-cephalic

14. To avoid thrombosis of PTFE grafts:
   a. Use clamps on needle sites
   b. Use high UF rates
   c. Avoid excessive pressure after needle removal
   d. None of the above

15. A “new” fistula is defined as:
   a. AVF that has been successfully cannulated for less than 6 weeks
   b. AVF that has been successfully cannulated for less than 2 weeks
   c. AVF that has been successfully cannulated for more than 6 weeks.
   d. AVF that has been resting for 2 weeks

16. What is Same Site Cannulation (Buttonhole)?
   a. Putting the needles in same site
   b. Putting the needles in the same angle
   c. Putting the needles in the same depth
   d. All of the above

17. List three reasons why Same Site Cannulation (Buttonhole Technique)
may be a beneficial needling choice.

a. _______________
b. _______________
c. _______________

18. A “Track” is created by the same person inserting sharp needles________ times.

19. Two things to remind the patient regarding removal of the scab

a. ___________________
b. ___________________
ANSWERS
1. Thrombosis, arterial steal syndrome, pseudoaneurysm formation, venous hypertension, hematoma.

2. c) be a minimum of 3" apart hub to hub

3. a) be a minimum of 1" apart hub to hub

4. Visual inspection for infection, Determine patency (auscultation/palpation), assess dialysis flowsheets, kardex and progress notes.

5. d) it reduces the risk of pseudoaneurysm formation

6. e) all of the above

7. a) it has longevity

8. d) remove the needle and apply digital pressure

9. d) leave the needle in and apply ice to the site until the dialysis treatment is finished.

10. False

11. d) all of the above

12. c) PTFE graft

13. d) looped brachial-cephalic

14. c) avoid excessive pressure after needle removed

15. a) AVF that has been successfully cannulated for less than 6 weeks

16. d) all of the above

17. a) Less pain when needled b) fewer missed sticks 
   c) less infiltrates d) shorter bleeding time 
   e) less chance of being picked with a sharp needle 
   f) patients are happier

18. 8-10 times

19. a) Use plastic cannula or Capick to remove each scab
b) Do not remove the scab with your fingernails
### PROFICIENCY STANDARD SKILLS CHECKLIST

#### Cannulating an AVF/AVG

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assemble the equipment (refer to procedure).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Confirm that patient has washed arm</td>
<td></td>
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<tr>
<td>3. Wash hands prior to procedure.</td>
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</tr>
<tr>
<td>4. Place tourniquet loosely around fistula arm for AV fistula only. <strong>Do not use tourniquet on graft.</strong></td>
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</tr>
<tr>
<td>5. Palpate, inspect and auscultate fistula/graft to confirm needle placement and blood flow direction. Remove tourniquet if applicable.</td>
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<tr>
<td>6. Apply protective goggles/glasses/face shield, mask and gloves.</td>
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</tr>
<tr>
<td>7. Clean 6 inch radius of needle placement sites with separate chlorhexidine (Solu-IV) swab. Allow to dry for 2 minutes. Use betadine if allergic to chlorhexidine.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. Open fistula needles, visually check tubing for patency, sharpness of needles, and loosen sealing caps. Connect saline filled syringes to fistula needles and flush the needles. If obtaining blood, keep one fistula needle dry.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Place tourniquet on arm to dilate vessels. <strong>(Do not use on graft).</strong></td>
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</tr>
<tr>
<td>10. a. (For native AV fistula only). Hold skin taut and insert fistula needle at 20-35 degree angle with bevel up.</td>
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<td></td>
</tr>
<tr>
<td>b. (For AV graft only). Stabilize graft by pulling skin taut in the opposite direction of the needle insertion, insert fistula needle at 45 degree angle with the bevel up until a “pop” was felt, and then reduce angle and slowly advance the needle to the hub</td>
<td></td>
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</tr>
<tr>
<td>11. Observe for back flash in fistula needle tubing,</td>
<td></td>
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<tr>
<td>12. Reduce angle of needle while slowly advancing.</td>
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</tr>
<tr>
<td>13. <strong>Release tourniquet on AV fistula.</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>15. Tip syringe at 90° angle, pull back on plunger, tap to remove air, place fingers at a tip of needle and flush if no resistance. Clamp. If resistance felt, pull back needle and redirect at different angle. Flush and clamp.</td>
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</tr>
<tr>
<td>16. If tip felt, place 2x2 gauze under wings and tape securely.</td>
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</tr>
<tr>
<td>17. Repeat steps 9, 10, 11, 12 and 13 for second needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>18. a. (If obtaining blood sample) attach vacutainer holder to vacutainer Luer lock adaptor.</td>
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</tr>
<tr>
<td>b. Open fistula needle clamp, withdraws appropriate amount of blood for sample.</td>
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</tr>
<tr>
<td>c. Close fistula needle clamp. Remove vacutainer and flush fistula needle with saline</td>
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</tr>
<tr>
<td>19. Initiate dialysis as per unit policy.</td>
<td></td>
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</tr>
<tr>
<td>20. Secure tubing and needles to arm, ensuring placement and function are not compromised.</td>
<td></td>
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</tr>
</tbody>
</table>
21. Document needle size, cannulation sites and any needling problems on the hemodialysis record sheet and progress notes as appropriate.
# PROFICIENCY STANDARD SKILLS CHECKLIST

