

Progress in Surgical Treatment of Coronary Myocardial Bridge

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Received: November 14, 2018; Accepted: November 28, 2018; Published: December 6, 2018

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Abstract

Coronary myocardial bridge is a kind of congenital anatomical variation. With the development of imaging examination technology, the detection rate of myocardial bridge is obviously improved, and the viewpoint that myocardial bridge can cause myocardial ischemia or even malignant cardiovascular events is gradually accepted by people. It is generally believed that surgical treatment is a safe and effective treatment for myocardial bridges in which the drug cannot relieve symptoms. Therefore, clinicians should improve their understanding of myocardial bridges and grasp the principles of treatment of myocardial bridge patients. This article reviews the research progress of surgical treatment of myocardial bridge, in order to improve the understanding of myocardial bridge, follow up the research progress of surgical treatment of myocardial bridge, and provide a basis for optimizing surgical treatment of myocardial bridge.

Keywords: Coronary Artery; Myocardial Bridge; Surgical Treatment

Introduction

The coronary arteries usually travel in the connective tissue under the epicardium. If a segment of the coronary artery or a segment of its branch travels in the myocardium, this bundle of myocardial fibers is called the myocardial bridge (myocardial bridge MB), which travels through the myocardial bridge. The underlying coronary artery is called the wall coronary artery [1]. With the development of imaging techniques such as CT Angiography (CTA), Coronary Angiography, and Intravascular Ultrasound (IVUS), the detection rate of MB has been significantly improved, and people's understanding has gradually deepened. MB, which was previously considered to be a benign lesion, is increasingly thought to be closely related to myocardial ischemia, arrhythmia, myocardial infarction, and even sudden death [2,3]. It is generally believed that the asymptomatic myocardial bridge generally does not require treatment. For the myocardial bridge causing symptoms, the use of stents is not recommended except for the conventional use of β -blockers, calcium channel blockers and other drugs that reduce myocardial contractility. Treatment

of wall coronary artery compression due to its long-term rate of restenosis, combined with myocardial contraction, Hagger and other reports of myocardial bridge interventional stent treatment, restenosis rate as high as 36% [4]. Moreover, malignant events such as stent fracture and coronary perforation have also been reported [5]. Therefore, surgically isolated wall coronary arteries and Coronary Artery Bypass Grafting (CABG) are considered to be the cure for this disease. This is a review of the latest advances in surgical treatment of myocardial bridges.

Clinical Typing and Grading

The clinical classification of MB is generally divided into three types according to Schwars classification: A, B, and C. Type A patients only found myocardial bridge during coronary angiography, and there is no objective basis for myocardial ischemia, which is generally superficial; type B patients have ischemic manifestations during stress test, and there is an objective basis for myocardial ischemia; type C patients Quantitative coronary angiography confirmed hemodynamic changes in the coronary arteries [6]. Regardless of the objective basis of myocardial ischemia, B and C were mostly deep myocardial bridges.

The severity rating of MB is still based on Noble and other roots proposed in 1976 according to the degree of changes in coronary artery diameter under myocardial bridge under systolic and diastolic grades are classified into grade III: grade I: vascular stenosis < 50%, grade II stenosis in 50-75% Between, grade III vascular stenosis > 75% [7]. As the degree of stenosis deepens, myocardial perfusion decreases, myocardial ischemia and hypoxia increase, causing corresponding symptoms.

Surgical Indication

At present, there is no uniform guideline or expert consensus on the indications for surgical treatment of myocardial bridge. However, according to various case reports, patients who need surgery can be roughly divided into two categories: one is MB

grade III or Schwars classification that is not effective for non-surgical treatment. Patients with type C simple myocardial bridge without other comorbidities; second, patients with myocardial bridges with other heart disease requiring surgery, and that myocardial bridges may aggravate their symptoms or affect cardiac function.

Simple MB without other Complications

In 2010, Xu Jianping and other 10 cases of patients with simple MB who underwent surgery, the degree of stenosis of the anterior descending coronary artery was 80% to 95% [8]. 18 patients reported by Zheng Shaoyi, et al. in 2017 [9], the Noble grade was grade III, and there were obvious symptoms such as chest tightness and shortness of breath. In 2016, Wang Sheng [10] reported that 8 patients had obvious symptoms of angina,

and the degree of coronary artery stenosis was between 50% and 90%. Because patients with simple myocardial bridge have a higher rate of long-term restenosis after interventional therapy, and there is a risk of stent fracture, coronary perforation, etc., for patients with obvious clinical symptoms and drugs cannot be alleviated, MB grades above grade III are surgical Indications.

