

OLYMPIC VASCULAR LAB
CEPHALIC AND BASILIC VEIN MAPPING
Revised/Approved Date: 4/10/02

I. PURPOSE

To assess the suitability of a vein for use as a dialysis access graft or as a bypass conduit.

- A. The cephalic vein or the basilic vein may be used as arteriovenous fistulas for dialysis.
- B. Dialysis shunts may be anastomosed to either the cephalic or the basilic vein.
- C. In the absence of greater saphenous veins, arm veins become an alternative for autogenous bypass grafts.

II. INDICATIONS

- A. Patients in renal failure that require fistulas for hemodialysis.
- B. Severe ischemia of the lower or upper extremities or the heart may necessitate revascularization with autogenous bypass grafts. The greater saphenous veins are the first choice for an autogenous graft. However, the saphenous veins may:
 - 1. Be absent, previously used as a bypass, or stripped if varicose
 - 2. Be unusable as a graft because of thrombophlebitis or varices
 - 3. Not long enough for the required bypass.

III. CONTRAINDICATIONS AND LIMITATIONS

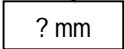
- A. The following conditions limit the areas accessible to the ultrasound beam:
 - 1. Open wound, fresh incision, ulceration, or skin staples
 - 2. Bandages and casts
 - 3. Trauma.
- B. Patient position and inability to move (e.g., surgical procedure, traction, paralysis) may limit arm vein mapping.

IV. EQUIPMENT AND SUPPLIES

- A. High-resolution B-mode duplex with color flow imager.
- B. Standard supplies for ultrasonic examination: acoustic coupling gel, gloves and skin wipes
- C. Although not absolutely necessary, tourniquets, heating pads and warm room help facilitate the exam and give a more accurate representation of vessel size.
- D. Liquid marking ink (gentian violet) if skin mapping is required.
- E. Pillow(s) or foam pad to position the patient comfortably
- F. Material for hardcopy documentation (we use MO Disc and Sony black and white film)

V. PATIENT PREPARATION

- A. Explain the procedure to the patient and answer any questions
- B. Document the pertinent history and appropriate indications

- C. The patient may be sitting, resting supine with the arms dependent, placed in the reverse Trendelenburg's position, or placed in a Trendelenburg's position with the hands over the head. Patient position should be optimized so that gravity helps dilate the veins.
- D. The room and the patient should be warm and comfortable.
- E. A heating pad or hot water bottle can be used (with caution) around the hand during forearm or upper arm imaging or around the forearm during upper arm imaging. The pad temperature should be below 44 C.
- F. While imaging veins distal to the shoulder, a tourniquet can be placed around the upper arm to dilate the veins and optimize the procedure. Especially if the veins are of inadequate size (<3cm) 
- G. Hand exercise may help dilate the veins.
- H. Tapping the veins may cause reactive dilation.

VI. PROCEDURE: GENERAL CONSIDERATIONS

- A. Before beginning, make sure that the Vascular Technologist and the patient are both comfortable. Complex and small venous systems can take as long as 1 hour to map completely.
- B. Use enough gel to facilitate visualization.
- C. Marking the skin may not be essential; check with the appropriate physician. During excision, the surgeon usually traces the pathway of the vein under direct vision. Marking may help in cases of unusual anatomy or double channels or for the design of dialysis fistulas. Make sure to keep the probe perpendicular to the surface of the skin so that the line marked on the surface is directly over the vein. Use a short straw or coffee stirrer to mark the skin through the gel. After completing a section, wipe the area dry and mark with gentian violet.
- D. Follow the venous branches to their completion to avoid missing variant anatomy.
- E. The location of valve sinuses need not be noted unless they are stenotic or otherwise abnormal.
- F. Confirm the patency of the vein with pulsed Doppler or color flow imaging. Position the Doppler cursor within the segment of the vein in question and tap the vein distally. Color flow examination may speed the entire examination. This only needs to be done when the vein does not coapt with compression or if there is **any** question of patency.
- G. The veins should be dilated as much as possible. Gravity, heating, occlusion, tapping, and hand exercise can help. However, stagnant flow forced by the application of a tourniquet may not be easily differentiated from surrounding tissues.
- H. The diameter and depth of the veins (anteroposterior and/or lateral), measured in a transverse plane without any probe compression, should be noted approximately every 2 inches or when a significant change in size is seen.
- I. Thrombosed or phlebotic segments of the vein should be noted.
- J. The length and continuity of the veins should be measured and noted, respectively. We only measure if to be used for lower extremity bypass.
- K. Detailed identification of branches is not essential. However, identification of the particular variants at the median antecubital fossa is mandatory.
- L. Identification of the level where the basilic vein joins one of the brachial veins is mandatory.
- M. A drawing to be taken to surgery should identify the following preferential segments for **bypass**:
 1. Forearm cephalic vein in continuity with the upper arm cephalic vein. This vein is preferentially used in a reversed fashion but can be implanted nonreversed with the valve stripped.
 2. Forearm cephalic vein in continuity with the upper arm basilic vein. This vein is used preferentially nonreversed with the valve stripped.
 3. Upper arm cephalic vein in continuity with the upper arm basilic vein.
 4. Upper arm basilic vein in continuity with the forearm basilic vein.
 5. Any segments of forearm or upper arm basilic veins.

