Original Article

Wt. & Diameter of Heart & Aorta Walls

Weight of the Heart and Diameter and the Thickness of the Walls of Aorta, A Comparative Study

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ABSTRACT

Objectives: To analyze cadaveric based data of weight of heart, diameter and thickness of the walls of aorta in our population

Study Design: Descriptive / cross sectional study

Place and Duration of Study: This study was conducted at the Department of Anatomy and Pathology, Dow Medical College, DUHS, Karachi from 2008 – 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 (Vicenarian group), Group B: 30-39 (Tricenarian group), Group C: 40-49 (Quadrangarian group),Group D: 50-59(Quinquagenarian group), Group E: 60-69 (Sexagenarian group) and Group F: 70-79 (Septuagenarian group).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 weight of the heart is 286.14 grams ± 3.23 and between male and female the P-value is($P<0.00$) which is significant. Average aortic diameters are 2.77 cm, ± .023 and between male and female the P-value is ($P<0.01$) which is significant. Average aortic wall thickness is 1.07mm ±0.16 with significant male and female p-value ($P<0.01$).

Conclusion: Our study provided the measurement in the cadavers with regards to weight of heart and aortic diameter and the thickness of the wall of aorta. It is also concluded that results obtained show significant difference between male and female hearts with regards to these parameters.

Key Words: Descriptive cross sectional study, cadavers, significant p-value.

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INTRODUCTION

Knowledge of the morphometery of heart, including weight and size of heart, diameter of great vessels, and size of chambers, variant anatomy and anomalies of coronary circulations arevital component in the management of congenital and acquired heart diseases. Increasingly complex cardiac repair demands enhanced understanding of the basics to improve the operative outcome

By definition according to American Heritage Medical Dictionary, morphometery is "Measurement of the form of organism or their parts".

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It is simply stated "the process or technique of measuring the external form of an object-morphometery.[1]

According to Dictionary of Cell and Molecular Biology 2008, morphometery is "The method that involves the measurement of shape". Varieties of methods which exist to enable to examine structure for example, the distribution of objects in a section of cell and then to use this to predict the shapes and distribution of these objects in three dimension.

The identification of structural changes in the human tissue or organs can be observed by using different morphometric measurement and the different ways to study human tissue and to measure it either in living condition, at biopsy or of dissected tissue are, ultrasonographic morphometric studies, CT Scan morphometric studies, MRI Scan based measurement, Variner caliper for the measurement of dissected tissues, Microscopic morphometric studies.

Progress has been made in the last few decades in the management of cardiovascular diseases. The known uncorrectable lesions have nowadays become amenable to corrections as more and more new surgical and interventional techniques are being introduced.

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, number and thickness of cusps and anomalies of coronary arteries are observed.[2-5] These parameters are not extensively studied in Pakistan and present study is, therefore aimed to analyze morphometric features of some of above parameters i.e. heart e.g. weight of the heart, diameter and circumference of aorta, which may increase our knowledge regarding these parameters.

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 male and female cadavers were obtained from the morgue of Civil Hospital and other morgues of the Karachi. The hearts were removed in the usual necropsy procedure.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 (Vicenarian group).
- Group B was with age ranging from 30 – 39 years (Tricenarian group).
- Group C was with age ranging from 40 – 49 years (Quadrangarian group).
- Group D was with age ranging from 50–59 years (Quinquagenarian group).
- Group E was with age ranging from 60 – 69 years (sexagenarian group).
- Group F was with age ranging from 70 – 79 years (Septuagenarian group).

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 scalewith one gram precision.

The internal diameter of the ascending aorta was measured using the critical calipers, 1cm above the superior margin of the aortic sinus and inspected for atheroma or aneurysm.

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

RESULTS

Weight of Heart: Average weight of heart in Vicenarian groupwas 269.00 gm, while mean weight in nine males was 299.67 gm ± 15.44 and the mean weight of eleven females is 243.91 gm ± 11.85 and P-value (P<0.00) is significant.

