GUNDERSEN/LUTHERAN ULTRASOUND DEPARTMENT POLICY AND PROCEDURE MANUAL

SUBJECT: Vein Mapping Ultrasound
SECTION: Vascular Ultrasound
ORIGINATOR: Kraig Schuster BS, RDMS, RVT
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APPROVED BY: _____
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Scheduling: One every 30 minutes per limb.

Prep: None.

Patient Position:

- Lower Extremities: Supine, reverse Trendelenburg position with head elevated 10-20 degrees.
- Upper Extremities: Supine, flat (raising head will collapse proximal upper extremity veins).

Equipment: Color flow duplex ultrasound unit with 7 MHz and 5 MHz linear array transducers.

Purpose: To determine size, location, and patency of the greater saphenous, lesser saphenous, cephalic, and / or basilic veins prior to surgical use.

Exam Protocol: Vein mapping has two major components:

1. Vein Mapping: Assessment of size, location, and major branches of the greater saphenous, lesser saphenous, cephalic, and / or basilic veins. In the setting of AV fistula planning, if the vein diameter is < 3 mm, a tourniquet should be applied to the patient's arm and the vein remeasured. The larger of the 2 diameters (with or without the tourniquet applied) will then be recorded on the worksheet. The outer to outer diameter of the distal brachial artery (just above the elbow) is also measured in the setting of AV fistula planning.
2. Patency: A complete compression exam of the deep and superficial veins of the extremity imaged for evidence of acute or chronic DVT, but only if adequate vein length is seen first in the extremity or extremities to be mapped

Additional Criteria:

1. Determine the length of vein needed for the planned arterial bypass procedure. If the type of surgery planned is not in the chart or on the request then the referring surgeon should be paged to find out. Using a tape measure on the patient's skin measure the length of the expected course of the bypass. (For example, if the patient is going to have a fem-pop bypass, measure from the groin to just below the knee. If the patient is going to have a femoral to dorsalis pedis bypass, measure from the groin to the foot).
2. The purpose of this exam is to find an adequate vein (veins) of this predetermined length. Note that the surgeon can perform a vein-to-vein anastomosis to obtain the length they need. Therefore they may use one or more veins on a single bypass procedure.
3. An "adequate" vein must be 2.5 mm or greater in diameter in the upper extremity and 3 mm or greater in diameter in the lower extremity
4. Some veins work better than others for these procedures. Please use the following order in the examination of these veins. As soon as the predetermined length has been reached, no further veins need to be investigated, even if the request is for both upper and lower extremities to be mapped.
    - GSV from the leg where the bypass is planned.
    - GSV from the other leg.
    - LSV from the leg where the bypass is planned.
    - LSV from the other leg.
    - Cephalic vein from one arm.
    - Cephalic vein from the other arm.
    - Basilic vein from one arm.
    - Basilic vein from the other arm.
5. For AV fistula planning:
    - Scan the non-dominant arm if there is no pacer, defibrillator, or central venous catheters
    - If veins are adequate in the non-dominant arm (> 2.5mm) no need to scan the other arm
    - If the patient has a pacer, defibrillator, or central venous catheter or other contra-indications for AVF creation in the non-dominant arm, then scan the dominant arm
    - If the patient's vein size is too small (< 2.5 mm) in the non-dominant arm, then scan the dominant arm

Vein Mapping Exam:

- **Greater Saphenous Vein (GSV):** Place the transducer at the junction of the GSV with the CFV (approximately four cm below the inguinal ligament). Follow the GSV from this point inferiorly, in transverse orientation, as far distally as possible until the diameter becomes < 3 mm. Vein compressibility should be noted throughout. GSV total length and diameter at 30 cm AK, 20 cm AK, 10 cm AK, knee, 10 cm BK, 20 CM BK are imaged and documented.
- **Lesser Saphenous Vein (LSV):** If the GSV is of inadequate quality or surgically absent, the LSV may need to be mapped. The LSV empties into the popliteal vein

posteriorly and extends along the posterior aspect of the calf. The LSV is superficial and lies between the two heads of gastrocnemius muscle. Follow the LSV from the proximal point inferiorly, in transverse orientation, as far distally as possible until the diameter becomes < 3 mm. Vein compression should be noted throughout. LSV total length and diameter are imaged and documented at knee, 5 cm BK, 10 cm BK, 15 cm BK and 20 cm BK.

