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Original article

Screening for Abdominal Aortic Aneurysm by Means of Transthoracic Echocardiography

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ABSTRACT

Introduction and objectives: The increasing incidence of abdominal aortic aneurysm (AAA), mainly due to the aging population, and its mortality of 85-90% in the event of rupture justify opting for early diagnosis and elective treatment to repair it. The main aim of this paper is to analyze the utility of transthoracic echocardiography (TTE) in the study of infrarenal aorta and AAA screening.
Methods: The study included 512 patients (309 men and 203 women) consecutively assessed by TTE and, where possible, abdominal ultrasound for any reason in a cardiology department.
Results: An AAA was detected in 25 patients (5.1%), the minimum age at diagnosis was 55 years, the ratio of men to women was 7.3:1 and the mean diameter of the aneurysms was 39.5 ± 12.2 mm. Risk factors associated with AAA were to current and former smoking, age, and presence of femoral murmur. The TTE results were equivalent to those of abdominal ultrasound. All patients with AAA studied by coronary angiography showed significant coronary lesions.
Conclusions: It is feasible and useful to complement conventional TTE with the study of the infrarenal aorta for AAA screening in patients visited at the department of cardiology. This study should be performed mainly in patients ≥55 years old or with risk factors to develop an AAA.

Screening del aneurisma de aorta abdominal mediante ecocardiografía transtorácica

Palabras clave:
Aneurisma de la aorta abdominal
Ecocardiografía transtorácica
Aterosclerosis

RESUMEN

Introducción y objetivos: La creciente incidencia del aneurisma de la aorta abdominal (AAA), principalmente por el envejecimiento de la población, y su mortalidad del 85-90% en caso de rotura justifican su diagnóstico precoz y un tratamiento reparador electivo. El objetivo principal del presente trabajo es analizar la utilidad de la ecocardiografía transtorácica (ETT) para el estudio de la aorta infrarrenal y el cribado del AAA.
Métodos: Se estudió a 512 pacientes (309 varones y 203 mujeres) consecutivos evaluados mediante ETT por cualquier causa en el servicio de cardiología.
Resultados: En 25 pacientes (5,1%) se detectó un AAA; la edad mínima al diagnóstico era 55 años; la razón varones:mujeres, 7,3:1 y el diámetro de los aneurismas, 39,5 ± 12,2 mm. Los factores de riesgo relacionados con el AAA fueron ser fumador o ex fumador, la edad y la presencia de soplo femoral. Los resultados de la ETT fueron concordantes con los de la ecografía abdominal también realizada. Todos los pacientes con AAA estudiados mediante coronariografía mostraron también lesiones coronarias significativas.
Conclusiones: Completar la ETT convencional con el estudio de la aorta infrarrenal (acceso paraumbilical) resulta útil y válido para el cribado del AAA en los pacientes visitados en cardiología, y se recomienda dicho estudio principalmente en los adultos de de edad ≥ 55 años o con factores de riesgo para sufrir un aneurisma.

INTRODUCTION

Abdominal aortic aneurysm (AAA) is the term used to describe ≥3 cm diameter dilatation of the infrarenal aorta. Incidence of AAA is increasing[1–3] due, principally, to the aging population. It affects 1.5%-2% of adults,[2,4–7] 6%-7% of those aged >60 years, and ≤12% of those aged >80 years.[4,6]

In 75% of patients, AAA is related with atherosclerosis. Principal risk factors are: age >60 years, tobacco use, high blood pressure (HBP), male sex, history of interventions or death due to AAA in first-degree family members, and presence of atherosclerotic coronary, peripheral or cerebrovascular atherosclerotic disease.[8–12] Among patients with AAA, 75% are asymptomatic and the condition

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Abbreviations

AAA: abdominal aortic aneurysm
aCT: abdominal computed tomography
OR: odds ratio
TTE: transthoracic echocardiography

is found by chance when undergoing imaging. However, the complication that is most feared is rupture, which relates directly to size and is especially frequent in patients with AAA ≥5.5 cm.[4,13–17] Rupture entails mortality of 60% prehospital and 40%-70% inhospital following emergency interventions. Overall mortality is 85%-90%. This accounts for 1%-2% of all deaths in the Western world[8] and is the 10th-ranked cause of death among individuals aged >55 years in the United States.[16,18] Early diagnosis of AAA and elective repair surgery reduce morbidity and mortality by avoiding rupture.[19] However, AAA screening in the general population is not cost-effective and so the principal scientific societies recommend abdominal ultrasound for men aged 65-75 years who are smokers or ex-smokers.[14,20,21]

