

# Is coronary artery bypass grafting an acceptable alternative to myotomy for the treatment of myocardial bridging?

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## Abstract

A best evidence topic in cardiothoracic surgery was written according to a structured protocol. The question addressed was 'Is CABG an effective alternative for the treatment of myocardial bridging?' Altogether, only six papers were identified using the reported search that represented the best evidence to answer the clinical question. The authors, journal, date and country of publication, patient group studied, study type, relevant outcomes, and results of these papers are tabulated; these studies reported the outcome of myotomy and coronary artery bypass grafting (CABG) for myocardial bridging. All of these studies were retrospective reports of the results of surgical intervention in patients with myocardial bridging. They showed that the incidence of myocardial bridging was less than 1–1.5% in patients with angina requiring angiography, and 7–9% of these patients had refractory angina despite medical treatment and required surgery. The evidence on the treatment of this congenital condition that mainly affects the middle segment of left anterior descending artery is limited, and there are no treatment guidelines currently available. Stenting of the tunnelled segment has shown high failure rates in approximately half of the cases. Current evidence in the literature suggests that surgery is the mainstay treatment for myocardial bridging. Surgery is performed either as supra-arterial myotomy and de-roofing of the muscle bands on- or off-pump, or as coronary artery bypass grafting of the affected coronary artery beyond the tunnelled segment. Although no mortality was reported with either of these operations, surgical myotomy on deep and extensive myocardial bridges carries the risk of entering the right ventricle, bleeding and aneurysm formation. In addition, in a small percentage of the patients undergoing myotomy, angina recurred. Despite the possibility of competitive flow in the native coronary artery after CABG for myocardial bridging, we did not identify any evidence demonstrating graft occlusion after CABG for myocardial bridging. In conclusion, in extensive and deep myocardial bridgings, CABG may be the treatment of choice that carries low risk, limited complications and excellent symptomatic relief.

**Keywords:** Coronary artery bypass grafting • Myocardial bridging • Surgery

## INTRODUCTION

A best evidence topic was constructed according to a structured protocol. This is fully described in the ICVTS [1].

## THREE-PART QUESTION

In [patients with myocardial bridging] will [coronary artery bypass grafting] result in a [better outcome/survival rate]?

## CLINICAL SCENARIO

Cardiologists have requested a surgical review of a 42-year old man who has been experiencing angina for the past few years. He was diagnosed with myocardial bridging (MB) of his left anterior descending artery (LAD) and despite being on beta-blockers and calcium channel antagonists, his angina is deteriorating. His recent angiogram showed >75% compression of the middle segment of LAD (tunnelled segment) during systole, which continues to the initial stage of diastole. Tc-99 m-sestamibi SPECT (single-photon emission computed tomography) showed

reversible ischaemia of the LAD territory. The rest of his coronary arteries were normal. Cardiologists consider that anastomosis of the left internal mammary artery to his LAD can be the way forward compared with stenting or myotomy. You decide to assess the evidence before accepting this patient for surgery.

## SEARCH STRATEGY

Medline 1950 to September 2012 was searched using OVID interface [exp myocard\$ bridge\$/OR myocard\$ muscle bridge\$.mp] AND [exp surgery/OR CABG.mp].

## SEARCH OUTCOME

Six papers were found using the reported search that provided data to answer the question. Non-English papers, case reports and studies, on stenting only, were excluded. Of the six papers, two were on myotomy only, one on coronary artery bypass grafting (CABG) and the other three papers, on the results of both treatments. No randomized controlled trials were identified

and all the studies were only retrospective reports of surgery for MB. These are presented in Table 1.

## RESULTS

The first line of treatment for myocardial bridging is medical therapy with negative inotropic and chronotropic agents [2].

Stenting of the tunnelled segment has also been used; however, the failure rate in approximately 50% of the cases is a major drawback [3]. Therefore, in patients with refractory symptoms, surgery is the treatment of choice. Supra-arterial debridging myotomy is performed on- or off-pump to de-roof the artery. It can be conventionally done through a median sternotomy. Minimally-invasive myotomy through mini-thoracotomy and robotic approach have

