Prevalence and Severity of Mitral Valve Regurgitation in Patients with Systolic Left Ventricular Dysfunction

Al-Hussaini, A. R., Al-Haddad, H. S., Al-Hilali, K. A.

Abstract

Background: Functional mitral regurgitation may develop in patients with congestive heart failure due to left ventricular systolic dysfunction, which is common, costly and lethal syndrome. Echo-Doppler is an extremely sensitive tool for the detection of mitral regurgitation.

Objective: To determine the prevalence and severity of functional mitral regurgitation in patients with left ventricular systolic dysfunction using echocardiography.

Setting: Al-Hussain Hospital echocardiography clinic in Karbala city.

Methods: One hundred sixty patients were divided into two groups: Group A: constituted of 80 consecutive patients who had a left ventricular ejection fraction \( \leq 40\% \) and group B: constituted of 80 consecutive patients who had a left ventricular ejection fraction \( > 40\% \). The study patients underwent standard echocardiogram. Severity of mitral regurgitation was graded as mild, moderate and severe.

Results: In patients with left ventricular systolic dysfunction (group A), mitral regurgitation was more common. It was mild in 22.5%, moderate in 52.5% and severe in 21.25%.

Conclusion: The majority of patients with left ventricular systolic dysfunction had mitral regurgitation. Echo-Doppler should be included in the evaluation of these patients.
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Introduction

Congestive heart failure (CHF) is a common, costly and lethal syndrome. As many as 25% of patients has advanced disease with limited treatment strategies. Mitral regurgitation (MR) may develop in patients with severe systolic dysfunction and left ventricular dilatation without organic mitral valve disease (i.e., functional MR). MR causes left-sided chamber dilatation and worsens neuroendocrine activation. The degree of MR in CHF is associated with local left ventricular (LV) remodeling resulting in tethering of mitral leaflets. This serves as the main mechanism, although mitral annular dilation or leaflet abnormalities may coexist. The volume overload imposed by MR may cause inflammatory and other cytokine activation. It causes LV, left atrial, and mitral annular dilatation. This may lead to further worsening of MR and cause atrial fibrillation. Dilatation of the left ventricle will lead to a stretch of the mitral valve annulus. If the annulus dilates to the point where complete leaflet coaptation is not possible, a leak will result usually producing a central jet of MR. A wall motion abnormality affecting the anterolateral or posteromedial left ventricular walls with or without direct papillary muscle involvement may also have an effect on mitral valve competency.

As murmur intensity correlates poorly with the degree of MR of ischemic or functional origins cardiologists use echo-Doppler grading of regurgitation severity in conjunction with patient symptoms and signs and occasionally invasive haemodynamic information to make decisions on the need for and timing of mitral valve surgery. Echo-Doppler is an extremely sensitive tool for the detection of MR. As echocardiography is the most widely available cardiac imaging modality, it is the technique which is routinely used to assess patients with suspected or known MR. If MR is discovered on an echocardiographic examination it is extremely important to make an assessment of severity as this will be required to guide the patient’s subsequent management.

This study was designed to determine the prevalence and severity of functional MR in patients with left ventricular systolic dysfunction, and to define the role of echocardiography in the evaluation of these patients.

Patients and Methods

Study Population

One hundred sixty patients from Al-Hussain Hospital echocardiographic clinic were enrolled between June 2006 and August 2007. Demographic data, presence of comorbidities, and physical examination data including jugular venous pressure, presence of abnormal heart sounds, and the presence of MR murmur were entered into the study database. We excluded patients with inadequate or incomplete echocardiograms, and patients with organic mitral valve disease (mitral stenosis, mitral prolapse, rheumatic or degenerative MR) that was identified at echocardiography.

Patients were divided into two groups:
Group A: constituted of 80 consecutive patients who had a left ventricular (LV) ejection fraction (EF) ≤40%.
Group B: constituted of 80 consecutive patients who had a left ventricular (LV) ejection fraction (EF) ≥40%.

Echocardiographic Data

The study patients underwent standard echocardiogram using Philips EnVisor C machine (Philips medical systems, USA). EF was estimated visually and by Tiecholtz formula at the time of the examination. Severity of MR was graded as mild, moderate and severe using the grading system described by Helmcke by indexing the regurgitation jet area to the left atrial size which encompass approximately <20%, 20-
40%, and >40% of the left atrial area, respectively.

**Statistical Analysis**

Comparison between the two groups was done using the chi square ($\chi^2$) test for statistical analysis of data (Microsoft Excel 2×2 chi square). P value equal or less than 0.05 was considered the level of significance.

**Results**

In group A, 80 patients were studied. Age range between 21-81 years with a mean age of $51 \pm 30$ years. Male/ female ratio was 1.9. Ejection fraction range between 20-40%. Mean ejection fraction was $30 \pm 10$.

In group B, 80 patients were studied. Age range between 20-80 years with a mean age of $50 \pm 30$ years. Male/ female ratio was 1.2. Ejection fraction range between 42-70%. Mean ejection fraction was $56 \pm 14$.

Table 1 shows the distribution of patients in both groups according to age groups. Thirty five percent of patients in group A were between 60-69 years old. Patients above 50 years constituted 77.5% of all patients in this group. Ninety percent of patients in group A were above 40.

Table-2 compares between current study and similar studies regarding mean age, LVEF and sex.

