

## Screening of Abdominal Aortic Aneurysm in the Elderly Population of the City of Guarapari/ES

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### Abstract

**Introduction:** Abdominal aortic aneurysm is a silent disease with high mortality rate if not diagnosed and treated early.

**Objectives:** To determine the prevalence of abdominal aortic aneurysm in the elderly population of the city of Guarapari/ES and associate it with risk factors.

**Methods:** Prevalence study conducted by simple random sampling. The individuals were recruited by the Family Health Program (PSF) team after an awareness campaign about the importance of early diagnosis of the disease. The test was performed by doctors specializing in vascular ultrasound in a local healthcare center using the ultrasound machines HDI 5000-ATL. Aneurysm was defined as an aorta caliber greater than or equal to 3 cm or when the dilatation was 1.5 times the diameter of the aortic segment considered normal.

**Results:** The study included 576 people aged over 65 years, from January to June 2010. The prevalence of patients with abdominal aortic aneurysm was 2.1%, representing 12 people. The mean age of the positive cases was  $72.4 \pm 6.2$  years. Of these, 75% were male 50% were smokers or former smokers; and seven (58.3%) reported use of medications for the treatment of hypertension. Concerning aneurysms, the mean diameter was  $3.9 \pm 0.9$  cm, with 91.7% located below the kidneys. Concomitant aneurysms were found in the iliac and popliteal arteries in two (16.6%) patients.

**Conclusion:** The prevalence of abdominal aortic aneurysms found in the elderly population of the city of Guarapari/ES was 2.1% and vascular ultrasound proved to be an effective method for diagnosing this disease. (Arq Bras Cardiol: Imagem cardiovasc. 2015;28(2):60-66)

**Keywords:** Abdominal Aortic Aneurysm/epidemiology; Elderly; Age Factors; Risk Factors; Cross-Sectional Studies; Ultrasound/use.

### Introduction

Abdominal aortic aneurysm (AAA) is defined as a dilation smaller than or equal to 3 cm of the abdominal aorta or 1.5 times greater than the aortic segment considered normal<sup>1,2</sup>. It is considered a public health problem and its importance stems from its silent evolution and may have its own rupture as the first symptom, an event that leads to a high mortality rate (80%)<sup>3</sup>.

The factors considered of risk for the development of AAA are: old age; male sex; family history; atherosclerosis; hypercholesterolemia; coronary and cerebrovascular disease; hypertension; and, particularly, smoking<sup>4-9</sup>.

Genome association studies have recently demonstrated the relationship of AAA with variants of the chromosome 9p21<sup>10</sup>.

Factors associated with higher risk of rupture are diameter, considered as the main independent risk factor; female sex, hypertension, smoking and expansion progression rate<sup>11-13</sup>. Black people and Asians are considered of low risk for the development of AAA<sup>5,14</sup>, and women are affected six times less than men<sup>15</sup>.

The prevalence of the disease varies with age, gender and geographical location is between 1.7% and 7.2%, according to some randomized studies involving men aged over 65 years<sup>16-19</sup>.

In Brazil, there are few studies screening abdominal aortic aneurysm. We draw attention to the studies of Bonamigo and Siqueira<sup>20</sup> (RS) and Barros et al.<sup>21</sup> (ES). In the study by Barros et al. (ES) they examined 834 people (men and women aged over 60 years) and found an overall prevalence of 2.5%<sup>21</sup>. In the study by Bonamigo and Siqueira (RS), they screened 2,281 men aged over 54 years<sup>20</sup>. Of these, 768 were in cardiology clinical treatment, 501 had undergone coronary artery bypass grafting or suffered from severe coronary lesions, and 1,012 were from the general population. These groups presented a prevalence of 4.3%, 6.8%, and 1.7%, respectively<sup>20</sup>.

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Four large randomized studies conducted in the United Kingdom, Denmark and Australia, which results are summarized in the Cochrane review in 2007 showed that screening programs using ultrasound as a diagnostic method allows elective treatment, significantly reducing mortality (level 1A of evidence)<sup>16-18,22,23</sup>.

The objective of this study is to determine the prevalence of AAA in elderly patients referred to the vascular laboratory in the city of Guarapari/ES and to associate it with possible risk factors for the development of AAA, such as hypertension, sex, smoking and family history.

