Echocardiographic Assessment of Left Atrial Volume Index in Elderly Patients with Anterior Wall Myocardial Infarction

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Abstract
Enlarged left atrium (LA) predicts outcomes in patients with heart failure, atrial fibrillation and stroke. Left atrial volume (LAV) especially when corrected for body size (LAVi), is a more accurate representation of true LA size. Therefore we studied left atrial volume index (LAVi) in elderly patients with left ventricle anterior infarction and correlated LAVi with left ventricle ejection fraction (LVEF) and transmitral Doppler flow. We found LAVi was significantly raised in elderly patients who suffered from AMI (26.7±2.1 vs 10.8±2.9) (p<0.005). There was significant negative correlation of LAVi with LVEF, E wave peak velocity and deceleration time.

Introduction
Recent evidences highlights the importance of enlarged left atrium (LA) as a barometer of diastolic burden and good predictor of cardiovascular outcomes – including heart failure, atrial fibrillation, stroke and mortality.1 It is considered a validated marker of chronically increased left atrial pressure and/or volume. The LA volume has been compared to the “glycated hemoglobin of diabetes mellitus”,2 as it is a reflection of long-standing hemodynamic condition. Because left atrial size can be measured noninvasively by echocardiography, measurement of LA size is part of the standard echocardiographic examination. However, though traditional method of assessing maximal end-systolic anteroposterior dimension of LA from the parasternal long-axis view in M-mode is simple and convenient, it’s accuracy may be limited by the anatomical confinement afforded by the spine and sternum and the resulting asymmetrical or pillow – shaped enlargement of the left atrium.3 Therefore, measurement of a single LA diameter may underestimate actual LA size. For these reasons, multiple linear dimensions or measurement of left atrial volume (LAV) especially when corrected for body size (LAVi), is a more accurate representation of true LA size.4

Aims and Objective
Our aim in the present study was to study left atrial volume index (LAVi) in elderly patients with left ventricle anterior infarction and to correlate LAVi with left ventricle ejection fraction (LVEF) and transmitral Doppler flow.

Material and Methods
The present study was conducted at department of cardiology of Jawahar Lal Nehru Medical College and Associate Group of Hospitals, Ajmer. The study was approved by the institutional ethics committee. Informed consent was obtained from all patients. We included 50 women (25 elderly patients with anterior wall myocardial infarction) (study group) and 25 matched patients without history of myocardial infarction (control group). All the patients were classified into control group and study group on the basis of history of myocardial infarction. Patients with history of significant valve lesions (mitral stenosis, or greater than moderate mitral regurgitation), atrial flutter and fibrillation, bundle branch block, large shunts, poor acoustic window, significant valve lesions (mitral stenosis, or greater than moderate mitral regurgitation), atrial flutter and fibrillation, bundle branch block, large shunts, poor acoustic window, positive serum cardiac markers (CPK-MB, Troponin I), and history of significant valve lesions and cardiovascular disease were excluded from the study.

Exclusion Criteria
a. Significant valve lesions (mitral stenosis, or greater than moderate mitral regurgitation)
b. Large shunts
c. Atrial flutter and fibrillation
d. Bundle branch block
e. Poor acoustic window

Design of Study
In all subjects following detail analysis was done
a. ECG: Complete and through analysis of all anterior leads in rest and exercise ECG was done.
b. Transthoracic 2D-Echo: A transthoracic 2D echocardiographic examination was performed with patients in left lateral decubitus position. The equipment used was SIEMEN’S transthoracic echocardiographic machine G-5 and CV-70 with 3.5 MHz transducer. With the use of apical four chamber view Simpson’s LVEF was calculated as percentage of changes in LV chamber volumes between diastole and systole using formula EDV - ESV / EDV X 100. LA volume was measured from standard apical 4-chamber views at end-systole just before mitral valve opening. LA borders were traced using planimetry in control and study subjects (Figures 1, 2).The borders consisted of the walls of the left atrium excluding pulmonary veins and left atrial appendage. The biplane method of disks was used to calculate LA volume. LAVi was calculated by dividing LA volume by body surface area of subjects. Peak transmitral flow E and A wave velocity, E wave deceleration time, were measured from the apical 4-chamber view.

