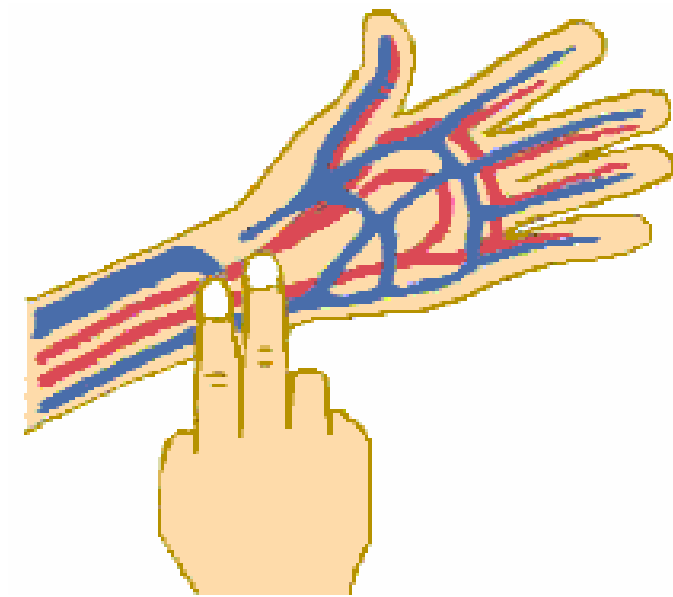


On Course With Cannulation



Techniques & Troubleshooting AV Fistulas for Dialysis Staff

Northwest Renal Network would like to thank the following members of the Cannulation Committee for their assistance in the creation of this booklet:

C.J. Kuan, MD, PhD
Nephrologist
Kidney & Arthritis Clinic, Everett, WA

Linda Jackson, RN, BSN, CNN
Director of Nursing Services
Puget Sound Kidney Centers, Everett, WA

Becky Lee, RN, CNN
Nephrology Case Manager
Renaissance Health Care, Inc, Westport, WA

Liz Swift, RN, CNN
Staff Educator
Skagit Valley Kidney Center, Mt. Vernon, WA

Barbara Warfield, RN, CNN
Vascular Access Coordinator
St. Alphonsus Nephrology Center, Boise, ID

A special thanks to Phillip Cade, MSW

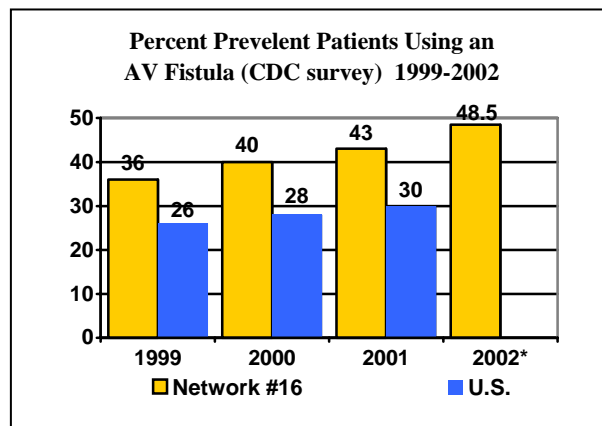
The principal author of this booklet is:
Lynda K. Ball, RN, BSN, CNN
Quality Improvement Coordinator
Northwest Renal Network
206.923.0714 x 111
lball@nw16.esrd.net

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Introduction

All ESRD Networks have begun to work with the Centers for Medicare & Medicaid Services (CMS) and the Institute for Healthcare Improvement (IHI) to design and implement a multi-year collaborative quality improvement initiative to increase the appropriate use of arteriovenous fistulae (AVFs) in hemodialysis patients. This initiative is called the **National Vascular Access Improvement Initiative (NVAII) – Fistula First**. As part of the initiative, ESRD providers will be working with their Network to raise AVF utilization rates in their geographic area. Northwest Renal Network will be implementing “Fistula First” in the States of Alaska, Idaho, Montana, Oregon and Washington.

Northwest Renal Network has been a leader in the nation in utilization of AV Fistulae in our hemodialysis patient population for several years (see below).



Because cannulation of AVFs is technically more challenging than AV grafts, this booklet has been designed to assist nurses, technicians, and educators in improving the cannulation techniques to maintain our patient’s fistulae.

