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Morphological Assessment and Possible Clinical Implications of the Left Ventricle Papillary Muscles. Study in a Colombian Population Sample

Evaluación Morfológica y Posibles Implicaciones Clínicas de los Músculos Papilares del Ventrículo Izquierdo. Un Estudio en una Muestra de Población Colombiana

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SUMMARY: Papillary muscles in the left ventricle present multiple anatomic expressions that are relevant for medical fields focusing on the understanding of clinical events involving these structures. Here, the aim was to perform a morphological characterization of the left ventricle papillary muscles in a sample of Colombian population. In the study were included eighty-two hearts from male individuals who underwent autopsy at the Institute of Legal Medicine and Forensic Sciences in Bucaramanga, Colombia. In each heart was carefully performed a longitudinal incision on the obtuse margin to visualize the papillary muscles. Data set was registered, and analysis of the continuous and categorical variables was carried out. Single anterior papillary muscle was observed in 74 samples (90.2 %) whereas this represented only 48 specimens (58.5 %) for the posterior papillary muscle ($p = 0.3$). Mean length and breadth of the anterior muscle were 29.9 ± 4.94 and 11.74 ± 2.75 mm, and those for the posterior muscle were 27.42 ± 7.08 and 10.83 ± 4.08 mm. Truncated apical shape was the most frequent type observed on the papillary muscles, anterior 41 (50 %) and posterior 37 (45.1 %), followed by flat-topped in the anterior 25 (30.5 %) and bifurcated in posterior muscle 14 (17.1 %). A mean of 9.04 ± 2.75 chordae raised from the anterior and 7.50 ± 3.3 from posterior papillary muscle. In our study we observed a higher incidence of single papillary muscles and slightly larger dimensions than information reported in the literature. The anatomic diversity of the papillary muscles should be considered for the correct image interpretation, valve implantation and performance evaluation on myocardial ischemic events.

KEY WORDS: Heart; Left ventricle; Anterior papillary muscle; Posterior papillary muscle.

INTRODUCTION

The left ventricle (LV) has a conic chamber with rougher cavity than the observed in right ventricle (RV). The LV´s interior is highly trabeculated and contains the bicuspid valve (BV), composed of the annulus, leaflet, chordae tendineae (CT) and papillary muscles (PM) (Ho, 2002; Ho & Nihoyannopoulos, 2006). During ventricular diastole, as the atrium contracts, the papillary muscles supported by the tendinous chordae open the BV and the oxygen-rich blood flows in the LV, while in systole, the ventricular ejection is facilitated by the opening of the aortic semilunar valve (Haddad *et al*., 2008; Whiteman *et al*., 2021). The papillary muscles arise from the sternocostal (anterior papillary muscle, APM) and diaphragmatic (posterior papillary muscle, PPM) surfaces of the LV. Given the nature of its origin and the anatomical arrangement of the heart, the nomenclature of the PM has been the subject of discussion in the scientific community, varying from APM, anterolateral or superolateral, and PPM, posteromedial or inferoseptal (Anderson & Loukas, 2009; Anderson *et al*., 2013; Whiteman *et al*., 2021). The highest incidence reported for origin of the LVPM has been the middle third of the anterolateral and posteromedial ventricular surface. This followed by the upper third for the APM and lower third for PPM; this level of origin influences the length of the PM and CT (Brock, 1952; Gheorghitescu *et al*., 2016; Saha & Roy, 2018).

In morphological analyzes of LVPM, variability in size, number and shape has been reported, for the APM it was identified a length of 16.3 – 25.5 mm and PPM 18.1 – 26 mm (Krawczyk-Ozóg *et al*., 2018; Saha & Roy, 2018; Hosapatna *et al*., 2022). It is the same case for thickness at

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the papillary base level of the anterior and posterior group, including the accessory muscles, 8.2 – 9.9 mm and 8.1 – 9.7 mm respectively (Saha & Roy, 2018). The classic anatomic representation of finding a single APM or PPM in the LV is reported with an incidence of APM 25 – 75.8 % and PPM 25 – 50 %. When registered, authors identified double or triple APM with frequencies of 20 – 27 % or 3 – 13 % and for PPM 18 – 58 % or 4 – 36 %, respectively; whereas 4 or more PM account for less than 3 % of all reported cases (Gunnal *et al*., 2013; Gheorghitescu *et al*., 2016; Krawczyk-Oz˙óg *et al*., 2018; Saha & Roy, 2018). The shape characterization of the PM also varies between the different studies: generally, these are classified as conical, cylindrical, truncated or fusiform structures. More detailed descriptions include the characterization of the apex, the papillary base and the presence of connections between multiple PM (Victor & Nayak, 1995; Gheorghitescu *et al*., 2016; Saha & Roy, 2018). In APM, the forms reported with the highest incidence are truncated and conical, 66.2 and 56.9 %, whereas in the PPM conical shape is the most frequently observed, in a range of 45.8 – 70.8 % (Gheorghitescu *et al*., 2016; Saha & Roy, 2018).

