



Research Paper

A BRIEF OBSERVATIONAL STUDY OF SEPTOMARGINAL TRABACULAE IN CADAVERS: ORIGINAL RESEARCH

Mathada V Ravishankar^{1*}

*Corresponding Author: **Mathada V Ravishankar**, ✉ ravishankarv707@gmail.com

Objective: Study of Septomarginal trabaculae in the ventricular chambers of the heart. **Methods:** The muscular ridges in the wall of ventricle is called Trabaculae carneae, a modified well-defined muscular band connecting like a bridge is known as moderator band. The length, breadth and number of these routinely existing moderator bands along with the additional bands were measured to compare the same in different cadaveric hearts. **Results:** Morphologically there was no significant pattern of variations were found in gross appearance of Septomarginal trabaculae, but some additional bands were recognized only in 2 hearts. **Conclusion:** Among 20 cadavers only 2 hearts were found with the additional bands. These additional bands may play a significant role, if they support in carrying any additional conducting fibers or blood vessels to wall of the heart. Such contributions may play an important functional role to prevent any possible damage during myocardial ischemia.

Keywords: Atrio-ventricular node, Sinuatrial node, Trabaculae carneae

INTRODUCTION

Human Septomarginal trabaculae or Moderator Band (MB) studies lacks much attention in the literature, most of the information were gathered through the studies in animals more than humans. The musculature of the heart is highly modified to support the rapid conduct and spread of impulses; their specialized functional fibers are nodal, transitional, purkinje fibers, and working myocytes. They exhibit the property of excitation and conduction of impulses with functional

syncytium in the cardiac musculature. This property is supported by cell to cell junction through electrical synapse. The electrical conducting system of the heart plays an important role in maintaining the normal cardiac cycle, which consists of the pacemaker or sinuatrial node (SA) node, Atrioventricular node (AV), right and left bundle branches and purkinje fibers (Susan Standing, 2008; and Datta, 2003). These are the modified specialized myocardial cells having their unique capacity to initiate, conduct and distribute

¹ Department of Anatomy, J N Medical College, KLE University, Belgaum- 590010, Karnataka State, India.

the impulses from one part of the heart to the other without overlapping the events of the cardiac cycle. Any lesion which interrupts these supporting vascular channels can lead to abnormal clinical findings which can be recorded through conventional electrocardiography. Such variable patterns of Septomarginal trabecular studies may be correlated with the unusual clinical findings in the heart beat variability.

MATERIALS AND METHODS

We have studied the interior of ventricles of twenty hearts of adult male cadavers aged between 50-70 years in the Department of Anatomy at Jawaharlal Nehru Medical College, Belgaum, Karnataka, India. The twenty hearts were collected from different cadavers and their right and left ventricular chambers were cut opened to see its interior without disturbing its prominent features. We have used simple geometrical pointer and scale, to measure the length and thickness of these bands. We have used Nikon 5 MP (mega pixels) Digital camera to record the findings and they are converted to JPG, format with 300 dpi resolutions. Our observational study was basically focused on the identification of additional moderator band along with routinely existing moderator band pattern (Figure 1) which is connecting the septal wall with the base of the anterior papillary muscle.

We have noticed the dense appearance of the trabaculae carneae in the interior of the right ventricle along with special attention to morphology of moderator band. During this study in few of the cadavers we have noted the additional band (Figure 2) which was running along with the routinely existing moderator band up to the base of the anterior papillary muscle. The length and breadth of these bands were noted and tabulated as below. At the same time

Figure 1: Arrow Indicating Routinely Seen Single Thick Moderator Band

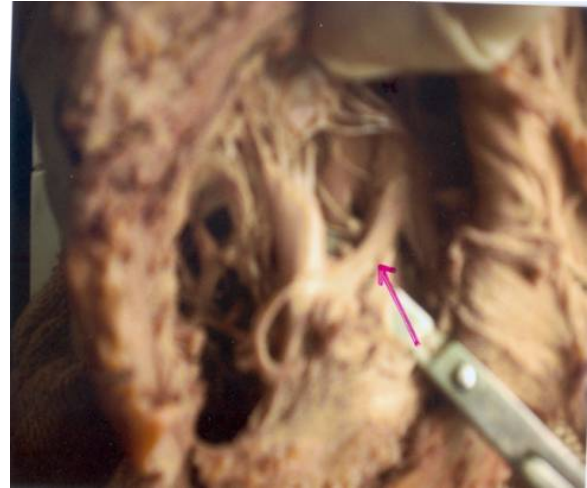


Figure 2: Arrow Indicating Double Moderator Band



we have observed the interior of left ventricle too, but here we could not find any such established bands unlike right ventricular chamber. Interestingly the density of the appearance of these muscular ridges in the floor part of left ventricle was sparse when compared the same with right ventricle.

