

MORPHOMETRIC AND CLINICAL ANALYSIS OF MODERATOR BAND IN HUMANS

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ABSTRACT

Background: The moderator band has the right bundle of His within the right ventricle. It also is known to prevent the over dilatation of RV. It is important because of its involvement in RV infarcts, in differentiating RV from LV in congenital anomalies, in VPDs & VTs and in VSDs. The present literature is very much lacking in its morphometry.

Materials and Methods: Moderator band was looked for in 50 hearts and only in this study did we find it in all the hearts. The length, the thickness, the distance from the tricuspid valve along with the presence of any trabeculations in the septal end or in the papillary muscle end were looked for and recorded.

Results: The average length was 14.71 ± 4.99 mm, the average thickness was 4.97 ± 1.64 mm, the average distance from the tricuspid orifice was 19.85 ± 5.92 mm. The attachment to the anterior papillary muscle was found to be branched in 8 hearts that is having an incidence of 14%. The septal end were branched and separated as two in only two specimens. Only one specimen had branched attachments on both the apical and septal ends.

Conclusion: The distance from tricuspid valve and knowledge of branching are important in corrective surgeries of the VSDs. An awareness of length and thickness helps the clinician to differentiate moderator band from the other structures, which may result in misdiagnosis during echocardiography. Its presence may in fact be of significance in preventing over distension of the heart in RV myocardial ischaemia.

KEY WORDS: Moderator Band, Right Ventricle, Anterior Papillary Muscle, VSD, Tricuspid Valve.

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INTRODUCTION

The moderator band or septomarginal trabecula is seen in the right ventricle of the heart. It is supposed to strengthen the septal wall of the right ventricle and gains attachment to the anterior papillary muscle and the parietal ventricular wall [1]. The moderator band is supposed to regulate the distension of the right ventricle and hence it has derived the name "moderator", as it contains the right bundle of His. The moderator band is a least studied structure of the human heart. There are very minimal works done on the moderator band. The main reason for this deficiency, is the practical difficulty of viewing it in the echocardiogram. This study aims at the various morphological criteria of moderator band in human cadaveric hearts. The various criteria included in the study are length, thickness, distance from the tricuspid orifice, its appearance, number of connections to the anterior papillary muscle, the nature of tissue (either muscular or fibrous) and any other variations encountered during the study. Hence, this study aims at creating a baseline data all about moderator band.

MATERIALS AND METHODS

The study on moderator band was done in the Anatomy department of Chettinad Hospital and Research Institute. A total of fifty hearts were dissected for this study. These hearts were all preserved in 10% formalin solution. The pericardium was removed and then an incision parallel to the anterior inter ventricular groove was done. This incision was then extended to the right a little above the inferior margin of the heart and care was taken as not to damage the anterior papillary muscle or the moderator band. The digital Vernier caliper was used to measure the various criteria. The length was measured across the two ends of attachment of the moderator band, namely the septal wall and the anterior papillary muscle. The thickness was measured across the thickest portion of the moderator band. The distance from the tricuspid valve (TV) was measured from the annulus of the TV to the attachment of the moderator band to the septal wall. It was further classified into near the TV, midway or near the apex. The presence of any trabeculat-

-ions, the number of attachments to the anterior papillary muscle and the nature of tissue, whether muscular or fibrous were looked for and recorded. Additionally, there were trabeculations observed in the septal end of the moderator band and they were also recorded.

Fig. 1: Measurement of length of moderator band.

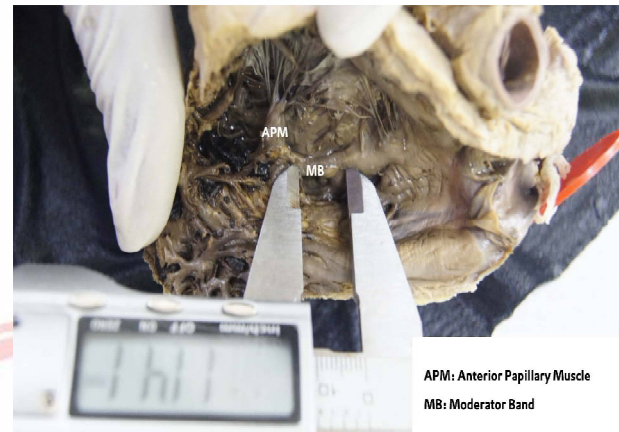


Fig. 2: Measurement of thickness of moderator band.