During ventricular contraction, the PM relocates the cups to their systolic position, reducing the possibility of ventricular regurgitation; however, pathological alterations such as ventricular dilatation, degenerative cardiomyopathy, post-infarction akinesia of the wall segment that includes the PM or reduction in size of the PM/CT would produce alteration of the valve dynamics and consequently myocardial dysfunction (Wang *et al*., 2019; Whiteman *et al*., 2021).

This study identified the most frequent morphological patterns and the anatomical variability of LVPM in a sample of Colombian population. The findings obtained contrasted with the few previous reports carried out in other population groups. These also enrich the anatomical concepts on the field and the clinical/surgical applications involving these structures.

MATERIAL AND METHOD

This non-probabilistic cross-sectional descriptive study determined the LVMP morphological characteristics in eighty-two hearts from a male Colombian population group, who underwent autopsy at the Institute of Legal Medicine of Bucaramanga, Colombia. Women´s hearts were considered as exclusion criteria because their low numbers prevented a gender comparison of the results in this study. In addition, specimens with trauma in the pre-cordial area or recorded history of cardiovascular disease were also excluded.

The study was developed following the AQUA checklist, study ethics guidelines in deceased research subjects or tissues (hard/calcified or soft) obtained from human subjects. These consensus guidelines helped standardizing an ethical and reproducible study method (Henry *et al*., 2018). This study was approved by the Ethics Committee at the Universidad Industrial de Santander (082022-14).

Obtained hearts were fixed using 7 % paraformaldehyde for 10 days prior dissection. A longitudinal incision, following the obtuse edge, was made on each cardiac specimen to visualize the left ventricular cavity containing the different components of the BV. Subsequently, the number, shape and presentation pattern of the PM were recorded according to the criteria of (Saha & Roy, 2018). Base and apex PM characteristics were considered for the shape identification. Those with single apex were identified as classic MP and classified as conical, truncated and flat-topped. PM with more than one apex or base were classified as bifurcated or trifurcated with simple or separated base, this considering all possible combinations. PM sharing / joined by a common rabecular or bridge were characterized by the number and type of union: horizontal (in H), oblique (in N) or arcuate (in V or Y shape) (Victor & Nayak, 1995; Whiteman *et al*., 2021). Presence of multiple APM or PPM was also recorded.

The following biometric measurements were performed using a digital caliper (Mitutoyo 500 series): PM and ventricular cavity length; PM and ventricular wall thickness, as well as width of the ventricular cavity. A photographic record of the LVPM was taken from each specimen.

Statistical analysis. Descriptive statistics, graphic representations and contrast of variables were performed using SPSS 20 software (SPSS, Chicago, IL, USA) and Microsoft Excel 2013. Continuous variables were expressed as the average and categorical as percentage. This study considered a p.<0.05 as significant value. For qualitative dichotomous variables, such as patterns and PM shapes, chi-square test was applied. In the case of quantitative variables with normal distribution, student´s t-test was used when comparing two variab les or ANOVA test for multiple variables. Data was expressed as mean and standard deviation for all dimensions measured.

RESULTS

Anterior papillary muscle. In total 90 APM were determined, 74 were presented as single-APM (Fig. 1A-B) and 8 as double-APM, the last furtherclassified as first- and second-APM (Fig. 1C). First-APM shared similar characteristics and dimensions as the single-APM, being the distal length the only significant different between these two anatomical presentations (Fig. 1D). To simplify data description, single and first-APM are group together and were denominated as first-APM.

Proximal and distal length as well as thickness of the first-APM were significantly higher than second-APM; first-APM (12.72 +/- 2,87 mm, 30.73 +/- 4 mm and 12.24 +/- 2.26 mm) and second-APM (7.72 +/- 2.33 mm, 21.38 +/- 4.67 mm and 6.66 +/- 2.13 mm) respectively. Majority of first- and second-APM originated from the middle third of the LV, 79.3 and 75.0 % respectively.

First-APM presented in 50 % of the cases truncated apex followed by flat-topped 30.5 %, other apex shapes were less than 10 % (bifurcated 9.8 %, conical 7.3 % and trifurcated 2.4 %). Second-APM showed less variable apex and only conical shape was observed (Fig. 2). Two types of papillary base were recorded in this study, simple and separated bases. First-APM presented simple papillary base in 73.2 % of the cases and it was significantly higher (p<0.001) than separate base type, 26.8 % (Fig. 2). No significant difference was observed when the papillary base shape was analyzed for the second-APM, frequency of 50 % for each single and separate shape.

