

Research Article

Comparison of central and peripheral hemodynamics in association with left ventricular diastolic dysfunction in the community-based elderly Chinese

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Abstract

The aim of the study was to investigate the association of left ventricular diastolic dysfunction (LVDD) with central and peripheral hemodynamics. A total of 1599 community-based senior residents (aged ≥ 65 years) in northern Shanghai, China, were recruited as of August 2015. Echocardiography was performed for each participant using the MyLab30 Gold CV system. According to the recommendations from the American Society of Echocardiography, the ratio of E (peak early diastolic transmitral flow velocity) to E' (early diastolic lateral mitral annulus velocity) was assessed for the evaluation of LVDD. Central blood pressure (BP) components were measured using the SphygmoCor system. In community older population (72.7 ± 6.01 years), brachial systolic BP (mm Hg) was higher than central systolic BP (141.9 ± 19.5 vs. 130.3 ± 20.1 mm Hg). A total of 214 subjects (13.4%) showed LVDD, and female showed higher prevalence of diastolic dysfunction than male (17.3% vs. 8.4%, $P < .01$). After adjustment for confounding variables, only central systolic BP, not brachial systolic BP, was significantly associated with E/E' in the total population. Similar result was found in the subgroup analysis (participants without antihypertensive agents treatment, man, woman). Similar findings were obtained for the pulse pressure (PP) analysis. Within central hemodynamics, only central PP, but not central systolic BP or augmentation pressure, was significantly associated with E/E' after adjustment. When LVDD was defined by E/E' and other echocardiographic parameters, our findings remained unaltered in the multivariate logistic regression with similar adjustment in the total population and subgroup analysis. In the Chinese elderly cohort, central hemodynamics, especially central PP, is superior to other BP components in identifying LVDD (NCT02368938). *J Am Soc Hypertens* 2017; ■(■):1–10. © 2017 American Society of Hypertension. All rights reserved.

Keywords: Central hemodynamics; central pulse pressure; left ventricular diastolic function; population study.

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Introduction

Heart failure (HF) is one of the heaviest socioeconomic burdens in the world. Nowadays, according to patients' left ventricular ejection fraction (LVEF), HF is categorized into HF with reduced ejection fraction and HF with preserved ejection fraction (HFpEF), with the latter accounting for approximately 50% of patients with HF and having similar mortality.¹ After decades of development of cardiovascular (CV) agents, including angiotensin-converting enzyme inhibitors, angiotensin receptor blockers, diuretics, and adrenergic beta-antagonists, clinical studies have found that nonconventional CV agent has confirmed curative effect on HFpEF.^{2–7} Furthermore, some investigators have hypothesized that HFpEF is not a simple disease, but a syndrome with combination of varied uncontrolled CV conditions, such as uncontrolled blood pressure (BP), uncontrolled metabolic profile, or even the presence of obstructive sleep apnea syndrome. Some indirect evidence came from the positive result of some nonclassical HF exercise intervention and statin treatment studies.^{8,9} If this assumption is true, effective antihypertensive treatment would theoretically benefit to HFpEF patients. Some investigators have demonstrated that in the ambulatory setting, only central BP but not brachial BP was significantly associated with patients' left ventricular filling pressure.¹⁰ In addition, many investigators have reported that central BP is superior to brachial BP in identifying patients' asymptomatic target organ damages (TOD).^{11,12}

Diastolic dysfunction, a common cardiac disorder, which can be reliably detected by echocardiography, was recognized as the fundamental mechanism of HFpEF. Considering most HFpEF patients are senior and suffer from hypertension, we therefore conducted a community-based population study in the elderly with a high prevalence of hypertension. Our aim was to identify which one is the best BP indicator, peripheral or central, in terms of the amelioration of patients' left ventricular diastolic function (LVDD).

Methods

Study Design and Subject Eligibility Criteria

The Northern Shanghai Study is an ongoing community-based investigation. We recruited participants aged >65 years to build a CV risk index in the urban, senior residents. A framework for CV risk assessment, including all CV risk factors and TOD, was conducted with financial support from the Shanghai municipal government (Grant ID. 2013ZYJB0902; 15GWZK1002) and registered in the clinicaltrials.gov database (Identifier: NCT02368938). A total of 1721 subjects were initially invited, of whom 1599 (92.9%) were enrolled and initially examined before August 2015. To be eligible for the study, the subject must meet the following inclusion criteria: (1) age \geq 65 years; (2) informed

consent should be voluntarily obtained; (3) the individual must be a long-term resident in northern Shanghai. Exclusion criteria include (1) existing diagnosis of serious heart disease (NYHA \geq IV) or end-stage renal disease (chronic kidney disease \geq 4); (2) existing diagnosis of cancer with life expectancy <5 years; (3) history of stroke within 3 months before enrollment; (4) is not willing to participate in the clinical study; (5) quit the study because of other disease; and (6) violated study protocol.

Social, Clinical and Biological Parameters

Medical and family history was obtained from the standardized structured questionnaire. The questionnaire includes smoking, drinking, and exercise habits, history of diabetes mellitus, renal disease, cardio-cerebrovascular disease including chronic HF, peripheral vascular disease, hypertension, arrhythmia, and previous CV event (defined as the presence of history of myocardial infarction, stroke, or cardiac revascularization via angioplasty or coronary artery bypass grafting).

When measuring body height and body weight, subjects were barefoot, wearing light clothing, and standing straight. Waist circumference and hip circumference were measured by flexible ruler at the narrowest and widest points, respectively. Body mass index (BMI) was calculated in kg/m^2 .

Venous blood was obtained from subjects after an overnight fast. All examinations including lipid profiles, fasting plasma glucose, urinary creatinine, and microalbumin were conducted in the laboratory department of Shanghai Tenth People's Hospital by standard methods.

Evaluation of Peripheral Artery Involvement

Ankle-brachial index (ABI) was assessed for each participant automatically using VP-1000 system with in-built software (Omron, Japan). This measurement was performed in the morning without having consumed caffeine or tobacco for at least 8 hours before measurement and an ambient temperature of 22°C–24°C.

Ultrasonography

All ultrasonography including echocardiography and carotid ultrasonography was performed by experienced cardiologists using the MyLab30 Gold CV system (Esaote SpA, Genoa, Italy). The common carotid arteries were evaluated bilaterally with a 7.5-MHz transducer. Carotid artery intima-media thickness (IMT) was measured in the left common carotid artery, on plaque-free segments a minimum of 2 cm from the bifurcation, and determined from changes of density on the section perpendicular to the vessel wall. The measurement of IMT was repeated three times, and the average result was taken for further analysis. Common, internal, and external carotid arteries were all scanned longitudinally and transversely to determine the presence of plaques.

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