Section: Anatomy

Original Research Article

MORPHOMETRIC STUDY OF MITRAL VALVE IN TAMIL NADU POPULATION (CADAVERIC STUDY)

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ABSTRACT

Background: Morphometric study or shape, of the mitral valve (MV) is key to many aspects of functions and disease as identified by clinical studies; hence, the study of MV of cadavers has clinical significance. **Materials and Methods:** 30 (thirty) non-pathological cadaveric human hearts were studied. The left atrium was opened along the left border of the heart so as to expose the mitral valve. Different parameters of M.V. are studied with a mean value (±SD). **Results:** The maximum circumference of the MV was 9.9, the minimum was 8.3, and the length of the anteriorleaflets was 2.2 cm and the posteriorleaflets was 1.8 (cm). Thickness of anterior leaflets 0.3 (cm) posterior leaflet: 0.3 (cm) minimum length of ant. leaflet: 1.2 cm, 1.2 post leaflet. The minimum thickness of the anterior leaflet is 0.1 cm, while the posterior leaflet is also 0.1 cm. The number of papillary heads was 53.3%, while the number of single muscle heads was 23.3%. The maximum length of papillary muscle was 2.2 cm, and the minimum was 1.3 cm. **Conclusion:** Present anatomical study of the mitral valve is useful to radiologists, cardiologists, and cardiac surgeons to compare the abnormal parameters of MV.

INTRODUCTION

The mitral valve (MV) is one of the heart's four valves, lying between the left atrium and the left ventricle.[1] It prevents blood flowing backwards as it moves through the heart, and it has complex geometry, comprising the mitral annulus, the anterior and posterior leaflets and the sub valvular apparatus.[2] The latter is formed by the chordae tendineae and the papillary muscles (PM), which are inserted into the left ventricular wall. These structures work in synchrony towards an effective mechanism to enable closing and opening through the cardiac cycle.[3]

The morphometry of the mitral valve is key to many aspects of its function and disease as identified in clinical studies.[4] Hence, morphometric studies of the MV of cadavers preserved in formalin were studied to evaluate the normal structures of the mitral valve (MV).

MATERIALS AND METHODS

30 (thirty) non-pathological, dissected hearts of the cadavers present in the dissection theater of the Indira Medical College and Hospital, VGR Nagar, Pandur, Tiruvallur, Tamil Nadu-631203, were studied.

Inclusion Criteria: The dissected heart preserved in formalin were selected for study.

Exclusion Criteria: Pathological hearts with congenital anomalies torn during dissection were excluded from the study.

Method: Cadaveric hearts were washed and opened along the left border through the atrio-ventricular value. The cavity of the left atrium was opened. The left atrioventricular orifice was cleared by removing clots. The maximum and minimum diameters of the opening were measured with a venire caliper. Then the cavity of the left ventricle was opened and cleared to study the mitral valve complex. The circumference of the mitral valve was measured by cotton thread and measured on simple scale. The number of heads of papillary muscles and the length of the papillary muscles of the mitral valves were also noted.

The duration of the study was April 2025 to May 2026.

Statistical Analysis: Mean values (± SD) of circumference of mitral valve, length and thickness of leaflets, number of heads of papillary muscles, and length of papillary muscle mean values were recorded. The statistical analysis was carried out using SPSS software. The ratio of male and female cadaveric hearts was 3:1.

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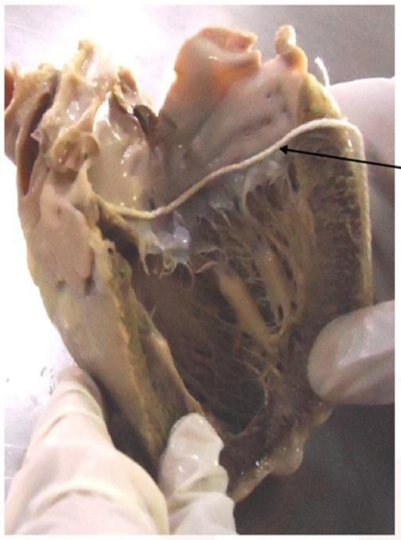

Figure. 1: measuring the annular circumference of mitral valve.

