Fluttering of the Mitral Valve in Aortic Insufficiency

By Fred Winsberg, M.D., George E. Gabor, M.D., Joseph G. Hernberg, M.D., and Barry Weiss, M.D.

SUMMARY
Thirty-five patients with clinical evidence of aortic insufficiency were studied by echocardiography. Eleven patients had characteristic diastolic fluttering of the mitral valve (30 to 40 Hz, maximal amplitude 4 mm). In five others the fluttering was classified as equivocal.

In a control group of 500 echocardiograms in patients without evidence of aortic insufficiency, there were three examples of equivocal fluttering. Atrial fibrillation also produces diastolic fluttering but of slower frequency.

Additional Indexing Words:
Echocardiogram Ultrasound Austin Flint murmur

During diastole the anterior leaflet of the mitral valve lies between the regurgitant jet from the incompetent aortic valve and the emptying flow of the left atrium. It has been suggested that the anterior leaflet of the mitral valve could be set into vibration.\textsuperscript{1-9} Although “jet lesions” have been found on the anterior leaflet of the mitral valve,\textsuperscript{5, 10} no direct evidence of diastolic vibration has been presented. This study provides evidence of diastolic vibration of the anterior leaflet of the mitral valve by means of echocardiography.

Methods
The study includes 35 patients with clinical evidence of aortic insufficiency. In nine patients the diagnosis of aortic insufficiency was confirmed by cardiac catheterization, angiocardiography, surgery, or autopsy.

All of the patients had echocardiographic studies in the supine position using a 2 mHz transducer with a Hoffrel 101A echoscope and 704 slow sweep attachment. Transducer placement was adjusted to obtain maximal excursion of the anterior leaflet of the mitral valve. All patients were carefully auscultated for Austin Flint murmurs. Eighteen patients had phonocardiographic studies with the Electronics for Medicine multichannel oscilloscopic recorder using TS-1 B pulse and sound microphones.

A patient was considered to have an Austin Flint murmur if he had a mid-diastolic or late-diastolic low pitched apical murmurs heard or recorded phonocardiographically, and if the diastolic closing slope of the anterior leaflet of the mitral valve was greater than 50 mm/sec by echocardiography.\textsuperscript{11, 12}

Five hundred echocardiograms in patients without evidence of aortic insufficiency were reviewed as controls.

Results (Table 1)

Eleven patients with aortic insufficiency had characteristic fluttering motion of the anterior leaflet of the mitral valve (figs. 2 and 3). The frequency of the fluttering is estimated to be 30 to 40 Hz and the maximal amplitude is 4 mm. In five patients with aortic insufficiency similar fluttering motion was observed but was insufficiently characteristic to be distinguished with regularity from all members of the control set. In these five cases the fluttering is classified as equivocal.

In 12 of the 16 cases (characteristic and equivocal) fluttering began at the point of
<table>
<thead>
<tr>
<th>Sex</th>
<th>Age</th>
<th>Etiology</th>
<th>Apical diastolic murmur</th>
<th>Diastolic slope of second sound</th>
<th>Mitral valve sclerosis (cm)</th>
<th>Asymmetry of AV valves</th>
<th>Mitral valve calcification</th>
<th>Regurgitation detected by ECG</th>
<th>Heart enlarget</th>
<th>Remarks</th>
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<tbody>
<tr>
<td>M</td>
<td>40</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Catherized</td>
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<tr>
<td>M</td>
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<td>Unknown</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Low frequency flutter, consistent with fibrillation</td>
</tr>
<tr>
<td>M</td>
<td>68</td>
<td>Syphilis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Surgical replacement of valve</td>
</tr>
<tr>
<td>F</td>
<td>29</td>
<td>RHD</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Surgery</td>
</tr>
<tr>
<td>M</td>
<td>63</td>
<td>Syphilis</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Catherized</td>
</tr>
<tr>
<td>F</td>
<td>58</td>
<td>RHD</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>X-rays show aortic aneurysm, diastolic closing slope not measurable</td>
</tr>
<tr>
<td>M</td>
<td>32</td>
<td>RHD; SBE</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>Only case with MS and flutter</td>
</tr>
</tbody>
</table>

Table 1: Summary of Results in Thirty-five Cases
### Figure 1

Normal echocardiogram of the motion of the anterior mitral valve leaflet. A = maximum opening during atrial systole; C = closed position during early ventricular systole; upstroke D to E = opening movement of the anterior mitral leaflet; E to F = the rapid diastolic downstroke during the period of rapid ventricular filling (2-sec sweep).

maximal opening of the anterior leaflet of the mitral valve (E point). In four it began at the onset of mitral valve opening (D point). Fluttering terminated with ventricular systole.