## Methodology

The study was conducted in the elderly population of Guarapari/ES, the main tourist town of Espírito Santo. Its population was estimated at 105,286 inhabitants in 2010. The study included men and women older than 65 in the city of Guarapari/ES from January to June 2010.

The elderly population of Guarapari is 7,750 (7.4%) individuals older than 65, including 3.4% of men and 4% of women (Source: IBGE: Instituto Brasileiro de Geografia e Estatística).

A study of prevalence was performed. The sample size was calculated by the simple random sampling formula, taking into account this population, the estimated prevalence of 2.5%<sup>21</sup>, sampling error of 1.3% and 5% significance level. The minimum sample size was estimated at 518 seniors who were proportionally distributed by sex, around 46% of men and 54% of women. The sample was recruited by the Family Health Program after an awareness campaign on the severity of the disease and the need for early diagnosis.

The tests were performed in a vascular laboratory by specialists in vascular ultrasound, who adopted the same criteria for diagnosing AAA. The ultrasound device used was HDI 5000-ATL and the convex transducer 2-5 MHz. Using the transverse US cut (Method B), the machine scanned the aortoiliac segment with the purpose of screening the aneurysm; if the AAA was found, the patient was referred to a more detailed test.

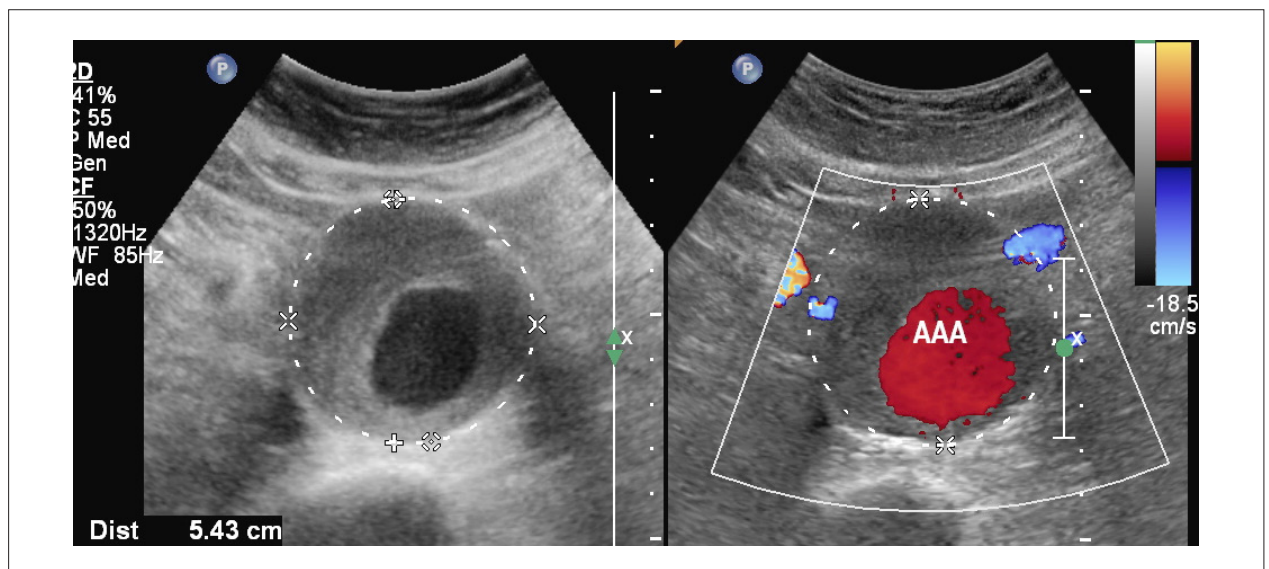
The preparation of the patient before the test consisted of light diet the day before, without the use of drugs.

Ultrasound test included the abdominal aorta from its segment above the celiac trunk to the iliac arteries bilaterally. The measure of its diameter was made above and below the renal arteries. In a transverse ultrasound section, the anteroposterior diameter of the aortic segment with the patient in the supine position was taken as a measure.

Diagnosis of AAA was considered when the abdominal aorta had a diameter equal to or greater than 3 cm, or 1.5 times greater than the aortic segment considered normal; the latter criterion was used for diagnosing aneurysm of the iliac and popliteal arteries. The type of aneurysm was classified as saccular when it affected only one wall of the aorta (anterior or posterior) or spindle-shaped when both the posterior and the anterior wall of the aorta were involved (Figure 1).

