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Prevalence of abdominal aortic aneurysm detected by ultrasound screening in individuals over 50 years of age: Argentine Multicenter Registry (SCREANRA)

Gastón Mosso[1], Adrián D'Ovidio[2], Gerardo García Mallea[3], Lucas Villedary[4], Celeste Burguener[5], María José Castro[6], Fernando Gragera[7], Alejandro Peñaloza[8], Ignacio Vogliotti[9], Laura Titievsky[10].

Committee of Peripheral Vascular Diseases and Stroke of the Argentine Federation of Cardiology

1 Hospital Central de Mendoza, Argentina. 2 Hospital Rawson and CIMAC, San Juan, Argentina. 3 Sociedad Española de Socorros Mutuos, Mendoza, Argentina. 4 Hospital Central de Mendoza, Argentina. 5 CIMA, Corrientes, Argentina. 6 LEBEN Salud, Neuquén, Argentina. 7 Hospital Italiano de Córdoba, Argentina. 8 Hospital Marcial Quiroga, San Juan, Argentina. 9 Clínica E.J. Carrá San Francisco, Córdoba, Argentina. 10 Instituto de Cardiología de Corrientes, Argentina.

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ABSTRACT

Introduction: Abdominal aortic aneurysms (AAA) are a vascular condition associated with high morbidity and mortality, particularly when rupture occurs. Their prevalence increases with age and is more common in individuals older than 65 years, although they may occur from the age of 50 in the presence of cardiovascular risk factors. Among the most relevant risk factors are smoking, hypertension, and atherosclerotic disease. Most patients with AAA remain asymptomatic for long periods, and diagnosis is therefore often incidental or occurs after complications develop. Early detection through ultrasound allows identification of aneurysms at earlier stages and facilitates appropriate clinical follow-up.

Objective: To evaluate the detection of abdominal aortic aneurysms through ultrasound screening in patients older than 50 years in Argentina. As a secondary objective, to analyze the feasibility of evaluating the abdominal aorta by cardiologists during echocardiographic studies.

Materials and Methods: During cardiovascular or abdominal ultrasound examinations, the anteroposterior and transverse diameters of the abdominal aorta were measured. Patients older than 50 years with risk factors for AAA were included. Public and private medical centers from different provinces of Argentina participated in the study.

Results: A total of 2148 patients were included: 1063 men and 1085 women. Seventy-seven abdominal aortic aneurysms were detected, corresponding to an overall prevalence of 3.58%. Most cases were observed in patients older than 65 years.

Conclusions: Ultrasound evaluation of the abdominal aorta during cardiovascular or vascular studies allows detection of aneurysms in patients with risk factors.

INTRODUCTION

Abdominal aorta aneurysm (AAA) is a potentially lethal vascular disease, characterized by progressive dilatation of the abdominal aorta, that may evolve into rupture if not detected and treated timely. Its prevalence increases significantly with age, being estimated in between 3% and 8% in men older than 65 years in western populations. Aneurysm rupture is one of the main causes of sudden death of vascular origin in the elderly, and is associated to mortality rates of more than 80%, turning this pathology into a relevant problem of public health.[1,2,3,4,5,6]

From an anatomical point of view, the abdominal aorta extends from the diaphragm to its bifurcation in the common iliac arteries, where it splits into significant visceral branches like the celiac trunk, the superior mesenteric artery, the inferior mesenteric artery and the renal arteries. The diameter of the abdominal aorta varies according to age, sex and body surface, with its proximal segment being larger than the distal one. It is considered normal when its maximum diameter is approximately 20 mm[3].

The abdominal aorta aneurysm is defined as a segmental dilatation that compromises the three layers of the arterial wall with a diameter equal or greater than 30 mm, measured in an anteroposterior or transversal sense, or when it exceeds by 50% the normal caliber or is 1.5 times greater than the adjacent segment. The diameters between 26 and 29 mm are considered subaneurysmal dilatations.[1]

From an epidemiological point of view, AAA constitutes a relevant cause of cardiovascular mortality. In the United States, it is the tenth cause of death in men older than 65 years, and it is estimated that in Argentina it affects more than 150,000 individuals, with more than 1000 yearly deaths associated to its rupture.[2]

Different population studies have shown that the prevalence of AAA increases progressively with age. In men, a prevalence of

Corresponding author's address: **Dr. Gastón Mosso**. Cerro del Melón 532, Código postal 5539, Las Heras, Mendoza, Argentina.
e-mail: comitevascularfac2022@gmail.com

1.3% up to 54 years of age has been estimated, and of 3.9-7.2% in those older than 65 years, and 12.5% among those between 75 and 84 years; while in women older than 65 years, prevalence is between 1% and 1.3%.[4] Due to this epidemiological distribution, most screening programs have focused on populations older than 65 years.

