Eur J Vasc Endovasc Surg (2021) 61, 7—8

EDITORIAL: FOR DEBATE

The Indication for Elective Repair of Abdominal Aortic Aneurysm Should Be Reviewed

Abdominal aortic aneurysm (AAA) still results in around 3000 deaths in the UK every year.[1] Aneurysm rupture can be prevented by planned intervention either by open aortic surgery or endovascular aneurysm repair (EVAR). However, not all large AAAs rupture; although opinions vary, it is estimated that between 1.5 and 3 people need to undergo elective AAA repair to prevent one death from rupture. Thus much elective aortic surgery is undertaken on people whose aneurysm would never have ruptured. They are exposed to the hazards of aortic intervention and reduced quality-of-life post-operatively for up to six months.

The main risk factor for AAA rupture is increasing aortic diameter. No other risk factor comes close in importance, although smoking, older age, female sex, and accelerated aneurysm growth rates may contribute.[2] Modern management of AAA was defined by two seminal RCTs: the Small Aneurysm Trial (UKSAT)[3] and the Aneurysm Detection And Management study (ADAM).[4] Both studies randomised patients with AAA 4—5.4 cm in diameter. These values were chosen as vascular surgeons had equipoise about optimal treatment at the time. Patients were randomised to early surgery or surveillance until their AAA reached 5.5 cm in diameter, then open surgery. Both UKSAT and ADAM provided consistent conclusions: there was no survival advantage in early surgery compared with watchful waiting until the AAA reached 5.5 cm in diameter.[3,4] Thus, by default, aortic diameter of 5.5 cm became the agreed indication for elective intervention for patients with a standard aneurysm, a threshold that has remained the same around the world today. Modern treatment of AAA is thus based on a misunderstanding of the evidence, as there has never been a randomised study comparing intervention with watchful waiting for AAA >5.5 cm.

Elective intervention for AAA relies on the balance between risk and benefit. Accurate information concerning the risk of rupture for AAA >5.5 cm would need a natural history study. Many such studies exist, but only in patients considered unsuitable for elective repair. The results of these studies are variable, and death from other causes is common as patients with an aneurysm are at risk of other cardiovascular diseases and smoking-related cancers. The risk of AAA rupture is surprisingly low (5% per annum).[5]

The latest contribution to the discussion about AAA rupture risk comes from the surveillance arm of the NHS AAA Screening Programme in England (NAAASP). A number of population screening programmes for AAA now exist, notably in the UK and Sweden.[6,7] Around 1% of 65 year old men have an AAA (aortic diameter > 2.9 cm in diameter); most of these are < 5.5 cm in diameter and the men are therefore followed in a regular ultrasound surveillance programme. The men are also given advice about healthier lifestyle and smoking cessation, and prescribed statins and antiplatelet therapy. Men in surveillance are referred for consideration of treatment when their AAA reaches 5.5 cm in diameter.[8]

A recent report from the NAAASP studied men in surveillance (18 652 men, 50 103 men years of follow up). In these men the risk of AAA rupture while under formal surveillance was 0.03%/annum in men with small AAA (3—4.4 cm), and 0.28%/annum in men with medium AAA (4.5—5.4 cm).[9] Even in men with AAA just below the threshold for referral for intervention (5—5.4 cm), the annual rupture risk was only 0.4% (confidence intervals 0.22—0.73%).

The NAAASP uses ultrasound imaging for AAA screening and surveillance. It employs the inner wall to inner wall method of diameter measurement, which excludes the aortic wall, and is 0.5—1 cm lower than when measured on computed tomography (CT).[10] It can be concluded that the risk of AAA rupture is thus < 0.4%/annum in men whose AAA is < 6 cm in diameter on CT. In a recent report from America, around 40% of planned EVAR procedures were done on patients with AAA <5.5 cm in diameter on CT.[11] Thus maybe as many as half of American patients are having an intervention for a disease which is low risk, and when arguably up to two out of three would never have ruptured anyway. It is also inconceivable that the risk of AAA rupture suddenly increases significantly from 0.4% per annum when an AAA just exceeds the 5.5 cm threshold. These points, together with the low risk of rupture in patients with smaller AAA, should at least prompt reconsideration of the process of informed consent for patients before elective AAA repair.

In the era of personalised medicine, it seems incongruous to use a single measure (AAA diameter) to decide on a potentially risky intervention. Clearly, the risk of an adverse outcome from intervention is likely to be higher in an 80 year old multimorbid patient than a relatively fit 65 year old. There are a number of methods of risk scoring that have been developed to try and individualise the balance between the risk and benefit of intervention for patients with AAA. These include dynamic CT imaging and risk scoring algorithms. The major problem with all studies

https://doi.org/10.1016/j.ejvs.2020.09.001

concerning these methods is that most include very few patients with ruptured AAA.

It has been argued that delaying elective aortic intervention increases the risk of rupture. In an international comparison between the UK and USA, AAA repair was less common in the UK, and they were larger at the time of treatment. It was argued this delay was the cause of the higher AAA-related death rate reported in the UK compared to the USA.[12] However, when this study was repeated involving a larger number of countries, the findings could not be confirmed, and mean aortic diameter at elective intervention did not correlate with the national rate of ruptured AAA.[13]

It is time for vascular surgeons to revisit the indications for AAA interventions. Ideally, the vascular community should conduct another study randomising patients with an AAA 5.5–6 cm (or even 6.5 cm) on ultrasound to intervention or continued surveillance. This could be particularly important in patients aged >75 years. Such a trial may not be acceptable because of lack of equipoise, and perhaps a logical alternative would be to use one of the available scoring systems to identify patients at low risk of AAA rupture, and include only these in RCT.

