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Sex-related differences of the aortic root in a middle-aged Mexican population: insights of a structural and functional assessment by cardiac computed tomography

Diferencias de la raíz aórtica, relacionadas con el sexo, en una población mexicana de mediana edad: hallazgos de una evaluación estructural y funcional mediante tomografía computarizada cardiaca

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Keywords:
Aortic root, sex-related differences, cardiac computed tomography.

Palabras clave:
Raíz aórtica, diferencias relacionadas al sexo, tomografía computarizada cardiaca.

ABSTRACT

Introduction: Specific aortic root (AR) features appear to have clinical and prognostic implications, and sex-related differences have been described previously. However, there is a lack of data on the Mexican population. **Objectives:** To describe the sex-related variances regarding the AR qualities in a structural and functional analysis. **Material and methods:** We analyzed information of cardiac computed tomography (CCT) of the AR in 71 Mexican patients having a three-leaflet aortic valve and without stenosis or history of aortic aneurysm. We divided the sample to describe the sex-specific disparities; it had 53.5% (n = 38) women and 46.5% men (n = 33). The median age was 56 years (interquartile range IQR: 49-64), with a similar prevalence of hypertension, diabetes, smoking, and dyslipidemia. Weight, height, and body surface area (BSA) stood significantly lower in females, without distinctions in body mass index (BMI). There were no relevant differences regarding systolic and diastolic aortic annulus (AA), eccentricity, and diastolic aortic angulation. Nevertheless, systolic aortic angulation was higher in ladies, and systolic annulus dimensions were significantly greater in men. The initial AR sizes were more prominent in men, but when indexed to BSA, they proved larger in women. A small AA was found in 71% of females and 18.1% in men, and a small AR was pointedly higher in men than women (30.3% versus 2.6%, p = 0.001). **Conclusions:** Individual characteristics such as weight, height, and BSA had consequences in comparing aortic magnitudes. Sex-related

RESUMEN

Introducción: *Los rasgos específicos de la raíz aórtica parecen tener algunas implicaciones clínicas y pronósticas, y las diferencias relacionadas con el sexo se han descrito previamente. Sin embargo, faltan datos sobre la población mexicana.* ***Objetivos:*** *Describir las discrepancias relacionadas con el sexo con respecto a las características de la raíz aórtica en un análisis estructural y funcional.* ***Material y métodos:*** *Se analizaron los datos de hallazgos de la tomografía computarizada cardiaca de la raíz aórtica en 71 pacientes mexicanos con válvula aórtica de trivalva, sin estenosis valvular ni antecedentes de aneurisma de la aorta. Se dividió la población para describir las desviaciones específicas por sexo; mujeres 53.5% (n = 38) y hombres 46.5% (n = 33). La mediana de edad fue de 56 años (IQR: 49-64) con una prevalencia similar de hipertensión, diabetes, tabaquismo y dislipidemia. El peso, altura y área de superficie corporal (ASC) fueron significativamente más bajos en las féminas, sin divergencias en el índice de masa corporal. No hubo disparidades notorias con respecto a la excentricidad del anillo aórtico durante la sístole y la diástole y la angulación de la aorta durante la diástole. No obstante, la angulación aórtica durante la sístole fue mayor en mujeres y las dimensiones del anillo aórtico en sístole resultaron ostensiblemente más altas en varones. Las magnitudes de la raíz aórtica se revelaron superiores en los hombres, pero cuando se indexaron a ASC fueron más elevadas en las señoras. Se encontró un anillo aórtico pequeño en 71% de las féminas y 18.1% de los varo-*

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disparities in these parameters, such as low physical stature in Mexican females, could explain the greater prevalence of small AA, especially when indexing dimensions to bodily height and the aortic features at different levels. The clinical implications of such findings remain unclear.

nes, y una raíz aórtica pequeña fue significativamente mayor en los señores en comparación con las señoras (30.3% versus 2.6%, p = 0.001). ***Conclusiones:*** *Características individuales como el peso, estatura y ASC tienen consecuencias al comparar las dimensiones aórticas. Las diferencias de estos parámetros entre sexos, como la baja estatura corporal en las mujeres mexicanas, podrían explicar la alta prevalencia de un anillo aórtico pequeño, especialmente cuando la medida se indexa por altura del cuerpo y las otras particularidades de la aorta a diferentes niveles. Las implicaciones clínicas de estos hallazgos permanecen inciertas.*

