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Aortic Orifice Measurement – Cadaveric and Echocardiographic Study

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ABSTRACT

Heart is the organ which pumps blood to various organs of the body. Nutrition of various tissues depend on efficient functioning of the heart .This in turn depends on the proper functioning of the four cardiac valves that are mitral , tricuspid , aortic and pulmonary. The cardiac valves are frequently damaged by chronic rheumatic heart disease caused by streptococcal infection and congenital heart diseases. A diseased valve may produce conditions known as stenosis or regurgitation. Important aspect of management of valvular heart disease is replacement of diseased valve by a prosthetic valve surgically (i.e. valvular reconstruction surgery). This needs accurate assessment of valvular area, circumference. The area and circumference of aortic valve are measured in cadavers manually and in living persons by echocardiographic study and compared with that of previous studies for standardization which can help in prosthetic valve manufacturing. In living condition Echocardiography (ECHO) was chosen as a means for measuring valvular areas, as it is a safe and noninvasive method.

Keywords: aortic valve, echocardiography, prosthetic valve.

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INTRODUCTION

Vascular system of embryo develops in 3rd week of intrauterine life in the splanchnic mesoderm within the pericardial cavity. It includes the heart and the blood vessels. The vascular system is essential to supply nutrients and oxygen for all cells of the body. Heart is the main organ of this system as it acts as central pump which receives and ejects blood uninterruptedly. Mitral, aortic, pulmonary and tricuspid valves play an important role in proper functioning of the heart. The mitral and tricuspid valves are formed by proliferation of connective tissue of endocardium. The aortic and pulmonary are formed from endocardial cushions at truncus arteriosus.

Besides the developmental abnormalities these valves are damaged by acquired diseases like rheumatic heart diseases etc. In such conditions they are to be replaced completely by surgery. For this the accurate measurements of these valves are required. This study is done in 25 cadavers and in 50 living people of both sexes and different age groups and an attempt is made to compare the measurements of area and circumference of aortic valve with that of previous studies for standardization which can help in prosthetic valve manufacturing.

In this study, in cadavers the measurement was done using the calipers and for living cases echocardiography (ECHO) was chosen as a tool for measuring valvular areas, as it is a safe, painless noninvasive means.

MATERIAL AND METHOD

In Cadavers - Cadavers received into the Anatomy Department of Deccan College Of Medical Sciences, Hyderabad were embalmed with embalming fluid. After proper fixation, cadaver is kept on the dissection table in supine position. Sex of each cadaver was noted. An incision was done on either side of sternum, the ribs and clavicles were cut with the bone cutter. The sternopericardial ligaments were cut. The sternum is dissected down, fibrous pericardium is cut. Later all the major blood vessels connected to heart are cut. The heart is thus free and removed from the body. The diameter of the aortic valve is measured with the vernier calipers and the area is calculated.

This is done in 25 cadavers out of which 20 are male and 5 are of female.

Echocardiography in living cases - Normal echocardiographs of fifty patients who attended cardiology department of Gandhi Hospital, Secunderabad were taken. Patients with normal valvular areas are selected by taking history, general, cardio vascular system (cvs) examination, ECG and echo cardiographic examination.

50 persons of all age groups and both sexes were included in this study. 30 patients were with various surgical problems and were referred to Cardiology Department for evaluation of heart as pre-operative check-up to assess fitness for surgery. 20 Patients were



with some cardiac problem but with normal valvular function. There were 39 male patients aged from 7 months to 71 years and 11 female patients aged between 24 years to 66 years

For assessing the aortic valvular area 2D Echo was chosen as method of study. This can be performed by directing the plane of transducer beam along several cross sectional planes through the heart as follows :

1. Parasternal view :

In this view subject is inclined towards left lateral plane. Transducer is to be placed by the side of left sternal edge between second to fourth intercostal spaces. By changing the plane of the scan two views can be visualized.

A) Parasternal long axis view (PLAX)

The patient position and transducer location is maintained & parasternal long axis view can be obtained by aligning the plane of the scan from right shoulder to left kidney.

B) Parasternal short axis view

Parasternal short axis view can be viewed by keeping the patient in the same position and transducer in the same location but rotating the plane of the scan 90° clock-wise. For this view, index of the transducer is to be pointed towards the midpoint of left clavicle.

2. Apical view:

For this view, the subject is to be turned to left lateral position. The transducer is to be placed at the point where the maximum apical beat can be felt. Generally, this is in left fifth intercostal space within mid clavicular line.

By changing plane of the scan two views can be noted.

A) Apical long Axis View (APLAX) : The plane of the scan from apex of the heart to right shoulder APLAX view can be studied. For this view index of the transducer should be pointed upwards.

B) Apical four chamber view (AP4C): By rotating the plane of scan 90° clock-wise AP4C view can be seen.

The findings are in both are noted and tabulated.