In the analyzed APM samples 87.8 % did not present bridges between APM. In the observed 12.2 % (10 cases), 7 cases were considered as H shaped bridges and other identified variants were determinate as unique for each type.

In the first-APM significantly more CT were observed than the second-APM, 10 +/- 2 and 3 +/- 1, p<0.001. Due to numerical superiority of the first-APM, most of the CT were reported as originated from this structure (total 784), of which 76.8 % have a shared insertion in the anterior and posterior leaflet, the remaining 23.1 % in the anterior leaflet exclusively. On the other hand, for the second-APM in total only 30 CT were registered, 62.5 % originated from the anterior, 12.5 % posterior and 25.0 % from both anterior-posterior leaflets.

Posterior papillary muscle. The frequency of the PPM was higher than the APM, a total of 121 muscles were identified

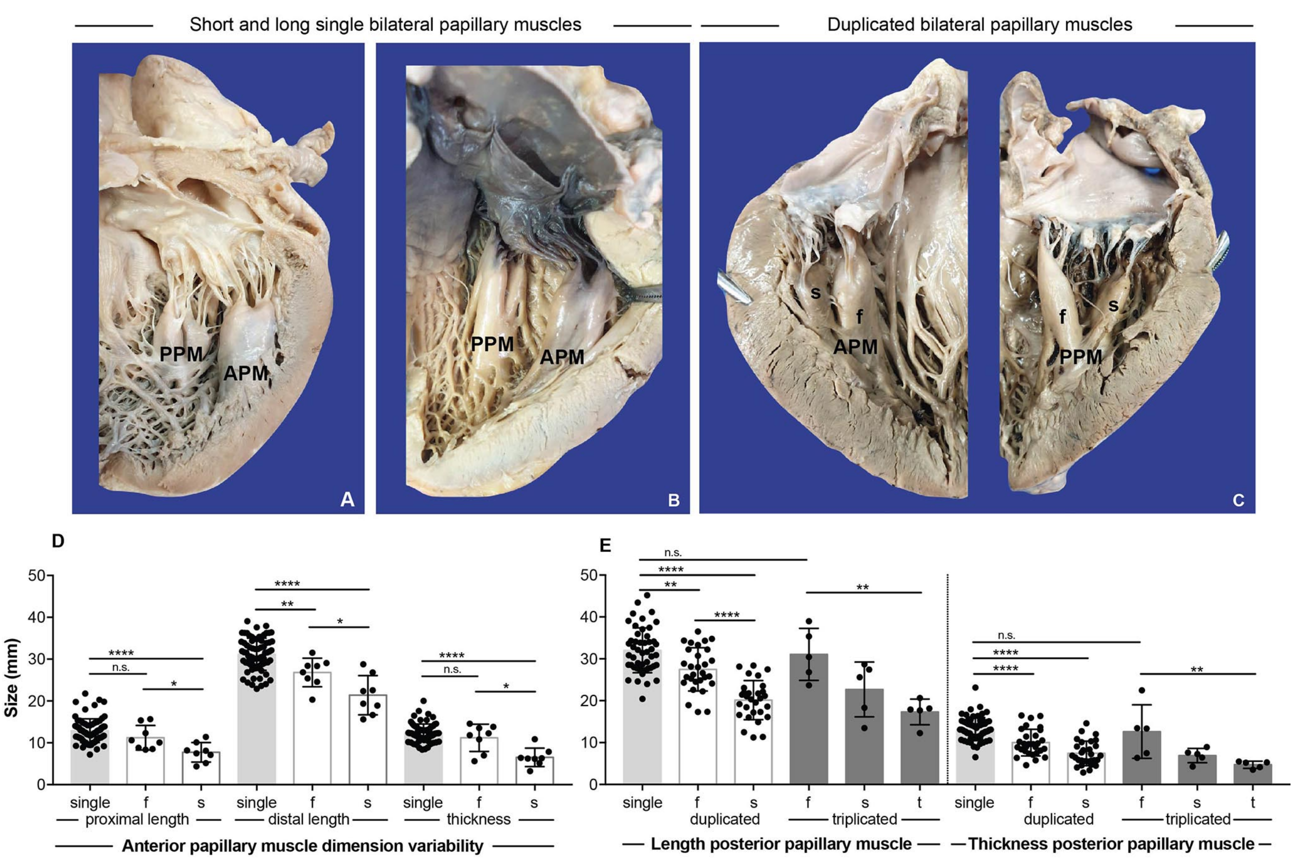

Fig. 1. (A,B) Short and long single bilateral papillary muscles in left ventricle. (C) Duplicated bilateral papillary muscle from the same case. (D,E) Variability in the dimensions of the APM and PPM, total number of PM were included in the corresponding single, duplicated or triplicated group. (A-E) f, first-PM; s, second-PM; n.s. non-significance *, p.0.01; **, p.0.001; ****, p<0.0001.

