CASE REPORT

Anomalous course of the left anterior descending coronary artery between the aorta and pulmonary trunk: a rare cause of myocardial ischaemia at rest

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Abstract
When the left anterior descending coronary artery follows an anomalous course between the aorta and pulmonary artery it can cause myocardial ischaemia or sudden death during exercise in young people. Coronary arteriography in a 27 year old man with angina pectoris at rest showed a left anterior descending coronary artery arising from a common right trunk and running from the aorta to the pulmonary artery. Follow up after revascularisation was uneventful.

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Young people in whom the left coronary artery has an anomalous origin and runs between the aorta and pulmonary artery are at risk for myocardial ischaemia and sudden death. These ischaemic events may be caused

by the left main coronary artery being compressed between the aorta and pulmonary trunk during exercise.

Case report

In 1986, a 27 year old white man was admitted to the intensive care unit with chest pain at rest. Physical examination was normal and the resting electrocardiogram and the echocardiogram were within normal limits. The patient did not smoke and had no cardiovascular risk factors. The thallium treadmill scintigram was normal. Endoscopy showed stage 1 oesophagitis and this was believed to explain the chest pain. After 7 symptom free years, the patient was admitted with an 8 day history of episodes of chest pain at rest that were suggestive of unstable angina. During an episode of chest pain the electrocardiogram showed a 2 mm displacement of the ST segment in leads V1-V3 that resolved within 10 minutes when intravenous glyceryl trinitrate (0.25 µg/kg/min) was given. The serum concentration of creatine kinase was normal, as was the echocardiogram. Selective coronary arteriography showed that the circumflex artery and first septal artery arose from the left anterior sinus (fig 1) and that a right main trunk originated from the right anterior sinus and divided into a right coronary artery that ran in the coronary sulcus and into a left anterior descending coronary artery (LADCA) that ran between the aorta and pulmonary trunk (fig 2A). These abnormalities were confirmed angiographically in a lateral view taken after simultaneous injection of contrast into the pulmonary artery and right common trunk (fig 2B). There was no evidence of coronary atherosclerosis and spasm was not provoked by methylergometrine. Ventriculography showed normal wall motion in the left ventricle.

Despite treatment with 100 mg/day atenolol, 160 mg/day diltiazem, 6 mg/day molsidomine, and 250 mg/day aspirin he had a new episode of chest pain at rest with electrocardiographic changes (negative T waves in leads V1-V3. This prompted revascularisation.

The size of the heart was normal at operation. Dissection of the anterior wall of the aorta identified the origin of the right coronary artery but not of the LADCA because this artery followed an intramyocardial course

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Figure 1 Selective coronary arteriography (cranial left anterior oblique view) showing the circumflex artery (CA) and first septal artery (FSA) arising from the left anterior sinus.

Figure 2 Selective coronary arteriography (left transversal oblique view) showing (A) the right coronary (RC) artery and left descending anterior (LDA) coronary artery arising from the right anterior sinus and (B) simultaneous injection of the right common trunk (RCT) and pulmonary artery (PA). The LDA coronary artery runs between the aorta and PA trunk.

between the aorta and pulmonary trunk. The left internal mammary artery was anastomosed to the middle third of the LADCA, which ran in the anterior interventricular sulcus. A 6 mm longitudinal arteriotomy was performed. The artery was 1.6 mm in diameter. The anterior left mammary artery was

anastomosed to the coronary arteriotomy. The postoperative course was uneventful.

The postoperative treadmill thallium scintigram was normal, there were no electrocardiographic changes, and the patient did not have further episodes of chest pain. At follow up examinations six months and one year later, the patient had no symptoms and the electrocardiogram showed no changes.

Discussion

Isolated congenital anomalies of the coronary arteries are found in only 0.3–1.3% of patients undergoing selective coronary arteriography.^{1–3} Of these anomalies only 2.3%–8.9% are left main coronary arteries or branches with an anomalous course between the aorta and pulmonary artery.^{1–3} It is vital to identify this abnormality because it can cause sudden death.

There are four anatomical subtypes of left coronary artery arising from the right anterior sinus, which are based on the course that the artery takes in relation to the aorta and pulmonary trunk—they are, anterior, interarterial, posterior, and septal. Only the interarterial type poses a serious risk to the patient. Clinical manifestations include angina, syncope, myocardial infarction, and sudden death, in the absence of coronary atherosclerosis. Cheitlin *et al* reported nine (27%) cases of sudden death among 33 patients.⁴ Several hypotheses have been put forward to explain the occurrence of myocardial ischaemia. Congenital atresia of the left coronary artery was found in several cases but not in our patient. Exercise may cause myocardial ischaemia by compressing the left main coronary artery between the aorta and pulmonary artery,⁴ by reducing the diameter of the coronary ostium as a result of closure of the aorta-coronary angle during aortic distension,^{4,5} by a flaplike ostium,⁴ or by sudden kinking that narrows the coronary artery lumen.^{3,4} None of these hypotheses explains why our patient had unstable angina at rest.

Maddoux *et al* first reported a case of anomalous origin of the left coronary artery from the right sinus of Valsalva with unstable angina at rest.⁶ Vasospasm of this coronary artery was confirmed. It resolved when intravenous glyceryl trinitrate was given. In our patient, however, the negative methylergometrine test ruled out vasospasm. As in our patient, at surgery Maddoux *et al* found that the left coronary artery followed an intramyocardial course.⁶ This feature is more common in the septal variety of anomalous LADCA.⁵ Myocardial bridging could cause myocardial ischaemia because it has been responsible for angina and sudden death.⁷ There was no evidence of systolic myocardial bridging of the LADCA during coronary angiography in our patient. In our patient the most likely mechanism of myocardial ischaemia was kinking of, or shearing strain to, the LADCA caused by its being compressed between the aorta and pulmonary artery. Because the patient had symptoms at

rest which recurred despite intensive anti-anginal treatment, exercise testing was not performed before surgery. He had surgical revascularisation by anastomosis of the LADCA to an internal mammary artery graft—the procedure recommended in most previous reports,⁴⁻⁶ irrespective of exercise test findings, because of the high risk of cardiac events including sudden death.

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