

Assessment of the New AVF for Maturity

Fistula Maturation

- Definition: Process by which a fistula becomes suitable for cannulation (ie, develops adequate flow, wall thickness, and diameter)
- Rule of 6's: In general, a mature fistula should:
 - Be a minimum of 6 mm in diameter with discernible margins when a tourniquet is in place
 - Be less than 6 mm deep
 - Have a blood flow greater than 600 mL/min
 - Be evaluated for nonmaturation 4–6 weeks after surgical creation if it does not meet the above criteria

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National Kidney Foundation. *Am J Kidney Dis.* 2006;48(suppl 1):S1-S322.

Clinical Clarification

- The fistula should be examined regularly following surgery. At 4 weeks post surgery, the fistula should be evaluated specifically for nonmaturation.

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During AVF Maturation Process

- Look, listen, and feel the new AVF at every dialysis treatment
- After the scar heals, begin assessing AVF using a “gentle” tourniquet placed high in the axilla area
- Instruct patient to start access exercises after healing (check with surgeon first)
- Document patient education as well as condition and maturation of the AVF

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Fact

- Experienced dialysis nurses have an 80% success rate for identifying fistula maturity.

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Robbin ML, et al. *Radiology*. 2002;225:59-64.

Maturing Fistula

- Vessel diameter must be 4–6 mm
- Vessel walls should toughen and be firm to the touch
- There should be no prominent collateral veins

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Tourniquet



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Photo courtesy of J. Holland

Clinical Clarification

- Several studies *suggest* that performing access exercises after surgery may contribute to the development of the fistula.¹⁻³ However, it is important to note that exercise alone will not turn a poor fistula into a good, functional fistula.

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1. Rus RR, et al. *Hemodialysis Int*. 2005;9:275-280.
2. Leaf DA, et al. *Am J Med Sci*. 2003;325:115-119.
3. Oder TF, et al. *ASAIO J*. 2003;48:554-555.

During Maturation

- Feel for strong thrill at arterial anastomosis
- Listen for continuous low-pitched bruit
- Document fistula maturation, patient education

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During Physical Examination

- Assess AVF for complications
 - Thrombosis
 - Stenosis
 - Infection
 - Steal syndrome
 - Aneurysms
- Select cannulation sites

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Is This New AVF Mature and Ready for Cannulation?



AVF

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Photo courtesy of D. Brouwer

Is This AVF Mature and Ready for the Initial Cannulation?

- a) Vein looks large enough
- b) Vein feels prominent and straight
- c) Vein has a strong thrill and good bruit
- d) Physician order
- e) All of the above

ANSWER:
(All of the above)

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Fistula Maturation

- What diagnostic tools or techniques can be used to determine if an AVF is ready for cannulation?
- Can the same tools or techniques be used to select the cannulation sites?

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Diagnostic Tools/Techniques to Determine If an AVF Is Ready

- Duplex Doppler study
- Physical exam by the:
 - Nephrologist
 - Nephrology nurse
 - Surgeon
- Angiogram (fistulogram)

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Best Tool/Technique?

Physical Exam!

Look, Listen, and Feel

Use Your:

Eyes



Ears



Fingertips



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Maturing Fistula Physical Exam

- Firm, no longer mushy
- Vessel wall thickening
- Vessel diameter enlargement (to 4–6 mm)
- Absence of prominent collateral veins

If in doubt, “Just Say No”

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Inspection

Look for:

- ✓ Changes compared to opposite extremity
- ✓ Skin color/circulation
- ✓ Skin integrity
- ✓ Edema
- ✓ Drainage
- ✓ Vessel size/cannulation areas
- ✓ Aneurysm
- ✓ Hematoma
- ✓ Bruising

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Look for Complications

Changes in Access

- Redness
- Drainage
- Abscess
- Cannulation sites
- Aneurysms

Infection

Changes in Access Extremity

- Skin color
- Edema
- Small blue or purple veins
- Hematoma
- Bruising

Central or outflow vein stenosis

- Distal Areas of Access Extremity

- Hands/Feet:
Cold
Painful
Numb

- Fingers/Toes:
Discolored

Steal syndrome

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Clinical Clarification

- Thrombosis represents the loss of the access. Stenosis, infection, steal syndrome, and aneurysms need to be addressed to prevent thrombosis and the resultant loss of the access.

