Acute Inferior Myocardial Infarction and Coronary Spasm in a Patient With an Anomalous Origin of the Right Coronary Artery From the Left Sinus of Valsalva

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A 56-year-old Japanese woman with an acute inferior myocardial infarction was admitted to hospital. Emergency coronary angiography revealed an anomalous origin of the right coronary artery from the left sinus of Valsalva, but there was no stenosis or thrombus in either the right or left coronary artery. Coronary spasm was provoked at the site of the proximal portion of the anomalous coronary artery, which was located between the aorta and pulmonary trunk. This was thought to be the cause of the myocardial infarction. (Jpn Circ J 2000; 64: 641-643)

Key Words: Acute myocardial infarction; Anomalous origin; Coronary spasm; Right coronary artery

The anomalous origin of the coronary arteries can lead to angina pectoris, acute myocardial infarction and sudden death, despite the absence of significant atherosclerotic coronary artery disease.4 The incidence of all coronary anomalies ranges from 0.3 to 1.2%, and anomalous origin of the right coronary artery is reported to constitute from 6 to 27% of all coronary anomalies.1-3 Although anomalous origin of the right coronary artery has not been considered clinically important? recent reports have revealed that such malformations can cause serious complications. In some cases, surgical revision has also been proposed to correct such malformations.1-3 We describe a patient with acute inferior myocardial infarction with anomalous origin of the right coronary artery, in whom coronary spasm at the proximal portion of the anomalous right coronary artery was thought to be the cause of the myocardial infarction.

Case Report

A 56-year-old Japanese woman who had no discernible coronary risk factors complained of severe chest pain during minimal physical exertion. She was transported to hospital via ambulance, and inferior ST segment elevations and complete atrioventricular block were noted on her initial electrocardiogram (Fig 1A). Her symptoms and ST segment elevations were relieved with the administration of sublingual nitroglycerin.

Emergency coronary angiography revealed an anomalous origin of the right coronary artery from the left sinus of Valsalva, but there was neither stenosis nor thrombus in the right or left coronary artery (Fig 2). Neither a slit-like orifice of the anomalous right coronary artery nor transient luminal narrowing of the proximal portion of this artery during systolic phase were noted at rest (Fig 2). Left ventriculography revealed severe hypokinesis of the infero-posterior wall. Creatine kinase was elevated to 702 IU/L (normal <130 IU/L) and abnormal q waves and inverted T waves were found on a subsequent ECG (Fig 1B).

To clarify the cause of the acute inferior myocardial infarction, coronary angiography was repeated with provocation testing for coronary artery spasm. Severe coronary spasm was induced by intracoronary injection of acetylcholine (20 µg) at the site of the proximal portion of the anomalous coronary artery, which was located between the aorta and the pulmonary trunk (Fig 3). Nitrites and calcium-channel blocker therapy were started to prevent vasospasm, and she remained free from recurrent angina. Before discharge, treadmill exercise test and exercise thallium-201 myocardial single photon emission computed tomography using a supine bicycle ergometer were performed. No myocardial ischemic changes were detected in either of these 2 tests.

Discussion

The most common type of anomalous coronary artery origin in Japanese patients is origination of the right coronary artery from the left sinus of Valsalva. An anomalous origin of the right coronary artery can lead to angina pectoris, acute myocardial infarction or even sudden cardiac death, even in the absence of atherosclerosis.4 In our previous study,5 5 of 44 patients with an anomalous origin of the right coronary artery had histories of syncope, 2 patients exhibited exercise-induced hypotension associated with myocardial ischemia, and 1 patient exhibited exercise-induced ventricular tachycardia.

There are 2 major explanations for the pathogenesis of myocardial ischemia or sudden death in patients with an anomalous origin of a coronary artery. The oblique takeoff of the anomalous artery produces a slit-like orifice in the aortic wall which can collapse like a valve, particularly during exercise.1-4 Furthermore, the presence of an aberrant right coronary artery between the aorta and pulmonary
trunk has been proposed to lead to compression by these 2
great vessels. Based on autopsy findings, Virmani et al
emphasized that an anomalous origin of a coronary artery
is not uniformly fatal and that the clinical significance of
this anomaly depends on its proximal structure such as the
angle of takeoff and its proximal course.

However, these hypotheses explain only exercise-related
ischemic events. On the other hand, some patients with an
anomalous origin of a coronary artery complain of chest
pain at rest or during low levels of physical exertion. In our
previous study, nitrates or calcium-channel blocker were
effective in some patients, but the reason was unclear.

Coronary spasm associated with an anomalous origin has
been reported. However, there are only a few reports,
because the provocation test of coronary artery spasm is
not easy because of its anatomical difficulty, and none
mentioned the relationship between the proximal structure
of the anomalous coronary artery and the spastic site.
Maddoux et al have reported a case of unstable angina with
coronary spasm at a site in the proximal portion of the
anomalous coronary artery that was located between the
dia and pulmonary trunk. They speculated that a compres-
sion or kinking phenomenon could result in some degree of
intimal disruption and subsequent vasospasm at a site of
proximal portion in the anomalous coronary artery. In the present patient, we also found coronary spasm at the site of the proximal portion of the anomalous coronary artery using an acetylcholine provocation test and we believe this was the cause of her acute inferior myocardial infarction.

Although there is no general evidence that coronary anomaly predisposes to coronary spasm, the present case and Maddoux et al’s report suggest a relationship between the anomalous origin of the coronary artery and coronary spasm, especially at the proximal portion of the anomalous coronary artery. We believe that vasospasm at such sites may cause resting angina or acute myocardial infarction in some patients. Further investigation is necessary to fully understand the mechanism of myocardial ischemia associated with an anomalous origin of a coronary artery.

References