Brief Communication

Is mitral early to late wave ratio a predictor for silent cerebral infarction in elderly patients with coronary artery disease

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Silent cerebral infarction (SCI) is thought to be an underlying or concomitant condition of clinical subcortical brain infarction or brain hemorrhage in the general population. It may be related to dementia, cognitive deficits, and depression.[1] Kotani and colleagues[2] studied an elderly population whose mean age was 77.5 ± 8.7 years, and observed SCI in 48% of their elderly population. To prevent SCI, it is important to know its related factors. It is known that coronary artery disease (CAD) and cerebrovascular disease frequently coexist and have similar risk factors. A patient with ischemic stroke usually has CAD and its manifestations. In epidemiological studies, it was shown that decreased ejection fraction seems an important determinant for overt stroke and SCI in patients with CAD.[3] However, decreased diastolic function may contribute to SCI in elderly patients with CAD. The aim of this study was to investigate left ventricular diastolic function in elderly patients with and without SCI, and related risk factors for left ventricular diastolic function.

Study population. Sixty-five patients with CAD diagnosed by coronary angiography proved stenosis (>50% of the luminal diameter), were recruited for the study (mean age 82±7 years), which was carried out in the Shanghai Jiao Tong University Affiliated Sixth People's Hospital from December 2007 to the end of January 2008. In all patients, an ejection fraction >60% was documented by M-mode echocardiography. Patients with intracardiac thrombi, a history of myocardial infarction, chronic obstructive pulmonary disease, atrial fibrillation, diabetes, history of transient ischemic attack or stroke, significant valvular disease, resting ischemia diagnosed by ECG, renal dysfunction, and any other chronic diseases were excluded from the study (n=18). Hypertension was defined as systolic blood pressure (SBP) ≥140 mm Hg and/or diastolic blood pressure (DBP) ≥90 mm Hg. Pulse pressure (PP) was calculated by the formula PP = SBP – DBP. The study was approved by the Institutional Review Board and participants gave signed written informed consent.

Ultrasound evaluation. All patients underwent 2D and Doppler echocardiography with a Hewlett-Packard Sonos 5500 device and 2.5 MHz transducer (Vivid Seven System, GE, Horten, Norway). Left ventricular ejection fraction was calculated from a 4-chamber view with modified Simpson's algorithm. We evaluated peak early (E wave), late (A wave) transmitral velocities and E/A ratio. Cases with mitral E/A <1 were accepted as having diastolic abnormalities. The intima-media thickness (IMT) of the far wall of the common carotid (CCA) was performed with an Aplio (Toshiba Co., Tokyo, Japan) using a 7.5-MHz linear-array transducer.

Magnetic resonance imaging. All neurologically asymptomatic patients with CAD had a brain MRI (Philips Intera Master, Eindhoven, Netherlands). Two neuroradiologists who had not been notified of any clinical information assessed the MR images independently. There were 35 patients with SCI and 30 without SCI.

Statistical analysis. The Statistical Package for Social Sciences version 13 (SPSS Inc., Chicago, IL, USA) was used to perform all statistical calculations. Continuous variables of patients with and without SCI were compared by unpaired Student t-test. If necessary, the Mann Whitney U test was used instead of Student t-test and categorical variables were compared with chi-square test. Interaction between parameters that could be relevant for the E/A was calculated by multivariate forward stepwise logistic regression analysis, adjusting for age, ejection fraction, and SCI. Differences with $p<0.05$ were considered statistically significant.

According to the echocardiographic findings, there were no significant differences in left ventricular systolic and diastolic diameters, left atrial diameter, pulmonary arterial systolic pressure (PASP) or left ventricular ejection fraction (LVEF) between the groups (**Table 1**). The mitral E/A ratio in patients with SCI was significantly lower than those without SCI. The SCI group had a larger pulmonary artery diameter compared with the group without SCI. However, there was no significant difference in PASP in both groups. In addition, a significant inverse correlation between E/A and PP (r=–0.304; $p=0.012$), IMT (r=–0.371; $p=0.018$),

Table 1 - Echocardiography characteristics of patients with (+) and without (-) silent cerebral infarction (SCI).

Characteristics	SCI(+) (n=35)	SCI(-) (n=30)	*P*-value
LVSD (cm)	3.0±0.8	2.9±0.3	0.48
LVDD (cm)	4.6±0.9	4.5±0.3	0.57
Ao dimension (cm)	3.0±0.3	3.1±0.3	0.41
Pu diameter (cm)	2.6±0.3	2.4±0.3	0.02
Mitral E/A ratio	0.7±0.2	0.8±0.3	0.02
LVEF (%)	68±5	70±7	0.36
E [cm/s]	0.66±0.26	0.73±0.13	0.19
A [cm/s]	0.95±0.2	0.93±0.24	0.69
E dec (ms)	184±32	176±35	0.35
PP (mm Hg)	72±13	66±11	0.09
LA (mm)	45±5	44±6	0.37
PASP (mm Hg)	30±5	29±4	0.08

LVSD - left ventricular systolic diameter, LVDD - left ventricular diastolic diameter, Ao - aorta, Pu - pulmonary artery, LVEF - left ventricular ejection fraction, PP - pulse pressure, LA - left atrium diameter, PASP - pulmonary arterial systolic pressure

pulmonary artery diameter (r=–0.336; p=0.004), and age (r=–0.385; p<0.001) was found. There was also a significant correlation between pulmonary artery diameter and late (A) wave (r=0.28; p=0.026).

Previous studies focused on ejection fractions and SCI. Kozdag et al[4] reported that the prevalence of SCI was 39% in ischemic, 27% in nonischemic, and 3.6% in dilated cardiomyopathy. It is known that patients with a history of CAD events show a tendency to have higher cerebrovascular events than those without a history of CAD events. The present study showed SCI patients with CAD had lower diastolic dysfunction compared with patients without SCI. Interesting, our study also showed that pulmonary artery diameter was significantly larger in patients with SCI than without SCI subjects. Left ventricular diastolic dysfunction has been suggested to be an important determinant of pulmonary hypertension (PHT) in patients with heart failure. The present study did not show significant differences in PASP between patients with and without SCI. It may be speculated that a patient with CAD who has a high pulmonary artery diameter and a relatively decreased diastolic function, has a higher risk of developing SCI than a patient without those characteristics. Eren et al[5] reported that the aortic stiffness and LV diastolic dysfunction were associated with patients suffering from hypertension, diabetes, or both. Similarly, risk factors of SCI such as age, PP, and IMT were found related to the mitral E/A ratio.

In conclusion, the present study showed that mitral E/A ratio and pulmonary artery diameter were associated with SCI in elderly patients. Older patients who have chronic bronchitis and hypertension, which lead to PHT and decreased diastolic dysfunction may be given preventative therapy to protect them from SCI. However, further studies are needed to investigate this issue.

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