Once the presence of AAA was confirmed, the patients were referred for outpatient follow-up if the aneurysm size was smaller than 4.5 cm, and for specialized service of angiology and vascular surgery when its caliber was equal to or greater than 4.5 cm.

Carotid and iliac arteries, and the arteries of lower limbs were studied as a complement to the study of abdominal aorta in patients with the disease in order to investigate the



**Figure 1** – Abdominal aortic aneurysm: transverse ultrasound section demonstrating the anteroposterior diameter measurement (adventitia-adventitia). Criteria for diagnosing AAA: caliber greater than or equal to 3 cm.

association of aneurysm of the iliac and popliteal arteries, as well as the presence of associated atherosclerosis. The criteria used for classifying carotid stenosis were based on B-mode image, color mapping of the flow and speeds measured by pulsed Doppler<sup>24</sup>.

The research of risk factors associated (hypertension, smoking, diabetes, dyslipidemia, and family history of aneurysm) was made by means of a questionnaire.

The associations between the presence of AAA and risk factors were performed using the chi-square test. Student's t test was used to compare the ages of patients with and without aneurysm. The significance level adopted was 5% and the statistic software SPSS, version 18.0 was used.

The project was approved by the Ethics Committee of Universidade Federal do Espírito Santo (UFES) on November 4, 2009, filed with the number 158/08. All patients signed an Informed Consent Form.

## Results

From January to June 2010, 576 seniors, 230 men (40%) and 346 (60%) women were examined. We found 12 cases of AAA, with a prevalence of 2.1%. Table 1 shows the description of cases. The average age of the cases was  $72.4 \pm 6.2$  years.

The prevalence of iliac artery aneurysm in patients with AAA was 16.6% (2/12); one was bilateral and the other was unilateral. The prevalence of popliteal artery aneurysm was also 16.6% (2/12); one was bilateral and the other was unilateral.

The carotid arteries were studied in 10/12 with AAA. Severe stenosis was detected in 1/10 (10%) of patients. Light-grade stenosis was detected in 9/10 (90%)<sup>24</sup>.

The average diameter of the aneurysms was  $3.9 \pm 0.9$  cm. As for the location, 91.7% (11/12) of the AAA had infrarenal location. As for the type, all AAA were spindle-shaped (dilation of both the anterior and the posterior wall of the aorta).

Table 2 shows the associations between the presence of aneurysm and epidemiological variables and risk factors. A statistically significant association was only found for gender, with more cases in males.

The average age of patients with aneurysm vs without aneurysm was  $72 \pm 6$  years vs  $71 \pm 7$  years, respectively. The age difference was not statistically significant ( $p = 0.610$ ).

## Discussion

The main objective of this study was to record the prevalence of AAA in the population of the city of Guarapari/ES and to promote an informative campaign for the local population about the severity of aneurysm and the importance of early diagnosis. It is a consensus in the world literature with degree 1 of recommendation and level of evidence A that screening AAA in men older than 65 is a cost-effective method to reduce mortality related to rupture<sup>16-18,22,23,25-27</sup>.

We emphasize the difficulties in conducting an epidemiological study of this size:

1. It was only possible to conduct a randomized study with the support of PSF, which had the task of recruiting the individuals to be studied.
2. Building a multidisciplinary team of doctors, scholars, nurses and statisticians is still a difficult task because it is difficult to pay their hourly fees in the research project.

**Table 1 – Description of cases of AAA**

Case	Sex	age	SAH	Smo	Diab	Dysl	AO	I <sub>s</sub> R	RCIA	RPOP	LCIA	LPOP	carotid
1	M	65	S	EX	N	N	4.0	IR	1.3	N	1.3	N	light
2	F	80	S	N	N	S	3.1	IR	N	1.1	N	1.2	light
3	M	72	S	S	S	N	4.5	IR	N	N	N	N	NS
4	M	76	S	EX	N	N	5.3	SR	N	N	N	N	NS
5	M	70	N	S	N	N	3.6	IR	N	N	N	N	light
6	M	65	S	S	N	N	4.0	IR	N	N	N	N	light
7	M	74	N	N	N	N	4.6	IR	2.2	N	2.0	N	light
8	F	73	N	N	N	S	3.2	IR	N	N	N	N	light
9	M	78	S	N	N	S	5.0	IR	3	N	1.6	N	severe
10	M	81	N	N	N	N	3.0	IR	1.8	N	N	N	light
11	M	74	S	EX	N	N	3.9	IR	1.6	N	1.34	N	light
12	F	65	N	N	N	S	3.3	IR	1.3	0.9	1.28	N	light

