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Transesophageal echocardiography in adults with a continuous precordial murmur

Ying-Tsung Chen, Ying-Siu Lee, Mee-Nin Kan, Jung-Sheng Chen, Wei-Shiung Hu, Wu-Wei Lin, Kao-Yang Wang, Chun-Jou Lin and Benjamin N. Chiang

Division of Cardiology, Taichung Veterans General Hospital, National Yung-Ming Medical College, Chung Shan Medical and Dental College, China Medical College, Taichung, Taiwan, ROC

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In order to assess the ability of echocardiography in the detection of intracardiac and extracardiac shunts, we studied 11 patients (aged 22–64 yr) with a continuous precordial murmur using transthoracic and transesophageal echocardiography, and correlated the results with the subsequent angiographic and surgical findings. We found that only in 5 of 6 patients with a patent arterial duct could the continuous flow pattern be detected in pulmonary artery using transthoracic echocardiography, whereas it could be readily and accurately identified by transesophageal echocardiography in all patients. The diameters of the patent arterial duct were also measured and found to be in good correlation with subsequent surgical findings ($r = 0.98$, $p < 0.05$). In 2 patients with a ruptured aneurysm of sinus of Valsalva which originated from the right coronary sinus and perforated into the right ventricle, transesophageal echocardiography gave a better image than transthoracic echocardiography. In 2 patients with coronary artery fistula, the origin and site of drainage of the coronary artery could be imaged using transesophageal echocardiography, but the course of coronary artery fistula was more easily detected by transthoracic echocardiography. In one patient with aortopulmonary window, the defect between ascending aorta and main pulmonary artery could readily be imaged by transesophageal echocardiography. We therefore recommend transesophageal echocardiography when evaluating patients with precordial continuous murmur in whom intracardiac and extracardiac shunts or defects are suspected.

Key words: Transesophageal echocardiography; Patent arterial duct; Coronary artery fistula; Coronary sinus of Valsalva; Aortopulmonary window

Introduction

In pediatric cardiology, real-time cross-sectional echocardiography allows the diagnosis of

Correspondence to: Ying-Tsung Chen, M.D., Division of Cardiology, Taichung Veterans General Hospital, 160 Chung-Kang Road Section 3, Taichung, Taiwan 40705, ROC.

intracardiac as well as extracardiac shunts such as atrial septal defect, ventricular septal defect, patent arterial duct or other complicated cardiac lesions via direct imaging of these defects [1–4]. In adult cardiology, however, it has been somewhat plagued by images of poor quality obtained from routine transthoracic echocardiography. These limitations are caused by ultrasonic interference which arises from the chest wall and lung, particularly in patients who are obese, or have chronic pulmonary diseases. Because of the proximity of the esophagus to the cardiac chambers, transesophageal echocardiography may solve this problem. As yet, the diagnosis of congenital heart disease by transesophageal echocardiography in patients with patent arterial duct, coronary arteriovenous fistula, aortopulmonary connection, or rupture of the sinus of Valsalva has rarely been reported. We have used transesophageal echocardiography in the evaluation of 11 patients with a