INTRODUCTION

Currently, as medical specialties advance, personalized medicine is emerging. Some patient characteristics have been considered relevant in this discipline, including age, sex, and comorbidities. In addition to the lack of data on age, thoracic aortic diameter values have been determined regardless of sex. As a result, one-size-fits-all cut-off quantities are used. At the same time, the Framingham Heart Study has indicated that age and sex matter for vascular sizes, such as thoracic aortic caliber. Vascular area differences in women seem to have clinical and prognostic implications. Therefore, a need for sex-specific cut-off numbers in this setting could be evaluated and be variable in dissimilar female populations.[1] Aortic dimensions are variably dependent on age, gender, and body size.[2,3] However, reported ranges of average extents are limited by reduced sample sizes, diverse measurement sites, and heterogeneous cohorts.[4,5] Transthoracic echocardiography is the first-line modality to evaluate the aortic root morphology and proportions because it is widely available, safe, and cost-effective.[6,7] Nevertheless, this measurement can differ from the maximum aortic dimensions,[8] since it may be significantly underestimated because echocardiography is traditionally assessed based on the measurements performed in only one plane. The evaluation of the maximum size of the AR should be done on the cross-section of the aorta, preferably using a 3D multiplanar reconstruction mode in CCT or magnetic resonance imaging.[9] Specifically, there is a lack of records on AR anatomic and functional qualities in Mexican people. We aimed to describe the sex-related divergences by CCT analysis from an integrated structural and functional viewpoint.

MATERIAL AND METHODS

The study sample comprised 71 patients referred for CCT coronary angiography at the National Institute of Clinical Derivation. In all of them, the aortic root was analyzed retrospectively on the acquired CCT scan to determine differences in structural and functional parameters of the AR. They all had tricuspid aortic valves without significant stenosis and no history of aortic aneurysm or dilatation. The total sample was divided into two groups: men (n = 33) and women (n = 38) to detect sex-related disparities. The clinical data of patients were recorded previous to the imaging acquisition.

Cardiac computed tomography

The CCT examinations were performed using a 64-slice multi-detector CT scanner (IQon Spectral; Phillips, Netherlands). For the CCT coronary angiogram, collimation of 64 × 0.5 mm and a rotation time of 400 ms were used. A multisegment reconstruction algorithm was employed, resulting in a temporal resolution of 330 ms. The tube current was 300 mA at 120 kV. Nonionic contrast material, from 80 to 110 mL, was administered in the antecubital vein, at a rate of 5.0 mL/s, depending on the total scan time. Automated peak enhancement detection in the ascending aorta was used for the timing of the scan. After the threshold level of +110 Hounsfield units was reached, data acquisition was automatically initiated. Such process was performed during an inspiratory breath-hold of approximately 8 to 10 s. ECG was recorded simultaneously to allow retrospective gating of the figures. The dataset of the contrast-enhanced scan was reconstructed at 30-40% and 75-80% of the RR interval for the systolic and diastolic phases, respectively. All images were rebuilt with a slice thickness of 0.6 mm and a reconstruction interval of 0.3 mm. Then, axial datasets were transferred to a remote workstation for post-processing and subsequent image examination. Additionally, we used the free ProSize^{AV} plugin in Horos version V3.3.6 for estimating aortic annulus area, eccentricity, and aortic angulation in the course of systole and diastole.

Functional analysis of the aortic root

The functional assessment of the AR during systole and diastole included measuring the AA dimensions in an anteroposterior orientation, area, eccentricity, and aortic angulation. Caution was taken to correctly orient both views by reviewing the reconstructed double oblique transverse view at the level of that aortic ring. Aortic angulation was defined as the angle between the horizontal plane and the plane of the aortic collar. Examples of the coronal, single oblique sagittal, and double oblique transversal views are shown in *Figure 1*.

Anatomical analysis of the aortic root dimensions

Standard orthogonal axial and sagittal views were used for initial orientation on the AR sizes at different levels: sinuses of Valsalva, sinotubular junction, and ascending aortic portion. Because the AR is oriented obliquely to the standard axial view, a coronal and a single oblique sagittal view through the aortic valve were reconstructed. These steps allowed

