

# Assessment of Newly Created AV Fistulas and Grafts

(Approved August 21, 2007)

## Vascular Access Guideline



**BC Renal Agency**  
An agency of the Provincial Health Services Authority

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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 Guideline(s):

- BC Provincial Renal Agency. *Provincial Recommendations for VA for Patients with HD as Primary Modality*, 2005.
- BC Provincial Renal Agency. *Initial Cannulation of AV Fistula and Graft*, 2006.
- Canadian Society of Nephrology Guidelines. Chapter 4: Vascular Access, *Journal of American Society of Nephrology*, 17: S16–S23, 2006.
- National Kidney Foundation. KDOQI Clinical Practice Guidelines and Clinical Practice Recommendations for 2006 Updates: Hemodialysis Adequacy, Peritoneal Dialysis Adequacy and Vascular Access. Guideline 3: Cannulation of Fistulae and Grafts and Accession of HD Catheters and Port Catheter Systems and Guideline 4: Detection of Access Dysfunction: Monitoring, Surveillance, and Diagnostic Complications, *American Journal of Kidney Disease*, 48:S201 - S233, 2006 (suppl 1).
- Recommendations for New VA Management in HD Patients (recommendations 1 – 7), *CANNT Journal*, vol 16 (supp 1), July – September 2006.

## 2.0 Recommendations, Rationale, & Evidence

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

**Table 1: Scheduled Assessments of New AVFs and AVGs**

<i>When</i>	<i>Who</i>	<i>Focus</i>
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
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 4).

**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 if available (evidence).*

**Assessing Maturation of AV Fistulas:**

Assessing the maturation of an AV *fistula* is more difficult than an AVG. 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 through the use of physical assessment skill is excellent. One study reported a success rate of 80%.<sup>1</sup>

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<sup>1</sup> 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.

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	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
<ul style="list-style-type: none"> <li>• Palpable vein which is larger and firmer than original vein (not soft or mushy); vein partially collapses when arm is elevated above head</li> <li>• Vein depth of &lt;0.6 cm with discernible margins</li> <li>• Vein diameter of &gt; 0.6 cm (minimum 0.4 cm for initial cannulation)</li> <li>• Area of straight vein available for cannulation</li> <li>• No irregular/dilated areas or aneurysm formations</li> <li>• No collateral veins visible</li> <li>• Portable ultrasound flow &gt;500 mL/min (if u/s available)</li> </ul>	<ul style="list-style-type: none"> <li>• Vein not easily palpable or does not partially collapse when arm is elevated</li> <li>• Vein narrowed</li> <li>• Poorly defined area of straight vein available for cannulation</li> <li>• Visible aneurysm</li> <li>• Visible collateral veins in arm or neck above the access</li> <li>• Dilated neck veins</li> <li>• At 6 weeks post-creation, portable u/s flow &lt;500 mL/min</li> <li>• See Tables 4 &amp; 5 for additional problems</li> </ul>	<p>Poor maturation due to:</p> <ul style="list-style-type: none"> <li>• Juxta-anastomotic venous stenosis (JAS; stenosis adjacent to the anastomosis)</li> <li>• Stenosis (arterial or venous)</li> <li>• Aneurysm</li> <li>• Poor arterial supply</li> <li>• See Tables 4 &amp; 5 for additional problems</li> </ul>

**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 requires hemodialysis, has no other access, and a physician’s order has been obtained.

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	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
<ul style="list-style-type: none"> <li>• Palpable, uniform sized graft in a loop or straight configuration</li> <li>• No irregular/dilated areas</li> <li>• Portable ultrasound flow &gt;650 mL/min (if u/s available)</li> </ul>	<ul style="list-style-type: none"> <li>• Graft not easily palpable;</li> <li>• Graft not uniform in size; may bulge in places</li> <li>• Limited straight portions for cannulation</li> <li>• Portable ultrasound flow &lt;650 mL/min</li> <li>• See Tables 4 &amp; 5 for additional problems</li> </ul>	<ul style="list-style-type: none"> <li>• Graft defect</li> <li>• See Tables 4 &amp; 5 for additional problems</li> </ul>

