



Coronary artery fistula: Comparison of diagnostic accuracy by echocardiography versus coronary arteriography and surgery in 63 patients studied between 2002 and 2012 in a single medical center in China



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ABSTRACT

Background: Coronary artery fistula (CAF) is a rare congenital anomaly, which is conventionally diagnosed by coronary arteriography; however, the relation of the coronary artery fistulas to other structures, their origin and course may not be always apparent.

Methods: The echocardiograms of 63 patients with coronary artery fistulas, who had undergone coronary arteriography and/or surgery from June 2002 to December 2012 at the Union Hospital, Tongji Medical College, Huazhong University of Science and Technology, were analyzed retrospectively, and the results were compared with findings by coronary arteriography and at surgery.

Results: Right CAFs were detected in 33 of the 63 patients (52.4%); 11 had drainage to the right atrium, 10 to the right ventricle, 2 to the left ventricle, 9 to the main pulmonary artery, and 1 to the coronary sinus. Left CAFs were detected in 29 patients (46.0%); 6 had drainage to the right atrium, 12 to the right ventricle, 1 to the left atrium, 2 to the left ventricle, 7 to the main pulmonary artery, and 1 to the coronary sinus. One patient (1.6%) had the origin of the fistula in both coronary arteries. The entry point of the fistula was most often a single orifice (96.8%) and rarely multi-orificial (3.2%). 57 patients (90.5%) had isolated coronary fistulas (90.5%); 6 patients (9.5%) had other congenital cardiac malformations. The ultrasonic diagnosis of 60 patients was in line with findings at surgery and/or coronary arteriography. The diagnostic accuracy rate for coronary artery fistula was 95.2%. Preoperative transthoracic echocardiography missed the diagnosis of coronary artery fistula in three patients (4.8%). There is no difference ($P > 0.05$) in diagnostic accuracy between echocardiography and coronary arteriography and/or surgery.

Conclusions: Transthoracic echocardiography, in comparison with coronary arteriography and/or surgery, is much simpler, easier, less expensive, safer, readily repeatable, and more convenient with equal accuracy, and should be the first-line method for the diagnosis of congenital coronary artery fistula.

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1. Introduction

Coronary artery fistula (CAF) is a rare congenital anomaly [1]. Congenital heart defects are associated with CAFs in 0.2%–0.4% of cases [2, 3]. Coronary fistulas may originate from the right coronary artery, left

coronary artery or its branches; the most common vessel of origin is the right coronary artery [4]. Most patients are asymptomatic. However, symptoms of heart failure, pulmonary hypertension, coronary ischemia or even myocardial infarction may occur in some cases [5]. The traditional technique used for diagnosis of congenital coronary artery fistula has been coronary arteriography. However, the relation of coronary artery fistulas to other cardiovascular structures and their origins and courses may not be always apparent [6]. With the development of ultrasonic imaging, transthoracic echocardiography is, nowadays, another method for diagnosis of coronary artery fistula. In this review, we retrospectively analyzed the echocardiographic results of 63 patients with

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coronary artery fistulas treated in our hospital. The results were compared with the findings at surgery and on coronary arteriography in order to assess the diagnostic value of echocardiography.

2. Materials and methods

2.1. Patient population

63 patients with coronary artery fistulas admitted to the Union Hospital of Tongji Medical College, Huazhong University of Science and Technology between June 2002 and December 2012 were identified through a retrospective review. The mean age was 22.6 ± 22.1 years (range 2 days–71 years). 38 were males and 25 were females. 34 patients were under the age of 20 years and 29 patients above the age of 20 years. The clinical characteristics of all patients with CAF are shown in Table 1.

2.2. Apparatus and methods

With a Doppler ultrasonic diagnostic apparatus of GE Vivid7 and Philips IE33 with 2.0–5.0 MHz transducer and the patients in left lateral position, two-dimensional echocardiograms were recorded in the left ventricular long axis view, apical four-chamber view and short axis view first to observe the shapes and inner diameters of the main left and right coronary arteries and the initial segments of the left and right coronary arteries carefully in order to detect and confirm whether or not they were dilated or not. All four cardiac chambers were measured. Color Doppler ultrasound was used to determine whether abnormal colorful mosaic flow signal existed in any of the four cardiac chambers or pulmonary artery. If abnormal colorful mosaic flow signal existed, the width of abnormal color Doppler flow was measured. Continuous wave spectral Doppler ultrasound was used to measure the abnormal blood flow speed and shunt differential pressure.

2.3. Data statistics and analyses

Statistical analyses were performed using SPSS 19.0 software. Quantitative variables were expressed as mean \pm standard deviation and qualitative variables were expressed as a percentage (%). Comparison was performed with the chi-square test or Fisher exact test for categorical data. A p-value < 0.05 was considered statistically significant.

3. Results

3.1. Echocardiographic features

63 patients were examined echocardiographically before coronary arteriography and/or surgery; 60 patients' diagnoses were in line with findings at surgery and/or coronary arteriography. The accuracy rate was 95.2%. Three patients' CAFs were missed on preoperative transthoracic echocardiography. The missed diagnosis rate was 4.8%.