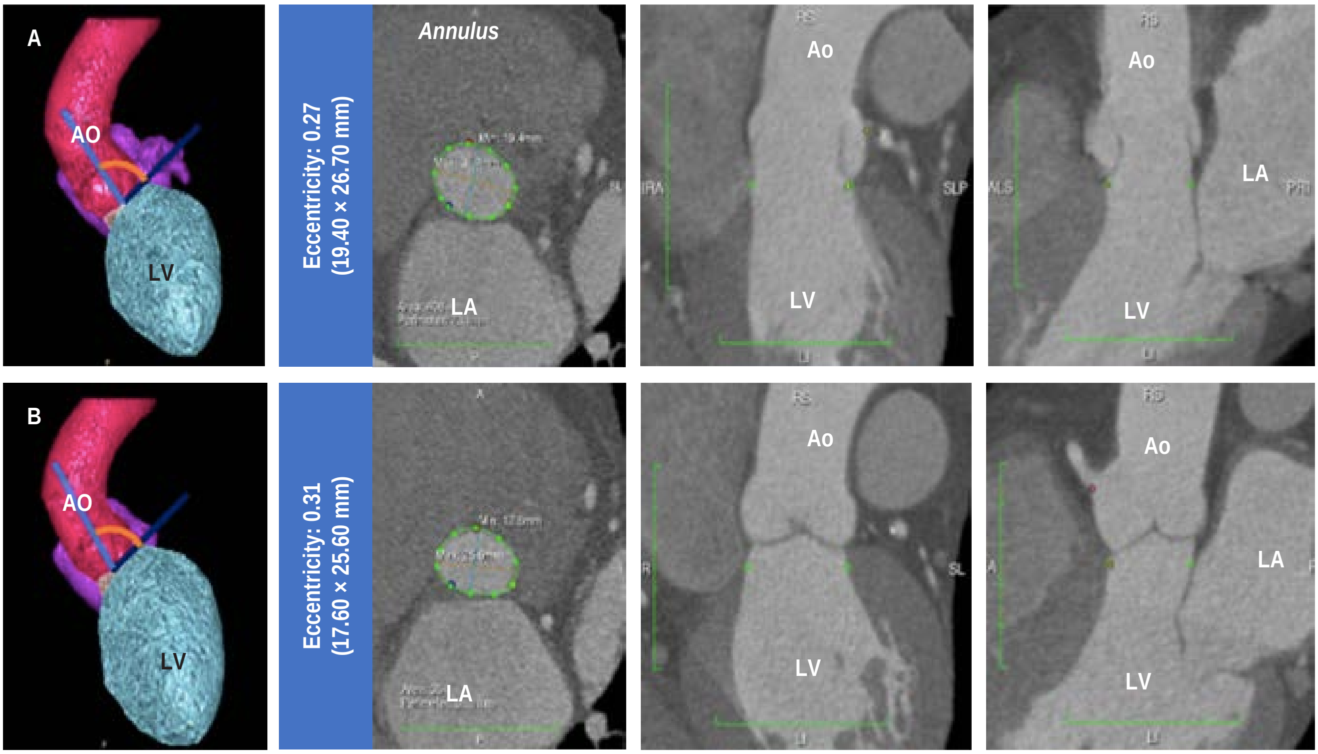

Figure 1: Cardiac computed tomography (CCT) analysis of the functional assessment of features of the aortic root during systole **(A)** and diastole **(B)**. Left upper and bottom: aortic angulation, middle-upper, and bottom: aortic annulus dimensions, eccentricity, and area; right upper and bottom: coronal and sagittal views of the AR. Ao = aorta; LV = left ventricle; LA = left atrium.

