An Adult Case with an Abnormal Right Ventricular Structure Causing Intraventricular Pressure Gradient and a History of Aphthous Stomatitis and Thrombophlebitis

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SUMMARY

We report a 50-year-old man with a right ventricular structure causing an intraventricular pressure gradient. He had been diagnosed as vasculo-Behçet with a history of aphthous stomatitis and thrombophlebitis. He had also been suffering from atrial flutter and mild right-side heart failure. Echocardiography showed that there was an abnormal structure attached to the right ventricular free wall and protruding into the cavity, and that it caused the pressure gradient estimated to be approximately 19 mmHg. Chest X-ray computed tomography demonstrated that the structure was partially calcified. Magnetic resonance imaging depicted the structure separating the right ventricle into two chambers. Angiographic study revealed a markedly enlarged right atrium and a filling defect at the mid-portion of the right ventricle, which divided the right ventricular cavity into two parts. Hemodynamic study showed a slightly elevated right atrial pressure (mean 7 mmHg) and a peak-to-peak intraventricular pressure difference of 18 mmHg in the right ventricle. The diastolic pressure tracing of the right ventricular low pressure chamber showed a 'dip and plateau' pattern. Although the pathological features of the abnormal right ventricular structure in this case were not fully clarified, abnormal muscle bundle and/or endocardial fibrosis, which were reported to be associated with Behçet's disease, may have contributed to its generation. (*Jpn Heart J* 1999; 40: 517-525)

Key words: Double-chambered right ventricle, Endocardial fibrosis, Atrial flutter, Vasculo-Behçet, Right-side heart failure

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AN abnormal structure in the right ventricle is not common, but may cause intraventricular obstruction or heart failure in some cases, while it may be asymptomatic in others. Endocardial fibrosis, intraventricular thrombus, abnormally hypertrophied muscle bundle, and cardiac tumors are known causes of abnormal right ventricular structure. Double-chambered right ventricle is commonly known to be accompanied with an abnormal right ventricular structure. This disease was first reported by Keith,¹⁾ and it was observed that anomalous muscle bundles occurred below the infundibulum and traversed the right ventricular cavity, extending from its anterior wall to the crista supraventricularis and/or the portion of the interventricular septum just beneath the crista.²⁾

On the other hand, Behçet's disease is a chronic inflammatory disease affecting systemic organs and characterized with uveitis, oral and genital ulcerations, and dermatitis. Recently, various cardiovascular complications have been reported in some patients (about 1–7%) with Behçet's disease by means of biopsy, operative specimen, or autopsy.^{3–6)} The reported complications include endomyocardial fibrosis (in both the right and left ventricles),³⁾ pericarditis, myocarditis, valvular disease,⁴⁾ thrombus in the pulmonary artery or right ventricle, thrombophlebitis,⁵⁾ and coronary arteritis.⁶⁾ In some cases, symptoms or signs including edema, jugular vein distention, and shortness of breath on effort have been reported.³⁾ However, the clinical spectrum of the cardiovascular complications has not yet been established, especially with respect to its functional aspect.

Thus, we here report a case with an abnormal structure in the right ventricle causing intraventricular pressure gradient and a history of oral ulceration and thrombophlebitis. Right ventricular diastolic dysfunction was also noted. Possible contributions of double-chambered right ventricle and/or Behçet's disease to the hemodynamic findings of the present case are discussed.

CASE REPORT

A 50-year-old Japanese man was admitted for the evaluation of an abnormal structure in the right ventricle, and for the treatment of atrial flutter and mild right-side heart failure. He was diagnosed as vasculo-Behçet at the age of 34 because he had developed aphthous stomatitis and thrombophlebitis, including deep vein thrombosis of the left leg. Since then, he had been receiving oral prednisolone for 11 years. He had been suffering from atrial flutter since he was 45 years old, but attempts at pharmacological defibrillation were unsuccessful. Ventricular rate gradually became uncontrollable despite treatment with oral verapamil 200 mg/day. Physical examination revealed a mild pitting edema, but no oral or genital ulceration or uveitis was observed. His blood pressure was 120/