SAH: hypertension; Smo: smoking; Diab: diabetes; Dysl: dyslipidemia; AO: aorta; RCIA: right common iliac artery; RPOP: right popliteal artery; LCIA: left common iliac artery; LPOP: left popliteal artery; M: male; F: female; Y: yes; N: no, EX: former smoker, NS: non-studied; IR: infrarenal; SR: suprarenal.

**Table 2 – Association between the presence of aneurysm and risk factors**

Variable	Category	Presence of AAA				p-value
		no		yes		
		N	%	N	%	
sex	F	343	61%	3	25%	0.012
	M	221	39%	9	75%	
SAH	No	184	33%	5	42%	0.509
	Yes	380	67%	7	58%	
Smoking	No	397	70%	6	50%	0.127
	Yes	167	30%	6	50%	
Fam hist	No	562	99%	12	100%	1,000
	Yes	2	1%	0	0%	

AAA: abdominal aortic aneurysm; Fam Hist: family history.

3. The availability of ultrasound equipment and specialized doctors for conducting the tests is also a limitation for non-profit epidemiological studies.

The tests were conducted without a technical limitation that prevented the proper viewing of the abdominal aorta and iliac segment. It was not necessary to repeat the test due to inconclusive diagnosis and neither was it necessary to complement with another imaging method. Patients with indication for surgical treatment were referred to the vascular surgery department of Universidade Federal do Espírito Santo (UFES), which maintained a partnership with the research group. The overall prevalence (man and woman) of AAA found in our study was 2.1%, which is similar to the 2.5% found in a previous study in the city of Vitória, capital of Espírito Santo<sup>21</sup>. This prevalence is considered low when compared to large studies, which is explained by the inclusion of women in our study. When we selectively analyze the male population we find a 3.9% prevalence of AAA, thereby enhancing the recommendations cited in the literature of screening programs for the group considered of risk (men aged over 65 years)<sup>18,26,28-31</sup>.

Screening AAA in women is controversial and can be recommended in those aged 65 or older, with a history of smoking or family history<sup>26,31,32</sup>.

Regarding the characteristics of AAA, the predominance of small aneurysms (8/12), spindle-shaped and infrarenal location are not different from other citations<sup>20,21,33</sup>.

Among the possible risk factors studied for the development of AAA, the only one that was statistically significant was sex ( $p = 0.012$ ), corroborating the findings of epidemiological studies that report a higher involvement in white and elderly men<sup>7,34,35</sup>. Hypertension and smoking have been reported frequently, but were not statistically significant compared with the presence in the elderly.

As for hypertension, it is still not clear whether it is a factor involved in the pathogenesis of the disease or only

exacerbates the effects of a weakened arterial wall<sup>35</sup>. Smoking is particularly the strongest risk factor associated with the onset of aneurysm and the vast majority of authors recommends screening AAA in male smokers older than 65<sup>7,19,29</sup>.

None of the patients diagnosed with AAA in the study reported positive family history. A possible explanation for these data is the fact that the investigation as to the presence of these risk factors was conducted through a questionnaire and patients often fail to properly inform the data. The literature shows that about 12% to 19% of patients undergoing treatment of aneurysms have first-degree relatives with abdominal aortic aneurysm<sup>36,37</sup>.

The association found with carotid atherosclerotic disease was 100% in those diagnosed with AAA and submitted to ultrasound study of the carotid arteries. This contributes to reaffirm the idea that atherosclerosis has a primary role in the genesis of AAA. This finding reinforces the indication of AAA screening in patients with atherosclerotic disease in other vessels, such as coronary and carotid arteries<sup>6,20</sup>.