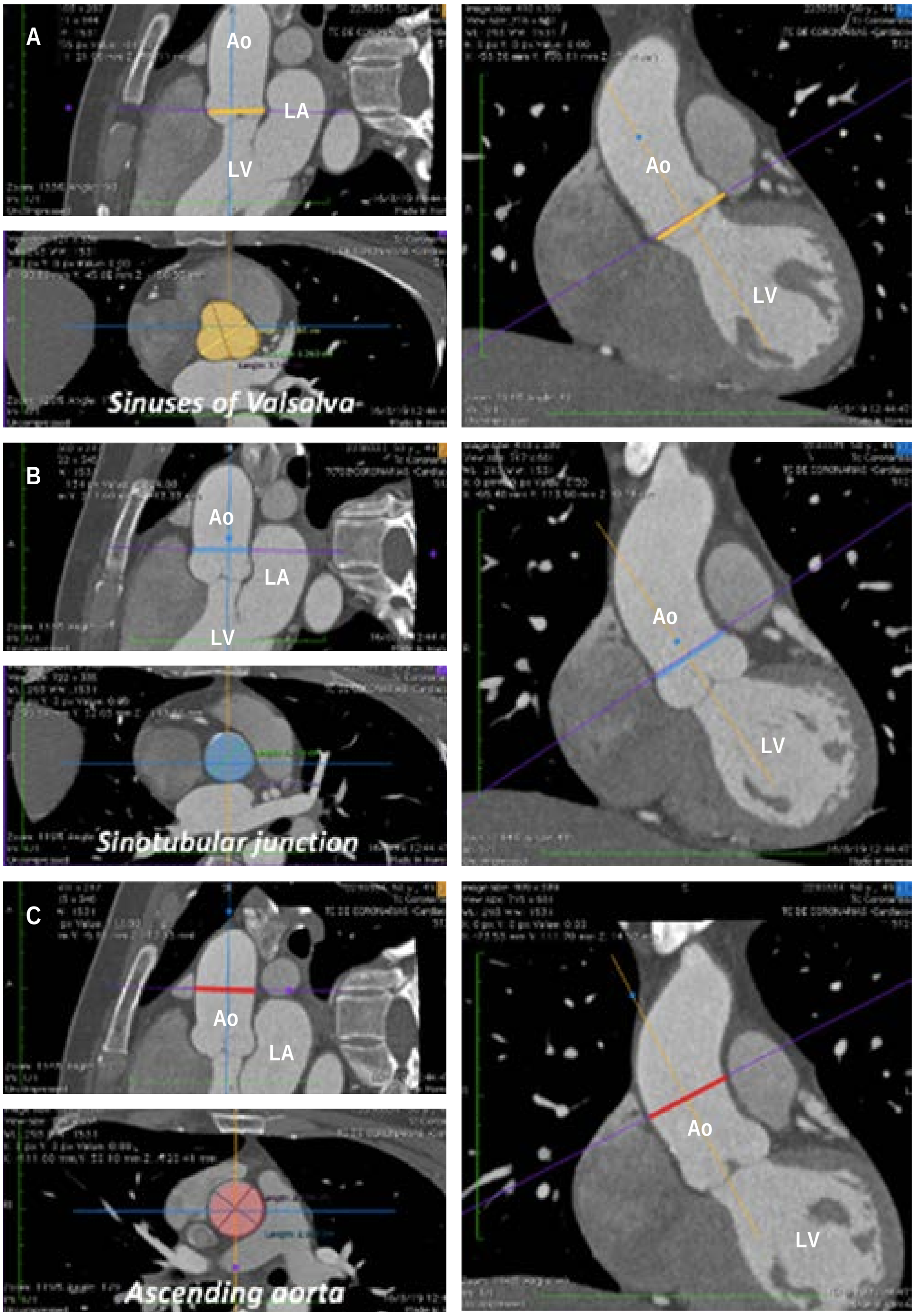

Figure 2:

Cardiac computed tomography (CCT) analysis of the anatomical assessment of features of the aortic root at different levels during diastole: **A)** At the level of the sinuses of Valsalva, sinus to commissure dimension. **B)** At the level of the sinotubular junction and **C)** at the level of the proximal ascending aorta. Ao = aorta; LV = left ventricle; LA = left atrium.

an accurate orientation of both views by reviewing the reconstructed double oblique transverse thus:

A. Diastolic phase 75-80% for calculating maximal dimensions at three distinct levels: 1. At the sinuses of Valsalva, performing a sinus to commissure measurement, 2. At the sinotubular juncture, and 3. At the proximal aortic ascending portion to 40 mm from the AA. All measurements became indexed for BSA for comparative scrutiny. A specific cut-off indexed body stature dimension of < 15 mm/m in men and < 14 mm/m in women was used to define small AR at the level of the sinotubular aortic junction accordingly using previous information available to avoid the overestimation of adjustment in obese subjects,[10,11] and

B. Systolic phase 30% for the measurement of the AA. A specific cut-off dimension of *Figure 2*.

Statistical analysis

All analyses were performed using SPSS v26.0 (SPSS Inc., IBM, Chicago, IL). The normality of data distribution was assessed using the Shapiro-Wilk test. If normally distributed, continuous variables were expressed as mean and standard deviation (SD) and as the median and interquartile range (IQR) if non-normally distributed. Continuous variables were analyzed using the Student t-test or the Mann-Whitney U test depending on the normality of the distribution. Categoric variables were expressed as percentages. The distribution of these variables was compared using the χ^2 test. All tests were two-sided, and a p-value of < 0.05 was considered indicative of a statistically relevant difference.

