Original Article

Morphometric Study of the Valves of Heart

Morphometric Study of the Valves of Heart, A Cadaveric, Comparative Study in Karachi

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ABSTRACT

Objective: Analyze cadaveric based data of valves of heart and compare data between male and females of Karachi
Study Design: Descriptive / cross sectional study
Place and Duration of Study: This study was conducted at the Department of Anatomy, Dow Medical College, DUHS, Karachi from 2008 to 2012
Materials and Methods: The hearts of one hundred cadavers (both male and female) were obtained from the morgue of Civil Hospital and other morgues of the Karachi. The hearts were removed in the usual necropsy procedure. Male and female cadaveric hearts were divided into six groups which were constituted ranging in age from 20 to 79 years i.e. Group A: 20-29, Group B: 30-39, Group C: 40-49, Group D: 50-59, Group E: 60-69 and Group F: 70-79. Young and otherwise healthy individuals (died due to road traffic accident, Gunshot injury, Suicide or Homicide) were included in the study. The cadaver whose cause of death was known to be cardiac was not included in the study
Results: The mean circumference of tricuspid valve showed a significant p-value (P- < 0.05) except age Group F. Mean circumference of mitral valve showed a significant p-value (P- < 0.05) in all groups. Mean circumference of pulmonary valve showed a significant p-value (P- < 0.05) in age Groups A and age Group C. Mean circumference of aortic valves showed a significant p-value (P- < 0.05) in all age groups except age Group E.
Conclusion: The mean circumference of valves are heart in both sexes haves significant differences in most of groups in tricuspid, mitral valve and aortic valves but in case of pulmonary valves age Group A and C showed significant difference
Key Words: Valves of heart, p-value, cadavers

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INTRODUCTION

Morphometery is "Measurement of the form of organism or their parts". It is simply stated "the process or technique of measuring the external form of an object" [1]
According to Dictionary of Cell and Molecular Biology 2008, morphometery is "The method that involves the measurement of shape."
The study of the tricuspid valve plays an important role for the interventional cardiology. The atrioventricular valves are formed in part from the myocardium, and in part from mesenchymal elements like the endocardial cushions[2,3].

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The knowledge of normal and variant anatomical types of tiscuspid valve helps in repair and prosthesis replacement[2]
The opening of the pulmonary artery is circular, and is situated at the summit of the conus arteriosus, close to the ventricular septum. It is placed above and to the left of the atrioventricular opening, and is guarded by the pulmonary semilunar valves. One of the most common lesion with which pulmonary artery variation is associated, is Tetrology of Fallot.[4]
Now a day's open-heart operations for the correction of mitral incompetence and stenosed valves commonly take place, but still some details of the structural anatomy of these valves are not widely known so there is a need for standardization. The studies conducted on the open heart surgical procedure as well as on cadaveric heart described the dimension of valves and papillary muscles and chordae tendineae were observed. The detailed dimensional data were standardized regarding the measurement of mitral Valve[5].
The aortic root is the direct continuation of the left ventricular outflow tract. It is situated to the right and posterior, to the sub pulmonary infundibulum, with its posterior margin wedged between the orifice of the mitral valve and the muscular ventricular septum.(6) It

extends from the basal attachment of the aortic valvular leaflets within the left ventricle to their peripheral attachment at the level of the sinutubular junction[6].

In different parts of the world studies have been conducted on the heart in relation to age and sex, in which variations of different parameters like thickness of pericardium, origin of great vessels, circumference of atrioventricular valves, number and thickness of cusps and anomalies of coronary arteries are observed.[6-10] These parameters are not extensively studied in Pakistan and present study is, therefore aimed to analyze morphometric features of the circumference of atrioventricular valves heart.

MATERIALS AND METHODS

This descriptive cross sectional study on human hearts in the Anatomy was carried at the Department of Anatomy with the collaboration of the Department of Pathology, Dow Medical College, Dow University of Health Sciences Karachi, for the duration of four years i.e. 2008 to 2012.

The hearts of one hundred cadavers were obtained from the morgue of Civil Hospital and other morgues of the Karachi. The hearts were removed. Six groups were constituted ranging in age from 20 to 79 years and were further divided into male and female groups according to senescence distribution.

- Group A was with age ranging from 20 – 29 years.
- Group B was with age ranging from 30 – 39 years.
- Group C was with age ranging from 40 – 49 years.
- Group D was with age ranging from 50–59 years.
- Group E was with age ranging from 60 – 69 years.
- Group F was with age ranging from 70 – 79 years.

