

Original Article

Gender differences in the dimensions of tricuspid valve orifice and leaflets in the Bangladeshi population - a morphometric study

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Abstract:

Background: The present study aims to measure the circumference, length, and breadth of the different leaflets of the tricuspid valve orifice in men and women to enable improved treatment and management for cardiac patients in future. **Materials and methods:** In this cross-sectional study, samples of the cadaveric heart (41 male, 19 female, and age ranging between 20 and 70 years) were collected within 12–24 hours of death from unclaimed dead bodies that were autopsied in the morgues of Sir Salimullah Medical College (SSMC) and Dhaka Medical College (DMC), Dhaka, Bangladesh. Unpaired t-test was conducted to determine significant gender differences using SPSS 16. **Results:** There were no significant difference in the circumference, length, and breadth of the anterior, posterior, and septal leaflets of tricuspid valves between men and women. **Conclusion :** The circumference, length, and breadth of the anterior, posterior, and septal leaflets of tricuspid valves are similar between men and women in the Bangladeshi population. Therefore, there will be no specific difference in the surgical and therapeutic treatment for men and women.

Keywords: Human heart; tricuspid valve orifice; circumference; leaflets; cadaveric heart.

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Introduction

Extensive knowledge of the heart is necessary for treatment and therapy by cardiologists in cardiothoracic surgery, forensic medicine, etc. The four chambers of the heart, that is, the two upper atria and two lower ventricles are separated by two valves. The right atrioventricular valve is called the tricuspid valve¹. The human tricuspid valve has three (anterior, posterior, and septal), two, and four leaflets in 62%,

30%, and 8% of the population, respectively². The tricuspid valve orifice is larger than the mitral valve (the left atrioventricular valve) orifice, and it measures an average of 10–12 cm diameter in adults. The orifice is oval or circular depending on the phase of the cardiac cycle¹. Different diseases depend on the complexity of the tricuspid valve³. To treat different valvular diseases with surgery, anatomical knowledge of the tricuspid valve is important⁴.

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Moreover, it is helpful in the practice of various types of valve surgery, such as in the partial transfer of leaflets of the tricuspid valve to the mitral valve for repairs⁵⁻⁷. Right annular dilation and right ventricular enlargement cause tricuspid valve regurgitation⁸⁻⁹. Infective endocarditis which commonly occurs in intravenous drug abusers can directly affect the tricuspid valve¹⁰⁻¹². Thus, anatomical knowledge of the tricuspid valve has great clinical importance and can help in the improvement of cardiothoracic surgery and the development of innovative operating techniques¹¹.

So far, there are few studies on the anatomy of the tricuspid valve in the Bangladeshi population.

Tricuspid and pulmonary valve abnormalities are more common in India, Pakistan, Bangladesh, and other developing countries than in North America or Western Europe¹³. In addition, the anatomy of the tricuspid valve may differ across various groups of people in different geographic areas. Therefore, the Bangladeshi population may have its own range of variations. This study aims to see the anatomical measurement of the tricuspid valve in a Bangladeshi population and evaluate whether any the gender differences exist. This data can be used by interventional cardiologists, cardiac surgeons, and forensic scientists.

Materials and Methods



Figure 1: Tricuspid valve orifice (TVO) was shown in a cadaveric heart.



Figure 3: Measurement of the length of the posterior leaflet of a tricuspid valve in a cadaveric heart.

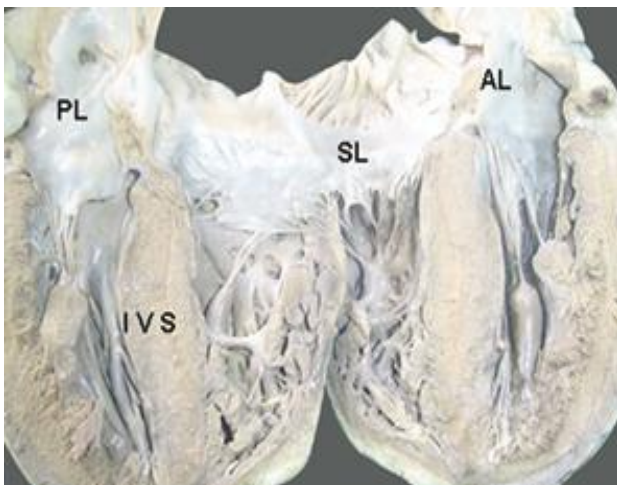


Figure 2: Interventricular section of a cadaveric heart to show tricuspid valve leaflets: IVS= Inter Ventricular Septum, AC= Anterior Leaflet, SC= Septal Leaflet, PC= Posterior Leaflet.



