



## A MORPHOLOGICAL STUDY ON MODERATOR BAND IN HUMAN HEARTS

## Anatomy

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|----------------------------|----------------------------------------------------------------------------------------------------|
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## ABSTRACT

**Introduction:** Moderator band is a muscular trabecula which extends from interventricular septal wall to the base of anterior papillary muscle in right ventricle of heart. The moderator band carries the part of right bundle branch of the atrioventricular bundle of the conduction system of the heart to the anterior papillary muscle. **Aim of the Study:** The purpose of the study is to observe the morphology and to determine the variation in the moderator band of the heart. **Materials and methods:** A total of 45 formalin fixed cadaveric adult hearts were studied in the Department of Anatomy, Gauhati Medical College and Hospital for a period of 1 year. **Result:** The morphometric measurements like the average length, thickness and distance from tricuspid valve are tabulated as observed. **Conclusion:** An awareness of length and thickness helps the cardiologists and cardiothoracic surgeons to differentiate moderator band from other relevant structures.

## KEYWORDS

Moderator band, Right ventricle, Anatomy

## INTRODUCTION:

The interior of the right ventricle has a specialized bridge type of Trabeculae carneae known as the Septomarginal trabecula or 'Moderator band'. It connects the Septal band of Crista Supraventricularis to the Anterior Papillary muscle.<sup>1</sup> The Moderator Band carries the right branch of the atrioventricular bundle and it prevents over distension of the right ventricle hence the name. The blood supply is from the septal perforators of the left anterior descending coronary artery and posterior descending coronary arteries.<sup>16</sup>

It has been reported that Moderator band is related to onset of ventricular arrhythmias, Systolic Murmur, Idiopathic Tachycardia.<sup>16,17</sup> Loukas et al. (2010)<sup>7</sup> reported iatrogenic consequences following removal of Moderator Band. However several anatomical studies on the shape of the Moderator Band have revealed that it can take a variety of shapes. An abnormal Moderator Band has been reported to have clinical significance in the double-chamber right ventricle as well as atrial and ventricular septal defects.<sup>7,12,13</sup> The major impediment to repairing apical ventricular septal defects is the moderator band or any other such large trabeculations. The morphometric study of the moderator band may aid surgeons during surgical procedures to correct such defects. In this study the length, breadth, distance from tricuspid valve and presence of any morphological variation are noted.

## MATERIALS AND METHODS:

This study involved 45 formalin-soaked cadaveric hearts taken from the Department of Anatomy, Gauhati Medical College and Hospital, Guwahati. 10% Formalin, Scalpel, scissors, blunt-end forceps and pointed forceps, vernier callipers, pen, torch, digital camera were used during the study.

## Inclusion criteria:

Hearts dissected from donated adult cadavers received in the Department of Anatomy, Gauhati Medical College and specimen of previously stored adult human heart.

## Exclusion criteria:

Morphologically damaged heart, heart with pathological lesions, heart with developmental anomalies. The criteria like sex of the specimen were excluded from the study.

## The exposure of the interior of the right ventricle was done meticulously following the steps of dissection:

First a horizontal cut was made through the anterior wall of the right ventricle then with the help of scissor a cut parallel to the coronary

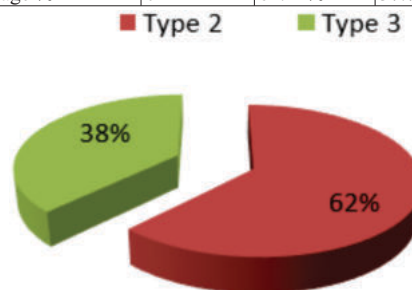
sulcus upto the inferior border of heart was made. Another cut made along the anterior interventricular groove then the flap of right ventricular wall is raised and the blood clots are washed out with water. The moderator band was identified as a fleshy band running from the apical part of the interventricular septum to the base of the anterior papillary muscle. The measurements are taken manually and noted down. All measurements were taken in millimetres. The results are documented and compared with previous studies. The length of the moderator band is taken from the interventricular septum to the base of the anterior papillary muscle, the breadth is taken at the midpoint of the band and the distance from the tricuspid valve is taken from the midpoint of the free margin of the cusp of the valve to the midpoint of the band.

## RESULTS:

The Moderator band was observed in all the 45 specimens (100%). Lee JY et al. (2019)<sup>11</sup> classified the Moderator band into three distinct types according to their shape: type 1 cylindrical column, type 2 long and thin column and type 3 wide and flat. Of which type 2 and 3 are most common. In our study we got most commonly the type 2 variant 28 specimen out of 45 (62.22%) and type 3 in 17 out of 45 (37.77%) and type 1 was absent. The Moderator band originated from a single root in 44 out of 45 specimens (97.77%). In one specimen a pair of roots was observed (2.22%). In all the specimen the moderator band originated from the middle third of the interventricular septum.