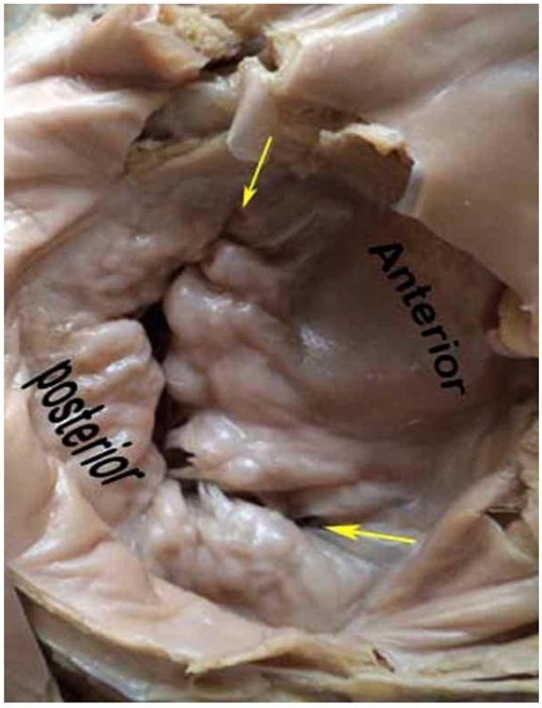

Figure 2: mitral valve observed from the atrial side in normal anatomical position of the heart. The major commissures (arrows) separate the two leaflets

RESULTS

Table 1: Length and thickness of anterior and posterior leaflets (in cms)

Length

Maximum length: 2.2 - ant leaflet,
1.7post-leaflet

Minimum length: 1.3 ant leaflet
1.2 postleaflet

Mean value 1.8 (± 0.2) ant. leaflet

Mean vlaue 1.4 (± 0.1) post. leaflet

Thickness

Maximum: 0.3 - ant leaflet,
0.3postleaflet

Minimum: 0.1ant leaflet
0.1 postleaflet

Mean value: 0.2 (±0.01) ant leaflet
0.2 (±0.01) post leaflet

Table 2: Study of the number of heads of papillary muscles observed in mitral value

Anterior papillary Muscles:

No. of heads: 16 (53.3%) were single, 7 (23.3%) were double, 5 (16.6%) were triple, 2 (6.6%) were more than triple

Posterior papillary muscles:

14 (46.6%) single, 8 (26.6%) double, 6 (20%) triple, and 2 (6.6%) more than triple

Table 3: Study of the length of the papillary muscles of the mitral valve (in cm)

- **Length of ant. lat. papillary muscle:**
  2.2 Maximum
  1.3 Minimum
- **Mean value 1.8 (± 0.1) length of post-lateral medial papillary muscles**
  2.0 Maximum Length
  1.1 Minimum length

Mean value 1.7 (±0.2)

Table 4: Comparative study of circumference of mitral valve orifice in formalin preserved heart.

In present study: 9.9 Maximum (cms)
8.3 Minimum (cms)

Mean value 8.99 (±0.7)

These findings are more or less in agreement with previous studies.

Table 1: Length and thickness of anterior and posterior leaflets (in cms) (30 male cadaveric heart)

Parameters	Length (cms)		Thickness (cms)	
	Ant. Leaflet	Post leaflet	Ant. Leaflet	Post leaflet
Maximum length	2.2	1.7	0.3	0.3
Minimum length	1.3	1.2	0.1	0.1
Mean value (±SD)	1.8 (±0.2)	1.4 (±0.1)	0.2 (±0.01)	0.2 (± 0.01)

Table 2: Study of number of heads of papillary muscles observed in mitral valve Total No. of cadavers: 30

Antero-lateral papillary muscle			Postero Medial papillary muscle		
No. of Heads	No. of Spaceman	Percentage	No. of Heads	No. of Spaceman	Percentage
Single	16	53.3	Single	14	46.6
Double	7	23.3	Double	8	26.6
Triple	5	16.6	Triple	6	20
More than triple	2	6.6	More than triple	2	6.6

