ORIGINAL RESEARCH PAPER
Volume-9 | Issue-2 | February-2020 | PRINT ISSN No. 2277 - 8179 | DOI : 10.36106/ijsr
INTERNATIONAL JOURNAL OF SCIENTIFIC RESEARCH

MORPHOMETRIC STUDY OF THE TRICUSPID VALVE IN CADAVERIC HUMAN HEARTS IN SOUTH-INDIAN POPULATION

Anatomy

Dr. P. Preethi Assistant Professor, Department of Anatomy, Tagore Medical College & Hospital, Rathinamangalam.

Mrs. M. Vani* Assistant professor, Department Of Anatomy, Tagore Medical College & Hospital, Rathinamangalam. *Corresponding Author

Dr. D. H. Gopalan Professor, Department Of Anatomy, Tagore Medical College & Hospital, Rathinamangalam.

ABSTRACT

BACKGROUND: The dimensions of the tricuspid valve complex will be useful in various medical fields, but very few articles are available in literature on the morphometry of the tricuspid valve.

PURPOSE OF THE STUDY: The objective of this study is to describe in detail the morphometry of the Tricuspid valve in cadaveric human hearts in South Indian population.

MATERIALS & METHODS: A cross-sectional, descriptive study was conducted on 45 cadaveric human hearts by conventional dissection technique and a detailed morphometry of the tricuspid valve was studied.

RESULTS: The mean total annular length of the tricuspid valve orifice was 10.91 ±1.00cm. The mean annular length of each leaflets were 4.55 ± 0.51cm; 3.37 ± 0.76cm and 2.70 ± 0.69cm. The mean height of each leaflets were 1.82 ± 0.36cm; 1.60 ±0.31cm and 1.20 ± 0.43cm. The mean height of each commissures were 1.06 ±0.30cm; 0.74 ± 0.28cm and 1.04 ±0.32cm.

CONCLUSION: The mean annular length & height of the leaflets of the tricuspid valve in south Indian population show a considerable difference with other Indian studies and also with western population. The measurements of the accessory leaflets and height of commissures were not available for the south Indian population in the literature, hence this study will be helpful for surgeons to plan commissurotomy and commissuroplasty for south Indian population.

KEYWORDS

Right Atrio-Ventricular Orifice, Tricuspid Valve, Tricuspid Leaflets, cardiac valves, commissure.

INTRODUCTION

The Tricuspid valve complex or the Right atrio-ventricular valve complex is present in between the right atrium and right ventricle. It consists of Tricuspid orifice and its associated annulus; Valvular leaflets or cusps; Commissures between the cusps; Supporting chordae tendinae of various types and Papillary muscles. The tricuspid valve is a heterogeneous structure with great variability. Because of its structural complexity it is difficult to assess tricuspid valve completely on two- dimensional echocardiography and so the knowledge of the tricuspid valve has always lagged behind mitral valve. But a new rotational two-dimensional echocardiographic technique showed that the tricuspid annular size varied during cardiac cycle and it provides additional information about normal and abnormal size and function of the tricuspid valve annulus.1It seems reasonable to calculate the height of the commissure in normal hearts in order to assess the criteria for distinguishing the normal and the pathological valvular stenosis [1]. But studies on height of commissure were very scarce. Following valve replacement surgeries, some patients may show little improvement in functional status, in part because their prosthesis is restrictive at rest. Improved prosthestic design, valve repair whenever possible, and annular enlargement procedures would be required to eliminate this size disparity[2].Hence, measurement of various parameters of normal tricuspid valve in formalin-fixed human hearts can serve as a baseline data for cardiac surgeons and bio-prosthesis manufacturers.