**Table 1:** Studies on surgery for myocardial bridging

| Author, date, journal and country<br>Study type<br>(level of evidence)   | Patient group  | Key results  | Outcome  | Comments and limitations   |
|--|--|--|--|--|
| Iversen <i>et al.</i> (1992),<br>Scand J Thorac<br>Cardiovasc Surg,<br>Germany [6]<br><br>Retrospective<br>(level III) | Nine patients;<br>all had myotomy  | Good results with myotomy<br>with minimal complications  | Accidental opening of<br>right ventricle in 2 cases<br><br>No further ischaemia  | Retrospective<br><br>No comparative<br>CABG group  |
| Wan and Wu (2005),<br>Interact CardioVasc<br>Thorac Surg,<br>China [8]<br><br>Retrospective<br>(level III)             | Seven years: 19 interventions:<br>4 stents, 15 surgery (CABG = 8,<br>myotomy = 7 based on<br>surgeon's choice)                   | Patients that were stented<br>developed in-stent stenosis<br><br>Surgical treatment is<br>superior to stenting | No complications with either<br>of surgical procedure<br><br>No difference in the outcome<br>with myotomy or CABG<br><br>Normal angiogram in 24<br>months in the surgical group<br>50% in the stent group<br>required CABG within a year | No randomization<br><br>Retrospective<br><br>Patients who had<br>surgery had also<br>coronary artery disease<br>in other vessels<br><br>CABG and myotomy<br>were not compared<br>No statistical analysis |
| Rezayat <i>et al.</i> (2006),<br>Saudi Media,<br>Iran [7]<br><br>Retrospective<br>(level III)                          | Five years: 26 patients<br>all had myotomy   | Myotomy is a safe procedure  | No complications<br><br>7-81-month follow-up<br><br>3 recurrence of symptoms<br><br>One required CABG  | No CABG group for<br>comparison<br><br>Retrospective study   |
| Wu and Xu (2007),<br>Chin Med J,<br>China [9]<br><br>Retrospective<br>(level III)                                      | Nine years: 31 operations<br>(CABG = 15,<br>myotomy = 16, based<br>on angiographic findings and<br>CABG in deep and tight bands) | Myotomy as first choice<br>unless there is extensive,<br>or deep myocardial bridging                           | No complications<br><br>Asymptomatic postoperatively<br>31 month-follow-up: no<br>angiographic stenosis  | Only 70% had follow-up<br>angio<br><br>Retrospective<br><br>No comparison between<br>myotomy and bridging  |
| Huang <i>et al.</i> (2007),<br>Chin Med J,<br>China [10]<br><br>Retrospective<br>(level III)                           | Nine years: 11 operations<br>for isolated MB (myotomy = 8,<br>CABG = 3)  | Surgical intervention<br>has good results<br><br>In cases of deep MB<br>CABG is superior                       | One case of right ventricular<br>perforation with MB<br><br>No complications with CABG<br><br>Follow-up: 35 months<br><br>Two patients in myotomy<br>group symptomatic   | No comparison between<br>the groups has been made<br><br>Retrospective   |
| Sun <i>et al.</i> (2012),<br>J Card Surg,<br>China [11]<br><br>Retrospective<br>(level III)                            | Three years: 13 operations<br>all CABG   | CABG is effective in<br>the treatment of MB  | No surgical complications<br><br>No stenosis or graft failure<br>in 1 year<br><br>All patients symptom free<br>after 2 years   | No comparative<br>myotomy group  |

MB: myocardial bridging; CABG: coronary artery bypass grafting.

also been reported [4, 5]. Alternatively, the tunnelled segment, which usually involves LAD, is bypassed with a conduit. Whether surgical myotomy is superior to CABG or not is debated.

Iversen *et al.* [6] reported one of the first series of on-pump supra-arterial myotomy on 9 patients. In 2 of his series, there was an accidental opening of the right ventricle during myotomy, which required intervention. Otherwise, good results were reported with no further ischaemia. Similarly, Rezayat *et al.* [7] showed the results of myotomy on 26 patients with no mortality or complications. However, 3 cases of angina recurrence were reported, 1 requiring CABG.

In 2005, Wan and Wu [8] published their 7-year experience with the treatment of MB; in the 19 patients who required intervention, four stents were inserted, 2 of which were occluded within 2 years, requiring re-intervention. The rest of the patients received CABG ( $n=8$ ) or myotomy ( $n=7$ ), based on the surgeon's choice. There were no complications with either of the treatments, and all of the patients remained symptom free with normal angiograms after 2 years. In another report by Wu and Xu [9], 15 patients underwent CABG and 16 had myotomy with no complications. Patients remained asymptomatic at follow-up and 70% who underwent computed tomography angiogram did not show any stenosis or graft occlusion. Huang *et al.* [10] also compared CABG ( $n=3$ ) with myotomy ( $n=8$ ) and showed slightly inferior results with myotomy with 1 case of right ventricular perforation and 2 patients remaining symptomatic postoperatively, although it was not possible to conduct any statistical analysis due to the size limitation.

One study by Sun *et al.* [11] published the results of CABG on 13 cases of MB with no complications, such as graft failure or symptom recurrence, after 2 years and concluded that CABG is an effective treatment for MB.

While no substantial evidence was provided, most of the authors suggested that MB is considered extensive if it is longer than 2.5 cm and deeper than 0.5 cm, or if angiographically, it is apparent that the affected coronary artery cannot recover during diastole, therefore due to the risk of ventricular rupture, bleeding and aneurysm formation as a result of myotomy, CABG is the treatment of choice and no complications have been reported by any of the above studies [9, 10].

Although it has been shown in a case report that CABG for MB can result in graft occlusion due to the competitive flow [12], it is important to note that there is no evidence in the literature to support this statement.

## CLINICAL BOTTOM LINE

Myocardial bridging is a congenital condition with good response to medical therapy, however in a small percentage of

patients, symptoms are refractory and require intervention for which stents have been tried with a high risk of failure. Surgery, however, carries low risk with excellent results and can be done on- or off-pump to either perform supra-arterial myotomy or CABG. In deep and extensive MBs, however, literature suggests that CABG is superior to myotomy in the short- and mid-term and should be the treatment of choice in patients with refractory symptoms unresponsive to medical treatment, particularly in whom extensive and deep bridges are present. With advances in imaging, it may be necessary to create some criteria to determine the choice of treatment (CABG/myotomy) preoperatively.

**Conflict of interest:** none declared.

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