Abdominal Aortic Aneurysm

Ultrasound equipment quality assurance guidance
Guidance for abdominal aortic aneurysm screening providers

Version 1.0
October 2014
About the NHS Abdominal Aortic Aneurysm Screening Programme

The NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP) aims to reduce aneurysm-related mortality through early detection, appropriate monitoring and treatment. NAAASP invites men for ultrasound screening during the year they turn 65 while men over 65 who have not previously been screened can self-refer.

The UK National Screening Committee and NHS Screening Programmes are part of Public Health England (PHE), an executive agency of the Department of Health. PHE was established on 1 April 2013 to bring together public health specialists from more than 70 organisations into a single public health service.
About this publication

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Outline and scope

Ultrasound equipment used in the NHS Abdominal Aortic Aneurysm Screening Programme (NAAASP) is subject to quality assurance testing to ensure the safe operation and performance of equipment. This comprises four specific elements:

1. acceptance testing on delivery of new equipment. To be performed by the regional medical physics department
2. safety checks prior to each scanning session
3. monthly performance tests to be carried out by ultrasound quality assurance lead or appropriately trained clinical skills trainers
4. annual performance checks conducted by the regional medical physics department in line with local trust policy of monitoring the performance of ultrasound equipment

Introduction

Quality assurance of ultrasound equipment within NAAASP is of fundamental importance to ensure safety, correct functioning of equipment and the accuracy and reproducibility of electronic calliper diameter measurements. Historically, regular performance of ultrasound equipment was assessed using tissue equivalent test objects. However, there are a number of limitations to this approach as equivalent test objects are expensive, can deteriorate with age and they require staff with expert knowledge to perform the testing.

Modern ultrasound scanners use digital electronics to produce ultrasound images and there are no moving parts within the transducer and consequently no calibration adjustments that can be performed by the operator. However, the performance of the equipment can be monitored using a range of simple tests that can be undertaken on a routine basis. This document is based on recommendations published by the Institute of Physics and Engineering in Medicine, Report 102 ‘Quality Assurance of Ultrasound Imaging Systems’ ¹, ².

Acceptance testing

Prior to new ultrasound systems entering service into the local screening programmes, a number of acceptance tests must be completed, to include the following:

- the scanner will be checked for electrical safety by the regional medical physics department. The equipment must be logged onto an appropriate medical equipment asset register and appropriate stickers attached to the equipment to identify this has been completed
• the accuracy of the calliper measurements, including axial and lateral resolution of the scanner, should be checked using either an open topped test object or tissue equivalent test object. The overall penetration of the system should be assessed using a specific preset with harmonic imaging and compound imaging disabled. These tests should be performed by the local medical physics department or, if this is not possible, by the equipment supplier at delivery and installation. A record of the values must be retained

• image uniformity should be assessed in line with IPEM report 102\textsuperscript{1}

• a baseline sensitivity test should be performed by imaging in-air as recommended by IPEM Report 102\textsuperscript{1} (Chapter 2). Measurement of the depth of reverberation lines ‘in-air’ is a proxy for sensitivity. This measurement is a baseline for subsequent tests. IPEM report 102 recommends that the acceptable range for future tests is ±distance to the next reverberation line

• a record of the pre-sets used during testing and images must be retained for future testing and reference. Reports and documentation will be retained by the local screening programme

• it is recommended that all programmes have maintenance contracts in place that ideally provide preventative maintenance visits on an annual basis.

**Checks prior to each scanning session**

The operator will do the following prior to each screening session:

• check the scanner for any visible damage such as cracks to the casing or damage to control buttons and the keyboard or screen

• check the integrity of the mains cable and, if present, power transformer. Make sure there are no breaks in the cable outer insulation and in particular that there is no kinking or breaks in the cable at the point where it joins the mains plug, transformer or back of the ultrasound machine. If any damage is identified the machine must be removed from service and the fault reported

• check the integrity of the transducer cable and transducer head. This includes breaks in the cable or damage, cracks or splits in the latex lens surface of the transducer face. If damage is identified, the scanner must be taken out of service or the transducer swapped

• when the scanner is switched on look for any error messages or obvious abnormalities such as a flickering screen or excessive noise in the image that might indicate a problem

• a log of faults, actions and outcomes should be recorded and retained by the local screening programme.
Monthly testing

The QA lead or clinical skills trainers will inspect the equipment on a monthly basis and a log of findings, faults and actions retained. The following tests must be undertaken to assess scanner and transducer integrity and sensitivity:

- the scanner and equipment should be checked as recommended prior to daily use (see checklist above)
- the image uniformity should be tested as recommended by IPEM report 102 (Chapter 2). Transmission and element faults can be checked by running a paper clip over the surface of the probe following application of a very thin layer of coupling gel. Problems such as axial banding may indicate a transmission or reception problem
- perform a sensitivity test by imaging in air as recommended by IPEM report 102\(^1\) (Chapter 2). Images should be recorded for comparison with previous tests, including the acceptance test
- reports and documentation to be retained by the local screening programme

Annual testing

Annual assessment of the systems are performed by the regional medical physics department by a trained specialist or by the equipment manufacturer as part of preventative maintenance using an appropriate test object in line with IPEM report 102\(^1\). This includes:

- accuracy of callipers including axial and lateral resolution
- penetration assessment
- assessment of transducer integrity
- general equipment inspection
- reports and documentation are retained by the local screening programme

Note, for some programmes local medical equipment policy requires ultrasound equipment to be assessed on a six-monthly basis and if this is the case, local policy should be followed.

The performance and sensitivity of ultrasound machines can be monitored by regular testing as outlined in this document. This will also help identify deterioration that will support decision making regarding the need for replacement equipment that can be reported to the programme boards.

Equipment logs

It is important that equipment checking and testing logs are kept up to date and maintained as local programmes may be called upon to provide these as evidence
that appropriate checking processes have been undertaken and acted upon, as part of the ongoing quality assurance programme delivered by Public Health England.

References:


3. The Royal College of Radiologists 2005 'Standards for Ultrasound Equipment'

The IPEM Report can be obtained from:

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