- **Cephalic Vein (CV):** Depending on the planned surgical procedure and the length of vein needed, the cephalic vein may need to be mapped. The cephalic vein is a superficial vein in the arm and empties into the axillary vein near the clavicle. Follow the cephalic vein from its junction with the axillary vein, in a transverse orientation, toward the elbow, until the diameter becomes < 3 mm. Vein compression should be noted throughout. Cephalic vein total length and diameter are imaged and documented at 30 cm AE, 20 cm AE, 10 cm AE, and at the elbow. In the setting of AV fistula planning the diameter of the cephalic vein is also documented at 10 cm BE, 20 cm BE, and at the wrist, and the diameter of the median antecubital vein is documented as well.
- **Basilic Vein (BV):** Depending on the planned surgical procedure and the length of vein needed, the basilic vein may need to be mapped. The basilic vein is a superficial vein in the arm that is located medially and empties into the axillary vein near the axilla. Follow the basilic vein from its junction with the axillary vein, in transverse orientation, toward the elbow, until the diameter becomes < 3 mm. Vein compression should be noted throughout. Basilic vein total length and diameter are imaged and documented at 20 cm AE, 10 cm AE, and at the elbow.

Patency Exam:

- **Lower Extremity:** The patency exam will consist of a transverse compression exam of the lower extremity veins for DVT. The common femoral vein through the popliteal, deep calf veins, greater saphenous, and (if requested) lesser saphenous will be evaluated in this fashion. The vein will be compressed sequentially every one to two cm's with moderate probe pressure. The vein should be observed to completely coapt and then reopen as pressure is released.
- **Upper Extremity:** The patency exam will consist of transverse compression of the cephalic, basilic, brachial, and distal portions of the axilliary veins. The proximal axillary vein and internal jugular vein will be evaluated by color flow imaging. A duplex angle-corrected spectral Doppler signal of the subclavian vein will be obtained to evaluate the subclavian vein for indirect assessment of proximal DVT.

<u>Imaging Protocol:</u>

- Lower Extremities:
    - Greater Saphenous Vein:
        - Transverse GSV @ 30 cm AK with diameter measurement.
        - Transverse GSV @ 20 cm AK with diameter measurement.
        - Transverse GSV @ 10 cm AK with diameter measurement.

        - Transverse GSV @ the knee with diameter measurement.
        - Transverse GSV @ 10 cm BK with diameter measurement.
        - Transverse GSV @ 20 cm BK with diameter measurement.
    - Lesser Saphenous Vein:
        - Transverse LSV @ the knee with diameter measurement.
        - Transverse LSV @ 5 cm BK with diameter measurement.
        - Transverse LSV @ 10 cm BK with diameter measurement.
        - Transverse LSV @ 15 cm BK with diameter measurement.
        - Transverse LSV @ 20 cm BK with diameter measurement.
    - Patency Exam - Lower Extremities:
        - Transverse noncompressed/compressed CFV
        - Transverse noncompressed /compressed mid FV
        - Transverse noncompressed/compressed popliteal vein
        - Longitudinal color flow of the posterior tibial and peroneal vein
- Upper Extremities:
    - Brachial Artery: Measure the outer to outer AP diameter of the brachial artery just above the elbow in the setting of AV fistula planning.
    - Radial Artery: If cephalic vein is >3 mm at the wrist, measure diameter of radial artery
    - Cephalic Vein:
        - Transverse CV @ 30 cm AE with diameter measurement.
        - Transverse CV @ 20 cm AE with diameter measurement.
        - Transverse CV @ 10 cm AE with diameter measurement.
        - Transverse CV @ the elbow with diameter measurement.
        - Transverse CV @ 10 cm BE with diameter measurement.
        - Transverse CV @ 20 cm BE with diameter measurement.
        - Transverse CV @ the wrist with diameter measurement.
    - Basilic Vein:
        - Transverse BV @ 20 cm AE with diameter measurement.
        - Transverse BV @ 10 cm AE with diameter measurement.
        - Transverse BV @ the elbow with diameter measurement.
        - Transverse median antecubital vein with diameter measurement.
    - Patency Exam – Upper Extremities:
        - Color images of the internal jugular, subclavian and axillary veins, including angle-corrected spectral Doppler of the subclavian vein as indirect assessment of proximal DVT.
        - Transverse noncompressed / compressed internal jugular vein.
        - Transverse noncompressed / compressed brachial veins.
        - Transverse noncompressed / compressed basilic vein.
        - Transverse noncompressed / compressed cephalic vein.

