Hemodynamic Effects of Exercise in Isolated Valvular Aortic Stenosis

To the Editor:

I read with interest the article by Bache et al.1 The problem of constancy vs inconstancy of aortic valve area during exercise was reviewed again, and I believe that an error is being made in failing to include regurgitant flow in total aortic flow calculations. Measurement of systolic valve area by the hydraulic formula of Gorlin2 requires total systolic flow across the valve to be measured. This is equal to the sum of forward flow (cardiac output) and regurgitant flow, and not of forward flow alone, as used in the calculations of both Bache et al. and Anderson et al. Bache acknowledges the presence of a “trace” of angiographically visualized contrast material in 14 of the 20 patients studied. An angiographic correlation with dye-dilution measurements of aortic regurgitation from our laboratory4 has shown that so-called 1+ regurgitation on the angiogram may include a leak of up to 25% of total flow. The mean apparent increase in aortic valve area demonstrated in the 20 patients of Bache, 0.12 cm², is small and represents only a 16% increase over resting valve area, and may have been explained, at least in part, by considering that the reduction in regurgitant fraction induced by exercise was the factor most likely to explain the apparent increase in valve area. When patients with mixed AS-AR were evaluated by us, measuring forward and regurgitant flow,5 there were no changes in valve area during exercise. Total transaortic systolic flow must be measured in order to calculate valve area; certainly, the small predictable difference in orifice areas found by Bache et al. is well within the range of error that could be induced by small degrees of regurgitation.

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References

2. Gorlin R, Gorlin SG: Hydraulic formula for calculation of the area of the stenotic mitral valve, other cardiac valves, and central circulatory shunts. Amer Heart J 41: 1, 1951

The authors reply:

To the Editor:

As Dr. Ettinger points out, the presence of aortic insufficiency in patients with aortic stenosis will result in underestimation of total aortic valve flow and aortic valve area. However, if the regurgitant flow constitutes only a small fraction of total valve flow, a modest change in this regurgitant fraction will result in only a very small change in total systolic valve flow. For this reason, patients included in our study had either no aortic insufficiency clinically and by cineangiography, or a cineangio-graphically demonstrated degree of aortic insufficiency less than that generally defined as 1+ aortic insufficiency. Since 1+ aortic insufficiency has previously been shown in Dr. Ettinger’s laboratory to represent a mean regurgitant fraction of 15%, we anticipated that our patients had a mean regurgitant fraction of no more, and probably less, than this. Any change in regurgitant fraction would modify only this 15% of total valve flow. Thus, if our patients had a mean regurgitant fraction of 15% at rest, in order for the observed 16% increase in mean
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