Average weight of heart in Tricenarian group was 278.72 gm, while mean weight in thirteen males is 299.31 gm ± 16.26 and the mean weight of nine females is 249 gm ± 15.18 and P-value (P<0.00) is significant.

Table-1: shows diameter of aorta (cm)

Diameter of Aorta (cm)						
Age Groups	Over all Mean	Sex	N	Mean	Std. Deviation	P-value
Age Group 20-29 Vicenarian group)	2.65	M	9	2.84	0.15	0.00
		F	11	2.50	0.13	
Age Group 30-39 (Tricenarian group)	2.67	M	13	2.75	0.26	0.00
		F	9	2.57	0.17	
Age Group 40-49(Quadrangarian group)	2.65	M	6	2.87	0.05	0.00
		F	9	2.51	0.11	
Age Group 50-59	2.91	M	10	3.04	0.08	0.00
		F	16	2.83	0.09	
Age Group 60-69	2.87	M	5	2.96	0.11	.057
		F	6	2.80	0.13	
Age Group 70-79	3.11	M	5	3.12	0.13	0.275
		F	1	3.10	.	

Average weight of heart in Quadrangarian group was, 281.80 gm, while mean weight in six males is 313 gm ± 16.12 and the mean weight of nine females is 261 gm ± 8.06 and P-value (P<0.00) is significant (Graph No. 1).

Average weight of heart in Quinquagenarian group was,288.96 gm, while mean weight in ten males is 309.1 gm ± 17.69 and the mean weight of sixteen females is 276.38 gm ± 16.15 and P-value (P<0.00) is significant. Average weight of heart in sexagenarian group was, 302.27 gm, while mean weight in five males is 321.2 gm ± 3.70 and the mean weight of six females is 286.5 gm ± 7.34 and P-value (P<0.00) is significant.

Average weight of heart in Septuagenarian group was,339.50 gm, while mean weight in five males is 349.4 gm ± 42.90 and the weight of single females is 286.5 gmP-value (P<0.05) is significant.

Diameter of aorta: The average diameter of aorta in Vicenarian group was,2.65 cm, while mean diameter in nine males is 2.84 cm ± 0.15 and the diameter in eleven females is 2.50 cm ± 0.13 (Table - 1).

The average diameter of aorta in Tricenarian group was, 2.75 cm, while mean diameter in thirteen males is 2.75 cm ± 0.26 and the diameter in nine females is 2.57 cm ± 0.17 (Table - 1).

Table-2: shows diameter of aorta (cm).

Wall thickness of Aorta (mm)						
Age Group	Over all Mean	Sex	N	Mean	Std. Deviation	p-value
Age Group 20-29 (Vicenarian group)	1.01	M	9	1.10	0.226	0.1
		F	11	0.95	0.142	
Age Group 30-39 (Tricenarian group)	1.06	M	13	1.12	0.153	0.073
		F	9	0.98	0.171	
Age Group 40-49 (Quadrangarian group).	1.04	M	6	1.16	0.136	0.008
		F	9	0.97	0.10	
Age Group 50-59	1.08	M	10	1.185	0.116	0.005
		F	16	1.02	0.139	
Age Group 60-69	1.13	M	5	1.22	0.130	0.091
		F	6	1.07	0.137	
Age Group 70-79	1.25	M	5	1.26	0.089	0.573
		F	1	1.2	.	

The average diameter of aorta in Quadrangarian group was, 2.65 cm while mean diameter in six males is 2.87cm ± 0.05 and the diameter in nine females is 2.51 cm ± 0.11(Table - 1).

The average diameter of aorta in Quinquagenarian group was, 2.91 cm while mean diameter in ten males is 3.04 cm ± 0.08 and the diameter in sixteen females is 2.83 cm ± 0.09 (Table - 1).

The average diameter of aorta in sexagenarian group was,2.87 cm while mean diameter in five males is 2.96 cm ± 0.11 and the diameter in six females is 2.80 cm ± 0.13 (Table - 1).

The average diameter of aorta in Septuagenarian group was, 3.11 cm, while mean diameter in five males is 3.12 cm ± 0.13 and the diameter in single females is 3.10 cm (Table - 1).

