PROVINCIAL STANDARDS & GUIDELINES

BCRenal
Provincial Health Services Authority

Assessment of Newly Created AV Fistulas and Grafts

Approved Aug 2007; Last updated Nov 2019
Approved by the BC Hemodialysis Committee

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IMPORTANT INFORMATION

This BC Renal guideline/resource was developed to support equitable, best practice care for patients with chronic kidney disease living in BC. The guideline/resource promotes standardized practices and is intended to assist renal programs in providing care that is reflected in quality patient outcome measurements. Based on the best information available at the time of publication, this guideline/resource relies on evidence and avoids opinion-based statements where possible; refer to www.bcrenalagency.ca for the most recent version.

For information about the use and referencing of BC Renal guidelines/resources, refer to http://bit.ly/28SFr4n.

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1.0 Scope

This guideline makes recommendations about assessing the maturation of newly created AV fistulas (AVFs) and grafts (AVGs) and identifies potential problems.

Related Guidelines (BC, Canada, or International):
BC Renal. Available at: www.bcrenalagency.ca/health-professionals/clinical-resources/vascular-access#Resources:

- Initial Cannulation of AV Fistula and Graft.
- Provincial Recommendations for VA for Patients with HD as Primary Modality.
- Canadian Association of Nephrology Nurses and Technologists (CANNT). Nursing Recommendations for the Management of Vascular Access in Adult HD Patients, 2015 Update. www.cannt.ca/en/standards-of-practice/vascular-access-guidelines (available for purchase).
- Canadian Society of Nephrology Guidelines. Report of the Canadian Society of Nephrology Vascular Access Working Group, 2012 Available at www.ncbi.nlm.nih.gov/pubmed/22273524
- National Kidney Foundation. KDOQI Clinical Practice Guideline for Vascular Access: 2018. AJKD Submission draft April 2019.

2.0 Recommendations, Rationale, & Evidence

Recommendation 1: At a minimum, schedule assessments of new AVFs and AVGs at 2 and 6-weeks post-creation, every 6 months (preemptive fistulas) and 4 - 6 weeks prior to hemodialysis initiation (opinion).

Table 1: Scheduled Assessments of New AVFs and AVGs

When	Who	Focus
2 weeks post-creation	Trained VA or kidney clinic RN +/- nephrologist +/- surgeon	Confirm presence of thrill & bruit
6 weeks post-creation	VA team (VA RN, nephrologist, and vascular surgeon)	Confirm maturing appropriately
Q6 months preemptive fistulas	VA team (VA RN, nephrologist, and vascular surgeon)	Confirm patency
4 – 6 weeks prior to anticipated initiation	VA team (VA RN, nephrologist, and vascular surgeon)	Confirm readiness for cannulation

In addition to scheduled assessments, it is recommended that centres have a protocol in place that requires dialysis staff to examine the access and outflow vein of patients with newly created or developing accesses at every dialysis visit (in addition to examining the current access). Patients who have not yet started on dialysis should be taught to perform self-examination and be given appropriate contact information for questions and concerns (see recommendation 3).

Recommendation 2: Utilize physical examination as the primary mechanism for assessing maturation, utility and problems with newly created AVFs and AVGs; augment with portable ultrasound (evidence).

Assessing Maturation of AV Fistulas:
An AVF needs to be able to be cannulated with minimal risk for infiltration and be able to deliver the prescribed blood flow during dialysis. Generally speaking, the bulk of AVF maturation occurs within the first 2 weeks after creation, making early evaluation of a new AVF particularly important.

Some AVFs may be mature enough to cannulate as early as one-month post-creation while others may require several months or may never be mature enough to cannulate. Premature cannulation may result in infiltration with associated compression of the vessel by hematoma and a permanent loss of the AVF.