**Table 1:- Showing the types of three distinct shapes of Moderator Band**

|                   | Type 1 | Type 2 | Type 3 |
|-------------------|--------|--------|--------|
| Total number (45) | 0      | 28     | 17     |
| Percentage %      | 0      | 62.22% | 37.77% |

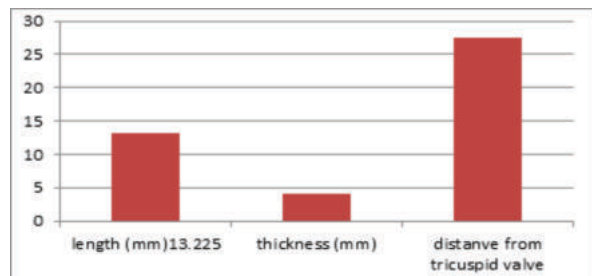


**Figure 1: Pie diagram showing the Morphological types of Moderator band**

The average length of the moderator band was 13.22mm with the SD of 2.79 and the average thickness being 4.18mm with the SD of 1.75. The average distance from tricuspid valve was 27.46mm with the SD of 4.67.

**Table.2: Showing Morphometry of Moderator Band**

|      | Length (mm) | Thickness(m) | Distance from free margin of the cusp of the Tricuspid valve(mm) |
|------|-------------|--------------|------------------------------------------------------------------|
| Mean | 13.22533    | 4.186667     | 27.46                                                            |
| SD   | 2.795363    | 1.757979     | 4.672159                                                         |



**Figure 2: Bar diagram showing the morphology of the Moderator band.**



**Figure 3: white arrow showing a long and thin column (type 2) variety of moderator band**



**Figure 4: Blue arrow showing wide and flat variety (type 3) of moderator band**



**Figure 5: showing the measurement of thickness of moderator band**



**Figure 6: showing the procedure of measuring the distance from tricuspid valve**



**Figure 7: Red arrow showing the origin of moderator band from middle 1/3<sup>rd</sup> of the interventricular septum**



**Figure 8: showing two roots (red arrow) of moderator band at its origin which joins and inserts at the base of the anterior papillary muscle.**

### DISCUSSION:

The anatomical study of moderator band is very important in correction of congenital ventricular septal defects<sup>3</sup>. A hypertrophy of moderator band can lead to double chambered right ventricle and which in turn leads to the stenosis of pulmonary outlet<sup>4</sup>. Earlier studies have reported different forms and morphological classifications of Moderator band. Depreux et al.<sup>9</sup> who investigated 100 hearts based on observations and measurements, classified three types of moderator band: I- muscular and thick, II- fibrous and thin, and III- fibromuscular.

The Results of the present study are compared with the earlier studies as shown in the table below

| Author                | Sample size | Mean Length  |
|-----------------------|-------------|--------------|
| Loukas M et al.       | 100         | 16.23±2.3mm  |
| Shenoy P et al.       | 50          | 15.06mm      |
| Raghavendra AY et al. | 20          | 13.82±3.94mm |
| Present study         | 45          | 13.22±2.79mm |

In Shenoy P et al.<sup>5</sup> study, the mean length was found to be 15.06mm. In Loukas M et al.<sup>7</sup> study, 42% of the hearts were short and thick with a mean length of 16.23 ±2.3 mm and the mean thickness was 4.5±1.8mm with a range of 1.3 to 8.4mm. In the study of Adam Kosinski et al.<sup>6</sup>, the thickness ranged from 3 to 5mm in 56% of the hearts. In our study we measured a mean thickness of 4.18mm. In Mamatha H et al.<sup>8</sup> in their study they found one moderator band of 1mm thick. In Raghavendra A Y et al.<sup>9</sup> study, the mean distance from tricuspid valve is found to be 36mm. In our study we measured a mean distance from the cusps of the tricuspid valve to be 27.46mm.

### Summary and Conclusion:

The role of Moderator band is to contract the Anterior Papillary Muscle to avoid tricuspid regurgitation by tensing the chordae tendineae. When the Moderator Band becomes unusually thick or expanded, it can impede blood flow to the pulmonary trunk, resulting in a double-chamber right ventricle or an apical ventricular septal defect<sup>[7,12,13,14]</sup>. As a result, removing the MB during the surgical repair of an apical ventricular septal defect may impair the normal function of Anterior Papillary Muscle. We would like to conclude that the current study's findings will add to the existing list of studies on the morphology of the moderator band and will be valuable in charting cardiac procedures.

**Conflict of Interest :-** None

**Source Of Funding :-** Self

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