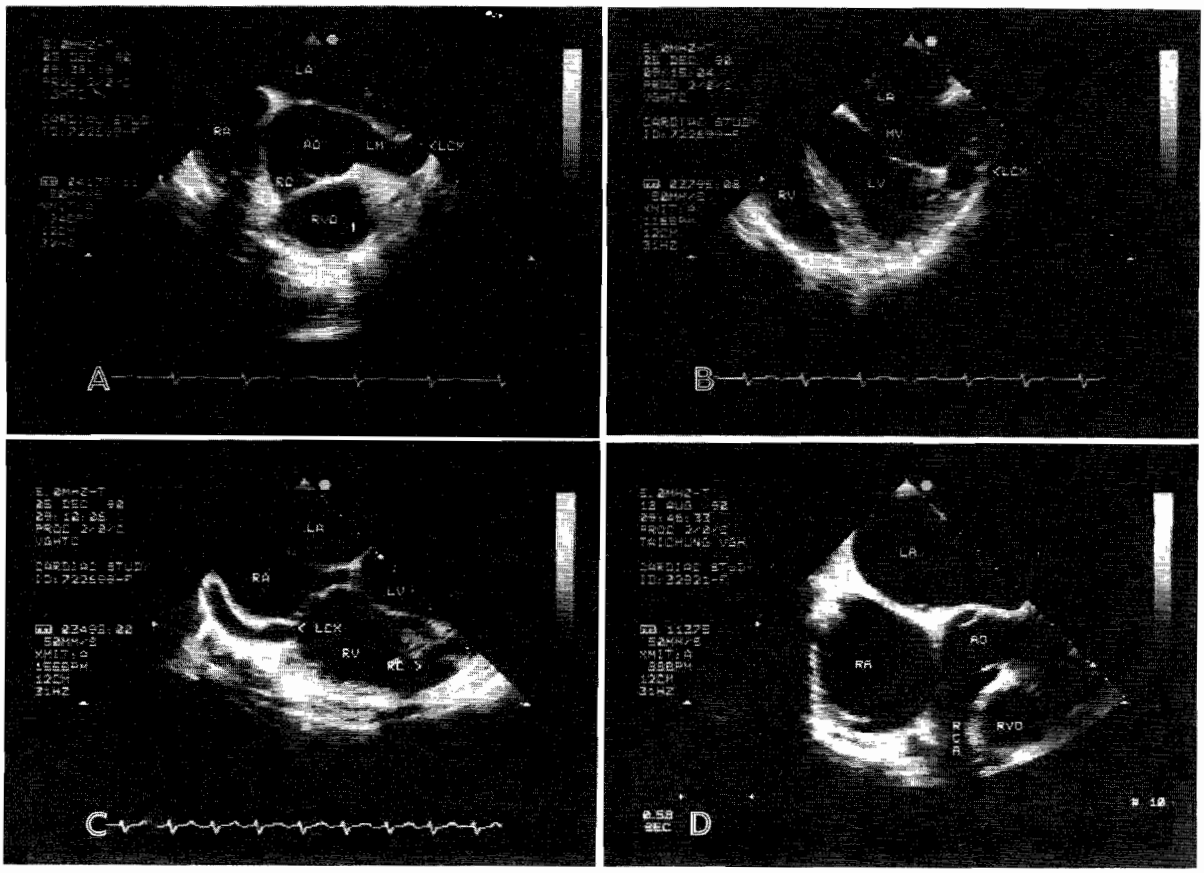

Fig. 1. Echocardiography of coronary artery fistula. In the first patient, basal axis scan of coronary artery showed dilatation of left main (LM), left circumflex (LCX) and right coronary artery (RCA) (A). Frontal long-axis four chamber view showed part of the course of a dilated left circumflex coronary artery in the atrioventricular groove (arrow head) (B) as the feeding vessel along the lateral wall of right atrium which drained into right ventricle under tricuspid valve (arrow head) (C), and right coronary artery which drained into apex of right ventricle (arrow head) (C), respectively. In the second patient, a basal short axis scan of coronary artery showed dilatation of right coronary only (D). LA = left atrium; RA = right atrium; RVO = right ventricular outflow tract; AO = aorta; RV = right ventricle; LV = left ventricle.

continuous precordial murmur, and we compare the results with those obtained from transthoracic cross-sectional echocardiography.

Patients and Methods

Patients

We performed cross-sectional echocardiography and transesophageal echocardiography in 31 patients prior to cardiac catheterization and angiography. There were 21 males and 10 females, aged 19–65 yr.

