THE SOCIETY FOR VASCULAR TECHNOLOGY OF GREAT BRITAIN AND IRELAND

Vascular Technology Professional Performance Guidelines

Endovascular Aneurysm Repair (EVAR) Duplex Ultrasound Examination

Introduction

This guideline was prepared by the Professional Standards Committee (PSC) of the Society for Vascular Technology (SVT) as a template to aid the clinical vascular scientist/vascular sonographer and other interested parties. It can be used in conjunction with local protocols. It may be used in part or in its entirety with suitable additions made by local policy implements, and should be read in combination with the following guidelines when setting up a service to provide post abdominal aortic aneurysm repair surveillance: Guidance is given to implementation of duplex in the Vascular Society Great Britain and Ireland document The Provision of Services for Patients with Vascular Disease 2018 [1].

Suggestions for improving this guideline are welcome, and should be sent to the Chair of the PSC; see www.svtgbi.org.uk for current Chair details.

Purpose

EVAR surgery employs the use of stent-grafts positioned within the aorto-iliac system in individuals with abdominal aortic and iliac artery aneurysms. The primary role of this surgery is to eliminate the pressure exerted on the aneurysmal arterial walls, therefore reducing the risk of rupture.

The technique is typically performed using total arterial percutaneous catheterisation or surgical exposure of the groin to gain access to the common femoral artery[1].

Routine surveillance, post procedure, is important to detect and evaluate complications that can arise which may result in potential aneurysm rupture. These complications can potentially be life threatening and require rapid detection and repair/correction.

Post procedural complications have been reported in almost 30% of EVAR surgeries with late intervention for complications being required in almost 2-3% of cases [2, 3].

The surveillance of EVAR should be effective in detecting endoleaks, sac growth, further aneurysm formation, in-stent stenosis, stent kinking and thrombosis. Early post procedural access site complications should also be included in the assessment.[1]

The latest recommendations for the use of EVAR in the management of abdominal aortic aneurysm are given in guidance issue by NICE[1].

Common indications
Common indications for performing this examination include:

- Initial post-EVAR assessment (~48 hours)
- Routine EVAR surveillance
- Post surgical intervention follow-up e.g. post limb extension or angioplasty
- Patency and functionality of crossover grafts, fenestrations and multi-branched devices
- False aneurysm/fluid collection(s) at access site(s)

Contraindications and limitations
Contraindications for post EVAR duplex ultrasound assessment are unlikely; however, some limitations exist and may include the following:

- Obesity
- Dressings, open wounds etc..
- Patient unable to lie flat
- Bowel gas when examining the abdominal area
- Give an explanation of the procedure and it's duration – consideration should be made to the age and mental status of the patient
- Patient discomfort
- Acoustic shadowing from certain graft types

Patient pathway
It is suggested that patients who have undergone EVAR procedures should be placed on a surveillance programme. Proper surveillance relies on appropriate imaging protocols and interpretations. [6]

Patient referral
Referrals for post EVAR duplex allow for follow-up of patients with the above clinical indications and can be used to check technical adequacy following intervention.

Post-EVAR referral, surveillance intervals and procedures should be agreed locally[1,5].

Patient preparation
The examination may be successful without the patient fasting, but images may be improved by asking the patient to consume clear fluids only for 4-6 hours before the examination. Caution should be exercised when altering the diet of diabetic patients. Dressings may need to be removed to assess access sites for potential psuedoaneurysm formation. Infection control procedures should be followed.

Explanation of examination and patient history
There is no legal requirement that written patient consent be obtained prior to a post EVAR duplex examination. However, patients should be fully informed about the nature and conduct of the examination so that they can give verbal consent.

Obtain a pertinent medical history from the patient and/or notes:

- Verify that the requested procedure correlates with the patient's clinical situation
- Previous extent of aneurysmal dilatation
- Type of device e.g. bifurcating, aorto-uni-iliac with crossover graft, fenestrated, branched or chimney and complex device types
- History of previous treatment e.g. angioplasty or embolization
- Results of other relevant diagnostics & previous vascular studies [4]

Examination
The patient is asked to remove their clothing to expose the abdomen. The patient is examined supine. The patient's dignity and privacy should be maintained at all times. Due to the intimate nature of the examination it may be considered necessary to offer a chaperone[7].

During the examination the patient's mental and physical status should be monitored and modifications made to the examination accordingly.

The following techniques should be used to evaluate the aorto-iliac system and their stented component:

- B-mode should be used to image the EVAR graft, its position and location, the size of the residual aneurysm sac and echogenicity of its contents.
- Spectral Doppler should be used to determine: waveforms within the main body and each limb of the graft, direction of flow, stenotic flow and absence of flow
- Colour Doppler should be used to assess for the presence/absence of flow within the stent graft limbs and aid position of spectral Doppler when quantifying stenoses. Examine the residual aneurysm sac in both transverse and longitudinal planes to assess for the presence/absence of flow (endoleak) within the residual aneurysm sac.

General Considerations
Colour Doppler parameters must be set using the most sensitive settings to detect slow flow within the aneurysm sac; some centres may consider the use of contrast enhanced ultrasound to aid visualisation of low flow endoleaks[6].

Evaluation of the following arteries may be included:

- Aorta
- Common iliac artery (CIA)
- External iliac artery (EIA)
- Common femoral artery (CFA)
- Crossover graft if applicable

Other General considerations
Measurement technique should ensure accuracy is optimised as appropriate to the clinical scenario, this may require:

- Optimal adjustment to scale, gain and cursor placement for velocity measurements
- Selection of an appropriate probe including knowledge of probe resolution (axial/lateral) for linear measurements.
- Ensuring reported linear measurements are consistent with the level of accuracy/resolution possible, including the use of rounding where appropriate.
- Optimised technique for volume flow measurements, applying knowledge of all sources of error and ensuring reported measurements do not imply a level of accuracy which is not possible.
- Currently there is no universally accepted standard for ultrasound measurement of Abdominal Aortic Aneurysm (AAA). Two basic methods are used: Inner To Inner (ITI) or Outer To Outer (OTO) [16,17]. There is expected difference in AAA diameter between the two methods. However, ITI wall method looks measurably more reproducible but it is up to the local service to decide which method should be used.

Reporting

The report is a recording and interpretation of observations made during the EVAR duplex ultrasound examination; it should be written by the CVS undertaking the examination and viewed as an integral part of the whole examination.

The report should include correct patient demographics; date of examination; examination type and the name and status of the person carrying out the examination [9,10].

The report should include:

- Presence/absence of endoleak(s), including location and endoleak type: [3,6,11,12,13,14]

Endoleak Type:	Description:
Type Ia Ib	Proximal (a) or distal (b) limb attachment leak
Type II	Lumbar or IMA vessel involvement
Type III	Graft fabric tear or modular limb connection failure
Type IV	Sac increase due to graft porosity
Type V	Sac increase due to endotension

- Residual aneurysm sac diameter and the method of measuring aneurysm diameter should be documented e.g. anterior-posterior outer wall – outer wall etc.. [5,15].
- Patency of stent/limb(s) with flow quality, including crossover graft if applicable
- Any other incidental findings, e.g. false aneurysm, haematoma, arterio-venous fistula, intimal flaps, dissection etc.
- Any limitations e.g. difficult examination due to body habitus, stent attenuation, bowel gas, calcification etc.
- An appropriate number of annotated images that represent the entire ultrasound examination in accordance with local protocols and SVT Image Storage Guidelines [18]. Referral of critical ultrasound results should be made to the referring consultant or appropriate medical/surgical team (as per local protocol) prior to the patient being discharged, so that treatment plans can be enforced or expedited accordingly.

References

1. https://www.vascularsociety.org.uk/patients/procedures/2/endovascular_aneurysm_repair_evar
2. Follow-up of endovascular aneurysm repair: plain radiography, ultrasound, CT/CT angiography, MR imaging/MR angiography, or what? Kranokpiraksa P,Kaufman JA. 2008, J Vasc Interv Radiol, pp. 19: S27-S36. https://www.sciencedirect.com/science/article/pii/S1051044308002820
3. National Institute for Health and Care Excellence. Abdominal aortic aneurysm: NICE guideline DRAFT. www.nice.org.uk [Online] May 2018. https://www.nice.org.uk/guidance/gid-cgwave0769/documents/short-version-of-draft-guideline.
4. The Society for Vascular Ultrasound. Abdominal Aortoiliac Duplex Evaluation. www.svunet.org.[Online]2019. https://higherlogicdownload.s3.amazonaws.com/SVUNET/c9a8d83b-2044-4a4e-b3ec-cd4b2f542939/UploadedImages/PPG_Docs/17_Abdominal_Aortolliac_Duplex_Evaluation_Updated_2019_.pdf.
5. Essentials of Endovascular Abdominal Aortic Aneurysm Repair Imaging: Postprocedure Surveillance and Complications. Nikhil, Andrew C Kansal and Picel.s.l.: American Journal of Roentgenology, 2014, Vol. 203. https://www.ajronline.org/doi/10.2214/AJR.13.11736
6. Follow-up evaluation of endoluminally treated abdominal aortic aneurysms with duplex ultrasonography: validation with computed tomography, d'Audiffret A, Desgranges P, Kobeiter DH, Becquemin JP.2001, J Vasc Surg, pp.33: 42-50. https://www.jvascsurg.org/article/S0741-5214(01)44034-1/fulltext

7. The Society of Vascular Technology Great Britain and Ireland. Society for Vascular Technology Professional Standards Committee Chaperone Guidelines. https://www.svtgbi.org.uk/professional-issues/.[Online]April 2012
8. The EFSUMB Guidelines and Recommendations for the Clinical Practice of Contrast-Enhanced Ultrasound (CEUS) in Non-Hepatic Applications: Update 2017 (Long Version). Sidhu PS, Cantisani V, Dietrich CF et al. 2018, Ultraschall Med., pp. 39(2): e2-e44. https://pubmed.ncbi.nlm.nih.gov/29510439/
9. Society and College of Radiographers and British Medical Ultrasound Society. Guidelines for professional ultrasound practice. [Online] 2016. https://www.sor.org/learning/document-library
10. The RCR and the Society and College of Radiographers. Standards for the provision of an ultrasound service. https://www.rcr.ac.uk/publication/standards-provision-ultrasound-service. [Online] 2014. https://www.rcr.ac.uk/system/files/publication/field_publication_files/BFCR%2814%2917_Standards_ultrasound.pdf.
11. Hartshorne, Abigail Thrush & Tim. Duplex assessment of Aneurysms and Endovascular Repair. Vascular Ultrasound How, Why and When Third Edition. S.l.: Churchill Livingstone, 2009, p.Chapter 11.
12. Duplex Ultrasound Scanning is Reliable in the Detection of Endoleak Following Endovasculr Aneurysm Repair. Sandford RM. Bown MJ, Fishwick G et al. 2006, Eur J Vasc Endovasc Surg. https://www.sciencedirect.com/science/article/pii/S1078588406003133
13. The Use of Colour-flow Duplex Scan for the Detection of Endoleaks. McLafferty RB, McCrary BS, Mattos MA et al. 2002, J Vasc Surg, pp. 36: 100-104.
14. https://radiologykey.com/endoleaks-classification-diagnosis-and-treatment/
15. AIUM Practice Parameter for the Performance of Diagnostic and Screening Ultrasound Examinations of the Abdominal Aorta in Adults. [Online] 2015. https://www.aium.org/resources/guuidelines/abdominalAorta.pdf.
16. https://www.sciencedirect.com/science/article/pii/S1078588417307050
17. https://www.sciencedirect.com/science/article/pii/S107858841100133X
18. The Society of Vascular Technology Great Britain and Ireland. Image Storage Guidelines https://www.svtgbi.org.uk/

SVT Professional Standards Committee, April 2021. Review date April 2024.