LEFT VENTRICULAR END DIASTOLIC PRESSURE ESTIMATION USING COLOR DOPPLER MYOCARDIAL IMAGING

Hassan Moladoust (1), Manijhe Mokhtari-Dizaji (1), Zahra Ojaghi-Haghighi (2), Ahmad Mirdamadi (2), Amir Khajavi (2); Parinaz Mehnati (3)

1. Medical Physics, Tarbiat Modares University, Iran; 2. Echocardiography, Shaheed Rajaie Heart Center, Iran; 3. Medical Physics, Tabriz Medical Sciences University, Iran

Introduction
Chronic coronary artery disease (CAD) is most commonly due to obstruction of the coronary arteries by atherosclerotic plaque. [Zipes, 2005]. The noninvasive assessment of left ventricular end diastolic pressure (LVEDP) provides important information on the hemodynamic status and can be an important clinical tool in these patients [Mansencal, 2004]. The aim of this prospective study was to determine how the ratio of early transmitral inflow velocity measured by routine pulsed-Doppler to early diastolic velocity of the lateral and septal mitral annulus measured by color tissue Doppler echocardiography (color-TDE) or \( E_m/E_a \) ratio in CAD patients correlate with LVEDP.

Methods
Sixty CAD patients (30 with significant and 30 with moderate left anterior descending (LAD) stenosis in proximal part) 40-60 years old without history of myocardial infarction with sinus rhythm imported in this study. Left ventricular ejection fraction (LVEF) measured using Simpson’s biplane method by measuring end diastolic and end systolic volumes in 2D images. Doppler echocardiography (Color-TDE and transmitral flow measurements) was done within 12±5 hours of the catheterization for LVEDP directly using a fluid-filled catheter that is attached to a calibrated pressure transducer (Figure 1).

Furthermore, in 30 healthy age matched persons, only \( E_m/E_a \) ratio without LVEDP was measured. All Doppler velocities were measured in end-expiration and average of three cardiac cycles was taken into account for analysis in this study.

Results
Mean measured LVEF was 47±10% (34 patients had LVEF lower than 50%) and 57±7% for patient and healthy groups respectively. The results showed that \( E_m/E_a \) ratio was greater in patients with CAD than healthy group (10.8±4.5 at patients versus 8.1±1.7 at healthy group, \( p<0.003 \) for lateral \( E_m/E_a \) and 13.1±5.5 at patients versus 10.5±1.8 at healthy group, \( p<0.000 \) for septal \( E_m/E_a \)). Both lateral and septal \( E_m/E_a \) ratio significantly correlated with LVEDP, but lateral \( E_m/E_a \) ratio had the stronger relation to LVEDP (\( r=0.83 \) versus \( r=0.65, p<0.01 \)).

Discussion
Nagueh et al. proposed the mitral inflow to annular velocity ratio to assess LV filling pressures [Nagueh, 1997]. This approach uses measures of annular velocity by pulsed-TDE, a method that provides a spectrum of velocities for each point in time. Color-TDE can compute mean of all velocity components found within the sample volume and in this study we used Color-TDE for measures of annular velocity. It can be concluded from our experience that, noninvasively obtained Doppler \( E_m/E_a \) ratio as an interesting application of tissue Doppler echocardiography, provides an index of LVEDP in CAD patients, which, can be measured using color Doppler myocardial imaging. Based on initial very encouraging results, we plan to do future study to identify myocardial wall stress in cardiac diastolic phase noninvasively.

References