UNIVERSITY HOSPITALS OF COVENTRY AND WARWICKSHIRE

PROTOCOL FOR ULTRASOUND SURVEILLANCE OF ENDOVASCULAR ANEURYSM REPAIRS (EVAR’S)

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INTRODUCTION

EVAR procedures using endovascular stentgrafts to repair aortic and iliac artery aneurysms are becoming more common but they require lifelong surveillance to detect various complications that may arise. Previously contrast CT has been the most common surveillance modality. Ultrasound is now becoming more popular due to its lack of need for nephrotoxic contrast, low cost and avoidance of ionising radiation. Both modalities have differing advantages/disadvantages.

Stent grafts can suffer from various complications including endoleaks (various different types), occlusion, stenosis, kinking, strut fracture, migration, disconnection of limbs and tearing of the graft material.

Ultrasound in experienced and specialist hands can detect most complications. However, plain abdominal X rays are often used at the same visit (AP and lateral) to assess migration of the graft and metal component fractures. However, perhaps the most important assessment through any surveillance programme is whether the aneurysm sac size has expanded giving a risk of rupture despite the treatment aiming to prevent it.

The agreed local unit policy is to perform EVAR surveillance with contrast CT post EVAR routinely at 1 month, 6 months and 12 months. If in the opinion of the Radiologist assessing the imaging, the sac size is stable or reducing, it is agreed unit policy then to transfer the patient to annual US/plain film assessment and surveillance for life until/unless the clinical situation demands otherwise.

Contrast enhanced (microbubble) ultrasound has been shown to give enhanced sensitivity (relative to Colour Duplex ultrasound) for endoleak detection in EVAR surveillance and can assist in definition of the type of endoleak. Consideration is being given to introducing a contrast ultrasound service for patients with sac expansion in whom a leak cannot be found or the type of leak is uncertain.

TREATMENT OF DIFFERENT ANEURYSM GEOMETRY

The easiest type of aneurysm to repair is an infrarenal abdominal aortic aneurysm. This is usually repaired using a bifurcated stentgraft that seals beneath the renal arteries and in the common iliac arteries. Sometimes one common iliac artery is deliberately occluded and a uni-iliac graft is used with a fem-fem crossover graft to supply blood to the other lower limb. The stentgrafts can extend distally to varying degrees. If the common iliac artery is itself aneurysmal to its distal bifurcation, then sometimes the stent may need to cover the origin of the internal iliac artery, which is normally occluded with an occluding device or embolised more distally with coils, both to prevent a type 2 endoleak from the internal iliacs. Fenestrated stents that have side branches into some of the major aortic branches are probably best surveyed using CT as proximal imaging can be difficult with ultrasound.

TYPES OF STENTGRAFT:

The most common type of graft is a covered stent with the proximal seal achieved due by a combination of hooks (fixation) and the outward radial force of the device. Devices are usually self expanding, but may need ballooning to obtain a seal. Some products, such as the Trivascular Ovation stent obtains a proximal seal using flexible rings proximally that are injected with polymer during the procedure. As the rings usually lie distal to the top of the stent, there appearance can suggest a type 1a endoleak for those not familiar with their geometry.

The Nellix device is radically different from other stentgraft designs. The Nellix device uses 2 straight stentgrafts each surrounded by two flexible endobags that are filled with a polymer during the procedure to occupy the space in the sac lumen and prevent sac endoleak whilst arterial flow is maintained via the stentgrafts.

The filled opposing endobags provide a seal within the aneurysm sac. The stents project above and below the filled endobags after the procedure and have a different appearance to a more standard device.

US operators should be familiar with the appearance of different devices being used.

TYPES OF ENDOLEAK

The most common complication post EVAR is an endoleak, which is categorized as to its type:

Type 1. This can be from the sealing zone at the proximal end (Type 1a) or distal end (Type 1b) of the stentgraft. They almost always require treatment.