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Table 3: Study of length of papillary muscles of mitral valve (in cms)

Details	Length of antero-lateral papillary muscle	Length of posterior-medial papillary muscle
Maximum length	2.2	2.0
Minimum length	1.3	1.1
Mean value (± SD)	1.8 (±0.1)	1.7 (±0.2)

Table 4: Comparative study of circumference of Mitral valve orifice in formalin preserved heart (in cms)

Name and Year	Maximum	Minimum	Mean value (± SD)
Chiechi and Lee 1956	11.5	8.5	10 (± 0.9)
Kulkarni PR, Makandar. UK 2012	9.7	8.2	8.97 (± 0.7)
Ravi Shankar 2024	9.8	8.3	8.98 (±0.8)
Present study 2026	9.9	8.3	8.99 (±0.7)

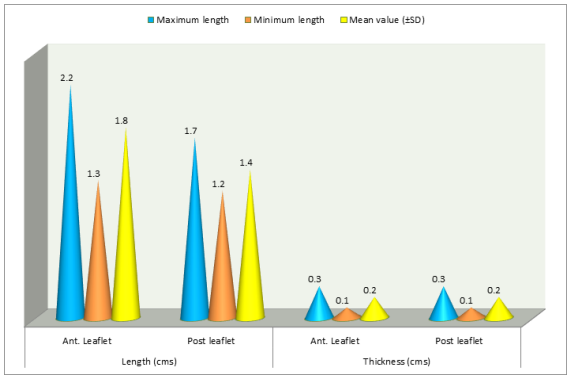

Figure 1: Length and thickness of anterior and posterior leaflets (in cms)

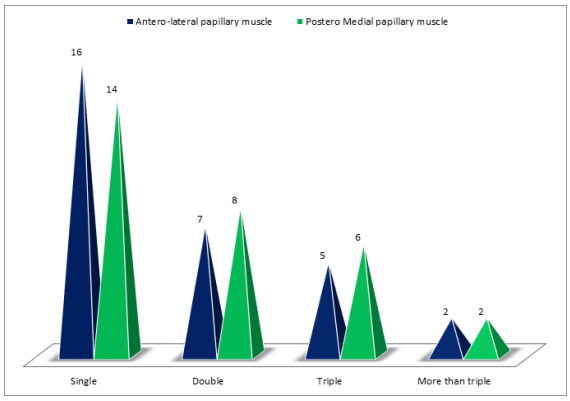

Figure 2: Study of number of heads of papillary muscles observed in mitral valve

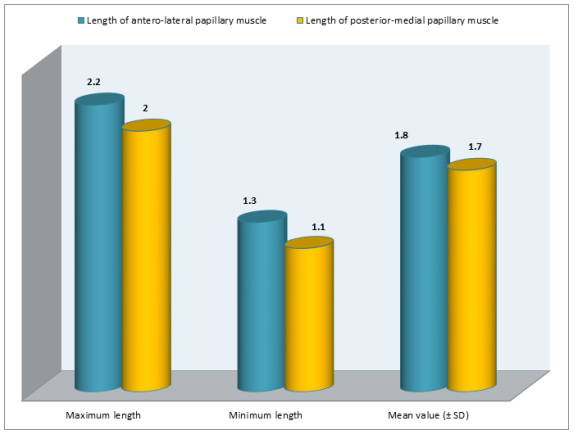

Figure 3: Study of length of papillary muscles of mitral valve (in cms)

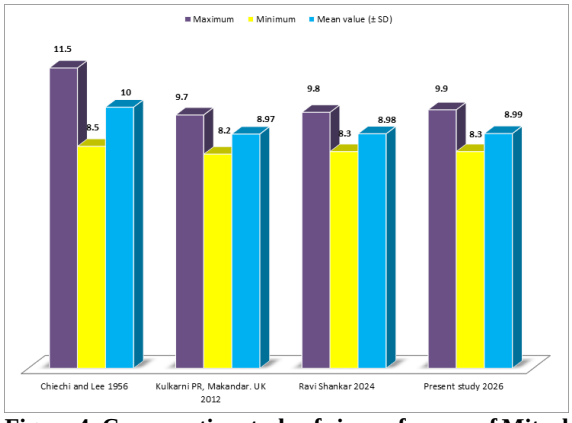

Figure 4: Comparative study of circumference of Mitral valve orifice in formalin preserved heart (in cms)

