Improvement of cardiopulmonary exercise capacity after radiofrequency ablation in patient with preexcitation during sinus rhythm: A new definition of symptomatic preexcitation?

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We report our observations in a 54-year-old woman with right midseptal AV accessory pathway (AP) and manifest ventricular preexcitation. Although the patient has a several-year history of paroxysmal palpitations, her major daily symptom was impaired exercise tolerance due to resting and exertional dyspnea. Organic diseases of the pulmonary vessels, lung, and heart were excluded by x-ray film and computed tomographic angiography. Cardiopulmonary exercise test prior to ablation showed objective evidence of exertional dyspnea. Stress echocardiography using tissue Doppler imaging revealed significant interventricular asynchrony. The patient underwent successful AP radiofrequency (RF) ablation, which resulted in immediate disappearance of her exertional dyspnea. Cardiopulmonary exercise test performed 1 week after ablation showed significant improvement in pulmonary and cardiac performance. However, within 2 weeks of the procedure, her symptoms of resting and exertional dyspnea recurred simultaneously with recurrence of ventricular preexcitation. Cardiopulmonary exercise capacity in cardiopulmonary exercise test deteriorated as well. After a second RF ablation, the patient's symptoms and preexcitation resolved, and tissue Doppler imaging was free of interventricular asynchrony. These findings suggest that in patients without organic heart and pulmonary diseases, ventricular preexcitation may lead to symptomatic exertional dyspnea in sinus rhythm and interventricular asynchrony that persists during exercise. RF ablation can reverse dyspnea associated with preexcitation. Therefore, in symptomatic patients, preexcitation-related exertional dyspnea during sinus rhythm can be diagnosed by cardiopulmonary exercise test and could be an additional indication for RF ablation in patients with Wolff-Parkinson-White pattern.

KEYWORDS Asymptomatic Wolff-Parkinson-White syndrome; Cardiopulmonary exercise capacity; Interventricular asynchrony; Radiofrequency ablation

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Introduction

The diagnosis of Wolff-Parkinson-White (WPW) syndrome is reserved for patients who have both ventricular preexcitation and symptoms related to paroxysmal tachycardia, such as chest pain, dyspnea, dizziness, palpitations, or syncope. Delta waves, the most common ECG indicators of manifest preexcitation, are present in approximately 0.2% of the population.[1] Patients with ECG signs of preexcitation without arrhythmia symptoms usually are diagnosed as WPW pattern or asymptomatic preexcitation. Some studies have associated WPW pattern with interventricular dyssynchrony and even developmental cardiomyopathy; however, no studies reported symptoms and exercise performance parameters related to preexcitation and interventricular dyssynchrony during sinus rhythm. In this report, we present a case of reversal of right ventricular preexcitation, restoration of interventricular synchrony, and disappearance of dyspnea after successful accessory pathway (AP) catheter ablation in a patient with WPW syndrome.

Case report

A 54-year-old woman was referred for electrophysiologic consultation because of occasional paroxysmal palpitations and persistent preexcitation, which was first detected years ago. Her medical history included mild hypertension and smoking. Despite being treated with metoprolol 25 mg for years, the patient continued to experience short episodes of palpitations (lasting a few minutes at a time), which occurred every 2 to 3 months and disappeared after resting and Valsalva maneuver. She had no other documented arrhythmia and normal x-ray film. Twenty-four-hour Holter monitoring showed normal sinus rhythm with manifest preexcitation. The patient reported dyspnea and chest pain with moderate exercise. These symptoms were not associated with paroxysmal palpitations but led to a decrease in her physical activity. The main complaints for which she was

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Table 1 Results of cardiopulmonary exercise tests

Parameter	Test before first RF ablation	Test after first RF ablation	Test before second RF ablation	Test after second RF ablation
FVC	3.39 (111%N)	3.65 (119%N)	3.53 (115%N)	3.49 (114%N)
FEV_1	2.69 (103%N)	2.84 (108%N)	2.65 (101%N)	2.79 (106%N)
Exercise time	7 minutes 44 seconds	8 minutes 9 seconds	9 minutes 6 seconds	9 minutes 10 seconds
VO_2 peak	27.0	31.1*	26.2	33.1*
VO_2 at AT	15.2	16.8*	14.5	18.2*
RER	1.02	0.94	1.05	1.07
HR max	169	123	147	147
O_2 pulse max	16.1	25.3	17.8	22.5
VE max	79	71	69	72
VT	1.97 (87%N)	2.04 (90%N)	1.95 (86%N)	1.93 (85%N)
VE/VO_2 at rest	26.1	21.1*	25.4	24.7*
VE/VO_2 at AT	23.8	19.5*	20.3	18.4*
VE/VO_2 max	32.1	25.2*	28.8	23.9*
VE/VCO_2 at rest	34.3	28.1*	31.8	29.9*
VE/VCO_2 at AT	29.1	26.4*	27.3	23.2*
VE/VCO_2 max	31.5	26.8*	27.4	22.3*
$VE\text{-}VCO_2$ slope	31	25*	31	19*
$PETO_2$ max	118	109*	114	108*
$PETCO_2$ max	32	37*	37	43*
VD/VT max	27	25	27	24