Figure 4. Measurement of the breadth of the septal leaflet of tricuspid valve in cadaveric heart.

Sample hearts collection

This was a cross-sectional study. We obtained 60 normal human hearts from the cadavers (41 male and 19 female) and measured the circumference of orifice, length, and breadth of the different leaflets in the tricuspid valve. The age range was 20–70 years in both groups. We collected cadaveric hearts from unclaimed dead bodies with no putrefaction within 12–24 hours of death. The ages of the cadaveric hearts were obtained from the record books, and all bodies were autopsied at different dates in the morgues of the department of forensic medicine of Sir Salimullah Medical College (SSMC) and Dhaka Medical College (DMC), Dhaka, Bangladesh. All

hearts that were studied were normal, and putrefied, injured, or diseased hearts were excluded. The measurements were taken at the Department of Anatomy, Sir Salimullah Medical College (SSMC).

Methodology of measurement

At the beginning of the measurement, each heart was segmented on the exterior along the line of the commissure of the right atrioventricular valve. A slit was made from the right atrium to the apex of the right ventricle, and the opened hearts were washed with tap water to remove blood clots. The cleaned hearts were preserved with 10% formalin¹³. Figure 1 and 2 shows an example of an open cadaveric heart along with the valves and leaflets, respectively.

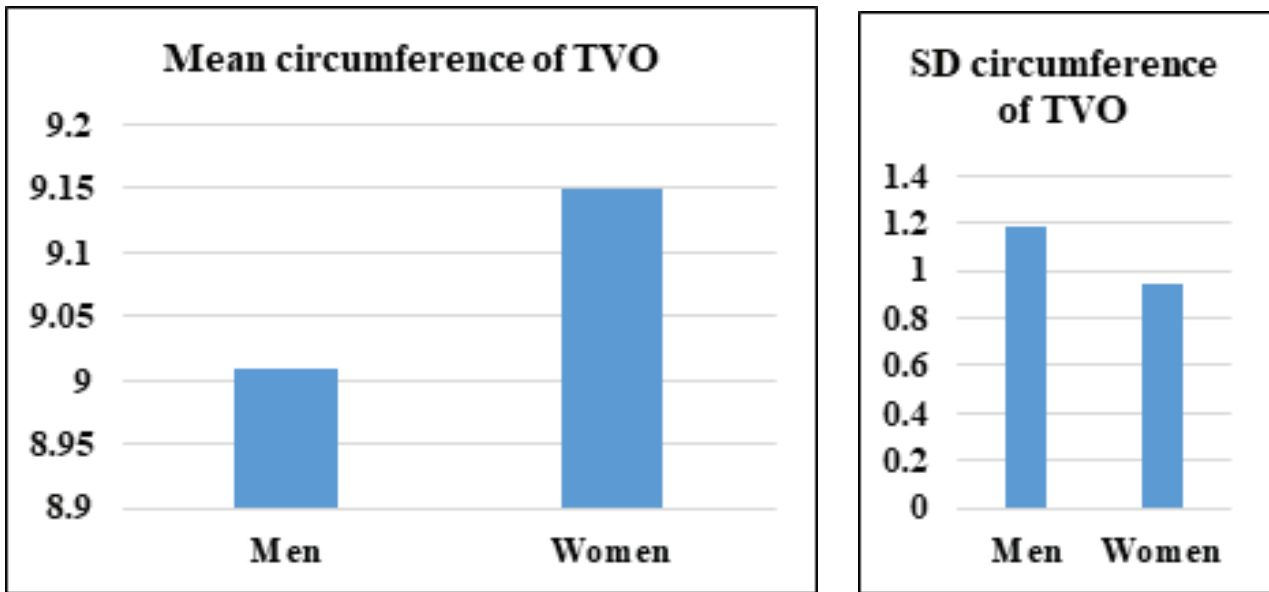


Figure 5: Mean (in cm²) and SD values of circumference of tricuspid valve orifice (TVO) were shown in this bar chart between groups.

