GENDER BASED DIFFERENCES OF ANATOMY OF SEMILUNAR LEAFLETS OF THE AORTIC VALVE IN HUMANS

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Relevance. The aortic valve (AV), responsible for unidirectional blood flow from the heart, exhibits subtle yet potentially clinically significant anatomical variations. While traditionally considered structurally similar, emerging evidence suggests that sex significantly influences the aortic valve's morphology and biomechanics [1].

Ignoring these variations can lead to suboptimal diagnostic accuracy, treatment strategies, and prosthetic valve design. Understanding how leaflet size, shape, and coaptation zones differ between males and females is crucial for precise echocardiographic assessment, predicting the progression of aortic valve disease (stenosis and regurgitation), and optimizing surgical or transcatheter valve repair/replacement [2, 3]. The findings will underscore the need for tailored approaches in managing aortic valve disease based on an individual's sex.

Purpose. To establish the gender-based differences of the anatomy of the semilunar leaflets of AV.

Materials and methods. 38 Autopsy Human Hearts: 18 Female hearts, 18 Male hearts and 2 of gender unspecified hearts were used as material for the study in age 68,50 (52,00; 78,50) years. Morphological and morphometric methods were used to study various parameters of each semilunar valve.

Parameters that were used to study the heart were: length of the cusp along the annulus (1), vertical length from nodule to cusp (2), left lunula length (3), right lunula length (4), inter commissural length on Sino tubular junction (5), vertical length of commissure (6), thickness of the commissure, perpendicular length from nodule to Sino tubular junction (7) and inter commissural horizontal diameter off the cusp (9) (fig. 1). All these parameters were measured on each left coronary leaflet of AV, right coronary leaflet of AV and non-coronary leaflet of AV.

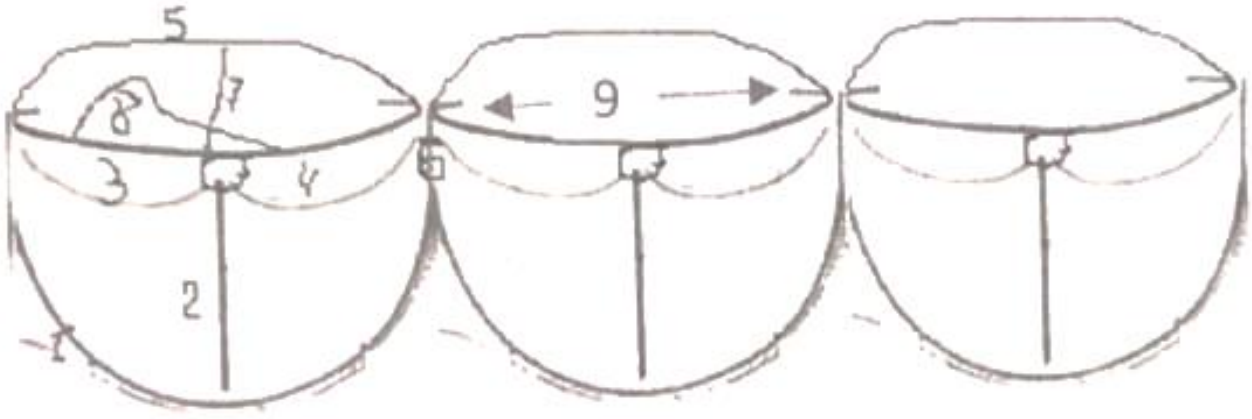

Figure 1. – Visual description of the parameters that was considered for the study

Totally 33 measurements were taken in each heart, in millimeters and were recorded in control sheets. These data were then entered into Microsoft Excel sheet. Statistical processing of the obtained data was carried out using the software "Statistica 10.0".

Results and discussion. Firstly, median values of the measurements related to each of the semilunar leaflet of AV (Table 1) were obtained without any gender consideration.