MATERIALS & METHODS

A cross-sectional descriptive study was conducted over 45 apparently normal formalin-fixed cadaveric human hearts of unknown age, sex and cause of death, of which 30 hearts were obtained from the Department of Anatomy, Tagore Medical College & Hospital, Rathinamangalam and 15 hearts were obtained from the Department of Anatomy, SRM Medical College Hospital & Research center, Potheri. Conventional dissection was done in each heart, the right atrium and ventricle were incised along their right lateral wall, the walls were carefully retracted, and the interior was thoroughly washed with saline. The tricuspid valve was then opened by cutting through the annulus fibrosus between the anterior and posterior leaflets. The tricuspid valve complex was examined and photographed in situ [3]. The measurements of different components of the tricuspid valve complex were measured using non-stretchable nylon thread, divider and metric ruler. The findings were tabulated and the parameters applied for statistical analysis are: (i) Range (ii) Mean ± Standard deviation.

RESULTS

Tricuspid valve Annulus –Annular Circumference

In each of the 45 cadaveric human hearts, detailed examination of the tricuspid annulus, leaflets, and commissures was carried out. The annular circumference is measured using a thread and a millimeter scale along the boundary of the annulus conforming to its shape. [Fig.1]. The circumference of the tricuspid annulus in 45 hearts, ranged from 8.7-12.9 cm, with a mean value of 10.91 ± 1.00 cm**.**

Fig. 1:-photograph Showing The Method To Measure Total Annular Length Of The Trciuspid Valve

Tricuspid leaflets

The height is measured as a perpendicular line from the base of attachment of the leaflet to the centre of free edge of leaflet [Fig2(a)& (b)]. The dimensions of the leaflets of the tricuspid valve are tabulated. The annular length of anterior leaflet ranged from 3.7-5.6 cm with a mean value of 4.55 ± 0.51 cm. The height of anterior leaflet ranged from 1.2-2.6 cm with a mean value of 1.75 ± 3.1cm. The annular length and height of the posterior leaflet were measured in the same way as the anterior leaflet. The annular length of the posterior leaflet ranged from 1.8-5 cm with a mean value of 3.37 ± 0.76 cm. The height of posterior leaflet ranged from 1.0-2.2 cm with a mean value of 1.62 ± 0.31 cm. The annular length and height of the septal leaflet were measured using thread, divider and a millimeter scale in the same way as the anterior leaflet. The annular length of the septal leaflet ranged from 1.2-4.2 cm with a mean value of 2.70 ± 0.69.cm; The height of the septal leaflet ranged from 0.8-2 cm with a mean value of 1.20 ±0.43 cm. The annular length of the accessory leaflet ranged from 1.5-2.4 cm with a mean value of 1.97 ± 0.4 cm. The

height of the accessory leaflet ranged from 0.8-1.3 cm with a mean value of 1.12 ±0.28 cm. (Table I & Table II)

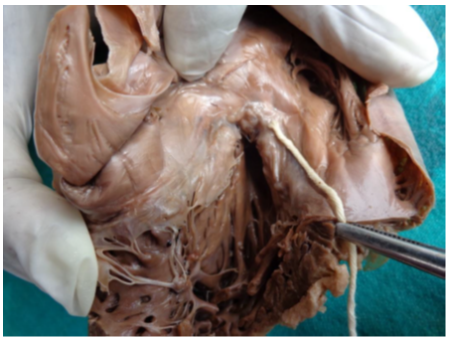

Fig. 2(a):- Photograph Showing The Method To Measure The Annular Length Of A Leaflet.

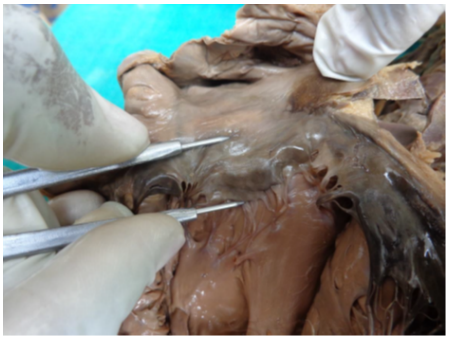

Fig. 2 (b):- Photograph Showing The Method To Measure The Height Of A Leaflet

Table I : Mean Annular Length Of Leaflets:

LEAFLETS	RANGE	MEAN	S.D (±)
ANTERIOR	3.7-5.6cm	4.55cm	0.51
POSTERIOR	1.8-5 cm	3.37 cm	0.76
SEPTAL	1.2-4.2 cm	2.70cm	0.69
ACCESSORY	1.5-2.4 cm	1.97cm	0.4