Assessing the Patient's Access

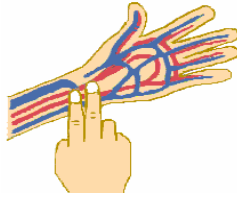


Observation

- Redness/edema/bruising
- Infection/abscess/drainage
- Infiltration
- Previous needle sites
- Choose new needle sites (include patient)

Palpation

- Track of the access
- Thrill
- Pulse



Auscultation

- Bruit
- Direction of flow



Preparation for Needle Insertion

- Patient should wash their access with anti-bacterial soap and water before coming to their chair.
- Apply Betadine in a circular motion from each selected needle site outward and let it dry completely.
- If iodine allergy, use 70% alcohol. Clean sites in a circular motion for 60 seconds immediately prior to each needle insertion.

Local Anesthetics

- Intra-dermal lidocaine to arterial then venous sites. Use of lidocaine should be discouraged as it causes scarring. It should be used only by request of the patient.
- Ethyl chloride spray to arterial site just prior to inserting needle, then to venous site just prior to inserting needle.
- EMLA cream should be applied to the access and covered with saran wrap by the patient one hour prior to dialysis. At the unit, the patient should remove the saran wrap and wash their access as stated above.

Anchoring the Access

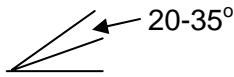
- Use the “three-point technique” – thumb and forefinger to stabilize the vessel. Use a finger from the needle hand to retract the skin to make it taut - this allows easier cannulation through the skin and helps to compress the nerve cells resulting in less pain.



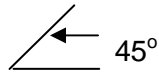
- Always insert needles bevel up.
- Once you see the flashback: stop advancing; drop the angle to skin surface; and, advance down the center of the vessel.

Angles of Entry

- Rule of thumb:
20-35° angles for fistulas



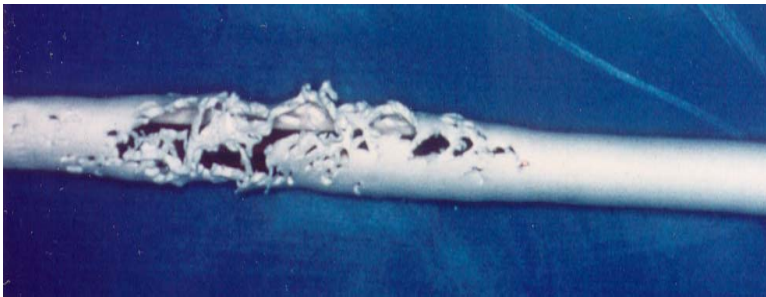
- 45° angle for grafts



- Reality:
Not every access will fit the “rule of thumb.” You will need to carefully assess the depth of the access and adjust your cannulation angle accordingly.

Rope (Site rotation) Technique – AVFs and grafts

- Can use different “stickers” and insertion sites.
- Utilizes the entire length of the access for cannulation.
- Prevents “one-site-itis” – see below.



- Needle tips need to be at least 1½” apart.
- Needles need to be at least 1½” away from an anastomosis.
- Avoid aneurysms, curves, and flat spots.
- Patient can self-cannulate.

Clamps

- Clamps should **never** be used on a new fistula.
- Clamps have no adjustability, and excess pressure on an access can cause it to clot off.
- All patients should be taught to hold their own sites or have a family member hold them.
- If clamps must be used, they should **never** be left on the access for more than 20 minutes.
- Clamp usage should be discouraged in your facility.

Flipping Needles

- Flipping needles can accidentally core an access requiring surgical repair.
- Flipping needles can cause the insertion site to enlarge allowing bleeding from the sites.
- Flipping needles should be discouraged in your facility.

Buttonhole (Constant-site) Technique – AVFs only

“Establish the Track”

- Same “sticker” for a minimum 8 cannulations (diabetics may take longer).
- Same angle, depth, and same insertion site every treatment.
- When the track is established, change to blunt needles and other “stickers” (e.g., patients and other staff).

