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Perimeter of The Tricuspid Valve: A Cadaveric Human Heart Study

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ABSTRACT

Historically, the research on the right ventricle (RV) has been neglected by his left equivalent because of the complexity of left ventricle (LV) dysfunction. Tricuspid regurgitation (TR) can be classified as linked to primary valve disease or functional in nature, but most are functional. Although it was historically assumed that such functional Tricuspid regurgitation, i.e. arising from left-sided disease, and it can be resolved after corrective surgery, but after successful surgery, on the aortic or mitral valve annular dilatation, the Tricuspid regurgitation and right ventricular dysfunction may persist.To study the circumference of tricuspid orifice and it's the diameter in two perpendicular planes and its comparison among the male and female population. The material for the present study comprised of 50 formalin fixed human hearts (35 males and 15 females) which were obtained from the department of anatomy. In this study, it is observed that: The mean value of circumference of a tricuspid orifice is 11.01+/-0.63 cm. The diameter of tricuspid orifice along the frontal dimension is 3.06+/-0.38 cm, and the diameter along the sagittal dimension is 2.26+/-0.23 cm. The measurements of the circumference of tricuspid orifice reported for males and females in western countries were higher than the present study and the diameter along the frontal dimension is greater than the diameter along the sagittal dimension. The tricuspid valve diameter along the frontal dimension was more than the diameter along the sagittal dimension in both males and females.

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INTRODUCTION

The research on the right ventricle (RV) has been neglected by his left equivalent because of the complexity of left ventricle (LV) dysfunction. The Right ventricle has been seen as a passive structure that allows blood flow from the body to the lungs (Wang *et al.*, 2019). The tricuspid valve consists of three tissue flaps that separate the right atria to the right ventricle. The right atrioventricular valve is having widest heart valve orifices among all heart valves. This is why the term 'atrioventricular valve apparatus/complex' is more appropriate. Tricuspid valve diseases may be congenital or acquired as

seen with pulmonary hypertension or in i .v. drug abusers (Rohilla and Singh, 2015). Ebstein's abnormality is the most frequent anomaly of the tricuspid valve and seen either alone or some time with other syndromes also (Khan and Cohen, 1999). Accessory valve tissue seems to be an uncommon congenital cardiac anomaly that exists alone or in involvement with other cardiac deformities, such as the Fallot's tetralogy, ventricular septal defects, coarctation of the aorta and transposition of the great vessels (Yoshimura *et al.*, 2000). Congenital duplication of the human tricuspid valve with obstruction of the right ventricular outflow is reported by echocardiography to be a rare cardiac anomaly Bisognano *et al.* (1998). Tricuspid regurgitation (TR) can be classified as linked to primary valve disease or functional in nature but found mostly are functional. Although it was historically assumed that such functional Tricuspid regurgitation, i.e. arising from left-sided disease, and it can be resolved after corrective surgery, but after successful surgery, on the aortic or mitral valve annular dilatation, the Tricuspid regurgitation and right ventricular dysfunction may persist (Luxford *et al.*, 2017). Considering the clinical importance of the tricuspid valve, the present work is undertaken to explore the precise morphology and to carry out a study of the tricuspid valve Perimeter in normal human hearts obtained by dissecting cadavers.

Aim and Objectives

To study the circumference of tricuspid orifice and it's the diameter in two perpendicular planes and its comparison among a male and a female population.

Figure 1: Showing measurement of the tricuspid orifice

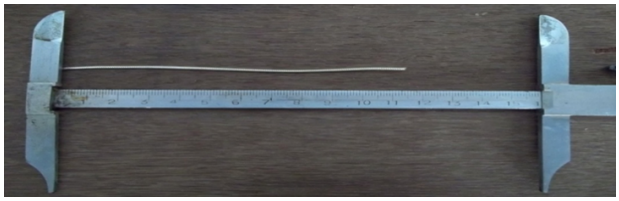


Figure 2: Showing straightening of wire on the scale

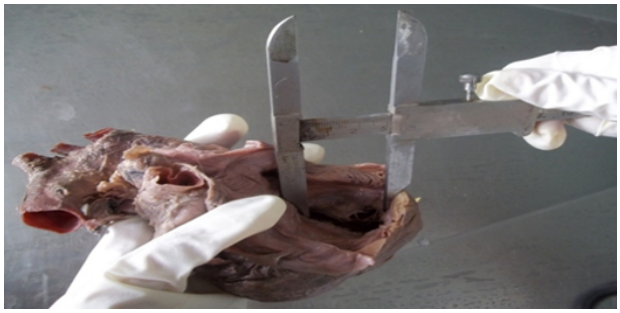


Figure 3: Showing measurement of the tricuspid orifice infrontal dimension

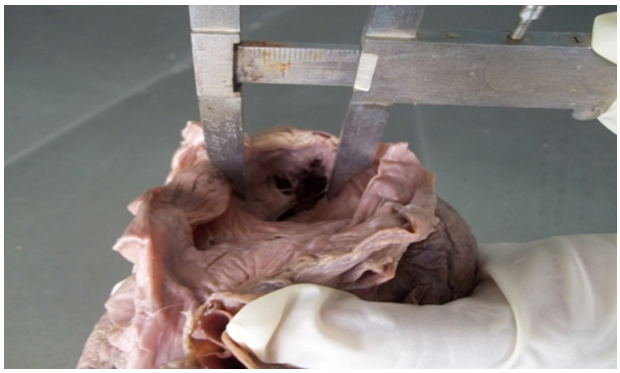
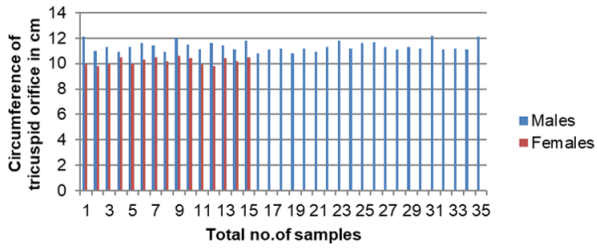


Figure 4: Showing measurement of the tricuspid orifice insagittal dimension



Graph 1: Circumference of tricuspid orifice in cm

MATERIALS AND METHODS

The material for the present study comprised of 50 formalin fixed human hearts (35 males and 15 females) which were obtained from the department of Anatomy. The hearts with macroscopic developmental failures or pathological changes were eliminated from the study.