The pathogenesis of AAA is multifactorial and is mainly associated with degenerative processes of the vascular wall and atherosclerotic phenomena. Between the most important risk factors, the following stand out: advanced age, male gender, smoking, hypertension, dyslipidemia, peripheral artery disease and family history of aneurysmal disease.[4]

AAAs usually remain asymptomatic for long periods, and are frequently diagnosed incidentally during imaging studies made due to other clinical reasons. In approximately 85% of cases, no symptoms are present until the time of rupture, a situation that is associated to an estimated mortality between 80% and 90% in patients that reach the hospital.[5] Due to this silent evolution, and the risk of catastrophic complications, AAAs have been frequently called "silent killers".[3]

Aneurysms can develop in any segment of the aorta, although the most frequent location is the infrarenal region. Approximately, 85% of AAAs are located below the renal arteries, while around 5% compromise the suprarenal aorta. From a morphological point of view, they may present as a fusiform, saccular or eccentric aneurysm, with the latter presenting greater risk of rupture. Likewise, the more proximal the location of the aneurysm, the greater the complexity for a surgical or endovascular repair.[6]

Between 25% and 40% of patients with AAA present associated peripheral aneurysms, mainly in the popliteal artery (70%) or in the iliofemoral territory (20%). A popliteal aneurysm can be bilateral in up to 50% of cases, and their main complication is distal embolization, which may cause critical ischemia of lower limbs and risk of amputation.[7] Furthermore, approximately two thirds of patients with AAA present concomitant CAD.

Early diagnosis and surgical or endovascular repair of the larger aneurysms (generally from 55 mm of diameter) allow to significantly improve prognosis. In this context, echocardiographic screening has proven to be an efficient tool for an early detection of AAA. Different international studies, including the Multicentre Aneurysm Screening Study (MASS), the Western Australia Screening Study, the Viborg Trial, the UK Small Aneurysm Trial and the ADAM Trial, have shown that ultrasound tracking significantly reduces the mortality associated to aneurysmal rupture in risk populations.[8,9,10,11,12,13,14,15,16,17,18,19,20,21,22,23,24,25,26]

In spite of the strong evidence backing the screening strategies, epidemiological data on the prevalence of AAA are still limited in many Latin American countries. In Argentina, the information available is scant and mainly comes from international registries. In this context, this study had the goal of evaluating AAA detection by echocardiographic screening in individuals older than 50 years in Argentina. As secondary goals, we sought to estimate the prevalence of this pathology in the studied population, and to analyze the feasibility of the evaluation of the abdominal aorta by cardiologists during echocardiographic studies.

MATERIALS AND METHODS

General characteristics and type of study. Design

A screening campaign on abdominal aorta was carried out during April 2023, in multiple centers of Argentina. It developed in a context of performing other auxiliary ultrasound imaging tests, such as color Doppler ultrasound, Doppler echocardiography of neck vessels, arterial Doppler echocardiography of lower limbs, aortoiliac, renal or abdominal Doppler echocardiography, from which the measurements of the maximum anteroposterior and transverse diameters of the abdominal aorta were obtained.

It was a multicenter, observational, transversal and descriptive registry of a screening program. Data were collected on the prevalence of AAA and on the distribution of associated risk factors, diagnosed by ultrasound according to the following criteria: segmental dilatation of abdominal aorta with a diameter equal or greater than 30 mm, or exceeding 50% of its normal caliber.

Echocardiographic screening was indicated in the whole population older than 50 years, in both genders. The main risk factors for the development of AAA were considered, such as current smoking or history of smoking, hypertension, family history of aneurysm, aneurysms in other locations, subclinical atherosclerosis and clinical atherosclerosis, including acute myocardial infarction, intermittent claudication or stroke.

Public and private medical centers from the different provinces of Argentina participated.

Inclusion criteria

Patients older than 50 years were included, of both sexes, with risk factors for AAA like history of current or past smoking, hypertension, family history of aneurysm, CAD (including history of AMI, coronary angioplasty or myocardial revascularization surgery), peripheral vascular disease, atherosclerosis, aneurysm in other locations, bypass or peripheral angioplasty, symptomatic arterial disease, pain in limbs or intermittent claudication, and cerebrovascular disease, including stroke or carotid disease.

Exclusion criteria

Patient with any clinical situation that would prevent them from going to the center, those who rejected participating in the study, those who presented history of previous AAA surgical or endovascular intervention and those who did not meet the requirements established in the inclusion criteria were excluded.

Enrollment and ending periods

Enrollment of patients was made at the time of their coming to the assigned public or private center, to undergo color Doppler ultrasound, Doppler ultrasound of the neck vessels, arterial or venous Doppler ultrasound of lower limbs, aortoiliac, renal or abdominal Doppler echogram.

The enrollment and ending periods were conducted between April 17, 2023, and April 30, 2023. The seven regions of the Argentine Federation of Cardiology (FAC) participated: Northwest, Northeast, Buenos Aires, Patagonia, Litoral, Cuyo and Center, along with its respective societies and associations.

The study had physicians with credited training and experience in echocardiography, vascular Doppler echocardiography or

abdominal ultrasound, using the equipment available in each center. Sectorial, convex or linear probes were used, from different brands and models according to local availability. The cardiologists acquire skills to explore the abdominal aorta when getting familiar with the subxiphoid views in echocardiography, particularly when defining severity of aortic valve failure by evaluation of reverse flow at that level, or when seeking flow alterations compatible with aortic coarctation.[9]

ECHOCARDIOGRAPHIC EXPLORATION

Significance of ultrasound

Echography or ultrasound (US), in its different modalities (2D, color and Doppler) allows to evaluate abdominal structures and to detect anomalies. This is a highly sensitive and specific imaging test (Se 93.3%, Sp 98.5%) to detect AAA, besides being cost-effective, affordable and applicable in different levels of care. It is a feasible, repeatable and safe tool; free from radiation and harmless, as it does not require nephrotoxic contrast.[10] It is also useful for follow-up and surveillance of aneurysms.

