Coarse Atrial Fibrillation in Congenital Heart Disease

By Manfred Thurmann, M.D.

A DEFINITE correlation between coarse fibrillatory waves (f waves) in lead V₁ of a standard electrocardiogram and the presence of rheumatic heart disease with mitral valve involvement has been described. Fine f waves have been seen very consistently in patients with arteriosclerotic heart disease.¹-⁷ Coarse f waves have also been seen although much less frequently in patients with atrial fibrillation who had thyrotoxicosis, functional atrial fibrillation, pulmonary emphysema,⁶,⁷ and hypertensive cardiovascular disease.² It has been shown⁷ that a certain number of cases with arteriosclerotic heart disease having coarse f waves in V₁ while in congestive heart failure developed fine f waves after appropriate therapy.

This study was undertaken to point out the fact that coarse f waves can also be seen in patients with congenital heart disease with right atrial or biatrial enlargement and not only left atrial enlargement, as is the case in most instances of rheumatic heart disease with mitral stenosis and insufficiency.²,⁵

Material and Methods

A search for patients with congenital heart disease whose electrocardiogram showed atrial fibrillation was undertaken at the St. Louis University Hospital. Five hundred records were reviewed. The diagnoses were established by either one or all of the following methods: cardiac catheterization, surgical exploration, and postmortem examination. The electrocardiograms were recorded on the usual direct-writing equipment and were standardized so that a 1-mv. input produced a 10-mm. deflection of the stylus. The f waves were measured in lead V₁ and analyzed according to previously described criteria.² The variability of the size of the f wave was studied in patients who had more than one tracing.

The clinical records were reviewed and the pertinent data concerning the age, sex, hemodynamic, electrocardiographic, roentgenologic, surgical, and postmortem findings were obtained (table 1).

Results

Since atrial fibrillation occurs very infrequently in patients with congenital heart disease,⁸ only four (0.8 per cent) were found to have this arrhythmia. Their ages were 8 months, 6 years, 16 years, and 53 years. The hemodynamic diagnoses were total anomalous venous return to the right atrium with atrial septal defect, right ventricular hypertension secondary to mitral stenosis and insufficiency, ventricular septal defect with tricuspid insufficiency, and atrial septal defect. The four patients had electrocardiograms with atrial fibrillation and coarse f waves in V₁, which measured from 1 mm. to 6 mm. in amplitude (fig. 1). Three tracings had peaked f waves and in one they were rounded.

The 53-year-old patient with atrial septal defect had no history of arteriosclerotic heart disease. The f wave size in three electrocardiograms taken in a 9-month period remained coarse. The patient was lost to follow-up, therefore an electrocardiogram many months after surgery was unobtainable.

The 16-year-old girl with atrial septal defect and malformation of the tricuspid and mitral valves (ostium primum) showed no significant changes in the size of the f waves in 10 tracings taken over one year.

The electrocardiograms before and after operation of the 8-month-old patient with total anomalous venous return with atrial septal defect and right atrial enlargement were unchanged. Two months after surgery sinus rhythm was present with no evidence of right atrial enlargement.

The 6-year-old boy with endomyocardial
### Clinical Data

<table>
<thead>
<tr>
<th>Name</th>
<th>Sex and age</th>
<th>Pressures, mm. Hg</th>
<th>Cardiac catheterization</th>
<th>Electrocardiogram</th>
<th>Roentgenogram</th>
<th>Surgery</th>
<th>Autopsy</th>
</tr>
</thead>
<tbody>
<tr>
<td>M.M.</td>
<td>M, 8 mo.</td>
<td>RA = ac 1.0 m 6</td>
<td>Total anomalous venous return to right atrium with atrial septal defect</td>
<td>Right ventricular hypertrophy, atrial fibrillation; 3-mm. tall, coarse, and peaked f waves in V1</td>
<td>Right cardiac enlargement</td>
<td>Total anomalous venous return to right atrium with atrial septal defect and right atrial enlargement</td>
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<tr>
<td></td>
<td></td>
<td>LA = ac 11 m 3</td>
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<td></td>
<td></td>
<td>RV = 67/0</td>
<td></td>
<td></td>
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<tr>
<td>S.S.</td>
<td>M, 6 yr.</td>
<td>RA = m 8</td>
<td>Right ventricular hypertension, due to mitral stenosis and insufficiency</td>
<td>Left ventricular hypertrophy, atrial fibrillation; 7-mm. tall, coarse, and peaked f waves in V1</td>
<td>Generalized cardiomegaly</td>
<td>Biventricular enlargement; endomyocardial fibrosis with left coronary artery arising from pulmonary artery; mitral valvular stenosis and insufficiency</td>
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<tr>
<td></td>
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<td>RV = 45/7</td>
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<tr>
<td>L.P.</td>
<td>F, 16 yr.</td>
<td>RA = ac 28 m 23</td>
<td>Ventricular septal defect, tricuspid insufficiency</td>
<td>Incomplete right bundle-branch block-pattern, atrial fibrillation; 1-mm. tall, coarse, and peaked f waves in V1</td>
<td>Biventricular hypertrophy</td>
<td>Atrial septal defect with mitral and tricuspid insufficiency</td>
<td>Atrial septal defect; malformations of mitral and tricuspid valves; biventricular enlargement</td>
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<tr>
<td></td>
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<td>RV = 72/18</td>
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<tr>
<td>J.K.</td>
<td>M, 56 yr.</td>
<td>RA = ac 10 m 6</td>
<td>Atrial septal defect</td>
<td>Complete right bundle-branch block-pattern, atrial fibrillation; 1-mm. tall, coarse, and rounded f waves in V1</td>
<td>Right ventricular hypertrophy, prominent pulmonary artery</td>
<td>Atrial septal defect, right atrial enlargement</td>
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<td></td>
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<td>LA = ac 12 m 6</td>
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<td></td>
<td></td>
<td>RV = 47/2</td>
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RA, right atrium; LA, left atrium; RV, right ventricle.
fibrosis had only one tracing before his demise; in it coarse $f$ waves were seen.

**Discussion**

The four cases studied had proven right or left atrial enlargement. As mentioned by others, the explanation for the occurrence of large $f$ waves in patients with atrial fibrillation is not clear. However, as has been suggested it may be explained on the basis of distention of the atria instead of hypertrophy of atrial myocardium. This concept would be in accordance with the presence of coarse $f$ waves in rheumatic heart disease, thyrotoxic heart disease, congestive failure, and in patients with congenital heart disease with overloading of the atria. In all these instances there is an increased volume of blood flowing through the atria. This might explain the fact that some patients observed by Skoulas et al. diminished the size of their $f$ waves after congestive failure had been treated. Prinzmetal and Scherff produced atrial fibrillation in dogs’ hearts by distending the atrium with a balloon in which saline was injected, but the size of the $f$ waves was not described.

The size of the $f$ waves in $V_1$ may be used as an electrocardiographic criterion for atrial enlargement, right or left, taking into consideration other available clinical and electrocardiographic data; as has been described, the incidence of left atrial enlargement will be much greater.

**Summary**

Four cases of congenital heart disease that showed coarse atrial fibrillatory waves in $V_1$ and evidence of right atrial or biatrial enlargement were discussed. It is suggested that the coarse $f$ waves may be due to distention of the atria.

**References**


**Figure 1**

Electrocardiograms showing atrial fibrillation with coarse fibrillatory waves in $V_1$. Tracings 1 to 4, left to right: 1, M.M. 8 months; 2, S.S. 6 years; 3, L.P. 16 years; 4, J.K. 56 years.
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MANFRED THURMANN

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