The usefulness of transthoracic echocardiography (TTE) in AAA screening has received little attention.[1,2,4,5,13,16,18] Those series that have been reported include selected patients and abdominal aorta evaluation from the subcostal position (only one study used an abdominal view). The major echocardiography societies (European and American,[22–24] among others) do now contemplate abdominal aorta study during TTE but only from the subcostal position –visualizing the proximal or suprarenal abdominal aorta – even though ≤91% of AAA affect the infrarenal segment.

Hence, the present study established its principal objective: to analyze the usefulness of TTE in studying the infrarenal aorta and AAA screening in cardiology patients undergoing TTE and to determine its prevalence, risk factors, and relationship with other aspects of the presence of atherosclerotic disease.

METHODS

Population

We studied 512 Caucasians (309 men and 203 women) who were consecutive ambulatory or hospitalized patients, referred to cardiology for TTE independently of indications for echocardiography. We designed a long-term, prospective, descriptive, observational study with an analytic component. Patient data were obtained from inhospital and primary care clinical histories, and from the clinical record and vascular examination performed during TTE by the attending cardiologist. We included imaging study results if conducted < 6 months before TTE (ie, date of inclusion in the study).

The variables recorded were: age; sex; tobacco use (smoker, >1 year ex-smoker, non-smoker); HBP (systolic blood pressure ≥140 mmHg or diastolic blood pressure ≥90 mmHg or antihypertensive treatment); dyslipidemia (low density lipoprotein cholesterol ≥160 mg/dl in primary prevention and ≥100 mg/dl in secondary prevention or triglycerides >150 mg/dl or receiving lipid-lowering treatment); diabetes mellitus (defined according to current criteria or receiving hypoglycemia treatment); body mass index (BMI); and chronic kidney failure (plasma creatinine >1.3 mg/dl in men and >1.2 mg/dl in women during >3 months). We also took into account a history of: *a)* ischemic heart disease: asymptomatic (myocardial ischemia in challenge test), angina or myocardial infarction, and coronary angiography results (defining lesions obstructing ≥50% of the left main coronary artery or ≥60% of the primary or secondary coronary arteries as significant); *b)* ischemic cerebrovascular disease: transitory ischemic accident or stroke, and echo-Doppler or angiography results for the supra-aortic trunks (defining lesions obstructing ≥50% of the vessel as significant atherosclerotic lesions); *c)* peripheral vascular disease: intermittent claudication, femoral murmur, absence of distal pulses or abnormal ankle-brachial index (ABI), and echo-Doppler or angiography results for lower limbs (defining lesions obstructing ≥50% of the vessel as significant); and *d)* abdominal pain, abdominal pulsatile mass, or abdominal aortic murmur.

All TTEs were performed by the same cardiac sonographer using General Electrics Vivid 5 ultrasound equipment, cardiology software, a 2.5-MHz transducer, and second harmonic imaging. Aortic segments were measured using online electronic calipers with the image frozen in systole. Measurement was from the anterior edge to the aortic anterior edge following a slice perpendicular to the longitudinal arterial axis. Maximum anteroposterior diameter was obtained in standard study planes; maximum transversal diameter at the level of the infrarenal aorta was also measured. The infrarenal aorta was measured in 2D in a left para-umbilical plane with the patient in supine decubitus or from a right para-umbilical plane with the patient in left-side semi-decubitus if visualization was impossible from the previous position.

We defined AAA as maximum infrarenal aorta diameter ≥30 mm and dilatation as diameter 21-29 mm.

We also recorded presence of atherosclerosis in the infrarenal aorta (defining ≥5 mm thick plaque protruding into the lumen as severe) and presence of infrarenal mural thrombosis. In patients with detected AAA, we determined whether abdominal echocardiography or, in its absence, abdominal computerized tomography (aCT) confirmed findings.

