CASE REPORT

Focal Atrial Fibrillation in Dextrocardia

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A 49-year-old woman with dextrocardia and situs inversus underwent catheter ablation of paroxysmal atrial fibrillation (AF). During the electrophysiologic study, AF triggered by frequent premature atrial contractions (PACs) with a short coupling interval exhibiting a "P on T" pattern occurred. Pulmonary vein mapping revealed that those PACs originated from right-sided (anatomic left) or left-sided (anatomic right) pulmonary veins. In this case with mirror-image dextrocardia, the P-wave morphologies in leads I and aVL and the II/III ratio of the P-wave amplitude were helpful for predicting a right- or left-sided pulmonary vein origin.

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P-wave morphology; premature atrial contraction; focal atrial fibrillation; dextrocardia

Atrial fibrillation (AF) triggered by frequent premature atrial contractions (PACs) with a short coupling interval exhibiting a "P on T" pattern is called "focal AF." The pulmonary veins (PVs) have been demonstrated to be the major source of "focal AF."^{1,2} However, to the best of our knowledge, there have been no reports describing "focal AF" in dextrocardia.

CASE

A 49-year-old woman with dextrocardia with situs inversus was referred for catheter ablation of paroxysmal AF. During the electrophysiologic study, bigeminal PACs followed by AF triggered by those PACs spontaneously occurred (Fig. 1). On the 12-lead electrocardiograms (left-sided precordial lead positions), the PACs triggering the AF exhibited a "P on T" pattern and positive P waves in leads I ($\geq 50 \mu\text{V}$), aVL, and the inferior leads, notched P waves in lead II, II/III ratio of the P-wave amplitude of ≥ 0.8 , and duration of the positive phase in lead V₁ of ≥ 80 ms (Figs. 1 and

2). Transseptal catheterization was then performed and angiograms of all the PVs were obtained (Fig. 3). PV mapping revealed that the AF originated from the right-sided (anatomic left) superior PV. Isolation of that PV was successfully performed with a 20-pole circular mapping catheter. However, "focal AF" spontaneously occurred again (Fig. 2). The PACs triggering the AF exhibited negative P waves in leads I and aVL, positive P waves in the inferior leads, a II/III ratio of the P-wave amplitude of ≤ 0.8 , and duration of the positive phase in lead V₁ of ≥ 80 ms. PV mapping revealed that the AF originated from a left-sided (anatomic right) PV with a common ostium and successful isolation of that PV eliminated the AF. Successful isolation of all PVs was achieved without any complications. During more than 1 year of follow-up, no atrial tachyarrhythmias have recurred.

DISCUSSION

To the best of our knowledge, this is the first report illustrating the electrocardiograms of "focal

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Figure 1. Twelve-lead electrocardiograms exhibiting the onset of “focal atrial fibrillation” originating from the right-sided (anatomic left) superior pulmonary vein.

Figure 2. Comparison of the P-wave morphologies of the premature atrial contractions triggering “focal atrial fibrillation” with an origin in the right-sided (anatomic left) superior pulmonary vein (PV) (left panel) and left-sided (anatomic right) PVs (right panel).

Figure 3. Angiograms of the right-sided superior PV (left panels) and left-sided PV with a common ostium (right panels). CS = coronary sinus; LAO = left anterior oblique view; RAO = right anterior oblique view. The other abbreviations are as in Figure 2.

AF" in dextrocardia. Yamane et al. reported that the P-wave morphology of the PACs triggering AF may be helpful for predicting whether the PACs originate from the right- or left-sided PVs in normal human hearts without any congenital abnormalities.³ In their algorithm, a positive P wave in lead aVL or an amplitude of the P wave in lead I of $\geq 50 \mu\text{V}$ indicates a right-sided PV origin and in the cases not satisfying those criteria, a notched P wave in lead II, III/II ratio of the P-wave amplitude of ≥ 0.8 , or duration of the positive phase in lead V₁ of ≥ 80 ms indicates a left-sided PV origin. In this case with mirror-image dextrocardia, the P-wave morphologies in leads I and aVL and a II/III ratio (reversed for dextrocardia) of the P-wave amplitude were helpful for predicting whether the PACs originated from the right- or left-sided PVs as demonstrated in normal hearts. The difference in the amplitude ratio of leads II/III between the right- and

left-sided PVs probably might reflect a more vertical axis of the activation from the right-sided PVs as opposed to a more rightward axis (in the frontal plane) of depolarization from the left-sided PVs. A notched P wave in lead II was not observed for the PACs with a left-sided PV origin but was for those with a right-sided PV origin. A notched P wave in lead II may be characteristic of lateral PVs. Because the duration of the positive phase in lead V₁ was more than 80 ms in both the right- and left-sided PV origins, that parameter could not differentiate between those PV origins. In mirror-image dextrocardia, the longer duration of the positivity in lead V₁ may usually reflect more posterior locations of the right-sided PV insertions into the left atrium as compared with the left-sided PVs. However, in this case, the PAC origin might have been located in the posterior aspect of the left-sided PVs with an opening more posterior than usual (Fig. 3).

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