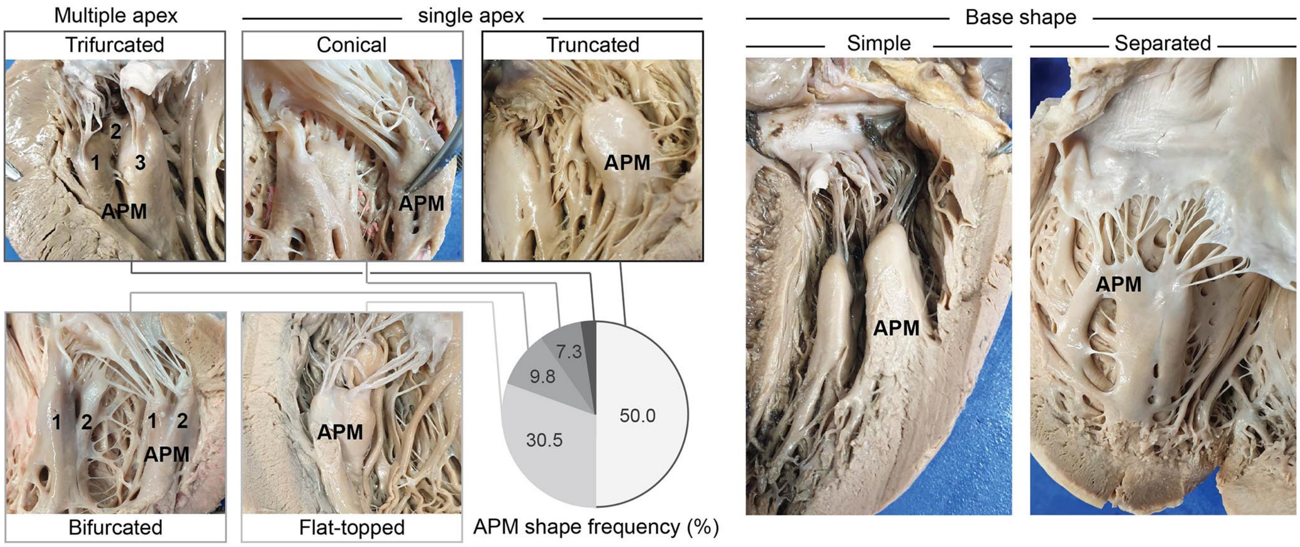

Fig. 2. Papillary muscle apex and base shapes. Pictures displayed in the figure are representative data from the APM, however the observed shapes could be used as examples for the analyzed PPM.

from which 82 were first-PPM, 34 second-PPM and 5 third-PPM. Due to the low number of third-PPM this anatomical finding was not considering for further analysis. Similar to what was observed for the APM length and thickness of the first-PPM was significantly higher ($p<0.001$) than the second-PPM (length 30.36 +/- 5.70 mm vs 20.51 +/- 4.94 mm and thickness 12.28 +/- 3.65 mm vs 7.34 +/- 2.77 mm) (Fig. 1E). Significant differences were observed for the length and thickness of the single-PPM when compared with the first-PPM and interestingly similitudes in length can be appreciated between the single-PPM and the distal length of single-APM (Fig. 1D-E).

In contrast to the origin observed for the anterior components, the distal third represented the point of origin for most of the first-PPM muscles in the LV (86.6 %, $p<0.001$) (Fig.1B and 3A). Different from what was observed for the first-PPM and similar to the second-APM, the second-PPM was mainly originated from the middle third of the LV, (55.9 %, $p<0.001$) (Fig. 3A).

Similar to the anterior compartment, truncated apex was the most frequently observed shape for first-PPM 45.1 % ($p<0.001$) and no significant differences were observed for the distribution of other patterns, bifurcated 17.1 %, conical 15.9 %, flat-topped 13.4 % and trifurcated 8.5 %. Second-PPM presented significantly higher conical apex (50 % of cases, p0.001) than other evaluated types, flat-topped 26.5 %, truncated 20.6 % and trifurcated 2.9 %. No case of bifurcated apex was identified in second-PPM.