Inclusion criteria: Autopsies performed to ascertain cause of death in medico-legal cases were included as unselected series.

Young and otherwise healthy individuals (died due to road traffic accident, Gunshot injury, Suicide or Homicide) were included in the study.

Exclusion criteria: The cadaver whose cause of death was known to be cardiac was not included in the study. The known cause of death of other associated morbities was also excluded.

Procedure: All bodies were received within four days of death by medico legal officers. The anterior mediastinum was exposed by removing the anterior thoracic wall. The first seven ribs were cut on either side close to the midaxillary line and manubrium was divided just below the sternoclavicular joint. The lungs were mobilized and resected at their roots and the pericardial sac was opened to expose the heart. The great vessels were cut close to their roots to free the heart from the thoracic cavity.

An external examination was carried out for each heart, following which the four chambers and coronary arteries were dissected.

Each heart was washed out thoroughly and left to air-dry in the dissecting room for one hour before it was weighted using an electric scale with one gram precision. The circumference of the atrioventricular, pulmonary and aortic valves was measured using the critical calipers.

Statistical analysis was done on SPSS; version 16 and results were compiled by using student's 't'-test.

RESULTS

Right atrioventricular valve (Tricuspid): The average circumference of right atrioventricular valve in age group A, B, C, D, E and F Groups along with p-value is shown in fig.1

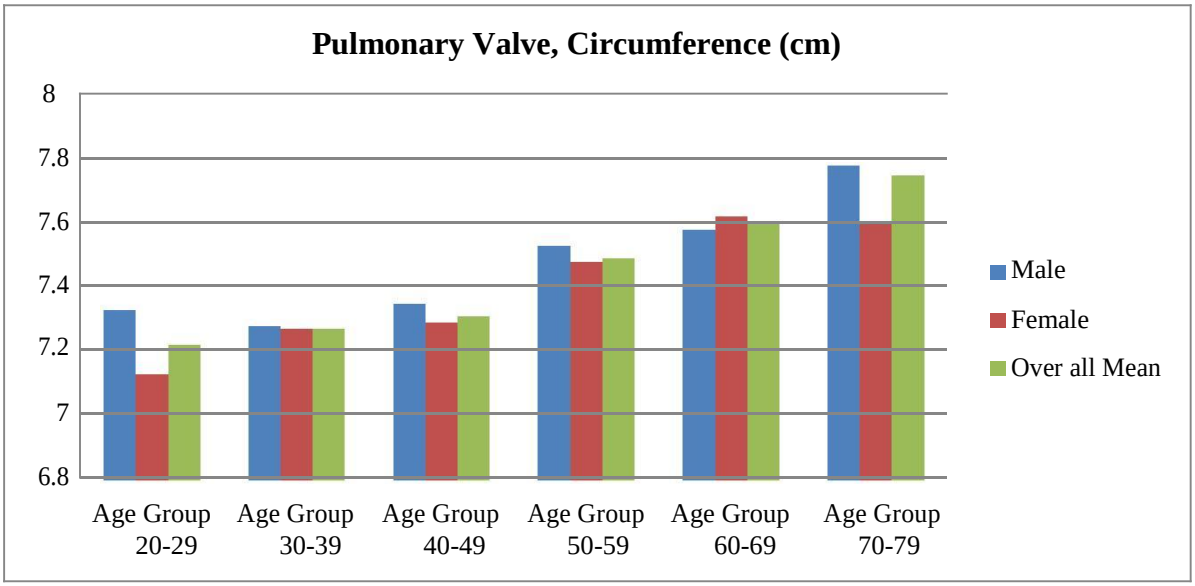
Left atrioventricular valve (Mitral): The average circumference of left atrioventricular (Mitral) valve in age group A, B, C, D, E and F Groups along with p-value is shown in fig.2

Table No-1. Right A/V Valve, Circumference (cm)