Table II: Mean Height Of Leaflets:

LEAFLETS	RANGE	MEAN	S.D (±)
ANTERIOR	1.2-2.6cm	1.82cm	0.36
POSTERIOR	1.0-2.2 cm	1.62cm	0.31
SEPTAL	0.8-2 cm	1.20cm	0.43
ACCESSORY	0.8-1.3 cm	1.12cm	0.28

Heights Of Commissures

The heights of the commissures were measured by using divider and a millimeter scale(Fig 3). The heights of the commissures ranged from: Anteroposterior- 0.6-1.4cm; Posteroseptal- 0.4-1.1cm; Anteroseptal- 0.4-1.6cm. The mean values of the heights of commissures were: Anteroposterior- 1.06 ± 0.30cm; Posteroseptal- 0.74 ± 0.28cm; Anteroseptal- 1.04 ± 0.32cm. In Subtype 2A (3hearts), the average of the height of commissure between the posterior and accessory leaflet was 0.86 ± 2.1cm and the average of height of commissure between the accessory and septal leaflet was 0.63 ± 0.12cm(Table III). In Subtype 2C (1heart), the height of commissure between the anterior and accessory leaflet was 1.1cm and between the accessory and posterior leaflet was 0.8cm.(Table III).

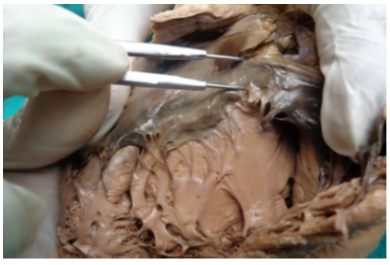

Fig. 3:- Photograph Showing The Method To Measure The Height Of A Commissure

Table III: Heights Of Commissures In 4-cuspidal Form:-

Subtype 2A	Ht. of commissure	Subtype 2C	Ht. of commissure
Bet. Posterior & Accessory leaflet	0.86cm	Bet. Anterior & Accessory leaflet	1.1cm
Bet. Accessory & Septal	0.63cm	Bet. Accessory & Posterior leaflet	0.8cm

DISCUSSION

In this study, various parameters of the tricuspid valve were compared with both Indian and western population and the results were found to be variable. The mean annular circumference of the tricuspid valve coincides with Kalyani et al., [4], M. Skwarek et al., [5] and lesser than studies by John F. Seccombe et al., [6] & Motabagani [7]. The mean annular length of anterior leaflet coincides with Kalyani et al., [4] and higher than other studies. The mean height of the anterior leaflet in the present study was less compared with the Motabagani [7] study. The mean annular length of the posterior leaflet in the present study coincides with M. Skwarek et al., [5]and higher than studies conducted by Mohamed A.B. Motabagani [7] and Kalyani et al., [4]. The mean height of the posterior leaflet in the present study was less compared with the Motabagani [7] study.

The mean annular length of septal leaflet coincides with M.Skwarek et al., [5]study and lesser than studies done by Motabagani [7], and Kalyani et al., [4]. The mean height of septal leaflet was lesser than the study done by Mohamed A.B. Motabagani[7]In the present study, the annular length of the accessory leaflet in Subtype 2A was higher and in Subtype 2C it coincides with M. Skwarek et al., [8].Whereas height of the accessory leaflet in the present study was less when compared with M. Skwarek et al., [8].

The mean heights of the commissures between each leaflet were compared with previous studies. In 3- cuspidal form, the observed mean heights of Anteroposterior (AP), Posteroseptal (PS) and Anteroseptal (AS) commissures coincides with the study by Mohamed A.B. Motabagani[7]. And the values were higher than the study by Ashraf M. Anwar et al., [9].[AP- 0.51± 0.11cm; PS- 0.52 ± 0.15cm; AS- 0.54 ± 0.15cm].In 4-cuspidal form with Subtype 2A (3hearts) and Subtype 2C (1 heart), there was no literature available to compare the heights of commissure between the accessory and usual leaflets. So the results show that there is considerable difference in variable parameters of tricuspid valve in South-Indian population compared with the western studies. This could be attributed to the racial difference, the taller and heftier western population has increased dimensions compared to the smaller Indian population. The reports by C Tei et al.,[10] and Anwar et al.,[9] have indicated that tricuspid annulus diameter and dimensions of the valve orifice closely correlated with age, body weight, height and body surface area. But since our study used cadaveric hearts procured during routine dissection for undergraduate students we couldn't find the above said relationship between dimensions of tricuspid valve and body surface area.