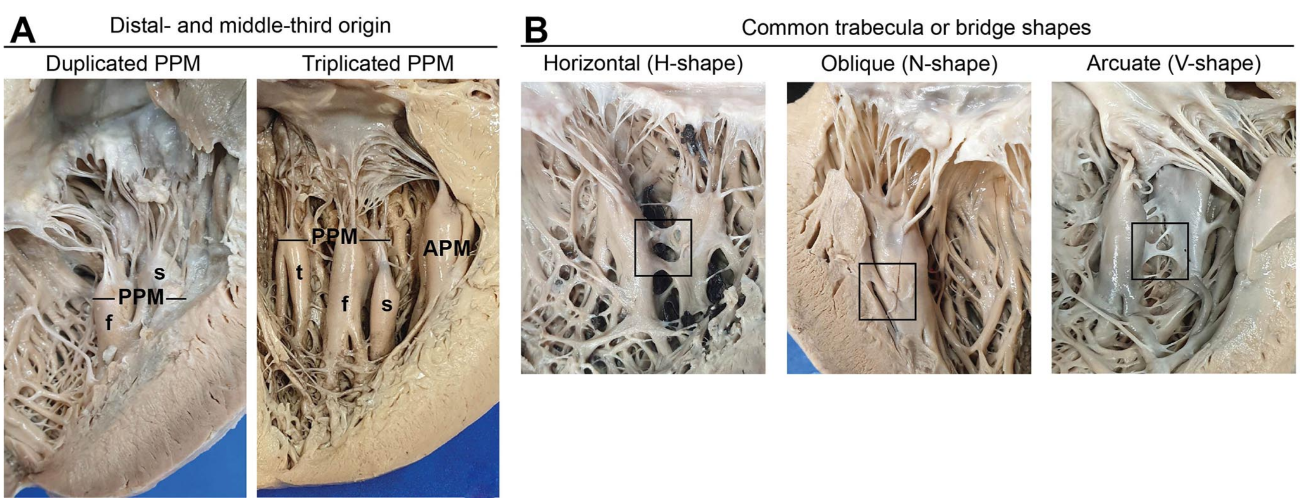

Fig. 3. (A) Differential origin in the ventricular wall of each PM in duplicated and triplicated forms. (B) Representative figure of common trabecula or bridge shapes observed in the present study.

In contrast to the observed for APM bridges were identified for the PPM in 37 cases (45.1 %), from which 28 % presented H-shape, 14.6 % V-shape, 2.5 % N- and Y-shape. None bridges were identified in 45 cases (54.9 %). A representative sample of each morphological feature could be observed in Figure 3B.

As expected the number of CT identified for the PPM is superior to the observed for the APM. In total 904 CT were identified, 737 for the first-, 156 second- and 11 third-PPM. The first-PPM presented significantly higher CT (9 +/-3, p<0.001) than the second-PPM (5 +/- 2), when present in third-PPM the mean CT was 2.2. Interestingly, it was also observed that majority (89 %, p<0.001) of the first-PPM originated CT are projected towards both anterior and posterior leaflet (Fig. 4A). However, most of the second-PPM originated CT (67.6 %, p<0.001) are inserted in the leaflet of the same posterior surface, followed by the insertion on both 26.5 % and only the anterior 5.9 % (Fig. 4B-C).

DISCUSSION

LVPMs present a great anatomical variability, especially in relation to their single or multiple presentation, dimension, origin in the ventricular wall, apices shape and CT number originated from their surfaces (Victor & Nayak, 1995; Gunnal *et al*., 2015; Kavimani *et al*., 2011; Krawczyk-Oz˙óg *et al*., 2018; Saha & Roy, 2018; Ambiga *et al*., 2023).