RESULTS

Seventy-one patients, comprising 38 women (53.5%) and 33 men (46.5%), were studied. The median age was 56 years (IQR 49-64). 46.4% had hypertension, 19.7% diabetes, 8.4% smoking, and 23.9% dyslipidemia. There were no statistically meaningful differences between both groups. The female population had significantly lower weight, height, and BSA when likened to men, and both clusters had similar BMI. The baseline characteristics of the sample are listed in *Table 1*.

Functional analysis of the aortic root

In all patients, adequate CCT images for evaluating the aortic root dynamics during systole and diastole were available. Indexed to BSA aortic systolic annulus area was higher in systole 2.36 ± 0.38 cm^2/m^2 compared to diastole 2.16 ± 0.36 cm^2/m^2 in the total population. Sex-related dissimilarities were found in such indexed expanse, showing greater quantities in males contrasted to females over the course of both systole and diastole (2.56 ± 0.39 versus 2.18 ± 0.20 cm^2/m^2, p < 0.001 and 2.33 ± 0.38 against 2.02 ± 0.28 cm^2/m^2, p < 0.001; respectively).

Aortic annulus eccentricity due to the elliptical shape of the structure was higher in diastole, having a mean value of 0.24 ± 0.05 when matched systole with a median number of 0.19 (IQR: 0.15-0.22); there were no statistically noteworthy differences in both sets. Aortic angulation was not significantly

Table 1: Baseline characteristics of the total population.

Baseline characteristics	Total N = 71	Male N = 33 (46.5%)	Female N = 38 (53.5%)	p
Age, years (IQR)	56 (49-64)	53 (46-63.50)	58.50 (52-66.20)	0.051
Hypertension (%)	46.40	48.40	44.70	0.752
Diabetes (%)	19.70	24.20	15.70	0.372
Smoking (%)	8.40	12.10	5.20	0.300
Dyslipidemia (%)	23.90	21.20	26.30	0.610
Weight (kg)*	72.90 ± 16	80.10 ± 18	66.60 ± 11.20	< 0.001
Height (m)*	1.61 ± 0.10	1.69 ± 0.07	1.55 ± 0.07	< 0.001
BMI (kg/m^2)*	27.70 ± 50	27.90 ± 5.90	27.60 ± 4.20	0.770
BSA (m^2)*	1.76 ± 0.21	1.89 ± 0.21	1.65 ± 0.13	< 0.001

BMI = body mass index; BSA = body surface area; IQR = interquartile range. * Mean ± standard deviation.

Table 2: Functional aortic root features in total population.

Aortic root functional features	Total N = 71	Male N = 33 (46.5%)	Female N = 38 (53.5%)	p
Indexed systolic annulus area (cm^2/m^2)*	2.36 ± 0.38	2.56 ± 0.39	2.18 ± 0.28	< 0.001
Indexed diastolic annulus area (cm^2/m^2)*	2.16 ± 0.36	2.33 ± 0.38	2.02 ± 0.28	< 0.001
Systolic eccentricity (IQR)	0.19 (0.15-0.22)	0.19 (0.14-0.22)	0.19 (0.16-0.23)	0.632
Diastolic eccentricity*	0.24 ± 0.05	0.24 ± 0.05	0.24 ± 0.05	0.900
Aortic systolic angulation (degrees)*	47.20 ± 8.30	44.10 ± 7.40	49.80 ± 8.20	0.004
Aortic diastolic angulation, degrees (IQR)	45.50 (41-51.10)	44.20 (39.30-49.40)	47.70 (43.40-51.80)	0.075

IQR = interquartile range. * Mean ± standard deviation.

different in diastole in both groupings. Men's median angulation was 44.2º (IQR: 39.3-49.4), whereas women revealed a median angulation of 47.7º (IQR: 43.4-51.8), p = 0.075. However, there was a statistically meaningful difference through systole showing greater angulation in females contrasted to males (44.1 ± 7.4 against 49.8 ± 8.2º, p = 0.004) *(Table 2)*.

Anatomical analysis of the aortic root dimensions

Data on the AR dimensions were available in all patients. The dimension of the systolic AA in an anteroposterior orientation, as usually measured by a two-dimensional method, had a mean value of 20.6 ± 2.4 mm. There was a statistically significant difference in both groups. It reached a higher number in men than in women (22.18 ± 2.20 versus 19.3 ± 1.7 mm, p < 0.001). We found a mean figure of 4.17 ± 0.89 cm^2 when estimating systolic annular area and statistically relevant differences in both clusters, displaying a greater quantity in males than in females (4.83 ± 0.76 against 3.60 ± 0.52 cm^2, p < 0.001). These alterations persisted even after adjusting the value to BSA (2.56 ± 0.39 versus 2.18 ± 0.28 cm^2/m^2, p < 0.001).