Table 1 – Median values of the semilunar valvular leaflets of AV

Parameters	Left Leaflet	Right Leaflet	Posterior Leaflet
Length of the cusp along the annulus, mm	42,00 (38,00; 44,00)	43,00 (39,00; 48,00)	42,00 (38,00; 47,00)
Vertical length from nodule to base of cusp, mm	14,00 (13,00; 15,00)	14,00 (12,00; 15,00)	14,00 (12,00; 15,00)
Left Lunula length, mm	12,50 (11,00; 15,00)	13,00 (12,00; 16,00)	14,00 (12,00; 16,00)
Right Lunula length, mm	14,00 (12,00; 16,00)	14,00 (13,00; 16,00)	14,00 (13,00; 17,00)
Inter commissural length on Sino tubular junction, mm	24,00 (21,50; 27,50)	25,00 (23,00; 28,00)	24,00 (21,00; 28,00)
Vertical length of the commissure, mm	4,50 (3,00; 6,00)	4,00 (3,00; 6,00)	4,00 (3,00; 5,50)
Horizontal length of the commissure, mm	1,00 (1,00; 2,00)	1,00 (1,00;2,00)	1,00 (1,00; 2,00)
Perpendicular length from nodule to Sino tubular junction, mm	14,00 (12,00; 16,00)	12,50 (11,00; 14,00)	13,00 (10,50; 15,00)
Inter commissural horizontal diameter of the cusp, mm	21,00 (18,00; 24,00)	23,00 (20,00; 25,00)	23,00 (19,00; 25,50)
Width of the nodule, mm	2,00 (1,00; 3,00)	2,00 (1,00; 4,00)	2,00 (1,00; 3,00)
Height of the nodule, mm	2,00 (2,00; 3,00)	2,50 (2,00; 3,00)	2,00 (2,00; 3,00)

A study conducted by Taylor S. Koerner [4] showed asymmetry of size and shape among coronary semilunar leaflets and noncoronary semilunar leaflets. But according to the data obtained in our study it is expressed as there were no significant differences were observed between morphometric parameters of semilunar leaflets of AV and they seem to be relatively equivalent to each other morphometrically.

According to the study conducted by Hena N Patel [5], all aortic root dimensions were larger in males compared to females. Hence the above obtained data for different parameters of the semilunar leaflet of AV was analysed to find the gender-based differences in the morphometric parameters.

Table 2 – Median values of the semilunar valvular leaflets of AV in Males

Parameters	Left Leaflet	Right Leaflet	Posterior Leaflet
Length of the cusp along the annulus, mm	42,00 (38,00; 44,00)	43,00 (42,00; 49,00)	43,00 (39,00; 46,00)
Vertical length from nodule to base of cusp, mm	14,50 (13,00; 15,00)	14,00 (13,00; 15,00)	14,00 (12,00; 15,000
Left Lunula length, mm	14,00 (12,00: 17,00)	15,00 (14,00; 16,00)	15,00 (13,00; 18,00)
Right Lunula length, mm	15,00 (12,00; 17,00)	16,00 (14,00; 17,00)	15,00 (13,00; 18,00)
Inter commissural length on Sino tubular junction, mm	26,00 (23,00; 28,00)	26,00 (24,00; 29,00)	24,50 (21,00; 28,00)

Vertical length of the commissure, mm	5,00 (4,00; 6,00)	4,00 (3,00; 7,00)	4,00 (3,00; 5,00)
Horizontal length of the commissure, mm	1,00 (1,00; 1,00)	1,00 (1,00; 2,00)	1,00 (1,00; 2,00)
Perpendicular length from nodule to Sino tubular junction, mm	14,50 (10,00; 17,00)	13,00 (11,00; 14,00)	13,50 (10,00; 15,00)
Inter commissural horizontal diameter of the cusp, mm	22,00 (17,00; 25,00)	24,00 (23,00; 25,00)	24,50 (22,00; 27,00)
Width of the nodule, mm	2,00 (2,00; 3,00)	2,00 (2,00; 3,00)	2,00 (2,00; 3,00)
Height of the nodule, mm	3,00 (2,00; 3,00)	3,00 (1,00; 4,00)	2,00 (2,00; 3,00)

