Association between Normal Aging and Phasic Left Atrial Volume as Assessed by Real-Time Three-Dimensional Echocardiography

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Background: Left atrial (LA) size is a good predictor of many cardiovascular outcomes, including atrial fibrillation, stroke and heart failure. Real-time 3D echocardiography (RT3DE) may be a superior index for estimating LA volume, compared with traditional M-mode and 2D methods. In this study, we used RT3DE to evaluate phasic LA volumes and functions among different age groups of healthy Taiwanese subjects.

Methods: Sixty-eight healthy volunteers were divided into three groups according to age. Group 1: under 40 years old (n = 20); group 2: 40-60 years old (n = 24); and group 3: over 60 years old (n = 24). RT3DE of LA volume was acquired from the apical view. Three phasic LA volumes, including maximal LA volume (LA Vmax), minimal LA volume (LA Vmin) and LA volume before atrial contraction (LA VpreA) were measured. These phasic LA volumes were used to calculate the emptying volume and emptying fraction at different phases of one heart cycle.

Results: There were significantly positive correlations between age and LA volumes ($\rho = 0.639$ for LA Vmax, $\rho = 0.642$ for LA VpreA, $\rho = 0.661$ for LA Vmin; all $p < 0.001$). Total LA empty volume ($p < 0.001$) and active LA empty volume ($p = 0.001$) also positively correlated with age. In contrast, total, passive and active LA emptying fractions were not significantly different among the three age groups.

Conclusion: Aging has a significant effect on phasic LA volumes, but phasic LA empty fractions remain unchanged in healthy Taiwanese adults.

Key Words: Aging • Left atrial function • Phasic LA volume • Real-time 3D echocardiography

INTRODUCTION

It is well-known that left atrial (LA) function plays an important role in overall cardiac performance.1 But due to a paucity of proper non-invasive tools to evaluate LA function within a three-dimensional structure, it has not been well studied. Increased LA diameter and area were related to many adverse cardiovascular outcomes, such as atrial fibrillation (AF), stroke, and heart failure.2-4 Assessment of LA diameter and area by M-mode and 2D echocardiography provides important physiologic and prognostic information in many different cardiovascular diseases. But LA area has a non-linear relationship to its volume. Morphology of LA may become less spherical and more elongated during its remodeling.5,6 Measurement of LA area by 2D echocardiography cannot actually reflect the true volume of LA, whereas LA volume evaluated by RT3DE may be a superior in-