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Research Letter

Letter to the editor

Despite the advances in medical imaging the accurate estimation of Left ventricular end-diastolic pressures (LVEDP) still requires the placement of fluid filled catheters into the left ventricle. Estimation of LVEDP plays an important role in the diagnosis of Systolic heart failure and heart failure with preserved ejection fraction.[1] However due to the inherent invasive nature of catheter based techniques over the years several non-invasive tools have emerged to identify patients with elevated LVEDP.[2] An ideal tool should be non-invasive, simple to perform, accurate and readily available at the bedside to address the key question of fluid status in critically ill patients. Echocardiography is one such tool, which is completely non-invasive and can be performed rapidly at the bedside for estimation of LVEDP. We propose a new non-invasive Doppler echocardiographically derived parameter of Left Atrial Volume Index over late diastolic mitral annulus velocity (LAVi/A') for the rapid estimation of LVEDP. The aim of the study is to see correlation between a new non-invasively obtained parameter (LAVi/A') and LVEDP (measured invasively) in patients and see how it performs as compared to E/e' in predicting LVEDP.

We retrospectively reviewed 80 consecutive echocardiographs of patient with simultaneous invasive measurement of LVEDP within 24 h of echocardiography. Patients with atrial fibrillation and mitral valvular disease were excluded. Invasive measurements of LVEDP were obtained using a fluid filled catheter placed in left ventricle. LVEDP was measured before any contrast injection was made and at the nadir of the atrial contraction wave. We studied various routinely measured echocardiographic parameters with particular attention to tissue Doppler measurement. Tissue Doppler was obtained from lateral mitral annulus location to obtain early (e') and late (a') mitral diastolic velocity. Pulsed wave Doppler was also performed to obtain mitral inflow velocities (A/E waves). The mean left atrial volume was calculated using Simpson's method in the apical 4/2 chamber views and divided by BSA to calculate left atrial indexed volume (LAVi). It is well known that left atrial size correlates with elevated left-sided pressures and is the sine qua non for an elevated LVEDP. Animal studies have also shown that with any increase in LVEDP the velocity of the late tissue doppler mitral annular velocity decreases. We hypothesized that the new parameter of LAVi/A' obtained by dividing these two measurement would be able to identify an elevated LVEDP in a dichotomous fashion. The ratio of E/e' was calculated in standard fashion using measurements obtained from pulsed (E) and tissue Doppler (e') of Mitral valve.

On the receiver operation characteristic curve analysis (ROC) for, the area under the curves of LAVi/A' was compareable to E/e' (63.4% vs. 63.9, $p > 0.5$). A LAVi/A' of 2.1 was the best cut-off value to identify anelevated LVEDP ($>$ 15 mm of Hg). LAVi/A' $\geq$ 2.1 was an independent predictor of an elevated LVEDP (2.824 odds ratio; 95% CI, 1.025, 7.776; P = 0.041). The sensitivity and specificity at LAVi/A'to detect an elevated LVEDP using a value of 2.1 was 80% and 41.4% respectively. The novel parameter of LAVi/A' could predict LVEDP by using the equation given below: LVEDP = 15.28 + 0.863 xLAVI/A' .On the other hand, using the standard cutoff of E/E' $>$ 8 to identify increased LVEDP. E/E' $\geq$ 8 was also an independent predictor of elevated LVEDP (2.312 odds ratio; 95% CI, 0.879, 6.081; P = 0.086). The sensitivity and specificity of E/e ' to identify an elevated LVEDP was 74% and 44.8% respectively.

Despite advances in medical technology the accurate of estimation LVEDP remains a challenge in hospitalized patients. We purpose a new Doppler echocardiographically derived parameter (LAVi/A') to identify patients with an elevated LVEDP. The measurement of this parameter is simple as individual variables (LAVi& A') are routinely measured during echocardiographic studies and no additional measurements are required for the calculation of this novel parameter. We also studied the performance of previously well-described parameter of E/e'[3] in our cohort of patients for the estimation of LVEDP. The novel parameter of LAVi/A' performed with superior sensitivity (80% vs. 74%) as compared to E/e'. Thus the utilization of this new parameter could help in early identification and treatment of patients with elevated LVEDP in a completely non-invasive fashion. Our study carries some limitations.

The invasive estimation of LVEDP and echocardiographic variables were not done simultaneously, thus LVEDP could have changed by the time echocardiographic parameters were obtained. Our study size is relatively small and included patients mostly with acute coronary syndromes; therefore validation of this parameter in a larger and different cohort of patients is needed. Overall the novel Non-invasive Echocardiographic Index of (LAVi/A') showed good correlation with invasively measured LVEDP and performed better than previously studied parameter of E/e' with a higher sensitivity in our patient cohort.

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