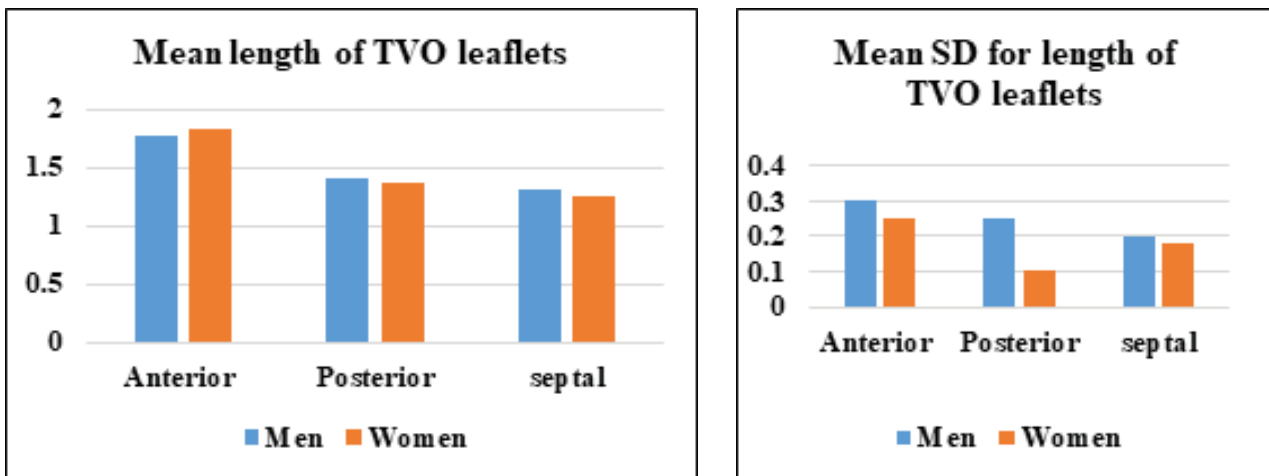


Figure 6: The bar chart showed the mean length (in cm) and SD values of tricuspid valve orifice between groups.

We measured the circumference of the orifice with a flexible metallic guide wire. The length of all 3 leaflets (anterior, posterior, and septal) was measured from base of the annulus to the apex of chordal attachment by a geometric divider (Figure 3). The breadth of all 3 leaflets was assessed with a geometric divider along the anterior-posterior, posterior-septal, and anterior-septal commissure for the anterior, posterior, and septal leaflets, respectively (Figure 4).

Data analysis

All the measurements were made in cm by means of a metric ruler. We measured all variables thrice and obtained the average of the three values. Statistical analysis was performed using Statistical Package for Social Sciences (SPSS) version 16. Unpaired t-test was used to determine the significance of the difference in the variables between men and women.

Ethical clearance: We obtained ethical approval from the Ethics Review Committee of Sir Salimullah Medical College, Dhaka, Bangladesh, before beginning the study dated 26 July 2010.

Results

The mean (standard deviation, SD) annular circumference of the tricuspid valve orifice was 9.01 cm² (1.19) and 9.15 cm² (0.94) in men and women, respectively. No significant difference ($p > 0.05$) was found between the two groups based on unpaired t-test (Figure 5). There was no significant difference in the mean length of the anterior, posterior, and septal leaflets between the two groups (Figure 6). As shown in the bar chart representation in Figure 7, the mean (SD) breadth of the anterior, posterior, and septal leaflets was 2.59 cm (0.55), 2.20 cm (0.52), and 2.04 cm (0.30) in men and 2.59 cm (0.46), 2.26 cm (0.39), and 1.99 cm (0.46) in women, respectively, and there was no significant difference in the mean breadth of the anterior, posterior, and septal leaflets between the two groups.