## 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 (highest to lowest frequency):**

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)
Collateral veins	Infection
Venous stenosis (may occur any place along venous outflow)	Ischemia <ul style="list-style-type: none"> <li>• Ischemic monomelic neuropathy</li> <li>• Vascular steal syndrome</li> </ul>
Aneurysm	
Ischemia (can also lead to neuropathy)	Pseudoaneurysm
Infection	

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	<ul style="list-style-type: none"> <li>• Consistent with previous readings</li> </ul>	<ul style="list-style-type: none"> <li>• Significant ▲ or ▼ from previous readings</li> </ul>	<ul style="list-style-type: none"> <li>• Impaired CV status</li> <li>• Dehydration</li> </ul>
Pulse Rate (bpm)	<ul style="list-style-type: none"> <li>• Consistent with previous rates</li> </ul>	<ul style="list-style-type: none"> <li>• Significant ▲ or ▼ from previous readings</li> </ul>	<ul style="list-style-type: none"> <li>• Infection</li> <li>• Impaired CV status</li> <li>• Dehydration</li> </ul>
Pulse Quality (Access Limb)	<ul style="list-style-type: none"> <li>• Peripheral pulses present in access limb</li> </ul>	<ul style="list-style-type: none"> <li>• Pulses in access limb absent or difficult to palpate (pulses present pre-creation)</li> </ul>	<ul style="list-style-type: none"> <li>• Venous stenosis/thrombosis</li> <li>• Steal syndrome</li> </ul>
Bruit (auscultation)	<b>AVF:</b> <ul style="list-style-type: none"> <li>• Prominent at the arterial anastomosis; decreases as move upstream</li> <li>• Low pitched, continuous, &amp; audible on diastole &amp; systole</li> </ul>	<b>AVF:</b> <ul style="list-style-type: none"> <li>• High pitched, discontinuous, &amp;/or audible on systole only</li> <li>• No bruit heard</li> </ul>	<b>AVF:</b> <ul style="list-style-type: none"> <li>• Stenosis (arterial or venous)</li> <li>• Thrombosis</li> </ul>
	<b>AVG:</b> <ul style="list-style-type: none"> <li>• Prominent at the arterial anastomosis; decreases as move upstream</li> <li>• Low pitched, continuous, &amp; audible on diastole &amp; systole (often louder than AVF)</li> <li>• If manually occluded, bruit increases at arterial anastomosis</li> </ul>	<b>AVG:</b> <ul style="list-style-type: none"> <li>• High pitched, discontinuous, &amp;/or audible on systole only</li> <li>• No bruit heard</li> </ul>	<b>AVG:</b> <ul style="list-style-type: none"> <li>• Stenosis (usually venous)</li> <li>• Thrombosis</li> </ul>