The associations of AAA with aneurysm of iliac arteries and popliteal arteries were 16.6% in both. Bibliographic citations show that abdominal aortic aneurysms may be present in approximately 62% of patients with popliteal aneurysm<sup>38,39</sup>. In contrast, the incidence of popliteal and/or femoral aneurysms in patients with AAA is 16%.<sup>40</sup>

Therefore, we recommend that in the presence of AAA, popliteal arteries be also studied. Regarding the association with iliac aneurysms, up to 40% of patients undergoing endovascular AAA repair have bilateral iliac aneurysms and the absence of such information may compromise the effectiveness of the procedure<sup>31,41,42</sup> (Figure 2).

This finding points to the importance of a thorough study of the arterial vascular system in patients with abdominal aortic aneurysm.

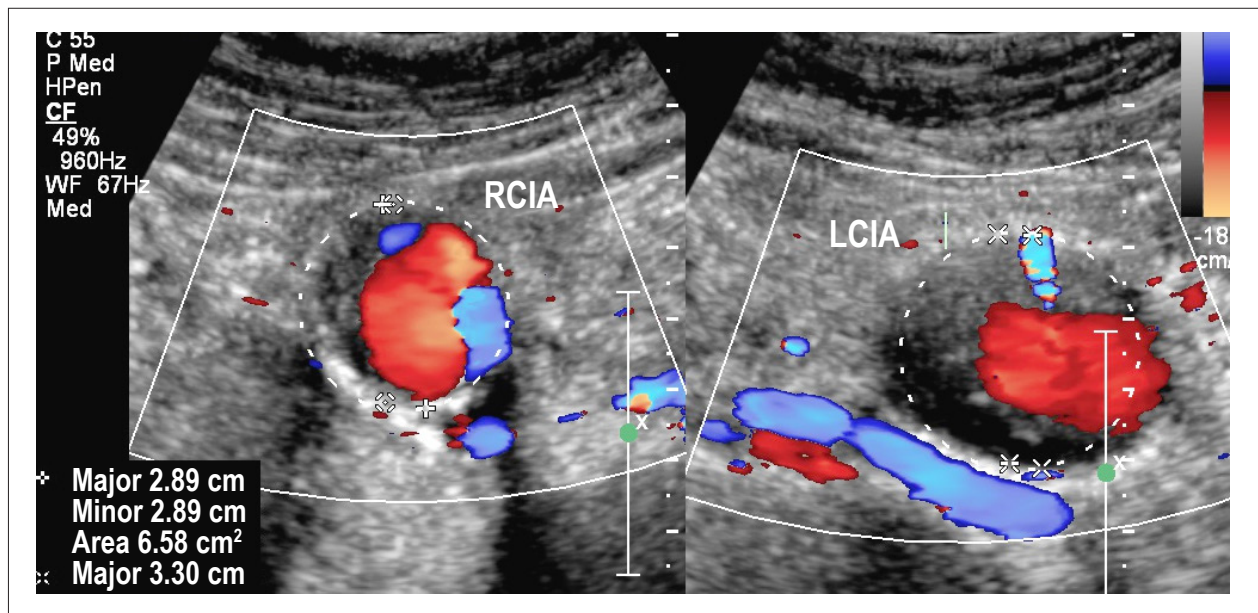


Figure 2 – Aneurysm of common bilateral iliac artery. Image in ultrasound section and color mapping: RCIA = 2.89 cm; LCIA = 3.3 cm.

## Conclusion

The prevalence of abdominal aortic aneurysms found in the elderly population of the city of Guarapari/ES was 2.1%. Vascular ultrasound is an effective, inexpensive and risk-free method for diagnosing abdominal aortic aneurysm.

The authors emphasize the importance of campaigns and AAA screening protocols, always seeking early diagnosis and the consequent decrease of mortality.

According to the results presented in this study, and just like other papers published in the national and international literature, they recommend screening AAA in men older than 65, regardless of the presence or absence of associated risk factors.

## Authors' contributions

Research creation and design: Zandonade E, Barros FS; Data acquisition: Barros FS, Pontes SM, Sandri PA, Roelke LH, Nofal DP, Barros DS, Almeida MASMT, Barros FS; Data analysis and interpretation: Zandonade E; Statistical analysis:

Zandonade E; Manuscript drafting: Barros FS, Oliveira RP, Barros FS; Critical revision of the manuscript for important intellectual content: Zandonade E, Barros FS.

## Potential Conflicts of Interest

No relevant potential conflicts of interest.

## Sources of Funding

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## Academic Association

This study is not associated with any graduate program.

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