We defined a small AA as having an anteroposterior dimension < 23 mm. The women group had a statistically significant higher prevalence of a small AA with 100% (38/38 patients) contrasted with 60% of men (20/33 of them), p < 0.001. Otherwise, defining a small AA as a zone < 4 cm^2, the female population also had statistically meaningfully more prevalence of a small AA, reaching 71% (27/38 patients) compared with 18.1% of males (6/33 of them), p < 0.001.

At the level of the sinuses of Valsalva, maximal sizes measured in diastole (sinus to commissure dimension) became notably greater in males when likened to ladies. Right coronary sinus to commissure (30.1 ± 2.6 against 27.2 ± 2.5 mm, p < 0.001), left coronary sinus to commissure (30.7 ± 2.1 versus 27.5 ± 2.7 mm, p < 0.001) and non-coronary sinus to commissure (31.2 ± 2.4 against 27.9 ± 2.2 mm, p < 0.001). These differences did not persist after fine-tuning by BSA. They had a higher value in women than in males but without statistically significant distinctions. Indexed right coronary sinus to commissure was (16.08 ± 2 versus 16.50 ± 1.60 mm/m^2, p = 0.27), then indexed left coronary sinus to commissure (16.4 ± 1.7 against 16.7 ± 1.5 mm/m^2, p = 0.32) and, finally, indexed non-coronary sinus to commissure, men median number 16.7 mm/m^2 (IQR: 14.8-18) contrasted with female median figure 16.9 mm/m^2 (IQR: 15.9-18.1), p = 0.496.

At the level of the sinotubular juncture, maximal dimension in males was significantly greater than in females (26.4 ± 2.6 against 25.1 ± 2 mm, p = 0.017) but after adjusting by BSA was higher in women against men (men 14.1 ± 1.8 mm/m^2 versus women 15.2 ± 1.3 mm/m^2, p = 0.004).

A small AR, defined as a dimension adjusted by body height at the level of sinotubular junction < 15 mm/m in males and < 14 mm/m in females, statistically was appreciably less prevalent in females than in males in this investigation (30.3% in men against 2.6% in women; p = 0.001).

Lastly, the proximal ascending aorta; its maximal dimension had no statistically noteworthy difference in both groups. The median value in males of 28.6 mm (IQR: 25.5-30.8), and females, a median figure of 28.2 mm (IQR: 25.7-29.8), p = 0.81. After correcting by BSA was statistically higher in women having a median rate of 16.5 mm/m^2 (IQR: 15.4-18.5) versus men with a median number of 15.2 mm/m^2 (IQR: 13.2-17.2), p = 0.002 *(Table 3)*.

DISCUSSION

The primary purpose of the present study was to evaluate sex-related distinctions in structural and functional assessment of the aortic root by CCT findings in Mexican patients. This study is the first to describe those features in such a population, to the best of our knowledge. Our records were similar to others confirming that the normal aortic annulus is oval and more circular with less eccentricity and more prominent in systole than diastole.[12-14] The AA was analogous in both sexes. The impact of the appropriate measurement of the systolic AA due to its elliptical shape by a three-dimensional modality as CCT is critical in the setting of aortic stenosis. It aids in the calculation of the left ventricular stroke volume

Table 3: Anatomical aortic root features in total population.