US is the most used method for screening and diagnosis in asymptomatic patients, in ER units with no previous diagnosis and in symptomatic patients. In a scenario of AAA rupture, it is the tool that less delays diagnosis.

Exploration technique

All ultrasound studies were made by physicians trained and with previous experience in cardiovascular ultrasound, vascular Doppler or abdominal echocardiography, which guaranteed a standardized acquisition and accurate measurements of the aorta diameters. The studies were carried out using the ultrasound devices available in each participating center.

Cardiological transducers were used, with average frequencies of 2.5 MHz and second harmonic imaging, and linear transducers with frequencies between 7 and 12-18 MHz.

A transversal sweep was made with the transducer in subcostal position, from the epigastrium in a caudal direction, followed by longitudinal exploration from the diaphragm until the aortoiliac bifurcation, and the first centimeters of the common iliac arteries.

The measurements were made in a transversal view, with the transducer beam perpendicular to the major axis of the abdominal aorta. The greatest diameters were registered, both anteroposterior (AP) and transversal (T), measuring from adventitia to adventitia during systole. The measurement of the anteroposterior diameter is considered more accurate than that of transverse diameter, due to the perpendicularity of the echography beam.

When it was not possible to obtain a circular section of the aorta (due to dilatation or tortuosity), the mean diameter was estimated for the ellipse, or the diameter was measured in an adequate longitudinal view, as long as it was perpendicular to the aortic axis.[11]

When aneurysmal dilatation was identified, both the maximal anteroposterior diameter and the maximal transversal diameter were recorded. Normal aorta was defined as a diameter ≤25 mm, ectasia between 26 and 29 mm, and aneurysm when it was ≥30 mm.

Patients with aneurysms of up to 4 mm were informed about the pathology and they were encouraged to undergo echocardiographic monitoring in their medical centers, given the low yearly probability of rupture. In the cases with aneurysms in a surgical range (55 mm in men, 50 mm in women, family history or saccular aneurysms), referral to the vascular surgery services of reference of each center was indicated.

Statistical analysis

A Coordinating Scientific Committee (CSC) was constituted for the registry, made up by members of the Committee on Peripheral Vascular Disease and Stroke of FAC, in charge of leading its development in all its aspects, with the support of the Data Control Group and the Group of Publications. In the statistical analysis, categorical variables were expressed as percentages and were compared by the Chi-squared test of Pearson. Continuous variables were presented as mean and standard deviation, being compared by Student's t-test.

To fulfill the enrollment and data loading, an online form was designed, where personal data, risk factors, center data, type of base study and results of measurements were recorded. Google Forms was used as software support to collect data, only accessible for the researchers in charge and the coordinators appointed for this goal.

The Center for Medical Teleinformatics of FAC (CETIFAC) acted as the only data center, managing the database, its maintenance, and control of load from the different centers. Data was encoded during internet transference and stored in a base protected against unauthorized access.

The study was made according to the ethical principles established in the Declaration of Helsinki for research in human beings. All participants were informed about the goals of the study and granted their informed consent before being included in the registry. The data of patients were anonymized and treated confidentially according to the current regulations for data protection.

Each patient obtained the corresponding consent, according to institutional policies and the current privacy regulations. The purpose of the study was explained in detail, namely evaluating the anatomy of abdominal aorta and detecting alterations such as dilatations, aneurysms, thrombosis and other pathologies. Likewise, it was clarified that the procedure was made as a supplement of other requested studies and that it would have an approximate duration of 20 minutes, with no complications or adverse effects expected.

Patients were given the chance to ask all the questions they would deem necessary for them to be at ease and understand the procedure. Participation was voluntary, with a chance of withdrawing their consent at any time, not affecting the medical care they would receive. The patients already incorporated to the registry would remain in it. The regulations also contemplated a voluntary withdrawal or not, from an investigator or a center.

RESULTS

Characteristics of the population

During the period of the study, 2252 patients were evaluated, from whom 14 were excluded as they did not meet the age cri-

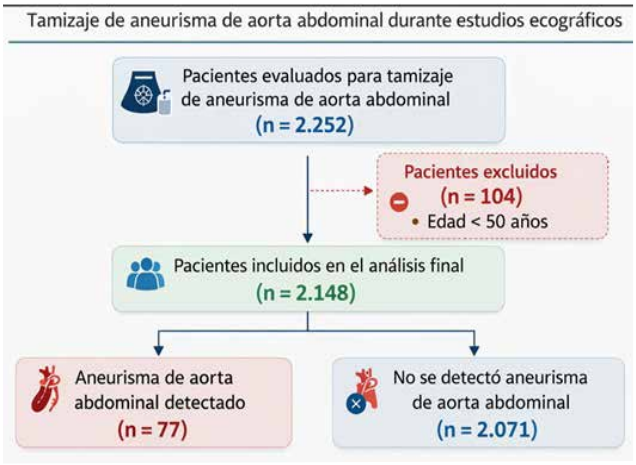

FIGURE 1.
Flowchart of the selection of patients and detection of abdominal aortic aneurysm in the study population

