Myocardial Bridging of the Right Coronary Artery inside the Right Atrial Myocardium Identified by ECG-gated 64-slice Multidetector Computed Tomography Angiography

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A myocardial bridge (MB) is defined as an intramyocardial course of a major epicardial coronary artery, and it is mainly confined to the left ventricle and the left anterior descending coronary artery. There are rare reports of right coronary MB seen during angiographic examination. Herein, we present a 49 year-old man with right coronary artery MB without luminal narrowing in the diastolic and systolic phases of electrocardiography-gated computed tomography images. The value of multi-detector computed tomography for the detection of anatomical variants in the cardiovascular system is further discussed. *(Chang Gung Med J 2010;33:216-9)*

Key words: CT coronary angiography, myocardial bridging, right coronary artery

Myocardial bridging (MB) is a congenital condition that a segment of an epicardial coronary artery runs intramurally through the myocardium.[1] The coronary arteries may dip into the myocardium for varying lengths, and then reappear on the heart surface. The muscle overlying the intramyocardial segment of the epicardial coronary artery is called a myocardial bridge, and the artery coursing within the myocardium is called a tunneled artery. The anterior interventricular branch of the left coronary artery has been reported as the most frequent site of myocardial bridges.[1] Multi-detector computed tomography (MDCT) coronary angiography has been established as a non-invasive diagnostic tool for the assessment of coronary anomalies.[2-5] This report presents a rare myocardial bridge of the right coronary artery (RCA) and demonstrates the luminal diameter of the myocardial bridge in both the systolic and diastolic phases.

CASE REPORT

A 49-year-old non-hypertensive, non-diabetic man had retrosternal chest pain on exertion for 30 minutes. The pain was not relieved by sublingual nitroglycerin tablets. The initial electrocardiography (ECG) and cardiac enzyme levels were unremarkable. Since his father died of a myocardial infarction and he smoked a half pack of cigarettes per day for thirty years, he underwent a self-referral ECG-gated computed tomography (CT) coronary angiography. The CT coronary angiography was performed on a 64-slice CT scanner (Aquilion, Toshiba, Japan) with a 0.4 second rotation time. The patient received 2 sprays of oral NTG and 10 mg of oral propranolol before the examination. The heart was in sinus rhythm at 60 beats per minute. Eighty milliliters nonionic contrast material followed by 50 ml saline was injected through the right antecubital vein using a

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pressure injector at a rate of 4 ml/sec. The scan was performed in 5.2 seconds with 120 kV, effective mAs of 440, a slice collimation of 0.5 mm, slice width of 1.0 mm and reconstruction increment of 0.3 mm. The post-processing of image was performed on a dedicated computer workstation (Vitrea, Toshiba, Japan). The 80% R-R interval images were selected for the diastolic phase, and 52% R-R interval images were chosen for the systolic phase.

In this examination, the middle segment of right coronary artery was not visualized in its normal epicardial course for a length of approximately 4 cm. Axial section imaging (Fig. 1) and curved multiplanar reformation depicted the proximal segment of the right coronary artery dipping into the myocardium of the right atrium. The distal right coronary artery was epicardial, and exhibited good opacification. A diagnosis of tunneled proximal right coronary artery was made. The data did not demonstrate luminal narrowing by myocardial compression during the systolic and diastolic phases (Fig. 1).

