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VARIANT ANATOMY OF THE PAPILLARY MUSCLES OF THE HUMAN HEART

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This literature review is dedicated to the variant anatomy of the human heart papillary muscles. The relevance of studying the architecture of these muscles is driven by the potential application of data on structural features and various topographic variations of individual anatomical formations. This information is valuable in cardiology and cardiac surgery for the development of treatment strategies and the prevention of possible hemodynamic disorders, as well as for reconstructive heart surgeries, given the increasing incidence of cardiac pathologies.

Papillary muscles are pivotal structures within the heart, particularly influencing the function of the atrioventricular valves. Their anatomy, which includes their number, shape, size, and morphology, varies significantly among individuals and can have important implications for cardiac function. In the literature, there are contradictions regarding the formation and variations of the structure of the papillary muscles, their topography, functional anatomy, the features of the structure and distribution of the tendinous chords, and the relationship between the structure of the papillary muscles and the tendinous chords. Papillary muscles, which have a complex structure, can cause turbulence in blood flow within the ventricles and create conditions conducive to thrombosis. Anatomists and cardiologists primarily focus on the left ventricle. In contrast, the muscles of the right ventricle are the subject of only a few studies, with authors mainly describing the structure, shape, and size of the papillary muscles and rarely investigating their position.

Modern studies highlight the anatomical variability of the anterior papillary muscle in both ventricles, providing useful insights into structural differences. While the right ventricle’s anterior papillary muscle was predominantly conical (42%), the left ventricle more frequently exhibited a broad apexed shape (32%). The posterior papillary muscle structure in both ventricles are also has variation. Thus, in the right ventricle, conical shapes were the most prevalent (36%), while fan-shaped muscles were more commonly observed in the left ventricle (38%). However, as with the anterior papillary muscle, these variations did not yield statistically significant results ($p=0.243$), indicating that although distinct morphological patterns are present, they may not have substantial clinical relevance. The uniqueness of the septal papillary muscle lies in its stable conical shape and size, which are less susceptible to anatomical variability compared to the anterior and posterior papillary muscles. Due to this morphological stability, it ensures the reliable function of the tricuspid valve. Additionally, the septal papillary muscle plays a supportive role in maintaining intracardiac hemodynamics and stabilizing the trabecular network of the right ventricle. Although this structure has been studied less extensively compared to other papillary muscles, its significance becomes evident in the context of surgical interventions and cardiac diagnostics. For example, its damage or abnormal development may affect the function of the tricuspid valve and contribute to circulatory disorders.

While the patterns of anterior and posterior papillary muscles did not yield statistically significant differences between the two ventricles, their classification provides a framework for understanding the variability that may affect clinical outcomes, particularly in surgical settings.

When performing ultrasound, endovascular diagnostic and therapeutic procedures in the heart's ventricles, as well as when interpreting findings during autopsies, it is important to consider not only the abstract, average "norm" but also to be aware of the various structural variations and positions of the intracardiac anatomical structures.