Diagnostic Criteria

Vein Mapping

Criteria for Adequate Vein to Qualify for Surgical Harvest

1. Available – GSV, LSV, cephalic, and / or basilic veins must not be needed to circumvent deep venous occlusion.
2. Patency - Vein must be compressible throughout.
3. Size - Vein diameter must be 3 mm or greater.
4. Length - Vein must be long enough to be useful.

Compression Criteria for Venous Thrombosis

- Lack of venous compressibility.
- Visualization of intraluminal thrombus with complete or partial obstruction of the vein lumen.

Upper Extremity Vein Mapping for Dialysis (AV) Fistula Planning

The clinical questions to be answered are:

- Are the thoracic and upper veins patent?
- Is there any venous stenosis?
- What is the caliber and patency of the basilic and cephalic veins? These two veins need to be measured from the level of the elbow to the insertion into the deep system. In addition, the cephalic vein should be measured from the level of the elbow to the wrist. Any vein that is 3.0 mm. or greater is acceptable in this setting.
- What is the diameter of the distal brachial artery?

References

1. Priest DL, Zwiebel WJ: Chronic Venous Insufficiency, Varicose Veins, and Saphenous Vein Mapping. In Zwiebel WJ (ed): Introduction to Vascular Ultrasonography, 3rd ed. 1992, pp 323-331

Gundersen Health System
Ultrasound Department
Upper Vein Mapping Form

Patient Name:_____ Planned Procedure:_____
Patient MRN:_____ Date:_____

Thrombus Exam	**Right**		**Left**	
Vessel	**Normal**	**Abnormal**	**Normal**	**Abnormal**
IJV				
Innominate V				
Subclavian V				
Axillary V				
Brachial V				
Basilic V				
Cephalic V				

*If Thrombus is present, fill out DVT worksheet

1. Cephalic Vein Mapping Exam

Cephalic V Location	**Diameter (mm)** **Right**	**Left**
30 cm AE		
20 cm AE		
10 cm AE		
Elbow		
10 cm BE		
20 cm BE		
At Wrist		

2. Basilic Vein Mapping Exam

Basilic V Location	**Diameter (mm)** **Right**	**Left**
20 cm AE		
10 cm AE		
Elbow		
Med Antecub V		
Distal Brachial Artery		
Radial Artery		

***Adequate vein must have a diameter of >2.5 mm in the upper extremity**

Sonographer:_____ Comments:_____

_____

Gundersen Health System
Ultrasound Department
Lower Vein Mapping Form

Patient Name:_____ Planned Procedure:_____
Patient MRN:_____ Date:_____

Thrombus Exam	**Right**		**Left**	
Vessel	**Normal**	**Abnormal**	**Normal**	**Abnormal**
CFV				
Femoral V				
Pop V				
PTV				
Peroneal V				
GSV				
SSV				

*If Thrombus is present, fill out DVT worksheet

1. GSV Mapping Exam

GSV Location	**Diameter (mm)** **Right**	**Left**
30 cm AK		
20 cm AK		
10 cm AK		
knee		
10 cm BK		
20 cm BK		

2. SSV Mapping Exam

SSV Location	**Diameter (mm)** **Right**	**Left**
Knee		
5 cm BK		
10 cm BK		
15 cm BK		

***Adequate vein must have a diameter of > 3mm in the lower extremity**

Sonographer:_____ Comments:_____

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