Color Doppler with cross-sectional echocardiography

All patients underwent transthoracic echocardiography by means of a 2.25 MHz transducer connected to a Hewlett-Packard ultrasound imaging system (Hewlett-Packard Co. U.S.A). The cardiac chambers were assessed from the standard parasternal apical views and suprasternal notch views. Special planes were also taken to obtain imaging of proximal and distal parts of the coronary arteries in case of suspected coronary fistula. Pulsed Doppler ultrasound and color flow imaging were done to define the origin, course, site of drainage of the coronary artery fistula and shunt flow of lesion.

Color Doppler flow with transesophageal echocardiography

All patients underwent transesophageal echocardiography after fasting and the administration of Buscopan (10 mg intramuscularly) and

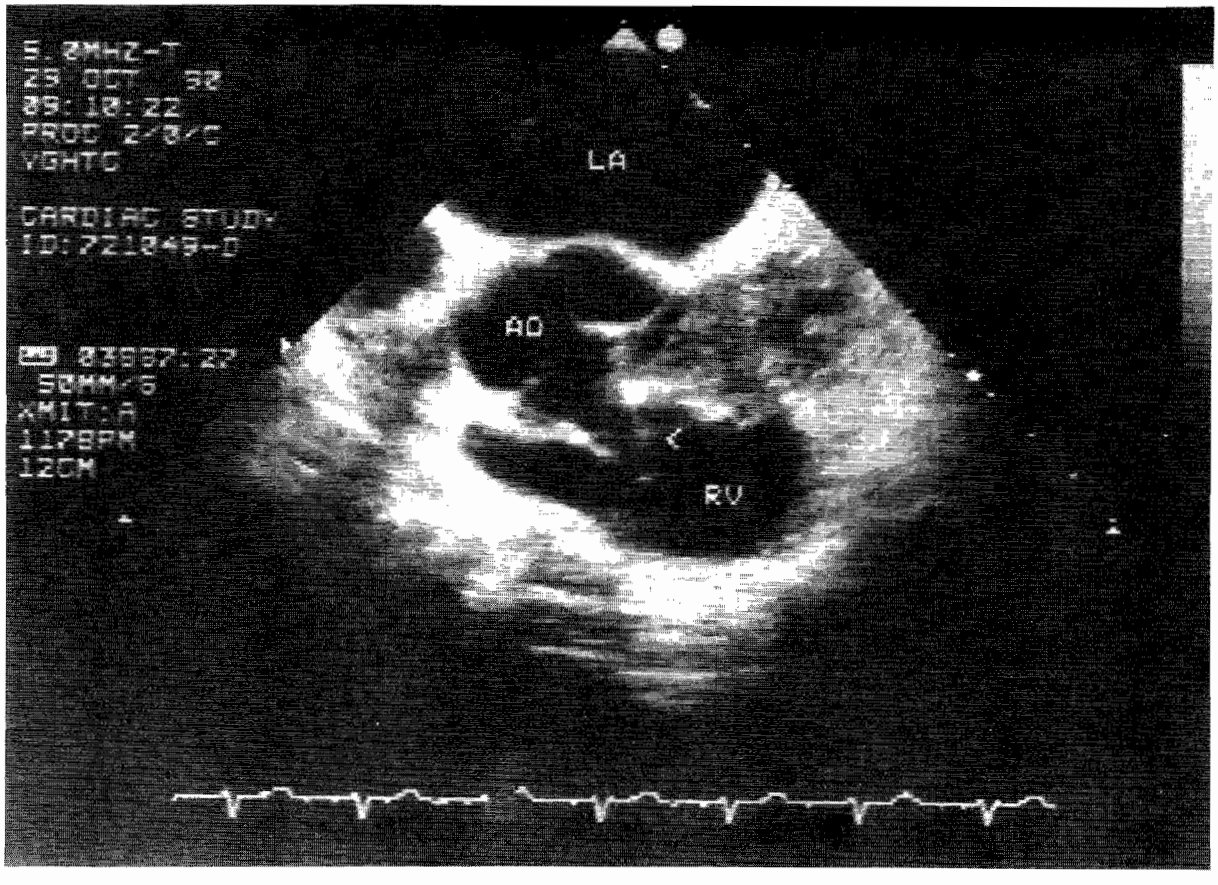

Fig. 2. Transesophageal echocardiographic basal scan of aortic root showing right coronary sinus. There was aneurysmal sac (arrow-head) protruding and ruptured into the right ventricle. LA = left atrium; AO = aorta; RV = right ventricle.