CONCLUSION

In the present study, morphometry of the tricuspid valve complex was studied and then compared and analysed with the works of many eminent scientists in this field. The morphometric analysis of the tricuspid valve complex will be useful for cardiac surgeons for determining the size of the prosthetic valve replacement, valvuloplasty and artificial chordae tendineae replacement. This study will be helpful for surgeons to plan commissurotomy and commissuroplasty in Indian population since the measurement of height of accessory leaflets and commissures were not available in the Indian literature. Also, the knowledge of the dimensions of the tricuspid annulus helps in distinguishing cardiac from non-cardiac causes of death, at autopsy. Hence, we conclude that the dimensions of the tricuspid valve will serve as reference data for further studies and in patients with various cardiac valve abnormalities.

REFERENCES

1. M.Skwarek, J.Hreczecha, M. Dudziak, J.Jerzemowski, M. Szpinda, M. Grzybiak,(2004).“Morphometric features of the right atrioventricular orifice in adult human hearts”; Folia Morphol.;67(1):53-57.
2. Steve Westaby, MD., Robert B. Karp, MD., Eugene H. Blackstone, MD.,Sanford P. Bishop, DVM,PhD,(1984). “Adult Human Valve dimensions and their surgical significance”. Am J Cardiol; 53: 552-556.
3. Mohamed A.B.Motabagani, (2006-07). Comparative Anatomical, Morphometric and Histological Studies of the Tricuspid Valve-Complex in Human and Mammalian Heart. Journal of Anatomical Society, India;Vol.55:No.1

4. R.Kalyani, M.J. Thej, Prabhakar K., Venkatesh T.K.,A.K.Thomas, Kiran J July,(2012). "Morphometric analysis of tricuspid valve: An Indian perspective"; Journal of Natural Science, Biology and Medicine; vol 3(2):147-151.
5. Magdalena Skwarek, Jolanta Hreczecha, Marek Grzybiak, Adam Kosinski, (2008). "Unusual anatomical features of the right atrioventricular valve"; Folia Morphol.; vol 64(3):183-187.
6. John F. Seccombe, Donald R Cahill, Dr.William D. Edwards, (2002). "Quantitative Morphology of the normal human tricuspid valve: Autopsy study of 24 cases"; Clinical Anatomy journal; vol 6 (4): 203-212.
7. Mohamed A.B.Motabagani,(2006). Comparative Anatomical, Morphometric and Histological Studies of the Tricuspid Valve-Complex in Human and Some Mammalian Heart. Journal of Anatomical Society, India;Vol.55:No.1).
8. Magdalena Skwarek, Marek Grzybiak, Adam Kosinki, Jolanta Hreczecha; "Notes on the morphology of the tricuspid valve in the adult human heart"; Folia Morphol.;2007 vol.63(3), pp.319-324.
9. Ashraf M. Anwar, Marcel L. Geleijnse, Osama I.I. Soliman, Jackie S.McGhie, Rene Frowijn, Attila Nemes, Annemien E. van den Bosch, Tjebbe W. Galema, Folkert J. ten Cate, (2007). "Assessment of normal tricuspid valve anatomy in adults by real-time three-dimensional echocardiography";Int J Cardiovasc Imaging; vol 23:717-724.
10. C Tei, J P Pilgrim et al, P M Shah, J A Ormiston and M Wong,(1982)."The tricuspid valve annulus: study of size and motion in normal subjects and in patients with tricuspid regurgitation" Circulation.;vol.66(3):665-671