Aortic root (AR) anatomic features	Total N = 71	Male N = 33 (46.5%)	Female N = 38 (53.5%)	p
Systolic aortic annulus (AP diameter)*	20.60 ± 2.40	22.18 ± 2.20	19.30 ± 1.70	< 0.001
Small aortic annulus (AP diameter < 23 mm) (%)	58/71 (81.60)	20/33 (60.00)	38/38 (100)	< 0.001
Systolic aortic annulus (area cm^2)*	4.17 ± 0.89	4.83 ± 0.76	3.60 ± 0.52	< 0.001
Small aortic annulus (area < 4 cm^2) (%)	33/71 (46.40)	6/33 (18.10)	27/38 (71.00)	< 0.001
Systolic aortic annulus area Indexed BSA (cm^2/m^2)*	2.36 ± 0.38	2.56 ± 0.39	2.18 ± 0.28	< 0.001
Ao sinus to commissure diameter (RCS) (mm)*	28.50 ± 2.90	30.10 ± 2.60	27.20 ± 2.50	< 0.001
Ao sinus to commissure diameter (LCS) (mm)*	29 ± 2.90	30.70 ± 2.10	27.50 ± 2.70	< 0.001
Ao sinus to commissure diameter (NCS) (mm)*	29.40 ± 2.80	31.20 ± 2.40	27.90 ± 2.20	< 0.001
Ao sinus to commissure diameter (RCS) indexed BSA (mm/m^2)*	16.30 ± 1.80	16.08 ± 2	16.50 ± 1.60	0.270
Ao sinus to commissure diameter (LCS) indexed BSA (mm/m^2)*	16.60 ± 1.60	16.40 ± 1.70	16.70 ± 1.50	0.320
Ao sinus to commissure diameter (NCS) indexed BSA (mm/m^2) (IQR)	16.90 (15.80-18)	16.70 (14.80-18)	16.90 (15.90-18.10)	0.496
Ao sinotubular junction maximum diameter (mm)*	25.70 ± 2.40	26.40 ± 2.60	25.10 ± 2	0.017
Ao sinotubular junction maximum diameter indexed BSA (mm/m^2)*	14.70 ± 1.70	14.10 ± 1.80	15.20 ± 1.30	0.004
% Small AR Indexed body height (men < 15 mm/m, women < 14 mm/m) (%)	11/71 (15.40)	10/33 (30.30)	1/38 (2.60)	0.001
Aortic tubular maximum diameter (mm) (IQR)	28.30 (25.70-30)	28.60 (25.50-30.80)	28.20 (25.70-29.80)	0.810
Aortic tubular maximum diameter indexed BSA (mm/m^2) (IQR)	15.80 (14.60-18)	15.20 (13.20-17.20)	16.50 (15.40-18.50)	0.002

IQR = interquartile range. * Mean ± standard deviation.

and the aortic valve area since there was a 29% underestimation of said parameters when calculated by a two-dimensional method. Consequently, as many as 25% of patients with severe aortic stenosis are reclassified as having only moderate stenosis when inputting the correct aortic left ventricular outflow tract extent into the continuity equation.[15]

Additionally, knowing the normal range for the systolic AA dimension has direct clinical applications. Using the typical values for AA size should facilitate diagnosing a fixed component of obstruction based on increased aortic gradients of unclear origin.[14] These expected ranges are variably dependent on age, gender, and physical size. There is a lack of data due to its heterogeneity in different populations depending on race and demographic locations. Our study found that women had shorter systolic AA size, measured as anteroposterior orientation, and a shorter systolic area. This list of differences persists even after the adjustment to BSA. To date, no clear consensus has been established regarding the cut-off number for defining a small AA, which results in multiple definitions used in various studies for the same concept.[16] A small AA is most frequently described as an annulus in the surgical series that would not accommodate a prosthesis extension of > 21 mm.[15,17,18] Due to the lack of statistics regarding typical values of AA in our sample, we chose an AA diameter ≤ 23 mm, described by echocardiography.

The systolic aortic angulation was significantly higher in females, demonstrating a more horizontal aortic orientation in those patients compared with men. Therefore, at similar BMI, a probable explanation of these findings can be related to specific somatotypes in Mexican women with a low body height which determines a different position of the heart and aorta in the thorax.

The degree of angulation between the aorta and the heart can have some procedural implications in aortic transcatheter valve replacement. The accurate positioning is more demanding, particularly in horizontal AR with a vertical aortic annulus.[19,20] There are no precise data regarding the feasibility of this procedure in different aortic angulations in men and women in Mexico. Still, the increased horizontal aortic angulation in them may result in the worst procedural success rate.

When evaluating sex-related differences between AR maximal magnitudes, our records are consistent with other studies,[21] showing significantly lower values in females contrasted to males in diverse AR levels. Interestingly, these change after adjusting to BSA with bigger numbers in females compared with males. The Mexican women's BSA can have some consequences in this finding, and lower BSA can lead to higher indexed dimensions. Therefore, the indexed measurement in this population can have a different cut-off, but such features need to be consistently demonstrated.

