Evaluation of Dialysis Access

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Evaluation of Dialysis Access

PURPOSE
To determine the patency of the dialysis access fistula or graft and/or identify abnormalities that may be present.

COMMON INDICATIONS
- Pseudo aneurysmal dilatation
- Pulsatile thrill
- Loss of thrill or decrease in strength of thrill in access
- Difficult canulation by the dialysis center
- Elevated recirculation time
- Elevated venous pressure
- Low urea reduction ratio
- Complaints of hand pain or numbness during or immediately after dialysis, or following creation of the access
- Venous hypertension or edema of affected limb
- Aspiration of clot during dialysis
- Excessive bleeding post dialysis

CONTRAINDICATIONS AND LIMITATIONS
Contraindications for evaluation of dialysis access are few; however, some limitations exist and may include the following:
- Open areas with skin surface where the graft is exposed
- Extreme hypotension (flow volume and velocities may be affected)
- Anastomosis sites are sometimes difficult to evaluate due to angulation. Color is helpful in the sagittal and transverse views
- Evaluation of the outflow vein may be difficult due to location of access and/or obesity
- Edema
GUIDELINE 1: PATIENT COMMUNICATIONS AND POSITIONING

1.1 Explain why the dialysis access evaluation is being performed and indicates how long it will take.

1.2 Explain the procedure to the patient, taking into consideration the age and mental status of the patient and to ensure that the patient understands the necessity for each aspect of the evaluation.

1.3 Respond to questions and concerns about any aspect of the dialysis access evaluation.

1.4 Refer specific diagnostic, treatment or prognosis questions to the patient’s physician.

1.5 Patient positioning is most often supine, with the arm relaxed and extended out to the side with area to be evaluated closest to the sonographer. For patient comfort, it is helpful to support the arm on a small pad or pillow. The patient may be examined in the sitting position, as long as the limb being examined can be positioned so that it is comfortable for the patient while still remaining accessible to the sonographer.

1.6 Thigh fistula/graft should be evaluated in the supine position.

GUIDELINE 2: PATIENT ASSESSMENT

Patient assessment must be performed before Evaluation of the Dialysis Access is performed. It includes assessment of the patient’s ability to tolerate the procedure and an evaluation of any contra-indications to the procedure.

The technologist/sonographer/examiner should:

2.1 Obtain a complete, pertinent history by interview of the patient or patient’s representative and review of the patient’s medical records whenever possible. A pertinent history includes:

a. Current medical status (including status of current dialysis)

b. Previous surgeries or invasive procedures involving the affected arm or neck

c. Current medications or therapies

d. Presence of any risk factors, recent or past surgery on the fistula/graft extremity.

e. Verify that the requested procedure(s) correlates with the patient’s clinical presentation

f. Current or past history of venous thrombosis (including the central veins)

2.2 A clinical evaluation of the dialysis access should be performed:

a. Determine access patency by the presence of a palpable thrill as well as the strength and consistency of thrill throughout the access (Note: prominent pulsatility is abnormal)

b. Provide a visual inspection of the limb and access site noting areas of redness, swelling, dilatation, presence of collateral vessels, ecchymosis, rotation of puncture sites and palpable prominent localized areas of pulsations (suggesting pseudoaneurysm)

c. To differentiate between the arterial and venous sides of the loop graft (U shape), gently compress the graft in the middle of the loop and check each side of the loop for an arterial pulsation. There will be pulsation on one side only, and thus identify the arterial side (inflow). There would not be any pulsation palpated during compression on the venous side.
GUIDELINE 3: EXAMINATION GUIDELINES

Throughout each exam, sonographic characteristics of normal and abnormal tissues, structures, and blood flow must be observed so that scanning technique can be adjusted as necessary to optimize image quality and spectral waveform characteristics. The patient's physical and mental status is assessed and monitored during the examination, with modifications made to the procedure plan according to changes in the patient's clinical status during the procedure. Sonographic findings are analyzed throughout the course of the examination to ensure that sufficient data is provided to the physician to direct patient management and render a final diagnosis.

INSTRUMENTATION:

3.1 Use appropriate duplex instrumentation, which includes display of both two-dimensional structure and motion in real-time and Doppler ultrasonic signal documentation with:
   a. Spectral analysis with or without color Doppler imaging
   b. Imaging carrier frequency of at least 5-10 MHz
   c. Doppler carrier frequency of at least 3.0 MHz

3.2 Hardcopy, film or digital storage capabilities

EXAMINATION PROTOCOL:

Follow a standard exam protocol for evaluation of dialysis access... studies are usually unilateral. The standard exam includes:

- Duplex begins with the inflow artery
- Proceed to the arterial anastomosis
- Continue scanning throughout the body of the access, obtaining spectral signals throughout; paying special attention to puncture sites (for narrowing, thrombus or psa from repeated punctures) which are easily identified along the access
- Proceed to the venous anastomosis if patient has a graft. If you are scanning a native access, follow the venous outflow as high on the chest as possible, including the cephalic/subclavian confluence and the subclavian vein as these are common sites of stenosis. Color may be helpful at these sites in order to help identify abnormal flow.
- If lower or decreased Pulsatility is seen in the proximal outflow vein, evaluate the internal jugular vein as far towards the central outflow system (innominate), to help determine possible central vein stenosis or occlusion.
  — Scan the fistula in transverse to locate possible branch veins that are preventing the access from maturing.
  — Measure the branches and document the location.
  — Aneurysmal areas should also be measured in transverse and document the location.

