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Outcomes of Sub-threshold Abdominal Aortic Aneurysms Undergoing Surveillance in Patients Aged 85 Years or Over

Ahmed Elbasty, Andrew T.O. Nickinson [*], Christopher Delaney, Philip W. Stather, Mandy Burrows, Michael Delbridge, Wissam Al-Jundi

Department of Vascular Surgery, Norfolk and Norwich University Hospital, Norwich, UK

WHAT THIS PAPER ADDS

Evidence on the surveillance of small abdominal aortic aneurysms (AAAs) in patients aged ≥ 85 years is limited. This study suggests that it might be safe to discontinue surveillance in patients aged 85 years with an AAA <40 mm, and that early assessment of surgical fitness in patients with larger aneurysms may reduce unnecessary investigations.

Objective: Despite an increasing elderly population there is limited evidence regarding the surveillance and management of small abdominal aortic aneurysms (AAAs) in octogenarians. This study investigated outcomes of patients aged ≥85 years undergoing AAA surveillance to identify whether discontinuation of surveillance might be safe.

Methods: This was a retrospective cohort study of all patients aged 85 years undergoing surveillance with a small (30–54 mm) AAA between January 2007 and November 2017. Patients were stratified depending on aneurysm diameter at index (<40 mm, 40–50 mm, > 50 mm). A threshold of 55 mm was used to decide intervention in all patients. Subsequent management of threshold aneurysms, aneurysm related and all cause mortality were also collected.

Results: One hundred and one patients were included (88 male, mean diameter at index 45 mm, median follow up 56.0 months). The majority of patients (72.3%) undergoing surveillance had not reached threshold at the end of follow up. Only one patient in the <40 mm group developed a threshold aneurysm, compared with five (11.6%) and 22 (75.9%) in the 40–50 mm and >50 mm groups, respectively ($p < .0001$). Of the 28 patients reaching threshold, eight (28.6%) underwent surgical repair (5 standard endovascular, one complex endovascular, and two open). Twenty-six (25.7%) patients died during follow up, with cardiorespiratory pathologies being the leading cause of death. Only three aneurysm related deaths were observed, including two fatal ruptures and one death following repair from an infected stent graft (all in the >50 mm index group).

Conclusion: The present data suggests that discontinuation of aneurysm surveillance in patients aged 85 years with aneurysms < 40 mm might be safe. In patients with a larger aneurysm or those approaching threshold, early assessment of fitness for surgery may prevent unnecessary surveillance. The decision to treat aneurysms reaching threshold is complex but is appropriate in selected patients.

Keywords: Abdominal aortic aneurysm, AAA, Octogenarian, Surveillance

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INTRODUCTION

Life expectancy continues to increase in the Western world, with >1.5 million over 85 year olds now living in the UK. This number is predicted to double by 2036.[1] Previous data has shown that abdominal aortic aneurysm (AAA) prevalence is 23.3% in those aged > 80, with 4.1% having a threshold aneurysm.[2]

There is debate in the literature regarding the surveillance and subsequent management of AAAs in octogenarians; however, evidence remains limited. Prior to the advent of endovascular aneurysm repair (EVAR), many patients would be refused repair by this age as open surgery was the only option. The inception of EVAR however has lead to profound change in how we manage patients. Despite this, randomised trials investigating aneurysm surveillance only included patients up to 79 years.[3,4] The current European Society of Vascular Surgery[5] (ESVS) guidelines provide little clarity on the management of small aneurysms in elderly patients. Thirty day mortality following aneurysm repair in

* Corresponding author. Norfolk and Norwich University Hospital, Colney Lane, Norwich, NR4 7UY, UK.

E-mail address: a.nickinson@me.com (Andrew T.O. Nickinson).

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this group has been reported to be up to 20%, with increased length of procedure, hospital stay, and morbidity.[6] There is also broad consensus among vascular surgeons within the UK that patients aged ≥85 should not be transferred to a vascular centre for treatment in the event of a rupture.[7]

The aim of this study was to investigate outcomes for patients aged ≥85 years undergoing surveillance with small AAAs to help identify whether discontinuation of small aneurysm surveillance might be safe and to clarify the natural history of the disease in this cohort.