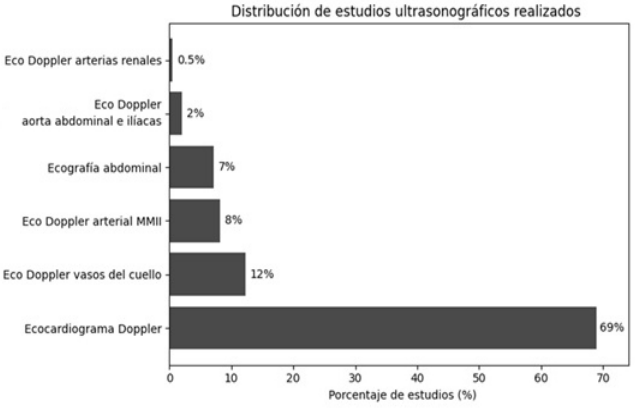

FIGURE 2.
Type of study made that allowed detecting AAA

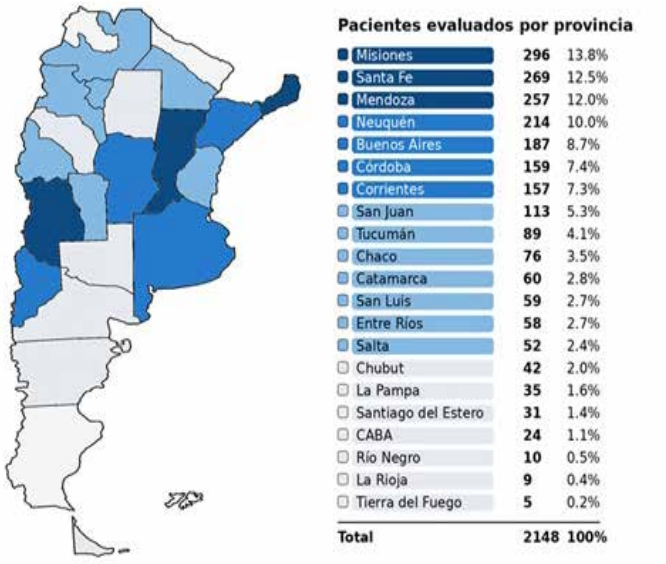

FIGURE 3.
Geographical distribution of the study.
Patients evaluated by abdominal aortic aneurysm (AAA) in Argentina. The political map shows the provincial distribution of patients included in the multicenter study. The intensity of color reflects the number of patients evaluated in each province. Total of evaluated patients: n = 2148.

TABLE 1.
Characteristics of the population

Variable	n	%
Total de pacientes evaluados	2148	100
Hombres	1063	49
Mujeres	1085	51
Aneurisma de aorta abdominal detectado (AAA)	77	3.58

TABLE 2.
Prevalence of abdominal aortic aneurysm according to sex

Grupo	n	Prevalencia (%)
Hombres	51	4,80
Mujeres	26	2,40
Total	77	3,58

teria. The final population analyzed included 2148 patients. The flowchart of the study is shown in *Figure 1*.

The average age of the population was 67±9.12 years in men. From the total of participants, 1063 patients were males (49%) and 1085 females (51%), showing a relatively balanced distribution between both genders *(Table 1)*.

Modality of the study and geographical distribution

The study that most frequently allowed to perform the abdominal aorta screening was color Doppler echocardiogram, made in 1489 patients (69.3%). Other studies that made the evaluation of the abdominal aorta possible included Doppler echography of neck vessels, arterial Doppler echography of lower limbs and abdominal echography *(Figure 2)*.

The geographical distribution of patients included multiple provinces of Argentina. The provinces that contributed the greater number of registries were Misiones (296 patients; 13.78%), Santa Fe (269; 12.52%) and Mendoza (257; 11.96%). Neuquén (214; 9.96%), Buenos Aires (187; 8.71%), Córdoba (159; 7.40%) and Corrientes (157; 7.31%) also had a relevant participation, reflecting a wide territorial representation of the registry *(Figure 3)*.

Cardiovascular risk factors

Hypertension was the most frequent risk factor, followed by dyslipidemia and history of smoking, with predominance of former smokers over active smokers. Other risk factors include diabetes mellitus, obesity and history of cardiovascular disease and peripheral artery disease, configuring a global profile of high atherosclerotic risk in the analyzed population.

Prevalence of abdominal aortic aneurysm

In the total population analyzed, 77 AAA were detected, representing a global prevalence of 3.58% (95% CI: 2.8-4.5) *(Table 2)*.

TABLE 3.
Comparative analysis of abdominal aortic aneurysm according to sex and age

Variable	Casos AAA n (%)	Sin AAA n (%)	Medida	IC95%	p
Sexo					
Hombres	51 (4,8)	1012 (95,2)	OR 2,05	1,25-3,35	0,004
Mujeres	26 (2,4)	1059 (97,6)	Referencia	-	-
Edad					
>65 años	59 (76,6)	-	RR 3,27	1,90-5,63	<0,001
50-64 años	18 (23,4)	-	Referencia	-	-

AAA: abdominal aortic aneurysm . **OR:** odds ratio . **RR:** relative risk. **95% CI:** 95% confidence interval

TABLE 4.
Multivariate analysis by logistic regression

Variable	OR ajustado	IC95%	P
Sexo masculino	2,01	1,22-3,30	0,006
Edad >65 años	3,18	1,84-5,49	<0,001
Tabaquismo	1,72	1,05-2,80	0,031
HTA	1,34	0,82-2,19	0,24
Dislipidemia	1,21	0,74-1,97	0,43

Comparative analysis by gender

Fifty-one cases were identified in men (4.8) and 26 cases in women (2.4%). Male gender was significantly associated with a greater risk of AAA (OR: 2.05; 95% CI: 1.25-3.35; p = 0.004), indicating approximately twice the chance of disease in comparison to women.

