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Original Research Article

A Study on Papillary Muscles of Ventricles in Human Adult Heart

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ABSTRACT

Background
Papillary muscles are one of the important components of musculature of ventricles in the human heart. It plays an important role for proper cardiac valvular function of the heart. The shape of papillary muscle of right and left ventricles is important for the cardiac surgeons in surgical procedures like mitral valve replacement and use of mitral valve homograft for mitral/tricuspid replacement.

Methodology
This study was conducted in the Department of Anatomy, Gauhati Medical College and Hospital using 40 formalin fixed adult human heart which were collected from Department of Anatomy and Department of Forensic Medicine & Toxicology, GMCH after completing the medico-legal formalities. The ventricles were opened by making incisions along the sterno-costal surface to expose the interior of heart and the shape of papillary muscles were observed both in right and left ventricles.

Results & Statistical Analysis
In this study the right ventricle showed 30% of conical shaped papillary muscle, 20% of the flat topped shaped papillary muscle and 10% of the truncated shaped papillary muscle were found. In the left ventricle shows 40% of the conical shaped papillary muscle, 22% of the truncated shape of papillary muscle and 15% of the flat-topped shape of papillary muscles were found.

Conclusions
The papillary muscles have complex anatomy structure having the shape of conical, flattop, truncated, bifurcated and trifurcated, so knowledge of these variation in papillary muscle

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during repair procedure and screening of hypertrophy is of utmost importance for cardiac surgeons.

Keywords: Heart, Papillary Muscles, Cadaveric study.

INTRODUCTION

The papillary muscles play an important role in valvular functioning [1]. The anterior papillary muscle of right ventricle is the largest as compared to posterior papillary muscle and septal papillary muscle is smallest [2]. All the papillary muscles supply chordae tendinae to the adjacent component of the tricuspid valve they support, the left ventricle has two papillary muscle, anterior papillary muscle and posterior papillary muscle supporting the mitral valve and the shape of papillary muscle were majority of conical type [3-12]. This can be of clinical significance since papillary muscle plays an important role in the contraction of right ventricle and in the closure of tricuspid valve so as to prevent ventricular blood from passing back into right atrium and also the mitral valve prolapse due to the left ventricular hypertrophy[13,14], hence for these reasons the variation in shape of papillary muscle in both ventricles were studied to help the surgeons during surgical procedures and is of utmost important for it.

MATERIALS AND METHODS

This study was performed in the dissection hall of Department of Anatomy, Gauhati Medical College, Guwahati. The specimens were collected from two sources. (I) The unclaimed and donated bodies officially received by Department of Anatomy and bodies were embalmed and heart were dissected out and the other source is from Department of Forensic Medicine Gauhati Medical College after fulfilling of all official formalities specimen were collected from unclaimed bodies in the department. Then incision over thorax was done according to Cunninghams manual of practical Anatomy, a long incision given midline from suprasternal notch to xiphisternum, two transverse incision made one above the suprasternal notch and other below xiphisternum and fourth incision was made from xiphisternum extending superolaterally to acromion, two parasternal incisions cutting across the costal cartilage were made then sternum were separated and removed from thoracic wall after it heart with pericardium covering was in situ afterwards heart were dissected out then specimen were washed in running water and all blood clots, blood were removed from chambers of heart by gently pressing the heart and keep in 10% formalin then the right ventricle and left ventricle were opened by making incisions along the sternocostal and diaphragmatic surface to expose the interior of the heart and then identified the shape of papillary muscle in both the right and left ventricle. The shape of tip of the papillary muscles identified and classified as conical, flattop, truncated, bifurcated and trifurcated according to standard literature[2].

Instruments and Materials uses were: 10% formalin, normal saline, jars, buckets, trays, surgical gloves, blue cloth, dissecting box which included plain forceps, toothed forceps, surgical blade, scalpels, scissors, pin, magnifying glass and vernier calipers

Inclusion Criteria	Exclusion Criteria
1. Heart without congenital anomalies	1. Heart with congenital anomalies
2. Heart without any injury or surgery	2. Heart with pathological lesions
3. Persons without history of ventricular hypertrophy	3. Persons having history of HTN

Table 1: List of inclusion and exclusion criteria

RESULTS AND OBSERVATION

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The study was done on 40 formalin fixed adult human heart for the anatomical variation of shape of papillary muscles of both the right and left ventricles and in these study papillary muscle were found to be present in the right and left ventricles.