90 mmHg, and the pulse rate was 113/min. Systolic murmur of grade 3/6 was heard on the 4th left sternal border. The blood test showed mild anemia (hemoglobin 13.9 g/dl), and no inflammatory signs (white blood cell count: 3100/ μ l; C-reactive protein: 0.3 mg/dl; blood sedimentation rate: 2 mm/hr), although he received no anti-inflammatory treatment. Serum levels of alkaline phosphatase and γ -glutamate carboxypeptidase were slightly elevated (208 IU/ml and 211 IU/ml, respectively), suggesting mild hepatic congestion. Electrocardiogram showed atrial flutter with 2:1 atrioventricular conduction at the time of admission (Figure 1). Echocardiography showed that there was an abnormal structure attached to the free wall in the apical portion of the right ventricle (Figure 2). This structure caused a turbulence of systolic flow in the right ventricle, and the pressure gradient across the structure was estimated to be approximately 19 mmHg by Doppler echocardiography. Chest X-ray computed tomography showed a markedly dilated right atrium and an abnormal structure with partial calcification as a defect of contrast enhancement in the right ventricle (Figure 3). These findings were suggested to represent hypertrophy of the right ventricular wall and calcification of chordae tendineae. Magnetic resonance imaging showed a structure at the mid-to-apical portion of the right ventricle and its signal intensity was almost identical with the myocardium (Figure 4). The structure separated the right ventricle into two chambers, and was suggested to be thickened during systole.

Figure 1. Electrocardiogram upon admission. Atrial flutter with 2:1 atrioventricular conduction is observed with a ventricular rate of 117 beats/min.

suggesting that the diastolic function of this chamber was impaired. Pulmonary arterial pressure was within normal ranges (14/4 mmHg, mean 8 mmHg). Electrophysiological study revealed atrial flutter of reverse common type. Catheter ablation to the isthmus between the tricuspid valve and inferior vena cava was attempted for the treatment of atrial flutter, but was unsuccessful because of a certain anatomical abnormality associated with extremely high impedance. Finally, atrial flutter was terminated by burst pacing. Oral administration of

Figure 6. The recordings of the right ventricular pressure wave form. **A:** The pressure curve during pull-back from the apex to the mid portion of the right ventricle revealed a peak-to-peak intraventricular pressure gradient of 18 mmHg. Note that the pressure dropped after the catheter was pulled back. **B and C:** right ventricular pressure curves in the high pressure chamber (B) and the low pressure chamber (C) after defibrillation. The right ventricular diastolic pressure tracing of the low pressure chamber shows a 'dip and plateau' pattern.

atenolol 25 mg/day was started for maintaining sinus rhythm and he was discharged from the hospital. As the right-side heart failure was mild and the peak right ventricular pressure was not overly elevated, he was followed up only with the medical treatment including oral furosemide (40 mg/day).

DISCUSSION

We have presented an adult case with an abnormal right ventricular structure causing intraventricular pressure gradient, which was pointed out incidentally by echocardiography. The present case also showed atrial flutter and mild right-side heart failure. The etiology of the abnormal right ventricular structure and the cause of the right-side heart failure appear to be worth discussing, particularly because this case had formerly been diagnosed with Behçet's disease.

As a differential diagnosis for this patient, a congenital double-chambered right ventricle should first be considered. This disorder is characterized by an abnormally-hypertrophied muscle bundle below the infundibulum, which separates the right ventricle into two chambers and causes a pressure gradient between the chambers.^{1,2)} Rowland, *et al.* reviewed 17 patients with double-chambered right ventricle and proposed the following diagnostic criteria:⁷⁾ 1) a pressure gradient recorded between the right ventricular sinus and subpulmonary area; 2) right ventricular angiogram revealing an obstructive filling defect below the infundibulum that demarcated well-defined, coarsely trabeculated chambers both proximal and distal to the site of obstruction; and 3) absence of infundibular hypoplasia. The present case seems to be compatible with these criteria in the finding that the hypertrophic muscle bundle appeared to separate the right ventricle into two chambers (Figure 4). Furthermore, MRI showed that this bundle was thickened during systole. In contrast, this case was discrepant for the diagnosis of double-chambered right ventricle in the following points: 1) this disorder is rarely diagnosed in adulthood; 2) it is often complicated with other types of congenital abnormalities;⁷⁾ and 3) reported intraventricular pressure gradients (ranging from 15 to 101 mmHg in infant patients) tended to increase at rates ranging from 1.2 to 5.0 mmHg/year.²⁾ An adult case of double-chambered right ventricle was reported to show an intraventricular pressure gradient of as much as 200 mmHg,⁸⁾ and accordingly, the pressure gradient recorded in the present report was considered to be exceptionally low for an adult case of double-chambered right ventricle.