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Stenosis

- Frequent cause of early fistula failure
- Juxta-anastomotic stenosis most common



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Photo courtesy of L. Spergel, MD

Juxta-Anastomotic Stenoses

- Most common AVF stenosis
 - Vein segment immediately above the arterial anastomosis
 - Stenosis also may be present in artery
- Caused by
 - ? Trauma to segment of vein mobilized and manipulated by the surgeon in creating the AVF

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Beathard GA. *A Multidisciplinary Approach for Hemodialysis Access*. New York, NY; 2002:111–118.
Beathard GA. *Semin Dial*. 1998;11:231–236.

Observe Access Extremity for Stenosis

- Before the patient has needles inserted
 - Make a fist with access arm dependent; observe vein filling
 - Raise access arm; entire AVF should flatten/collapse if no stenosis/obstruction
- If a segment of the AVF has not collapsed, stenosis is located at junction between collapsed and noncollapsed segment
- Instruct patient to perform this at home

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Infection

- Lower rate with AVF compared with other access types^{1,2}
- *Staphylococcus aureus* the most common pathogen²
- Patients and dialysis team personnel have high rates of *Staphylococcus* on skin³
- Handwashing before, after, and between patients is critical⁴

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1. National Kidney Foundation. *Am J Kidney Dis*. 2006;48(suppl 1):S1-S322.
2. Dialysis Outcomes and Practice Patterns Study (DOPPS) Guidelines. Available at: www.dopps.org.
3. Kirmani N, et al. *Arch Intern Med*. 1978;138:1657-1659.
4. Boyce JM, Pittet D. *MMWR* 2002;51(RR16):1-44.

Steal Syndrome

- Shortage of blood to hand
- Rare but can be serious
- Regularly evaluate sensory-motor changes to hand and condition of skin, especially in diabetic patients

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Aneurysm

- Localized ballooning

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Signs and Symptoms of Complications

- Differences in extremities
 - Edema or changes in skin color = stenosis or infection
 - Access
 - Redness, drainage, abscess = infection
 - Aneurysms
 - Access extremities
 - Small, blue/purple veins = stenosis
 - Discolored fingers = steal syndrome

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Signs and Symptoms of Complications (cont'd)

- Temperature Changes
 - Warmth of extremity = infection
 - Coldness of extremity may = steal syndrome

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Thrill for Stenosis

- Abrupt change or loss
- Pulse-like

Narrowing of vein = stenosis

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Feel for Cannulation Sites

- Superficial, straight vein section
- Adequate and consistent vein diameter

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Palpation

Temperature Change

- ✓ Warmth = possible infection
- ✓ Cold = decreased blood supply

Thrill

- ✓ Palpation can be started at the anastomosis
- ✓ Thrill diminishes evenly along access length
- ✓ Change can be felt at the site of a stenosis; becomes “pulse-like” at the site of a stenosis
- ✓ Stenosis may also be identified as a narrowed area

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Palpation (cont'd)

Feel for Size, Depth, Diameter, and Straightness of AVF

- Feel the entire AVF from arterial anastomosis all the way up the vein
- Evaluate for possible cannulation sites = superficial, straight vein section with adequate and consistent vein diameter

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Auscultation Listen for the Nature of the Bruit



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Photo courtesy of J. Holland

Auscultation (cont'd)

Listen for Bruit

- Listen to entire access every treatment
- Note changes in sound characteristics (bruit):
 - A well-functioning fistula should have a continuous, machinery-like bruit on auscultation
 - An obstructed (stenotic) fistula may have a discontinuous and pulse-like bruit rather than a continuous one—and also may be louder and high-pitched or “whistling”
 - Louder at stenosis than at anastomosis

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Requirements for Cannulation

- Physician order
- Experienced, qualified staff person
- Tourniquet

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Post-Op Follow-up

- Communicate assessment findings with access team, including surgeon
- Check maturity progress every session
- Assure evaluation by surgeon 4 weeks post-op
 - Intervene if there is no progress at 4 weeks or AVF is not mature and ready for cannulation at 6–8 weeks

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