

Bitesize Research:

ABDOMINAL AORTIC ANEURYSM

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Introduction

An abdominal aortic aneurysm (AAA) is a permanent dilation of the abdominal aorta, defined as an enlargement to ≥ 3.0 cm or 1.5 times its normal diameter. It develops gradually due to weakening of the aortic wall. This weakening is known to result from loss of structural proteins such as elastin and collagen, combined with the constant high pressure of blood flow that causes the vessel to bulge and risk of it rupturing. AAAs are often asymptomatic until rupture. Other factors leading to the formation of AAAs include chronic inflammation, atherosclerosis which thickens and damages the arterial wall, hemodynamic stress from ongoing mechanical forces and genetic conditions (Coady MA, Rizzo JA, Goldstein LJ, Elefteriades JA, 1999).

PAPER 1

R A P Scott, Scott (2002). The Multicentre Aneurysm Screening Study (MASS) into the effect of abdominal aortic aneurysm screening on mortality in men: a randomised controlled trial. DOI: [10.1016/S0140-6736\(02\)11522-4](https://doi.org/10.1016/S0140-6736(02)11522-4)

Summary:

In 2002 we saw the first publication of the landmark Multicentre Aneurysm Screening Study (MASS) which showed that screening significantly reduced aneurysm-related mortality. In this randomised control study there were 27,147 participants aged between 65-74 who were offered one-time ultrasound scan using the inner-to-inner (ITI) method. Out of the 27,147, there were 1,333 AAAs detected. The MASS trial found an overall reduction in AAA-related mortality and found the 30-day mortality after surgery to be 6% after elective surgery and 36% mortality after emergency surgery.

Pros

This study saw a high attendance showing feasibility. It used large sample size and having the randomised group element minimised bias and gave it a strong statistical power. Furthermore, the randomised control element reduced selection bias and confounding. After being followed up after four, seven, 10 and 13 years it still demonstrated durable benefits and remained cost-effective for the NHS.

Cons

This study included only men, leaving uncertainties about benefits for women and younger men. Participation was incomplete, and because the greatest benefit occurs among attenders, maintaining high uptake is crucial. Ruptures also occurred in men who initially screened normal; several had baseline diameters of 2.5–2.9 cm. A further limitation is the use of the ITI measurement method, which may underestimate aortic size. Had the OTO method been

used, some cases might have been classified as aneurysmal and monitored more closely, potentially preventing rupture.

Impact on Practise

MASS provided a definite evidence base for AAA screening, which led to the official roll-out of The National Abdominal Aortic Aneurysm Screening Programme (NAAASP) in the UK, reaching its full scale by 2013. It highlights the role of vascular ultrasound as a powerful preventive tool against AAA-related mortality. This study is applicable not just to the screening programme but also to vascular labs as it reiterates the importance of robust surveillance aiding timely elective repair and monitoring rapid growth AAAs requiring signposting. Although ITI is considered more reproducible, both ITI and OTO measurement methods are currently used across UK vascular labs. This variation highlights why standardisation may be useful.



PAPER 2

Borgbjerg J et al (2018). Superior Reproducibility of the Leading to Leading Edge and Inner to Inner Edge Methods in the Ultrasound Assessment of Maximum Abdominal Aortic Diameter. doi.org/10.1016/j.ejvs.2017.11.019

Summary

This retrospective study examined the debate over optimal caliper placement for measuring maximum aortic diameter on ultrasound. Eighteen radiologists measured 50 static images using LTL, ITI, and OTO methods, repeating measurements to assess inter- and intra-observer reproducibility. OTO diameters were on average 5.0 mm larger than ITI and 2.6 mm larger than LTL, with LTL exceeding ITI by 2.4 mm. These discrepancies significantly affected estimated AAA prevalence, which nearly doubled when OTO was used instead of ITI. The authors conclude that LTL and ITI are more reproducible than OTO and that measurement choice strongly influences reported AAA prevalence in screening programmes.

Pros

This paper helps clarify the substantial discrepancies among the three measurement methods and their clinical implications. It compares the three caliper-placement methods, giving clear data on reproducibility and measurement differences. With 18 different radiologists involved, the inter-observer variability data are meaningful and represent a realistic range of clinical practice. By reporting limits of agreement for both inter- and intra-observer measurements, the

