

Supplementary material

To obtain left atrial (LA) areas, 2-D volumetric measurements were performed based on tracings of the blood-tissue interface on apical four- and two-chamber views at the end-diastole and end-systole. End-diastolic areas were digitized from apical bi-plane echo images that were coincident with the beginning of the Q-wave on the electrocardiogram. End-systolic areas were digitized from video frames near the end of the T-wave with a maximum inward motion of the left ventricular walls. The LA volumes were calculated at the end-diastole and end-systole using Echopac software (GE Vingmed, Milwaukee, WI, USA) with the modified Simpson's rule.¹ The LA stroke volume was defined as the difference between the LA end-systolic and end-diastolic volumes, and the LA ejection fraction was defined as the proportion of the LA stroke volume to the LA end-systolic volume.² The LA appendage emptying velocity was measured using a pulsed Doppler wave, which was placed 1 to 2 cm from the LA appendage orifice within the chamber.³ Both inter-rater and intra-rater reliability for measurements were excellent for the LA stroke volume (intraclass correlation coefficient [ICC] = 0.919 and 0.974, respectively, $P < 0.001$), LA ejection fraction (ICC = 0.907 and 0.893, respectively, $P < 0.001$) and the LA appendage emptying velocity (ICC = 0.936 and 0.960, respectively, $P < 0.001$). Normal values for the LA stroke volume, LA ejection fraction, and LA ap-

pendage emptying velocity were determined in accordance with current recommendations.^{1,3,4}

References

- 1 Lang RM, Badano LP, Mor-Avi V, Afilalo J, Armstrong A, Ernande L et al. Recommendations for cardiac chamber quantification by echocardiography in adults: an update from the American Society of Echocardiography and the European Association of Cardiovascular Imaging. *J Am Soc Echocardiogr* 2015;28:1-39.
- 2 Russo C, Jin Z, Homma S, Rundek T, Elkind MS, Sacco RL et al. Left atrial minimum volume and reservoir function as correlates of left ventricular diastolic function: impact of left ventricular systolic function. *Heart* 2012; 98:813-20.
- 3 Hahn RT, Abraham T, Adams MS, Bruce CJ, Glas KE, Lang RM et al. Guidelines for performing a comprehensive transthoracic echocardiographic examination: recommendations from the American Society of Echocardiography and the Society of Cardiovascular Anesthesiologists. *J Am Soc Echocardiogr* 2013; 26:921-64.
- 4 Aune E, Baekkevar M, Roislien J, Rodevand O, Otterstad JE. Normal reference ranges for left and right atrial volume indexes and ejection fractions obtained with real-time three-dimensional echocardiography. *Eur J Echocardiogr* 2009;10:738-44.