Having a diminished aortic root has important clinical and prognostic implications. It was demonstrated that a small AR in itself is associated with increased cardiovascular morbidity and mortality during the progression of moderate asymptomatic aortic stenosis.[22] A small AR is a frequent finding in aortic stenosis patients, reported in the range of 17-33%.[23-25] Inconsistent definitions have been used, reflecting that no precise definition of a small AR is given in current guidelines.[5,26,27]

The indexation of the aortic diameter to body size is recommended.[28-30] The inner AR caliber is recommended by the American College of Cardiology/American Heart Association guidelines for the diagnosis and management of people with thoracic aortic disease.[5] It is also routinely used in other imaging modalities such as magnetic resonance[31] and computed tomography.[32] Because the aortic sinotubular junction is well defined in most aortic stenosis patients, we chose the inner aortic sinotubular juncture caliber based upon recently published average values to identify a small AR.[29] To avoid the overestimation of adjustment in obese subjects, we chose to index aortic diameter for physical stature.[10,11]

When analyzing the prevalence of small AR defined as a maximal caliber at the sinotubular coupling indexed to bodily height < 15 mm/m in males and < 14 mm/m in women, we found a significantly lesser prevalence of small AR in females compared to males (30.3% in males and 2.6% in females; p = 0.001) and a higher indexed BSA maximal dimension at this level in ladies.

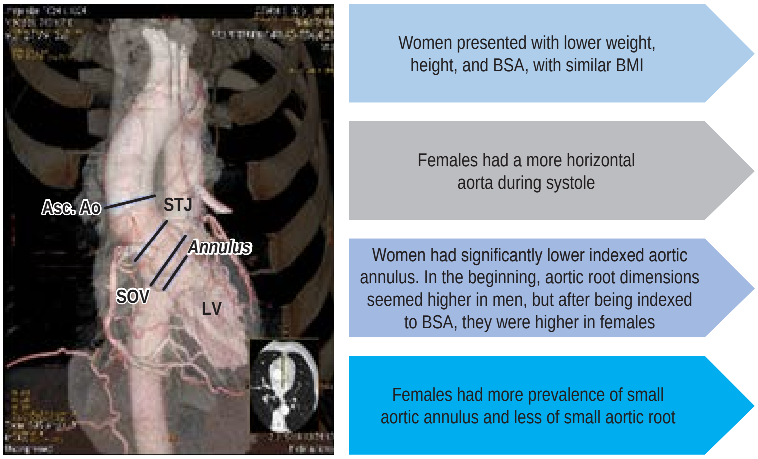

Figure 3: Sex-related differences of the aortic root features in a structural and functional cardiac computed tomography (CCT) analysis.
BSA = body surface area; body mass index = BMI; LV = left ventricle; SOV = sinuses of Valsalva; STJ = sinotubular junction; Asc. Ao = ascending aorta.

A possible explanation could be lower tallness in Mexican women with a mean figure of 1.55 ± 0.07 meters; this contrasted with other populations, when indexing AR dimension for body height and compared to men with a mean value of 1.69 ± 0.07 meters, who presented a more similar bodily stature to previously reported studies with similar BSA in a population of Asian patients.[33] Moreover, individuals with small AR dimensions also had a remarkably smaller annulus diameter (mean, 21.3 mm) than those with a standard AR.[22] Asian populations have a significantly smaller AA caliber than their European counterparts (20.40 ± 1.46 mm against 22.00 ± 1.84 mm, $p < 0.01$).[33] Our women sample ended having a high prevalence of small AA (100% patients with anteroposterior dimension) *(Figure 3)*.

Limitations

Our study had several limitations. It was a retrospective study with a limited number of middle-aged people of a single-center population. We did not have typical values described in our sample regarding aortic root in healthy people to compare our data. The definitions of a small aortic annulus and a small AR depend on several factors as clinical demographics, sex, age, and comorbidities. The cardiac imaging modality used affects the definitions as well. The majority of studies defining these features used information of echocardiographic evaluation, and there is a lack of statistics by CCT. We did not have figures of aortic gradients to evaluate the functional effects of having a small annulus or AR dimensions. More extensive studies of measuring aortic magnitudes by different cardiac imaging techniques are necessary to increase such findings. A more in-depth explanation about somatotype Mexican measures such as BMI, BSA, and especially body height, to confirm a low stature compared to other populations is needed to determine these specific findings' clinical and prognostic implications in women patients contrasted with men.

CONCLUSIONS

Aortic dimensions are measured in specific levels to define standard cut-offs in particular populations. When comparing sex-related findings in our sample by CCT analysis, we found differences in females related to the imaging technique used and specific anthropometric characteristics. BMI was similar in both sexes, but Mexican women appear to have somatotype characteristics with low stature, explaining a different orientation of the aorta in the thorax and distinct cut-off values at different levels. A high prevalence of small aortic root dimensions, indexed to height, was found in this setting, but these discoveries and specific clinical and prognostic implications need to be consistently studied.

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