

## Re: Evaluation of Left Atrial Volumes and Ejection Force by Real-Time Three-Dimensional Echocardiography

We are pleased that Dr Nemes and his colleagues are interested in our study on real-time three-dimensional echocardiography (RT3DE) for calculation of left atrial ejection force (LAEF).<sup>1</sup> We also appreciate their studies on the utility of LAEF on hypertrophic cardiomyopathy (HCM) and noncompaction cardiomyopathies (NCCM).<sup>2</sup>

However, we believe that a proper method for calculating LAEF is necessary and useful. The study by Anwar et al<sup>2</sup> differs from ours in several important aspects. Firstly, the formulation used in the study by Anwar et al<sup>2</sup> is adopted from Manning et al<sup>3</sup> ( $0.5 \times 1.06 \times MVA \times A^2$ ), which is different from ours ( $1/3 \times 1.06 \times MAA \times A^2$ ).<sup>1</sup> Secondly, peak A velocity is measured at mitral valve leaflet.<sup>2</sup> Ideally, peak A velocity must also be measured by putting the sample volume at the mitral orifice annulus. We found that peak A velocity measured at mitral valve leaflet are systemically higher than that measured at the mitral annulus. The use of peak A velocity measured at the mitral valve leaflet would hence overestimate LAEF substantially. Lastly, the timing of mitral annulus area (MAA) measurement from RT3DE should be measured at the instant of p-wave of ECG (this corresponds to atrial systolic contraction phase in Figure 1).<sup>4</sup>

LAEF, defined as the force expended by the atrium to eject the blood through the mitral valve during atrial systole, has played a more important role in diverse heart diseases.<sup>2,5,6</sup> We would look forward to see the study use three-dimensional speckle-tracking echocardiography for LAEF assessment,<sup>5</sup> with consideration of our modified formulation.

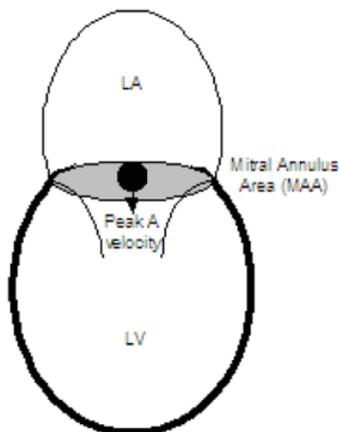


Fig. 1. Proper calculation of LAEF ( $1/3 \times 1.06 \times MAA \times A^2$ ), wherein MAA is the mitral annulus area from RT3DE, A is the peak A velocity measured by putting sample volume at the mitral orifice annulus from the Doppler echocardiography.

### REFERENCES

1. Zhong L, Tan LK, Finn CJ, Ghista DN, Liew R, Ding ZP. Effects of age and gender on left atrial ejection force and volume from real-time three-dimensional echocardiography. *Ann Acad Med Singapore* 2012;41:161-9.
2. Anwar AM, Soliman OI, Geleijnse ML, Michels M, Vletter WB, Nemes A, et al. Assessment of left atrial ejection force in hypertrophic cardiomyopathy using real-time three-dimensional echocardiography. *J Am Soc Echocardiogr* 2007;20:744-8.
3. Manning WJ, Silverman DI, Katz SE, Douglas PS. Atrial ejection force: a noninvasive assessment of atrial systolic function. *J Am Coll Cardiol* 1993;22:221-5.
4. Zhong L, Tan RS, Ghista D. Proper use of left atrial ejection force as a measure of left atrial mechanical function. *Echocardiography* 2012;29:878-84.
5. Nemes A, Hausinger P, Kalapos A, Domsik P, Foster T. Alternative ways to assess left atrial function in noncompaction cardiomyopathy by three-dimensional speckle-tracking echocardiography: (a case from the MAGYAR-Path Study). *Int J Cardiol* 2012;158:105-7.
6. Huang FQ, Zhong L, Le TT, Tan RS. Left atrio-ventricular matching in patients with heart failure. *Eur Heart J* 2012:in press.

Liang Zhong, <sup>1</sup>PhD, Reginald Liew, <sup>1</sup>MBBS (Hons), MRCP, PhD,  
Zee Pin Ding, <sup>1</sup>MBBS, MMed (Int Med)

<sup>1</sup>Department of Cardiology, National Heart Centre, Singapore

Address for Correspondence: Dr Liang Zhong, National Heart Centre Singapore, Mistri Wing 17 Third Hospital Avenue, Singapore 168752.  
Email: zhong.liang@nhcs.com.sg