FVC = forced vital capacity (L); FEV_1 = forced expiratory volume in first second (L); VO_2 peak = oxygen consumption at peak exercise (mL/kg/min); VO_2 at AT = oxygen consumption at anaerobe threshold (mL/kg/min); RER = respiratory exchange ratio VCO_2/VO_2; HR = heart rate (bpm); O_2 pulse = oxygen consumption per heart rate (L/beat); VE = minute ventilation (L); VT = tidal volume (L); VE/VO_2 = equivalent ventilation for O_2; VE/VCO_2 = equivalent ventilation for CO_2; $VE\text{-}VCO_2$ slope = slope ratio of regression between ventilation and carbon dioxide; $PETO_2$ = end-tidal pressure of O_2 (mmHg); $PETCO_2$ = end-tidal pressure of CO_2 (mmHg); VD/VT = ratio between dead space and tidal volume in the lungs; at AT = at anaerobe threshold; %N = related to norm for age and sex (pulmonologist criteria); RF = radiofrequency.

Cardiopulmonary exercise test was performed on treadmill according to the Rampe protocol.

*Values listed are the most significant improvements in cardiopulmonary capacity.

seeking medical attention were the resting and exertional dyspnea rather than the paroxysmal tachycardia.

Computed tomographic angiography performed to exclude other organic diseases of the heart, lungs, and pulmonary vessels showed no stenosis of the coronary arteries. Bronchial hyperreactivity was excluded by negative spirometric dilation test and negative methacholine inhalation test.

Cardiopulmonary exercise test revealed sinus rhythm and objective signs of exertional dyspnea during exercise (Table 1). Standard echocardiogram showed a normal heart with preserved systolic and diastolic function, including left ventricular (LV) ejection fraction 0.69, LV end-diastolic volume 110 mL, end-systolic volume 76 mL, LV end-diastolic diameter 54 mm, end-systolic diameter 33 mm, LV fractional shortening 0.40, and normal LV filling. However, Doppler tissue echocardiography revealed significant interventricular asynchrony (Figure 1). These findings led to a diagnosis of right-sided inferoseptal AP, and the patient was scheduled for elective radiofrequency (RF) catheter ablation.

After obtaining written informed consent, cardiac medications were discontinued, and electrophysiologic study was performed. A single mapping catheter was introduced through the right femoral vein. Resting sinus rate was 800 ms with manifest preexcitation; however, manipulation of the catheter induced sustained atrial fibrillation. A sharp negative deflection with "W" pattern preceding the surface ECG delta wave onset by 20 ms was present on the unipolar ECG above the coronary sinus and confirmed the presence of a midseptal AP. When the mapping catheter was moved higher, the distance from the application site and His-bundle potential recording was estimated at approximately 1 cm. The second RF application at this site led to immediate disappearance of preexcitation (confirmed during the 45-minute observation period), but atrial fibrillation persisted. Because the patient refused external cardioversion, atrial

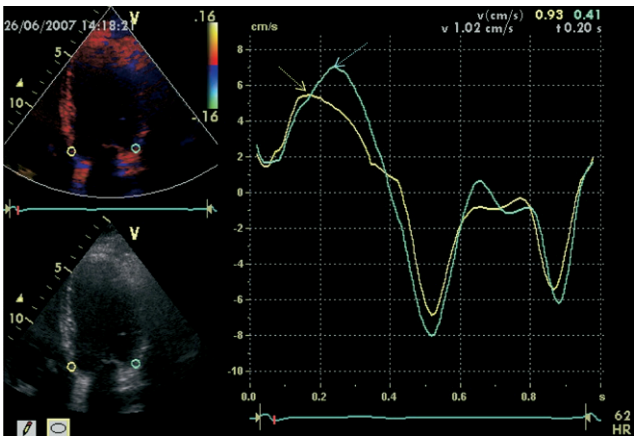

Figure 1 Baseline echocardiographic examination (Doppler tissue imaging) showed a delay between the peak systolic motion of the basal segment of the left lateral ventricular wall *(blue trace)* and the interventricular septum *(yellow trace)* of 80 ms *(arrows)*.