Procedure

- Assess the access.
- Remove the scabs from previous needle insertions with disinfected tweezers.
- Clean sites per unit protocol.
- Using the 3-point technique, stabilize the access and pull the skin taut.
- Insert the needles at the appropriate angle and depth for the access - keeping the same angle and depth for every cannulation.
- When flashback is observed, lower angle of insertion.
- Advance needle down the center of the vessel.
- Place tape over the wings and the insertion site.
- Confirm good flow using a syringe.
- Place chevrons, made from ½” plastic tape, under the needle, then cross over each wing in an “X” pattern to secure needles.
- Continue “On” procedure per unit protocol.

Benefits

- Patient can, and should, learn to self-cannulate.
 - Less painful for the patient.
 - Fewer infections.
 - Fewer missed sticks.
 - Fewer infiltrations.
- } extends the life of the AVF
- Blunt needles meet OSHA Bloodborne Pathogen requirements – safer for the staff and patient.

Cannulation of a New AV Fistula

Policy: Newly created primary AVF shall be allowed to develop for at least 8-12 weeks prior to cannulation. Initial attempts to perform dialysis via new fistulae shall proceed with caution. Without exception, fistulae shall not be progressed faster than these guidelines **without MD order**. All patient care personnel are responsible for implementing this policy.

Procedure:

1. Obtain order from vascular surgeon or nephrologist to begin cannulation of fistula 8 to 12 weeks after creation. All new fistulae should be examined by surgeon, nephrologist, and designated staff member before cannulation is initiated.
2. Only staff identified as demonstrating best cannulation practice techniques should be assigned to cannulate NEWLY developing fistulae.
3. **ALWAYS USE A TOURNIQUET**, even with well-developed fistulae. **NO EXCEPTIONS!**
4. Explain procedure to patient.
5. Educate patient on:
 - Checking the access daily for a thrill and for signs and symptoms of infection.
 - Performing fistula exercises to promote maturation process.
 - Understanding that hematoma could occur - most likely during the first two weeks of using the access.
 - For infiltrations, provide written materials about icing, elevation, and heat application.

Week One

- Check with charge nurse for any doctor-ordered heparinization changes. Heparin prime and hourly should be decreased by half of the ordered dose for the first week to prevent bleeding into the surrounding tissue. It may be necessary to initiate saline flushes during this week of decreased heparin.
- If no other access present, use two 17-gauge needles. **ALWAYS** stay at least 1.5-2” from the anastomosis.
- If catheter present, use 17-gauge needle as the arterial, and use catheter for venous return.
- Using a 25° angle, cannulate the fistula.
- Stabilize the butterfly with tape. Secure the access with a chevron.
- Instruct patient not to move access extremity, in order to prevent infiltration.
- Remove needles at the same angle as the angle of insertion. Never apply pressure before the needle is completely out. Apply pressure for 10 minutes, without peeking – no exceptions.
- Clamps are **NOT** to be used.

For week one: Use 17-gauge needles at a blood flow rate (BFR) of 250 ml/min. If BFR not tolerated, reduce to 200 ml/min. **** Blood flow rates are recommendations and can be modified based on center-specific guidelines.**

ONLY INCREASE BF RATES IF NO EVIDENCE OF INFILTRATION OR OTHER PROBLEMS NOTED.

Report any cannulation or BFR problems to the charge nurse.

Week Two

- If the first week is successful, cannulate with 16-gauge needles, rotating cannulation sites.
- Blood flow rate recommended: 300 ml/min.

Week Three

- Either repeat procedure for Week Two or may attempt to progress to prescribed BFR and needle gauge. When increasing BFR, recommend matching needle gauge to BFR as shown in the chart below.

(This policy may vary based on policies and procedures of specific dialysis Providers)

Infiltration instructions

If the fistula infiltrates, let it “rest” for one week and then go back to smaller gauge needles.

If the fistula infiltrates a second time, wait another two weeks and then go back to smaller gauge needles.

If the fistula infiltrates a third time, notify surgeon.

Catheter removal instructions

The patient’s catheter is not to be removed until the patient has had **SIX CONSECUTIVE SUCCESSFUL** arterial/venous needle cannulations at the prescribed BFR and needle gauge.

RECOMMENDED: It is important to match needle gauge to blood flow rate.

