

Prevalence of Synchronous and Metachronous Aneurysms in Women With Abdominal Aortic Aneurysm

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WHAT THIS PAPER ADDS

Abdominal aortic aneurysm (AAA) is less common and not so well studied among women compared with men. One of the outstanding issues is whether it is warranted to examine other large arteries prone to aneurysmal disease in a woman with AAA. This paper reports on a fairly large cohort of women with AAA, and offers some guidance. The findings suggest that the thoracic aorta should always be examined, and in the case of a synchronous iliac aneurysm, the femoral and popliteal arteries should also be examined.

Background: Abdominal aortic aneurysm (AAA) is three to five times more common among men compared with women, yet up to 38% of all aneurysm related deaths affect women. The aim of this study was to estimate the prevalence of synchronous or metachronous aneurysms among women with AAA, as diagnosis and treatment could improve survival.

Patients and methods: This is a retrospective study of prospectively registered patients. All women operated on, or under surveillance for, AAA were identified at two Swedish hospitals. Aneurysms in different locations were identified using available imaging studies. Aneurysms were defined according to location: thoracic ascending aorta ≥ 42 mm, descending ≥ 33 mm, abdominal aorta ≥ 30 mm, common iliac artery ≥ 20 mm or 50% wider than the contralateral artery, common femoral artery ≥ 12 mm, popliteal artery ≥ 10 mm.

Results: A total of 339 women with an AAA were included. The median follow up was 2.8 (range 0–15.7) years. Thirty-one per cent had an aneurysm in the thoracic aorta (67 of 217 investigated, 84% were located in the descending aorta), 13 (19%) underwent repair. Twelve per cent had a common iliac artery aneurysm (24/259, 76% were investigated). Common femoral artery aneurysms were identified in 4.3% (8/184, 54% investigated). Popliteal artery aneurysms were identified in 4.0% (6/149, 44% investigated). The prevalence of infrainguinal aneurysms was higher among patients with synchronous iliac aneurysms (40% vs. 1.6%, OR 42, 95% CI 6.4–279, $p < .001$).

Conclusions: Thoracic aortic aneurysms are common among women with AAA, most commonly affecting the descending aorta, and detection frequently results in repair. Popliteal and femoral aneurysms are not rare among women with AAA, and even common if there is a synchronous iliac aneurysm.

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INTRODUCTION

Abdominal aortic aneurysm (AAA) is a disease with significant mortality if left untreated. The disease most often affects men, and consequently most research has been performed on men, or on predominantly male cohorts.

AAA affects women and men differently.¹ Men are three to five times more prone to develop an AAA at the age of

65–70 compared with women,^{2–4} yet up to 38% of all aneurysm related deaths have been reported to be among women.⁵ This paradox is explained by the fact that women who develop AAA suffer a worse prognosis than men with an increased risk of rupture⁶ and increased in hospital mortality both after rupture and after elective repair.^{7–9} After the AAA has been repaired, affected women still suffer a much shorter life expectancy compared with unaffected women, whereas men with repaired AAA recover to almost the same life expectancy as unaffected men.¹⁰

Women have complex aneurysm anatomy more often, with more angulated, shorter, and wider necks,¹¹ suggesting a more pronounced disease, and creating technical problems for both open and endovascular repair.¹²

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In men, AAA has been shown to be associated with thoracic aortic aneurysm (TAA),^{13,14} as well as with peripheral arterial aneurysms.^{15–17} Few studies have been designed to estimate the prevalences of these other aneurysms among patients with AAA, as most association studies studied the prevalence of AAA among patients with other aneurysms.

Two previous reports have indicated a correlation between AAA and TAA among women.^{13,14} These studies were small, suffered from selection bias, and are commented on further in the discussion.