The ability of trained, experienced dialysis nurses to accurately predict eventual fistula maturation using physical assessment skills is excellent. One study reported a success rate of 80%.[1]

Table 2 provides a summary of normal and abnormal findings for maturing AVFs:

Table 2: Normal and Abnormal Findings for Patients with Maturing AVFs

Normal (6 Weeks Post-Creation)	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
• Palpable vein which is larger and firmer than original vein (not soft or mushy) • Vein partially collapses when arm is elevated above head (outflow assessment) • Pulsation of vein increases significantly when mid portion of fistula is manually occluded (inflow assessment) • Vein depth of <0.6 cm with discernible margins • Vein diameter of > 0.6 cm (minimum 0.4 cm for initial cannulation) • Area of straight vein available for cannulation • No irregular/dilated areas or aneurysm formations • No collateral veins visible • Portable ultrasound flow >500 mL/min (minimum 400 mL/min for initial cannulation) & biphasic bruit.	• Vein not easily palpable or does not partially collapse when arm is elevated • Vein narrowed • Poorly defined area of straight vein available for cannulation • Visible aneurysm • Visible collateral veins in arm or neck above the access • Dilated neck veins • At 6 weeks post-creation, portable u/s flow <500 mL/min &/or monophasic bruit. • See Tables 4 & 5 for additional problems	Poor maturation due to: • Juxta-anastomotic venous stenosis (JAS; stenosis adjacent to the anastomosis) • Stenosis (arterial or venous) • Aneurysm • Poor arterial supply • See Tables 4 & 5 for additional problems

[1] Robbin, ML, Chamberlain NE, Lockhart ME, Gallichio MH, Young CJ, Deierhoi MH, and Allon M, HD Arteriovenous Fistula Maturity: Ultrasound Evaluation, Radiology, 2002, Oct; 225 (1), p.p., 59 - 64.

Assessing Utility of AV Grafts:
Generally speaking, AV grafts should not be cannulated for at least 2 weeks after placement and not until the swelling has subsided enough to allow palpation of the course of the graft. Exceptions to the 14-day guideline may apply when a patient has had a rapid access graft inserted or requires hemodialysis and has no other access. Cannulation of an AVG in an edematous arm may lead to hematoma formation and graft wall damage as a result of inaccurate needle insertion.

Table 3 provides a summary of normal and abnormal findings for newly created AVGs:

Table 3: Normal and Abnormal Findings for Patients with Newly Created AVGs

Normal (6 Weeks Post-Insertion)	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
• Palpable, uniform sized graft in a loop or straight configuration • No irregular/dilated areas • Portable ultrasound flow >650 mL/min (if u/s available)	• Graft not easily palpable • Graft not uniform in size; may bulge in places • Limited straight portions for cannulation • Portable ultrasound flow <650 mL/min • See Tables 4 & 5 for additional problems	• Graft defect • See Tables 4 & 5 for additional problems

Identifying Problems in AV Fistulas and Grafts:
In addition to assessing maturation/utility of newly created AVFs/AVGs, it is important that they also be assessed for other problems which may impact the ability to utilize the access. Potential problems are similar but differ in terms of frequency for AVFs and AVGs. See Table 4.

Table 4: Common AVF and AVG Problems

AV Fistula	AV Graft
Juxta-anastomotic venous stenosis (JAS; stenosis adjacent to the anastomosis)	Venous stenosis (most common just distal to the graft-vein anastomosis but can occur proximal to the graft-artery anastomosis or within the graft itself)
Venous stenosis (may occur any place along venous outflow)	
Steal syndrome	Steal syndrome
Collateral veins	
Aneurysm	
Pseudoaneurysm	Pseudoaneurysm
Infection	Infection
Ischemic monomelic neuropathy	Ischemic monomelic neuropathy
Ischemia (can also lead to neuropathy)	

Table 5 provides a summary of normal and abnormal findings/potential problems for newly created AVFs/AVGs:

Table 5: Normal and Abnormal Findings for Patients with Newly Created AVFs/AVGs:

