Replacement of circumflex branch of left coronary artery originating from the right aortic sinus

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Abstract

Abstract: Replacement of the circumflex branch of the left coronary artery is extremely rare. We conducted a retrospective study to determine the incidence of this anomaly of circumflex branch of the left coronary artery. Two such patients were identified from 850 adults undergoing cardiac catheterization procedures. The circumflex branch of the left coronary artery was replaced by a vessel arising from the right aortic sinus. The course of this vessel was retroaortic. A knowledge of this anomaly is important for coronary artery bypass surgery.

Arterial blood reaches the cardiac tissues via two major coronary aa., each of which arises from the base of the ascending aorta. The left coronary a. arises from the left aortic sinus and moves immediately to the left, lying at first between the left atrium and pulmonary trunk. It divides into two major branches. Its second major branch, the circumflex branch, runs in the left coronary sulcus and almost reaches the posterior interventricular sulcus [10].

Anatomic variants of the normal coronary arterial circulation have been found in 0.6% to 1.55% of all patients undergoing coronary angiography [9, 15]. Antopol and Kugel (1933), then Page et al [13] first described anomalous origin of the circumflex branch of the left coronary a. from the proximal part of the right coronary a. or right aortic sinus [1]. In Ogden's classification of congenital coronary anomalies, these variations of origin are listed as minor congenital anomalies [12], but Cheitlin et al [3] indicated that this congenital anomaly is not really a minor one. Congenital anomalies of the coronary aa. are discovered as incidental findings during coronary arteriography or at autopsy. The major anomalies and some of the clinically significant minor anomalies may act as potential causes of myocardial ischemia resulting in arrhythmias, angina, serious perioperative myocardial injury or infarction, and sudden death [4, 5, 11]. Recognition and angiographic demonstration of the anomalous artery assumes its highest priority, however, in the patient undergoing evaluation for direct coronary a. surgery or prosthetic valve replacement [13]. A single coronary a. and origin of both coronary aa. from the same aortic sinus have been traditionally regarded as having little clinical significance and being compatible with a long and active live [3].

The purpose of this study is to describe two cases of this anomaly recognised among 850 patients undergoing selective coronary angiography.

Material and methods

The retrospective study reviewed cases obtained from the files of the cardiac catheterization center at the Cardiology Department. Coronary angiography was employed in 850 adult patients selected for this study. In the patients undergoing coronary angiography, the aim was to determine whether there is an anomalous vessel replacing circumflex branch of the left coronary a. or not. Two patients having this anomaly were identified in 850 adult cardiac catheterization procedures. These patients were both white males, ages 65 and 54. One patient described typical chest pain brought on by effort and relieved by rest. He underwent coronary angiography because of symptoms and positive exercise testing during examination. The other patient complained of exertional dyspnea resulting from rheumatic mitral valve disease.

Results

In both two cases, the circumflex branch of the left coronary a. was replaced by a circumflex a. arising from the right aortic sinus. This anomaly is illustrated in Fig. 1. The circumflex a. distributed on the diaphragmatic surface of the heart (Fig. 2). The circumflex a. passed posterior to the aorta, turning to the left in the coronary sulcus to reach its usual distribution. The anterior interventricular branch arose normally from the left coronary a. and it travelled as a continuation of the left coronary a. However, a circumflex branch of the left coronary a. was conspicuously absent in both oblique projections. The right coronary a. arose from the right aortic sinus. In addition, there was a serious narrowing in the proximal portion of the anterior interventricular branch and mid portion of the right coronary a. of one patient who described angina, and no stenosis in the coronary aa. of the other patients. In the other cases, coronary angiography demonstrated a normal course for the right and left coronary aa. and their bifurcating branches.

