tion of the coronal cross-section should have been rotated counter-clockwise as pointed out by Dr. Gramiak, although we think his figure shows somewhat exaggerated rotation. However, we do state clearly in our manuscript that the tricuspid valve is anterior to the interventricular septum and that the latter structure is continuous with the anterior aortic margin. In addition, and as also stated in our report, it should be emphasized that the tricuspid valve is positioned inferiorly and medial to the aortic valve. Because figure 3 is a coronal cross-section, the fact that the four cardiac valves are at different superior-inferior levels cannot be appreciated from any diagram.

We do not agree that an error exists in the diagrammatic portion of figure 1. We included a portion of a longitudinal section of the sternum in the illustration for clarity since the sternum is a usual anatomic landmark. Moreover, it should be pointed out that the sternum is minimally calcified in infants. While the parasternal position is employed commonly for left ventricular structure imaging the transducer position shown in our illustration does not preclude recording aortic valve or mitral valve images in infants and is preferred for viewing right ventricular structures.

ARTHUR D. HAGAN, M.D.
DAVID J. SAHN, M.D.
WILLIAM F. FRIEDMAN, M.D.
Department of Medicine
U.S. Naval Hospital and Division of Pediatric Cardiology
University of California, San Diego
School of Medicine
San Diego, California

Exercise Testing in CAD
To the Editor:

The recent article by Drs. Keleman et al., "Diagnosis of Obstructive Coronary Disease by Maximum Exercise and Atrial Pacing," (Circulation 48: 1227, 1973) was a concise study of real pertinence to the physician in the community hospital who uses the exercise tolerance test. However, the lack of data reported as to the heart rates achieved with the exercised patients limits the reader's ability to assess the efficacy of the method. If the authors could supply data as to maximum rates achieved relative to the predicted maximum heart rate for a given age, one would be able to better use their findings in evaluating the sensitivity of one's own exercise tolerance studies.

Finally there is one other minor question that comes to mind in regard to their results. That is, did any of the seven patients who were falsely negative by chest pain criteria have positive ST changes?

ROBERT H. BILBRO, M.D.
Raleigh, North Carolina

The author replies:

Dr. Bilbro's comments are appreciated. In reply to his question, the mean maximum heart rate attained during exercise testing in patients with significant coronary arteriographic obstruction was 130. There was no difference in maximum heart rate between patients who developed ischemic ST changes and those who did not.

The mean maximum heart rate attained in patients with negative coronary arteriography was 167. The predicted maximum heart rate in this age group (mean age 49 years) is 175–185.1 Thus, our patients attained greater than 90% of their maximum predicted heart rate.

Of the seven patients with positive coronary arteriography and exercise tests negative for chest pain, three developed ischemic ST abnormalities.

MICHAEL H. KELEMEN, M.D.
Alta Bates Hospital
Berkeley, California

References

Mitral Valve Prolapse
To the Editor:

I have read with interest the paper by Ranganathan et al. (Angiographic-morphologic correlations in patients with severe mitral regurgitations due to prolapse of the posterior mitral valve leaflet. Circulation 48: 514, 1973). The authors deserve credit for having shown that the posterior mitral leaflet is a triscalloped structure. I have already shown, as pointed out by these authors, that prolapse of the three scallops can be identified angiographically.1 Prolapse of the anterior leaflet is not as uncommon as indicated by these workers. I have reviewed 46 reported cases of mitral valve prolapse, including five of our cases, in whom identification of the deformed leaflet was provided by the surgeons or the pathologists, and have found that the posterior leaflet was prolapsed in 15, the anterior in four and both leaflets in 27.2 Echoangiographically, prolapse of both leaflets is common.3

I must add that figure 2, which is supposed to demonstrate posterior leaflet prolapse with minimal
antior leaflet disease, does actually show significant involvement of the anterior leaflet. The authors state that the anterior leaflet did not prolapse on angiography, and they ascribe an antero-superior bulge to the antero-lateral scallop of the posterior leaflet. This is a presumptive conclusion because the antero-superior bulge may well be due to anterior leaflet prolapse. Furthermore, they do not indicate how prolapse of the anterior leaflet is diagnosed in their laboratory.

Despite the superimposition of the anterior and posterior leaflets in the RAO position, we feel that the anterior leaflet tends to prolapse antero-superiorly and the posterior leaflet postero-inferiorly. This conclusion is based on angio-morphologic correlations in four of our patients with prolapse of both leaflets in one, of the anterior leaflet with a calcified retracted posterior leaflet in one, and of both leaflets in two. It is probable that prolapse of the antero-lateral scallop may be seen as a small bulge along the usually smooth and un-interrupted antero-superior wall of the left ventricle, (their figure 2 and in our figure 1); however, a large "anterior hump" (their diagram in figure 1 and our figures 4, 12, 16, 18) would warrant the diagnosis of anterior leaflet prolapse.