BLOOD FLOW RATE	RECOMMENDED NEEDLE GAUGE
< 300 ml/min	17-gauge
300-350 ml/min	16-gauge
350-450 ml/min	15-gauge
> 450 ml/min	14-gauge

Note: These are minimum recommended gauges for the stated BFR settings. Larger needles, when feasible, will reduce (make less negative) pre-pump arterial pressure and increase delivered blood flow.

TIPS AND TROUBLESHOOTIN

Time – Take your time to perform a good assessment of the access and chose your sites wisely. If in doubt, ask for help.

Technique – Use the three-point technique every time you cannulate. Needles go in smoother and are less painful.

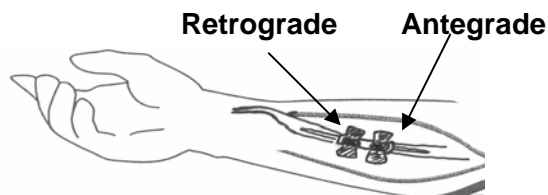
Resistance – Stop when you encounter resistance. Pull back slightly and readjust your direction and/or angle.

Infiltration – If infiltration occurs before dialysis is initiated, remove the needle. If it occurs after heparinization, leave the needle in place (unless it is causing extreme pain for the patient) and place another needle above the infiltrate. After the “on” is complete, place ice on the site. Teach the patient to elevate and ice the access at home if the infiltrate is large.

Vessel Spasm – Sometimes fistula diameters are small and when the blood pump is turned up the vessel will spasm, causing machine alarms. Placing the arterial needle toward the arterial anastomosis (retrograde) may help.

Deep Access – If you are having a hard time feeling the access, use your stethoscope to listen for the bruit along the entire length of the access. Do not just stick blindly or use prior needle tracks. Assess the access.

Taping – Taping an AV fistula needle site tightly can cause the needle to rest against the vessel wall resulting in poor arterial flow and frequent arterial pressure alarms. This is a particular problem with a very superficial mature fistula. This can be avoided by taping securely, not tightly.



NKF-K/DOQI VASCULAR ACCESS CLINICAL PRACTICE GUIDELINES 2000 UPDATE SUMMARY

Abbreviated Introduction:

“Adequate care of an ESRD hemodialysis-dependent patient requires constant attention to the need to maintain vascular access patency. An ideal access delivers a flow rate adequate for the dialysis prescription, has a long use-life and has a low rate of complications. Although no current access type fulfills all of these criteria, the native arteriovenous fistula (AVF) comes the closest to doing so. The substitution of synthetic grafts for native AVFs has increased patient care costs in part due to the increased number of procedures needed to maintain patency of grafts compared to AVFs. After evaluating all of the available data on vascular access, the Vascular Access Work Group concluded that quality of life and overall outcomes for hemodialysis patients could be improved significantly by achieving two primary goals: increasing the placement of native AVFs and detecting access dysfunction prior to access thrombosis.”

Note: For the purpose of this Summary Paper, evidence-based and opinion-based guideline information related to the AVF will be addressed. For the complete text of the K/DOQI Vascular Access Clinical Practice Guideline Update, please refer to the [American Journal of Kidney Diseases](#), Volume 37, Number 1 (January 2000), pages S141-S149 or go to www.kidney.org/professionals/kdoqi/guidelines.cfm

I. Patient Evaluation Prior to Access Placement

Guidelines 1-9

II. Monitoring, Surveillance, and Diagnostic Testing

Guidelines 10-12

Guideline 10: Definition of terms, monitoring, surveillance, and diagnostic testing of AV grafts

- Physical exam of vascular access should be performed weekly and include, but not be limited to, inspection and palpation for pulse and thrill at the arterial, mid, and venous sections of the access. (Opinion)

- Available techniques that can be used to monitor for stenosis in AV grafts include:
 - ✓ Intra-Access Flow (Evidence)
 - ✓ Static venous pressures (Evidence)
 - ✓ Dynamic Venous Pressures (Evidence)
 - ✓ Access recirculation (Evidence)
 - ✓ Decreases in KT/V or URR (Evidence)
 - ✓ Physical findings: arm swelling, graft clotting, prolonged bleeding after needle removal, change in thrill or bruit (Evidence/Opinion)
 - ✓ Elevated negative arterial pump pressures limiting blood flow rates (Evidence/Opinion)
 - ✓ Doppler ultrasound (Evidence/Opinion)
 - Persistent abnormalities in any of these parameters should prompt referral for venography. (Evidence)