## Same Site Cannulation (Buttonhole Technique)

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1.</strong> Follow Proficiency Standard Skills Checklist: Cannulating AVF /AVG Number 1-7 inclusive</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>2.</strong> Apply Solu-IV swab to soak each scab in order to soften scab. Do not over soak scab as it will become mushy and make it difficult to remove. Using aseptic technique, use a plastic cannula or capick to remove the scab.</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>3.</strong> Clean 6 inch radius of needle placement sites with separate chlorhexidine (Solu-IV) swab. Allow to dry for 2 minutes. Use betadine if allergic to chlorhexidine</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>4.</strong> Open fistula needles (sharp or Buttonhole needle), visually check tubing for patency, sharpness of needles, and loosen sealing caps. Connect saline filled syringes to fistula needles and flush the needles. If obtaining blood, keep one fistula needle dry</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>5.</strong> Place tourniquet on arm to dilate vessels</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
| **6.** a. Hold skin taut and inserts fistula needle at 20-35 °angle with the bevel up.  
   b. Using the same angle, same depth and same site use a sharp dialysis needle to create the “track”. Use a dull Buttonhole needle to tunnel the “track”. (For Native AV fistula only.)  
   c. Observe for back flash in fistula needle tubing  
   Reduce angle of needle while slowly advancing |     |    |
| **7.** Release tourniquet on AV fistula |     |    |
| **8.** Secure needle with tape. |     |    |
| **9.** a. Tip syringe at 90° angle, pull back on plunger, tap to remove air, place fingers at tip of needle and flush if no resistance. Clamp  
   b. If resistance felt, pull back needle and redirect at different angle. Flush and clamp  
   c. If tip felt, place 2x2 gauze under wings and tape securely |     |    |
| **10.** Repeat steps 4, 5, 6, 7, 8 for second needle. |     |    |
| **11.** a. (If obtaining blood sample) attach vacutainer holder to vacutainer Luer lock adaptor.  
   b. Open fistula needle clamp, withdraws appropriate amount of blood for sample  
   c. Close fistula needle clamp. Remove vacutainer and flush fistula needle with saline. |     |    |
| **12.** Initiate dialysis as per unit policy |     |    |
| **13.** Secure tubing and needles to arm, ensuring placement and function are not compromised. |     |    |
|   | Document needle size, cannulation sites and any needling problems the hemodialysis record sheet, Same Site Cannulation sheet and the progress notes as appropriate. |   |   |
## PROFICIENCY STANDARD SKILLS CHECKLIST
### Removal of Fistula Needles

<table>
<thead>
<tr>
<th>SKILLS</th>
<th>YES</th>
<th>NO</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Assemble equipment (refer to procedure).</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2. Apply gloves/protective goggles/glasses/face shield and mask.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3. Return Blood as Per Protocol</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4. If Post blood work required:</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a. Ensure needles are clamped. Attach a 10 mL syringe to fistula needle and open clamp. Withdraw 10 mL of blood from arterial needle. Reclamp arterial needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>b. Remove white cap from blue vacutainer adaptor and attach to vacutainer holder</td>
<td></td>
<td></td>
</tr>
<tr>
<td>c. Remove syringe from fistula needle; maintain sterility as this will be returned to patient and attach vacutainer holder. Open clamp. Insert necessary blood tubes into vacutainer holder and fill. Reclamp fistula needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>d. Remove vacutainer holder. Attach syringe with patient’s blood, open clamp and return patient’s blood. Close clamp and attach normal saline syringe and flush fistula needle</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5. Ensure that both fistula needles are clamped.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6. Gently place bandaid/sureseal® or 4x4 gauze over needle puncture site</td>
<td></td>
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</tr>
<tr>
<td>7. Remove needle at a 20° angle being careful not to apply pressure until needle is out</td>
<td></td>
<td></td>
</tr>
<tr>
<td>8. a. Apply pressure to needle puncture site x 15 minutes with fingertips. Use fistula clamps, if no one available to hold with fingertips on native fistula only. Ensure that bleeding has stopped.</td>
<td></td>
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</tr>
<tr>
<td>b. Apply pressure to needle puncture site x 15 minutes for graft with 2 fingertips. Ensure that bleeding is stopped from first site prior to removing second needle from graft.</td>
<td></td>
<td></td>
</tr>
<tr>
<td>9. Apply appropriate dressing to needle puncture site</td>
<td></td>
<td></td>
</tr>
<tr>
<td>10. Document on hemodialysis record sheet</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Appendix A