Type 2. Back bleeding to the aneurysm sac via a native arterial vessel; most commonly arise from lumbar branches of the aorta or from the inferior mesenteric artery. They can resolve spontaneously. They are usually managed conservatively unless the sac is expanding.

Type 3. From modular disconnections of the stentgraft component or erosion/failure of the graft material.

Type 4. From seepage through the graft material and are usually self –limiting and don’t usually require treatment. This is a very uncommon complication with current modern generation of stentgrafts being used

Type 5. Also called endotension, this occurs when the sac size increases without clearly detectable endoleak on imaging. It is thought that this may be due to pressure within the sac either due to seepage across the stent material or due to a leak that is too small to be detected. Treatment is difficult to define, but might involve relining the stent or surgical explantation of the stent and conversion to open repair.

SCHEDULE FOR SURVEILLANCE AT UHCW VASCULAR UNIT

Patients routinely have a CT scan at 1 month, 6 months and 12 months post EVAR. After this ultrasound surveillance with plain films at the same visit is routinely performed yearly indefinitely, or until a clinical decision is made to stop or patient no longer wishes to attend for surveillance (decision should be discussed with the relevant Consultant Vascular Surgeon). Decision to stop surveillance might be due to mutual agreement with patient, increased frailty/ill health or co-morbidities that make continued surveillance inappropriate or not clinically useful.

All of the patient’s initial CT surveillance appointments should be arranged, protocolled and reported by the Vascular Radiologists. If in the opinion of the Vascular Radiologist, the patient has completed CT surveillance successfully, the Radiologist will make arrangements for the first episode of US/PF surveillance. The Vascular Radiologists will deal with any complications or imaging issues arising through the CT surveillance period, either by discussion in Vascular MDT, by communication with the relevant Vascular Surgeon or by arranging further CT or invasive angiographic imaging.

ISSUES FOR THE VASCULAR LAB.

Any ectatic or aneurysmal segments of the aorta or iliac arteries should continue have their diameter measured during the EVAR surveillance scan, whether included in the stented segments or not.

If the ultrasound scan fails to visualise the EVAR and sac or relevant ectatic segments of artery outside the stented zone, then the relevant consultant surgeon should be informed. Usually a CT scan would be organised in this situation. Occasionally the vascular surgeon may request a repeat ultrasound, possibly with fasting, especially in patients with renal failure. If US surveillance subsequently does prove adequate to visualise the relevant anatomy, the patient should be kept under yearly ultrasound surveillance after this, or a clinical decision is made via Vascular MDT to revert to CT surveillance permanently. This might happen if the ultrasound images are very poor and it is judged unlikely to obtain adequate images on further ultrasound scans or there is some technical requirement to demand CT surveillance.

BACKGROUND INFORMATION TO BE DOCUMENTED IN VASCULAR LAB. FOR EACH PATIENT BEFORE SURVEILLANCE

Type of Aneurysm treated: Aorta +/- common iliacs or other ?

Type of stent: Bifurcated, uni-iliac with crossover, iliac branch device etc. Note whether and which vessels have been intentionally embolised/occluded.

Proximal level of the stent:

Distal level of stent on: Rt and Lt – eg. CIA or EIA.

Manufacturer of stent and type:

List of previous CT and ultrasound scan dates and sac diameters:

Date of procedure and follow up interval:

Previous interventions to stent (including any Interventional Radiology procedures post EVAR):

Size of ectatic or aneurysmal arterial segments proximal and distal to stent.

Pain in legs: rest pain or claudication: especially new pain.

It is useful to view previous CT scans of the EVAR graft to appreciate the geometry of the stent and vessels.

ULTRASOUND EVAR SURVEILLANCE METHOD

Use a low frequency curvilinear probe.

Measure inner to inner AP diameter of aorta proximal to stent – probably best measured in longitudinal section.