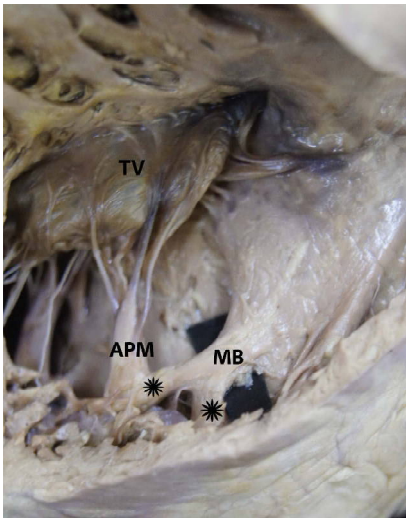


RESULTS

The moderator band was seen in all the 50 hearts, hence reporting an incidence of 100%. The average length of the moderator band was 14.71 ± 4.99 mm (Fig. 1). The average thickness of the moderator band observed in this study was 4.97 ± 1.64 mm (Fig. 2) ranging between 3.33 mm to 8.74 mm. The average distance from the tricuspid orifice was 19.85 ± 5.92 mm ranging from 10.11 mm to 28.39 mm. The attachment of the moderator band to the anterior papillary muscle (the apical end) was found to be branched in 8 hearts (Fig. 3). All the fifty moderator bands were found to be fibro-muscular in nature. The parietal/ septal end or the attachment of the moderator band to the interventricular septal wall were trabeculated and separated as two in only two specimens out of the 50 moderator bands

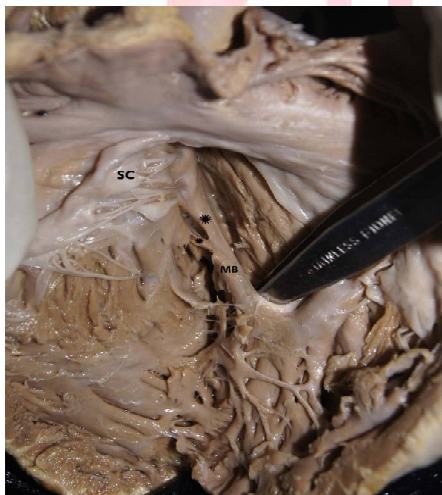
observed during this study (Fig. 4). Only one specimen had branched attachments on both the apical and septal ends (Fig. 5).

Fig. 3: Branching at the apical (anterior papillary muscle) end.



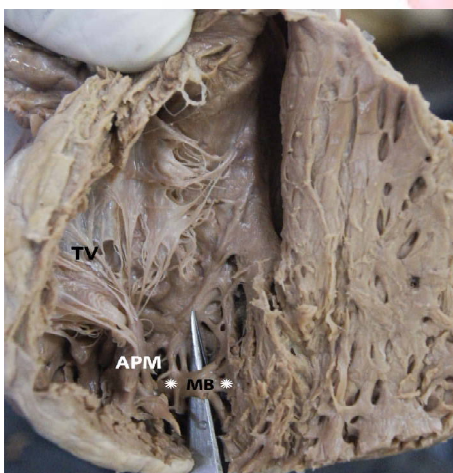
TV: Tricuspid Valve, MB: Moderator Band, APM: Anterior Papillary Muscle, *Branching at Apical end.

Fig. 4: Branching at the septal (interventricular septal) end.



MB: Moderator Band, SC: Septal Cusp * Branching at Septal end

Fig. 5: Branching at both the apical and septal ends.