Statistical Evaluation
Data were expressed as mean ± SD. Comparison of all variables in both groups was done by using “unpaired Student’s t-test”. Degree of freedom was calculated and p value was obtained. The results of p value were interpreted as follows: p >0.05 - Not significant, p<0.025-Significant, p<0.01-Very significant and p<0.005 – Highly significant.

Observation
Table 1 shows the basal clinical characteristics of the two groups. There was no significant difference in age, gender, BMI, pulse rate and blood pressure between the two groups (p>0.05).
Table 2 shows systolic dysfunction (LVEF - 45±10% vs 76±9%) and stage 1 diastolic dysfunction in patients with LV amI compared to healthy control group. LAVi was significantly raised in elderly patients who suffered from AMI (26.7±2.1 vs 10.8±2.9) (p<0.005). Table 3 shows significant negative correlation of LAVi with LVEF, E wave peak velocity and decceleration time.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Control</th>
<th>Study</th>
<th>P- Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>LVEF (%)</td>
<td>76±9</td>
<td>45±10</td>
<td>&lt;0.005</td>
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<tr>
<td>Ew velocity (m/s)</td>
<td>0.6±0.2</td>
<td>0.4±0.1</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>Aw velocity (m/s)</td>
<td>0.4±0.1</td>
<td>0.8±0.2</td>
<td>&lt;0.005</td>
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<tr>
<td>Ew-DeAct (msec)</td>
<td>160±10</td>
<td>260±8.6</td>
<td>&lt;0.005</td>
</tr>
<tr>
<td>LAVi (ml/m²)</td>
<td>10.8±2.9</td>
<td>26.7±2.1</td>
<td>&lt;0.005</td>
</tr>
</tbody>
</table>

Table 3: Significant negative correlation of LAVi with LVEF, E wave peak velocity and decceleration time

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Correlation</th>
<th>Level of Significance</th>
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<tbody>
<tr>
<td>LAVi</td>
<td>LVEF</td>
<td>Negative</td>
</tr>
<tr>
<td>LAVi</td>
<td>Ew Velocity</td>
<td>Negative</td>
</tr>
<tr>
<td>LAVi</td>
<td>Aw Velocity</td>
<td>Positive</td>
</tr>
<tr>
<td>LAVi</td>
<td>Ew DeAct</td>
<td>Negative</td>
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Patients with advanced left ventricular systolic and diastolic dysfunction had a significantly larger LAVi than healthy subjects. Our study describes that use of LAVi for risk stratification and for guiding therapy may prove to have a very important public health impact.

**Discussion**

LAVi <28 ml/m² at rest predicts normal stress echocardiogram⁵ and LAVi >32ml/m² predicts mortality in patients with acute MI.⁶ LAVi (>50ml/m²) predicts heart failure (HF) hospitalization and mortality with similar statistical power as LVEF (<45%) in ambulatory adults with coronary artery disease.⁷ Increased LA volume is also a predictor of stroke and death. An indexed LA volume of ≥23 ml/m² is associated with an increased risk of stroke independent of age and other clinical risk factors for cerebrovascular disease.⁸ LA volume is intimately related to LV mass / hypertrophy, systolic and diastolic dysfunction.⁹ The only determinant of LA size is body surface area. LA size in healthy person is independent of age. Indeed increase in LA size is a reflection of pathophysiologic perturbations that accompany advancing age rather than consequence of chronologic aging.⁹

**Conclusion**

Patients with advanced left ventricular systolic and diastolic dysfunction had a significantly larger LAVi than healthy subjects. Our study describes that use of LAVi for risk stratification and for guiding therapy may prove to have a very important public health impact.

**References**

7. Bryan Ristow, Sadia ali, Mary a. Whooley and Nelson B. Schiller. Usefulness of Left atrial Volume Index to Predict Heart Failure Hospitalization and Comparison to Left Ventricular Ejection Fraction. Am J Cardiol 2008;102:70 –76