Statistical Analysis

An initial descriptive study was conducted; results for quantitative variables are expressed as mean ± standard deviation and for discrete variables as number and percentage. To determine whether or not significant differences existed between patients with and patients without aneurysm we used chi-squared for categorical variables and the Student *t*-test for continuous variables. If the conditions needed to apply these tests were not met, we used Fisher's exact test and the Mann Whitney U test (Table 1). Subsequently, univariate and multivariate analysis were conducted with logistic regression. A value of $P < .05$ was established as statistically significant. Statistical analysis was with SPSS 16.0 for Windows.

RESULTS

We studied 512 patients, 309 men and 203 women; mean age 65.1 ± 12.1 (21-89) years. The infrarenal aorta could not be visualized in 18 patients so 494 patients, 299 men (60.5%) and 195 women (39.5%) were finally included in the analysis. The variables recorded are in Table 1. Of 512 patients, 169 (34.2%) had ischemic heart disease and 133 (26.9%) had recently undergone coronary angiography. Of these, 96 (72.2%) presented significant lesions, 57 (11.5%) cerebrovascular disease, and 94 (19.3%), peripheral vascular disease. Although murmur or abdominal pulsatile mass was detected in 3.4% of patients, only 1.6% reported abdominal pain.

The infrarenal aorta was visualized in 494 patients (96.5%), with mean diameter 18.7 ± 6.5 mm. The BMI of these patients was 28.7 ± 4.7 and in the remaining 18 patients (3.5%), 30.3 ± 4. There

Table 1
Patient Characteristics

	Total	Without AAA	With AAA	*P*[a]
Patients	494	464 (94.9)	25 (5.1)	
Sex				
Men	299 (60.5)	277 (59.1)	22 (88)	NA
Women	195 (39.5)	192 (40.9)	3 (12)	NA
Age (years)	65.1 ± 12.1	64.7 ± 12.3	71.1 ± 8.1	.01[b]
High blood pressure	349 (70.6)	330 (70.4)	19 (76)	.54[c]
Dyslipidemia	323 (65.4)	305 (65)	18 (72)	.48[c]
Diabetes mellitus	128 (25.9)	117 (24.9)	11 (44)	.03[c]
Body mass index	28.7 ± 4.7	28.8 ± 4.7	27.1 ± 4	.08[d]
Chronic kidney failure	71 (14.4)	66 (14.1)	5 (20)	.38[e]
Tobacco use				
Non-smokers	292 (59.1)	286 (61)	6 (24)	
Smokers	73 (14.8)	64 (13.6)	9 (36)	NA
Ex-smokers	129 (26.1)	119 (25.4)	10 (40)	
Ischemic heart disease				
No	325 (65)	315 (67.2)	10 (40)	
Asymptomatic	13 (2.6)	11 (2.4)	2 (8)	.13[e]
Angina	66 (13.4)	61 (13.0)	5 (20)	.36[e]
Acute myocardial infarction	90 (18.2)	82 (17.5)	8 (32)	.1[e]
Coronary angiography				
Normal	13 (9.8)	13 (10.5)	0	
Nonsignificant lesions	24 (18)	24 (19.5)	0	NA
Significant lesions	96 (72.2)	86 (70)	10 (100)	
Cerebrovascular disease				
No	437 (88.5)	413 (88.1)	24 (96)	
Transitory ischemic accident	17 (3.4)	17 (3.6)	0	1[e]
Stroke	40 (8.1)	39 (8.3)	1 (4)	.71[e]
Doppler imaging of supra-aortic trunk arteries				
Normal	9 (23.7)	8 (22.2)	1 (50)	
Nonsignificant lesions	17 (44.7)	17 (47.2)	0	NA
Significant lesions	12 (31.6)	11 (30.6)	1 (50)	
Peripheral vascular disease				
No	342 (69.2)	324 (69.1)	0	
Femoral murmur	58 (12)	47 (10.2)	11 (44)	<.001[e]
Intermittent claudication	18 (3.6)	15 (3.2)	3 (12)	.05[e]
Absence of distal pulses or abnormal ABI	76 (15.7)	65 (14.2)	11 (44)	.001[e]
Doppler imaging of lower limbs				
Normal	3 (37.5)	2 (33.3)	1 (50)	
Nonsignificant lesions	1 (12.5)	1 (16.7)	0	NA
Significant lesions	4 (50)	3 (50)	1 (50)	
Abdominal examination				
Murmur or abdominal mass	17 (3.4)	11 (2.3)	6 (24)	<.001[e]
Aorta dimensions (mm)				
Root	33.9 ± 4.7	33.9 ± 4.7	35.8 ± 4.5	.26[d]
Ascending aorta	34.1 ± 5.2	33.9 ± 5.1	35.3 ± 3.9	.43[d]
Aortic arch	25.9 ± 3.6	25.6 ± 3.4	29.5 ± 5.5	.009[b]
Descending thoracic aorta	23.7 ± 3.1	23.6 ± 3	25.8 ± 3	.001[d]
Suprarenal aorta	20.4 ± 3.1	20.2 ± 2.9	23.9 ± 3.4	<.001[d]
Infrarenal aorta	18.7 ± 6.4	17.4 ± 3.2	39.5 ± 12.2	
Infrarenal atherosclerosis				
No	160 (32.4)	160 (34.1)	0	
Nonsevere	313 (63.4)	295 (62.9)	18 (72)	<.001[e]
Severe	21 (4.2)	14 (3)	7 (28)	
Infrarenal thrombosis				
No	480 (98.5)	460 (99.5)	20 (80)	
Yes	7 (1.4)	2 (0.4)	5 (20)	<.001[e]