METHOD

A retrospective cohort study was performed collecting data from patients who underwent ultrasound surveillance of small (30—54 mm) AAAs at the Norfolk and Norwich University Hospitals NHS Foundation Trust between January 2007 and November 2017. Patients were identified from a prospectively maintained surveillance database. All patients undergoing surveillance with a small AAA (measured antero-posterior inner to inner diameter) were included following their first surveillance scan (index scan) after reaching 85 years. Patients who entered surveillance after the age of 85 years were also included. Those patients with an AAA <30 mm or >55 mm at index scan were excluded. All patients were scanned within the vascular studies laboratory within the Norfolk and Norwich University Hospital. All aneurysms were initially detected incidentally with none entering surveillance through the National Abdominal Aortic Aneurysm Screening Programme (NAAASP). Aneurysm surveillance was nurse led and patients were not routinely seen by a vascular surgeon until reaching threshold. Patients were consented for surveillance at the time of entry into the programme. Surveillance intervals of 12 months and six months were used for aneurysms of 30—39 mm and 40—54 mm diameter, respectively.

Clinic and general practice letters, electronic patient records and paper notes were assessed to ensure data completion. Data at index on demographics, medical history, active medications, and smoking status in addition to surveillance results and cause of death were recorded. Out of hospital cause of death was established from interrogating individual general practice records.

In line with ESVS[5] guidelines, a threshold for decision on intervention was set at 55 mm in men. Given the frailty of this age group, this threshold was extended to all women. After reaching threshold, all aneurysms were reviewed in a departmental multidisciplinary meeting. Aneurysm morphology was evaluated against indications for use (IFU) to assess radiological suitability for standard infrarenal, or if necessary, complex endovascular repair. All patients underwent clinical and functional assessment by the treating surgeon to assess fitness for repair, in the light of the treatment modality offered. Furthermore, tailored testing (e.g. echocardiogram) and formal anaesthetic assessment were undertaken in all patients deemed potentially suitable for treatment. Where doubt remained, suitability for repair was discussed in the multidisciplinary setting.

Patients were stratified into three groups according to AAA diameter at the index scan (<40 mm, 40—50 mm, > 50 mm). Aneurysms reaching threshold, subsequent management, and reasons for refusal to treat were recorded. Information on aneurysm related and all cause mortality was also collected. Follow up continued until death or January 1, 2018. Follow up and mortality data were completed for all patients.

Binary data were reported using frequency and percentages. The chi-square test was used to determine any association between index AAA diameter (<40 mm, 40—50 mm, > 50 mm) and the proportion subsequently reaching threshold for repair. All analyses were performed using IBM SPSS Statistics 22 (IBM, Armonk, NY, USA), with $p < .05$ deemed to be indicative of statistical significance.

Ethical approval was not applicable for this study.

RESULTS

Overall, 101 patients with a sub-threshold AAA at index scan (range 85—89 years at index) were identified and included. The mean aneurysm diameter at index was 45 mm (SD 9.2 mm). Median follow up was 56.0 months (IQR 36.8—80.5). Twenty-eight patients (27.7%) reached threshold for repair, of whom eight underwent elective surgical repair (5 standard endovascular, one complex endovascular, and two open). Characteristics of the study group are shown in Table 1 and reflect a standard cohort of

Table 1. Characteristics of 101 patients under abdominal aortic aneurysm surveillance

Characteristic	*n* (%)
Male sex	88 (87.1)
Age range at index in years	85—89
Mean aneurysm diameter (mm) at index	45 (SD 9.2)
Comorbidity	
Hypertension	56 (55.5)
Ischaemic heart disease	45 (44.6)
Atrial fibrillation	33 (32.7)
Chronic obstructive pulmonary disease	17 (16.8)
Diabetes mellitus	15 (14.9)
Renal disease	20 (19.8)
Congestive cardiac failure	12 (11.9)
Cerebrovascular disease	16 (15.8)
Smoking status	
Smoker/ex-smoker	49 (48.5)
Never	38 (37.6)
Unknown	14 (13.8)
Medication history	
Aspirin	52 (51.5)
Clopidogrel	13 (12.9)
Warfarin	26 (25.8)
Statin	86 (85.1)
Aspirin + statin	46 (45.5)
Clopidogrel + statin	10 (9.9)
Warfarin + statin	21 (20.8)

patients with aneurysms. No aneurysms with saccular morphology were identified within the cohort.