In the present study, 40(forty) formalin fixed cadaveric heart were observed for the shape of the papillary muscles in the right and left ventricles and were noted.

Fig. 1: Showing a portion of specimens of Heart collected for the study

Shape of the papillary muscles	Group of papillary muscle					
	APM		PPM		SPM	
	No.	%	No.	%	No.	%
Conical	24	60	32	80	24	60
Truncated	6	15	8	20	4	10
Flat top	10	25	0	0	12	30
Bifurcated	0	0	0	0	0	0
Trifurcated	0	0	0	0	0	0

Table 2: Showing the data of different groups of papillary muscle of Right ventricle

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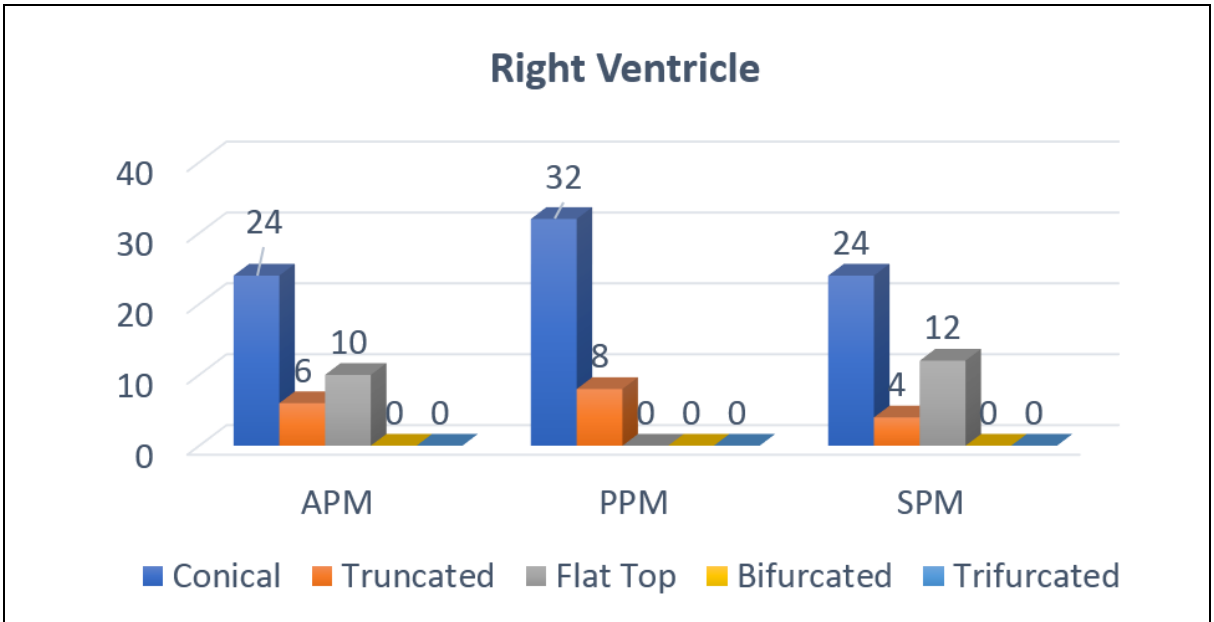

fig 2: histogram showing the shape of different groups of papillary muscle of right ventricle