Table 1 *(continued)*

	Total	Without AAA	With AAA	P[a]
Infrarenal dissection				
No	482 (99.4)	459 (100)	23 (95.8)	
Yes	1 (0.6)	0	1 (4.2)	NA

AAA, abdominal aortic aneurysm; ABI, ankle-brachial index.
Data are expressed as mean ± standard deviation or n (%).
[a] Differences between patients with AAA and without AAA.
[b] Mann-Whitney test.
[c] Chi-squared.
[d] Student *t*-test.
[e] Fisher exact test.

were no significant differences in BMI and aortic visualization results between the two groups ($P = .15$).

We detected an AAA in 25 patients (5.1%), with mean age of 71.1 ± 8.1 years and mean aneurysm diameter 39.5 ± 12.2 (30-69) mm; AAA length was determined in 9 patients, with a mean of 41.2 ± 10.5 (30-62) mm. Of these 25 patients, 22 were men, mean age 70.2 ± 7.6 (55-80); 3 were women, mean age 78 ± 9.5 (72-89) years. In the population aged ≥55 years, prevalence of AAA increased to 6.2%, but in the population aged 55-75 it was 5.7%. Severe infrarenal atherosclerosis was present in 4.2% of all patients and 28% of AAA patients.

Eighty-seven patients (17.6%) presented 21-29 mm aortic diameter (infrarenal aortic dilatation): 68 men (78.2%) and 21 women (21.8%), mean age 66.5 ± 9.3 (44-82) years and mean aortic diameter 23.1 ± 2.1 mm.

When bivariate analysis related presence or absence of AAA variables (Table 1), we identified a significant relationship between AAA and: *a)* age ($P = .01$); *b)* diabetes mellitus ($P = .03$); *c)* presence of femoral murmur ($P < .001$); *d)* absence of distal pulses or abnormal ABI ($P = .001$); *e)* anomalies in abdominal examination ($P < .001$); *f)* severe atherosclerosis of the infrarenal aorta ($P < .001$), and *g)* infrarenal thrombosis ($P < .001$).

We could not draw conclusions about the relationship between presence of an AAA and symptoms of ischemic heart disease, coronary angiography findings, or vascular Doppler findings because very few patients with aneurysm met the requisite conditions. However, 100% of patients with AAA who underwent coronary angiography were found to have significant lesions.

Bivariate analysis also showed a significant relationship between presenting or not presenting an AAA and the dimensions of the aortic arch and descending and suprarenal thoracic aorta segments (Table 1). Similarly, analysis of the correlation between infrarenal aorta dimensions and those of the remaining aorta segments showed a positive correlation between infrarenal diameter and aortic arch diameter, descending thoracic aorta diameter and suprarenal aorta diameter ($P < .001$).