To expose the tricuspid orifice, the right atrium was cut open through the opening of superior vena cava to the opening of inferior vena cava. The circumference of the annulus was measured from the atrial side with foldable wire, which was then straightened on the scale, to get the measurement in centimetres Figure 1 and Figure 2. The maximum diameter of the orifice in two different perpendicular planes was taken with the help of vernier calliper. First diameter (the frontal dimension) of the tricuspid valve was

Table 1: Showing mean value and standard deviation of study parameters (male and female combined, sample size 50)

S.No.	Study Parameters	Mean	Standard deviation
1	Circumference of the tricuspid orifice (C) in cm	11.01	0.63
2	The diameter of tricuspid orifice along frontal dimension (D1) in cm	3.06	0.38
3	Diameter of tricuspid orifice along sagittal dimension (D2) in cm	2.26	0.23

Table 2: Comparison of circumference of tricuspid orifice between males and females

Circumference of tricuspid orifice (cm)	Male	Female
Mean	11.35	10.21
SD	0.38	0.27
P value	<0.01(highly significant) Confidence interval 95%	

Table 3: Comparison of circumference of tricuspid orifice in cm between males and females inprevious study and present study

S. No.	Workers	Male	Female
1	(Skwarek *et al.*, 2008)	11.7+/-1.72	11.1+/-1.37
2	(Wang *et al.*, 2019)	11.4 cm	10.8
3	(Silver *et al.*, 1971)	11.4±1.1	10.8±1.3
4	(Westaby *et al.*, 1984)	11.95±1.26	10.4±1.06
5	(Kocak *et al.*, 2004)	12.4±1.1	11.8±1.3
6	Kalyani *et al.* (2012)	10.75±1.06	10.4±0.56
7	(Premkumar *et al.*, 2017)	8.0±0.77	7.54±0.54
8	Present study	11.35+/-0.38	10.21+/-0.27

Table 4: Comparison of diameters of tricuspid orifice in cm along frontal and sagittal dimensions between males and females in previous study and present study

S. No.	Workers	Male	Female
1	(Skwarek *et al.*, 2008) (formalin fixed hearts)		
	A. Diameter in frontal dimension	3.02+/-0.43	2.77+/-0.32
	B. Diameter in sagittal dimension	2.19+/-0.47	2.01+/-0.25
2	Present study (formalin fixed hearts)		
	A. Diameter in frontal dimension	3.15+/-0.39	2.87+/-0.30
	B. Diameter in sagittal dimension	2.32+/-0.24	2.11+/-0.14

Table 5: Comparison of diameter of tricuspid orifice along a frontal and sagittal dimension between males and females

		Male	Female
Diameter of tricuspid orifice in frontal dimension (cm)	Mean	3.15	2.87
	SD	0.39	0.30
	P value	>0.05 (not significant)	
Diameter of tricuspid orifice in sagittal dimension (cm)	Mean	2.32	2.11
	SD	0.24	0.14
	P value	>0.05 (not significant)	

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 Figure 3.

The second diameter (the sagittal dimension) was measured perpendicularly to the first diameter at the midpoint of its length Figure 4. Three such readings were recorded, and the average of them was taken to minimize personal error. For statistical analysis **'Student's t'** test is used in this study.

OBSERVATION AND RESULT

In this study, it is observed that: The mean value of circumference of the tricuspid orifice is 11.01+/-0.63 cm. The diameter of tricuspid orifice along the frontal dimension is 3.06+/-0.38 cm, and the diameter along the sagittal dimension is 2.26+/-0.23 cm. The difference of circumference of tricuspid orifice between males and females is found to be highly significant. [Table 1, Table 2 and Graph 1]

DISCUSSION

The measurements of circumference of tricuspid orifice reported for males and females in western countries from studies performed by Skwarek *et al.* (2008); Wang *et al.* (2019); Silver *et al.* (1971) were higher than the present study. However, the study published by Kalyani *et al.* (2012) and (Premkumar *et al.*, 2017) for Indian population depicts circumference of tricuspid orifice were less then what we found in present study. [Table 3] It shows that the values are different from country to country and the regional variations also (Westaby *et al.*, 1984) and (Kocak *et al.*, 2004).

Skwarek *et al.* (2008) examined 48 formalin fixed hearts and observed the average value of the diameter of tricuspid orifice along the frontal dimension as 3.02+/-0.43 cm in males and 2.77+/-0.32 cm in females. The value of diameter along sagittal dimension was observed as 2.19+/-0.47 cm in males and 2.01+/-0.25 cm in females. No significant difference was found for the value of both diameters of tricuspid orifice between males and females. The findings of present study are consistent with the previous study. From both the studies, it is observed that the diameter along the frontal dimension is greater than the diameter along the sagittal dimension. [Table 4 and Table 5]

CONCLUSION

The study shows that the tricuspid valve diameter along the frontal dimension was more than the diameter along the sagittal dimension in both males and females. The measurement of circumference of tricuspid orifice shows that the values are different from country to country and in regional variations also.

Conflict of interest

Nil

Source of funding

Nil

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