Item	Normal	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
Blood Pressure	• Consistent with previous readings	• Significant ↑or ↓ from previous readings	• Impaired CV status • Dehydration
Pulse Rate (bpm)	• Consistent with previous rates	• Significant ↑or ↓ from previous readings	• Infection • Impaired CV status • Dehydration
Pulse Quality (Access Limb)	• Peripheral pulses present in access limb	• Pulses in access limb absent or difficult to palpate (pulses present pre-creation)	• Venous stenosis/ thrombosis • Steal syndrome
Bruit (auscultation)	AVF: • Prominent at the arterial anastomosis; decreases as move away from the anastomosis • Low pitched, continuous, & audible on diastole & systole	AVF: • High pitched, discontinuous, &/or audible on systole only • No bruit heard	AVF: • Stenosis (arterial or venous) • Thrombosis
	AVG: • Prominent at the arterial anastomosis; decreases as move away from the anastomosis • Low pitched, continuous, & audible on diastole & systole • If manually occluded, bruit increases at arterial anastomosis	AVG: • High pitched, discontinuous, &/or audible on systole only • No bruit heard	AVG: • Stenosis (usually venous) • Thrombosis
Thrill (palpation)	AVF: • Prominent at arterial anastomosis; decreases as move away from the anastomosis (decrease is never sudden but is faster than with AVG); if manually occluded, thrill disappears moving away from the occlusion • Vessel is soft and easily compressible	AVF: • An additional thrill may be palpable along the course of the access. • Pulse palpable at site of stenotic lesion; pulse has water-hammer feel (with severe stenosis) and disappears rather abruptly beyond the stenotic site. Pulse proximally is weak, and vein may be poorly developed • No palpable thrill (no thrill = no blood flow = thrombosis). Pulse may be palpable up to the point of the occlusion • Vessel is not easily compressible	AVF: • Juxta-anastomotic venous stenosis (JAS) • Venous stenosis • Thrombosis
	AVG: • Thrill strongest at the arterial anastomosis • Pulse felt over entire graft	AVG: • No palpable thrill but may have a pulse (no thrill = no blood flow = thrombosis; may have a pulse if blood flow in artery is palpable) • If low intra-access blood flow, graft may appear collapsed and may be difficult to palpate	AVG: • Thrombosis • Stenosis (arterial or intragraft)

Item	Normal	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
Hand/Foot Temperature	• Warm	• Cool or cold	• Steal syndrome • Arterial stenosis • Pre existing arterial condition
		• Hot	• Infection
Hand/Foot Colour	• Normal	• Dusky or blue	• Steal syndrome • Arterial stenosis
		• Red	• Infection • Venous stenosis
Finger/Toe Capil Refill	• Normal	• Delayed	• Arterial stenosis • Steal syndrome
Pain	• Not present	• Mild to severe pain	• Steal syndrome • Infection • Neuropathy
Skin Integrity	• Normal although can be a post-surgical inflammatory red flare on the skin overlying the graft for a temporary period	• Small pustular lesions with minimal or no inflammation, swelling, or pain	• Superficial infection
		• Erythema which may spread beyond the skin overlying the access, tight, shiny (thin), & tender skin, drainage from access site, skin warm or hot to touch, and pain (variable)	• Deep infection • Venous congestion (swelling) • Steal syndrome (necrotic fingers) • At risk for rupture
Edema	• No edema	• Edema in access limb • Edema in chest, neck, arm, &/or face • Subcutaneous collateral veins observable in the neck, upper chest, & shoulder	• Venous stenosis • Central vein stenosis

Recommendation 3: Teach patients to recognize and report signs and symptoms suggestive of complications, including (opinion):

- *Sensations of coldness, numbness, tingling, and/or impairment of motor function in the limb with the access*
- *Absence of a thrill over the anastomosis site*
- *Absence of a bruit*
- *Redness, discharge, and/or pain in the limb with the access*
- *Fever*
- *Edema in the limb with the access which persists more than two weeks post-creation*
- *Development of collateral vessels over the neck, upper chest, and/or shoulder*
- *Bleeding fistula/graft and emergency measures (refer to the patient teaching pamphlet "Bleeding Fistula or Graft: Emergency Measures" at www.bcrenalagency.ca.).*

Recommendation 4: If the AVF or AVG has problems and/or the AVF has not matured within a 6 week timeframe, consult physician or VA Coordinator.