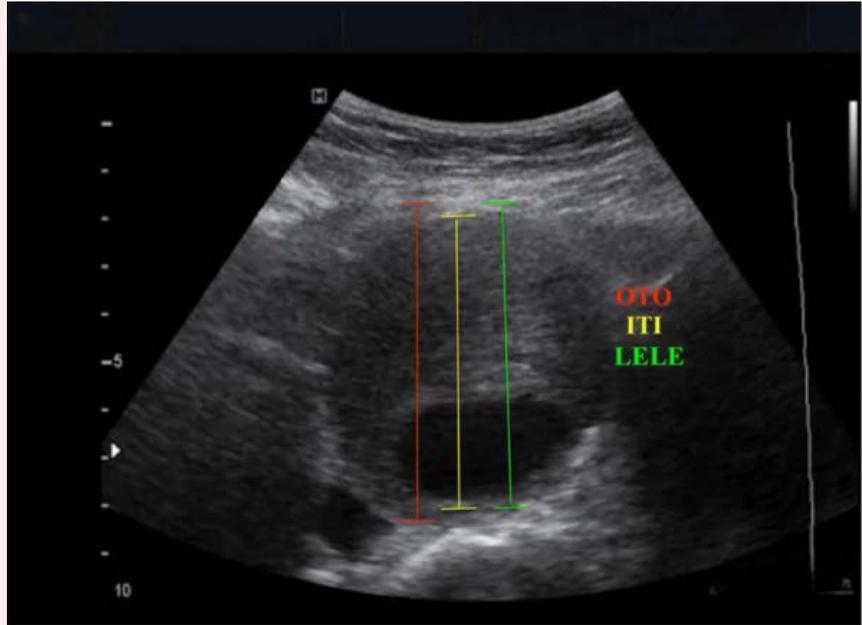


Figure 1: Caliper placement for measurement of aortic diameter OTO: outer to outer, ITI: inner to inner, LELE: leading edge to leading edge (Sidik AI, Al-Arifi MK et al, 2025).

study provides concrete estimates of how much measurement error might be expected in real-world settings. The authors went beyond measurement theory and estimated how different methods would affect AAA prevalence in screening, highlighting how methodological choice impacts screening outcomes and patient management thresholds.

Cons

Most of the static images used were non-AAA and the results may not be directly extrapolated to the whole range of aortic size, such as those measuring close to the surgical threshold of 5.5cm. Secondly, the generalisability was limited by the observer group as they solely consisted of radiologists, therefore the results may not extend to other groups such as AAA technicians and vascular scientists/sonographers. Thirdly, this study did not provide any reference to CT; the modality commonly employed when aortic repair is considered.

Thus, it provides no possibility of comparing validity of the methods. Fourthly, only static images were views in axial plane, historic data has shown that this variance accounts for about half of the total variability of maximum diameter of the AA.

Impact on practise

The findings of this study have significant implications for AAA screening and surveillance. It showed that ITI and LTL measurements are more reproducible than OTO, with ITI demonstrating particularly strong consistency. The 5-mm mean difference between OTO and ITI suggests that using OTO could result in approximately 50% more AAAs being classified as positive. Although OTO may appear preferable due to its similarity to CT measurements, evidence increasingly shows it is the least reproducible of the three methods. This raises questions of why both methods are used in UK vascular labs. According to the CSVS PPGs for EVAR surveillance, local

services may choose their preferred measurement method, provided they remain aware of the significant discrepancies between techniques. Perhaps it would be useful to include both measurements in our reporting with the final decision left with the clinician. In any case, this reiterates the repeated call for standardisation.

PAPER 3

Duncan A, Maslen C, Gibson C, Hartshorne T, Farooqi A, Saratzis A, Bown MJ (2021). Ultrasound screening for abdominal aortic aneurysm in high-risk women. Br J Surg. doi: 10.1093/bjs/znab220.

Summary

This cross-sectional population-based study evaluated whether AAA screening in high-risk women offers benefits comparable to male programmes. Women with AAA have a higher rupture risk and worse surgical outcomes, accounting for a third of ruptured AAA deaths. The FAST study invited 6,037 women aged 65–74 with high-risk factors to a single ultrasound screen; 5,200 attended (86.7%). AAA prevalence was low at 0.29% (15 women), with only three large AAAs detected and one repaired. Current smokers had the highest prevalence (0.83%) but the lowest attendance. Screening was also associated with reduced quality-of-life scores. The authors conclude that although attendance was good, the very low AAA prevalence makes targeted screening of high-risk women unlikely to be clinically or economically worthwhile.

Pros

The study was conducted over three years and involved a substantial sample size of 5,200 participants who attended screening. It highlights gender differences in AAA risk, noting that high-risk women may be more prone to aneurysm rupture. This study brings attention to the need for sex-specific screening strategies and increased awareness of AAA risk in women and by selecting women with known risk factors (smoking, coronary disease), the study targets the subgroup with the highest pre-test probability more relevant than general-population screening. The invitation and screening process mimicked that used in established male screening programmes, increasing generalisability. Lastly, the study went beyond detection, also exploring potential negative psychological impacts of screening.