Comparative analysis according to age

A significant increase in the prevalence of AAA was observed with age. From the total of cases detected, 59 aneurysms (76.6%) were identified in patients older than 65 years, while 18 cases (23.4%) corresponded to the group from 50 to 64 years.

In the group of patients older than 65 years, 38 aneurysms were identified in men and 21 in women; while in the age group from 50 to 64 years 13 aneurysms were recorded in men and 5 in women *(Figure 4)*.

Patients older than 65 years presented a significantly greater risk of AAA (RR: 3.27; 95% CI: 1.90-5.63; p<0.001) *(Table 3)*.

Analysis of associated factors

The analysis of association showed that the male gender, age of more than 65 years and smoking were significantly associated with the presence of AAA. Together, these findings show a clear association between advanced age, male gender and cardiovascular risk factors with a higher prevalence of AAA in the studied population.

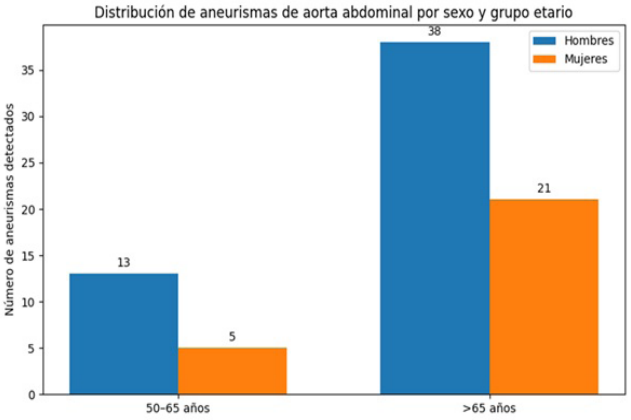

FIGURE 4.
Percentage distribution of abdominal aortic aneurysms according to sex and age group in the studied population
A higher frequency of cases is observed in patients older than 65 years and the male gender was predominant.

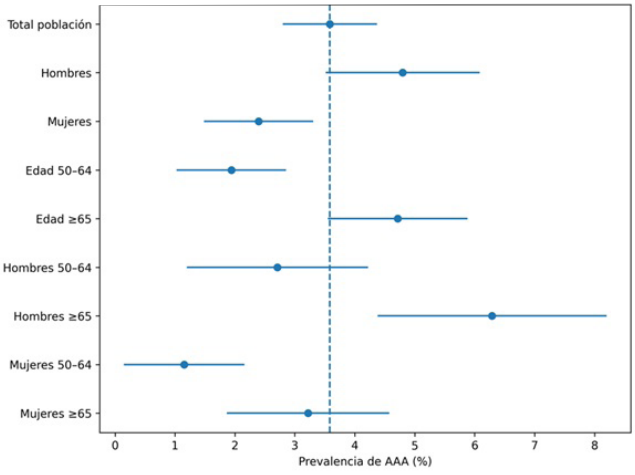

FIGURE 5.
Factors associated to AAA

Multivariate analysis

A multivariate logistic regression analysis was made to identify the factors associated independently with the presence of AAA. The variables included in the model were age, sex and relevant cardiovascular risk factors.

Multivariate analysis showed that the male gender and an age of more than 65 years were independently associated with the presence of AAA. Likewise, smoking remained as a significant risk factor in the adjusted model, while hypertension and dyslipidemia did not show a statistically significant association after adjustment by confusion variables *(Table 4)*.

Forest plot shows the prevalence of AAA in the total population and in different subgroups according to gender and age, with their respective 95% confidence intervals. Prevalence was higher in men than in women, and significantly increased in patients older than 65 years *(Figure 5)*.

DISCUSSION

Abdominal aortic aneurysm screening by Doppler echography has consolidated as an efficient strategy for early detection and reduction in the mortality associated to its rupture, particularly in risk populations like smokers older than 65 years.[12] Use of ultrasound allows to identify aneurysms in asymptomatic phases, facilitating its clinical follow-up and the implementation of timely therapeutic interventions.

Different clinical trials have supported the implementation of population screening programs. Among the most relevant, we find the MASS, Viborg, Western Australia and Chichester studies, which showed that echographic tracking significantly reduces mortality specifically due to AAA, mainly by decreasing the incidence of aneurysmal rupture.[12,15,16,17,18] The MASS study showed a significant reduction of specific mortality and rupture rate; while the Western Australia Screening Study confirmed these benefits in a long-term follow-up.[12,13]

Aneurysmal diameter constitutes the main rupture predictor, with a risk that increases progressively and exceeds 50% in aneurysms of more than 70 mm.[13] The goal of screening is to identify aneurysms with a clinically relevant diameter before the appearance of complications, allowing elective repair and reducing associated mortality.[16] However, there are differences between clinical guidelines in regard to the populations that should undergo screening, recommending in general doing it in men older than 65 years with history of smoking.[17]

Similarly, the UK Small Aneurysm Trial and ADAM studies established that echographic surveillance constitutes a safe strategy in smaller aneurysms, contributing to defining the current criteria of follow-up and intervention.[14,25,26]

In this multicenter registry, a prevalence of AAA of 3.58% was observed in adults older than 50 years, a figure comparable to that reported in international studies. Most cases were detected in patients older than 65 years, confirming the strong association between age and the development of the disease. Likewise, male gender and smoking were identified as independent risk factors, in agreement with the epidemiological evidence available.