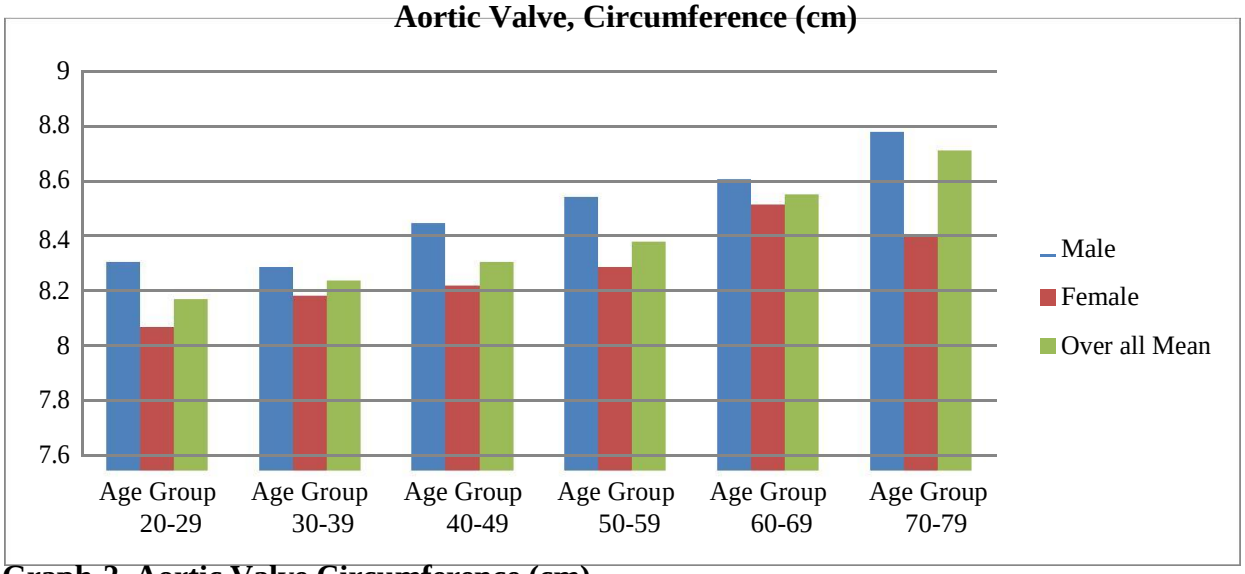
Right A/V Valve, Circumference (cm)						
	Over all Mean	Sex	N	Mean	Std. Deviation	p-value
Age Group 20-29	9.82	M	9	10.36	0.40	0.000
		F	11	9.39	0.24	
Age Group 30-39	10.08	M	13	10.37	0.31	0.000
		F	9	9.67	0.32	
Age Group 40-49	10.13	M	6	10.62	0.37	0.0001
		F	9	9.81	0.25	
Age Group 50-59	10.08	M	10	10.60	0.31	0.000
		F	16	9.76	0.33	.
Age Group 60-69	10.33	M	5	10.74	0.35	0.001
		F	6	10.00	0.17	
Age Group 70-79	10.81	M	5	10.98	0.44	0.111
		F	1	10.00	.	.

Table No.2. Mitral Valve Circumference (cm)

Mitral Valve Circumference (cm)						
	Over all Mean	sex	N	Mean	Std. Deviation	p-value
Age Group 20-29	8.70	M	9	9.34	0.34	0.00
		F	11	8.18	0.15	
Age Group 30-39	9.07	M	13	9.51	0.30	0.00
		F	9	8.44	0.28	
Age Group 40-49	8.99	M	6	9.65	0.29	0.00
		F	9	8.56	0.24	
Age Group 50-59	8.96	M	10	9.47	0.39	0.00
		F	16	8.65	0.18	
Age Group 60-69	9.09	M	5	9.54	0.42	0.001
		F	6	8.72	0.12	
Age Group 70-79	9.91	M	5	10.16	0.22	0.004
		F	1	8.7	.	.



Graph No.1: Pulmonary valve circumference (cm)



Graph-2. Aortic Valve Circumference (cm)

Pulmonary valve: The average circumference of pulmonary valve in age group 20-29 is 7.22 cm while mean circumference of pulmonary valve in nine males is 7.33 cm ± 0.15 and in eleven females is 7.13 cm ± 0.19 with P-value of 0.017 as shown in Graph 1.

The average circumference of pulmonary valve in age group 30-39 is 7.27 cm while mean circumference of pulmonary valve in thirteen males is 7.28 cm ± 0.14 and the mean circumference in nine females is 7.27 cm ± 0.17 with P-value of 0.878 as shown in Graph 1.

The average circumference of pulmonary valve in age group 40-49 is 7.31 cm while mean circumference of pulmonary valve in six males is 7.35 cm ± 0.16 and the mean circumference in nine females is 7.29 cm ± 0.14 with P-value of 0.447 as shown in Graph 1.

