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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echocardiographic assessment of pulmonary artery pressure and
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The authors reply:

To the Editor:

We welcome the important comments by Drs. Silverman and
Hoffman and appreciate their support of the concept and applica-
tion of echocardiographic assessment of pulmonary vascular resistance.1
Although stepwise, multiple linear regression techniques would
provide predictive values for the pre-ejection period, we were reluc-
tant 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 discus-
sion 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.3

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 vasocostrictive influences.
Echocardiographic evaluation of changes in the RPEP/RVET ratio
with a patient breathing room air and 100% oxygen provides a sim-
ple, accurate, noninvasive method for obtaining this kind of infor-
mation. (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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1975

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 techni-
cian 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 in-
troduced 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.
A A Luisada and E Craig

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