Left Ventricular Function in Rheumatic Mitral Stenosis

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No conflicts, no disclosures
Echocardiographic Investigations of Myocardial Function in Mitral Stenosis: Making Sense of the Echolalia

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Left ventricular function in patients with rheumatic mitral stenosis has been under investigation for decades

The first report of low LV end-diastolic volumes and low ejection fractions in rheumatic MS came in 1975 using left heart catheterization

2D Echocardiography, Doppler and tissue doppler imaging and 2D speckle tracking imaging has now allowed quantification of hemodynamic abnormalities and assessment of Left ventricular performance in patients of Rheumatic MS

Sengupta P et al. JASE 2004;17:824-828
Cayly M et al. JASE 2006;19:243-248
Integration of mitral valve with structures of LV
• The chordal apparatus and papillary muscles are directly continued with the trabeculae over the subendocardial region

• The fibers at the subendocardial region converge over the mitral valve annulus

• Fibrosis and shortening of the subvalvular apparatus in rheumatic MS, therefore, cause shortening of the longitudinal LV axis and spherical remodeling of the LV cavity

24 years old male

Breathlessness (NYHA III), Palpitation
Paroxysmal nocturnal dyspnea, no fever
MVA (planimetry) = 0.97 cm$^2$
Peak gradient = 16 mm Hg,
Mean gradient = 12 mm Hg

PA Pressure = 75 mm Hg
LVEF = 40%
Blood pressure = 100/70 mm Hg
The Patient was subjected to Balloon mitral valvuloplasty (BMV)
Peak gradient = 10 mm Hg
Mean gradient = 6 mm Hg

PA Pressure = 35 mm Hg

Post BMV
Status of LV function after BMV

- Deteriorated
- Improved
- No change
After BMV, LVEF = 55%
Peak gradient = 16 mm Hg
Mean gradient = 12 mm Hg

Pre - BMV

Peak gradient = 10 mm Hg
Mean gradient = 6 mm Hg

Post - BMV
Pre-BMV
PA Pressure = 75 mm Hg

Post BMV
PA Pressure = 35 mm Hg
LV dysfunction in MS

- Restriction or tethering of myocardium by the scarred mitral apparatus
- Chronically decreased chamber loading
- Abnormal right-sided and left-sided heart interactions
- Arrhythmia (Atrial fibrillation)
- Elevated systemic overload

Gash et al Circulation 1983; 67:1948-54
Mobilization of the mitral apparatus can lead to rapid reversal of the increased myocardial stiffness and to improved motion and function of the subvalvular structures and myocardial segments, which explains the immediate improvement in mitral annular velocities seen in our patients. Other mechanisms, such...
<table>
<thead>
<tr>
<th>Study</th>
<th>Condition</th>
<th>Subjects</th>
<th>Methodology</th>
<th>Findings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ozdemir et al., 2002</td>
<td>Mild-to-severe MS</td>
<td>46</td>
<td>Pulsed wave TD</td>
<td>Significantly reduced TD velocities which correlated with mitral valve area</td>
</tr>
<tr>
<td>Sengupta et al., 2004</td>
<td>Severe MS</td>
<td>25</td>
<td>TD velocity</td>
<td>Significantly reduced TD velocities which improved after percutaneous mitral valve commissurotomy and change in HDV correlated with improvement in mitral valve area</td>
</tr>
<tr>
<td>Ozer et al., 2004</td>
<td>Mild-to-severe MS</td>
<td>52</td>
<td>TD velocity</td>
<td>Significantly reduced TD velocities</td>
</tr>
<tr>
<td>Cayly et al., 2006</td>
<td>Mild-to-moderate MS</td>
<td>80</td>
<td>TEE, TD velocity</td>
<td>Significantly reduced TD velocities, positive correlation between annular systolic velocity and left atrial appendage emptying velocity</td>
</tr>
<tr>
<td>Dogan et al., 2006</td>
<td>Mild-to-moderate MS</td>
<td>30</td>
<td>TD strain, SR</td>
<td>Significantly reduced TD strain, SR</td>
</tr>
<tr>
<td>Ozdemir et al., 2010</td>
<td>Mild-to-moderate MS</td>
<td>60</td>
<td>2D STE strain</td>
<td>Significantly reduced 2D STE strain, more in LV basal segments</td>
</tr>
<tr>
<td>Bilen et al., 2011</td>
<td>Mild-to-severe MS</td>
<td>72</td>
<td>2D STE strain</td>
<td>Significantly reduced 2D STE strain and SR independent of severity of MS</td>
</tr>
</tbody>
</table>
Flow Dynamics in LV function in MS (More than Myocardial factor in MS)

• Post BMV, LV end diastolic volume is unchanged

• LV diastolic filling characterised by intracavitary vortex formation which enhances the flow redirection from mitral inflow to LV outflow

Flow Dynamics In MS
Increase mitral stenosis

Increase transmitral jet velocity

Alteration in vortex ring formation

Mitral annulus recoil force attenuated

Inadequate priming of myocytes and lower LV longitudinal shortening

BMV- improvement in vortex

Resolution of myocardial contractility
Conclusion

- LV dysfunction in mitral stenosis is commonly seen.
- It can be reversibly acute after relief of mitral obstruction and may be related to improved diastolic filling (flow dynamics), acute changes in motion of the mitral valve apparatus, and relief of tethered myocardial segments.