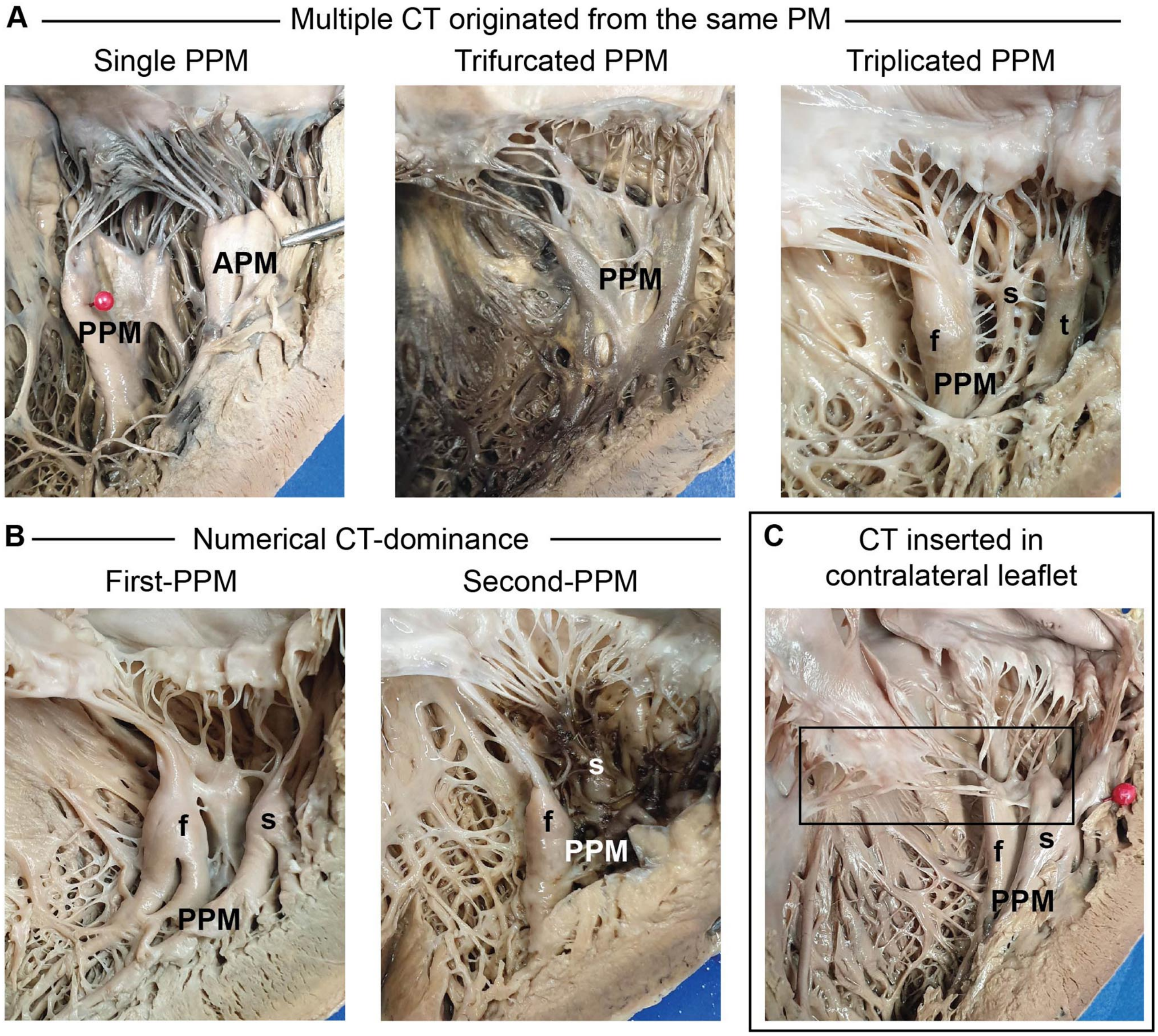

Fig. 4. (A) Multiple CT originated from single-, trifurcated- or triplicated-PM. (B) Numerical CT-dominance associated to first- or second-PM. (C) Representative figure of CT insertion in contralateral leaflet.

For single-APM, low incidences have been reported in a range of 31.3 - 62 % (Kavimani *et al.*, 2011; Gheorghitescu *et al.*, 2016), medium 65.4 - 68 % (Victor & Nayak, 1995; Gunnal *et al.*, 2015; Saha & Roy, 2018) and high incidences 75 - 77.8 % (Roberts & Cohen, 1972; Krawczyk-Oz˙óg *et al.*, 2018). In the present study, single-APM was observed in 90.2 % of the cases, a figure close to or similar to described in formation in classic text and anatomy courses. A second-APM was observed in 9.8 % of the cases, lower incidence in relation to previous reports (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Gunnal *et al.*, 2015; Saha & Roy, 2018;). Double-APM has been reported in different population groups in a range of 21.2 - 56.3 % (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Gunnal *et al.*, 2015; Gheorghitescu *et al.*, 2016; S. Krawczyk-Oz˙óg *et al.*, 2018; Saha & Roy, 2018), while triplicated-APM is reported in 4 - 6 % (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Gunnal *et al.*, 2015; S. Krawczyk-Oz˙óg *et al.*, 2018). We highlight the 13.5 % incidence reported by (Saha & Roy, 2018), however in our study we did not find specimens with triplicated-APM.

Low incidences of single-PPM are reported in the literature, 25 - 38.4 % (Gheorghitescu *et al.*, 2016; Krawczyk-Oz˙óg *et al.*, 2018; Saha & Roy, 2018). However, our findings (58.5 % single-PPM) are consistent with reports of higher incidence (49 - 58.5 %) (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Gunnal *et al.*, 2015). The report done by Roberts & Cohen (1972) stands out with an incidence of 75 %. Low duplicated-PPM incidence has been reported in a range of 29 - 36.4 %, which is consistent with our results 35.3 % and differ with higher reported incidences 38.3 - 58.3 % (Gheorghitescu *et al.*, 2016). Triplicated or more PPM´s are reported with a frequency of 4 - 25 %, in the samples examined in the present study, only five (6.1 %) cases were identified (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Gheorghitescu *et al.*, 2016; Krawczyk-Oz˙óg *et al.*, 2018; Saha & Roy, 2018).