Table 3 – Median values of the semilunar valvular leaflets of AV in Females

Parameters	Left Leaflet	Right Leaflet	Posterior Leaflet
Length of the cusp along the annulus, mm	42,00 (37,50; 45,00)	44,50 (39,00; 46,00)	40,00 (37,00; 47,00)
Vertical length from nodule to base of cusp, mm	13,50 (13,00; 14,00	12,00 (12,00; 15,00)	14,00 (12,00; 14,00)
Left Lunula length, mm	11,50 (10,00; 14,00) *	12,50 (11,00; 13,00) *	12,50 (11,00; 15,00) *
Right Lunula length, mm	12,50 (11,00; 14,50) *	13,00 (11,00; 14,00) *	13,00 (12,00; 14,00)
Inter commissural length on Sino tubular junction, mm	23,50 (19,00; 28,50)	24,00 (22,00; 28,00)	23,00 (21,00; 27,00)
Vertical length of the commissure, mm	4,00 (3,00; 6,00)	4,00 (2,00; 5,00)	4,00 (3,00; 5,00)
Horizontal length of the commissure, mm	1,00 (1,00; 1,00)	2,00 (1,00; 2,00)	1,00 (1,00; 2,50)
Perpendicular length from nodule to Sino tubular junction, mm	14,50 (13,00; 16,00)	12,00 (10,00; 16,00)	12,50 (11,50; 17,00)
Inter commissural horizontal diameter of the cusp, mm	19,50 (18,00; 23,00)	20,00 (19,00; 25,00) *	19,50 (18,50; 23,00) *
Width of the nodule, mm	1,50 (1,00; 3,50)	2,00 (1,00; 4,00)	2,50 (1,00; 6,00)
Height of the nodule, mm	2,50 (1,00; 3,00)	2,00 (2,00; 4,00)	3,00 (2,00; 4,00)

*- P value of median difference between male and female ≤0,05

The study found (Table 2 and 3) that in males' length of left lunula of left coronary leaflet of AV is 14,00 (12,00: 17,00) mm and in females it is 11,50 (10,00; 14,00) mm (z=2,432, p=0,015). Also, in males' length of right lunula of left coronary leaflet of Av is 15,00(11,00; 14,50) and in females it is 12,50 (11,00; 14,50) mm (z=2,312, p=0,021). The length of left lunula of right coronary leaflet of AV in males is 15,00 (14,00; 16,00) mm and in females it is 12,50 (11,00; 13,00) mm (z=2,888, p=0,004). The length of right lunula of right coronary leaflet of AV in males is 16,00 (14,00; 17,00) mm and in females it is 13,00 (11,00; 14,00) mm (z=2,740, p=0,006).

The left lunula length of non-coronary leaflet of AV in males is 15,00 (13,00; 18,00) mm and in females it is 12,50 (11,00; 15,00) mm (z=1,975, p=0,048).

The length of the free border of the semilunar leaflets of AV was not measured directly. It could be derived as a summation of the left lunula length of the semilunar leaflet of AV and right lunula length of the semilunar leaflet of AV. Thus, the length of the free edge of the left and right coronary valves in men is greater than in women.

The study revealed that the inter-commissural horizontal diameter of right coronary leaflet in males was 24,00 (23,00; 25,00) mm and in females it was 20,00 (19,00;25,00) mm (z= 2,508, p= 0,012). The study also revealed that inter-commissural diameter of noncoronary leaflet in males was 24,50 (22,00; 27,00) mm and in females it was 19,50 (18,50; 23,00) mm (z=2,540, p=0,011). Thus, Inter-commissural diameter of right coronary and noncoronary leaflet in men is greater than in women.

Conclusion. No significant differences were found between morphometric parameters of different semilunar valves of the AV when the respective genders of the hearts were not considered into the study. All three semilunar leaflets of AV seem to be relatively equivalent to each other morphometrically.

Significant differences were observed when the morphometric parameters of the semilunar leaflets of AV were studied when the respective genders of the specimen used for the study taken into consideration. The length of the free edge of the left and right coronary valves in men is greater than in women. The study also expressed that the inter-commissural diameter of right coronary and noncoronary leaflet in men is greater than in women.

Literature

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