Unique Single Coronary Artery with Acute Myocardial Infarction
Observation of the Culprit Lesion by Intravascular Ultrasound and Coronary Angioscopy

Masamichi Takano, Koji Seimiya, Shinya Yokoyama, Kentaro Okamatsu, Fumiyuki Ishibashi, Ryota Uemura, and Noritake Hata, MD, Kyoichi Mizuno, PhD

SUMMARY

We report an acute myocardial infarction in a patient with a single coronary artery. The right coronary artery arose from the middle portion in the left anterior descending artery through the transverse branch. This type of single coronary artery has not been previously reported. Moreover, this is the first report in which the culprit lesion in a patient with a single coronary artery was observed by intravascular ultrasound and coronary angioscopy. The patient underwent successful coronary stent deployment. (Jpn Heart J 2003; 44: 271-276)

Key words: Single coronary artery, Acute myocardial infarction, Atherosclerotic plaque, Intravascular ultrasound, Coronary angioscopy, Coronary stent deployment

A single coronary artery is a rare congenital anomaly, with an incidence of 0.02% in subjects who undergo coronary angiography.1 A single coronary artery is often associated with myocardial ischemia and additional cardiac congenital anomalies.2-6 We report a patient with an isolated single coronary artery and an acute myocardial infarction. This case deals with a very unusual type of single coronary artery in which the right coronary artery originated from the middle portion in the left anterior descending artery through the transverse branch. Moreover, this is the first case in which the culprit lesion in a single coronary artery was observed by intravascular ultrasound and coronary angioscopy.

CASE REPORT

A 35-year-old Japanese male smoker with hyperlipidemia visited a physi-
A 47-year-old man complained of typical chest pain that lasted for 40 minutes. Upon arrival, his blood pressure was 120/94 mm Hg and his heart rate was 67 beats per minute. The electrocardiogram record showed ST-T elevation in leads I, aVL, and V1 to V4 without abnormal Q waves. After injection of 5,000 IU heparin, he was transferred to our hospital by ambulance. When he arrived, he complained of mild chest discomfort. Emergency cardiac catheterization was performed, however, the catheter could not be inserted into the right coronary artery. Selected coronary angiography showed severe stenosis at the middle portion in the left anterior descending artery without filling delay (Figure 1A). An intravascular ultrasound (Atlantis Plus; Boston Scientific/SCIMED, Minneapolis, Minnesota) showed the existence of atherosclerotic plaque at the site of angiographic stenosis (Figure 1B). After balloon angioplasty, a coronary stent (NIR-Sox 4.0 mm in diameter, 9 mm in length; Boston Scientific/SCIMED), was deployed at a pressure of 10 atmospheres, and optimal angiographic and intravascular ultrasound results were obtained (Figure 2A, B). On the coronary angiograph, the right coronary artery originated from the middle portion in the left anterior descending artery through the transverse branch (arrows in Figure 3A, B). This branch passed anterior of the right ventricle and reached the acute margin. Therefore, this branch was anatomic.

Figure 1. A: Coronary angiogram before percutaneous coronary intervention. A coronary angiography (RAO 30°, CRA 30°) showed severe stenosis at the middle portion in the left anterior descending artery (arrow). B: Intravascular ultrasound image before percutaneous coronary intervention. Intravascular ultrasound showed eccentric atherosclerotic plaque at the site of angiographic stenosis (arrow in Figure 1A).
ically regarded as a right ventricular branch or an acute marginal branch. The left anterior descending artery extended to the crux and the posterior descending artery from the right coronary artery was absent (Figure 3).

Figure 2. A: Coronary angiogram after stent deployment. After stent deployment, an optimal angiographic result was obtained (arrow). B: Intravascular ultrasound image after stent deployment. The coronary stent was dilated symmetrically on intravascular ultrasound.

Figure 3. General view of the single coronary artery. Coronary angiography (A: CRA 30°, B: RAO 30°) showed that the right coronary artery originated from the middle portion of the left anterior descending artery through the transverse branch (arrows in Figure 3A, B). This branch passed anterior of the right ventricle and reached the acute margin. The left anterior descending artery extended to the crux and the posterior descending artery from the right coronary artery was absent.
After admission to the Coronary Care Unit, a peak CK enzyme level of 5643 U/L and a peak CK-MB isoenzyme level of 359 U/L were found. Abnormal Q waves appeared in leads V₁ to V₄ on an electrocardiogram. Echocardiography showed severe hypokinesis in the anterior, septal, and lateral walls, although there were no other cardiac anomalies.

Cardiac catheterization was performed after 14 days from the onset of acute myocardial infarction. The existence of a single coronary stem originating from the left sinus of Valsalva and the absence of the right coronary artery from the right sinus of Valsalva were confirmed by aortography (Figure 4). Left ventriculography showed hypokinesis at the anterolateral and apical segments and the ejection fraction was 51%. Coronary angioscopy (Vecmova; Clinical Supply, Gifu, Japan) demonstrated that atherosclerotic yellow plaque was compressed by the stent struts (Figure 5).

There were no cardiac events during the follow-up period and restenosis was not seen in follow-up angiography after 12 months.
Several cases of a single coronary artery have been reported sporadically. In 1979, Lipton, et al\(^7\) proposed a detailed classification for single coronary artery according to the site of origin and anatomical distribution of the branches. Until now, this type of single coronary artery has not been reported.

Several mechanisms of myocardial ischemia in single coronary artery, such as entrapment of an anatomically ectopic artery between the aorta and the pulmonary trunk,\(^2\) flap-like ostium closure,\(^3\) coronary vasospasm,\(^4\) slow controlled ischemia,\(^5\) and atherosclerotic change in the coronary artery\(^6\) have been proposed. In this case, acute myocardial infarction was attributed to a significant stenosis at the middle portion in the left anterior descending artery, which was subsequently dilated by a coronary stent. Additionally, atherosclerotic plaque was found at the culprit lesion by intravascular ultrasound and coronary angioscopy. Therefore, the most probable mechanism of ischemia in this case was an insufficient blood supply due to the atherosclerotic changes. A reasonable corollary is that the increase flow in a single coronary artery may cause excessive stress and turbulence as well as accelerate the atherosclerotic process, in addition to the existence of coronary risk factors.

**Figure 5.** Coronary angioscopic image at the site of stent deployment. Coronary angioscopy showed yellow plaque compressed by stent struts (between 0 o’clock and 3 o’clock) and residual red thrombi (between 10 o’clock and 11 o’clock).
To the best of our knowledge, this type of single coronary artery is unprecedented, and this is the first report in which the culprit lesion in a single coronary artery was observed by intravascular ultrasound and coronary angioscopy.

REFERENCES