Mortality in surveillance

Twenty-six (25.7%) deaths were recorded at a median age of 87 (range 85—90). Of these, only three of the 26 deaths (11.5%) were aneurysm related (Table 2).

Eighteen out of 26 deaths (69.2%) occurred in surveillance patients with a small aneurysm. Six (26.9%) patients died with a threshold aneurysm without undergoing repair because of significant cardiovascular comorbidity, metastatic malignancy, or patient wishes. Two patients died from a ruptured AAA, both with a conservatively managed threshold aneurysm (108 and 468 days following decision not to treat). Overall, the median time to death following decision not to treat a threshold aneurysm was 10.6 months (IQR 4.5—15.2). Eight patients underwent repair with no 30 day mortality recorded. Two patients who underwent repair died, one from an infected endovascular stent graft at 13.0 months, and one from community acquired pneumonia 64.3 months post-operatively. Median follow up in surviving patients following aneurysm repair was 16.0 months (10.8—36.3).

Relationship between initial surveillance AAA size and outcome

Table 3 shows the outcomes of aneurysms from initial index scan. An association was observed between aneurysm diameter at index and proportion reaching threshold ($p < .0001$).

Patient with AAA diameter <40 mm

Twenty-nine patients (28.7%) had an AAA of <40 mm diameter at index. One patient reached threshold for consideration of repair at the age of 90 years. He was subsequently declined surgery as deemed unfit. No ruptures were observed within this group.

Patient with AAA diameter 40—50 mm

Forty-three (42.6%) patients had an AAA of 40—50 mm diameter at index. Five patients reached the threshold diameter, and, of these, two patients had elective repair. Surgery was declined for the other three patients as either they were deemed unfit for repair ($n = 1$) or to comply with the patient's wishes ($n = 2$). The age range at threshold was 88—90 years. No ruptures were observed within this group.

Patient with AAA diameter >50 mm

A total of 29 (28.7%) patients had an AAA of diameter > 50 mm at threshold. Twenty-two patients reached the threshold for treatment. Of these, six patients underwent elective repair with the remaining declined surgery because they were either deemed unfit for repair ($n = 13$) or to comply with the patient's wishes ($n = 3$). The age range at threshold was 85—91 years. Two ruptures were observed within this group, both occurring in patients reaching threshold and subsequently being declined repair. Furthermore, one patient died as a results of a complications from an infected stent-graft following repair.

DISCUSSION

This study followed 101 patients, aged ≥85 years at index, undergoing surveillance for a small AAA. The majority of patients (72.3%) undergoing surveillance had not reached threshold at the end of follow up. Only one patient in the <40 mm diameter group developed a threshold aneurysm (managed non-operatively), compared with five (11.6%) and 22 (75.9%) patients in the 40—49 mm and >50 mm groups, respectively. The mortality rate was high by the end of follow up (25.7%), with cardiorespiratory pathologies representing the leading cause of death. Only two ruptured aneurysms were observed in this cohort, both occurring in patients within the >50 mm group. No 30 day post-operative mortality was observed following aneurysm repair.

Table 2. Cause of death as recorded on death certificate

Cause of death	All deaths ($n = 26$)	Deaths: anterior-posterior diameter (APD) <55 mm at last scan ($n = 18$)	Deaths: APD ≥55 mm at last scan and not repaired ($n = 6$)	Deaths: underwent aneurysm repair ($n = 2$)
Non-aneurysm related				
Pneumonia	10	8	1	1
Cerebrovascular accident	6	5	1	0
Sepsis	1	1	0	0
Malignancy	4	3	1	0
Ischaemic heart disease	1	1	0	
Ischaemic bowel	1	0	1	0
Aneurysm related				
Rupture (operated)	0	0	0	0
Ruptured (not operated)	2	0	2	0
Other[a]	1	0	0	1

[a] Complication of infected stent graft; APD = anterior-posterior diameter.

Table 3. Outcomes of aneurysm from index scan

Aneurysm diameter at index, mm	*n* (%)	Total reaching threshold (% total)	*p*[a]	Surgical repair (% threshold)	Ruptured abdominal aortic aneurysm (% total)	Median follow up, in months (interquartile range)
<40	29 (28.7)	1 (3.4)	<.0001	0 (0.0)	0 (0.0)	62 (40–90)
40–50	43 (42.6)	5 (11.6)		2 (40.0)	0 (0.0)	56 (42–78)
>50	29 (28.7)	22 (75.9)		6 (27.3)	2 (6.9)	58 (32–67)

[a] Chi-square test.

