Coronary Artery Disease with Single Coronary Artery

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The authors have reviewed the literature in search of the coexistence of single coronary artery with significant coronary artery disease. Two cases of single right coronary artery are described. In both, the anomalies were unsuspected and diagnosed roentgenographically in life. Both patients had angina pectoris, positive graded-exercise stress tests, and hemodynamically significant obstruction or occlusion to the coronary arteries. In neither case was the stenosis proximal or amenable to bypass surgery.

Congenital anomalies of the coronary arteries occur more frequently than is generally supposed. Major anomalies, such as anomalous origin of one or both coronary arteries from the pulmonary artery, present in the neonatal period or infancy. Minor anomalies may be compatible with a normal life span and be discovered incidentally at surgery, autopsy, or cardiac catheterization.

Alexander and Griffiths (1) reported the incidence of coronary artery anomalies in autopsies performed in a general hospital over a 10-year period as 2.85 per 1000 autopsies. In their experience of 54 cases, no case of single right coronary artery was encountered. A total of 165 cases of single coronary artery was reported up to 1974 (2). The concurrence of single coronary artery with other congenital anomalies was noted by Murphy (3) in his review of 79 cases of single coronary artery. Approximately one-third of these cases was associated with other anomalies. Hillestad and Eie (4) reported three cases of single coronary artery diagnosed angiographically, each case being associated with a bicuspid aortic valve.

The present report is of two patients who were subjected to cardiac catheterization and selective coronary arteriography during the investigation of angina pectoris. Both were found to have a single right coronary artery with significant coronary artery disease.

CASE REPORTS

Case No. 1, Mr. G.E.G.

This 62-year-old man was transferred to University Hospital, London, Ontario, for the investigation of angina pectoris. Following an episode of severe retrosternal chest pain with radiation to the left arm and neck, he was admitted to another hospital where sequential electrocardiograms showed only T wave inversion in lead I and AVL. Cardiac enzymes remained normal and a Master's two-step test was negative. Past medical history included arterial hypertension which was treated with hydrochlorothiazide, 50 mg daily, and potassium supplementation. Family history was unremarkable. He had smoked between 20 and 30 cigarettes per day for many years.

Physical examination was unrevealing with the exception of mild arterial hypotension; blood pressure, 170/100.

Laboratory data. Hemoglobin, 16.9 g%; hematocrit, 46.8%; urinalysis, negative; electrolytes, normal; blood urea nitrogen, 21 mg/dl; creatinine, 1.0 mg/dl; uric acid,
10.5 mg/dl; fasting blood glucose, 116 mg/dl; serum cholesterol, 284 mg/dl; triglycerides, 353 mg/dl.

A graded treadmill exercise tolerance test with 12 lead ECG recording during the recovery phase showed ischemic ST depression in leads II, III, AVF, and V3, V4, V5, and V6. An echocardiogram showed mild left ventricular hypertrophy.

FIG. 1. Case 1. Single right coronary artery with 75–80% stenosis in posterior atrio-ventricular groove. (a), R.A.O. projection; (b), L.A.O. projection.
Cardiac catheterization and selective coronary arteriography were performed by the percutaneous Seldinger technique from the right groin. Judkins preformed catheters were used for selective coronary arteriography.

_Hemodynamic data._ Left ventricle, 135/3 (mm Hg); following angiography, 130/24; aorta, 135/85; mean, 115. Left ventricular cineangiography showed mild hypokinesis of the anterolateral wall and prolapse of the posteromedial scallop of the posterior leaflet of the mitral valve. Selective coronary arteriography of the right coronary artery (Fig. 1) showed a large vessel with an abnormal distribution. The right coronary artery arose in a normal location and gave branches corresponding to the normal right coronary artery. These vessels passed along the inferior wall to supply the apex. A large vessel passed posteriorly around the atrioventricular groove supplying the posterior descending artery and several smaller branches on the posterior aspect of the heart before terminating in the area usually supplied by the left circumflex coronary artery. This large anomalous vessel showed a 75–80% stenosis midway along the atrioventricular groove on the posterior surface of the heart.

