Original Research Paper

Volume - 7 | Issue - 6 | June - 2017 | ISSN - 2249-555X | IF : 4.894 | IC Value : 79.96

Anatomy

An Unusual Morphological Variant Accessory Posteromedial Papillary Muscle with Accessory Leaflet of Tricuspid Valve in Right Ventricle in An Adult Cadaver in Middle East - A Case Report

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ABSTRACT Papillary muscles are part of the myocardium and are very important in the proper functioning of the atrioventricular valve. Here we describe a rare finding of accessory posterolateral papillary muscle with an accessory leaflet of tricuspid valve in right ventricle of an adult female cadaver. Such variation has not been reported in past in this region. They may causes tricuspid regurgitation due to improper closure or may be an etiological factor for pulmonary and tricuspid stenosis. Their presence may lead to multiple waves during investigative procedures without any clinical symptoms and therefore may lead to misdiagnosis. Awareness of such variations is extremely important in cardiac surgery techniques, prognosis in the repair of the tricuspid valve replacement, regurgitation, pulmonary stenosis and right ventricular outflow tract obstruction and in various valvular graft surgeries.

KEYWORDS : Accessory papillary muscle; Tricuspid Valve, Right ventricle, Right atrioventricular opening; Heart

INTRODUCTION

Huang Ti in 2600 B.C. in his "Canon of Medicine" wrote, "Heart is a king, who rules over all the organs of the body; the lung are his executives, who carry out his orders."(1)

Margins of tricuspid valvular orifice are described as anterosuperior, inferior and septal, corresponding to the lines of attachment of the valvular cusps. The three cusps are located anterosuperiorly, septally and inferiorly. The two major papillary muscles in the right ventricle are located in anterior and posterior positions. A third, smaller muscle has a medial position. The anterior papillary muscle (APM) is largest. Its base arises from the right anterolateral ventricular wall below the anteroinferior commissure of the inferior cusp and it also blends with the right end of the septomarginal trabecula. The posterior, or inferior, papillary muscle (PPM) arises from the myocardium below the inferoseptal commissure and is frequently bifid or trifid. The septal, or medial, papillary muscle is small but typical, and arises from the posterior septal limb of the septomarginal trabecula. (2)

The papillary muscle in the right ventricle is supplied by "straight" type arteries. The arteries supplying the anterior papillary muscle arises both from branches of the right coronary and left anterior descending artery..

Joudinad etal in 2006 proposed functional terminology for the tricuspid valve, the papillary muscles can be grouped according to the distribution of their cords to a definite commissure and its contiguous main leaflets. Therefore, the APM becomes the anteroposterior, the PPM the posteroseptal and the SPM the anteroseptal papillary muscle, respectively. (3)

Moore etal stated that papillary muscles start to contract before ventricular contraction. They lie so close cusps and chordae tendonae that their contraction lasts throughout the ventricular systole, so blocking blood to reflux into the atrium. (4)

CASE REPORT

The purpose of present commentary is to report a rare accessory posteromedial papillary muscle (PMPM) with accessory posteromedial leaflet of tricuspid valve with and which was encountered during routine cadaveric dissection of 49 yr old female cadaver who died of liver cirrhosis. The tricuspid valve extended from antero-medial commissure (C1), posteromedial commissure (C2), posterolateral commissure (C3) and anterolateral commissure (C4) (shown with black stars). The rare finding PMPM was seen in posteromedial right ventricular wall (Figure 1). PMPM was seen to be was 2.2 cm in length and 05mm in thickness at its widest point. Bunch of chordae tendonae were attached from tip of PMPM to area mostly between C2 and C3. Strikingly, some of the chordae were attached till midpoint of area between C3 and C4 also. The accessory posteromedial cusp extended from posterolateral commissure (C2) to posteromedial commissure (C3). Additional commissure made the opening as quadricuspid (In between black stars) with accessory posteromedial leaflet. Anterior and septal papillary muscle were arising from anterior ventricular wall and interventricular septum respectively. Cavity of right ventricle was measured to be 8.9 cm in length and 4.7 cm in width. Accessory PMPM had separate origin from posterolateral papillary muscle and tip of all four papillary muscles gave rise to strut of chordae tendonae attaching to free margin of the cusps. Right ventricular outflow tract was measured to be 3.5 cm in circumference with usual three pulmonary cusps at its edge.

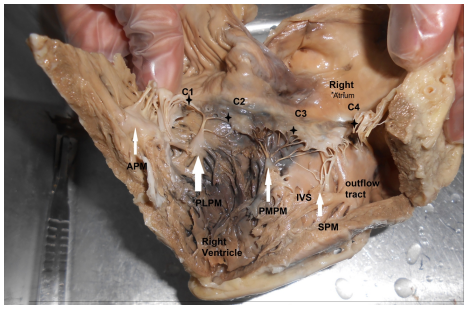

Figure 1 Showing-
Anterior Papillary Muscle (APM), Postero-Medial Papillary Muscle (PLPM); Postero-Medial Papillary Muscle (PMPM); Septal Papillary Muscle (SPM); Inter Ventricular septum (IVS)