# Assessment of Newly Created Fistulas & Grafts

Item	Normal	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
Thrill (palpation)	<p>AVF:</p> <ul style="list-style-type: none"> <li>• Prominent at arterial anastomosis; decreases as move upstream (decrease is never sudden but is faster than with AVG); if manually occluded, thrill disappears upstream to occlusion</li> <li>• Pulse is soft and easily compressible</li> </ul>	<p>AVF:</p> <ul style="list-style-type: none"> <li>• An additional thrill may be palpable along the course of the access.</li> <li>• 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</li> <li>• No palpable thrill but may still have a pulse (no thrill = no blood flow = thrombosis); may have a pulse if blood flow in artery is palpable; access is not easily compressible</li> </ul>	<p>AVF:</p> <ul style="list-style-type: none"> <li>• Juxta-anastomotic venous stenosis (JAS)</li> <li>• Venous stenosis</li> <li>• Thrombosis</li> </ul>
	<p>AVG:</p> <ul style="list-style-type: none"> <li>• Thrill strongest at the arterial anastomosis</li> <li>• Pulse felt over entire graft</li> </ul>	<p>AVG:</p> <ul style="list-style-type: none"> <li>• 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)</li> <li>• If low intra-access blood flow, graft may appear collapsed and may be difficult to palpate</li> </ul>	<p>AVG:</p> <ul style="list-style-type: none"> <li>• Thrombosis</li> <li>• Stenosis (arterial or intragraft)</li> </ul>
Hand/Foot Temperature	<ul style="list-style-type: none"> <li>• Warm</li> </ul>	<ul style="list-style-type: none"> <li>• Cool or cold</li> </ul>	<ul style="list-style-type: none"> <li>• Steal syndrome</li> <li>• Arterial stenosis</li> <li>• Pre existing arterial condition</li> </ul>
		<ul style="list-style-type: none"> <li>• Hot</li> </ul>	<ul style="list-style-type: none"> <li>• Infection</li> </ul>
Hand/Foot Colour	<ul style="list-style-type: none"> <li>• Normal</li> </ul>	<ul style="list-style-type: none"> <li>• Dusky or blue</li> </ul>	<ul style="list-style-type: none"> <li>• Steal syndrome</li> <li>• Arterial stenosis</li> </ul>
		<ul style="list-style-type: none"> <li>• Red</li> </ul>	<ul style="list-style-type: none"> <li>• Infection</li> <li>• Venous stenosis</li> </ul>
Finger/Toe Capil Refill	<ul style="list-style-type: none"> <li>• Normal</li> </ul>	<ul style="list-style-type: none"> <li>• Delayed</li> </ul>	<ul style="list-style-type: none"> <li>• Arterial stenosis</li> <li>• Steal syndrome</li> </ul>
Pain	<ul style="list-style-type: none"> <li>• Not present</li> </ul>	<ul style="list-style-type: none"> <li>• Mild to severe pain</li> </ul>	<ul style="list-style-type: none"> <li>• Steal syndrome</li> <li>• Infection</li> <li>• Neuropathy</li> </ul>

Item	Normal	Abnormal (Notify MD)	Possible Implications of Abnormal Findings
Skin Integrity	<ul style="list-style-type: none"> <li>Normal although can be a post-surgical inflammatory red flare on the skin overlying the graft for a temporary period</li> </ul>	<ul style="list-style-type: none"> <li>Small pustular lesions with minimal or no inflammation, swelling, or pain</li> </ul>	<ul style="list-style-type: none"> <li>Superficial infection</li> </ul>
		<ul style="list-style-type: none"> <li>Erythema which may spread beyond the skin overlying the access, tight, shiny, &amp; tender skin, drainage from access site, skin warm or hot to touch, and pain (variable)</li> </ul>	<ul style="list-style-type: none"> <li>Deep infection</li> <li>Venous congestion (swelling)</li> <li>Steal syndrome (necrotic fingers)</li> </ul>
Edema	<ul style="list-style-type: none"> <li>No edema</li> </ul>	<ul style="list-style-type: none"> <li>Edema in access limb</li> <li>Edema in chest, neck, arm, &amp;/or face</li> <li>Subcutaneous collateral veins observable in the neck, upper chest, &amp; shoulder</li> </ul>	<ul style="list-style-type: none"> <li>Venous stenosis</li> <li>Central vein stenosis</li> </ul>

***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
- Emergency measures to take in the case of a bleeding fistula/graft.

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

Examples in which to avoid cannulation and consult a physician or VA Coordinator include but are not limited to:

- Signs and symptoms of severe infection.
- Signs and symptoms of a localized, superficial infection that is on or near the needling site.
- Absence or poor quality of bruit and thrill.
- Extreme edema or other factors (e.g. rash or unexplained aneurysm) which would render cannulation inappropriate.

Examples in which to proceed with cannulation but consult the physician or the VA Coordinator at the earliest opportunity include but are not limited to:

- Signs and symptoms of a localized, superficial infection that is not on or near the needling site.
- A pulse is palpated instead of a thrill, and is abnormal for the access in question.
- A significant increase in pitch is noted on auscultation.
- Aneurysm (AVFs) or pseudoaneurysm formation (AVGs).
- Difficulties in cannulation, despite the use of advanced cannulators.

### 3.0 Procedure

See procedure in BCPRA guideline entitled *Initial Cannulation of AV Fistula or Graft*.

