USE OF ULTRASOUND TO DEFINE SHUNTING
IN VENTRICULAR SEPTAL DEFECTS

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INTRODUCTION

Echocardiography has become a well established procedure useful in the evaluation of adults with heart disease. The technique has also proved helpful in the anatomic diagnosis of infants and children with certain forms of congenital heart disease. Recent information now suggests that echocardiography may be a valuable method to study various physiologic aspects of congenital heart disease. Silverman and co-workers have reported the use of ultrasound to measure the left atrial diameter in order to assess the magnitude of cardiac left to right shunting in preterm infants with patent ductus arteriosus.

Uncomplicated ventricular septal defects are also characterized by cardiac left to right shunting. This lesion is probably the most common malformation of the heart recognized in the pediatric age group. Children with this isolated defect and normal pulmonary vascular resistance (PVR) invariably have increased pulmonary blood flow due to the intracardiac left to right shunting. If the pulmonary flow is large, the left atrium will enlarge.

The purpose of the present study was to measure with ultrasound the left atrial diameter (LAD) as a means of differentiating small shunts from hemodynamically significant shunts in children with isolated ventricular septal defect.
Echocardiography was carried out on seventeen patients with isolated ventricular septal defect diagnosed by cardiac catheterization. In all cases the ultrasound examination was performed within 24 hours of catheterization study. The patients ranged in age from 3 weeks to 17 years (mean = 4.8 yrs). All subjects except one (PVR = 5.1 units) had normal pulmonary vascular resistance.

All cardiac catheterizations were undertaken with the patient breathing room air. Oxygen consumption was measured continuously in each instance using a flow through circuit. In every case oxygen consumption remained stable, indicating a steady state. Pulmonary and systemic cardiac outputs were then calculated using the standard Fick method. The patients were separated into two groups according to the magnitude of their pulmonary flow: systemic flow (Qp:Qs). Group I consisted of seven patients with a Qp:Qs of 1.5 or less (range 1.1-1.5). Group II was ten patients with a Qp:Qs over 1.5 (range 1.7-5.6).

The sonograms were obtained with the patient in a recumbent position, breathing room air. The mean heart rate during echo examination was 123±7 (S.E.), which did not differ significantly from the mean heart rate at cardiac catheterization, 126±7.

The techniques utilized in obtaining the echocardiograms were similar to those described by others. An Ekoline 20 Ultrasoundoscope with a 5.0 MHz, non-focused transducer of 0.75 inch outer diameter was used in all cases. Water soluble gel provided airless contact between the transducer and the patient's skin. With the transducer in the patient's third or fourth left intercostal space at the sternal border, the mitral valve echo was located. The ultrasound beam was then directed superiorly and medially until the aortic root was reached. The left atrial diameter was measured from the posterior aspect of the posterior aortic wall to the anterior surface of the left atrial wall.

Since the LAD is known to vary with body size, this value was divided by the patient's body surface area (BSA) in order to adjust for differences in body size. The LAD/BSA ratio was then compared to the pulmonary to systemic flow ratio in each patient.