Thickness of aortic wall: The average wall thickness of aorta inVicenarian group was,1.01 mm while mean wall thickness in nine males is 1.10 mm ± 0.226 and the diameter in eleven females is 0.95 mm ± 0.142 with P-value of 0.1.(Table - 2).

The average wall thickness of aortain Tricenarian group was 1.06 mm while mean wall thickness in thirteen males is 1.12 mm ± 0.15 and the diameter in nine females is 0.98 mm ± 0.171 with P-value of 0.07. (Table - 2).

The average wall thickness of aorta in Quadrangarian group was,1.04 mm while mean wall thickness in six males is 1.16 mm ± 0.13 and the diameter in nine females is 0.97 mm ± 0.10 with P-value of 0.008. (Table - 2).

The average wall thickness of aorta in Quinquagenarian group was, 1.08 mm while mean wall thickness in ten males is 1.18 mm ± 0.116 and the diameter in sixteen females is 1.02 mm ± 0.139 with P-value of 0.005. (Table - 2).

The average wall thickness of aorta in sexagenarian group was, 1.13 mm while mean wall thickness in five males is 1.22 mm ± 0.13 and the diameter in six females is 1.07 mm ± 0.137 with P-value of 0.009. (Table - 2).

The average wall thickness of aorta in Septuagenarian group was, 1.25 mm while mean wall thickness in five males is 1.26 mm ± 0.08 and the diameter in single females is 1.2 mm ± 0.137, P-value of 0.57.(Table 2).

DISCUSSION

Weight of heart: The weight of the heart has a great significance. In this study the mean weight of heart (in grams) is 286.14 ± 25.58. The average weight of male hearts was 306.48 ± 29.16. The female hearts was on an average 261.62 ± 22.00 and P-value is <0.01 in this study. This is a significant difference. The difference in the weight of heart in male and female reflects the fact that males are well built and their body structure supports this fact.

The body structure of females is quite different from males. Their physical working is also quite different. So the observation is quite natural and valid.The age factor did not have any significant influence after the puberty, as there is no significant increase in weight of the hearts in our study, in any age groups.

A study which was conducted in Thai population to correlate the weight of internal organs between males and females of normal population found that the ratio of

normal heart weight in male and female was 291/246. This suggests that the weight of heart was increased in male in relation to increasing age as compared to female population. This fact is supporting our study but further exploration is required.[6.7]

Diameter of aorta: The diameter of aorta is dependent on work load of the heart. In the present study the mean diameter of aorta (in cm) is 2.76 ± 0.19. The male and female mean is 2.67 ± 2.85 respectively with p-value <0.01. It is quite significant d. This reflects the physical working variations in two genders. American heart association has been continuously debating on aortic diameter, stiffness. All these were increased with age. Studies on autopsies showed that there was a clear-cut increase in the aortic surface area with increased age.[8,9] Cross sectional studies on aortic diameter conducted by angiography shows lesser but definite increase in the aortic diameter with increasing age. These studies also concluded that gender difference was due to the small body weight of females as compared to males.[10, 11]

The progress in age influences physical working of any human. The human activity is at its peak in around fifty years of age. It declines after that peak. In our study the ascending aortic diameter is increasing with age. It was at its peak at 50-59 age group. The retirement had a clear influence. It is reflected in our study. Gender specific and age adjusted normal values for aortic diameters are necessary to differentiate pathologic atherosclerotic changes in the ascending aorta. This establishes age and sex as a powerful predictor of subclinical atherosclerotic disease.[12 -15]

The aortic wall thickness continues to increase till fifty years of age group. This may reflect the fact that human activity is at its maximum around fifty years of age, and it is more in males than in females. In our study, men had greater average and maximal wall thickness than women. This is in correlation with morbidity and mortality. An excess of coronary death rates among men in all age groups has been documented.[16,17]

CONCLUSION

Our study provided the measurement in the cadavers with regards to weight of heart and aortic diameter and the thickness of the wall of aorta. It is also concluded that results obtained show significant difference between male and female hearts with regards to these parameters.

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

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