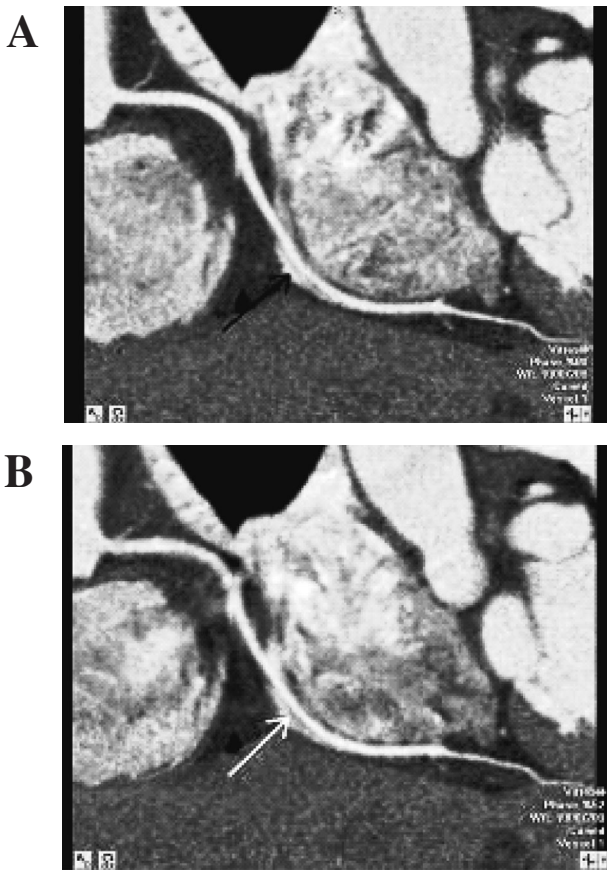

Fig. 1 Cardiac computed tomography with curved multiplanar reformation images shows the middle segment of the right coronary artery embedded in the myocardium of the right atrium (arrow) without luminal stenosis on both the diastolic (A) and systolic phases (B). The luminal diameter of the right coronary artery is 3 mm in cross section.

Conventional catheter angiography was not conducted, because no obvious coronary artery stenosis or calcification was observed on CT coronary angiography. The patient was also referred to the gastroenterology clinic and a esophagogastroduodenoscopy revealed reflux esophagitis. His symptoms improved under medical treatment with a proton pump inhibitor and lifestyle modulation. The patient had no cardiovascular events or hospital admission for chest pain during two years of follow-up.

DISCUSSION

A myocardial bridge was first described in 1922 by Crainician, and was regarded as a simple variant of coronary artery anatomy. A myocardial bridge is a common finding in cardiac examinations, with the incidence depending on the study method. The incidence of tunneled major coronary arteries identified at autopsy (5.4-85.7%) is significantly different from that determined on angiography (0.5-12%).[6] The condition is mainly confined to the left anterior descending coronary artery. However, a few cases of RCA bridging have recently been reported on CT coronary angiography.[7,8] The clinical significance of MB is controversial. A suggested association between myocardial ischemia and myocardial bridges increases their clinical relevance.[9] Postulated reasons for the discrepancy of prevalence on autopsy and angiography include length of the tunneled vessel, level of systolic compression and heart rate. Longer segments of tunneled vessel, severe systolic narrowing of the tunneled segment and tachycardia may contribute to myocardial ischemia. A myocardial bridge predisposes to the development of atherosclerosis in the segment of coronary artery proximal to the bridge, revealing that a myocardial bridge should be viewed as an anatomic risk factor in the assessment of coronary artery disease.[10]

The imaging modality most commonly use for diagnosis of myocardial bridge is conventional

catheter angiography, which demonstrates the milking effect, rhythmical compression/ occlusion of the involved vessel during systole and opacification during diastole. However, a tunneled artery may be missed by this modality, particularly if images are only obtained during diastole. CT coronary angiography indicates the intramyocardial course of the artery, and multiplanar reconstruction capability improves the visualization to assess the length of the involved segment. The source images gathered in the systolic and diastolic phases constitute the dynamic imaging of a myocardial bridge, which reveals stenosis in the systolic phase and recovery to uniform luminal diameter in the diastolic phase.[11] Hence, CT coronary angiography is potentially a better noninvasive diagnostic approach than conventional catheter angiography for symptomatic patients who have a myocardial bridge without atherosclerotic lesions.

The recommended treatment of symptomatic myocardial bridges includes beta and calcium channel blockers to control tachycardia and antispasmodic effects. Supra arterial myotomy, involving release of the bridge, is undertaken to obtain relief of symptoms.[12] Postoperative improvement is judged by the nuclear imaging and intra-operative high frequency echocardiography.

Conclusion

In summary, we presented a rare case of an RCA myocardial bridge found on ECG-gated MDCT angiography, and further evaluated the luminal diameter in the systolic and diastolic phases.

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右冠狀動脈心肌橋以 64 切面電腦斷層冠狀動脈攝影診斷之病例報告

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心肌橋的定義是一段主要的冠狀動脈被包圍在心肌纖維中。出現的區域位置幾乎都侷限在左心室與冠狀動脈左前降枝。在血管攝影檢查中發現右冠狀動脈的心肌橋在文獻上是相當罕見的，本篇病例報告提出一例右冠狀動脈心肌橋以 64 切面多層次電腦斷層診斷。進一步分析收縮期與舒張期血管管徑並沒有顯著狹窄，由此討論多層次電腦斷層對冠狀動脈變異的診斷價值。(長庚醫誌 2010;33:216-9)

關鍵詞：電腦斷層冠狀動脈血管攝影，心肌橋，右冠狀動脈

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