Black Star Represents:
C1-Anteromedial Commissure
C2- Posteromedial Commissure
C3- Additional Posterolateral Commissure
C4- Anterolateral Commissure

Area Between Commissures: Cusps of tricuspid valve

DISSCUSSION

During the development of mesenchymal cells of cardiac tube around the right and left atrioventricular canals proliferate to form collars of endocardial cushions. The ventricular surface of the proliferated mass is excavated to form the atrioventricular valves which are attached to the ventricular wall by the trabeculae. (5)

Trabeculations, develop from myocardium are first observed about the 40th day of gestation, coarse in the right ventricle. Tricuspid valve is formed at the site of the initial atrioventricular canal from endocardially derived mesenchyme.. All of the leaflets form initially as internal endocardial projections which enclose a myocardial basement membrane, matrix, and mesenchymal cells. (2)

Szostakiewicz-Sawicka and Grzybiak, postulated, the papillary muscles migrated during evolution along the walls of the right ventricle as the tricuspid valve changed from being crescent-shaped to its present form. A septomarginal trabecule developed during this migration. (6)

Nigri et al. (2001) reported 21.5% of hearts with absent septal papillary muscle. The PPM had 1 head in 25.4%, 2 heads in 46.8%, 3 heads in

21.5% and 4 heads in 6.3% of the cases it was 11.53 mm in length. 1-8 Tendinous cords (TC) originated from PPM (mean 2.67). (7)

Ruxandra G. etal reported single posterior papillary muscle in 52.38% of cases, in 33.33% of cases was double, triple in 11.90% of cases and in one case (2.38%) the posterior papillary was quadruple. Conical shape was in 65.22% of cases, in 27.54% of cases was cylindrical, in 2.90% of cases in reversed ,Y" shape (at double papillary), and in one single case (1.54%) arcuated papillary (in one double papillary), one irregular papillary (at unique papillaries) and one papillary in reversed N" letter (between two muscular bodies of one triple papillary) In 13.95% of cases the existence of the posterior's angle papillary muscle of the right ventricle, conical and cylindrical papillary muscle. They reported single most common papillary muscle in 26.97%, the double in 12.97%, the triple lower by 4% and the quadruple in 3.92% cases. (8)

Grochowski studied the papillary muscles of the right ventricle and introduced the concept of multi-apical and multi-segmental papillary muscles. Multi-apical papillary muscles are, according to Grochowski, muscles with more than one point from which the tendinous chords grow. He describes multi-segmental papillary muscles as apparently separate muscles lying on one wall of the ventricle. (9)

Parvatha etal reported double anterior papillary muscle in 10% of cases. 30% had absence of septal papillary muscle, 1% cases with four papillary muscles in right ventricle. Average length was decreased with more than two papillary muscles. A double posterior papillary muscle length ranged between 5.22mm to 17.67mm. When three posterior papillary muscles were found its length ranged between 4.14mm to 13.35mm. 10% cases had double anterior papillary muscle. (10)

Wafae et al found an average number of 3.86 papillary muscles per heart and an average number of 4 papillary muscles in 46% hearts. Right AV valve was observed with 2, 4, 5 or 6 cusps in 72% of cases; moreover, additional "commissural cusps" were found in 64% cases independent of the number of "supernumerary cusps". (11)

Lakhanpal etal in 2016 studied male, female and children heart and reported extra-anterior and extra-posterior papillary muscles in 35% and 83% hearts respectively. The septal papillary muscles were found in 62% hearts .Undivided PPM in 55% hearts, bifid in 32% hearts and trifid in 13% hearts.(12)

Babita etal reported anterior, posterior and septal leaflet in 100% of cases with no accessory leaflet. one case, three accessory papillary muscles were found in the posterior wall of right ventricle. PPM was single headed in 16 cases, double headed in 26 out of 42 hearts. (13)

Xanthos etal reported PPM with 1 head in 25.4%, 2 heads in 46.8%, 3 heads in 21.5% and 4 heads in 6.3% cases. When more than one PPM was found, the average length was decreased so that the higher the number of papillae, the lower their length. They reported bicuspid right AV in 12% hearts; quadricuspid AV was found in 2.4% of the cases. Accessory orifices were found in 2.4% hearts, with mitral stenosis and aortic atresia. (14)

Munoz etal reported Valve atresia with complete absence of the three leaflets, chordae tendonae and papillary muscles, probably due to a primary pathogenic step preventing the morphogenesis of the tricuspid valve, has also been reported with only the fibrous ring being present in the AV junction. (15)

Motbagani in 2006 reported posterior papillary muscle of the human tricuspid valve-complex was the second muscle in size and also in the form of a biapical single belly and had same morphology as camel and monkey. (16)

Shunk etal states that heart attack can also affect papillary muscle myocardium. A decrease in blood perfusion can lead to muscle tissue necrosis and papillary muscle rupture, in which the valve does not close properly and blood will reflow toward the atrium during ventricular systole. (17)

Ker etal reported a case of an accessory papillary muscle with a prominent J-wave ,where papillary muscle variants may be the cause of the J-wave. on Electrocardiogram. Echocardiography demonstrated an accessory (third) papillary muscle, clearly visible on both the parasternal long axis and the parasternal short-axis view as a separate structure. (18) Admittedly we have not conducted histological evaluation of accessory papillary muscle and cusp of tricuspid valve.