Next, we should discuss other possible causes of the right ventricular abnormal structure. In this regard, his history of aphthous stomatitis and thrombophlebitis should be noted, although his symptoms and signs did not completely satisfy the diagnostic criteria of Behçet's disease. Endocardial fibrosis and intracavitary thrombosis have been reported as cardiovascular complications of Behçet's disease.³⁻⁵⁾ Huong, *et al.* reported four cases with Behçet's disease, who developed endocardial fibrosis in either ventricle.³⁾ In three of these four cases, endocardial fibrosis caused right ventricular filling defects detected by angiography, and/or bright echoes displayed by echocardiography in the right ventricle.³⁾ Thus, it is possible that endocardial fibrosis and/or thrombosis may have played some roles in the formation of the right ventricular abnormal structure in this case, though systolic thickening of the structure cannot be explained by mere fibrosis or localized thrombosis. Histological examination of the biopsy or surgical samples may be helpful to determine the pathological features of the abnormal structure. In some earlier reports of Behçet's disease with cardiovascular complications, histological examination revealed fibrosis, neovessels, infiltration of inflammatory cells,³⁾ and thrombus⁵⁾ in the heart. However, we did not

perform a biopsy of the structure in this case because we thought that a right ventricular biopsy was too risky for this patient, who had been diagnosed with Behçet's disease. Moreover, the therapeutic strategy did not appear to be influenced by the results of the histological examination.

Right-side heart failure observed in this patient may be in part attributable to right ventricular diastolic dysfunction, the mechanism of which should also be discussed. The diastolic pressure in the 'low pressure' chamber (Figure 6C) was constantly higher than that in the 'high pressure' chamber (Figure 6B). In addition, only the diastolic pressure wave form of the low pressure chamber showed the 'dip and plateau' pattern. These findings may exclude the possibility that the hypertrophied wall of the high pressure chamber or the abnormal muscle bundle itself was responsible for the diastolic dysfunction. On the other hand, it is possible that a narrow passage between the two chambers may have impeded the inflow from the low pressure chamber into the high pressure chamber. However, this mechanism may not be the case for the following reasons: 1) the diastolic pressure difference in this case was disproportionately high as compared with the systolic pressure gradient; and 2) nonetheless, flow turbulence was observed in the right ventricle only during systole. Endocardial fibrosis or thrombosis of the low pressure chamber, which might be related to Behçet's disease, appears to be another probable cause of the diastolic dysfunction. Indeed, Huong *et al.* mentioned that one of their cases with Behçet's disease and endocardial fibrosis demonstrated right ventricular diastolic dysfunction, although the hemodynamic characteristics of the case were not described in detail.³⁾ Our present case showed a large right atrium, a small or normal sized right ventricle, a 'dip and plateau' pattern on the right ventricular pressure curve, and tricuspid regurgitation, all of which seem to be compatible with the hemodynamic consequences of endocardial fibrosis.⁹⁾ Furthermore, right atrial dilatation as well as fibrotic changes might have been involved in the genesis of atrial flutter in this case. Histological examination may also be necessary to clarify the mechanisms underlying the right ventricular diastolic dysfunction, but endomyocardial biopsy was not performed in this case for the above-mentioned reasons.

The case described above showed a rare combination of an abnormal structure causing a pressure gradient in the right ventricle, right ventricular diastolic dysfunction, and atrial flutter at the same time. His history of having been diagnosed with Behçet's disease seemed intriguing from an etiological point of view. Although the pathologic features of the abnormal structure were not fully clarified in this case, congenital muscle bundles (atypical double-chambered right ventricle) and/or endocardial fibrosis (possibly related to Behçet's disease) were considered to be responsible for its generation. In contrast, diastolic dysfunction of the right ventricular low pressure chamber, which may have caused right atrial

overload and subsequently atrial flutter, might be attributable to the endocardial fibrosis.

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