Table-3 shows the frequency of different grades of MR in both groups. Only three patients in group A (3.75%) do not have MR in comparison with 60 (75%) of patients in group B ($P \text{ value} < 0.0001$). There was no statistically significant difference in the incidence of mild MR between the two groups ($P \text{ value} = 0.699$), whereas there was a statistically significant difference in the incidence of moderate and severe MR between the two groups ($P \text{ value} \leq 0.0001$). As shown in figure 1, the majority of patients in group A have MR that was mild in 22.5%, moderate in 52.5% and severe in 21.25%.

<table>
<thead>
<tr>
<th>Age group(year)</th>
<th>Group A</th>
<th>Group B</th>
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<tbody>
<tr>
<td>20-29</td>
<td>3(3.75%)</td>
<td>7(8.75%)</td>
</tr>
<tr>
<td>30-39</td>
<td>5(6.25%)</td>
<td>11(13.75%)</td>
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<tr>
<td>40-49</td>
<td>10(12.5%)</td>
<td>18(22.5%)</td>
</tr>
<tr>
<td>50-59</td>
<td>18(22.5%)</td>
<td>20(25%)</td>
</tr>
<tr>
<td>60-69</td>
<td>28(35%)</td>
<td>17(21.25%)</td>
</tr>
<tr>
<td>70-79</td>
<td>12(15%)</td>
<td>6(7.5%)</td>
</tr>
<tr>
<td>80-89</td>
<td>4(5%)</td>
<td>1(1.25%)</td>
</tr>
<tr>
<td>Total</td>
<td>80(100%)</td>
<td>80(100%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Robbins et al$^{11}$ (inpatients)</th>
<th>Robbins et al$^{11}$ (outpatients)</th>
<th>Varadara-jan et al$^{12}$</th>
<th>Koelling et al$^{14}$</th>
<th>Current study</th>
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</thead>
<tbody>
<tr>
<td>Mean age (y)</td>
<td>$69 \pm 15$</td>
<td>$59 \pm 15$</td>
<td>$65 \pm 15$</td>
<td>$61.7 \pm 14.7$</td>
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<tr>
<td>LVEF (%)</td>
<td>$26 \pm 8$</td>
<td>$29 \pm 9$</td>
<td>$21 \pm 12$</td>
<td>$20 \pm 5$</td>
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<tr>
<td>Sex (% female)</td>
<td>41</td>
<td>35</td>
<td>46</td>
<td>32.3</td>
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<table>
<thead>
<tr>
<th>Grade of MR</th>
<th>Group A</th>
<th>Group B</th>
<th>$P \text{ value}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>none</td>
<td>3(3.75%)</td>
<td>60(75%)</td>
<td>$\leq 0.0001$</td>
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<tr>
<td>mild</td>
<td>18(22.5%)</td>
<td>16(20%)</td>
<td>0.699</td>
</tr>
<tr>
<td>moderate</td>
<td>42(52.5%)</td>
<td>4(5%)</td>
<td>$\leq 0.0001$</td>
</tr>
<tr>
<td>severe</td>
<td>17(21.25%)</td>
<td>0(0%)</td>
<td>$\leq 0.0001$</td>
</tr>
<tr>
<td>total</td>
<td>80(100%)</td>
<td>80(100%)</td>
<td></td>
</tr>
</tbody>
</table>
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Discussion

Table 1 showed that about 1 of 3 patients with LVSD were between 60-69 years old and that 3 of 4 were above 50. Nine of ten patients were above 40 years old. As shown in Table 2, LVSD occurred in our study at younger age than other studies. EF was slightly higher in our studies than other studies. Further studies are needed to determine the causes of these differences. Sex ratio was close to other studies. Our study shows that MR is common and present in the majority of patients with LVSD. As shown in Figure 1, MR was mild in 22.5%, moderate in 52.5% and severe in 21.25%. Only 3.75% of patients do not have MR.

In comparison, Robbins et al. showed that in hospitalized patients who had a LV ejection fraction ≤40%, 26% had no to mild MR, 42% had moderate MR, and 32% had severe MR. While in the outpatient group, 55% had no to mild MR, 32% had moderate MR, and 13% had severe MR. Batel et al. concluded that in patients with advanced CHF, MR was severe in 4.3%, moderate-severe in 12.5%, moderate in 21.9%, mild-moderate in 11.8%, mild in 39.1%, and absent or present as only a trace in 10.4%. In other study conducted by Varadarajan et al., MR was present in 94% of patients with heart failure, being mild in 44%, moderate in 22%, moderate to severe in 15%, and severe in 14%. Koelling et al. found that in patients with LVEF ≤35%, 18.9% were found to have severe MR, 29.7% had moderate MR and 51.3% had none-mild MR.

In this study, the results were comparable to those of Robbins et al. (hospitalized patients) and more than those of Koelling et al. in number and severity. Possible explanations for this difference is the use of more sensitive echo machine, late medical counseling, and poor compliance to medical treatment.

Echocardiography has become indispensable in the evaluation of patients with CHF. Previous studies have shown that MR is associated with advanced CHF and left ventricular dilation. Our study shows that MR is a common complicating element in patients with LVSD. This finding provides justification for the inclusion of color Doppler echocardiography in the evaluation of patients with LVSD.

Conclusion and Recommendations

The study proved that moderate to severe (but not mild) MR is significantly more common in patients with LVSD. As echo-Doppler is an extremely sensitive tool for the detection of MR, it should be included in the evaluation of patients with LVSD patients because early detection of severe MR may facilitate its surgical correction with possibly improved symptoms, morbidity, and mortality. Further studies are needed to determine the prognostic value of each grade of MR.
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References