Particularly in light of the increasing number of cardiac interventions, knowledge of normal and variant anatomic features has become more important than in the past. Radiologists and surgeons should be aware of such variation as they could compress and from an etiological factor for tricuspid and pulmonary regurgitation and stenosis. Due to this, may lead to extra j wave during investigation and therefore misdiagnosing certain diseases. Such variations could be significant to surgeons operating in various valvular repair and graft surgeries.

CONCLUSION

At present, every practicing radiologist and surgeon must have in-depth knowledge of such variations for better understanding of associated clinical conditions such as and tricuspid stenosis and regurgitation and right ventricular outflow tract obstruction. Pre-operative radiological analysis such as catheterization of the right side of the heart with selective right ventricular cine angiocardiography or 3-D echocardiography should always be performed for better understanding of structures in operative field. Anatomical variants should be differentiated from pathological masses needed for proper diagnosis and treatment of the case. Functional anatomic studies can provide new insights that are difficult to observe in conventional anatomy studies. Such diversity in the shapes of tricuspid valves is of immense value in designing prototype of tricuspid valve prosthesis

ACKNOWLEDGEMENTS

We are grateful to all our faculty members for their kind support and encouragement at every step. We also thank our college administration for incredible support and wishes.

REFRENCES

1. Intuitivebody work.net. history of Anatomy. Available from: http://www.intuitivebody work.net/ (Last accessed on 2017 February 21).
2. Standring S. Pectoral girdle and Upper limb in Gray's Anatomy. 40th edn. In: Borley NR, Healy JC, Collins P, Johnson D, Crossman AR, Mahadevan V.Spain: Churchill Livingstone, Elsevier ;2008:777-906
3. Joudinaud T.M., Flecher E.M., Duran C.M Functional terminology for the tricuspid valve. J. Heart Valve Dis.2006; 15: 382-328.
4. Moore, K. & Dalley, A. Anatomy doctor. Aspects fondamentaux et Cliniques applications. Brussels:Ed. De Boeck Université..2001:127-131
5. Dutta AK. Essentials of Human Embryology. 5th edn., Ch.15. Current Publishers, Kolkata; 2005:176
6. Szostakiewicz-Sawicka H, Grzybiak M (1981) Zgodność rozwoju osobniczego niektórych cech budowy sercaz przypuszczalnym kierunkiem ich rozwoju w antropogenezie. Skrypty AWF. University of Physical Culture, Poznań
7. Nigri, G.R., Di Dio, L.J.A. & Baptista, C.A.C. Papillary muscles and tendinous cords of the right ventricle of the human heart morphological characteristics. Surg Radiol Anat. 2001; 23 (1), 45-49
8. Ruxandra G., Toba M., Iliescu D.M., Bordei P. Morphological features of papillary muscles in the right ventricle. ARS Medica Tomitana. 2016; 3(22): 135-144
9. Grochowski P. Kształtowanie się mięśnia brodawkowatego tylnego w prawej komorze serca w rozwoju osobniczym człowieka. Rozprawa doktorska. Medical University, Gdańsk 2001
10. Priya, Parvatha etal. Study on Variations in the Anterior Papillary Muscle of the Right Ventricle. .International Journal of Innovative Research and Development 2014; 3 (3): 416-419
11. Wafae N., Hayashi H., Gerola L.R. and Vieira M.C. Anatomical Study of the human tricuspid valve. Surgical Radiological Anatomy. 1990; 12:37-41.
12. Lakhanpal A. V., Shrivastava S. K., Verma S. K.. Study of types of papillary musles of tricuspid valve in central Indians. International Journal of Contemporary Medical Research 2016; 3(9):2811-2814.
13. Babita Kujur1, Narendra Thakur2 and Renu Prasad3.Morphological Study of Tricuspid Valve And Its Variations in Adult Human Hearts .2016;Volume 15 (1)9 Ver. I : 72-78
14. Xanthos, Th., Dalivigkas, I. & Ekmektzoglou, K. . Anatomical variations of the heart valves and papillary muscles of the right heart. Italian J. Anat.Embr. 2011:116 (2), 111-126
15. Muñoz Castellanos L., Salinas C.H., Kuri Nivón M., García Arenal F. Absence of the tricuspid valve. A case report. Arch. Inst. Cardiol. Mex.1992: 62: 61-67.
16. Motabagani MA. Comparative anatomical, morphometric and histological studies of the tricuspid valve complex in human and some mammalian hearts, Indmedica. J Anat Soc India 2006; 55:1-23.
17. Schunk, M., Schulte, E. & Schumacher, U. Atlas d'anatomy. Cou et organes internes,Paris:Ed Maloine.2005:104-106
18. Ker J., Toit L. D. The accessory papillary muscle with inferior J-waves peculiarity or hidden danger? Cardiovascular Ultrasound 2009, 7:50