Robert M. Jeresaty, M.D.
Director, Section of Cardiology
Saint Francis Hospital
Hartford, Connecticut

References


The authors reply:

We have read with interest the letter from Dr. Jeresaty and appreciate the opportunity to reply.

As pointed out by Dr. Jeresaty, the concept that the posterior mitral valve leaflet is a triscalloped structure arose from detailed morphologic studies carried out in our laboratory. In these studies, indicating the triscalloped nature of the posterior leaflet, the scallop adjacent to the posteromedial commissure was named the posteromedial commissural scallop, while the scallop adjacent to the anterolateral commissure was named the anterolateral commissural scallop. In between these two scallops was the usually larger middle scallop.

Although not evident in Dr. Jeresaty’s letter, the first report on the angiographic recognition of prolapse of a middle scallop of the posterior leaflet of the mitral valve originated from this center. Furthermore we clearly suggested that prolapse of the commissural scallops should produce bulges at either extremity of the posterior mitral leaflet in the right anterior oblique left ventricular cineangiogram, and referred to previously reported angiograms which showed such bulges.

Subsequently, Dr. Jeresaty, quoting extensively from our previous work, has presented his observations. In fact he has agreed with our concept that a prolapsed posterior leaflet produced a triple scalloped bulge in the right anterior oblique left ventricular cineangiogram. The difference between our viewpoint and his on the angiographic interpretation was quite obvious at the 45th Scientific Sessions of the American Heart Association Meeting held in Dallas in November, 1972, where both of our papers were presented at the same session. The main point of difference is whether in the right anterior oblique left ventricular cineangiogram, the anterosuperior bulge just below or behind the aortic root (depending on the degree of obliquity) represents the anterolateral commissural scallop of the posterior leaflet, which is our opinion, or the anterior leaflet, which is Dr. Jeresaty’s. Dr. Jeresaty admits that a prolapsed anterolateral commissural scallop may be seen in this position, as we have reported. However, he believes that if the bulge is large, it represents the anterior leaflet of the mitral valve. This seems to be an illogical conclusion. We would believe that if the bulge is small that the prolapse of the anterolateral commissural scallop is mild, whereas, if the bulge is large, that the prolapse of this scallop is more severe.

We agree with his comment that anterior leaflet prolapse may be associated with posterior leaflet prolapse. In our series, ten of 45 patients had combined leaflet prolapse. In our experience, prolapse of the anterior leaflet in the right anterior oblique left ventricular cineangiogram primarily overlaps the region of the middle scallop prolapse of the posterior leaflet, and not the region of the anterolateral commissural scallop prolapse as suggested by Dr. Jeresaty. Careful review of right anterior oblique left ventricular cineangiograms in ten patients with combined leaflet prolapse demonstrated subtle ways in which prolapse of the anterior leaflet could be distinguished from prolapse of the posterior leaflet of the mitral valve. These are 1) actual discontinuity in outline between the prolapsing anterior leaflet and the prolapsing scallops of the posterior leaflet, 2) a temporal dissociation between the bulging leaflets as to the time of maximal prolapse, 3) the overlapping mid-
Mitral Valve Prolapse
ROBERT M. JERESATY

Circulation. 1974;49:1267-1268
doi: 10.1161/01.CIR.49.6.1267-b

Circulation is published by the American Heart Association, 7272 Greenville Avenue, Dallas, TX 75231
Copyright © 1974 American Heart Association, Inc. All rights reserved.
Print ISSN: 0009-7322. Online ISSN: 1524-4539

The online version of this article, along with updated information and services, is located on the World Wide Web at:
http://circ.ahajournals.org/content/49/6/1267.3.citation

Permissions: Requests for permissions to reproduce figures, tables, or portions of articles originally published in Circulation can be obtained via RightsLink, a service of the Copyright Clearance Center, not the Editorial Office. Once the online version of the published article for which permission is being requested is located, click Request Permissions in the middle column of the Web page under Services. Further information about this process is available in the Permissions and Rights Question and Answer document.

Reprints: Information about reprints can be found online at:
http://www.lww.com/reprints

Subscriptions: Information about subscribing to Circulation is online at:
http://circ.ahajournals.org//subscriptions/