RESULTS

In the present study out of 20 human hearts only 2 of them were showing additional bands in the right ventricular cavity while left ventricular chamber was free from such obvious banding patterns.

DISCUSSION

Importance of Septomarginal trabaculae or moderator band not only signifies through their morphological variations, the advanced studies in the field of histology and electron microscopy have revealed many more details regarding their functional correlations. Histological studies through special stains and keen micro dissection studies have revealed its minute structures in detail. These specialized structures are having surgical importance not only with respect to their usual anatomical variable presentations in morphology or in the number, but also important in handling the intra cardiac invasive procedures. The components of conducting system of heart is deriving its blood supplied from the 1st and 3rd interventricular septal branches in 27% of cases and 2nd interventricular septal branch in 33% of cases coming from the anterior interventricular branch of left coronary artery (Futami *et al.*, 2003). In the existing literature the studies regarding the moderator band is very limited. The peculiarity of the moderator band not only limited to right ventricle but to the left ventricle as well, this fact was realized by dissecting the left ventricle where the number of such delicate fibro muscular bands in the ventricular cavity was considered as their usual anatomical appearance. The structural complexity of fibro muscular components in the left ventricle of heart, may be having some relevance with congenital or acquired cardiac defects (Gerlis *et al.*, 1984). Examination of the right ventricle of 100 hearts in the cadavers through right atriatomy where they have measured the distance from the base of the papillary muscle to the right side of the interventricular septum and the distance from the origin of the band to the base of the pulmonary valve and noted the diameter of moderator band on sectioning. In the

majority of the hearts they have observed the variable morphological and topographical pattern of MB (moderator band) which has facilitated other researchers to classify them under five categories by considering their features as short and thick, long and thick, short and thin, long and thin and the heart without any moderator band was noted. These observations show the versatile pattern of its anatomical presentation which has stressed the significance of the moderator band for its careful handling during the surgical procedures. The surgical procedures related to the apical region of the heart where surgeon needs to handle with utmost care, to avoid damage which can result in undue interruption of impulse conduction (Loukas *et al.*, 2010). Through the micro dissection study it was found that the moderator band is supplied by the arterial branches derived from the septal artery. Which undergoes anastomosis with the various other branches of the right coronary arteries. Such minute connecting arterial channels in the myocardial wall going through the additional trabecular bands, which could be an important structural component to overcome obstruction during the blood supply (Reig *et al.*, 2000). It was observed clinically that such variations could influence the fixation of the endocardial leads which signifies its functional influence that was correlated with 50 autopsied bodies (Victor and Ravindran, 1985). The best way of understanding the virtual structural pattern of the human heart is through the anatomical dissection and autopsy studies, where their retrospective clinical case details can be correlated with the existing cadaveric findings noted during special investigations. Micro anatomical study in Pigs hearts moderator band has revealed that the cholinesterase content in the purkinje fibres along

with purkinje cells. The Acetylcholine containing nerve fibers are identified by using fluorescence technique. It was confirmed through the strong acetylcholine reactions showing the versatile components of moderator band (Bojsen-Moller and Trandum-Jensen, 1971):