VII. PROCEDURE: TEST PROTOCOL

- A. Start at the Internal Jugular vein. Check for patency by identification of flow and changes in vessel size with respiration.
- B. Document flow in both the subclavian artery and vein. Arterial flow should be triphasic. Flow in the vein should vary with respiration.
- C. Locate cephalic vein junction and measure diameter and depth.
- D. Follow the cephalic vein in cross-section with intermittent probe compressions, taking diameter and depth measurements, to the antecubital fossa.
- E. Note the presence of and continue mapping double cephalic systems.
- F. If the upper arm cephalic vein is absent, note if a forearm cephalic vein–upper arm basilic vein connection is present.
- G. Bend arm up and out to expose the axilla and confirm patency of the axillary artery and vein.
- H. Measure diameter and depth of axillary vein.
- I. Locate the basilic vein as it joins the brachial vein. (The basilic vein is not one of the veins adjacent to the brachial artery.)
- J. Follow the basilic vein to the antecubital fossa.
- K. Repeat same probe compression maneuvers, diameter measurements, and flow determination for the basilic vein.
- L. Compression maneuvers to increase flow can be performed manually.
- M. Determine the anatomy of the median antecubital vein and note potential anomalies, which are common:
 1. Predominant forearm cephalic upper arm basilic vein
 2. Dual upper arm cephalic veins
 3. Y-shaped connection between the cephalic and basilic veins
 4. Other less common and unusual variations.
- N. Follow the cephalic vein from the antecubital fossa to the "snuffbox" (the hollow on the radial aspect of the wrist when the thumb is extended fully)
- O. Follow the basilic vein posteromedially in the forearm as far as possible

Note: If you are marking the skin, indicating anatomy and other major branches, follow steps similar to those described in the venous procedure *Saphenous Vein Mapping*.

VIII. DOCUMENTATION

- A. A useful document is a drawing of the arm veins that can be taken to the operating room. Draw a map of patent venous segments. State diameter dimensions every 1 or 2 inches or when major changes in diameter occur.
- B. Document representative diameters of the veins on hardcopy and on MO Disc.
 1. Document diameters proximal to the elbow and distal to the shoulder for upper arm veins.
 2. Document diameters from the elbow to the wrist for forearm veins
 3. Document intermediary measurements according to the lack of uniformity of the vein.
 4. Document significant changes in diameter.
 5. Document all abnormal findings.
- C. Document representative flows in the venous segments studied. Document all abnormal flow findings.
- D. Record the overall assessment of the venous system and any problems with the procedure.

IX. INTERPRETATION

- A. Patent veins greater than 2 mm in diameter usually will result in grafts greater than 4 mm in diameter. Use a tourniquet to re-measure any vein that measures less than 3mm to confirm that the vein will dilate.
- B. The length of available vein(s) determines the autogenous graft to be implanted. The extent of obstruction within the vein is measured as well.
- C. The anatomic configuration alone should not be used to interpret an examination as normal or abnormal. Venous flow findings and wall and valve leaflet appearances also should be considered.
 - 1. Phasicity with breathing and augmentation with distal compression indicate normal flow.
 - 2. Lack of flow or diminished augmentation on compression indicate thrombosis and/or obstruction in the same manner as in studies for deep venous thrombosis
 - 3. Tortuous flow channels suggest recanalization of previous thrombosis.
 - 4. A good vein appears thin-walled and is easily compressible. A poor-quality vein appears thick-walled and has a residue under compression.
 - 5. If valve leaflets are visualized, they should appear thin and freely moving within the lumen. If the valve leaflet is rigid and fixed in the lumen, report it as an abnormality.
- D. The interpreter should state the patent veins in order of preference for a dialysis fistula or a bypass based on patency, diameter, and available length. The interpretation should include specific statements regarding the forearm and upper arm cephalic and basilic veins and comments about anatomic variances if necessary. Longer veins with diameters greater than 2 mm are listed first.

X. REPORTING

- A. A copy of the arm vein mapping report, including the drawing of the veins, is sent or given to the referring physician and/or surgeon.
- B. The surgeon should be notified of any serious abnormalities such as vein absence, thrombosis, inadequate length of good veins, or unusual anatomic variants.
- C. A final report is mailed or faxed to the referring physician, if not one of our surgeons, after medical interpretation and signature. The original copy is filed in the Vascular Lab chart and a copy is also filed in the office chart

XI. CLEANING AND CARE OF EQUIPMENT

- A. Transducers and equipment are cleaned with appropriate cleaner as directed by the manufacturer.
- B. Heating blankets, tourniquets etc. are wiped clean after use. Alcohol or stronger disinfectant is used as appropriate.
- C. General vascular laboratory routine should be followed as in any other test.