JACC: CARDIOVASCULAR IMAGING
© 2017 BY THE AMERICAN COLLEGE OF CARDIOLOGY FOUNDATION
PUBLISHED BY ELSEVIER
VOL. 10, NO. 10, 2017
ISSN 1936-878X/$36.00

iMAIL

## LETTERS TO THE EDITOR

### Post-Extrasystolic Transaortic Valve Gradients Differentiate "Pseudo" and "True" Low-Flow, Low-Gradient Severe AS During Dobutamine Stress Echocardiography

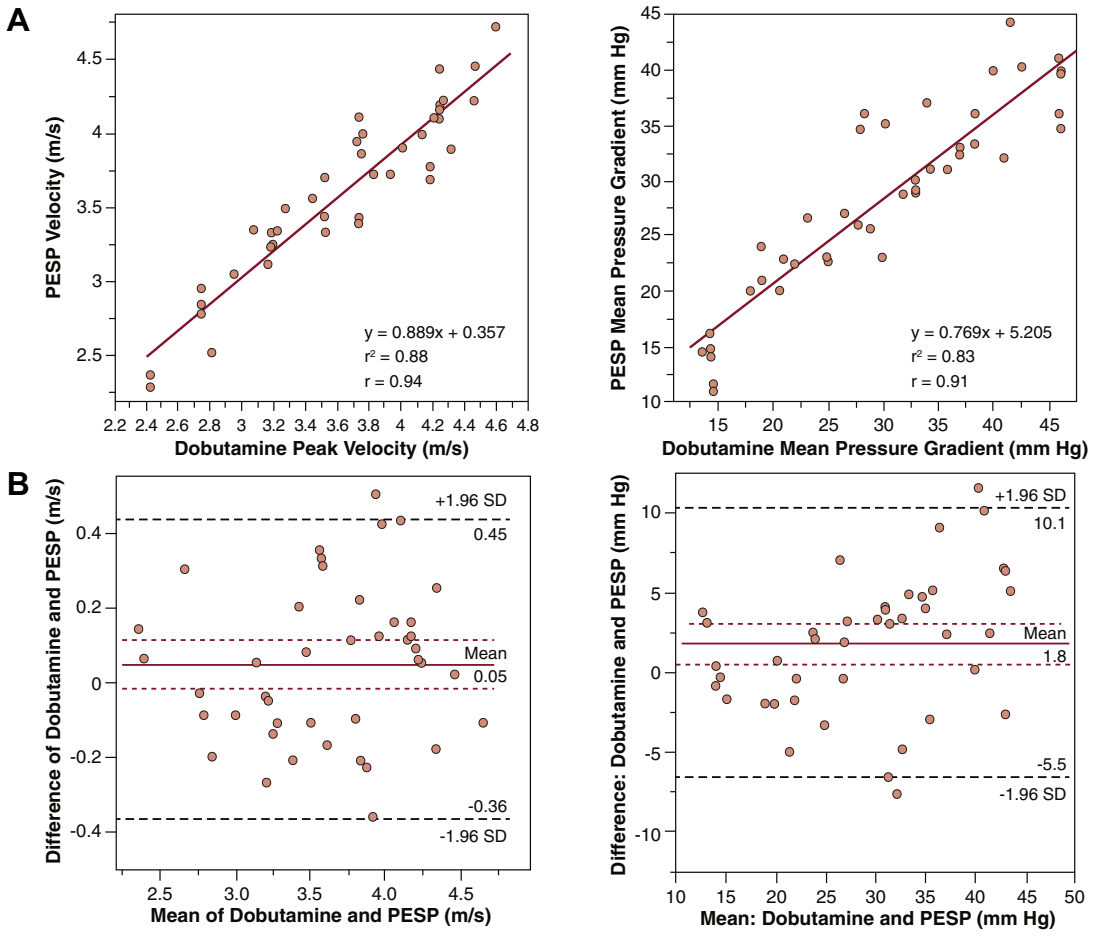
Dobutamine stress echocardiography (DSE) is used in "low-flow, low-gradient" aortic stenosis (LFLG-AS) to distinguish between "true" severe AS and "pseudo" severe AS (1). A method to predict the DSE response in LFLG-AS could potentially reduce the risk of the complications associated with dobutamine infusion and reduce unnecessary testing. This study examined post-extrasystolic potentiation (PESP) of transaortic valvular gradients after a premature beat and correlated those results with DSE gradients.

All transthoracic DSEs from January 1, 2011 to April 30, 2015 (n = 249) that showed AS and impaired left ventricular systolic function (left ventricular ejection fraction [LVEF] <55%) were retrospectively reviewed for the presence of a PESP event recorded during the baseline resting portion of the stress test before dobutamine infusion or on a resting echocardiogram within 1 month of the index dobutamine stress test. A PESP event was defined as a ventricular contraction that occurred after a prolonged pause initiated by a pre-mature atrial or ventricular contraction, with a cycle length longer than the underlying RR interval using synchronized electrocardiographic rhythm tracings present on continuous-wave Doppler spectral recordings. Patients with irregular rhythms, atrial fibrillation, or atrial flutter were excluded (n = 37). If multiple PESPs occurred during a single study, each PESP was analyzed as a single event. DSE was performed using a standard graded dose protocol (peak dose 20 μg/kg/min) with interrogation of transaortic valve gradients conducted during each incremental dose of dobutamine and peak gradients recorded at optimal contractile reserve. The Shapiro-Wilk test was used to assess the normality of distribution, and comparisons between values were made using Student *t* test and the Mann-Whitney test, as appropriate. The Pearson product-moment correlation coefficient was used to measure the strength of the linear relationship, and odds ratios were calculated with Fisher exact test.