Here, we documented 90.2 % APM and 58.5 % PPM single cases, incidence that is higher/consistent with previous studies (Victor & Nayak, 1995; Krawczyk-Oz˙óg *et al.*, 2018) and differ with data reported by others (Gunnal *et al.*, 2015; Saha & Roy, 2018). This allows us to infer the variable spectrum of the papillary muscles in the left ventricle, a first-order anatomical substrate in the evaluation of clinical events. An ischemic event affecting the PM base will render the involved CT dysfunctional, resulting in BV regurgitation. This will be less damaging if more PM are associated to the same BV group, meaning that the sub-valvular apparatus will be partially affected causing less hemodynamic effect (Gunnal *et al.*, 2015; Krawczyk-Oz˙óg *et al.*, 2018). However, it must be taken into account that in cases with multiple-PM and concomitant hypertrophic cardiomyopathy, where there is a global increase in volumes, the diastolic ventricular flow may be obstructed (de Gregorio, 2007).

In ventricles compromised by ischemic events an additional PM near the apex may also be confused on echocardiograms with mural thrombi (Madu & D'Cruz, 1997). To clarify this doubt and avoid administering anticoagulant therapy incorrectly, it is advice to perform heart tomography for these cases. As a complication of acute myocardial infarction rupture of a papillary muscle might occurs in the first week after infarction, leading to acute mitral insufficiency, pulmonary edema or cardiogenic shock. Around 0.4 - 5 % of all deaths after myocardial infarction have been associated with rupture of a papillary muscle (Vlodaver & Edwards, 1977; Wei *et al.*, 1979).

In agreement with previous studies, we found that APM is longer than PPM, however the reported dimensions differ considerably from lengths of 16 - 16.4 mm to a greater range of 21.3 - 29.9 mm, in which our measurements are located. The PPM length reported is also variable, ranging from 14.6 - 17.6 mm to 21.4 - 27.1 mm, the latest being consistent with our finding (Hosapatna *et al.*, 2014; Krawczyk-Oz˙óg *et al.*, 2018; Sinha *et al.*, 2021; Hosapatna *et al.*, 2022; Ambiga *et al.*, 2023). The evident difference observed between the PM length reported might be given by the size of the hearts evaluated, the segments of the ventricular wall where PM is originated and, in the case of the APM, if the measurements were taken from the upper or lower emergency point of this structure.

The thickness of the PM measured in the present study is located in the upper segment of the reported range 7.98 - 12.38 mm for the APM or larger than the reported range of 8.5 - 9.8 mm for the PPM (Krawczyk-Oz˙óg *et al.*, 2018; Saha & Roy, 2018). The non-observation of higher number of PM in our samples, could explain the presence of more robust muscles. However, it should be considered that in healthy patients isolated PM-hypertrophy obstructs the outflow tract and constitutes a subtype of hypertrophic cardiomyopathy. Papillary hypertrophy is defined by echocardiographic measurement when at least one muscle has 1.3 cm in horizontal diameter (Kobashi *et al.*, 1998; Ferreira *et al.*, 2014).

In the present study, considering total number of analyzed PPM, we found that the main origin was the lower segment of the ventricular wall (74.1 %), while other authors reported 50 - 92.5 % of PPM originated from the middle segment (Victor & Nayak, 1995; Kavimani *et al.*, 2011; Saha & Roy, 2018). Our findings concerning the APM origin are consistent with previous studies that indicate the middle third of the ventricular wall as the most frequent site in 51.9 -79.5 % (Table I) (Victor & Nayak, 1995; Saha & Roy, 2018). Gunnal *et al*. (2015) globally indicates the origin of the LVPM in the middle third of the ventricular wall in 95 % and the lower third in 5 %.

The discrepancies between the reported frequencies of the PM origin might be given by disparity in the criteria used for determining the corresponding origins, mainly in the subjective assessment of the three defined segments in the ventricular walls. The diversity in the PM origin constitutes a substrate for the development of various clinical events: The origin in the lower third can lead to long PM with short chordae tendineae or short PM and long chordae tendineae. In the first scenario, the MP is vulnerable to ischemic episodes because, due to its extensive length, its apex cannot be perfused and its rupture can be precipitated (Victor & Nayak, 1995; Saha & Roy, 2018). However, PM originated in the ventricular upper third are usually small in size, and even if they are configured in groups, their volume in normal hearts does not interfere with adequate ventricular diastolic filling (de Gregorio, 2007).

There are limited number of studies reporting morphological aspects of the PM base. In our analyzed series we found higher incidence of simple bases than the information reported, 50 and 43.3 % (Gunnal *et al*., 2015; Sinha *et al*., 2021). No descriptions were found about the possible pathophysiological implications of these anatomical expressions.