Cons

The study used an ITI diameter measurement and a ≥ 3.0 cm threshold to define AAA, which may underestimate disease burden in women who naturally have smaller aortas than men (mean diameter: 1.57 cm in women vs. 1.79 cm in men). Only three large AAAs detected, and only one repair carried out, therefore limiting evidence that screening leads to meaningful interventions. Furthermore, only three large AAAs detected, and only one repair carried out, limiting evidence that screening leads to meaningful interventions. Lastly, the study reports detection and prevalence, but does not provide long-term data on rupture, mortality, or benefit of surveillance/repair.

Impact on practise

Although women are not currently offered routine AAA screening, these findings suggest that vascular laboratories could consider enhanced surveillance for high-risk women who are current smokers or have coronary artery disease. Those with sub-aneurysmal aortas could also benefit from this as women are known to have smaller aortas than men and using the same absolute threshold as men might under-detect relative dilation. This supports arguments for sex-specific thresholds or size-index adjustments in women.

PAPER 4

Sidik AI, Al-Ariki MK et al (2025) Advances in Imaging and Diagnosis of Abdominal Aortic Aneurysm: A Shift in Clinical Practice. Cureus. doi: 10.7759/cureus.81321.

Summary

This PRISMA-style literature review summarises recent advances in imaging for abdominal aortic aneurysm (AAA) and how they are reshaping clinical practice. It covers established modalities (ultrasound, CT, MRI) as well as emerging techniques such as IVUS, PET-CT and AI-driven image analysis. The review highlights how these developments enhance detection, risk stratification, preoperative planning and decisions about surveillance versus intervention. With AAA prevalence declining, due to reduced smoking and better cardiovascular risk control, the authors note a shift toward targeted rather than population-wide screening. They also emphasise the need to standardise imaging protocols, particularly aortic diameter meas-



urement methods. Finally, the review suggests that integrating AI with genetic or biomarker data could enable more personalised management through improved risk prediction and tailored surveillance or treatment strategies.

Pros

Firstly, extensive number of studies were used in this paper. Secondly the paper draws attention on the latest advancements that are available and how they can transform AAA for personalised care. The review points to future possibilities signalling where research and clinical practice might head next. Lastly, by discussing caliper placement techniques and the impact on measured aortic diameter, the paper draws attention to an often overlooked but critical source of variability in AAA management.

Cons

As a review covering many modalities and studies, there is wide variation in methods, populations, and quality which could mean some recommendations are based on limited or early-level evidence. Techniques like IVUS, PET-CT for wall inflammation/stress, or AI-driven segmentation are promising but not yet universally available or validated in large prospective cohorts. Therefore, the translation into routine clinical practice remains uncertain. High-resolution CTA, MRA, PET-CT, or AI-assisted analysis may be expensive, require infrastructure and expertise, limiting its broader implementation, especially in resource-constrained settings.

Impact on practise

This study tells us that the future of screening should place focus on refining risk-based stratification models to optimise screening and treatment strategies. Caliper placement is crucial as are standardisation of protocols and vascular labs should adopt and adhere to a consistent caliper placement method (e.g. inner-to-inner, or other standard), to ensure accurate, reproducible aortic diameter measurements, especially important for surveillance over time. Overall, despite advances, this paper confirms that US remains the preferred first-line screening too as it is non-invasive, cost-effective, widely available, and sensitive for initial detection.

PAPER 5

Tuveson V, Löfdahl HE, Hultgren R (2016). Patients with abdominal aortic aneurysm have a high prevalence of popliteal artery aneurysms. Vasc Med. doi: 10.1177/1358863X16648404.

Summary

This cross-sectional study assessed how common popliteal artery aneurysms (PAA) are in patients with AAA and whether those with both conditions share distinct risk factors. Among 465 AAA patients, 225 underwent popliteal imaging, with PAA detected in 19% using a ≥ 12 mm definition and 11% using ≥ 15 mm. Patients with both AAA and PAA reported claudication more often. Clinical examination identified only 26% of radiologically confirmed PAAs, though specificity was high. The authors conclude that PAA is relatively common

in AAA patients and, given the low cost and low risk of imaging and the poor sensitivity of physical exam, recommend popliteal artery screening for all men and women diagnosed with AAA.

Pros

Demonstrates high prevalence of PAA in AAA patients as it identifies that 11–19% of AAA patients have a popliteal aneurysm. Helps justify routine screening protocols as it shows physical exam is unreliable as clinical examination only detected ~26% of PAAs, therefore, it strengthens the case that ultrasound is essential, not optional. It further supports a low-cost, high-value screening addition as PA US is quick, non-invasive, and inexpensive and can easily be added to existing AAA surveillance. This study applies to both men and women as it recommends screening for all AAA patients, simplifying guidelines.