In scenarios where there are no national screening programs, as it currently happens in Argentina, timely detection during imaging studies represents a potentially cost-effective strategy. In this regard, the evaluation of the abdominal aorta during transthoracic echocardiography acquires special relevance, as many of these patients present cardiovascular risk profiles similar to those associated with AAA.[19,20]

Although the prevalence of aneurysm is smaller in women, this group presents particular clinical characteristics, like risk of rupture and presentation with smaller diameters.[22,23] In specific populations, like elderly women or patients in high risk, screening could be considered individually.[17,21,24]

The screening programs have proven to significantly reduce specific mortality related to AAA, although this benefit does not always translate to a decrease in overall mortality in the long-term.[18] This situation has generated a debate on the universal implementation of screening programs, particularly in health care systems with no organized programs.

From a clinical point of view, the systematic incorporation of echographic evaluation of the AAA during cardiovascular ultrasound tests could facilitate detection in asymptomatic stages, optimize risk stratification and allow a timely referral for treatment. This strategy can contribute to reduce morbimortality associated to AAA rupture in the usual clinical practice.

In this regard, the risk of rupture of AAA is directly related with its maximal diameter, main rupture and mortality predictor, and a determinant factor for surgical indication. Other associated factors include smoking, the female gender, hypertension, family history, saccular morphology and decrease in FEV1. Rupture presents a mortality of more than 80% in patients who reach hospital care.

Elective repair presents significantly less mortality in comparison with urgency surgery, with rates between 0.73% and 5%, while in broken aneurysms it may reach 50-60% in the hospital environment, and up to 100% with no intervention.[27] In this scenario, early detection and timely treatment constitute the mainstay of clinical management.

Intervention in aneurysms with diameters ≥55 mm in men and ≥45 mm in women, as well as those with growth >0.5 cm/year or associated symptomatology.[28] Echography represents a safe, accurate, affordable and cost-effective diagnostic method for the detection of aneurysms in asymptomatic patients.

Within this framework, echographic screening of the abdominal aorta in a selected population allows an early detection of aneurysms and other aortic pathologies, favoring the implementation of timely therapeutic managements and improving morbimortality.[29]

However, the results of this study should be interpreted considering certain limitations. First, this is an observational registry of cross-sectional character, which prevents establishing causal relationships between the risk factors evaluated and the presence of AAA. Second, enrollment included patients who went to health care centers to undergo ultrasound tests because of different clinical indications, which may introduce a selection bias, given that this population probably presents a greater load of cardiovascular risk factors in comparison with the general population. Similarly, the tests were made in multiple centers with ultrasound devices with different features, which may generate a certain variability in measurements; however, all studies were made by physicians with experience in ultrasound, which contributes to reducing this effect. On the other hand, the enrollment period was limited to two weeks, which prevented having a longitudinal follow-up and evaluating the progression of the aneurysms detected or its clinical results in the long term. Finally, although the results match international evidence, the differences observed between studies may be attributed to demographic, epidemiological and methodological variations, including the age of inclusion, selection criteria and the duration of the screening programs.

CONCLUSIONS

This Argentine multicenter registry showed a prevalence of AAA of 3.58% in a population older than 50 years with cardiovascular risk factors. Most cases were detected in patients older than 65 years (76.6%), with predominance of the male gender in both age groups.

The risk factors most frequently associated were hypertension, dyslipidemia and history of smoking. The echographic evaluation of the abdominal aorta during cardiovascular or vascular ultrasound tests proved to be feasible, useful and applicable for a timely detection of aneurysms, both in asymptomatic and symptomatic patients.

These findings back the incorporation of the AAA evaluation to supplement the usual echographic tests, even in the field of primary care by trained physicians. This strategy could improve the early detection of AAA by a simple, affordable and cost-effective method.

Although these results do not modify the current recommendations that prioritize screening in people older than 65 years, they do suggest that a directed evaluation in patients older than 50 years with risk factors could constitute a valuable supplementary strategy in clinical practice.

Participants in AAA screening

The authors wish to express their deep gratefulness to all the health care professionals that participated in the development of the multicenter SCREANRA registry, whose collaboration and commitment made it possible to perform this study at national level.

We particularly wish to acknowledge the participation of cardiologists, echography specialists, imaging diagnosis specialists, and all the other professionals who contributed to data collection and performing ultrasound tests in the different regions of Argentina.

Likewise, we would like to thank the public and private institutions that facilitated the implementation of the screening, as well as the Committee of Peripheral Vascular Disease and Stroke of the Argentine Federation of Cardiology because of their coordination and support in the performance of this registry.

Finally, we highlight the valuable participation of all patients that were part of this study, whose collaboration allowed to generate relevant information for the epidemiological knowledge on abdominal aortic aneurysm in our country.