Transonic Monitoring

GUIDELINES

1. Transonic monitoring should be performed initially every month for 3 months to establish a baseline and then every 2 months on all patients with fistulas.

2. Transonic monitoring should be performed every month on all patients with grafts.

3. The patient should be assessed for a fistulogram if:
   a. AVF access flow is less than 400-500 mL/min. or AVG access flow less than 600 mLS/min
   b. Access flow that has decreased greater than 25% decrease in flow over four months from baseline flow.
   c. Recirculation is greater than 0%.

4. Procedure guidelines are as follows:
   a. Should not respond to a single isolated abnormal value.
   b. Transonic measurement preferably to be completed during the first 1.5 hour of dialysis. Do not perform transonic monitoring when patient is hypotensive.
   c. Do not perform transonic in the last hour of dialysis (potential hypotension in patients with decreased cardiac output related to ultrafiltration)
   d. It is preferred not to perform monitoring on blood work day.
   e. It is preferred for the arterial needle to be pointing towards the anastomosis.
   f. Recommended that needles be placed in a single segment at least 3 inches apart.
   g. If concerns regarding access flows, repeat transonic the next month.
   h. If known to have recurring stenosis or stent, transonic monitoring to be done monthly.

5. Post fistuloplasty the following will occur:
   a. Transonic to be completed as soon as possible post plasty.
   b. Post plasty transonic monitoring should be completed monthly x 3 months. If access flows are stable, transonic monitoring with be completed every 2 months.

6. Documentation will include the following:
   a. Date and time of transonic procedure
   b. Location of fistula/graft.
c. Identification of needle size and direction.
d. Notation of any needling difficulties.
e. Access flow analysis.