To determine AAA risk factors, a logistic regression analysis was constructed with all variables (Table 1). This model (Table 2) found statistically significant relationships between AAA and age ($P = .01$), sex ($P = .009$), diabetes mellitus ($P = .04$), current ($P < .001$) or previous ($P = .009$) tobacco use, femoral murmur ($P < .001$), absence of distal pulses or abnormal ABI ($P < .001$), and intermittent claudication ($P < .001$). Later, multivariate analysis of all variables only showed (Table 3) associations between AAA and age (odds ratio [OR] = 1.1; 95%, confidence interval [CI], 1-1.1; $P = .001$), current tobacco use (OR = 13.3; 95% CI, 3.9-45.6; $P < .001$), previous tobacco use (OR = 4.7; 95% CI, 1.6-14.2; $P = .006$), and femoral murmur (OR = 3.9; 95% CI, 1.5-9.8; $P = .004$).

The TTE findings in patients with AAA were confirmed in 12 cases by abdominal ultrasound and in 5 cases by aCT. For various reasons, the other patients could not undergo confirmatory radiologic tests. Results of TTE and abdominal ultrasound in the 12 patients who underwent both assessments showed a high positive correlation ($r_s = 0.73$; $P = .001$).

In general, the infrarenal aorta study extended TTE duration by ≤3 min maximum. Only in patients in whom AAA was detected, was TTE duration extended to a maximum 5 min to define its characteristics in detail).

DISCUSSION

The results of this study show the feasibility and usefulness of complementing TTE with a final study of the infrarenal aorta using a para-umbilical view, which permits AAA screening and detects infrarenal arteriosclerosis, in patients referred to cardiology for any indication whatsoever.

In a study of 512 patients referred to cardiology for conventional TTE using a left or right para-umbilical abdominal view, the infrarenal aorta was visualized in 95.5% of cases and AAA was detected in 5.1%. This requires no additional equipment and in general increases examination time by ≤3 min (maximum 5 min if

Table 2
Variables Significantly Associated in Univariate Analysis With Probable Appearance of Abdominal Aortic Aneurysm

Variable	Reference	OR*	95% CI	P
Age	—	1.1	1-1.1	.01
Sex	Women	5.1	1.5-17.2	.009
Diabetes mellitus	Without diabetes	2.3	1-5.3	.04
Smoker	Nonsmoker	6.7	2.3-19.5	<.001
Ex-smoker	Nonsmoker	4	1.4-11.3	.009
Femoral murmur	Absence	6.9	2.9-16	<.001
Absence of distal pulses or abnormal ABI	Absence	4.8	2.1-10.9	<.001
Intermittent claudication	Absence	4.1	1.1-15.3	.03

ABI, ankle-brachial index; CI, confidence interval; OR, odds ratio.
The significance of each predictive variable is not adjusted with respect to the remaining variables.
* Calculated using nonconditional logistic models.

Table 3
Multivariate Analysis, With the Significance of Each Predictive Variable Adjusted With Respect to the Remaining Variables

Variable	Reference	OR*	95% CI	*P*
Age	—	1.1	1-1.1	.001
Smoker	Nonsmoker	13.3	3.9-45.6	<.001
Ex-smoker	Nonsmoker	4.7	1.6-14.2	.006
Femoral murmur	Absence	3.9	1.5-9.8	.004

CI, confidence interval; OR, odds ratio.
* Calculated using nonconditional logistic models.

AAA is detected). Evaluation of the infrarenal aorta up to its bifurcation enables us to determine its dimensions as well as the presence of atherosclerosis, thrombosis, or associated dissections.

If we compare these results with those of the few studies that have previously evaluated the usefulness of TTE in AAA screening, the substantial heterogeneity of the populations studied, the aortic segment evaluated (suprarenal or infrarenal), and the definition of AAA used (the most widely accepted being infrarenal dilatation ≥30 mm) is surprising. Eisenberg et al.[16] studied 323 patients who underwent TTE, using a subcostal view, to determine the proximal abdominal aorta (visualized in 88% of cases), and found AAA prevalence of 3%. Schwartz et al.[13] studied 250 patients (men aged >55 years and women aged >65 years) using subcostal views (visualization possible in 86.4%) and found 6% prevalence. Spitell et al.[2] studied 200 hypertensive patients aged >50 years using subcostal views (visualization adequate in 95.7%) and found an AAA in 6.5%. Jaussi et al.[1] evaluated 301 patients referred for TTE using abdominal views (visualization 95.6%) and found 5.7% prevalence. Finally, Roshanali et al.[18] reported that, after evaluating 1285 patients referred for TTE using subcostal views (visualization of the aorta in 91.4% of cases), AAA was detected in 3.8% of patients.