The histological studies on ostrich bird moderator was presenting with single or branched appearance, through the special staining like hematoxylin and eosin, masons trichrome, orcein, vangisson have revealed the presence of purkinje cells, endocardium, loose connective tissue, muscle fibers, purkinje fibers and partly tendons as a part of moderator band components. The electron microscopic studies have revealed the presence of the collagen fibres, elastic fibres, randomly distributed number of mitochondria and cell junctions like desmosomes and small quantity of glycogen components were observed, unlike human moderator bands (Parto *et al.*, 2010). Examination in 12 dogs with electrocardiography was showing the presence of the left ventricular moderator band, where the investigative electro cardiograph was showing the higher magnitude in the QRS complex without any appreciable clinical significance in the cardiac activity (Hiroshi *et al.*, 2007). It was quite interesting to see the interior of the ventricular chambers of the heart where there was a striking difference in the appreciation of the density of smooth muscular ridges, which are dominating in right ventricular chamber of all the cadaveric hearts. The complex mesh work like appearance of randomly running thick, thin, short and long muscular ridges particularly in the floor of the right ventricular chamber was dragging its attention in every heart. Probably these existing structures located in the gravitationally most dependent area of the ventricular chamber which could influence the aggregation of blood cells and clot formation,

which intern can threaten the pulmonary or systemic embolism. This fact can be realized by correlating the tendency of clot formation in rough interior pattern of right and left auricles.

CONCLUSION

The ventricular floor of heart is more abundantly packed with smooth muscular ridges called trabeculae carneae. The septomarginal trabeculae or moderator band is one among them, which has received less attention in the existing literature. The moderator band gets its special importance as it is believed to carry some fibers of conducting system coming from the right branch of AV bundle. The existence of additional bands were observed only in the right ventricular chamber which are extending up to the base of the anterior papillary muscle, such additional trabecular band components can act as a supporting element to carry the conducting system components or minute blood vessels to the myocardium to overcome interrupted conduction or vascular defects. Though our study is limited to minimum and limited number of available specimens in the department, which may further needs histological, electron microscopic and investigative clinical evaluation in large numbers. The students with advanced studies may be benefitted with such minor observations, for an effective management of cases with unusual clinical presentation.

CONFLICT OF INTEREST

The authors clearly states that they don't have any competing interests

ACKNOWLEDGMENT

The authors would like to acknowledge Dr P S Jevoor, professor and former head of anatomy

Jawaharlal Nehru Medical College, KLE University for his co-operation to study this case series.

REFERENCES

1. Susan Standing (2008), *Text Book, Gray's Anatomy, The Anatomical Basis of Clinical Practice*, 14th Edition, Churchill Livingstone, China, pp. 975-978.
2. Datta A K (2003), *Essentials of Human Anatomy*, 6th Edition, Current Books International, Calcutta, pp. 66-67.
3. Futami C, Tanuma K, Tanuma T and Saito T (2003), "The Arterial Blood Supply of the Conducting System in Normal Human Hearts", *Surgical Radiological Anatomy*, Vol. 25, pp. 42-49.
4. Gerlis L M, Wright H M, Wilson N, Erzenin F and Dickinson D F (1984), "Left Ventricular Bands A Normal Anatomical Feature", *British Heart Journal*, Vol. 52, pp. 641-647.
5. Loukas M, Klaassen Z, Tubbs R S, Derderian T, Paling D, Chow D, Patel S and Anderson R H (2010), "Anatomical Observations of the Moderator Band", *Clinical Anatomy*, Vol. 23, pp. 443-450.
6. Reig J, Alberti N and Petit M (2000), "Arterial Vascularization of the Human Moderator Band; An Analysis of this Structures Role as a Collateral Circulation Route", *Clinical Anatomy*, Vol. 13, No. 4, pp. 244-250.
7. Victor S and Ravindran P (1985), "Anatomical Factors Influencing Fixation of Endocardial Pacing Leads in the Right Ventricle", *Texas Heart Institute Journal*, Vol. 12, No. 1, pp. 23-32.
8. Bojsen-Moller F and Trandum-Jensen J (1971), "Nerves and Nerve Endings in the Conducting System of Moderator Band (*Septomarginal trabaculae*)", *Journal of Anatomy*, pp. 387-395.
9. Parto P, Tadjalli M and Ghazi S R (2010), "Macroscopic and Microscopic Study on Moderator Bands in the Heart of Ostrich (*Stuthio camelus*)", *Global Veterinaria*, Vol. 4, pp. 374-379.
10. Hiroshi K, Akashi H, Manabu S, Naoaki T and Masami U (2007), "Clinical Evaluation of Left Ventricular Moderator Band in 12 Dogs", *Journal of Veterinary Medical Science*, Vol. 69, pp. 965-967.