Guideline 11: Monitoring primary AV fistula for stenosis

- Primary AV fistulae should be monitored for stenosis as outlined for dialysis AV grafts. (Opinion)
- Direct flow measurements are preferable, if available, compared to more indirect measures. (Evidence)
- Indirect measurement methods (i.e., dynamic and static venous pressures) are not as accurate for monitoring AV fistulae. (Evidence)
- Recirculation and Doppler analyses are both of possible benefit. (Opinion)

Guideline 12: Recirculation methodology, limits, evaluation, and follow-up.

- Recirculation should be measured using a nonurea-based dilutional method or the two needle urea-based method. (Evidence)
- The three-needle peripheral vein method of measuring recirculation should not be used. (Evidence)
- If access recirculation is >20%, correct needle placement should be confirmed before further testing (Evidence/Opinion)
- Elevated levels of access recirculation should be evaluated using angiography (fistulography) to determine stenosis (Evidence).

Guideline 13: Infection Control Measures

- Staff and patient education should include instruction on infection control measures for all hemodialysis access sites (Opinion).

Guideline 14: Skin Preparation Technique for Permanent AV Accesses

- A clean technique for needle cannulation should be used for all cannulation procedures (Evidence).

1. Locate and palpate the needle cannulation sites prior to skin preparation.
2. Wash access site using an antibacterial soap or scrub (e.g., 2% chlorhexidine) and water.
3. Cleanse the skin by applying 70% alcohol and/or 10% povidone iodine using a circular rubbing motion.

Notes:

- Alcohol has a short bacteriostatic action time and should be applied in a rubbing motion for 1 minute immediately prior to needle cannulation.
- Povidone iodine needs to be applied for 2-3 minutes for its full bacteriostatic action to take effect and must be allowed to dry prior to needle cannulation.
- Clean gloves should be worn by the dialysis staff for cannulation. Gloves should be changed if contaminated at any time during the cannulation procedure.
- New, clean gloves should be worn by the dialysis staff for each patient.

Guideline 15: Catheter Care and Accessing the Patient's Circulation

Guideline 16: Managing Potential Ischemia in a Limb Bearing an AV Access

- After AV access surgery, all patients should be monitored for development of limb ischemia (Opinion).
- High-risk group (the elderly, those with diabetes and multiple access attempts in an extremity) should be monitored for the first 24 hours post-op (Opinion).
- Patients with an established fistula should be assessed monthly for ischemia (Opinion).
- Refer patients with new findings suggestive of ischemia to a vascular access surgeon emergently (Opinion).

Guideline 17: When to Intervene – Dialysis AV Grafts for Venous Stenosis, Infection, Graft Degeneration and Pseudoaneurysm Formation

- Hemodynamically significant stenosis (Evidence).
- Infection (Evidence).
- Graft degeneration and pseudoaneurysm formation when severe degenerative changes of the graft or overlying skin are present; the skin above the graft is compromised; there is a risk of graft rupture or spontaneous bleeding; limited puncture sites are available (Opinion).

Guideline 18: When to Intervene – Primary AV Fistulae

- For primary AV fistulae appropriate intervention should be initiated upon identification of:
 1. Inadequate flow to support the prescribed dialysis blood flow (Evidence/Opinion).
 1. Hemodynamically significant venous stenosis (Evidence).
 2. Aneurysm formation when the skin overlying the fistula is compromised; there is risk of a fistula rupture; available puncture sites are limited (Opinion).