MB Combined with other Cardiac Surgery Diseases

MB with three or left main coronary lesions, MB with valvular disease, and MB with congenital heart disease are all indications for surgery. In particular, the superficial type of MB, which is thought to be associated with myocardial ischemia, should relieve the pressure of the myocardial bridge against the coronary artery while treating other lesions of the heart.

Table1: MB current surgical treatment principles and methods

Reasons for MB surgical treatment:	1. Patients with poor drug treatment; 2. Clear myocardial ischemia; 3. A high degree of vascular stenosis.
Classification of patients requiring surgery in MB:	1. Non-surgical treatment of patients with MB grade III or Schwars type C simple myocardial bridge without other comorbidities; 2. Patients with myocardial bridges with other heart disease requiring surgery, and that myocardial bridges may aggravate their symptoms or affect cardiac function.
Surgical approach:	1. Myocardial release; 2. Coronary artery bypass grafting.
Possible postoperative complications (low probability of occurrence):	1.Extracorporeal circulation-related complications during cardiopulmonary bypass; 2. Wall digging, heart rupture; 3. Scar formation compression at the cutting site Coronary artery; 4. Postoperative arrhythmia and so on.

Surgical Approach

The surgical treatment of myocardial bridge mainly includes myocardial release, coronary artery bypass or both.

Myocardial Release

Minimally invasive non-cardiopulmonary bypass of myocardial lysis is the most common procedure for simple MB use. It has the following advantages: 1. it avoids the complications associated with extracorporeal circulation; 2. It is easier to find the coronary artery and it is not easy to dig through the wall [11]; 3. Hemostasis after the incision of the myocardium is more accurate and timely; 4. Small trauma, reduce the length of hospital stay and costs. For some experienced and more mature units, minimally invasive coronary artery bypass grafting and endoscopic valvuloplasty can be performed simultaneously for patients with coronary heart disease and valvular disease. However, for deep myocardial bridges and long muscle bridges (length > 2.5cm), considering the risk of muscle bridge release, it is recommended to perform coronary artery bypass grafting [12].

Coronary Artery bypass Grafting

For myocardial bridge thickness ≥ 5mm, length ≥ 2.5cm, most literature reports strongly recommend coronary artery bypass grafting, the main reason is that the deep cut of the myocardium is easy to cause ventricular perforation, postoperative scar formation, and secondly, it may damage the coronary artery and lead to the formation of ventricular aneurysm [13,14]. For patients with coronary heart disease at the same time, and the muscle bridge is superficial, combined with muscle bridge lysis and coronary artery bypass grafting. For patients with other intracardiac surgery, the procedure should be chosen according to the specific conditions of the muscle bridge. In addition, Zheng Shaoyi believe that after myocardial release, although the myocardial bridge has been fully relieved during surgery, when coronary blood flow filling is poor, coronary artery bypass grafting should be decisive [15]. For the blood vessels selected for bypassing, most reports suggest that the long-term patency rate of the internal thoracic artery is the best, but Bockeria, et al. pointed out that for patients with Noble grade II or lower, the patency rate of the internal mammary artery as a bridge vessel is lower than that of the great saphenous vein [16].

Surgical Complications

Surgical treatment of MB, depending on the situation, choose myocardial release or coronary artery bypass surgery is a safe and effective way. Although there are few reports of postoperative complications, the following complications may still occur: 1. Extracorporeal circulation-related complications during cardiopulmonary bypass; 2. Wall digging, heart rupture; 3. Scar formation compression at the cutting site Coronary artery [11]; 4. Postoperative arrhythmia and so on. There is no specific quantitative index for the need for surgery for MB. How to avoid postoperative complications? First, we must carefully grasp the surgical indications, accurately assess the patient's symptoms before surgery, and evaluate the coronary lesions based on imaging findings. Staging, grading, and multidisciplinary discussion of coronary lesions are necessary for surgery. Secondly, it is very important to choose the appropriate surgical method. The surgical procedure should be selected in combination with the preoperative imaging results and the specific conditions of the intraoperative observation. It is also necessary to change the surgical procedure according to whether the operation is effective or not.

Summary

In most cases, the coronary myocardial bridge is a benign lesion, however, in some cases myocardial bridges can also cause myocardial ischemia or even severe cardiovascular events. Therefore, after the diagnosis of myocardial bridge, the condition should be evaluated, staged and graded according to the patient's clinical symptoms and imaging findings. For patients with poor drug treatment, clear myocardial ischemia, and a high degree of vascular stenosis, surgical treatment may be preferred. Because the pathogenesis and pathophysiological mechanism of myocardial bridge are not clear, there are no complete standards and guidelines for diagnosis and treatment. Therefore, through the above review, it is hoped to provide some help for clinical understanding of myocardial bridge and optimization of surgical treatment of myocardial bridge.

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