Little is known about lower limb arterial aneurysms among women with AAA, but the prevalence of popliteal and femoral artery aneurysms (PA, FA) is very low among women in general, at just 1.07 per 100,000 in hospitalised women in the USA.¹⁸ In an international report on 1471 operations for PA, only 4.4% were performed on women.¹⁹ A recent study with data from a large Swedish cohort reported a similar figure of 4.3%.²⁰ The present authors have identified just one study investigating the association between AAA and peripheral aneurysms in women, and in that study no peripheral arterial aneurysms were found among 62 women.¹⁵

The aim of this study is to characterise the frequency of synchronous and metachronous aneurysms in other locations among women with AAA, to enable development of an algorithm for examination when an AAA is diagnosed in a woman, as well as recommendations for future surveillance.

PATIENTS AND METHODS

This article was written in accordance with the STROBE²¹ and RECORD²² statements.

All women with diagnosed AAA were identified in the two Swedish counties of Uppsala and Västernorrland with a total population of 587,637 inhabitants in 2013,²³ using the Swedish national vascular registry (Swedvasc), the local AAA surveillance registries, and medical case records. The Swedvasc registry has been shown to have an excellent external validity (few missing cases) on several occasions.^{24–26} Patients were first diagnosed between January 1982 and December 2013. Both non-ruptured and ruptured cases were included. An AAA was defined as an abdominal aortic diameter ≥ 30 mm.

The clinical routine has been to screen the common iliac, common femoral, and popliteal arteries for aneurysms with ultrasound among all patients with newly detected AAA, and to perform a CT examination of the thoracic and abdominal aorta prior to surgery. During surveillance, when performing aortic ultrasound, the iliac arteries were examined routinely. The popliteal and femoral arteries were screened every 5 years. In later years, a CT examination of the thoracic aorta without contrast had usually already been performed at the time of the initial diagnosis of an AAA.

Available clinical data (arterial aneurysm surgery, age, time and cause of death) and vascular imaging studies were collected. From CT studies performed for other reasons, the

Table 1. Definitions of aneurysms in the studied arterial segments.

Arterial segment	Definition of an aneurysm
Ascending thoracic aorta	≥ 42 mm
Descending thoracic aorta	≥ 33 mm
Infrarenal abdominal aorta	≥ 30 mm
Common iliac artery	≥ 20 mm (or $>50\%$ contralateral side)
Common femoral artery	≥ 12 mm
Popliteal artery	≥ 10 mm

vessel diameters were measured, either by a radiologist, or by a vascular surgeon with experience in vascular imaging. The peripheral arteries were measured using ultrasound.

When indicated, additional imaging studies were performed after informed consent of the patient, unless the patient was considered unfit for aneurysm repair. In cases of missing imaging data, the patients were excluded from statistical analysis of that arterial segment.

Patients without imaging who had their common iliac arteries treated as part of AAA treatment were defined with or without iliac aneurysms based on the peri-operative finding.

General follow up was defined as time from diagnosis of AAA to the last imaging of any arterial segment. Specific follow up was defined as time from diagnosis of AAA to the last imaging of that particular arterial segment.

An aneurysm was defined based on the cut off diameters for the different arterial segments given in Table 1. These definitions were based on previous investigations of healthy 70 year old Swedish women by MR,²⁷ and ultrasound measurements of healthy Swedish women with a median age of 68 years.^{28,29} Problems reviewing old duplex scans of the common iliac arteries (CIAs) meant that the present study used a definition of >20 mm diameter or 50% larger than contralateral CIA, as has been used in the present authors' departments. This is in agreement with suggested standards for reporting on arterial aneurysms by the SVS/ISCS Ad Hoc Committee published in 1991,³⁰ while current European and US aortic guidelines do not include a clear definition of an iliac aneurysm.^{31,32}

Statistics

Data were analysed using IBM SPSS Statistics version 21 and R version 3.4.2. Medians are presented with range. Prevalences are presented as number of cases with the corresponding percentages. Comparisons were performed with independent sample *t* test and Fisher's exact test, when appropriate. Comparisons of aortic diameters were performed with Wilcoxon rank sum test. A *p* value $< .05$ was considered to be statistically significant.

RESULTS

A total of 339 women with AAA were identified, 47 (14%) presented with rupture. Twelve (3.5%) were identified in a population based study to determine the prevalence of AAA in 70 year old women²; all the others were diagnosed in routine clinical practice. Among those with intact aneurysms

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