3.0 Procedure

See procedure in BCR guideline entitled *Rope Ladder Cannulation of AV Fistulas and Grafts*.

4.0 References

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5.0 Sponsors

Developed by:

- BC Vascular Access Educators Group (VAEG)

Approved by:

- Provincial Vascular Access Team (2007)
- BCR Hemodialysis Committee (2015) – minor updates made to 2019 version so not reviewed by the BCR Hemodialysis Committee

6.0 Effective Date

- Effective date: May 11, 2007. Revised Nov 5, 2019

- This guideline is based on scientific evidence available at the time of the effective date; refer to www.bcrenalagency.ca for most recent version.

7.0 Appendices

Appendix 1: Assessment of Maturation of AV Fistula or Graft (Documentation Tool)

This tool utilizes similar categories and language to that in the PROMIS database for ease of entry into the database.

Appendix 1:
Assessment of Maturation of AV Fistula or Graft (Documentation Tool)

Add Health Authority Logo	Add Addressograph/Label
Add Name & Address of Vascular Access Clinic	
Phone #: _____ Fax #: _____ **ATTENTION: VASCULAR ACCESS NURSE**	

ASSESSMENT OF MATURATION OF FISTULA OR GRAFT

Access Creation Date: _____ **Surgeon:** _____

Post Access Creation Assessment: ☐ 2 weeks ☐ 6 weeks Other _____

Assessment Date: _____ **Name of Assessor** _____

Access Type (if any):

Side:	**Left**	**Right**	**Location:**	**Fistula**	**Graft**	**AVG Only:**	
	☐	☐	Upper Arm	☐	☐	Straight	☐
			Lower Arm	☐	☐	Looped	☐
			Thigh	☐	☐		

Assessment	**Findings**			
Location of Pulse Assessed	☐ Radial	☐ Ulnar	☐ Pedal	
Pulse Quality	☐ Present	☐ Absent		
Bruit	☐ Strong ☐ High Pitched	☐ Adequate ☐ Low Pitched	☐ Poor	☐ Absent
Thrill	☐ Strong	☐ Weak	☐ Absent	☐ Pulsatile
Hand/Foot Temp	☐ Hot	☐ Warm	☐ Cool	☐ Cold
Hand/Foot Colour	☐ Normal	☐ Red ☐ Dusky	☐ Blue	☐ White
Finger/Toe Capillary Refill	☐ Delayed	☐ Normal		
Pain	☐ Not Present	☐ Mild	☐ Moderate	☐ Severe
Skin Integrity	☐ Normal ☐ Edematous	☐ Tight ☐ Breakdown	☐ Shiny	☐ Tender
Vessel Condition	☐ Soft ☐ Mild bulging	☐ Easily compressible ☐ Moderate bulging	☐ Easily palpable ☐ Collateral development	☐ Poorly palpable ☐ Normal
Vein diameter Vein depth	_____mm _____mm			
Is patient exercising access arm?		☐ Yes	☐ No	

Summary of Findings:

- ☐ Maturing as expected for age/stage of access
- ☐ Maturing but concerns identified
- ☐ Not maturing as expected for age/stage of access

If maturing but concerns identified, or not maturing, please complete the next two sections:

Comments re concerns:

Potential Conditions:

- ☐ Collateral vessels developing
- ☐ Failure to mature
- ☐ Needs more time to assess
- ☐ Poor arterial supply
- ☐ Possible steal syndrome
- ☐ Possible stenosis
- ☐ Possible thrombosis
- ☐ Possible infection
- ☐ Swollen
- ☐ Other, please specify _____