OBSERVATIONS:

In cadavers:

**1) Aortic valve diameter (cm)**

	Range	Average
Male	1.87-2.66	2.54
Female	1.63-2.52	2.13

2) Aortic valve area (sq cm)

	Range	Average
Male	2.54-5.55	5.06
Female	2.50-4.98	3.59

3) Aortic valve circumference

	circumference(cm)	
	Range	Average
Male	5.65-8.36	7.98
Female	5.03-7.92	6.72

4) Aortic valve circumference/body surface area (cm/sq m)

This was not calculated as the bodies are embalmed the correct body weight could not be noted so it was not done.

By Echocardiography in living people :**1) Aortic valve diameter (cm)**

	APLAX		AP4C		PLAX	
	Range	Average	Range	Average	Range	Average
Male	1.04-2.48	2.13	1.07-2.36	1.94	1.33-2.5	2.24
Female	1.71- 2.05	1.9	1.61-2.09	1.77	1.77-2.29	1.93

2) Aortic valve area

	Area (sq cm)	
	Range	Average
Male	1.04-4.41	3.63
Female	2.41-3.50	2.75

3) Aortic valve circumference

	circumference(cm)	
	Range	Average
Male	3.61-7.45	6.60
Female	5.50-6.63	5.87

4) Aortic valve circumference/body surface area (cm/sq m)

	20-29yrs	30-39yrs	40-49yrs	50-59yrs	60 and above	Average
Male	3.73	3.79	4.08	4.72	4.54	4.17
Female	3.98	4.02	4.36	4.18	3.90	4.08

DISCUSSION

Aortic valvular measurement of the heart were obtained in different planes of echocardiogram from 50 patients and in 25 cadavers by manual measurements. This includes both sexes and of different age groups .

Aortic Valve Diameter

Studied by	Male	Female
SCOTTB et al	2.31 +/- 0.2	2.1 +/- 0.18
Present study - cadaver	2.54	2.13
Present study – Echo	2.10	1.87

Aortic Valve Area

Studied by	Valve Area
HASSA CHAMSI PASHA	3-4
PAUL D THOMPSON	3-4
WR ERIC JAMISON	3-4
Present study – Cadaver	4.32
Present study- Echo	3.44

Aortic Valve Area in Male & Female

Studied by	Male	Female
WESTABY S etal	4.81 +/- 1.30	3.73 +/- 0.98
Present study – cadaver	5.06	3.59
Present study –Echo	3.63	2.75

Circumference of valve

Male

Age group (Years)	No. of Patients	Aortic Valve			
		Circumference (Cm)	Kazman study	Present Study- Echo	Present study- Cadaver
20-29	4	6.23	3.14	3.73	
30-39	6	5.65	3.38	3.79	
40-49	7	6.78	3.62	4.08	
50-59	12	7.45	4.03	4.72	7.98
60 & Above	7	7.26	4.24	4.54	
Ave- rage	7	6.67	3.68	4.17	

Female

Age group (Years)	No. of Patients	Aortic Valve			
		Circumference (Cm)	Kazman study	Present Study- Echo	Present Study- Cadaver
20-29	2	5.66	3.59	3.98	
40-49	2	5.49	3.81	4.36	
50-59	2	6.63	4.11	4.18	6.72
60 & Above	5	5.80	4.49	3.90	
Ave- rage	5	5.89	4.00	4.11	

Most of the parameters of present study are correlating with previous studies which were done in western countries. In the cadavers the values are little higher than the normal range may be because of postmortem changes of myocardium and papillary muscles.

CONCLUSION

In this study diameter of aortic orifice is measured accurately as per as possible by Echo cardiogram in living persons and by manual method in cadavers. Based on the diameter measurements the radius, area and circumference of aortic valves of hearts are tabulated.

Body surface area was calculated for all the patients by using height and weight with the help of "Geigy scientific tables" for all the age groups for male and female. Circumference of valve / body surface area were calculated and all these values were compared with that of previous studies.

Though there are some changes in the values most of them are correlating to the previous studies.

REFERENCES

- [1] Foster GP et al. Determination of Aortic Valve Area in Valvular Aortic Stenosis by direct measurement using intracardiac Echocardiography a comparison with the Gorlin and continuity equations. *J Am Coll Cardiol* 1996; 27(2):392-8.
- [2] Hassan Chamsi-Pasha. Guidelines for the Management of patients with Valvular Heart Diseases, *Journal of Saudi Heart Association* 2006.
- [3] Paul D Thompson. Aortic Valvular Disease in Active Patients - Overcoming Diagnostic and Management Challenges. *The Physician and Sports medicine* 2002; 30(12).
- [4] Kazman et al. Cardiac Chamber and Valve Measurements. *Mayoclin Proc* 1988; 63: 137.
- [5] Scott B Cappa et al. Surger for acquired Cardiovascular Disease - Body Surface Area as a Predictor of Aortic and Pulmonary Valve Diameter. *J Thorac Cardiovasc Surg* 2000; 119:975-982.
- [6] WR Eric Jamieson et al. Surgical Management of Valvular Heart Disease, *Canadian Cardiovascular Society Consensus Co* 1999.