CABA (Autonomous City of Buenos Aires)
Cirone Gisella. Complejo PFA Churruca Visca
Curcio Andrea. Complejo PFA Churruca Visca
Jaliff Fidel. Complejo PFA Churruca Visca
Nieves Piazza Nicolás. Complejo PFA Churruca Visca
Palacios Karina. Hospital General de Agudos "Dr. Teodoro Álvarez".
Rodriguez Agustina. Complejo PFA Churruca Visca
Zubiri Javier. Complejo PFA Churruca Visca

Buenos Aires
Barr Cecilia. CARDIOLAUQUEN .
Bassino Marcelo. Hospital Municipal "Pedro T. Orellana".
Caprini Romina. Sanatorio de la Trinidad de Quilmes.
De Iraola Ana. HIGA Hospital San Martín de La Plata.
Faliva Mai Gianina. HIGA Hospital San Martín de La Plata.
Gomez Daniela. HIGA Hospital San Martín de La Plata.
Marciello Rafael. ICTUM
Mardzin Brenda. HIGA Hospital San Martín de La Plata.
Musante Christian .Sanatorio de la Trinidad de Quilmes
Mutti Luis. Hospital "Dr. Alberto Duhau".
Pagola Juan. HIGA Hospital San Martín de La Plata.
Sciarresi Esteban. Instituto de Cardiologia San Nicolás.

Catamarca
Chacur Johana. Instituto Médico de la Comunidad.
Ríos Sergio. Instituto Médico de la Comunidad.
Rodríguez César. Instituto Médico de la Comunidad.
Verderone Mauricio. Instituto Médico Privado.

Chaco
Gómez Flora Romina
Gyoker Juan. Sanatorio Loma Linda.
Harawiska Carlos.Sanatorio Loma Linda.
López Marisa. Sanatorio Loma Linda.
Verón Gustavo. Clinica Centro Médico.

Chubut
Benaim Leonel. Hospital Zonal de Trelew.
Caminos Mario. Hospital Privado Bariloche.
Frías Juan Manuel. Clínica del Valle.
Gay Papp Matías. Clínica del Valle.
Ingaramo Roberto. Instituto de Cardiología Pueblo de San Luis.
Ivanovich Vladimir. Clínica del Valle.
Maldonado Pablo. Centro Médico Patagonia.
Ramírez Víctor. Clínica del Valle.
Tejerina Nuria. Hospital Zonal de Trelew.

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López Rigo Alejandro. Centro Médico Ituzaingó
Miño Miguel Alejandro. CIMA.
Titievsky Laura. Instituto de Cardiología

Entre Ríos
Acevedo Juan. Alianza Médica.
Alterini Pablo. Hospital San Martín.
Ferrer Ricardo. Hospital San Martín.
Kramer Julio. Hospital de la Baxada

Formosa
Pereira Zini Gustavo. Instituto Modelo de Gastroenterología.

Jujuy
Barbaza Augusto. Sanatorio Los Lapachos.
Flores Héctor. Hospital Pablo Soria.
Gonzalo Nicolás. Sanatorio Nuestra Señora del Rosario.
Pastore Ignacio. Clinica Lavalle.

La Pampa
Alonso Fernando. Centro DIM.
Arevalo Aldo. Hospital Centeno General Pico
Barolo Julio. Clinica Regional General Pico
Berges Omar. Clinica Regional Genereal Pico
Brocal Lorena. Instituto Cardiovascular General Pico.
Campins Rodrigo. Cardiología integral.
Delia Julio. Clínica Santa Teresita.
Liuzzo Fabricio. Instituto Cardiovascular General Pico.
Picchio Diego Humberto. Instituto Polymedic.

La Rioja
Córdoba Carlos. CIMA
De La Vega Mario. CIMA
Guglieri Germán. Centro Modelo Cardiovascular.
Martinez Florencia. Centro Modelo Cardiovascular.
Tripolone Marcela. CIMA

Mendoza
Bengolea Pablo. Hospital Universitario.
Bertín José. Hospital Tagarelli.
Borovina Bruno. Hospital Schestakow
Bressán Sergio. Hospital Central
Cerruti Fausto. IDM
Cubells Sebastián. Hospital Del Carmen.
Della Fazia Gonzalo. Hospital Schestakow
Estrada Eliana. Hospital Central.
Ferraro Martín. Hospital Enfermeros Argentinos
Ferreira Karina. IDM
Gimenez Daniel. DICAMEN
Giner Eduardo. Clínica Santa Clara
Herrero Bruno. IDM (San Rafael)
Herrero Leandro. Hospital Schestakow (San Rafael)
Hopp Martín. Hospital Enfermeros Argentinos (General Alvear)
Migone German. Clínica Santa Clara
Niella Natalia. Clínica de Cuyo.
Ortega Lina. Clínica Arizu
Ricci Enrique. Clínica de Cuyo
Richarte Valeria. Hospital Central
Russo Rodolfo. Hospital Central.
Sanchez Dario. Clinca Francesa
Schiavone Leonardo. Hospital Schestakow (San Rafael)
Senatra Pablo. DICAMEN
Trinasjtik Marcos . Clínica Santa Clara
Vega Gustavo. Hospital Del Carmen.
Vera Celeste. Hospital. Regional de Malargue
Videla Manuel. Clinica Francesa
Villedary Lucas . Hospital Central.
Vissio Franco. Hospital Central