### 4.0 References

Beathard, Gerald, A Practitioner's Resource Guide to HD AVFs, *ESRD Network 13*, Fistula First Project, 2004.

Beathard, Gerald, A Practitioner's Resource Guide to Physical Examination of Dialysis VA, *ESRD Network 13*, Fistula First Project, Nov 2003.

End Stage Renal Disease Clinical Performance Measures Project, *2001 Annual Report*, Department of Health and Human Services, Centers for Medicare & Medicaid Services, Baltimore, Maryland, December 2001.

Gray, Richard and Sands, Jeffrey, ed., *Dialysis Access: A Multidisciplinary Approach*, Philadelphia et al, 2002, Chapters 15 (Schanzer, Harry, Overview of Complications and Management after VA Creation, p.p., 93 – 98) and 18 (Beathard, Gerald, Physical Examination: The Forgotten Tool, p.p., 111 – 119) .

Lok, Charmaine and Oliver, Matthew, Overcoming Barriers to AVF Creation and Use (Toronto), *Seminars in Dialysis*, vol 16, no 3, May/June, 2003, p.p., 189 - 196

Reddan D, et. al., National ESRD CPM Work Group: National Profile of Practice Patterns for Hemodialysis Vascular Access in the United States, *American Society of Nephrology*, vol 13, no 8, Aug 2002, p.p., 2117-24.

Robbin, ML, Chamberlain NE, Lockhart ME, Gallichio MH, Young CJ, Deierhoi MH, and Allon M, HD Arteriovenous Fistula Maturity: Ultrasound Evaluation, *Radiology*, vol 225, no 1, Oct 2002, p.p., 59 - 64.

U.S. Department of Health and Human Services. Healthy People 2010: *Understanding and Improving Health*. 2nd ed. Chapter 4: Chronic Kidney Disease Washington, DC: U.S. Government Printing Office, November 2000.

## 5.0 Sponsors

This provincial guideline was developed to support improvements in the quality of vascular access care delivered to patients with chronic kidney disease in BC. Based on the best information available at the time it was published, the guideline relies on evidence and avoids opinion-based statements where possible. When used in conjunction with pertinent clinical data, it is a tool health authorities and health professionals can use to develop local guidelines.

Developed by a Vascular Access Working Group of multidisciplinary care providers from across BC, the guideline was approved by the Provincial Vascular Access Services Team and the BC Provincial Renal Agency Medical Advisory Committee. It has been adopted by BCPRA as a provincial guideline.

## 6.0 Effective Date

- Effective date: May 11, 2007.
- This guideline is based on scientific evidence available at the time of the effective date; refer to [www.bcrenalagency.ca](http://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.

# Assessment of Newly Created Fistulas & Grafts



Add Health Authority Logo
Add Name & Address of Vascular Access Clinic
Phone #: _____ Fax #: _____
<b>ATTENTION: VASCULAR ACCESS NURSE</b>

Add Addressograph/Label

## ASSESSMENT OF MATURATION OF FISTULA OR GRAFT

**Access Creation Date:** \_\_\_\_\_ **Surgeon:** \_\_\_\_\_  
**Post Access Creation Assessment:**     2 weeks             6 weeks            Other \_\_\_\_\_  
**Assessment Date:** \_\_\_\_\_

**Access Type** (if any):

<b>Side:</b>	<b>Left</b>	<b>Right</b>	<b>Location:</b>	<b>Fistula</b>	<b>Graft</b>	<b>AVG Only:</b>
	<input type="checkbox"/>	<input type="checkbox"/>	Upper Arm	<input type="checkbox"/>	<input type="checkbox"/>	Straight
			Lower Arm	<input type="checkbox"/>	<input type="checkbox"/>	Looped
			Thigh	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

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

**Summary of Findings:**

# Assessment of Newly Created Fistulas & Grafts

- 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:

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**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:**