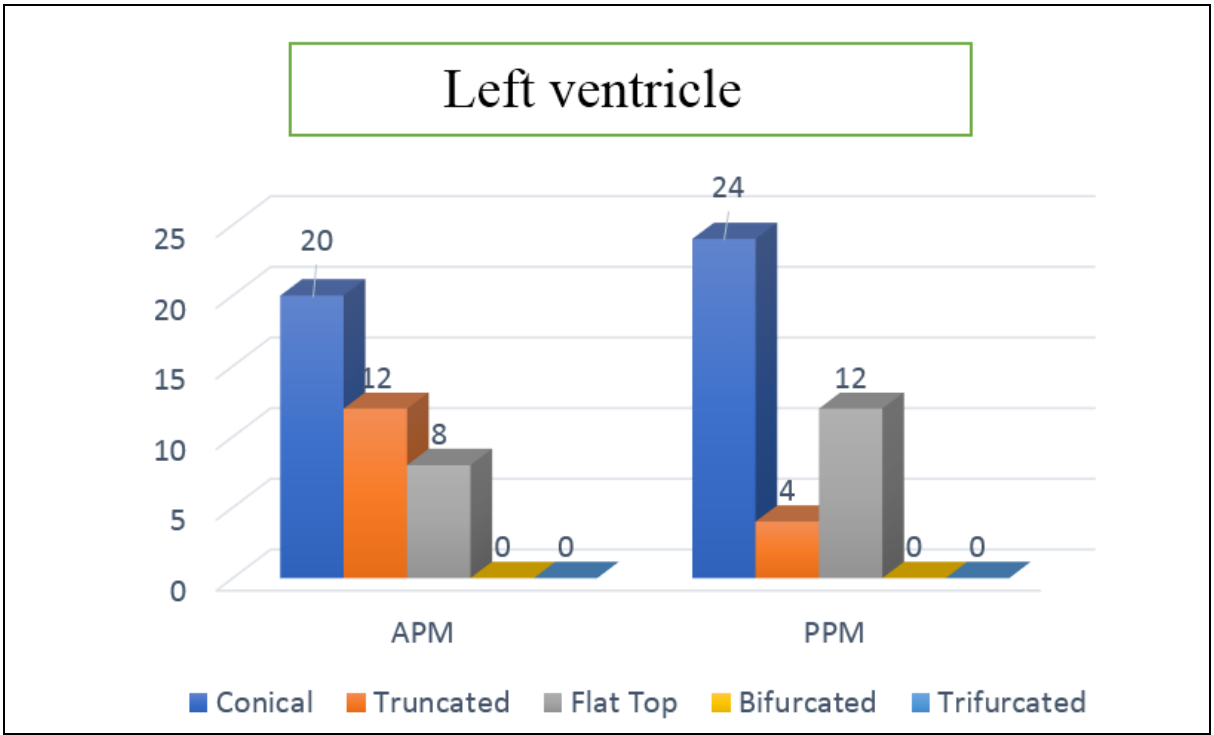

Fig 3: Histogram Showing the shape of different groups of papillary muscle of Left ventricle

Shape of the papillary muscles	Group of papillary muscle			
	APM		PPM	
	No.	%	No.	%

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Conical	20	50	24	60
Truncated	12	30	4	10
Flat top	8	20	12	30
Bifurcated	0	0	0	0
Trifurcated	0	0	0	0

Table 3 : Showing the data of different groups of papillary muscle of Left ventricle

Types	Right Ventricle	Left Ventricle
Conical-flat topped (Present)	4(10%)	6(14%)
Conical-flat topped (Absent)	36(90%)	34(86%)