Cons

Not all AAA patients received popliteal imaging as only 48% of the cohort had popliteal imaging and this could potentially introduce selection bias. Imaging definition varies (12 mm vs 15 mm) as the different diameter thresholds changed prevalence notably (19% vs 11%). This could lead to inconsistency if other labs use different criteria. This study does not show outcomes as this study identifies prevalence but does not follow patients to see which PAAs later thrombosed, which required surgery and if there were any impact on limb ischemia.

Impact on practise

Based on the prevalence of PAAs observed in this study, it seems reasonable to consider incorporating PAA screening into AAA assessments. However, the literature contains inconsistent definitions regarding PAA thresholds for intervention. Currently, practice varies across to local trusts with no definitive measurement in place to flag PAA requiring surgical intervention. Clear, standardised protocols for PAA diameter within the CSVS for example would therefore be beneficial for vascular laboratories to follow as these do not currently exist.

PAPER 6

Behr-Rasmussen C et al (2014). Mural thrombus and the progression of abdominal aortic aneurysms: a large population-based prospective cohort study. Eur J Vasc Endovasc Surg. doi: 10.1016/j.ejvs.2014.05.014.

Summary

This population-based prospective study investigated whether the relative size of intraluminal thrombus (ILT) in abdominal aortic aneurysms (AAAs) influences aneurysm growth. Using ultrasound in men aged 65–74, ILT area was measured relative to the aneurysm cross-section. ILT was common, increasing in prevalence and size with larger AAAs, and greater relative ILT was significantly associated with faster aneurysm growth, independent of factors like smoking and blood pressure. The findings suggest that ILT may contribute to AAA progression, with higher thrombus burden linked to more rapid expansion.

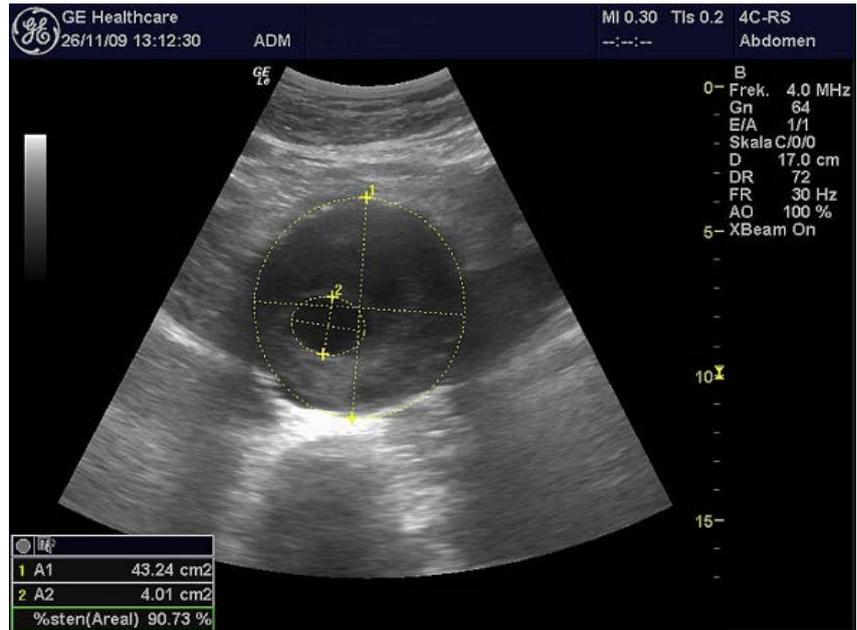


Figure 2: Cross-sectional view, with area measurements using the built-in semi-automated program to calculate the relative intraluminal thrombus size (Behr-Rasmussen et al., 2014).

Pros

The use of a semi-automated sonographic method provides a non-invasive, reproducible measurement tool for evaluating thrombus relative to aneurysm size, which is directly relevant to vascular labs. Adjustment for key confounders supports a direct link between thrombus burden and growth, not just diameter alone.

Cons

The mean observation time was relatively short (1.8 years), so long-term thrombus impact beyond early growth trends is uncertain. Although this is useful, ultrasound is less precise than CT/MRI for quantifying thrombus volume which can introduce measurement variability. This study only assessed men aged 65–74 and the findings may not generalise to women or younger patients. Although it identifies an association between ILT size and growth it cannot confirm whether the thrombus

drives expansion or simply reflects underlying disease processes.

Impact on practise:

This study helps understand that routine documentation of thrombus area/relative ILT would be useful to document alongside diameter measurements when reporting. Furthermore, by incorporating ILT assessment it may help identify AAAs that are likely to expand faster, possibly prompting closer surveillance intervals. Lastly, it would also be useful to mention diameter reduction to compliment overall diameter measurements within our report when scanning AAAs. ➦