TV: Tricuspid Valve, MB: Moderator Band, SC: Septal Cusp * Branching at Both ends

DISCUSSION

The moderator band is usually present in 90% of hearts [2], though in this study it was found in 100% of all the 50 hearts studied. It is often confused for one another trabeculae carnea. It is an important structure which has the main right bundle of His of the conduction system of heart and hence aids in the right ventricular free wall depolarisation. It also helps in preventing over distension of the right ventricle (RV), as it forms a bridge between the septal wall and the anterior wall of RV. Apart from these functions, it also helps in directing the blood from the inflow tract to the outflow tract of RV. The moderator band is supplied by the septal artery, which undergoes numerous anastomoses with other branches of the septal branches of the right coronary artery [3]. These numerous anastomoses are responsible for protection against massive RV infarct when there is occlusion of the proximal part of the right coronary artery [4].

Moderator band is one of the contributors for misdiagnosis of intracardiac masses. Even in fetus, it is known to cause specular reflections, in as high as 5.5% of the cases [5]. Andre Keren et.al [6], has stated that using two dimensional echocardiography, moderator band can be visualised in 79% of their cases using an apical four chamber view, though the normal incidence of moderator band is about 90%. Using M mode echocardiography, they have reported that there is significant difficulty in differentiating the right side of interventricular septum from the moderator band.

In ventricular septal defects (VSD), if the region of the moderator band is involved, it is labelled as component 3 of VSD, according to Richard van pragh et al. [7]. which is named as septal band or proximal conal defect. While treating such defects, the moderator band has to be preserved carefully. Moderator bands are known as unique sites for origin of ventricular tachyarrhythmias and ventricular premature depolarisations. In a rare condition called arrhythmogenic right ventricular dysplasia (ARVD), the moderator band is visualized as a highly thick echogenic band and hence helps in differentiating ARVD from RV ischaemia [8]. The same is also useful in distinguishing RV from LV

in congenital anomalies as there is no muscular or trabecular attachment on the LV [9].

Mamata et al. [10] has classified the attachment of the moderator band into single and double type. The single type showed only one whole strip of moderator band from the septal wall of right ventricle to the anterior papillary muscle. They had further divided the single type into simple and complex type, where the simple did not have branching pattern in the attachment to the papillary muscle but there were branching pattern seen in the complex type. In the present study, there were eight moderator bands belonging to the single but complex type, whereas, the study done by Mamata et al. [10] showed 10 such specimens out of the 28 hearts studied. They have further reported one another type as double, where there are two moderator bands, going separately from septal wall to the anterior papillary muscle the whole way. We did not come across such a finding, but in two out of the fifty hearts, there were branching pattern seen in the septal end of the moderator band.

The distance of moderator band from the tricuspid valve is of importance in treating apical ventricular septal defects. Marios Lukas et al. [11] have found that the incidence of origin of moderator bands close to TV was 13% (12 of 96 hearts), midway between TV and the apex was 47% (45 of 96 hearts) and nearer to the apex was 40% (39 of 96 hearts). In the current study, these were 25%, 40% and 35% respectively. Hence, the midway origin is more common, followed by the apical origin and then the nearer to the TV origin in both the studies. The thickness also were very similar (4.5 ± 1.8 mm and 4.97 ± 1.64 mm) in both these studies, whereas, the average length was 16.23 ± 2.3 mm in Marios Lukas et al. [11] study as against 14.71 ± 4.99 mm in the present study.

CONCLUSION

The moderator band is a very significant structure clinically. It can appear as a RV mass during echocardiography and be the cause for diagnostic confusions. It creates additional stress to RV, when there is myocardial infarction of the right ventricle and hence prevents its distension. Moderator band by itself is a known cause of ventricular premature depolarisations (VPD) &

ventricular tachyarrhythmias (VT) and can cause hindrance during pacing surgeries. As mentioned above, its relation to VSD is of utmost importance as it may be accidentally cut during VSD repair surgeries. Hence, the morphometry of moderator band should be known to prevent any confusions clinically.

ABBREVIATIONS

RV - Right Ventricle

LV - Left Ventricle

VSD - Ventricular Septal Defect

VPD - Ventricular Premature Depolarisations

VT - Ventricular Tachyarrhythmias

ARVD - Arrhythmogenic Right Ventricular Dysplasia

Conflicts of Interests: None

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