Pulsed Doppler Echocardiographic Detection of Coronary Artery to Right Ventricle Fistula

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SUMMARY. The pulsed Doppler echocardiographic (PDE) findings in a case of coronary artery right ventricle fistula are described. The PDE examination revealed normal flow patterns within the right atrium, pulmonary artery, and left ventricle, thus excluding these structures as the distal site of the fistula. Sampling within the right ventricular inflow revealed a turbulent, continuous, systolic-diastolic flow pattern that suggested the right ventricle was the distal end of the fistula. Postoperatively, the PDE examination of the right ventricle reverted to a normal, nonturbulent, phasic flow pattern. We conclude that PDE may be a useful noninvasive method of defining the site of drainage in cases of coronary artery fistula.

KEY WORDS: Congenital heart disease — Doppler echocardiography — Coronary caramel fistula

Pulsed Doppler echocardiography (PDE) is a form of diagnostic ultrasound that permits a description of the direction (toward or away from the examining transducer) and character (turbulent vs nonturbulent) of blood flow within the chambers of the heart and great vessels. This information is contained within an electronic display (the time interval histogram) of the change in frequency shift of an incident ultrasound signal, as that signal is reflected from moving RBCs (ie, the Doppler frequency shift) [1]. Net flow toward the transducer is indicated by a positive deflection of the time interval histogram, while net flow away from the transducer is indicated by a negative deflection. Second, the character of the blood flow (turbulent vs nonturbulent) can be assessed. Turbulent blood flow is registered as a dispersion of the dots comprising the time interval histogram. While performing the PDE examination, turbulence is also readily detected by the examiner as a change in the character (harshness) of the audio representation of the flow pattern. Using this technique in the pediatric patient, it has been possible to diagnose left-to-right shunts at the ductal [7], atrial [2], and ventricular levels [8], as well as to diagnose and describe the sites of drainage in cases of total anomalous pulmonary venous return [5, 6, 10].

In the following report, the preoperative and postoperative PDE findings are presented in a catheterization-proved case of coronary artery fistula to the right ventricle. The abnormal flow pattern detected and localized to the right ventricle, which disappeared postoperatively, represents an important diagnostic feature of this lesion and should be sought in patients in whom this lesion is clinically suspected.

Case Report

A 2-year-old girl was referred with a diagnosis of patent ductus arteriosus. She had been in good health all her life, without significant illnesses or hospitalizations. Her growth and development had been normal. She was born in Greece by normal

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spontaneous vaginal delivery and without perinatal complications. At the age of 20 days a heart murmur was noted. She was followed up in Greece without any signs or symptoms of congestive heart failure or cyanosis. The family history was unremarkable. She was referred to the University of Miami for further evaluation.

Physical examination revealed a cooperative girl in no distress. The pulse rate was 100 beats per minute; respirations, 20/min; and blood pressure, 100/50 mm Hg. Cardiovascular examination revealed equal and bounding pulses in the upper and lower extremities. The examination of the heart revealed an active left ventricular impulse and a systolic thrill at the third left intercostal space. On auscultation, the first heart sound was increased and the second heart sound was normal. There was a grade 4/6 continuous systolic-diastolic murmur heard best in the midleft sternal border, which radiated over the entire precordium as well as to the back. The rest of the physical examination was unremarkable. The ECG revealed sinus rhythm (rate, 130); PR interval, 0.18 sec; QRS axis, 90°; and left atrial and biventricular hypertrophy. The chest x-ray film showed mild cardiomegaly and increased pulmonary blood flow.

The location of the murmur was not typical for a patent ductus arteriosus; therefore, cardiac catheterization was performed. A step-up of oxygen saturation was encountered in the right ventricle, which persisted into the pulmonary arteries. The right-sided pressures were within normal limits. The ratio of pulmonary to systemic blood flow was 1.9:1. The injection of contrast material into the ascending aorta revealed a normal right coronary artery. The left coronary artery was dilated at its origin, measuring approximately 1 cm. From a continuation of the left circumflex, contrast material could be seen entering the right ventricle, inferiorty, near the atrioventricular groove. No other abnormalities were noted.

The diagnosis of left coronary artery-right ventricle fistula was confirmed at the time of surgery. The fistula was opened and probed to demonstrate its termination into the right ventricle. The fistula was then ligated distal to the take-off of the posterior descending coronary artery. The patient had an uneventful postoperative course, with disappearance of the bounding pulses and heart murmurs.

**Pulsed Doppler Echocardiography**

Pulsed Doppler echocardiography was performed with a 3-MHz Advanced Technology Laboratories instrument. Examinations were performed both preoperatively and postoperatively. Ex-