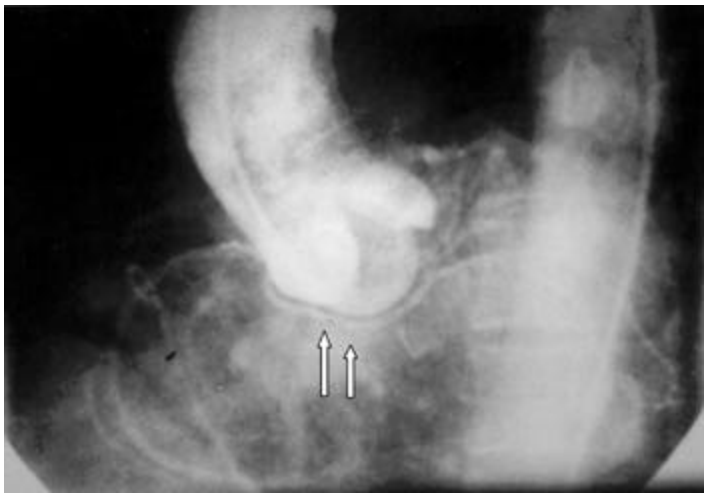

Fig. 1 Circumflex a. originating from right aortic sinus (*arrow*). This vessel extended leftward posterior to the root of the aorta (from LAO 45° projection)

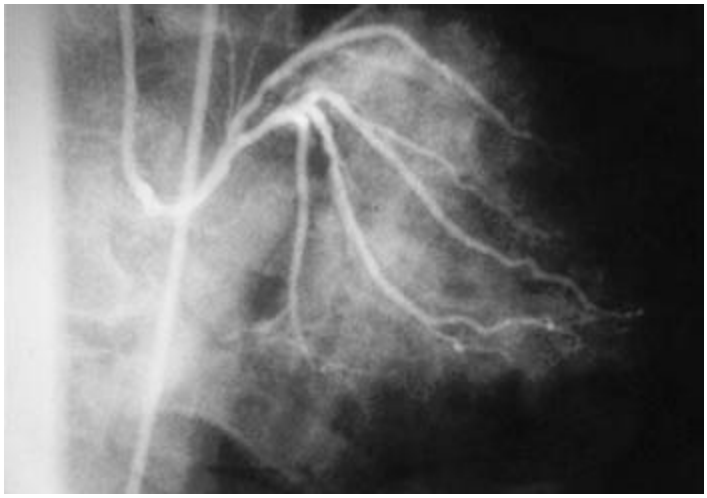

Fig. 2 The distribution in the diaphragmatic surface of the heart of the abnormal circumflex a. (from RAO 30° projection)

Discussion

Congenital anomalies of the coronary aa. form a rare but important subset of non-atherosclerotic coronary aa. Despite their rare occurrence, these anomalies are often seen in patients in whom ischemic heart disease is uncommon and unsuspected [5]. Anomalous origin of the coronary aa. from the aorta is an extremely rare cause of sudden death in the general population. However, in a selected series of young persons dying suddenly following exertion, a small number of deaths have been attributed to coronary a. anomalies [9]. Anomalous coronary origin from the aorta has been well described [4, 5] as has anomalous coronary origin from the pulmonary trunk complicating other congenital cardiac anomalies [9]. Anomalous origin

of the coronary aa. from the aorta in the absence of associated congenital heart disease has also been reported by many researchers [4, 5, 7, 12]. Moreover, they may occur together with other complicated congenital heart defects and, as a result of their abnormal course or distribution, increase the risk of coronary a. trauma during cardiac operations [8]. There are, however, sporadic cases of sudden death described in patients in whom both coronary aa. arose as a single or double vessel from the right aortic sinus, which suggests that these anomalies are not always without clinical importance [3, 9, 15]. Cheitlin et al [3] have collected cases of sudden death with this anomaly. Today, these anomalies can be easily diagnosed, accurately located, and safely corrected with gratifying long-term results, and for these reason surgical intervention should be strongly recommended once accurate diagnosis is established [5].

In our study, the replacement of the circumflex branch of the left coronary a. by a vessel arising from the right artic sinus was identified in two cases. This branch then ran behind the aorta to reached the left atrioventricular sulcus. The anterior interventricular branch arose from the left coronary a. Since the circumflex a. in this anomaly did not pass through aorta and right ventricular outflow tract, a decrease did not occur in coronary a. blood flow and thus it did not cause any symptoms. Symptoms such as chest pain in these patients, as in our patients, generally depend upon other pathologies in the coronary a. Because of the peculiar anatomic configuration, this anomaly does not lend itself well to percutaneous coronary angioplasty. Therefore, surgical revascularization of the anomalous circumflex a. is valid [15].