Discussion

We measured the difference in the circumference, length, and breadth of the leaflets of tricuspid valve orifice between men and women in Bangladesh. Nevertheless, we found that there was no substantial deviation in the circumference, length, and breadth of tricuspid valve orifice between two groups.

In general, the diameter of the tricuspid valve orifice

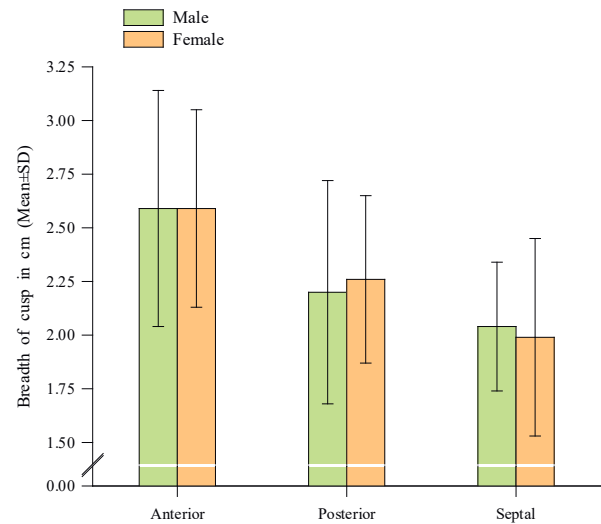


Figure 7. The mean breadth (in cm) of anterior, posterior and septal tricuspid valve leaflets in both groups.

circumference can vary between 10–12 cm. The circumference of the tricuspid valve is larger in the Western population (11.63 cm² in men and 10.4 cm² in women) than in the Bangladeshi population^{14,15}. Another study revealed that the tricuspid valve circumference ranged from 11.8 to 13.9 cm in men and 11.3 to 12.4 cm in women². Moreover, the people who died of cardiac diseases have a larger circumference than those who died of non-cardiac diseases in both groups¹³. The circumference of the tricuspid valve is directly correlated with the age, weight, height, and body surfaces¹⁶. Therefore, we can assume that the circumference of the tricuspid valve is smaller in the Bangladeshi population than in the Western population since the height, weight, and body surfaces are larger in the Western population than in the Bangladeshi population^{1,2,13,15,16}. Our result is consistent with that of Begum et al., (1996)¹⁷. However, we were unable to measure the height, weight, and body surface in our study population.

The lengths of the anterior, posterior, and septal leaflets of tricuspid valve vary according to the weight, height, and body surface of the population. Accordingly, the length of the anterior, posterior, and septal leaflets was shorter in the Bangladeshi population than in the Western population^{13, 18}. Moreover, these results are consistent with a previous study¹⁷.

The breadth of the anterior, posterior, and septal leaflets of tricuspid valves was higher in individuals

who died of cardiac reasons than in those who died of non-cardiac reasons in both men and women^{12, 13}. However, in our study, the breadths were smaller than that measured in previous studies in the Western¹³ or Bangladeshi population¹⁷. This may be because of the difference in some measurement techniques or cadaveric heart preparation procedures between our study and the study done by Begum et al.¹⁷.

Conclusion

To determine the differences in the surgical and therapeutic treatment of the tricuspid valve between men and women, we measured the circumference, length, and breadth of the leaflets of tricuspid valve orifice in the Bangladeshi population. There is no significant difference in these variables between the two groups. Therefore, our study concluded that there is no difference in the surgical and therapeutic treatment between men and women in Bangladesh. Moreover, the anatomical data of the tricuspid valve orifice will be useful for the clinicians, cardiologists, anatomists, and forensic specialists in deciding the diagnosis and management of different abnormalities.

Conflict of Interest: None

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Authorship Contribution Details

LS, HN helps in concept, design, data acquisition, manuscript editing, LS & SK collected data; LS wrote the first draft; SK helps in manuscript writing. SK & NR help in data analysis, statistical analysis, and manuscript review. TB overviewed, rechecked and rearranged the final draft of this manuscript. TB also contributed financial support for English edit of this manuscript. NI helps for manuscript editing. BP contributes to find the literature review & data acquisition.

Limitations of this study

1. Unequal sample size between groups.
2. Formalin soaked specimens might have changed the physical dimensions of the hearts.

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