Plan:

- ☐ Continue regular follow-up
- ☐ Repeat assessment in 1 – 2 weeks
- ☐ Further investigation needed
- ☐ Refer to Nephrologist for assessment and/or antibiotics
- ☐ Refer to Surgeon for assessment
- ☐ Refer to VA Clinic for assessment

Investigations Required:

☐ Arteriogram	☐ Unilateral ☐ Arm ☐ Right	☐ Bilateral ☐ Leg ☐ Left
☐ Venogram	☐ Unilateral ☐ Arm ☐ Right	☐ Bilateral ☐ Leg ☐ Left

- ☐ CT Scan
- ☐ Doppler Ultrasound
- ☐ Fistulogram
- ☐ Fistulogram +/- Angioplasty
- ☐ Other (please specify) _____

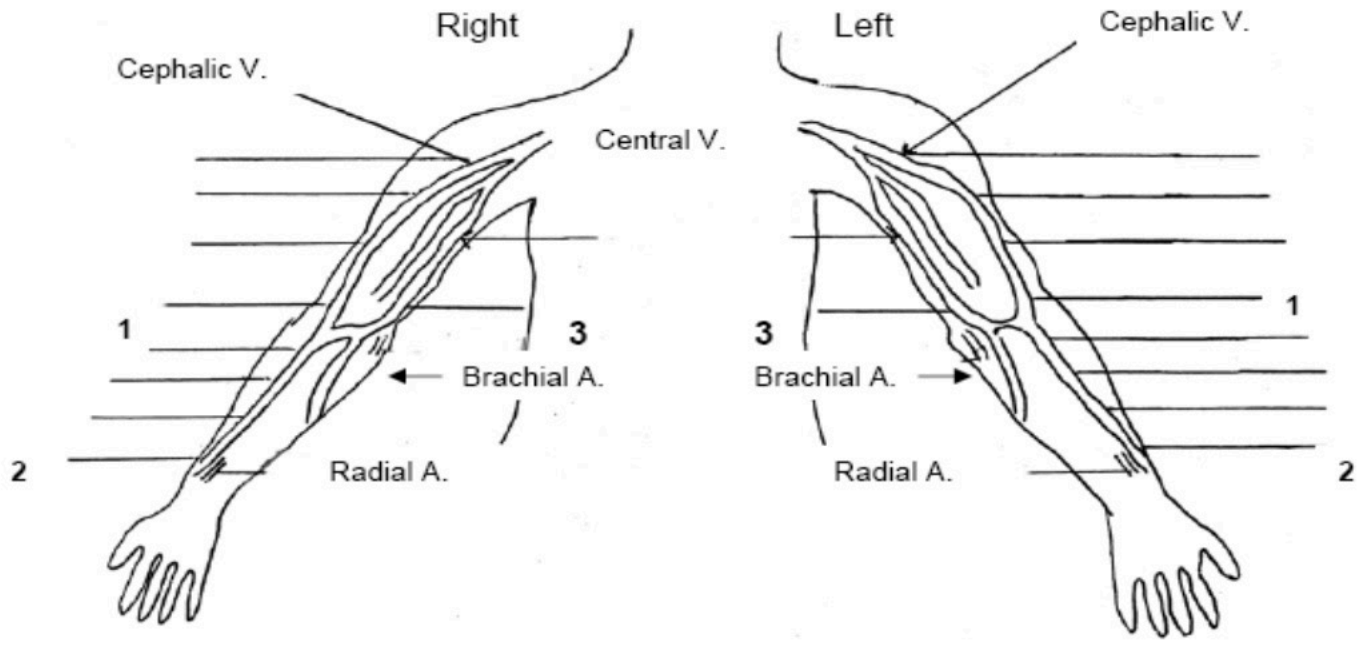
Additional Notes:

Assessed by: _____

Location assessment completed: _____

Next appointment date (if applicable): _____

Vascular Access Mapping



COMMENTS: