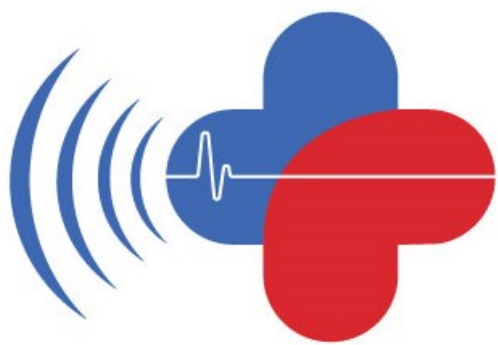




CSVs

THE COLLEGE AND SOCIETY
FOR CLINICAL VASCULAR SCIENCE
Great Britain and Ireland

Vascular Science Guidelines

Endovascular Aneurysm Repair (EVAR) Duplex Ultrasound Examination

Version 2.0

December 2025

Doc Ref PS-PG006



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Purpose

This document was prepared by the Professional Standards Committee (PSC) of the College and Society for Clinical Vascular Science (CSVS) to support the practise and delivery of high quality standardised Clinical Vascular Science. This document may be used in its entirety (or referenced in part with suitable additions made by local policy implementers) by all parties involved with clinical vascular science. Suggestions for improving this document are welcome and should be sent to the Chair of the PSC (see csvs.org.uk for current PSC Chair details).

Introduction

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 issued 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
- 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, and so services should consider how they might support patients to minimise disruption to this, which may include offering to amend the timing of appointments with this in mind. Dressings may need to be removed to assess access sites for potential pseudoaneurysm 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 embolisation
- Results of other relevant diagnostics & previous vascular studies⁴

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:

Evaluation of the following arteries may be included:

- Aorta
 - Common iliac artery (CIA)
 - External iliac artery (EIA)
 - Internal iliac artery (IIA)
 - Common femoral artery (CFA)
 - Crossover graft if applicable
 - In complex devices, the coeliac axis (CA), superior mesenteric artery (SMA), and the renal arteries may also be examined
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- 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

1. 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 or to further characterise it.⁶ Use of contrast agents by non-medical staff including clinical vascular scientists, should be performed in conjunction with local professional practice guidelines specific to the use of contrast agents, and in line with an organisationally approved governance framework with consideration for the legal mechanisms for prescribing and administration of contrast.
2. 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. It is up to the local service to decide which method should be used.

Contrast Enhanced Ultrasound

Use of an ultrasound contrast agent can yield a higher sensitivity for detection of endoleak, and assist in characterising the type of endoleak. Contrast enhanced ultrasound (CEUS) may be considered for use in cases where standard duplex surveillance and/or other imaging is unable to ascertain a cause for sac expansion or there is uncertainty over the nature of any detected endoleak.^{12, 20}

Where CEUS is utilised, services should do so governed by a local protocol accounting for the need to adhere to the statutory requirements for prescribing and administering the contrast agent. Processes should be in place to mitigate risks associated with adverse reactions to contrast, and to care for patients when they arise.

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 the location and the type of endoleak.^{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 expansion due to graft porosity
Type V	Sac expansion 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, presence of absence or stenosis 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 CSVS Image Storage Guidelines.¹⁸
- Escalation of critical 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.

Criteria for visceral artery stenosis within fenestrated or branched devices¹⁹

Vessel	Criteria for Abnormal Appearances
Coeliac axis	PSV >250cm/s with post-stenotic turbulence Suggests >60% stenosis
Superior mesenteric artery	PSV >275cm/s with post-stenotic turbulence Suggests >70% stenosis
Renal artery	PSV 280cm/s or RAR >4.5 Suggests >60% stenosis For renal aortic ratio (RAR) the aortic velocity should be taken within the graft at the level of the renals
Common Iliac artery	PSV >300cm/s with post-stenotic turbulence Suggests >50% stenosis

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