DISCUSSION

In the present morphometric study of the mitral valve in cadavers in the study of the length and thickness of anterior and posterior leaflets (cms), the anterior leaflet maximum length is 2.2, the minimum length is 1.3, and the mean value is 1.8 (± 0.2). In the posterior leaflet, maximum length was 1.7 (cm), minimum length was 1.2 (cm), mean valve was 1.4 (±0.01). The maximum thickness is 0.3 (cm) in the anterior leaflet, the minimum is 0.1, and the mean value is 0.2 (±0.1). The thickness of the posterior leaflet maximum was 0.3, the minimum was 0.1, and the mean value was 0.2 (± 1.1) (Table 1). In the study of the number of heads of papillary muscle observed in the MV, 16 (53.3%) were single, 7 (23.3%) double, 5 (16.6%) triple, 2 (6.6%) medial papillary muscles: 14 (46.6%) single, 8 (26.6%) double, 6 (20%) triple, and 2 (6.6%) more than 3 heads (Table 2). In the study of the length of papillary muscles of MV (in cms), the length of the anterolateral papillary muscle is a maximum of 2.2 (cms), a minimum of 1.3 (cms) mean value of 1.8 (± 0.01). The length of the postero-medial papillary muscle – the maximum length was 2.0 (cms) the minimum length was 1.1, with a mean value of 1.7 (± 0.02) (Table 3) The maximum circumference of MV was 9.9 cm, and the minimum circumference was 8.3 cm. mean value was 8.99 (±0.7) (Table 4) (Figures 1 and 2). These findings are more or less in agreement with previous studies.[5,6,7] The mitral valve (MV) develops from the cushion tissue and myocardium of the ventricle. Abnormal

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splitting of the cushion tissue may result in an increased number of cusps.[8] The technique of cusp commissuroplasty can be used to reconstruct atrioventricular valves that have been damaged by endocarditic damage to the commissure and adjacent cusps. An increase in the number of cusps and their improper approximations will be more likely to cause various valvular disorders.

Mitral valve repair is considered the gold standard to treat mitral regurgitation. The re-emergence of the edge-to-edge approximation of the leaflets is commonly called the Alferi technique. This technique helps for suturing anterior and posterior leaflets at a single point midway between the circumferences of the leaflets, creating the double orifice. This technique for mitral valve repair is a simple solution for the complex problems of MV.[9]

Congenital increase in the number of cusps may increase the chances of mitral valve regurgitation with disturbances in edge-to-edge cusp closure. It is also reported that there were variations in quantities of cusps because small accessory cusps are always found between two major cusps of MV. It impairs normal blood flow and leads to the regurgitation of blood.[10]

Conservation MV repair with preservation of annul papillary muscle continuity by retaining the sub-valvular apparatus is possible if there is a proper approach to MV with complete anatomical knowledge.

CONCLUSION

Present study of M.V. in cadaveric heart. The M.V. was exposed, and the length, breadth, and thickness of the M.V. were noted. The arrangement of M.V. and its contents are important for clinicians, surgeons, and echocardiologists because M.V. is approached in orthogonal, cross-sectional, and short axial planes. Moreover, the AV (atrio-ventricular) bundle is more or less directly related to M.V. Hence, a morphometric study is important for cardio-thoracic surgeons to avoid damage to the A.V. bundle during surgery.

Limitation of study: owing to the tertiary location of the research center, the small number of cadaveric hearts, and the lack of the latest technique, we have limited findings and results.

- This research work was approved by the ethical committee of Indira Medical College and hospital, VGR Nagar, pandur, Tiruvallur, Tamil Nadu-631203.
- No Conflict of Interest
- Self Funding

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