The description of the PM shape has given rise to multiple typifications making difficult contrasting the information, added to the fact that, up to date the International Federation of Associations of Anatomists has not established an official term to describe the different PM shapes. In thepresent work we adopted (Saha & Roy, 2018) criteria because we considered it as complete and clear evaluation of the PM morphological expression. We agree with (Saha & Roy, 2018; Bhadoria *et al*., 2022) and identified truncated as the most common APM shape (32 - 66.2 %), followed by flattened (20 - 27.8 %), conical (5.2 - 15.6 %), bifurcated (8.9 - 10.4 %) and trifurcated (<5 %). The conical shape of the MPP for (Saha & Roy, 2018) is the most frequent (45.8 %) while in the present study considering 121 total PPM the truncated shape is documented as having the highest incidence (36.4 %). The bifurcated and trifurcated forms, as observed in APM, are the ones with the lowest incidence: Bifurcated (APM, 3.8 %; PPM, 11.6 %) and trifurcated (APM, 0.9 %; PPM, 6.6 %). Gunnal *et al*. (2015) report globally that the most common morphology of LVPM is truncated (50.4 %) followed by conical shape with 45 %.

The PM shape could interfere with the blood flow dynamic. Conical-PM shape is the one that best facilitates cardiovascular physiology, presenting minimal obstruction to the blood flow. It has a wide base attached to the ventricular wall and narrow apex that occupies minimum space in the center of ventricular cavity. On the other hand, truncated form has a wider apex that could interfere with flow towards the ventricular cavity, situation that worsens in concentric hypertrophic heart diseases determined by arterial hypertension (Madu & D'Cruz, 1997; Gunnal *et al*., 2015). A better understanding of the differential PM architecture and their clinical implications would help the surgeon to adapt the surgical procedure according to the papillary muscle pattern of the individual patient (Maron *et al*., 1998).

The number of APM CT (average 10) and PPM (average 9.5) documented in the present study is consistent with the information reported by (Victor & Nayak, 1995; Krawczyk-Oz˙óg *et al*., 2018; Saha & Roy, 2018). The sub-valvular component, so-called false-CT, was not evaluated in the present study; however we are aware that these structures can significantly affect the function of the bicuspid valve due to the direct insertion in the ventricular walls.

CONCLUSIONS

Our findings, documenting the APM origin in the middle third of the ventricular wall and the APM larger size in relation to the PPM, are consistent with previous reports. In contrast with the literature, this study reported a greater number of unique APM and PPM in the mixed-race population sample. Additionally, the high incidence of PPM origin in the lower ventricular third and its larger dimensions, shows the harmony of the PPM in the ventricular geometry of healthy individuals. These morphological traits should

Table I. Frequency of the PM origin in the different ventricular thirds.

	Ventricular wall origin	Saha & Roy	Victor & Nayak	Kavinami & Johnson	Present study
APM	Superior	45.5	19.5	40	2.2
	Middle	51.9	79.5	51.9	78.9
	Inferior	2.3	1.5	7.1	18.9
PPM	Superior	26.3	6	27.2	0.8
	Middle	50	92.5	67.1	28.1
	Inferior	23.7	1.5	6.7	71.1

be considered in new studies focusing in the PM characterization of the mestizo population group in Latin America.

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RESUMEN: Los músculos papilares del ventrículo izquierdo presentan múltiples expresiones anatómicas que son relevantes para las áreas médicas que se centran en la comprensión de los eventos clínicos que involucran estas estructuras. El objetivo fue realizar una caracterización morfológica de los músculos papilares del ventrículo izquierdo en una muestra de población colombiana. En el estudio se incluyeron ochenta y dos corazones de individuos masculinos a los que se les realizó autopsia en el Instituto de Medicina Legal y Ciencias Forenses de Bucaramanga, Colombia. En cada corazón se realizó cuidadosamente una incisión longitudinal en el margen obtuso para visualizar los músculos papilares. Se registró el conjunto de datos y se realizó el análisis de las variables continuas y categóricas. Se observó un solo músculo papilar anterior en 74 muestras (90,2 %), mientras que este rasgo se presentó en 48 muestras (58,5 %) para el músculo papilar posterior (p = 0,3). La longitud y anchura media del músculo anterior fueron 29,9 ± 4,94 y 11,74 ± 2,75 mm, y las del músculo posterior fueron 27,42 ± 7,08 y 10,83 ± 4,08 mm. La forma apical truncada fue el tipo más frecuente observado en los músculos papilares, anterior 41 (50 %) y posterior 37 (45,1 %), seguido de la forma plana en los 25 anteriores (30,5 %) y bifurcada en el músculo posterior 14 (17,1 %). Una media de 9,04 ± 2,75 cuerdas elevadas desde el músculo papilar anterior y 7,50 ± 3,3 desde posterior. En nuestro estudio observamos una mayor incidencia de músculos papilares únicos y dimensiones ligeramente mayores que la información reportada en la literatura. La diversidad anatómica de los músculos papilares debe ser considerada para la correcta interpretación de imágenes, implantación valvular y evaluación del desempeño en eventos isquémicos miocárdicos.

PALABRAS CLAVE: Corazón; Ventrículo izquierdo; Músculo papilar anterior; Musculo papilar posterior.

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