ORIGINAL RESEARCH PAPER
Volume - 13 | Issue - 12 | December - 2024 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

AN OBSERVATIONAL STUDY ON AORTIC MEASUREMENTS IN SOUTH INDIAN POPULATION DONE AT TERTIARY CARE CENTRE

Cardiology

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ABSTRACT

Background: Aortic dimensions vary between populations due to factors like age, sex, BSA, and ethnicity. Global reference ranges may not be applicable for the Indian population. The present study is aimed at defining the standard aortic dimensions in the South Indian population using 2D echocardiography. **Methods:** An observational study was conducted on patients admitted to Chengalpattu Medical College, Tamil Nadu, in the period from October 2023 to March 2024. A total of 800 patients aged 10 years to 80 years, in both sexes and with different sizes of BSA, had their aortic dimensions measured on 2D echocardiography. Descriptive statistics and Pearson correlation were analyzed. **Results:** The study involved 280 men (35%) and 520 women (65%). The average age was at 38.33 ± 16.02 years. Average aortic diameter was AA 1.82 ± 0.42 cm, SOV 2.91 ± 0.52 cm, STJ 2.37 ± 0.47 cm and ascending aorta 2.64 ± 0.48 cm. The dimension diameters were greater in men by all measurements as compared with women by all the other parameters (AA, SOV, STJ). A positive correlation was found between BSA and aortic dimensions. Age significantly influenced aortic size, with older groups showing larger values. Comparisons with the WASE guidelines showed that aortic dimensions in the Indian population were slightly smaller, particularly in females. **Conclusion:** Population-specific data on aortic dimensions of South Indians with the help of this study and, thereby, the need for region-specific reference ranges would be the take-home message. Thereby, sex differences were significant, and a good correlation was found with age and BSA, which would definitely improve clinical assessment and intervention.

KEYWORDS

Aortic dimensions, echocardiography, body surface area, WASE guidelines, aortic annulus, sinus of Valsalva, sinotubular junction.

INTRODUCTION

Aortic measurements are significantly different from one population to another due to age, sex, BSA, ethnicity, bicuspid aortic valve, and connective tissue disorders, among others (1). Accurate assessment of the aortic dimensions is important for identifying progressive dilation and its potential risks such as rupture and dissection (2). Transthoracic echocardiography (TTE) remains a method of choice for studying the aortic root and its proximal segments since it is non-invasive and easily accessible, plus has good reliability (3). However, population reference ranges often fail to be represented sufficiently by ethnic and regional factors, and therefore necessitates population-specific data to draw conclusions (4).

In India, smaller sizes of cardiac chambers and unique aortic root sizes have been reported in contrast to the European population; hence, regionally based echocardiographic research is much needed (5, 6). This is an observational study that is aimed at formulating the standard measurements of aorta in the South Indian population through 2D echocardiography to provide an essential reference in both clinical and interventional practices.

METHODS

This was an observational study conducted in the Department of Cardiology at Chengalpattu Medical College, Tamil Nadu, from October 2023 to March 2024. It measured aortic dimensions in 800 South Indian individuals aged 10–80 years, across both sexes and varying BSA, by 2D echocardiography. Patients with cardiac or systemic conditions or poor echo windows were excluded. Descriptive statistics and Pearson correlation were used to explore the relationship between age, BSA, and aortic measurements. Ethical approval and informed consent were obtained to ensure confidentiality.

RESULTS

The study included 800 participants (280 males, 35%, and 520 females, 65%) with a mean age of 38.33 ± 16.02 years (Table 1). The mean BSA was 1.57 ± 0.16 m² (Table 3). The mean aortic dimensions in the study were: AA 1.82 ± 0.42 cm, SOV 2.91 ± 0.52 cm, STJ 2.37 ± 0.47 cm, and Ascending Aorta 2.64 ± 0.48 cm (Table 4). Males had significantly larger dimensions than females, including AA (2.14 ± 0.32 cm vs. 1.66 ± 0.36 cm), SOV (3.28 ± 0.44 cm vs. 2.73 ± 0.46 cm), and STJ (2.66 ± 0.41 cm vs. 2.23 ± 0.43 cm) (Table 5). BSA showed a positive correlation with AA (r = 0.329), SOV (r = 0.310), and STJ (r = 0.269) (Table 6). Age significantly influenced dimensions, with older age groups showing larger values for AA, SOV, and STJ (Table 7). Comparisons with WASE guidelines (Table 8) indicated that the study population had slightly smaller mean values: for males aged 18–40 years, AA was 2.14 cm (vs. 2.15 cm), SOV was 3.28 cm (vs. 3.12 cm), and STJ was 2.66 cm (vs. 2.67 cm); for females aged 18–40 years, AA was 1.66 cm (vs. 1.94 cm), SOV was 2.73 cm (vs. 2.81 cm), and STJ was 2.23 cm (vs. 2.44 cm).