Ueyama et al [15] reported 40 patients having an anomalous circumflex branch of the left coronary a. from 10,216 adult cardiac catheterization procedures. According to their finding, in 14 of 40 cases, the circumflex a. arose from a separate orifice in the right aortic sinus, with the remainder arising as a branch of the right coronary a. As in our study, in all cases the anomalous circumflex a. passed behind the aorta before entering the atrioventricular sulcus. Liberthson et al [9] observed that the circumflex a. arose from the right aortic sinus in 5 of 21 cases of anomalous circumflex branch of the left coronary a. Page et al [13] examined this anomaly in 20 cases of 2996 coronary angiographic procedures. Cheitlin et al [3] determined anomalies of the circumflex a. arising from the right aortic sinus in 33 hearts. Fernandes et al [5] reported the coronary aa. as arising from the contralateral aortic sinus in 10 of 202 coronary aa. However, Ogden [12] reported the anomalous circumflex branch origin in 14 of 224 congenital variations of the coronary aa.

These vessels may be found arising from the aorta, the carotid aa., the brachiocephalic trunk, and the pulmonary trunk. These anomalies often exist with other congenital malformations [4]. Chang et al [2] reported a combination of dual anterior interventricular branch type IV and an anomalous circumflex a. from the right aortic sinus. We consider that this anomaly presents a prognostic importance. This anatomic variation has been previously described by other researchers [6, 14]. The incidence of this anomaly is 0.20% to 0.70% in investigations [15]. It is rare for this to cause symptoms or sudden death [9, 15]. A knowledge of this anomalous circumflex a. and its accurate demonstration by angiography is important for coronary a. bypass surgery.

References

1. Antopol W, Kugel MA (1933) Anomalous origin of the left circumflex coronary artery. Am Heart J 8 802

2. Chang CJ, Cheng NJ, Ko YS, Ko YL, Chiang WC (1997) Dual left anterior descending coronary artery and anomalous aortic origin of the left circumflex coronary artery A rare and complicated anomaly. Am Heart J 133 598-601

3. Cheitlin MD, De Castro CM, McAllister HA (1974) Sudden death as a complication of anomalous left coronary origin from the anterior sinus of Valsalva A not-so-minor congenital anomaly. Circulation 50 780-787

4. Chopra PS, Reed WH, Wilson AD, Rao PS (1994) Delayed presentation of anomalous circumflex coronary artery arising from pulmonary artery following repair of aortopulmonary window in infancy. Chest 106 1920-22

5. Fernandes ED, Kadivar H, Hallman GL, Reul GJ, Ott DA, Denton AC (1992) Congenital malformations of the coronary arteries The Texas Heart Institute experience. Ann Thorac Surg 54 732-40

6. Greenberg MA, Spindola-Franco H (1994) Dual left anterior descending coronary artery (dual LAD). Cathet Cardiovasc Diagn31 250-253

7. Killen DA, Wathanacharoen S (1994) Proximal bypass to anomalous circumflex coronary artery. J Thorac Cardiovasc Surg 107 447-449

8. Levin DC, Fellows KE, Abrams HL (1978) Hemodynamically significant primary anomalies of the coronary arteries

Angiographic aspects. Circulation 58 25-34

9. Liberthson RR, Dinsmore RE, Bharati S, Rubenstein JJ, Caulfield J, Wheeler EO, Harthorne JW, Lev M (1974) Aberrant coronary artery origin from the aorta diagnosis and clinical significance. Circulation 50 774-779

10. Lindner HH (1989) Clinical Anatomy. Appleton & Lange, Norwalk, Connecticut/San Mateo, California, p 246

11. Lipsett J, Cohle SD, Berry PJ, Rusell G, Byard RW (1994) Anomalous coronary arteries a multicenter pediatric autopsy study. Pediatr Pathol 14 287-300

12. Ogden JA (1970) Congenital anomalies of the coronary arteries. Am J Cardiol 25 474-479

13. Page HL, Engel HJ, Campell WB, Thomas CS (1974) Anomalous origin of the left circumflex coronary artery Recognition, angiographic demonstration and clinical significance. Circulation 50 768-773

14. Sajja LR, Farooqi A, Shaik MS, Yarlagadda RB, Baruah DK, Pothineni RB (2000) Dual left anterior descending coronary artery surgical revascularization in 4 patients.Tex Heart Inst J 27 292-296

15. Ueyama K, Ramchandani M, Beall AC, Jones JW (1997) Diagnosis and operation for anomalous circumflex coronary artery. Ann Thorac Surg 63 377-81

Surg Radiol Anat 23: 281-283