The echocardiographic features of CAF are as follows: (I) The proximal segment of the involved coronary artery is dilated (Fig. 1). The coronary arteries of 60 cases of CAFs diagnosed by echocardiography have different degrees of dilatation. The mean inner diameter was 12.6 ± 3.6 mm (range 3.1–33.0 mm). The ectatic coronary arteries are tortuous. (II) 58 patients had a single fistula; 2 patients had multiple fistulas. The mean inner diameters of all fistulas are 4.7 ± 2.1 mm (range 3.2–16.7 mm). (III) Color Doppler ultrasound shows abnormal high velocity flow signal in the ectatic coronary arteries and fistulas. Abnormal high speed flow was detected in the fistulas entering the cardiac chambers or pulmonary artery (Fig. 2). When the coronary artery fistulas drain into the right heart, pulmonary arteries or left atrium, color Doppler

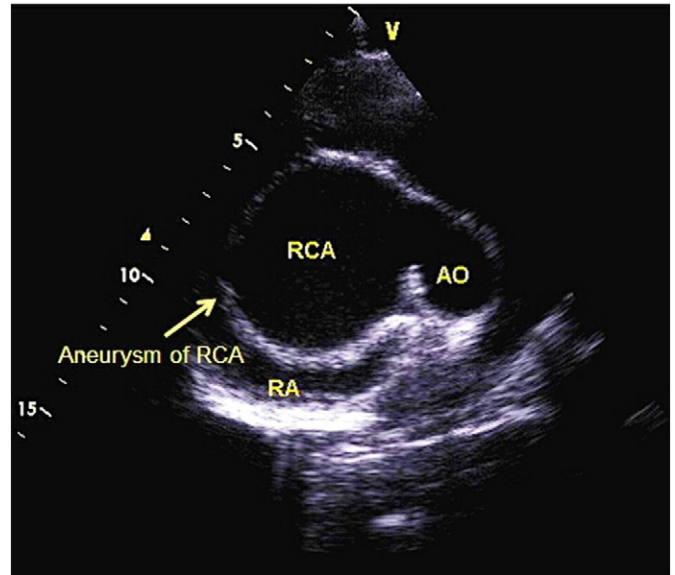


Fig. 1. Echocardiogram of an aneurysmally dilated right coronary artery fistula to right atrium in the parasternal short axis view. (RCA: right coronary artery; AO: ascending aorta, RA: right atrium).

ultrasound shows a continuous Doppler signal (Fig. 3). On the other hand, when the coronary artery fistulas drain into the left ventricle, the high speed blood flow signals are seen only during diastole (Fig. 4). For those patients with small coronary artery fistulas, the coronary arteries show no expansion, with the high speed blood flow signals observed only near the coronary artery fistulas (Fig. 5). The peak velocity of abnormal blood flow from sites of drainage ranges between 1.5 and 6.1 m/s (average velocity 3.03 ± 1.36 m/s) and the differential pressure ranges 9–150 mm Hg (mean pressure 43.14 ± 39.10 mm Hg). (IV) Whenever the coronary artery fistulas drain into the left ventricle, its cavity might or might not be enlarged.

There are five rare cases among the 63 patients of coronary artery fistulas, which include one case of left anterior descending coronary artery fistula draining into the right ventricle via dissection of the interventricular septum, two cases of coronary artery racemose hemangioma coronary artery fistula and two cases of coronary artery fistulas draining into the coronary sinus. For the patient with left anterior descending coronary artery fistula draining into the right ventricle via

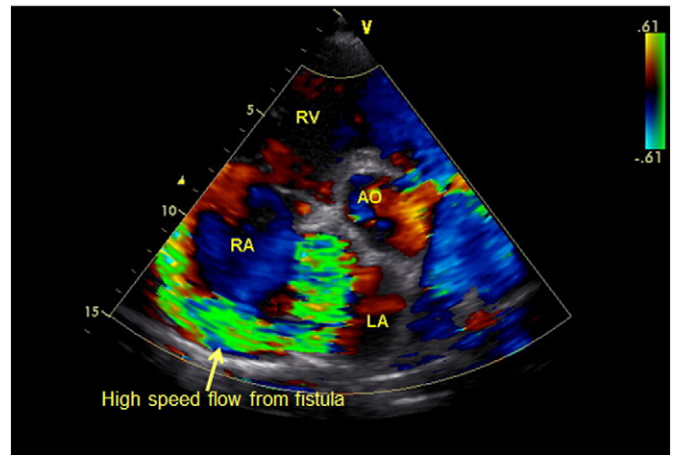


Fig. 2. Same patient as in Fig. 1. Color Doppler signal on parasternal short axis view showed the high speed flow from the right coronary fistula draining into right atrium (yellow arrow) (RV: right ventricle; RA: right atrium; LA: left atrium; AO: ascending aorta).

Table 1
Clinical characteristics of 63 patients with CAFs.

Clinical characteristics	N (%)
M/F	38/25
Average age	22.6 ± 22.1 years
Age range	2 days to 71 years
Under the age of 20	34 (54.0%)
Greater than or equal to 20 years of age	29 (46.0%)
Asymptomatic	35 (55.6%)
Symptomatic ^a	28 (44.4%)

^a Symptoms include dyspnea, arrhythmia, oppression in chest and palpitation. Patients with symptoms are mostly greater than or equal to 20 years of age and/or with other congenital cardiac malformations.

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