Thus, ours is the first study to evaluate the feasibility and usefulness of studying the infrarenal aorta via TTE in all patients who undergo the examination and to use 2 viewing positions, subcostal and para-umbilical.

Multivariate analysis shows that the principal AAA risk factors in our patients are current tobacco use, which increases risk 13.3-fold, or previous tobacco use (a 4.7-fold increase), femoral murmur (3.9-fold increase in risk) and age (1.1-fold increase in risk). These results partly coincide with those published elsewhere, but do not demonstrate the reported relationship between aneurysm and symptomatic cerebrovascular or peripheral vascular disease or ischemic heart disease, even though we would highlight our finding that all patients with AAA studied by coronary angiography present significant obstructive coronary artery lesions. Nor does multivariate analysis show a relationship between the AAA and HBP, which is a current controversy, or chronic kidney failure, as has been indicated by Forsdahl et al.[13], or diabetes, as earlier studies have shown[8–12,25,26] (this relationship is only significant in univariate and bivariate analysis).

With regard to sex, the prevalence of AAA in men in our series is greater than that previously published[8,26] (men:women, 7.3:1) and moreover the minimum age at diagnosis is 55 years in men, whereas in women it is 72.

Despite the fact that the prevalence of AAA found is 5.1%, if we analyze the prevalence in patients aged ≥55 years (those at greatest risk), this increases to 6.2%, whereas if we only consider the group aged 55-75 years (the potentially operable population), the prevalence is 5.7%; depending on the age group we consider, the number of patients susceptible to diagnosis of aneurysm by TTE is considerable. In this sense, to the clinician it is relevant that, although AAA associates significantly with the existence of anomalies in the abdominal examination (murmur or pulsatile abdominal mass is found in 24% of patients), our results confirm once again that physical examination does not enable early detection of AAA,[1,2,7] because these are normal in up to 76% of the remaining cases. However, the existence of a femoral murmur does entail greater risk of having an AAA (OR = 3.9; 95% CI, 1.5-9.8; *P* = .004) or severe infrarenal atherosclerosis (OR = 6.1; 95% CI, 2.4-15.7; *P* < .001), which demonstrates the importance of conducting a complete vascular examination in our patients.

On the other hand, from an echocardiographic point of view, the aortic segments that are normally, and almost exclusively, evaluated during TTE in daily practice are the aortic root and the ascending aorta. As no significant relationship has been proven between their dimensions and having an AAA, this evaluation also does not permit us to suspect the existence of an AAA. In this series, in contrast with what other authors report,[2,5,18] the visualization of the infrarenal aorta was not conditioned by the patient's BMI, which does not differ significantly between patients in whom the infrarenal aorta is visualized and those in whom it is not (96.5% and 3.5%, respectively).

Currently, the major vascular societies involved in the management of AAA recommend screening by abdominal pain ultrasound in men aged 65-75 years who are current or previous smokers,[14,20,21] a strategy that is considered cost-effective, and only consider it reasonable to screen women aged >65 years with AAA risk factors.[21] However, against that recommendation, the results of the present study lead us to recommend TTE screening primarily in men aged ≥55 years, those who smoke or have smoked at some time, and those with femoral murmur. If, moreover, other risk situations coincide, such as atherosclerotic disease in other regions or other AAA risk factors described in the literature, this screening is even more justifiable in these patients. The limited number of women affected in the series prevents us from drawing solid conclusions about their screening. Given that the results of TTE coincide with those of abdominal ultrasound, it is reasonable to presume that this diagnostic strategy could prove equally or more cost-effective, because most of the patients at risk do not require an abdominal ultrasound for aneurysm screening. The main outcome of detecting an AAA in presymptomatic patients is to indicate elective repair or follow-up to avoid rupture. In this series, 24 of the 25 AAA detected (96%) were asymptomatic (1 was diagnosed post-rupture), 3 of which were ≥59 mm and 1 was 47 mm diameter. Considering that in fact the patients with AAA ≥5-5.5 cm and on occasions also >4.5 cm are those who can benefit from elective repair surgery, these findings can have important implications for prognosis and therapy.