Table 4: Ventricles with two types of papillary muscle

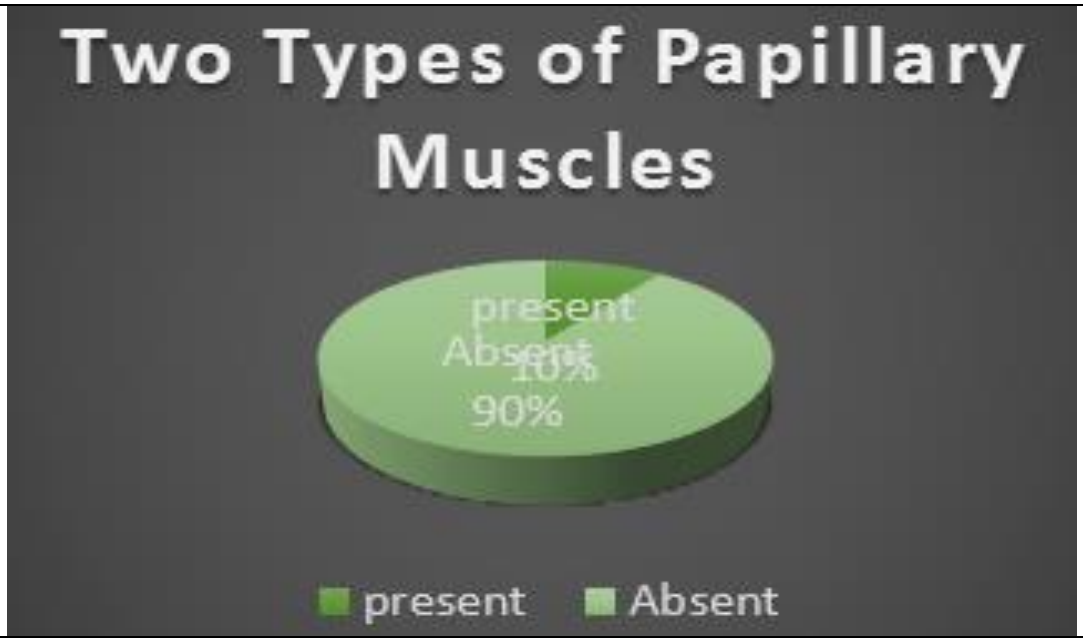

Fig 4: Pie diagram showing presence and absence of two types of papillary muscle in right ventricle

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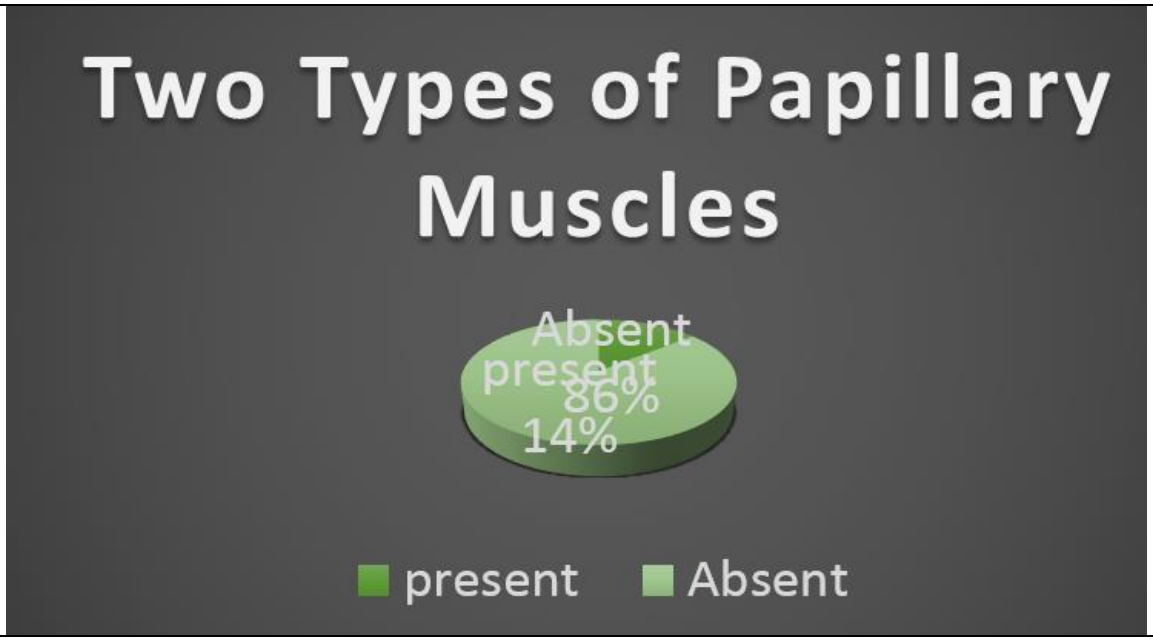

Fig 5: Pie diagram showing presence and absence of two types of papillary muscle in left ventricle

