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Extensive unroofing of myocardial bridge: A case report and literature review

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Abstract

Background: Myocardial bridge is defined as a segment of a coronary artery that takes an intramyocardial course. The presence of myocardial bridge has been observed in as many as 40%–80% of cases on autopsy, angiographically from 0.5% to 16.0%, and often asymptomatic. However, it has been associated with angina, coronary spasm, myocardial infarction, arrhythmias, syncope, sudden cardiac arrest, and death. Conflicting opinions exist on the timing of surgical intervention for myocardial bridge.

Methods: We present an unusual case of a young female, with prior aortic surgery, who had refractory chest pain despite optimal medical therapy. Stress testing revealed anterior ischemia. Cardiac catherization showed myocardial bridge of the left anterior descending artery with significant compromise of blood flow (fractional flow reserve = 0.75 with adenosine). We proceeded with surgery. Intraoperatively, we found an unusually long (10-cm) intramyocardial segment of the left anterior descending artery which was managed by surgically unroofing. Our patient felt better post procedure. Repeat cardiac catheterization showed no further narrowing of the left anterior descending artery with a fractional flow reserve of 0.87 in its distal segment.

Results/discussion: Myocardial bridge is present mostly in female patients (74.5%), with median age at 56.2 years and mostly involving the left anterior descending artery (77.2%). The average length of myocardial bridge is 21.85 ± 16.10 mm (range: 5–70 mm). Our case is unique as the involved myocardial bridge was 10 cm in length, the longest ever reported. Multiple imaging modality revealed significant coronary insufficiency, with a subsequent clinical and angiographic improvement upon unroofing of the culprit coronary vessel.

Conclusion: Management decision on myocardial bridge remains controversial. This is a case of the longest symptomatic myocardial bridge, with a subsequent improvement post unroofing.

Keywords

Myocardial bridge, intramyocardial left anterior descending artery, myocardial bridging, myocardial ischemia

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Introduction

Myocardial bridge (MB) is defined as an epicardial segment of the coronary artery which takes an intramyocardial course, resulting in systolic compression.[1] It was first recognized at autopsy by Reyman in 1737, first described angiographically by Porstmann and Iwig,[2] and first surgically managed with myotomy by Binet et al.[3] We report a case of a very long segment left anterior descending artery (LAD) MB requiring a corresponding extensive surgical myotomy.

Case report

A 55-year-old woman presented to the emergency room with chest pain. Her past medical history was significant for type A aortic dissection repaired with a Dacron vascular graft from the sinotubular junction to the proximal aortic arch 8 years ago, persistent chest pain on medical therapy with known LAD MB, ex-tobacco use (quit 10 years ago), migraines, and gastroesophageal reflux. Her serial electrocardiograms and cardiac enzymes were normal with mildly elevated beta-natriuretic peptide of 290 pg/mL. Computed tomographic angiography (CTA) of the chest was negative for aortic dissection or pulmonary embolism. Transthoracic echocardiogram showed normal biventricular function and size, normal tricuspid aortic valves, and trivial mitral and

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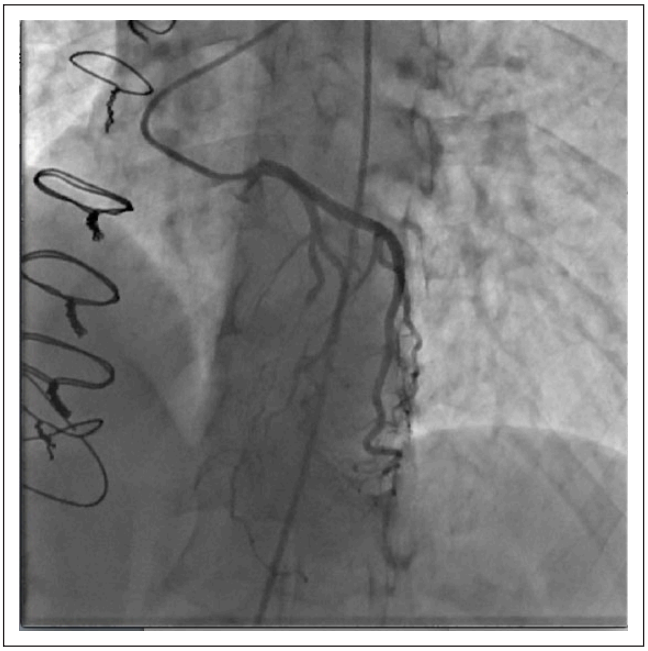

Figure 1. Snapshot of the preoperative coronary angiogram at systole showing compression of the proximal and mid-segments of the LAD.

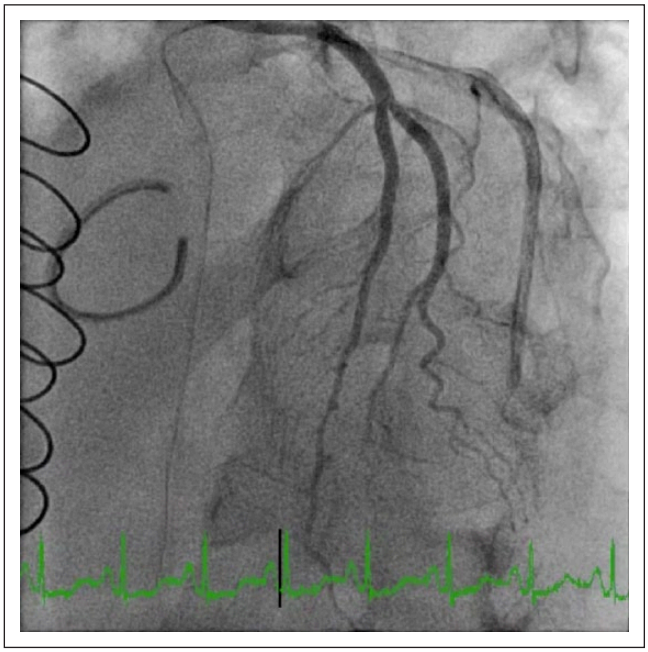

Figure 2. Snapshot of the postoperative coronary angiogram showing resolution of any compression of the LAD.