Another issue addressed in the study is to determine if the presence of severe infrarenal arteriosclerosis (arteriosclerotic plaque ≥5 mm thick) constitutes a risk marker for ischemic heart disease. We did not find a significant relationship with infarction, angina, or the presence of significant coronary lesions; however, we did detect a significant relationship between severe infrarenal arteriosclerosis and AAA, and, in turn, all patients with AAA studied by coronary angiography presented significant lesions, a percentage greatly surpassing that previously published.[26] (It is reported that 85% of patients with AAA have a concomitant arteriosclerotic disease,[6,7,14,27] which in one third of cases is angiographically severe coronary arteriosclerosis.[6]) All these observations together are in accord with previous studies, such as that by Freiberg et al.[19], who after a 10-year follow-up of patients with AAA reported a significant increase in the risk of presenting cardiovascular events and in overall mortality in this population.

Other results of the study raise less well-known issues: 87 of 494 patients (17.6%) presented infrarenal aorta dilatation (mimi-

mum age at diagnosis, 44 years), and up to 4.5% of the non-aneurysmatic infrarenal aortas presented severe atherosclerosis (minimum age at diagnosis, 38 years). It seems reasonable to think that both groups could be at greater risk of suffering an AAA in the future, and therefore also should undergo periodic echocardiographic screening.

Currently, in an effort to clarify this and other issues unresolved with the data available, we continue to broaden the sample size of the series.

Limitations

The study design prevents us from determining causal relationships between the variables. The number of patients with ischemic heart disease may have been insufficient to detect significant relationsships with the infrarenal aortic condition.

CONCLUSIONS

Adding an infrarenal aorta study, using para-umbilical access, to conventional TTE proves useful and valid in AAA screening of cardiology patients. This study is possible in 96.5% of cases, requires no additional equipment, and minimally extends total examination time. The prevalence of detected AAA is 5.1%, and is 6.2% in those aged ≥55. Risk factors associated with AAA are current or previous tobacco use, age, and presence of femoral murmur. Hence, AAA screening is recommended to complement TTE with a final study of the infrarenal aorta, mainly in adults aged ≥55 or with aneurysm risk factors. Detecting an AAA will lead to confirmation of the finding and completion of the evaluation using conventional radiology.

CONFLICTS OF INTEREST

None declared.

