The Correlation between Left and Right Ventricular Ejection Fractions in Patients with Ischemic Heart Disease, Documented by Cardiac Magnetic Resonance Imaging

Ali Eshraghi, Mahmoud Mohammadzadeh Shabestri, Majid Jalalyazdi, Zahra Alizadeh Sani

1 Cardiologist, Mashhad University of Medical Sciences, Mashhad, Iran
2 Cardiologist, Atherosclerosis Prevention Research Center, Imam Reza Hospital, Faculty of Medicine, Mashhad University of Medical Sciences, Mashhad, Iran

Abstract

Introduction: The correlation between right and left ventricular ejection fractions (RVEF and LVEF, respectively) has been studied in only a small number of patients with a marked decrease in RVEF and LVEF. The aim of the present study was to compare LVEF and RVEF in patients with ischemic heart disease. RVEF and LVEF were measured by Cardiovascular Magnetic Resonance (CMR) imaging.

Materials and Methods: This observational study was done in Ghaem general hospital in 2014. LVEF and RVEF were measured in a series of 33 patients with ischemic heart disease, undergoing CMR for the evaluation of myocardial viability. The correlation between RVEF and LVEF in patients with ischemic heart disease was studied, using Pearson product-moment correlation coefficient analysis.

Results: Right ventricular end diastolic volume (186.33±58.90) and left ventricular end diastolic volume (121.72±61.64) were significantly correlated (r=0.223, P=0.005). Moreover, there was a significant correlation between right ventricular end systolic volume (88.18±40.90) and left ventricular end systolic volume (140.96±35.33) (r=0.329, P=0.000). The most significant association was observed between RVEF and LVEF (r=0.913, P=0.000).

Conclusion: Based on the findings, RVEF and LVEF were significantly correlated in patients with ischemic heart disease, although this association was not always present in all cardiac patients. The cause of this discrepancy is still unknown.

Introduction

Ejection fraction (EF) is commonly applied as a measure of cardiac performance. EF is known to be both preload and afterload dependent. Besides left ventricular dysfunction, decreased right ventricular EF (RVEF) is an independent predictor of mortality (1-3). However, the direct correlation between RVEF and left ventricular EF (LVEF) has been studied in only a small number of patients with moderate to severe cardiomyopathy (4, 5).

Research on various patients including those with severe pulmonary disease has indicated a poor correlation between RVEF and LVEF (6). The aim of the present study was to evaluate the correlation between RVEF and LVEF in patients with ischemic heart disease (IHD). RVEF and LVEF were measured by Cardiovascular Magnetic Resonance Imaging.
Magnetic Resonance (CMR) imaging. This correlation can help us to estimate RV function by LV function and improve our clinical decision making.

Materials and Methods
This observational study was done in Ghaem general hospital in 2014 with simple sapling. In this study, we analyse CMR data of 33 patients with Ischemic heart disease, who had been referred to our hospital for assessment of cardiac viability. we evaluate the correlation of RVEF and LVEF. We exclude patients with myocardial infarction in the last month. This correlation was studied by correlation analysis, using SPSS 18. This association was evaluated in all patients with or without cardiomyopathy (defined as LVEF and RVEF < 50%) and those with severe cardiomyopathy (LVEF and RVEF < 30%).

All imaging procedures were performed, using a 1.5 T SIEMENS MRI scanner (manufactured by Germany). By use of MRI short axis cine views, RVEF and LVEF were assessed through conventional manual tracing of systolic and diastolic endocardial borders.

In the present study, the obtained data were normally distributed. Pearson’s correlation coefficient test was used to explore the association between LVEF and RVEF. P-value less than 0.05 was considered statistically significant.

Results
A male predominance was observed in the study population (61%). Baseline characteristics of patients are presented in Table 1.

Right ventricular end diastolic volume (RVEDV) was measured in all patients. Minimum and maximum RVEDV were reported to be 77 mm³ and 200 mm³, respectively, with the mean of 186.33 mm³ (standard deviation= 58.90). Left ventricular end diastolic volume (LVEDV) was also measured in all patients. Minimum LVEDV was reported to be 108 mm³ and maximum LVEDV was 342 mm³; the mean value was estimated at 121.72 mm³ (standard deviation= 61.64).

As the results indicated, correlation between RVEDV and LVEDV was statistically

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Patients (n=33)</th>
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<tbody>
<tr>
<td>Male sex</td>
<td>20(61%)</td>
</tr>
<tr>
<td>Age</td>
<td>52.27(5.88)</td>
</tr>
<tr>
<td>Ischemic heart disease</td>
<td>33 (100%)</td>
</tr>
<tr>
<td>History of coronary artery bypass grafting</td>
<td>5 (15%)</td>
</tr>
<tr>
<td>History of diabetes</td>
<td>15(45%)</td>
</tr>
<tr>
<td>History of hypertension</td>
<td>14(42%)</td>
</tr>
<tr>
<td>History of smoking</td>
<td>5 (15%)</td>
</tr>
<tr>
<td>History of chronic obstructive pulmonary disease</td>
<td>2 (6%)</td>
</tr>
</tbody>
</table>

**Figure 1.** The significant correlation between RVEF and LVEF
significant (P=0.005). Right ventricular end systolic volume (RVESV) (88.18±40.90) and left ventricular end systolic volume (LVEDV) (140.96±35.33) were also significantly correlated (P=0.000). The significant correlation was observed between RVEF and LVEF (r=0.913, P=0.000) (Figure 1).

Discussion

The most important finding of our study was the significant correlation between RVEF and LVEF in IHD patients with normal or reduced EF. Previous studies on the correlation between RVEF and LVEF have focused on a small number of patients with a marked decrease in ventricular function and these studies found a moderate correlation (r=0.63) between right and left ventricular functions in patients with cardiomyopathy (4-8). However, no patients with preserved ventricular function were evaluated in the mentioned studies.

The present research is the only study evaluating RVEF and LVEF correlation in IHD patients with normal and reduced EF. Although Maddahi et al. (9) simultaneously measured left and right ventricular functions using multiple-gated equilibrium blood pool scintigraphy. They have only 11 patients with normal RV and LVEF > 50%. They found no correlation between the two chambers size and function. Maddahi in his study found that mean RVEF was significantly less than left ventricular ejection fraction (p < 0.001).

The findings reported by Vizza et al. (6) indicating a poor correlation between LVEF and RVEF (r=0.44) further substantiate our results (r=0.32). Moreover, multiple studies are in accordance with the present findings regarding the significant correlation between left ventricular and right ventricular systolic functions in patients with decreased EF (4, 5, 10, 11). For instance, Emilsson (10) and MacNee et al. (11) found that RVEF and LVEF are only correlated in patients with severe emphysema and decreased left and right ventricular functions.

Furthermore, Benedetto and Nusynowitz (12) found a strong correlation between LVEF and RVEF in patients with cardiomyopathy. However, patients with preserved left and right ventricular functions were not evaluated. In the present study, we assessed the correlation between LVEF and RVEF in IHD patients with normal or decreased RVEF and LVEF and we found strong correlation between them. Small study population and restriction in IHD patients like other study may be our limitation.

Conclusion

Estimation of RVEF is very important in clinical practice. Based on the findings, there was a significant correlation between LVEF and RVEF in patients with IHD. This association was observed in patients with preserved or reduced EF, although such a correlation is not present in all cardiac patients. The cause of this discrepancy is still undetermined. We suggest further study in different type of cardiomyopathy and with larger sample. Verifying of this correlation is very important in clinical decision and practice.

Conflict of Interest

The authors declare no conflict of interest.

References