moderate tricuspid regurgitation. She subsequently underwent right and left cardiac catheterization revealing a LAD with a long intramyocardial segment. Its proximal portion supplied a large bifurcating diagonal branch. There were two separate regions of total systolic compression yet relatively preserved diastolic caliber. Fractional flow reserve (FFR) on the muscle bridge was 0.85 at rest and 0.75 with adenosine, consistent with hemodynamic significant stenosis (Supplemental Video 1, with a snapshot of the same in Figure 1).

As her New York Heart Association (NYHA) Class III symptoms persisted despite optimal medical therapy comprising beta-channel and calcium channel blockers, surgical management involving dividing the MB was her next and only option.

She underwent redo sternotomy, unroofing of LAD MB, and tricuspid repair with an annuloplasty ring. Dense adhesions made it difficult to localize the distal LAD. Once localized, the MB over the LAD was carefully and slowly divided. The mid LAD coursed under the right ventricular (RV) endocardium and the unroofing created a small 5-mm opening to the RV parallel to the LAD. This opening was repaired with direct suture from the adventitia to the endocardium. The LAD was freed all the way up to the takeoff of its large diagonal branch. The length of the divided intramyocardial segment of LAD measured 100 mm. The tricuspid valve showed annular dilation and was repaired by a 28-mm Carpentier-Edwards (CE) classic annuloplasty ring. Post-pump echocardiography showed preserved biventricular function and no mitral or residual tricuspid regurgitation.

Her postoperative course was uneventful. Postoperative cardiac catherization (Supplemental Video 2, with a snapshot of the same in Figure 2) was performed on postoperative day 6 and confirmed resolution of the MB, with an FFR of 0.87 in the distal LAD. She was discharged home a day later.

Discussion

Myocardial bridging (MB) is considered a benign inborn coronary abnormality. On autopsy, MB has been reported in as many as 40%–80% of cases,[4] angiographically in 0.5%–16.0%. It is more frequent in females, involving mostly the LAD (77.2%), then the left circumflex artery (40%), and the right coronary artery (36%).[5] The average length of the MB is 21.85 ± 16.10 mm (range: 5–70 mm) with a muscle thickness above the artery of 3.744 ± 1.48 mm.[6] Our case involved an MB that was 10 cm in length, the longest that it was ever reported.

Although generally benign, MB has been associated with coronary spasm, myocardial infarction, unstable angina, supraventricular and ventricular arrhythmia, syncope, myocardial stunning,[7] ventricular septal rupture,[8] transient ventricular dysfunction, or sudden cardiac arrest or death.[9]

MB of coronary arteries is commonly noted on chest CTA; only approximately one-third of these show systolic compression. When symptomatic, stable angina is the usual presentation. Exercise stress tests often show nonspecific signs of ischemia and do not distinguish between MB and other causes of myocardial ischemia.

In patients with an MB in the LAD, the percentage of arterial compression is related directly to the burden of its

proximal atherosclerotic plaque, particularly in patients who otherwise have low coronary artery risk factors.[10] MB in the LAD is an independent risk factor for more than 50% coronary artery stenosis in proximal LAD, with or without hypertension,[11] suggestive of an obstructive nature of a LAD MB. Aside from increased propensity for atherosclerosis, diastolic compression and endothelial shear-stress-related vasospasm are the other mechanisms of myocardial ischemia.[4]

Coronary angiography, intracoronary Doppler, multislice CTA, positron emission tomography (PET) scan, and contrast stress echocardiography are the modalities to study the significance of an MB.[4] In our case, we diagnosed the MB of the LAD angiographically, which showed its systolic narrowing, as well as a reduced FFR. An FFR < 0.75 suggests a significant flow limitation. For a symptomatic patient with MB and an abnormal but nonsignificant FFR (>0.80), intravenous administration of dobutamine can lead to higher pressure gradients and reproduction of anginal symptoms, reflecting a clinically significant MB.[12]

First-line treatment of symptomatic MB is medical—namely, beta blockers. Nitrates should be avoided because symptoms may worsen.[13] Coronary stenting is reserved for refractory patients who are deemed too high risks for surgery, as stent fracture and coronary aneurysm have been reported.[14]

In a retrospective review of 31 patients who underwent surgical myotomy for significant MB, all postoperative patients became symptom free with an improvement in NYHA class from I–III to I–II.[15] Our patient was very symptomatic and was treated medically for an extended period of time. The surgery with the division of a very deep and long MB is of high risk particularly when the RV is punctured intraoperatively; however, the RV hole was easily repaired. Our patient underwent postoperative angiography with FFR (0.87 in the distal LAD), which confirmed a technically good result. Our case is unique as it represented the longest LAD unroofing that has ever been reported.

Conclusion

Although very common and most often benign, MB may be associated with significant anginal symptoms being the usual presentation. Surgical myotomy of the MB is an effective therapy in alleviating symptoms.

Declaration of conflicting interests

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Ethical approval

Our institution does not require ethical approval for reporting individual cases or case series.

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Informed consent

Written informed consent was obtained from the patient(s) for their anonymized information to be published in this article.

Supplemental material

Supplemental material for this article is available online.

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