REFERENCES

1. Jaussi A, Fontana P, Mueller XM. Imaging of the abdominal aorta during examination of patients referres for transtoracic echocardiography. Schweiz Med Wochenschr. 1999;129:71–6.
2. Spittell PC, Ehrsam JE, Anderson L, Seward JB. Screening for abdominal aortic aneurysm during transthoraric echocardiography in a hypertensive patient population. J Am Soc Echocardiogr. 1997;10:722–7.
3. Giaconi S, Lattanzi F, Orsini E, Prosperi R, Tartarini G. Feasibility and accuracy of a rapid evaluation of the abdominal aorta during routine transthoracic echocardiography. Ital Heart J Suppl. 2003;4:332–6.
4. Lee TY, Korn P, Heller JA, Kilaru S, Beavers FP, Bush HL, et al. The cost-efectiveness of a "quick-screen" program for abdominal aortic aneurysm. Surgery. 2002;132:399–407.
5. Bruce CJ, Spittell PC, Montgomery SC, Bailey KR, Jamil Tajik A, Seward JB. Personal ultrasound imager: abdominal aortic aneurysm screening. J Am Soc Echocardiogr. 2000;674–9.
6. Nevelsteen A, Kim Y, Meersman A, Suy R. Routine screening for unsuspected aortic aneurysms in patients after myocardial revascularization: a prospective study. Acta Cardiologica. 1991;2:201–6.
7. Saphira OM, Pasik S, Wassermann JP, Barzilai N, Mashiah A. Ultrasound screening for abdominal aortic aneurysms in patients with atherosclerotic peripheral vascular disease. J Cardiovasc Surg. 1990;31:170–2.
8. Forsdahl SH, Singh K, Solberg S, Jacobsen BK. Risk factors for abdominal aortic aneurysms. A 7-year prospective study the Tromsøn Study 1994-2001 Circulation. 2009;119:2202–8.
9. Scott RA, Wilson NM, Ashton HA, Kay DN. Influence of screening on the incidence of ruptured abdominal aortic aneurysm: 5-year results of a randomized controlled study. Br J Surg. 1995;82:1066–70.
10. Fleming C, Whitlock EP, Beil TL, Lederle FA. Screening for abdominal aortic aneurysm: a best-evidence systematic review for the U.S. Preventive Services Task Force Ann Intern Med. 2005;142:203–11.
11. Newman AB, Arnold AM, Burke GL, O'Leary DH, Manolio TA. Cardiovascular disease and mortality in older adults with small abdominal aortic aneurysms detected by ultrasonography: The Cardiovascular Health Study. Ann Intern Med. 2001;134:182–90.
12. Simon G, Nordgren D, Connelly S, Shultz PJ. Screening for abdominal aortic aneurysms in a hypertensive patient population. Arch Intern Med. 1996;156:2081–4.
13. Schwartz KV, Rashkow AM, Akella MS. Detection of abdominal aortic aneuriysm during routine echocardiography. Echocardiography. 1996;13:71–3.
14. ACC/AHA 2005 Practice Guidelines for the management of patients with peripheral arterial disease (lower extremity, renal, mesenteric, and abdominal aortic). Circulation. 2006;113:e463.
15. Pearce WH, Zarins CK, Bacharach JM. Atherosclerotic Peripheral Vascular Disease Symposium II. Controversies in abdominal aortic aneurysm repair. Circulation. 2008;118:2860–3.
16. Eisenberg MJ, Geraci SJ, Schiller NB. Screening for abdominal aortic aneurysms during transthoracic echocardiography. Am Heart J. 1995;130:109–15.
17. Lederle FA, Johnson GR, Wilson SE, Ballard DJ, Jordan WD, Blebea J, et al. Rupture rate of large abdominal aortic aneurysms in patients refusing or unfit for elective repair. JAMA. 2002;287:2968–72.
18. Roshanali F, Mandegar MH, Yousefnia MA, Mohammadi A, Baharvand B. Abdominal aorta screening during transtoracic echocardiography. Echocardiography. 2007;24:685–8.
19. Freiberg MS, Arnold AM, Newman AB, Edwards MS, Kraemer KL, Kuller LH. Abdominal aortic aneurysms, increasing infrarenal aortic diameter, and risk of total mortality and incident cardiovascular disease events 10-year follow-up data from the Cardiovascular Health Study. Circulation. 2008;117:1010–7.
20. U.S. Preventive Services Task Force. Screening for abdominal aortic aneurysm: recommendation statement. Ann Intern Med. 2005;42:198–202.
21. Mastracci TM, Cina CS. Screening for abdominal aortic aneurysm in Canada: review and position statement of the Canadian Society for Vascular Surgery. J Vasc Surg. 2007;45:1268–76.
22. Evangelista A, Flachskampf F, Lancellotti P, Badano L, Aguilar R, Monaghan M, et al. European association of echocardiography recommendations for standardization of perfomance, digital storage and reporting of echocardiographic studies. Eur J Echocardiogr. 2008;9:438–48.
23. Zuppiroli A, Corrado G, De Cristofaro M. Italian Society of Echocardiography: from operator's education to echocardiography report. Consensus document on Echocardiography organizational aspects in Italy. G Ital Cardiol (Rome). 2007;8:49–67.
24. Gardin JM, Adams DB, Douglas PS, Feigenbaum H, Forst DH, Fraser AG, et al. Recommendations for a standardized report for adult transthoracic echocardiography: A report from the American Society of Echocardiography's Nomenclature and Standards Committee and Task Force for a Standardized Echocardiography Report. J Am Soc Echocardiogr. 2002;15:275–90.
25. Golledge J, Karan M, Moran CS, Muller J, Clancy P, Dear AE, et al. Reduced expansion rate of abdominal aortic aneurysms in patients with diabetes may be related to aberrant monocyte-matrix interactions. Eur Heart J. 2008;29:665–72.
26. Lederle FA, Johnson GR, Wilson SE, Chute EP, Littooy FN, Bandyk D, et al. Prevalence and associations of abdominal aortic aneurysm detected through screening. Ann Intern Med. 1997;126:441–9.
27. Bergqvist D. Abdominal aortic aneurysms. Eur Heart J. 1997;18:545–6.