Tables Table 1: Age in the Study Population (N=800)

Parameter	Mean ± SD	Median	Minimum	Maximum
Age (years)	38.33 ± 16.02	32	20	87

Table 2: Sex in the Study Population (N=800)

Sex	Percentage	Count
Male	35%	280
Female	65%	520

Table 3: Descriptive Analysis of BSA in the Study Population (N=800)

Parameter	Mean ± SD	Median	Minimum	Maximum
BSA (m²)	1.57 ± 0.16	1.53	1.24	2.14

Table 4: Descriptive Analysis of Parameters in the Study Population (N=800)

Parameter	Mean ± SD	Median	Minimum	Maximum
AA (cm)	1.82 ± 0.42	1.81	1.01	3.13
SOV (cm)	2.91 ± 0.52	2.90	1.13	5.30
STJ (cm)	2.37 ± 0.47	2.33	1.06	4.00
Ascending Aorta (cm)	2.64 ± 0.48	2.60	1.01	4.02

Table 5: Comparison of Mean Parameters between Sex (N=800)

Parameter	Sex	Mean ± SD	P Value
Height (cm)	Male (N=280)	161.64 ± 8.47	<0.001
	Female (N=520)	150.93 ± 5.82	
Weight (kg)	Male (N=280)	65.47 ± 11.44	<0.001
	Female (N=520)	55.86 ± 8.48	
BSA (m²)	Male (N=280)	1.69 ± 0.16	<0.001
	Female (N=520)	1.50 ± 0.11	
AA (cm)	Male (N=280)	2.14 ± 0.32	<0.001
	Female (N=520)	1.66 ± 0.36	
SOV (cm)	Male (N=280)	3.28 ± 0.44	<0.001
	Female (N=520)	2.73 ± 0.46	
STJ (cm)	Male (N=280)	2.66 ± 0.41	<0.001
	Female (N=520)	2.23 ± 0.43	

Table 6: Correlation between BSA and Parameters (N=800)

Parameter	Spearman's Correlation	P Value
BSA vs AA (cm)	0.329	<0.001
BSA vs SOV (cm)	0.310	<0.001
BSA vs STJ (cm)	0.269	<0.001

Table 7: Comparison of Parameters across Age Groups (N=800)

Age Group	AA (cm) Mean ± SD	SOV (cm) Mean ± SD	STJ (cm) Mean ± SD	P Value
20–39	1.69 ± 0.31	2.75 ± 0.34	2.24 ± 0.29	<0.001
40–59	1.98 ± 0.37	3.10 ± 0.38	2.54 ± 0.36	<0.001
60–80	2.03 ± 0.42	3.19 ± 0.44	2.62 ± 0.41	<0.001
>80	1.96 ± 0.27	3.12 ± 0.33	2.59 ± 0.32	<0.001

Table 8: World Alliance Societies of Echocardiography (WASE) Normal Values for Western Population (2021)

Age Group	Gender	Aortic Annulus (AA) (cm)	Sinus of Valsalva (SOV) (cm)	Sinotubular Junction (STJ) (cm)
18–40 yrs.	Males	2.15	3.12	2.67
18–40 yrs.	Females	1.94	2.81	2.44
41–65 yrs.	Males	2.12	3.28	2.84
41–65 yrs.	Females	1.95	2.98	2.60
>65 yrs.	Males	2.07	3.31	2.86
>65 yrs.	Females	1.94	3.11	2.67

DISCUSSION

The purpose of this research is to give an accurate analysis of aorta dimensions within a diverse population by measurement of the aortic root, sinus of Valsalva, and sinotubular junction. Research shows that aortic dimensions do vary with body surface area, age group, and gender. Based on the study, males continuously showed larger measurements, thereby depicting a significant difference in the mean aortic dimensions of males and females. In addition, since men generally have a bigger size of the aortic structure compared with women, it would align with the studies that show gender-specific differences in aortic dimensions.

Aortic diameters also correlated highly with age and BSA. The older age groups had bigger aortic dimensions, especially at the sinotubular junction and ascending aorta. This pattern is also observed in other demographic studies. The reason why the size of the body should be considered in the analysis of aortic measurements is that the dimensions of the aorta correlate well with BSA. This, therefore, indicates that the aorta dimensions are not invariant but vary based on several factors, such as age, gender, and size. S. Venkatesan et al. (2020) determined the mean aortic dimensions as follows ascending aorta 24.93 ± 3.09 cm, sinus of Valsalva 28.22 ± 3.33 cm, sinotubular junction 23.27 ± 2.93 cm, and aortic annulus 18.19 ± 1.86 cm. The aortic diameters of men were greater than those of women. The ascending aorta and the sinotubular junction were substantially associated with age. Height and BSA exhibited strong positive associations with all aortic dimensions, whereas weight was associated with the annulus, sinus, and ST junction (1).

Moreover, when aortic measurements were compared to Western norms supplied by the World Alliance Societies of Echocardiography guidelines, the research group's aorta diameters were comparatively smaller. This may be influenced by geographic and ethnic differences, which further implies that in order to perform a more suitable clinical examination, reference values particular to a certain location must be established.

It should be acknowledged that because of the measurement procedures themselves, even with an inner-edge to inner-edge technique used in the study (e.g., MRI versus echocardiography), different modalities may be measured differently. Leading edge to leading edge measurements may result in inaccuracies due to the fact that this approach is used frequently in echocardiography. A standardized method of measurement is therefore needed to have uniformity among different imaging modalities, ideally one which minimized these inaccuracies.

CONCLUSION

In conclusion, this study found males to have larger aortic dimensions compared to females. There was a significant correlation between the body surface area and the aortic measurements. Also, age has an impact on aortic dimensions because older groups present with greater values. Comparing it with the WASE guidelines, the Indian population presented with slightly smaller aortic dimensions, mainly in females. These findings emphasize the requirement for population-specific norms in aortic sizing assessments, incorporating factors such as gender, age, and BSA.

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