A review of 212 echocardiograms yielded 43 PESP events in 32 studies (n = 29). The patients were primarily men (79%) and older adults (age 82.7 ± 6.9 years) with ischemic cardiomyopathies (55%). The baseline mean LVEF was 35.40 ± 13.24%, the mean indexed stroke volume was 26.71 ± 7.52 ml, and the mean aortic valve area was 0.74 ± 0.27 $cm^2$. The resting transaortic mean gradient was 21.71 ± 7.06 mm Hg, and the Vmax was 3.07 ± 0.51 m/s. The mean transaortic PESP and dobutamine derived Vmax were 3.62 ± 0.56 m/s and 3.66 ± 0.59 m/s, respectively ($p = 0.53$). The average mean pressure gradients for PESP and dobutamine were 28.50 ± 8.56 mm Hg and 30.20 ± 10.10 mm Hg, respectively ($p = 0.46$). The PESP and dobutamine maximum velocities and mean gradients demonstrated excellent correlation with $r = 0.94$ ($p < 0.001$) and $r = 0.91$ ($p < 0.001$), respectively (**Figure 1**). Adjusting for multiple PESP events in the same patient by taking the average of the gradients still yielded strong correlation with $r = 0.93$ ($p < 0.001$) for Vmax and $r = 0.89$ ($p < 0.001$) for the mean pressure gradient. Bland-Altman analysis demonstrated a difference of 0.05 m/s between mean dobutamine and PESP Vmax and a 1.8 mm Hg difference between mean dobutamine and PESP mean pressure gradients. Of the 16 DSE studies that demonstrated dobutamine Vmax ≥4.0 m/s (true AS), the corresponding PESP was Vmax >3.9 m/s in 14 (87.5%) and ≥3.7 m/s in the 2 outliers. The correlation of PESP when the dobutamine Vmax was ≥4.0 m/s was $r = 0.74$ ($p < 0.001$).

PESP has been proposed as a potential aid in the evaluation of LF-LGAS for transthoracic aortic valve replacement (2). DSE is the guideline recommendation for evaluation of LFLG-AS (1), and although we did not use an independent method to validate the severity of stenosis, the excellent correlation between PESP and dobutamine transaortic gradients suggest that PESP could be used to identify true severe LFLG-AS. We were not able to demonstrate a statistically significant correlation with PESP and contractile reserve. A cutoff of PESP Vmax ≥3.7 m/s yielded an odds ratio of 1.75 (95% confidence interval: 0.45 to 6.83; $p = 0.42$) for a stroke volume increase of ≥20% with dobutamine. However, we were limited to those patients with PESP gradients that could be analyzed. Altering our echo protocols to record all PESP gradients would increase the sample size and likely improve the statistical prediction of contractile reserve. Future prospective studies are needed to investigate the relevance of PESP transaortic hemodynamics for the assessment of contractive reserve and the prognostic value for patients undergoing aortic valve replacement. However, our results

**FIGURE 1 Correlation of PESP and Dobutamine Transaortic Gradients**




**(A)** Pearson correlation of gradients. **(B)** Bland-Altman analysis of gradients. PESP = post-extrasystolic potentiation.

provided promising potential for the use of PESP gradients in evaluation of patients with LFLG-AS and reduced LVEFs.

**Brandon M. Wiley, MD***
**Ari Pollack, MD**
**Ajay S. Vaidya, MD**
**Sunil K. Agarwal, MD**
**Partho P. Sengupta, MD**
**Farooq A. Chaudhry, MD**

*Mayo Clinic
Department of Cardiovascular Diseases
200 First Street South West
Rochester, Minnesota 55905
E-mail: brandowiley@gmail.com

http://dx.doi.org/10.1016/j.jcmg.2016.09.024

Please note: The authors have reported that they have no relationships relevant to the contents of this paper to disclose. Paul Grayburn, MD, served as the Guest Editor for this paper.

## REFERENCES

**1.** Nishimura RA, Otto CM, Bonow RO, et al. 2014 AHA/ACC guideline for the management of patients with valvular heart disease: a report of the American College of Cardiology/American Heart Association Task Force on Practice Guidelines. J Am Coll Cardiol 2014;63:e57–185.

**2.** Bhave NM, Patel AR, Shah AP, Lang RM. Postextrasystolic potentiation in low-gradient, severe aortic stenosis: a poor man's stress echo? Echocardiography 2013;30:E148–51.

## High-Sensitivity Troponin I Is Associated With High-Risk Plaque and MACE in Stable Coronary Artery Disease

Cardiac troponin I (cTnI) is a marker of myocardial injury, and improvements to assay sensitivity allow for precise quantification at extremely low concentrations. In stable coronary artery disease (CAD),