Image AAA sac in longitudinal and transverse section – carefully orientating probe to get the maximum AP inner to inner diameter. Try where possible to image orthogonal to the stent graft (how the diameter is measured on CT). In transverse the probe angle needs to generate as round a cross section as possible to be accurate.

If common iliac arteries are included in the stented section – measure CIA diameters and note if they have expanded. Usually it is more reliable to measure CIA diameters in longitudinal cross section as it can be difficult to get a circular cross section in transverse section.

In B mode assess the echogenicity of the thrombus in the sac. Echolucent areas sometimes correlate with a leak.

Patency of main body/limbs: Check Colour flow with PRF high to check for stenoses, kinks or occlusions in Longitudinal section.

Assess for Endoleaks: use PRF low - LO and TR projections throughout aneurysm sac, carefully optimise Doppler parameters to obtain accurate assessment of flow - inspect full length of graft including both limbs. Inspect any flow in sac including any flow into aortic branches.

PRF should be as low as possible, but this may be limited by movement artefacts if too low.

Note if there is any flow in arterial segments that have been intentionally occluded.

Note any Endoleaks: suggest type if possible and state confidence. For suspected Type 2 leaks note – take images of flow sonogram in sided branches of aorta and note direction and whether unidirectional or bi-directional. Bidirectional flow in side branches has a stronger association with spontaneous resolution of Type 2 leaks. Number of patent side vessels seen should also be noted.

Take flow waveforms at groins: These should be Biphasic or mildly damped – similar to previous waveforms. Scan crossover graft if waveforms change.

Check to make sure there is no evidence of false aneurysms or haematoma outside the aorta and iliac arteries.

ACTIONS:

No sac expansion and no leaks: scan yearly.

Leaks or any sac expansion – inform Vascular Surgeon and secretary by e mail. For minor sac expansion <5mm, repeat ultrasound in 6 mo. For any sac of 5 mm or more in 6 months or 9mm or greater total expansion in 1 year or more – inform vascular surgeon and secretary promptly and ask then to schedule Vascular MDT discussion.

Note: sac expansion should be judged over the history of the surveillance scans – not just on the last scan. E.g if sac was previously stable, then expands 5mm in 1 yr, then 4mm in the next 6 mo, then this would constitute 9mm expansion over the last 2 scans, which should be prompt MDT discussion.

Any non-visualisation of parts of the graft of aneurysms should be noted and the vascular consultant informed, so that a decision can be made whether further imaging with a different modality is necessary.

PLAIN ABDOMINAL X RAYS IN SURVEILLANCE

Patients need AP and lateral abdominal x rays at the same visit as their Post EVAR US surveillance scan. When the patient is transferred from CT surveillance to US/PF surveillance by a Consultant Radiologist, the Radiologist will request both tests and inform the date for the next surveillance visit. At that visit, Vascular Lab. staff (who are Non-medical Referrers) should request appropriate X rays in advance along with the next US surveillance appointment, so that the patient can attend as a matter of routine at their next visit, and have both the X rays and the ultrasound performed. This arrangement needs to be robust to ensure patients are not lost to follow up. An appropriate operating procedure will be presented to Radiology Dept. QIPS to ensure that designated Vascular Lab. Staff may request these plain radiographs only for the purposes of the UHCW Vascular unit EVAR surveillance programme solely.

REFERENCES

1. Surveillance after EVAR based on duplex ultrasound and abdominal radiography, Harrison GJ et al, Eur.J.Vasc.Endovasc.Surg. , 2011, 42, 187-192
2. SVS (Society for Vascular Surgery) practice guidelines for the care of patients with an abdominal aortic aneurysm: Executive Summary, Chaikof EL et al, J.Vasc.Surg., 2009, 50(4), 880 – 896.
3. Management of Abdominal Aortic Aneurysms Clinical Practice Guidelines of the European Society for Vascular Surgery, Moll FL et al, Eur.J.Vasc.Endovasc.Surg, 2009, 41, S1-S58.

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