The average circumference of pulmonary valve in age group 50-59 is 7.49 cm while mean circumference of pulmonary valve in ten males is 7.53 cm ± 0.14 and the mean circumference in sixteen females is 7.48 cm ± 0.23 with P-value of 0.508 as shown in Graph 1.

The average circumference of pulmonary valve in age group 60-69 is 7.60 cm while mean circumference of pulmonary valve in five males is 7.58 cm ± 0.13 and the mean circumference in six females is 7.62 cm ± 0.10 with P-value of 0.607 as shown in Graph 1.

The average circumference of pulmonary valve in age group 70-79 is 7.75 cm while mean circumference of pulmonary valve in five males is 7.78 cm ± 0.27 and the mean circumference in single females is 7.6 cm with P-value of 0.573 as shown in Graph 1.

Aortic valve: The average circumference of aorta valve in age group 20-29 is 8.26 cm while mean circumference of aortic valve in nine males is 8.4 cm ± 0.15 and in eleven females is 8.15 cm ± 0.14 with P-value of 0.001 as shown in Graph 2.

The average circumference of aortic valve in age group 30-39 is 8.33 cm while mean circumference of aortic valve in thirteen males is 8.38 cm ± 0.13 and in nine females is 8.27 cm ± 0.14 with P-value 0.061 as shown in Graph 2.

The average circumference of aortic valve in age group 40-49 is 8.40 cm while mean circumference of aortic valve in six males is 8.55 cm ± 0.12 and in nine females is 8.31 cm ± 0.20 with P-value of0.02 as shown in Graph 2.

The average circumference of aorta in age group 50-59 is 8.48 cm while mean circumference of aortic valve in ten males is 8.65 cm ± 0.20 and in sixteen females is 8.38 cm ± 0.16 with P-value of 0.001 as shown in Graph 2.

The average circumference of aortic valve in age group 60-69 is 8.66 cm while mean circumference of aortic valve in five males is 8.72 cm ± 0.18 and the mean circumference of aortic valve in six females is 8.62 cm ± 0.18 with P-value of 0.372 as shown in Graph 2.

The average circumference of aorta in age group 70-79 is 8.83 cm while mean circumference of aorta in five males is 8.9 cm ± 0.10 and in single females is 8.50 cm with P-value of 0.022 as shown in Graph 2.

DISCUSSION

In recent studies, there has been a lot of emphasis on the importance of morphometery of tricuspid valve. The valve shows considerable variation. The morphometery of tricuspid valve has significant clinical importance for cardiovascular surgeons, and the data in our subcontinent is quite limited. The circumference of tricuspid valve in our study was 10.123 cm. It is increasing with advancing age. In an Indian study by Skwarek a significant increase was observed both in men and women and hence knowledge of the morphology and morphometery of the tricuspid valve helps to differentiate between functional and organic tricuspid pathology.[11] Such data may also be helpful to cardiac surgeons treating patients with tricuspid valve abnormality.

Silver et al reported tricuspid circumference 114 mm in males and 108 mm in females. In our study it is coming to be 101.23 cm and on lower side in females.[12]

In another study on 96 human hearts by Skwarek M *et al*, the circumference of tricuspid valve ranged from 107.28 ± 16.76 mm to 120.9 ± 20.95 mm in men and from 104.04 ± 16.76 mm to 110.75 ± 14.38 mm in women. It is in correlation with our study. The authors from the subcontinent have concluded that the circumference is comparatively much smaller in this area as compared with the Western data.[13] Short height and smaller size of the body structure in this region as compared to the western[14, 15] population might be the probable reason for this difference.

In a study conducted by R.Kalyani, M.J.Theij on 100 formalin fixed hearts, of persons between eight to eighty five years, significant increase in tricuspid valve measurements were observed with advancing age both in men and women.[15]

The mitral valve has a significant importance for clinicians and is altered by various disease states. In our study the mean circumference was 9.002 cm. In a study by Gunnal it is 9.12 cm and diameter is 2.22 cm. It is in close correlation with our study.[16] In another study the circumference was 8.248 cm.[17]

CONCLUSION

This study provided the measurement in the cadavers with regards to valves of heart.

The mean circumference of valves are heart in both sexes have significant differences in most of groups in tricuspid, mitral valve and aortic valves but in case of pulmonary valves, age Group A and C showed significant difference.

Conflict of Interest: The study has no conflict of interest to declare by any author.

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