

MORPHOMETRIC ANALYSIS OF TRICUSPID VALVE IN THE HEARTS OF HUMAN ADULT CADAVER

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Abstract

Background: Morphometric studies of tricuspid valve using formalin preserved hearts are very seldom seen in the research realm. Most studies make use of two dimensional or three-dimensional echocardiography where the measurements are taken during cardiac cycles. However, this study utilises more advanced and accurate methodology and hence gives more knowledge in cases of valve replacement etc. Accordingly, the accurate knowledge of the morphology and morphometry of the tricuspid valve is of importance for differentiating between functional and organic tricuspid diseases. The tricuspid valve does not lie in a single plane. Its position and structural complexity add to the challenges in its assessment by radiological techniques in living human beings. The tricuspid valve is the most commonly affected (50%) in endocarditis. Tricuspid regurgitation is also common among the abnormalities in the morphology of the tricuspid valve. Tricuspid regurgitation is uncommon in normal children, but its incidence in children with congenital heart disease and/or respiratory distress is high. Thus, proper morphometry of the tricuspid valve is inevitable in the selection and synthesis of prosthetic valves. **Materials and Methods:** The materials used in this study include 20 formalin fixed hearts from the Department of Anatomy, TIRUNELVELI MEDICAL COLLEGE. Hearts of all age group from patients whose cause of death was non-vascular are taken. Heart with any heart defects or congenital valve defects are not taken. i. e no gross abnormalities observed. Also, vernier calliper and thread are used. **Result:** Present study revealed that the circumference of the tricuspid orifice ranges from 79.10 to 121.27mm with a mean of 102.1005 ± 13.461 mm; the no. of cusps in 19 of 20 hearts was 3 except one which had 2cusps. The length and width of anterior cusp ranges from 12.12mm to 24.84mm and 10.12mm to 43.83mm with a mean of 18.968 ± 4.217 mm and 29.1915 ± 9.052 mm respectively. The length and width of posterior cusp ranges from 11.02mm to 25.51mm and 11.63mm to 32.74mm with a mean of 17.5 ± 4.72 mm and 23.005 ± 6.07 mm respectively. The length and width of septal cusp ranges from 11.18mm to 25.30mm and 12.54mm to 26.40mm with a mean of 17.571 ± 3.724 mm and 19.345 ± 3.66 mm respectively. **Conclusion:** This research of morphometric parameters of tricuspid valve and correlation with various parameters will help in better understanding of the anatomy of the tricuspid valve complex and appropriate designing of valvular complex for transplantation. Thus, this study may turn out to be a potential database to fulfil the deficiency in the basic data on morphometric parameters of tricuspid valve.

INTRODUCTION

Rationale

Cardiac valves are complex muscular flaps present in the body which are of great clinical significance. Tricuspid valve guards the inlet of the right ventricle. As the name indicates, normally it has 3 cusps-anterior, posterior and septal which lie against 3 walls of ventricle. It prevents regurgitation of blood into the

right atrium and ensures unidirectional flow of blood. It can admit the tips of 3 fingers. The tricuspid valve complex includes fibrous ring, chordae tendineae, 3 leaflets and papillary muscles.

It is located in a nearly vertical oblique(4cm) line behind right half of sternum opposite to the 4th and 5th intercostal spaces. Normally tricuspid valve has 3 cusps and an orifice circumference of about an average 114mm in males and 108mm in females.

Objectives

The purpose is to study the morphometry of tricuspid valve under the following parameters:

- Number of cusps
- Circumference of tricuspid orifice
- Length of individual cusp
- Width of individual cusp

MATERIALS AND METHODS

The materials used in this study include 20 formalin fixed hearts from the department of Anatomy, Tirunelveli Medical College. Hearts of all age group from patients whose cause of death was non-vascular are taken. Hearts with any heart defects or congenital valve defects are not taken. ie no gross abnormalities observed. Also, vernier callipers and thread are used. The thoracic cage of the cadavers is to be removed to reveal the heart with pericardium. The fibrous pericardium along with parietal layer of serous pericardium is to be removed from the heart and great vessels. Superior Vena Cava and Inferior Vena Cava are to be identified, and cut close to their termination. The four pulmonary veins are to be identified and cut

close to the opening to the left atrium in the posterior wall. The pulmonary trunk and arch of aorta are also to be removed in a similar manner to free the heart. Using scissors, the initial cut is to be made from the inferior vena cava to the right atrial appendage and the tricuspid valve is to be exposed.

The following measurements of the tricuspid valve are to be recorded: attachment length of anterior leaflet (1), posterior leaflet (2), septal leaflet (3), frontal dimension (4), sagittal dimension (5) and the atrial circumference of the tricuspid valve attachment (6). The frontal dimension is to be measured from the commissure between the anterior and septal leaflet of the tricuspid valve along the axis of the right atrioventricular orifice to the sharp margin of the right ventricle. The sagittal dimension is to be measured perpendicular to the frontal dimension at the midpoint of its length. The circumference of tricuspid orifice is to be measured with the help of thread whereas a Digital Vernier Calliper is to be used to measure the length and width of cusps.