7. Follow-up care: - Notify Access coordinator with pertinent findings

REFERENCES

## Appendix B: Ease of Access to Cannulate

<table>
<thead>
<tr>
<th>Ease of Access to Cannulate</th>
<th>Criteria for AVFs</th>
<th>Criteria for AVGs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Easy</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Can be cannulated by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>a novice, skilled, or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>advanced cannulator</td>
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<tr>
<td>• AVF that has been</td>
<td></td>
<td>AVG that has been</td>
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<tr>
<td>successfully cannulated</td>
<td></td>
<td>successfully</td>
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<tr>
<td>with no infiltrations for</td>
<td></td>
<td>cannulated with</td>
</tr>
<tr>
<td>at least 6 weeks (established</td>
<td></td>
<td>no infiltrations</td>
</tr>
<tr>
<td>AVF)</td>
<td></td>
<td>for at least 2</td>
</tr>
<tr>
<td>• Well matured</td>
<td></td>
<td>weeks (i.e.,</td>
</tr>
<tr>
<td>• Vein firm, easily</td>
<td></td>
<td>established AVG)</td>
</tr>
<tr>
<td>palpated and stable upon</td>
<td></td>
<td>• Palpable,</td>
</tr>
<tr>
<td>palpation (vein diameter of</td>
<td></td>
<td>uniform sized</td>
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<tr>
<td>greater than 0.6 cm)</td>
<td></td>
<td>graft in a loop</td>
</tr>
<tr>
<td>• Vein superficial (vein</td>
<td></td>
<td>or straight</td>
</tr>
<tr>
<td>depth of less than 0.6 cm</td>
<td></td>
<td>configuration</td>
</tr>
<tr>
<td>with discernible margins)</td>
<td></td>
<td>• Sufficient</td>
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<tr>
<td>• Area of straight vein</td>
<td></td>
<td>surface area for</td>
</tr>
<tr>
<td>available for cannulation</td>
<td></td>
<td>cannulation</td>
</tr>
<tr>
<td>• No irregular/dilated</td>
<td></td>
<td>• No irregular/dil</td>
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<tr>
<td>areas or aneurysm formations</td>
<td></td>
<td>ited or edematous</td>
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<tr>
<td>that interfere with</td>
<td></td>
<td>areas</td>
</tr>
<tr>
<td>cannulation</td>
<td></td>
<td>• No signs of</td>
</tr>
<tr>
<td>• No collateral veins</td>
<td></td>
<td>pseudoaneurysm</td>
</tr>
<tr>
<td>visible that interfere with</td>
<td></td>
<td>formation</td>
</tr>
<tr>
<td>cannulation</td>
<td></td>
<td>• No signs of</td>
</tr>
<tr>
<td>• No edema, bruising, or</td>
<td></td>
<td>bruising or local</td>
</tr>
<tr>
<td>signs of local infection</td>
<td></td>
<td>infection</td>
</tr>
<tr>
<td>• Access flow of greater</td>
<td></td>
<td>• Access flow of</td>
</tr>
<tr>
<td>than 500 mL/min</td>
<td></td>
<td>greater than 650</td>
</tr>
<tr>
<td>• No limb tremors or muscle</td>
<td></td>
<td>mL/min</td>
</tr>
<tr>
<td>spasms</td>
<td></td>
<td>• No limb tremors</td>
</tr>
<tr>
<td>• Patient is not anxious</td>
<td></td>
<td>or muscle spasms</td>
</tr>
<tr>
<td>about needling or restless</td>
<td></td>
<td>• Patient is not</td>
</tr>
<tr>
<td>or confused</td>
<td></td>
<td>anxious about</td>
</tr>
<tr>
<td>• If buttonhole, well</td>
<td></td>
<td>needling or rest-</td>
</tr>
<tr>
<td>established track</td>
<td></td>
<td>less or confused</td>
</tr>
<tr>
<td><strong>Moderately Complicated</strong></td>
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<tr>
<td>Can be cannulated by</td>
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<td></td>
</tr>
<tr>
<td>a skilled, or advanced</td>
<td></td>
<td></td>
</tr>
<tr>
<td>cannulator</td>
<td></td>
<td></td>
</tr>
<tr>
<td>• Same as criteria for “easy” AVFs but have 1 of the cannulation complications listed under “complicated” AVFs OR • New AVF that meets all criteria for “easy” except it has not yet been cannulated for 6 weeks</td>
<td>• Same as criteria for “easy” AVGs but may have 1 of the cannulation complications listed under “complicated” AVGs OR • New AVG that meets all criteria for “easy” except it has not yet been cannulated for 2 weeks</td>
<td></td>
</tr>
<tr>
<td><strong>Complicated</strong></td>
<td></td>
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<tr>
<td>Can be cannulated by</td>
<td></td>
<td></td>
</tr>
<tr>
<td>an advanced cannulator</td>
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</tr>
<tr>
<td>• Same as criteria for “easy” AVFs but have 2 or more of the cannulation complications listed below: • Vein not easily palpable (vein deep or inconsistent depth; vein depth of greater than 0.6 cm; vein may roll upon palpation) • Vein narrow (vein diameter of less than 0.6 cm) • Poorly defined area of straight vein available for cannulation • Visible dilated area or aneurysm formation that may interfere with cannulation • has signs of edema, bruising, or local infection • Recent and repeated infiltrations • Access flow of less than 500 mL/min</td>
<td>• Same as criteria for “easy” AVGs but have 2 or more cannulation complications listed below: • Graft difficult to palpate and/or not a uniform size (i.e.: may bulge in places) • Graft deep or inconsistent depth (may be flat and/or mushy to palpate) • Limited area available for cannulation • Signs of false aneurysm • Access limb has signs of edema, bruising, or local infection</td>
<td></td>
</tr>
<tr>
<td>Patient has muscle spasms or limb tremors</td>
<td>infection</td>
<td></td>
</tr>
<tr>
<td>Patient is highly anxious about needling or restless and confused</td>
<td>• Recent and repeated infiltrations</td>
<td></td>
</tr>
<tr>
<td>• New AVF that has one or more of the cannulation complications listed above</td>
<td>• Access flow of less than 650 mL/min</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>• Patient has muscle spasms or limb tremors</td>
<td></td>
</tr>
<tr>
<td>• Established or new AVF in which a buttonhole track is being established.</td>
<td>• Patient is highly anxious about needling or restless and confused</td>
<td></td>
</tr>
<tr>
<td>OR</td>
<td>• New AVG that has one or more of the cannulation complications listed above.</td>
<td></td>
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</tbody>
</table>