- |   |                                     |                                    |
|---|-------------------------------------|------------------------------------|
| <input type="checkbox"/> Arteriogram                  | <input type="checkbox"/> Unilateral | <input type="checkbox"/> Bilateral |
|   | <input type="checkbox"/> Arm        | <input type="checkbox"/> Leg       |
|   | <input type="checkbox"/> Right      | <input type="checkbox"/> Left      |
| <input type="checkbox"/> Venogram                     | <input type="checkbox"/> Unilateral | <input type="checkbox"/> Bilateral |
|   | <input type="checkbox"/> Arm        | <input type="checkbox"/> Leg       |
|   | <input type="checkbox"/> Right      | <input type="checkbox"/> Left      |
| <input type="checkbox"/> CT Scan                      |                                     |                                    |
| <input type="checkbox"/> Doppler Ultrasound           |                                     |                                    |
| <input type="checkbox"/> Fistulogram                  |                                     |                                    |
| <input type="checkbox"/> Fistulogram +/- Angioplasty  |                                     |                                    |
| <input type="checkbox"/> Other (please specify) _____ |                                     |                                    |

# Assessment of Newly Created Fistulas & Grafts

**Additional Notes:**

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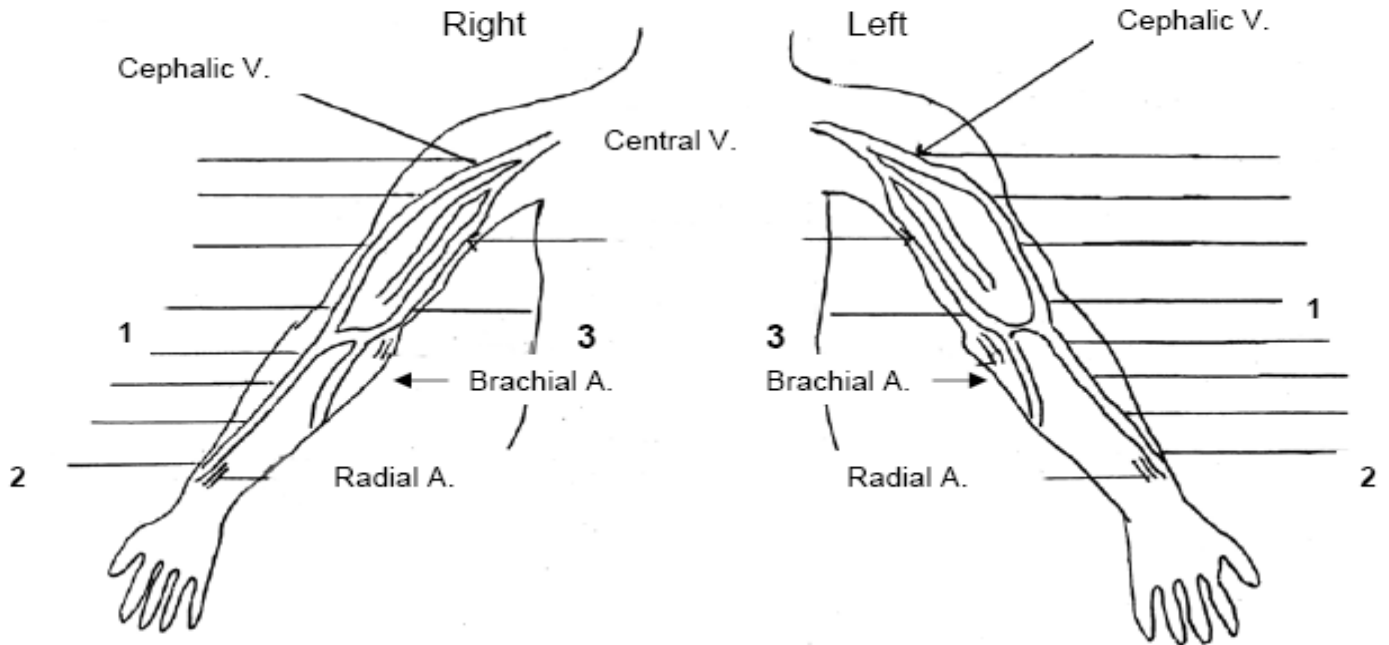
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**Assessed by:** \_\_\_\_\_

**Location assessment completed:** \_\_\_\_\_

**Next appointment date (if applicable):** \_\_\_\_\_

## Vascular Access Mapping



**COMMENTS:**

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