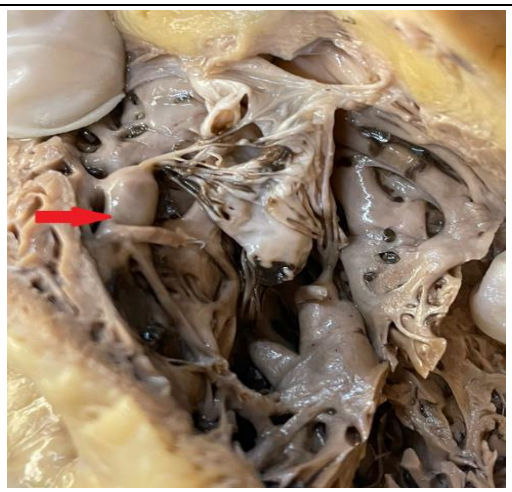

Fig. 6: Showing with arrow mark the conical shape papillary muscle

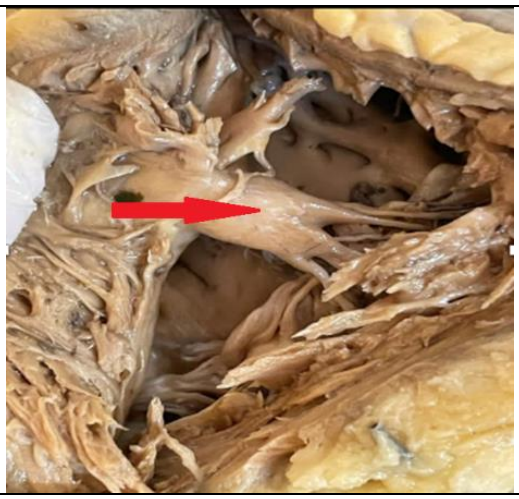

Fig .7: Showing with arrow mark truncated shape papillary muscle

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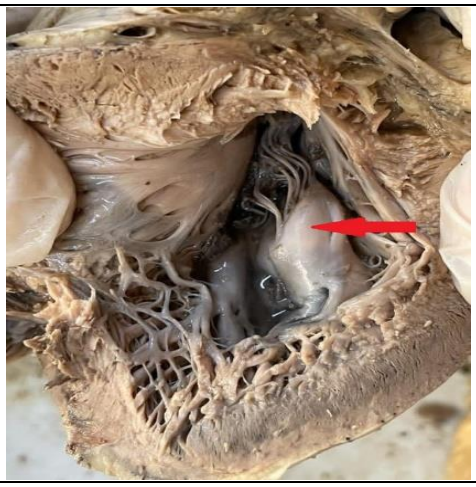

Fig. 8: Showing arrow mark flat-topped shape papillary muscle

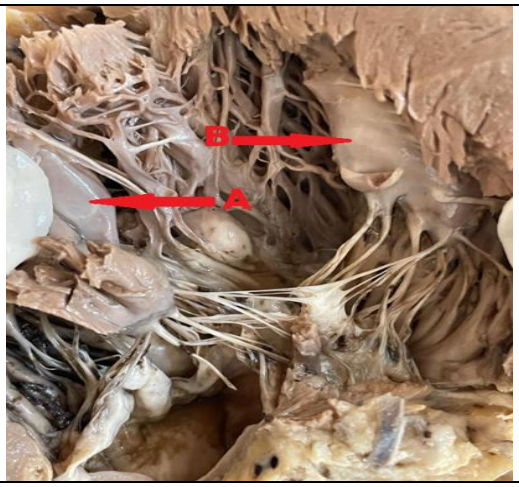

Fig 9: Showing arrow with two types of Papillary muscles (a) Conical (b) Flat topped

DISCUSSION

In the present study, the group of papillary muscles in the right ventricles and left ventricles was constantly found to be three and two respectively in all the hearts. While observing the shape of papillary muscles, conical was seen in 60%, flat-top in 25% and the truncated in 15% of the specimens.

In the study conducted by Hospatana et. al.[14] cone shaped papillary muscles were observed in majority of cases 87%, whereas flat topped shape was observed in 13% in right ventricle.

Nigri et al[15] in their study of right ventricles observed the conical shaped to be most common in anterior, posterior and septal (57%,74% and 86.4% respectively).

Saha et al[16] in their study of right ventricles common in anterior and posterior papillary muscle was flat topped (51.5% and 88.23% respectively).

Victor and Nayak [17,18] in their study stated that mitral valve apparatus including papillary muscle is as unique to each individual as one's fingerprint.

Gunnal.et al [19] says conical is the best to facilitate cardiovascular physiology for posing minimum obstruction to blood flow through ventricle.

The septal papillary muscle as study by Saha et al [16] maximum specimens show conical shape (90.62%) followed by flat topped shape (9.37%).

CONCLUSION

In present study majority of the heart (60%), the papillary muscle found was conical. The anatomical knowledge of the papillary muscle and its development is important as it is an important part of the subvalvular apparatus. It plays an important role in ventricular contraction and thus prevents valve prolapse.

With better understanding of different architectural arrangement, the surgeons may be able to do the surgical procedure according to papillary muscle shape of individuals.

Proper anatomical knowledge of papillary muscle is crucial for clinicians, surgeons and radiologists for their diagnostic interventions.

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LIMITATIONS

The present study has limited sample size and it was done on 40 heart. The specimens were taken from donated cadavers and unclaimed post mortem of the institute and it limits the findings to a bigger population.

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