Guideline 19: Treatment of Stenosis Without Thrombosis in Dialysis AV Grafts and Primary AV Fistulae

- Treatment with percutaneous transluminal angioplasty (PTA) or surgical revision is indicated when stenoses are > 50% of the lumen diameter and are associated with the following clinical/physiological abnormalities: (Evidence)
 1. Previous thrombosis in the access
 2. Elevated venous dialysis pressure
 3. Abnormal urea or other recirculation measurements
 4. Abnormal physical findings
 5. Unexplained decrease in KT/V or URR
 6. Decreasing access flow
- Each dialysis center should determine which procedure is best, based on the expertise at that center (Evidence/Opinion).
- Following intervention, stenosis, as well as the clinical parameters used to detect it, should return to within acceptable limits (Evidence).
- Centers should monitor stenosis treatment outcomes on the basis of patency; reasonable patency goals are:
 1. PTA: 50% unassisted patency at 6 months (Evidence)
 2. Surgical Revision: 50% unassisted patency at one year (Opinion).
- If angioplasty is required more than twice within 3 months, refer for surgical revision if such an option is available and if the patient is a good surgical candidate (Opinion).
- Stents are useful in selected instances (e.g., limited residual access sites, surgically inaccessible lesions, contraindications to surgery) when PTA fails (Evidence).

Guideline 20: Treatment of Central Vein Stenosis

- Stent placement combined with angioplasty is indicated in elastic central vein stenoses or if a stenosis recurs within a 3-month period (Evidence).

Guideline 21: Treatment of Thrombosis and Associated Stenosis in Dialysis AV Grafts**Guideline 22: Treatment of Thrombosis in Primary AV Fistulae**

- Each institution should attempt to resolve thrombosis with a preferred institutional technique (Opinion).

Guideline 23: Treatment of Tunneled Cuffed Catheter Dysfunction**Guideline 24: Treatment of Infection of Dialysis AV Grafts****Guideline 25: Treatment of Infection of Primary AV Fistulae**

- Infections of primary AV fistulae are rare and should be treated as subacute bacterial endocarditis with 6 weeks of antibiotic therapy. Fistula take-down is required in cases of septic emboli (Opinion).

Guideline 26: Treatment of Infection of Tunneled Cuffed Catheters**Guideline 27: Treatment of Pseudoaneurysm of Dialysis AV Grafts****Guideline 28: Aneurysm of Primary AV Fistulae**

- Aneurysms of primary AV fistulae require surgical intervention only when the aneurysm involves the arterial anastomosis. Avoid cannulating the aneurysm (Opinion).

Guideline 29: Goals of Access Placement – Maximizing Primary AV Fistulae

- Primary AV fistulae should be constructed in at least 50% of all new kidney failure patients electing hemodialysis. Ultimately, 40% of prevalent patients should have a native AV fistula (Opinion).
- Patients should be re-evaluated for a primary AV fistula after failure of every dialysis AV access (Opinion).

Each center should establish a database to track the types of accesses created and the complication rates (Opinion).

Guideline 30: Goals of Access Placement – Use of Catheters for Chronic Hemodialysis**Guideline 31: Center-Specific Thrombosis Rates**

- The rate of graft thrombosis should not exceed 0.5 thrombotic episodes per patient year at risk (Evidence/Opinion).
- After adjusting for initial failures, the rate of thrombosis of native AV fistulae should be less

than 0.25 episodes per patient year at risk (Opinion).

- Dialysis centers should examine their thrombosis rates and the underlying causes as part of an ongoing QA/CQI program (Opinion).

Guideline 32: Infection Rate

- The rate of infection should not exceed 1% in primary AV fistulae and 10% in dialysis AV grafts, both calculated over the use-life of the access (Opinion).
- For tunneled cuffed catheters, the recommended target rate of systemic infection is less than 10% at 3 months and less than 50% at 1 year (Opinion).

Guideline 33: Primary Access Failure Rate – AV Grafts

Guideline 34: Primary Access Failure Rate – Tunneled Cuffed Catheters

Guideline 35: Primary Access Failure – Native AV Fistulae

- No guideline is recommended (Opinion).

Guideline 36: Cumulative Patency Rate of Dialysis AV Grafts

Guideline 37: Cumulative Patency Rate of Tunneled Cuffed Catheters

Guideline 38: Cumulative Patency Rate of Primary AV Fistulae

- No guideline is recommended (Opinion).

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Northwest Renal Network
4702 42nd Avenue SW, Seattle, WA 98116
206.923.0714 (ph), 206.923.0716 (fx)
www.nwrenalnetwork.org

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