Repeated attempts were made to perform selective catheterization of the left coronary artery, and aortic root injection confirmed the absence of the left coronary artery. The aortic valve was tricuspid.

_Case No. 2, Mr. G.R._

This 59-year-old man was admitted to University Hospital for investigation of angina pectoris which had increased in frequency and severity in the month prior to admission. He had suffered an acute inferior wall myocardial infarction in 1968 and since then had had recurrent angina of effort which became more severe 6 months prior to study. One attack persisted for several days necessitating admission to another hospital. There was no evidence of acute myocardial infarction and he was discharged on propranolol.

Physical examination revealed an anxious man with an irregular pulse. A soft systolic ejection murmur was heard at the base of the heart; otherwise the physical examination was noncontributory.

_Laboratory data._ Hemoglobin, 14.6 g%; hematocrit, 39.7%; urinalysis, negative; electrolytes and blood urea nitrogen, normal. Uric acid, 8.4 mg/dl; fasting serum glucose, 80 mg/dl; cholesterol, 200 mg/dl; triglycerides, 236 mg/dl. Electrocardiogram showed old myocardial infarction, sinus rhythm, and multiple junctional and ventricular premature beats with a flat ST segment in leads V5 and V6.

A graded treadmill exercise tolerance test with 12 lead ECG recording during recovery phase showed ischemic ST depression in leads V5 and V6.

Cardiac catheterization and selective coronary arteriography were carried out using the percutaneous Seldinger technique via the right femoral artery. The procedure was complicated by the development of ventricular fibrillation during coronary artery injection; this was successfully terminated with dc countershock.

_Hemodynamic data._ Left ventricle, 130/18 (mm Hg); after angiography, 130/30; aorta, 130/90; mean, 105. Left ventricular cineangiography showed marked generalized hypokinesis; the mitral valve plane was normal. Selective coronary arteriography (Fig. 2) demonstrated a large proximal right coronary artery arising in a normal location. Immediately beyond the acute marginal branch, the right coronary artery was completely occluded; however, there was some distal filling of the right coronary artery through antegrade collaterals. Approximately 1 cm from the origin of the right coronary artery a large vessel arose and passed posteriorly to the aortic root and towards the left border of the heart. It divided into vessels supplying the territory of the left anterior descending and left circumflex coronary arteries. A
proximal left coronary artery could not be demonstrated by selective catheterization or aortic root injection. A tricuspid aortic valve was demonstrated.

DISCUSSION

In their review of coronary artery anomalies, Blake et al. (5) recorded the historical aspects of coronary artery anatomy. Morgagni, in 1761, was first to insist that
two coronary arteries were the norm. Both Fallopius and Riulanus, in previous centuries, had held that a single coronary artery was the norm.

Several schemata have been proposed to classify the anatomy of the single coronary artery. In 1970 Ogden and Goodyer (6) reviewed previous classifications of the single coronary artery and proposed a new schema of classification for use in future case reports.

The two cases of single right coronary artery described in this report have been classified according to the schema of Ogden and Goodyer (6). Figure 3 shows, in diagrammatic form, the normal coronary artery distribution and the two patterns, types R-1 and R-2a, which most closely resemble those of the cases described. In both cases the presence of a single right coronary artery was unsuspected prior to coronary angiography, and the patients were asymptomatic into the seventh and sixth decades, respectively. Both were evaluated by cardiac catheterization and coronary cineangiography after the clinical diagnosis of angina pectoris had been supported by a positive graded-exercise stress test (1 mm or greater ST segment depression of the postexercise electrocardiogram lasting 0.08 sec or longer). In neither case was the lesion demonstrated to be suitable for saphenous vein bypass surgery.

Previous reports have stressed the relatively good prognosis of patients with single coronary arteries; many of the case reports were autopsy studies of patients dying in middle or old age of unrelated causes. With increasing use of coronary cineangiography in the evaluation of patients with angina pectoris, more cases will be diagnosed in life. One would expect that the potential for collateral vessel development should not be affected if atheromatous stenoses occur in the middle or distal parts of the artery. However, proximal stenosis of a main, single coronary artery must be considered a more grave threat to life than in a patient with two, albeit diseased, coronary arteries.

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