While the control set of 500 echocardiograms contains no example of characteristic fluttering, there were three echocardiograms, which, when presented without clinical information, were sometimes classified as equivocal for fluttering. Six examples of diastolic vibration of the anterior leaflet of the mitral valve were found in patients who had atrial fibrillation but had no evidence of aortic insufficiency or mitral valve disease (fig. 5). However, the frequency of the vibration in the patients with atrial fibrillation is between 5 and 10 Hz and is easily distinguishable from

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**FLUTTERING OF THE MITRAL VALVE**

<table>
<thead>
<tr>
<th>Angiocardiography</th>
<th>Catheterization, angiography</th>
<th>Autopsy, angiography</th>
<th>Catheterization, autopsy, angiography</th>
<th>Angiocardiography</th>
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<td>+ 0 0 0 0 0</td>
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<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ + 0 100/40 0</td>
<td></td>
<td></td>
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<td></td>
<td></td>
</tr>
<tr>
<td>+ + 0 0 110/50 0</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>+ 0 0 0 110/70 0</td>
<td>+ + 0 0 110/30 0</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>+ 0 0 0 0 0 140/30</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Unknown**

- **M**: 75
- **F**: 43
- **M**: 29
- **F**: 20
- **F**: 27
- **M**: 27
- **M**: 27
- **M**: 15
- **RHD**: Right heart disease
- **SBE**: Subacute bacterial endocarditis

Abbreviations: **AS** = aortic stenosis; **MS** = mitral stenosis; **MV** = mitral valve disease; **RHD** = rheumatic heart disease; **SBE** = subacute bacterial endocarditis.
Echocardiogram of an 18-year-old female with aortic insufficiency. BP 140/50. Diastolic murmur classified as Austin Flint murmur. Fluttering of the anterior leaflet of the mitral valve (AMV) is shown between the E and F points (2-sec sweep).

Discussion

The echocardiogram permits continuous observation of the motion of the anterior leaflet of the mitral valve. In our group of patients with aortic insufficiency the echocardiogram shows diastolic vibration or fluttering of the anterior leaflet of the mitral valve in about half of the cases. Previous reports have shown that echocardiography is a reliable method of diagnosing mitral stenosis and of distinguishing patients with the Austin Flint murmur from patients with mitral stenosis and aortic insufficiency. The data do not permit any conclusion about the relationship of the Flint murmur and the phenomenon of fluttering.

Table 2

<table>
<thead>
<tr>
<th>Austin Flint murmur</th>
<th>Fluttering</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Present</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>Absent</td>
<td>10</td>
<td>25</td>
</tr>
<tr>
<td>Total</td>
<td>16†</td>
<td>35</td>
</tr>
</tbody>
</table>

* Eight of these had evidence of mitral stenosis clinically and by echo (diastolic closing slopes less than 50 mm/sec).
† In five of these cases fluttering was considered equivocal.
Echocardiogram of a 58-year-old female with aortic aneurysm and aortic insufficiency. There is fluttering of the valve which commences at the time of the D point. The E to F closing slope appears flattened on all but the third beat shown in this sweep. The anterior leaflet touches the septum. This echo mimics mitral stenosis. The patient has no apical diastolic murmur and no clinical evidence of mitral stenosis. AMV = anterior leaflet mitral valve (3-sec sweep).

Although mitral valve motion in atrial fibrillation resembles mitral valve vibration seen in aortic insufficiency, the fluttering is of lower frequency (5 to 10 Hz).

References
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6. HERMANN GR: The Austin Flint phenomenon:

Echocardiogram of a 49-year-old male, after resection of the left ventricular aneurysm, who has atrial fibrillation. Slow frequency fluttering of the anterior leaflet of the mitral valve (AMV) is shown during a long diastolic interval. S = systole; D = diastole (3-sec sweep)

An experimental and clinical study. Amer Heart J 1: 671, 1926
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