3.3 Doppler evaluation: Doppler is used primarily to document patency of the vessels and fistula/graft as well as to identify any areas of stenoses in the inflow artery, anastomosis, within the fistula/graft or in the outflow vessels. Doppler spectral analysis is performed in the sagittal plane. All Doppler samples must be performed at an angle of 60 degrees or less with respect to the direction of blood flow. Doppler cursor alignment is recommended parallel to the vessel walls. A representative waveform should be recorded. When stenosis is present, velocities should be measured prior to the stenosis as well as within the region of abnormality and distal to the stenosis.

3.4 Steal Phenomenon: Complaints of numbness and/or pain in the hand suggests a steal phenomenon may be present.
   a. Symptoms of steal are often not recognized by the patient until permanent damage has occurred. The patient should be questioned at each visit for the presence of any symptoms. Symptoms may include
intermittent or constant numbness of the fingers or hand, pain in the fingers or hand, discoloration of the fingers, and/or inability to use the hand.
b. If symptoms are present, pulse waveforms should be recorded for the patient record and then digital pressures of the symptomatic digits, or at a minimum the thumb or 1st digit and the 2nd or 4th digits should be taken at rest, using phytophlethysmography or volume pulse recordings.
c. The pressure should then be repeated with manual (digital) compression of the outflow (venous) access. If the pressures and waveform increase with compression then a steal is suspected or confirmed and these findings should be documented. The physician or medical director should be notified immediately of these results, as intervention urgently may be indicated. The significance of any steal will be determined by the attending physician.

GUIDELINE 4: REVIEW OF THE DIAGNOSTIC EXAM FINDINGS
The technologist/sonographer/examiner should:
4.1 Review data acquired during the Evaluation of the Dialysis Access to ensure that a complete and comprehensive evaluation has been performed and documented.
4.2 Explain and document any exceptions to the routine Evaluation of the Dialysis Access examination protocol (i.e., study limitations, omissions or revisions).
4.3 Record all technical findings required to complete the final diagnosis on a worksheet, or other appropriate methods, such as computer logs, etc., so that the findings can be classified according to the laboratory diagnostic criteria (these criteria may be based on published or internally validated data) (see Appendix).
4.4 Document the exam date, clinical indication(s), technologist performing the exam and a summary of the exam results in a vascular laboratory logbook or other appropriate method, i.e., computer log, etc.
4.5 Alert health care provider when immediate medical attention is indicated based on the Evaluation of the Dialysis Access findings and according to laboratory protocol.

GUIDELINE 5: PRESENTATION OF EXAM FINDINGS
5.1 Preliminary results may be provided when necessary as established by internal guidelines in individual laboratories.
5.2 Present record of diagnostic images, data, explanations, and technical worksheet to the interpreting physician for use in rendering a diagnosis and for archival purposes.

GUIDELINE 6: EXAM TIME RECOMMENDATIONS
High quality and accurate results are fundamental elements of the dialysis access examination. A combination of indirect and direct exam components is the foundation for maximizing exam quality and accuracy

6.1 Indirect exam components include pre-exam procedures: obtaining previous exam data; pre-exam paperwork; exam room and equipment preparatory activities; patient assessment and positioning (Guideline 1 & 2); and, post-exam procedures: cleanup; compiling, processing, reviewing exam data for preliminary and/or formal interpretation (Guidelines 3 and 4); patient communication (Guideline 2); exam charge and billing activities. Recommended time allotment is 25 minutes.
6.2 Direct exam components include equipment optimization and the actual hands-on, examination process (Guideline 3). Recommended time allotment is 35-45 minutes provided the procedure is unilateral.
GUIDELINE 7: CONTINUING PROFESSIONAL EDUCATION

Certification is considered the standard of practice in vascular technology. It demonstrates an individual’s competence to perform vascular technology at the entry level. After achieving certification from either ARDMS (RVT credential), CCI (RVS credential), or ARRT (RT-V) an individual must keep current with:

7.1 Advances in diagnosis and treatment of dialysis access grafts
7.2 Changes in dialysis access protocols or published laboratory diagnostic criteria.
7.3 Advances in ultrasound technology used for Dialysis Access Evaluation.
APPENDIX

It is recommended that published or internally generated diagnostic criteria should be validated for each ultrasound system used. When validating ultrasound diagnostic criteria, it is important to realize that equipment, operator and interpretation variability is inherent to this process.

REFERENCES

- Robbin, AM; Introduction to Vascular Ultrasonography, 5th edition. Zweibel