Original Research

A Pilot Study of Normal Adult Human Heart Valves Annular Circumferences at Medico-Legal Autopsies at Goa Medical College

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Abstract

Valvular heart disease is increasingly rising in India. The heart valve annular circumference is one of the important parameters to determine the normality and disease process of the valves. Since there are very few studies done in India, and non among Goans, to determine the normal sizes of heart valves, this study was undertaken. Apparently normal hearts valves of 100 bodies brought for autopsies at Goa Medical College were dissected, measured and the data was tabulated and analysed using SPSS software. The annular circumferences of mitral, tricuspid and pulmonary valves were similar to most of other studies or textbooks while aortic valves were found to be larger. Males were found to have larger valves than females.

Keywords: India, heart valves, annular circumference, autopsy, normal size

Introduction:

Valvular heart disease takes a major portion of heart related diseases disease worldwide and in India in particular.[1] The normal annular adult heart valve circumference is an important part of gross examination at autopsy to comment on the normal and pathological state of the heart valves, both in the living and the dead, and also useful in aspects of surgical intervention.[2,3] Few recent studies in medical science literature are available, especially of Indians, on the average adult valve annular circumferences. No any such specific study has been conducted among Goan population. This study is hence conducted to address this deficit of reliable data.

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Aims and Objectives:

This study aims to determine the average normal adult human heart valves annular circumferences in Goan population. It also compares the same to other similar measurements published in textbooks and journals in India and abroad.

Materials and Methods:

Dead bodies referred for medico-legal autopsy examinations at Goa Medical College from March 2017 to June 2018 were utilized for this study. Autopsies where there was history of disease process, prolonged medical intervention, or gross visible pathology at autopsy were excluded. Only those deceased of 18 to 35 years of age who were residing permanently in Goa state of India, born and brought up in Goa and at least one previous generation settled in Goa were included in the study. Hearts of 75 male bodies and 25 female bodies were dissected. The data was analysed using SPSS software. The approval of the Institute Ethics Committee was taken prior to the conduct of the study.

The solid organs were dissected by one of the accepted standard autopsy procedures- The vertical I – shaped external incision for the

mid- front trunk and the coronal incision for the scalp. Evisceration was conducted by the Virchow's method (piece- meal organ dissection). The heart was dissected after cutting open the pericardium and by holding at the apex and lifting upwards and all the major vessels connecting were cut as far away as possible from the base of the heart[4] so as to also include the arch of the aorta. Besides other aspects of forensic pathology dissection like coronary artery sectioning[4], the heart dissection with respect to the exposure of valves was followed as follows:-

The right border of the heart was given a vertical incision from the superior vena cava to the right atrium inferior vena cava. The inferior vena cava was cut horizontally from the above incision to the point where the coronary sinus enters into the right atrium. The tricuspid valve was exposed, washed and circumference measured.

The left margin of the heart was incised upto the apex of the heart exposing the mitral valve which was washed and circumference measured. The anterior surface of the arch of aorta was given an 'L' shaped incision and stopped just before the aortic cusps, exposing the aortic valve which was washed and measured.

The pulmonary trunk anterior surface was given an 'L' shaped incision till the pulmonary cusps were reached, exposing the pulmonary valve, which was washed and measured.[5]

Most pathologists measure valve circumference rather than diameters along the annulus of the atrioventricular valves and at the arterial sinotubular junction of the semilunar valves. Measurements should be to the nearest 0.1 cm.[6]

A thread was used to measure the circumference of all the valves were observed and measured by placing it at the border of annulus of the valve and then cutting it were it meets and then straightening and measuring it with a ruler.[3,6,7]

Observations and results:

The results were tabulated and their range for males and females with mean and standard deviation were determined as shown below:

Table 2: Showing Annular Circumference in males and females

Statistical Parameter	Annular circumference (cms)			
	Mitral	Tricuspid	Aortic	Pulmonary
MALES:				
Minimum	8.4	9.6	7.6	6.2
Maximum	10.6	12.6	10.3	8.1
Mean	9.52	11.38	9.31	7.41
Standard Deviation	0.68	0.65	0.64	0.44
FEMALES:				
Minimum	6.6	8.6	6.4	6.0
Maximum	8.7	10.5	8.2	7.2
Mean	7.67	9.5	7.38	6.61
Standard Deviation	0.65	0.58	0.60	0.35
TOTAL:				
Minimum	6.6	8.6	6.4	6.0
Maximum	10.6	12.6	10.3	8.1
Mean	9.06	10.91	8.83	7.21
Standard Deviation	1.05	1.03	1.05	0.54
t- value	11.786	12.667	13.141	8.056
p- value	0.000	0.000	0.000	0.000

