

## Myocardial Bridges: Pathogenetic Aspects of Functioning

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### Abstract

This article provides information on rare features of the relationship between the cardiac myocardium and the coronary arteries that result in the formation of myocardial bridges.

The myocardium, like any other tissue in the body, needs a constant supply of arterial blood for its normal functioning. The blood supply of the heart is carried out by two coronary arteries. Normally, these arteries are subepicardial and only occasionally immerse into myocardium with formation of small 1-2 cm long muscular bridges. This ensures the continuity of blood flow both in diastole and systole. But sometimes these muscle bridges become very pronounced, resulting in arteries passing in the myocardium (intramural) for a long distance. Such pronounced muscle bridges can play a decisive role in the changes of coronary blood flow and, as a consequence, participate in the pathogenesis of various diseases and in the prognosis of their outcome. Besides, dynamic stenosis of cardiac arteries, which largely depends on heart rate and strength and is not detected by all diagnostic methods, in the absence of organic coronary lesions (atherosclerosis, thrombosis) significantly complicates timely diagnosis and early prescription of adequate therapy.

**Keywords:** Myocardial Bridges; Muscle; Heart Rate

The study of myocardial bridges began in 1737, when pathologist H.C. Reyman [1] described an anomaly of the heart vessels, in which a segment of the artery is partially localized in the myocardial thickness.

There are many classifications of myocardial bridges. The best known is their division into superficial (thickness up to 5 mm, length up to 15 mm) and deep (thickness more than 5 mm, length more than 15 mm). It is believed that superficial myocardial bridges, as a rule, do not cause compression of the tunneled section of the artery in contrast to deep ones, which can disturb the normal blood flow in the heart and cause ischemic attacks [2].

There is also the classification of M.A. Tashnik (2009) [3]. According to it, myocardial bridges are divided into:

- Incomplete myocardial bridges - channel-like sections of myocardium covering the vessel from three sides (any) and, as a rule, for a small length (up to 15 mm);
- Complete myocardial bridges - the artery is surrounded by muscle bundles on all sides for 15 to 70 mm;
- Myocardial tunnels - suggest the entry of subepicardial branches of the coronary arteries into the myocardium without their subsequent exit under the epicardium.

According to different authors, the overall incidence of this phenomenon ranges from 1.5 to 16% when detected by intravital diagnostic methods and from 9 to 80% at autopsy [4]. Despite the fact that myocardial bridges are found in different branches of coronary arteries, they are most frequently (67-98% of cases)

localized in the area of anterior interventricular branch of the left coronary artery [5].

In most cases patients with myocardial bridges in the heart have no complaints. However, it cannot be said that this is a harmless deviation from the norm. Such peculiarity of coronary arteries topography is often accompanied by coronary blood flow disturbances due to tunnel artery compression during systole. It rarely results in severe ischemia, but can cause myocardial perfusion mismatch due to compression of intramural branches of the coronary arteries by muscular muffs. In pathological conditions (under increased physical or emotional load, coronary atherosclerosis, myocardial hypertrophy and fibrosis, etc.) such abnormal arterial location can become critical and provoke serious pathology, including acute coronary failure, arrhythmia, syncope and even sudden death [6].

Thus, every physician should keep in mind the probability of coronary artery topography abnormalities even in previously asymptomatic patients. The diagnostic search for such pathology is especially relevant in unexplained cases of ischemic attacks and myocardial infarction in young people, as well as in hypertrophic cardiomyopathy. Moreover, the study of features of clinical manifestation of myocardial bridges with a comparative assessment of immediate and long-term results of conservative and surgical treatment, the search for new methods of diagnostics of this pathology and their introduction into medical practice will allow to screen and treat this pathology more completely, which will undoubtedly contribute to reduction of mortality from circulatory diseases, and can significantly improve life quality of these patients. All the above facts indicate the relevance of the research topic.

### Purpose of the Study

To study the incidence and localization of myocardial bridges depending on the type of cardiac blood supply.

### Material and Methods of Study

140 macro preparations of the heart of people of both sexes who died at the age of 18-45 years, whose cause of death was not associated with pathology of the cardiovascular system, as well as arterial hypertension, diabetes mellitus, infectious diseases. The study was conducted at the department of normal anatomy

of Grodno State Medical University and was approved by the bioethics commission. The following methods were used in this study: 1) macro- and micropreparation; 2) morphometric method; 3) statistical method.

### Results

When studying preparations of adult heart with the most common right ventricular type of blood supply, the presence of myocardial bridges was detected in 43.1% of cases. The anterior interventricular branch of the left coronary artery was localized in 93.5% and the right coronary artery in only two preparations (6.5%). In 26 cases (83.9%), one muscular bridge crossed the vessels, in 3, two, and finally, in 2, three. According to M.V. Tashnik's (2009) classification, 19 preparations (61.3%) were classified as «incomplete» myocardial bridges, 10 preparations (32.3%) as «complete», and 2 preparations (6.4%) as «myocardial tunnels». In the latter group the bridges were always located in the right coronary artery area.

Myocardial bridges were detected in 25% of cases on the preparations with mixed type of blood supply of adult heart, with double bridges in two preparations. In 62.5% of cases bridges were located over the anterior interventricular branch of the left coronary artery and in 37.5% - over the right coronary artery.

### Conclusions

Thus, it was found that myocardial bridges were detected in 43.1% of cases in the right ventricular blood supply type, with myocardial bridges most frequently (93.5%) being located over the anterior interventricular branch of the left coronary artery, and only in 6.5% of cases - over the right coronary artery ( $p < 0.05$ ). In the left ventricular type of blood supply (25.7% of cases) myocardial bridges were less common ( $p < 0.05$ ) than in the other types (13.9% of cases) and were always located over the anterior interventricular branch of the left ventricular artery. Myocardial bridges in mixed type of cardiac blood supply were detected in 25% of cases. In 62.5% of cases, bridges were located over the anterior interventricular branch of the left coronary artery and in 37.5% - over the right coronary artery.

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