Misiones
Audisio Mariel. Hospital Madariaga
Báez Julio. Instituto de Cardiología Posadas.
Bazán Roxana. Hospital René Favaloro.
Doxostaxis Griselda. Instituto de Cardiología Posadas.
Gallo Noelia. Hospital René Favaloro.
Lepori Augusto. Instituto de Cardiología Posadas.
Lepori Orlando. Instituto de Cardiología Posadas.
Mestas Renzo. CEMEBA

Neuquén
Castro María José. Leben Salud.
Correa Eduardo. Leben Salud.
Gambazza Nicolás. Cardiología Integral.
Larronde Esteban. Consultorio Islas Malvinas.
Moreno Ricardo. Centro Médico la Trinidad.
Moreno Santiago. Centro Médico la Trinidad.
Ontivero Jeremías. Centro Médico la Trinidad.
Paz Federico. Clínica Pasteur.
Trujillo Silvina. Centro Médico FAVA.

Río Negro
Caminos Mario. Hospital Privado Bariloche
Maldonado Pablo Andrés. Centro Médico Patagonia

Salta
Abraham Jorge. IMAC.
Arroyo Arturo. CARDIOMED.
Barrientos Natalia. Hospital San Bernardo.
Ber Marcos. Hospital Papa Francisco
Botelli Valentina. Hospital San Bernardo.
Calvo Sebastián. Hospital Arturo Oñativia.
Herrera Luis. Hospital San Bernardo.
Moreyra Agustín. Hospital San Bernardo.
Moreyra Roberto. Hospital San Bernardo.
Samaniego Pablo. CARDIOMED.
Sanchez Javier. CEMESA
Toldo Cristian. Medicina Ambulatoria.

San Juan
Allende Juan Pablo. Hospital Rawson
D'Ovidio Adrián. Hospital Rawson
Gerber Daniela. Hospital Rawson
Laciar Amelia. Hospital Rawson
Navarro Yubel Betina. CIMAC

San Luis
Albisu José. Centro Médico de Metabolismo Nutrición y Diabetes
Bayona Emanuel. Hospital Carrillo
Becerra Sergio. Hospital Carrillo
Carbajal Maria Fernanda. ECOMED
Farez Gustavo. Hospital Carrillo
López Nahum Rodolfo. Hospital Carrillo
Muñoz Fernando. Integra Servicios Médicos
Pereyra Alejandro. Integra Servicios Médicos

Santa Fe
Allegrini Eduardo. Sanatorio San Martin Venado Tuerto
Bagnera Fernando. Instituto Cardiovascular de Rosario .
Beloscar Laura. Hospital Centenario. Rosario.
Benitez Sebastián. Hospital Privado de Rosario.
Bilancieri Flavia. Sanatorio Diagnostico.Santa Fe
Bisogni Carlos. Sanatorio San Martin Venado Tuerto
Bosso Mariana. Sanatorio de la Mujer. Rosario.
Cortes Fernando. Consultorio BIO. Casilda
Calderón Osvaldo. Hospital Español de Rosario.
Caliotti Lourdes. Hospital Privado de Rosario.
Cardona Santiago. Sanatorio Diagnostico. Santa Fe
Cigalini Belén. Hospital Privado de Rosario.
Dumont Carlos. Hospital Privado de Rosario.
Flecha Claudia. Sanatorio Regional de la Seguridad Social.
Freytes Diego. Hospital Privado de Rosario.
García Romina. Sanatorio Regional.Santa Fe
Genova Damián. Sanatorio Regional.Santa Fe
Gentile Cristian. Sanatorio de la Mujer. Rosario.
Gianolli Carolina. Hospital Centenario. Rosario.
Manavella Bibiana. Hospital Centenario. Rosario.
Matcovich Gabriel. Sanatorio San Martin Venado Tuerto
Mela Mariana. CEMAR Rosario.
Picech Adrián. Sanatorio Diagnostico.Santa Fe
Quaglia Fernando. Sanatorio Regional.Santa Fe
San Dámaso Esteban. COT Rosario
Vera Carlos. Hospital Privado de Rosario.
Zaffora Daniel. Hospital Privado de Rosario.

Santiago Del Estero
Ávila Sebastián. Hospital Ramón Carrillo
Bossi Ricardo. Instituto de Cardiología Santiago del Estero
Jensen Javier. Hospital Ramón Carrillo
Maldonado Gastón. Clínica Yunes
Méndez Florencia. Hospital Ramón Carrillo
Yunes Pablo. Clínica Yunes

Tierra Del Fuego
Corradi Lucas. Clínica San Jorge. Ushuaia

Tucumán
Augier Gerardo. CEMET
Buccharelli Juan Pablo. CEMET
Burgos Mario. Centro GAMMA.
Chain Sergio. Centro Méndez Collado.
Carrizo Álvaro. CEMET
Espinoza Miriam. CEMET
Estofan Mariano. Sanatorio 9 de Julio.
Feldman Gabriela. Centro Méndez Collado.
Hasbani Javier. Centro Privado de Cardiología.
Perea Martín. Sanatorio 9 de Julio.
Iriarte Enrique. Centro MATSA.
Rodríguez Federico. Centro Privado de Cardiología.
Tazar Jorge. Instituto de Cardiología.
Venturini Cristina. Centro Privado de Cardiología.

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