This editorial was written during the Coronavirus-19 pandemic, creating a potential natural experiment of not intervening on patients with AAA, as much elective surgery that requires intensive care has been postponed.[14] Using precious resources as effectively and as humanely as possible remains a primary goal for all clinicians. Intervention for AAA is coming under increasing scrutiny, brought into focus by the results of national population screening programmes and funding concerns by governments; the latest analysis from the National Institute for Health and Care Excellence in the UK suggests that EVAR is not cost-effective for elective AAA repair.[15] There is enormous variation worldwide on the indications for intervention, particularly dependent on whether healthcare is publicly or privately funded.[16] Patients with an AAA should expect more from the vascular community: more science to justify the interventions, and more trials to enable individualised decisions. At this stage AAA diameter remains the prime indication, but it is important that the method of measurement (ultrasound or CT) is taken into account and recorded. Patients undergoing elective repair below the 5.5 cm ultrasound threshold (6 cm on CT) should be made aware of the low risk of rupture even without intervention.

REFERENCES

1 Jacomelli J, Summers L, Stevenson A, Lees T, Earnshaw JJ. Update on the prevention of death from ruptured abdominal aortic aneurysm. *J Med Screen* 2017;**54**:1–2.

2 Sweeting MJ, Thompson SG, Brown LC, Powell JT on behalf of the RESCAN Collaborators. Meta-analysis of individual patient data to examine factors affecting growth and rupture of small abdominal aortic aneurysms. *Br J Surg* 2012;**99**:655–65.

3 United Kingdom Small Aneurysm Trial Participants. Long term outcomes of immediate repair compared with surveillance of small abdominal aortic aneurysms. *N Engl J Med* 2002;**346**:1445–52.

4 Lederle FA, Wilson SE, Johnson GR, Reinke DB, Littooy FN. Acher CW for the aneurysm detection and management veterans affairs cooperative study group. Immediate repair compared with surveillance of small abdominal aortic aneurysms. *N Engl J Med* 2002;**346**:1437–44.

5 Parkinson F, Ferguson S, Lewis P, Williams IF. Twine CP on behalf of the South East Wales Vascular Network. Rupture rates of untreated large abdominal aortic aneurysms in patients unfit for elective repair. *J Vasc Surg* 2015;**61**:1606–12.

6 Wanhainen A, Hultgren R, Linné A, Holst J, Gottsäter A, Langenskiöld M, et al. For the Swedish aneurysm screening study group (SASS). Outcome of the Swedish nationwide abdominal aortic aneurysm screening program. *Circulation* 2016;**134**:1141–8.

7 Jacomelli J, Summers L, Stevenson A, Lees T, Earnshaw JJ. Impact of the first 5 years of a national abdominal aortic aneurysm screening programme. *Br J Surg* 2016;**103**:1125–31.

8 Davis M, Harris M, Earnshaw JJ. Implementation of the national Health service abdominal aortic aneurysm screening programme in England. *J Vasc Surg* 2013;**57**:1440–5.

9 Oliver-Williams C, Sweeting MJ, Jacomelli J, Summers L, Stevenson A, Lees T, et al. Safety of men with small and medium abdominal aortic aneurysms under surveillance in the National Health Service screening programme. *Circulation* 2019;**139**:1371–80.

10 Hartshorne TC, McCollum CNC, Earnshaw JJ, Morris J, Nasim A. Ultrasound measurement of aortic diameter in a national screening programme. *Eur J Vasc Endovasc Surg* 2011;**42**:195–9.

11 Jones DW, Deery SE, Schneider DB, Rybin DV, Siracuse JJ, Farber A, et al. For the Vascular Quality Initiative. Differences in patient selection and outcomes based on abdominal aortic aneurysm diameter thresholds in the Vascular Quality Initiative. *J Vasc Surg* 2019;**70**:1446–55.

12 Karthikesalingham A, Vidal-Diez A, Holt P, Loftus IM, Schermerhorn ML, Soden PA, et al. Thresholds for abdominal aortic aneurysm repair in England and the United States. *N Engl J Med* 2016;**375**:2015–59.

13 Grima MJ, Behrendt A, Vidal-Diez A, Altreuther M, Bjorck M, Boyle JR, et al. Assessment of correlation between mean size of infrarenal abdominal aortic aneurysm at the time of intact repair against repair and rupture rate in nine countries. *Eur J Vasc Endovasc Surg* 2020;**59**:890–7.

14 Bjorck M, Boyle JR, Dick F. The need of research initiatives amidst and after the Covid-19 pandemic: a message from the Editors of the EJVES. *Eur J Vasc Endovasc Surg* 2020;**59**:695–6.

15 Hinchliffe R, Earnshaw JJ. Endovascular treatment of abdominal aortic aneurysm: a NICE U-turn. *Br J Surg* 2020;**107**:940–2.

16 Beck AW, Sedrakyan A, Mao J, Venermo M, Faizer R, Debus S, et al. For the international consortium of vascular registries. Variations in abdominal aortic aneurysm care: a report from the international consortium of Registries. *Circulation* 2016;**134**:1948–58.

Jonothan J. Earnshaw*

Gloucestershire Hospitals NHS Foundation Trust

*Corresponding author. Gloucestershire Royal Hospital, Great Western Road, Gloucestershire, GL1 3NN, UK.

Email-addresses: Jonothan.earnshaw@nhs.net, jonothanearnshaw@gmail.com