



MORPHOMETRY OF TRICUSPID VALVE COMPLEX IN INDIAN POPULATION

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ABSTRACT **INTRODUCTION :**The right atrioventricular orifice is oval or circular in outline and is oriented almost vertically making an angle of 45o with the sagittal plane .The tricuspid valve consist of 3 leaflets ,anterior ,posterior and septal .
MATERIAL AND METHOD: Thirty formalin fixed hearts without any malformation or pathology were used in the study. Circumference, cross-sectional area, length of annulus, length and height of cusps of tricuspid valves were measured and analyzed.
OBSERVATIONS : The circumference of tricuspid valves averaged 11.54±1.4 (range 8.2-14.1).The shape of the anterior leaflet was observed to be roughly semi circular to quadrangular with height average 2.25±0.4 and length average 4.3±0.5. Posterior leaflet had 1-3 scallops with the height average 1.5±0.5 and length average 4.4 ±1.04.The septal leaflet was semi-circular in shape with average length 4.4±0.4 and height 1.5±0.3.The average of area is 10.9±2.2.All measurements were in cm. **DISCUSSION :** Morphometry of valves thus calculated is essential information for manufacturing of prosthetic valve.

KEYWORDS : Morphometry , Tricuspid Valve, Indian Population, Prosthetic Valve

INTRODUCTION

The right atrioventricular orifice is oval or circular in outline and is oriented almost vertically making an angle of 45o with the sagittal plane .The tricuspid valve complex guards it and consist of 3 leaflets ,anterior ,posterior and septal . Valvular diseases constitute a major worldwide cause of disability and premature deaths from cardiovascular diseases . Tricuspid valve diseases can be either congenital(Ebstein's anomaly) or acquired and common in persons with pulmonary hypertension and in i.v. drug abusers [1]. The tricuspid valve does not lie in single plane, its position and structural complexity adds to the challenges in assessment of its dimensions by radiological techniques [2,3]. Many morphometric studies are done on mitral valve but there is scarcity of literature of tricuspid valve. Morphometry of tricuspid valve will be important for intervention and development of prosthesis during valve replacement in tricuspid regurgitation through parallel percutaneous approach by the surgeons [4] . . Most of the studies are pertaining to 2-dimensional or 3-dimensional echocardiography where the measurements are noted during cardiac cycle .Looking into paucity of studies done on cadaveric hearts , this study is done on cadaveric hearts[5,6] .

MATERIAL AND METHODS

30 formalin(10%) fixed hearts were dissected out whose age was ranging from 20 – 60 years & data was collected. Normal adult human hearts without any malformation or pathology were included in the study. Specimens were numbered & valves were dissected out after cleaning under tap water . 3 incisions are given:

- The first incision was given from right aspect of inferior vena cava and to superior vena cava.
- The second incision was given around the outer margin of annulus.
- Third incision : extended along the inferior border of heart till right margin of anterior inter-ventricular groove.

Tricuspid valve with annulus was removed .The Shape of the tricuspid valve was observed. Morphometric parameters measured like circumference of tricuspid valve, length of the leaflets and height of the leaflets . The circumference was taken by dissecting the valve and spreading it on paper and then the length was taken .The number of cusps of tricuspid valve and their position was noted. The lengths of all parameters were measured using Digital Vernier's caliper . Height was measured with help of a scale. Applying the formula for circumference($2\pi r$)[7],radius is calculated and by knowing the radius area of the valve is calculated $A=\pi r^2$.

OBSERVATION Table 1

S.No.	circumference	Anterior cusp H	Ant cusp W	Posterior cusp H	Posterior cusp W	Septal cusp H	Septal cusp W	AREA
2								

Range	8.2-14.1 cm	1.7-3.3cm	3.8-5.6cm	0.6-2.7cm	2.2-5.9cm	1.1-2.6cm	2.2-3.9cm	5.3-13.4cm
Average	11.54cm	2.25cm	4.3cm	1.5cm	4.4cm	1.5cm	2.8cm	10.9
Standard	1.4cm	0.4cm	0.5cm	0.5cm	1.04cm	0.3cm	0.4cm	2.2

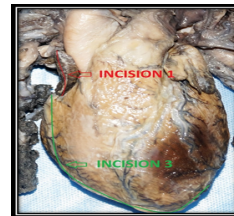


Figure 1-Showing Incision 1 and 3



Figure 2: Showing incision 2 around annulus

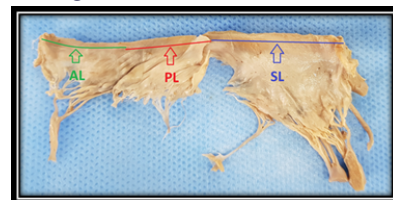


Figure 3 : Showing anterior ,posterior and septal leaflet

The circumference of the tricuspid valve averaged 11.54 cm with the standard deviation of 1.4 cm with the minimum circumference of 8.2 cm and maximum circumference of 14.1.