2% lidocaine spray topically. With the patients in a supine and slightly lateral position, a Hewlett-Packard 5 MHz transesophageal echocardiographic probe was inserted into the esophagus, while the electrocardiogram was continuously monitored. The transducer was manipulated to obtain a four chamber view and basal short axis of aortic root, and the left main and right coronary diameters were determined. By rotating the transducer posteriorly at a depth of 24–28 cm from the patient's teeth, the upper part of the thoracic aorta and aortic arch could also be visualized.

Cardiac catheterization

Cardiac catheterization including angiography of the aortic root, left ventricular angiogram and coronary arteriogram were performed in all patients.

Results

Echocardiographic findings

In all 11 patients with a precordial continuous murmur, both left and right coronary arteries could be clearly imaged. It was found that the diameters of left main and right coronary arteries were less than 8 and 6 mm, except in 2 patients with coronary artery fistula who had larger coronary arteries. At the site of coronary artery fistula, continuous flow pattern could readily be detected by color flow mapping with pulse Doppler. In one of these patients, fistula from

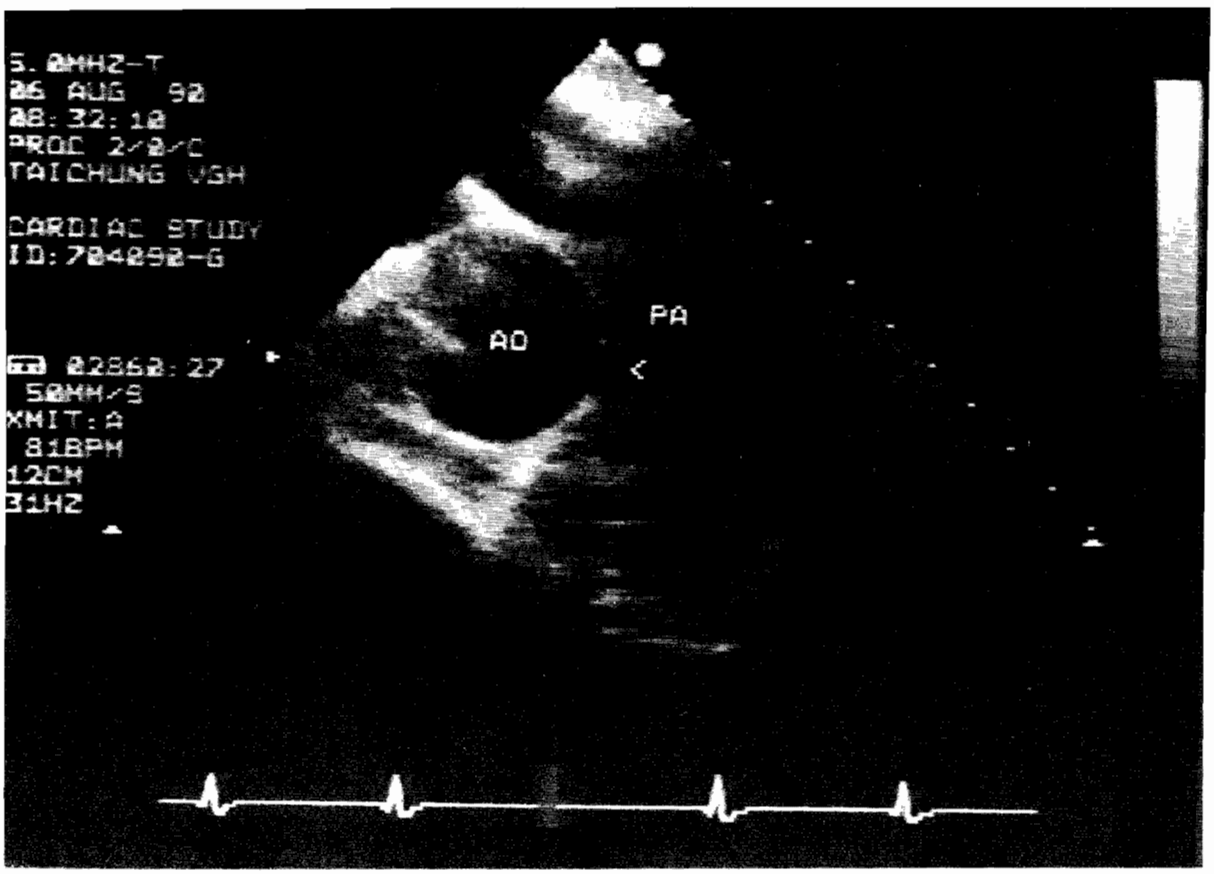

Fig. 3. Echocardiography of aortopulmonary window. Transesophageal echocardiographic basal short-axis scan of aortic root and main pulmonary artery (arrow head). There was absence of the aortopulmonary septum between ascending aorta and main pulmonary artery. AO = aorta; PA = pulmonary artery.

scending aorta, all cases of patent arterial duct could be clearly imaged. The flow velocities from aorta to pulmonary artery were determined, and the size of the duct could be measured directly, correlating well with surgical findings. The direction of flow velocity was closely related to pulmonary vascular resistance. All of them had left to right shunts, no bidirectional shunt was detected. Thus, transesophageal echocardiography is useful in both detection and prediction of severity of patent arterial duct.