The management of elderly patients with AAAs presents a significant challenge, especially because of their comorbid and frail nature. Two issues in particular are of note, firstly the decision on whether to continue surveillance and, secondly, whether to offer treatment if an aneurysm reaches threshold.

Continuing surveillance in this group is contentious. Evidence on surveillance in this age group is very limited with both the UK Small Aneurysm Trial[3] (UKSAT) and Aneurysm Detection and Management Study[4] (ADAM) only including patients up to 79 years of age. Given mean aneurysm growth rates identified by Powell et al.,[8] many patients will be unlikely to reach the threshold for treatment within their lifetime. Furthermore, a significant proportion will be unsuitable for repair when they eventually do reach threshold. This is especially pertinent in the <40 mm group, where the mean aneurysm growth rate is 2.6 mm/year.[8] The recent preliminary guidelines on the management of AAAs published by the National Institute of Health and Care Excellence[9] will probably extenuate this further.

Despite this uncertainty, the 2019 update of the ESVS[5] AAA guidelines provides vascular surgeons little clarity on this matter, only recommending against starting surveillance in incidentally discovered small aneurysms in those with "very limited life expectancy." Further to this, the guidelines also recommend surveying a <40 mm aneurysm every three years; however, they are ambiguous regarding this cohort of patients, where scanning at this frequency seems counterintuitive.

This study provides evidence that it might be safe to discontinue surveillance in patients with aneurysms <40 mm at the age of 85 and helps clarify some degree of the uncertainty seen within the new guidelines.[5] In patients with larger aneurysms the risk of rupture is low, although ongoing surveillance remains warranted given the proportion reaching threshold, especially in the >50 mm group. A prudent approach of early assessment of fitness for repair, however, may prevent unnecessary surveillance in frail and comorbid patients.

The management of aneurysms reaching threshold is also highly challenging. Age alone is not a contraindication to aneurysm repair; however, increasing age, frailty, and sarcopenia are independent risk factors for post-operative mortality.[10–14] Thirty day and mid-term mortality results from both open and endovascular repair in octogenarians are acceptable, however, mortality, hospital stay, and adverse events are all higher in this group compared with younger patients.[6,11,14] Meta-analysis by Han et al.[14] identified a 9.2% one year mortality following elective EVAR in octogenarians. In this study only two ruptures were identified in 19 patients with a threshold aneurysm managed conservatively. Furthermore, the long-term results from the EVAR-2[15] trial show that endovascular repair does not improve overall mortality in patients deemed unfit for open repair.

Ultimately, the best management option for a patient will be based on the joint decision of surgeon and patient. The present findings complement the current literature in highlighting the need for careful patient selection when offering aneurysm repair in this age group.

There are a number of limitations to this study. Firstly, it is a single centre observational study. Despite including all patients over a 10 year period, the population size is small and only a limited number of repairs and ruptures were observed. The study is therefore at risk of type 2 statistical error. Selection bias is possible as comorbid patients may have been removed from surveillance prior to 85 years, or never referred. Furthermore, the rate of repair could be biased by local practices; however, the rate of rupture was low in patients declined repair.

Regarding mortality, data presented in this study relied on death certificates to establish the cause of death. Post-mortems are not routinely carried out in the UK and therefore it is possible that ruptured aneurysms were missed or incorrectly assumed to be the cause of death.

Finally, the study did not investigate post-operative morbidity, which could be significant in this group and give further evidence on the safety of repairing threshold aneurysms in this cohort. Given the paucity of evidence related to the surveillance and management of aneurysms in octogenarians, further studies are required.

CONCLUSION

Aneurysm rated mortality is low in patients with small AAAs aged ≥85 years, with the majority of threshold aneurysms being treated conservatively. The present data suggest that discontinuation of aneurysm surveillance in patients with aneurysms <40 mm at the age of 85 years might be safe. In patients with larger aneurysms or those approaching threshold, surveillance remains warranted; however, early assessment of fitness for surgery may

prevent unnecessary surveillance. The decision to treat aneurysms reaching threshold is complex but is appropriate in selected patients.

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CONFLICT OF INTEREST

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