Circumference = $2\pi r$,with the help of this equation r (radius) is calculated. The value of radius is used to calculate the cross-sectional area using the formula for cross-sectional area = $A=\pi r^2$.

The shape of anterior Leaflet was observed to be roughly semicircular to quadrangular. The average of height of anterior cusp is 2.25 cm with the standard deviation of 0.4cm and the range of height is 1.7 cm to 3.3

cm. The average of width of anterior leaflet is 4.3cm with the standard deviation of 0.5cm and the minimum width is 3.8 cm and the maximum width is 5.6 cm .

The posterior leaflet is roughly triangular in shape as a whole & was divided into scallops ranging in no. from 1-3. The average of height of posterior valve is 1.5 cm with the standard deviation of 0.5cm and the range of height is 0.6 cm to 2.7 cm . The average of width of posterior leaflet is 4.4cm with the standard deviation of 1.04cm and the minimum width is 2.2 cm and the maximum width is 5.9 cm

The septal leaflet is roughly semicircular in shape . The average of height of septal valve is 1.5 cm with the standard deviation of 0.3cm and the range of height is 1.1cm to 2.6 cm .The average of width of septal leaflet is 2.8 cm with the standard deviation of 0.4cm and the minimum width is 2.2 cm and the maximum width is 3.9 cm .

As the circumference of tricuspid valve is $2\pi r$,from this the radius is calculated .From radius , we calculated the area of tricuspid valve which is one of the important parameter for the formation of prosthetic valve. The area of the tricuspid valve averaged 10.9cm² with the

standard deviation of 2.2cm² with the wide range of 5.3cm² and 13.4 cm² .

DISCUSSION

The present study correlates with all the studies given in the table 2 below however it also shows similarities with the dynamic studies done by Ormiston at al[7].Morphometric study will provide base line data with reference to the severity of the reduction in valvular lumen in cases of stenosis and in treatment plan. Area of valves thus calculated is essential information for manufacturing of prosthesis . Most of the studies are pertaining to 2-dimensional or 3-dimensional echocardiography where the measurements are noted during cardiac cycle . Looking into paucity of studies done in indian population this study is conducted. Exact measurements of valve prosthesis with reference to human valve measurements are the primary data for designing and of manufacturing.It is relevant to mention here that the measurements carried out in the study are on formalin fixed static hearts and they are manually taken. However in real-time studies,the valves, annulus, cusps are in a dynamic state in a cardiac cycle. Hence, the measurements two-dimensional, three-dimensional echo findings may differ from the static valve studies.

Comparison Of Data From Different Authors

Table 2

S.No.	circumference 2	Anterior cusp H	Ant cusp W	Posterior cusp H	Posterior cusp W	Septal cusp H	Septal cusp W	AREA .
Present study	11.54cm±1.4cm	2.25cm±0.4cm	4.3cm±0.5cm	1.5cm±0.5cm	4.4cm±1.04cm	1.5cm± 0.3cm	2.8cm±0.4 cm	10.9±2.2cm
Rohilla set al [8]	9.49cm±1.05cm	1.92 cm± .24cm	2.72 cm±.54cm	1.62 cm±.28cm	2.20 cm±.43cm	1.53 cm±.29cm	2.87 cm±.48cm	
Motabagani [9]			4.36 cm±.34cm		2.92 cm±.28cm		3.32 cm±.33cm	
Skwarek et al [6]	10.56cm±1.67cm	2.38 cm±.08cm	3.19 cm±.87cm	2.13 cm± .09cm	2.41 cm±.90cm	1.83 cm±.09cm	3.21 cm±.87cm	
Antoniali et al [10]	10.5 cm±1.27cm						3.06 cm±.37 cm	

CONCLUSION

1. Morphometry of valves thus calculated is essential information for manufacturing of prosthesis valve
2. This data help the clinicians in correlation between anomalous & normal valves as it forms the baseline for comparison .
3. There is a positive correlation between circumference and height and width of cusps.

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