The noninvasive diagnosis of the origin, course and site of drainage of coronary artery fistula is consistently possible by using cross-sectional echocardiography, together with color flow imaging and pulsed Doppler ultrasound [5–11]. In our study, we found that the course of fistula could be imaged by transthoracic echocardiography using different planes, but not by transesophageal echocardiography because of the limited views available. For visualization of proximal coronary artery and the location of the site of drainage of coronary artery fistulae into the cardiac chamber, however, transesophageal echocardiography was better than transthoracic echocardiography. Because trabecular structures may obscure the site of drainage color Doppler flow imaging can aid the visualization by measuring a continuous flow velocity. This procedure thus provides extremely important information for subsequent surgical ligation, because there are often multiple fistulous connections between the feeding coronary and the chamber of drainage as were present in our study.

Cross-sectional echocardiographic techniques have been proved to be better at detecting ruptured aneurysms of the sinus of Valsalva than M-mode [12,13]. In this study, we also found that the size and shape of aneurysmal sac, the site of rupture and the left-to-right shunt can always be identified by transesophageal echocardiography.

An aortopulmonary window represents an abnormal communication between the ascending aorta and the main pulmonary trunk. It is a relatively rare congenital anomaly. Clinically it is difficult to differentiate it from patent arterial duct, a more frequent lesion of left to right shunting. With a large patent arterial duct, moreover, even angiography may not be readily diagnostic. Using cross-sectional echocardiography in the parasternal short axis view, the aortopulmonary window can be clearly imaged [14–16]. Utilizing transthoracic or transesophageal echocardiography, however, we can detect the communication between ascending aorta and main pulmonary trunk, and a left to right shunt flow velocity can also be measured. Previous reports suggest that, with transthoracic echocardiography, it is necessary to avoid artifactual dropouts in the lateral wall of aorta due to normal or aberrant coronary arteries in the aortic root area. In this regard, we believe that transesophageal echocardiography together with color flow mapping may be better than transthoracic echocardiography.

In conclusion, we found that transesophageal echocardiography could readily and accurately define the anatomical cardiac lesions, which correlated well with the angiographic and surgical findings. This procedure should be recommended when evaluating patients with a precordial continuous murmur.

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