noninvasive measurement may be useful in the many patients in whom only pulmonary valve leaflet opening can be identified. It may then be possible on serial echocardiographic studies to allow more precise timing of cardiac catheterization in children in whom pulmonary vascular disease is a threat. Whatever the eventual form of echocardiographic technique used, however, this approach initiated by Hirschfeld et al. should be of great value.

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References


The authors reply:

To the Editor:

We welcome the important comments by Drs. Silverman and Hoffman and appreciate their support of the concept and application of echocardiographic assessment of pulmonary vascular resistance. Although stepwise, multiple linear regression techniques would provide predictive values for the pre-ejection period, we were reluctant to publish those data because we did not have sufficient normal values for given age groups and varying heart rates, or enough patients with a constant heart rate and varying age.

We agree that a curvilinear regression analysis for the RPEP/RVET ratio to pulmonary vascular resistance would improve the correlation coefficient from 0.66 to 0.85. However, since a correlation coefficient of 0.66 is significant and since the curvilinear regression analysis would not improve the predictive value of the ratio, this analysis was not included. We did mention in the discussion that there was deviation from the linear correlation when pulmonary artery diastolic pressures were greater than 60 mm Hg.

We did not wish to imply that pulmonary vascular resistance (PVR) could be predicted from the ratio of pre-ejection period (RPEP) and right ventricular ejection time (RVET) (fig. 6). We merely wanted to indicate our observations in 35 samples that the PVR was less than 3.0 units when the RPEP and RVET ratios were less than 0.3. There was only one patient with a RPEP/RVET ratio of 0.3 or less who had a pulmonary vascular resistance of greater than 3 units (fig. 6).

We recognize that the opening movement of the pulmonary valve echo is generally detected more consistently than the closure points of the valves. However, in our experience, this has not presented a problem in those patients in whom we were particularly interested in assessing the pulmonary vascular resistance, (i.e., with increased pulmonary blood flow or pulmonary hypertension). Nevertheless, utilization of the RPEP alone may be more applicable in some patients, particularly adults.

The majority of patients in our study had left-to-right shunts and the noninvasive technique was correlated with invasive measurements of pulmonary arterial pressures and vascular resistances. Since publication of the paper, an additional 125 patients have been studied both by echocardiography and cardiac catheterization and the echocardiographic findings have continued to be supported and validated by the hemodynamic data.

In order to maintain the proper perspective of the paper, we would like to emphasize the following points: (1) The value of the RPEP/RVET ratio is its application in the serial assessment of the same patient who thus serves as his own control. Dramatic increases in the pulmonary vascular resistance will be reflected in increasing RPEP/RVET ratios which then may help the timing of cardiac catheterization. (2) It is possible to distinguish fixed pulmonary hypertension from potentially reversible vasoconstrictive influences. Echocardiographic evaluation of changes in the RPEP/RVET ratio with a patient breathing room air and 100% oxygen provides a simple, accurate, noninvasive method for obtaining this kind of information. (3) The adequacy of pulmonary artery banding in patients with large interventricular communications may be evaluated using this technique.

Clearly, further experience with this technique is needed to assess pulmonary vascular resistance. To date, application of this method has continued to support our hypothesis.

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References


Heart Sounds by Echo

To the Editor:

I would like to make a few remarks concerning a recent Editorial by Dr. Craigie (Circulation 53: 207, 1976).

Echocardiography is an elegant and interesting method which, however, is largely based on the skill of the operator (often a technician or Resident) and cannot be successfully used in all cases. We owe to echocardiography the knowledge that openings and closures of the valves are events that require a certain time. Most statements of the past mentioning "valve closure" should be amended to say "completion of valve closure."

Echocardiography should not be overemphasized in regard to the exact timing of certain valve events because of the variables introduced by the angle of the beam in regard to the plane of a leaflet, plus the changing position of the latter induced by motion of the heart due to both its dynamics and the shift induced by respiration. Therefore, it should be kept in mind that recording the motions of
Letter: Heart sounds by echo.
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