TABLE-2 Showing Annular circumference in various studies/textbooks

Textbook/Study	Annular circumference (Range/Mean in cms) /M-Male; F-Female			
	Mitral	Tricuspid	Aortic	Pulmonary
Reddy KS [4]	8 – 10.5	10 – 12.5	6 – 7.5	7 - 9
Pillay VV[8]	8 -- 10	10 – 12.5	6 – 7.5	7 - 9
Mohan H[9]	10	12	7.5	8.5
Ludwig J[6]	9.4-9.9	11.2- 11.7	6-7.4	6.1-7.1
UmadethanB[10]	8.2-8.8	9.5-10.7	5.6-6.2	6.3-6.6
Chida K. 1994 [11]	8.3	9.9	7.3	6.8
Westaby S. 1984[12]	8.7	11.9	4.81	4.88
Ilankathir S. 2015 [5]	8.285	10.372	7.542	6.823
N. Charanya 2017 [3]	5-11.99	---	---	---
Premkumar S. 2017[13]	---	M- 8 ; F-7.54	---	---
Virupaxi RD 2016 [2]	---	---	M- 3.158 - 6.345 F- 2.335 - 5.620	---
Garg S. 2014[14]	---	---	---	5.4 -7.8
Gupta C. 2013 [7]	9.1	---	---	---
Deopujari R 2013[15]	8.27	---	---	---
Lee CW 1986 [16]	---	---	6.1	7
Tei C 1982 [17]	---	13.5	---	---
Present Study	M- 9.5 F- 7.67	M- 11.38 F- 9.5	M- 9.31 F- 7.38	M- 7.41 F- 6.61

Discussion:

The annular heart valve circumferences as mentioned or determined from various studies and/or noted in various textbooks are shown in table 2.

From the above tables, it appears that the mitral valve annular circumferences in total cases range from 6.6 – 9.06 cms which is consistent with most studies albeit decimally just less than that found by Ludwig et al[6] and having a smaller range than those in N. Charanya et al.[3] The ranges for tricuspid valves ranges of between 8.6 – 12.6 cms is again consistent with most studies except for being decimally more than by Premkumar S. et al and more in Tei C. et al.[13,17] The pulmonary valves of ranges 6 to 8.1 cms were found to be smaller than those found in textbooks by Reddy K.S., Pillay V.V. and Mohan H. and larger than in studies by Wastaby S. And Garg S.[4,8,9,12,14] The aortic valve with ranges of 6.4 – 10.3 cms was larger than those found mentioned in the textbook by Umadethan B. and studies by Wastaby S, Virupaxi R.D. and Tei C. [2,10,12,17]

The variation in circumference can be due to the fact that the valve annular circumference is proportional to the size of the heart which in turn is proportional to the body size.[3] Differences can also be due to the method of measurements. [2, 3, 7, 17] Standard fixation may decrease valvular circumference by 10-25%.[6] Valve circumferences, particularly of semilunar valves progressively dilate during adult life.[18] Noticeable differences were however noted in the mean aortic valve circumferences across studies.

For a given body size, women have slightly larger valves than men.[18] However, we found statistically significant difference between the larger sizes of valvular circumferences in men compared to women, which was consistent with other gender specific recent Indian studies.[2,13]

Conclusion:

The annular circumferences of heart valves among Goans in this study were found to be similar to the ranges obtained in other Indian and foreign studies except for those of the aortic valve where it was found to be greater.

This first study among Goans will contribute to laying down the normality and abnormality of heart valves at both autopsy and in clinical areas and also to the industries in artificial valve measurements. It also be useful as a platform to form more extensive full scale studies taking into account other parameters of height, weight, body mass of the subjects in all age groups and also studies to determine the causes of larger circumferences of aortic valves among Goans.

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