Study Center: Department of anatomy in our institution.

Study Period: 3 months

Study Size: 20 hearts.

RESULTS

Table 1: No. of cusps observed in specimen

Sn. No	No of Cusps	No of Hearts	Percentage
1	3	19	95%
2	Less than 3	1	5%
3	More than 3	Nil	Nil

Table 2: Circumference of tricuspid valve in observed specimen.

Sn. No	Circumference of Tricuspid Orifice (in mm)
1	89.5
2	93.85
3	95.16
4	92.27
5	108.25
6	79.10
7	85.90
8	87.2
9	87.3
10	121.27
11	98.98
12	111.94
13	111.41
14	120.44
15	103.85
16	99.83
17	118.4
18	120.12
19	119.12
20	98.12

Table 3: length and width of cusps of tricuspid valve

Sn. No	Anterior		Posterior		Septal	
	Length (mm)	Width (mm)	Length (mm)	Width (mm)	Length (mm)	Width (mm)
1	15.23	10.12	16.67	17.13	17.9	17.98
2	12.46	22.17	11.26	12.1	16.47	17.29
3	14.93	20.12	13.71	24.14	18.21	20.11
4	23.47	28.9	23.76	32.7	24.62	26.4
5	20.57	30.41	12.4	24.79	15.41	19.67
6	15.53	22.74	12.73	18.92	11.18	13.6

7	12.66	19.57	17.44	17.09	13.65	12.54
8	15.43	23.37	11.02	11.63	12.34	14.77
9	23.59	18.94	12.91	29.7	15.71	17.53
10	11.65	22.78	12.09	18.36	13.68	23.17
11	24.84	39.91	23.92	28.31		
12	22.85	34.29	18.53	32.74	25.3	15.5
13	16.48	27.27	21.45	25.62	20.72	21.76
14	21.15	30.71	14.51	21.54	15.98	20.9
15	20.42	43.83	18.47	26.25	19.57	22.21
16	21.49	36.57	19.21	19.59	19.54	24.33
17	22.12	38.55	19.58	29.25	16.8	17.9
18	23.14	34.55	21.52	22.41	17.54	19.23
19	19.88	40.12	25.51	22.21	18.52	20.92
20	21.47	38.91	23.31	25.62	20.72	21.76

DISCUSSION

Table 4: comparison of the circumference of the tricuspid orifice with other studies

Sn No	Name of study	Circumference of tricuspid orifice (mm)
1	Gray's anatomy, ^[14] [2008]	114mm male,108mm female
2	Kalyani et al, ^[15] [2012]	107mm
	Nagarathnamma B	
3	Manjunath A K [2018]	95.25mm
4	Motabagani et al, ^[10] [2006]	123.9mm
5	Antoniali et al, ^[12] [2007]	105mm
6	Silver et al, ^[2] [1971]	113mm in male and 107mm in female
7	Rohilla et al, ^[16] [2015]	90.50mm
8	My study	102.1005mm

Table 5: comparison of the length of the anterior, posterior and septal cusp of the tricuspid valve with other studies

Sn No	Name of study	Lengths of Cups		
		Anterior	Posterior	Septal
1	Nagarathnamma B Manjunath A K[2008]	26.87	23.07	29.44
2	Motabagani et al, ^[10]	37.2	26.3	31.3
3	Skwarek et al, ^[13]	31.98	24.10	32.16
4	Rohilla et al, ^[16]	27.3	22.1	28.8
5	Mishra et al	40.0	17.0	32.0
6	My study	18.968	17.57	17.571

Table 6: comparison of the height of the anterior, posterior and septal cusp of the tricuspid valve with other studies

Sn No	Name of study	Heights of Cups		
		Anterior	Posterior	Septal
1	Nagarathnamma B Manjunath A K	19.22	16.22	15.30
2	Skwarek et al, ^[13]	23.88	21.35	18.33
3	Motabagani et al, ^[10]	22.4	22.2	15.5
4	Mishra et al	28.6	15.0	25.7
5	My Study	29.191	23.005	19.345



Figure 1: Showing the tricuspid valve, its 3cusps and orifice



Figure 2: Tricuspid valve with two cusps (special finding)



Figure 3:



Figure 4: Measuring Length And Width Of Cusps Respectively

CONCLUSION

The tricuspid valve is also known as forgotten valve because of its lack of knowledge by the surgeons and cardiologists than any other heart valves. The tricuspid valve anatomy shows greater variability than the anatomy of the mitral valve.

This research of morphometric parameters of tricuspid valve and correlation with various parameters will help in better understanding of the anatomy of the tricuspid valve complex and appropriate designing of valvular complex for

transplantation. Thus, this study may turn out to be a potential database to fulfil the deficiency in the basic data on morphometric parameters of tricuspid valve.

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