

## Pulmonary Vein Tachycardia after Pulmonary Vein Isolation for Persistent Atrial Fibrillation in a Young Patient with the Dilated Right Atrium Following Surgical Repair

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### Abstract

The substrate for atrial fibrillation (AF) in young patients with congenital heart disease could be heterogeneous. We report a 24-year old patient with persistent AF having the dilated right atrium following surgical repair of congenital heart disease demonstrating sustained pulmonary vein tachycardia (PVT) after pulmonary vein isolation. The sustained PVT could have been a major substrate for the maintenance of AF in this young patient.

**Keywords:** Pulmonary vein tachycardia; Pulmonary vein isolation; Atrial fibrillation; Dilated right atrium

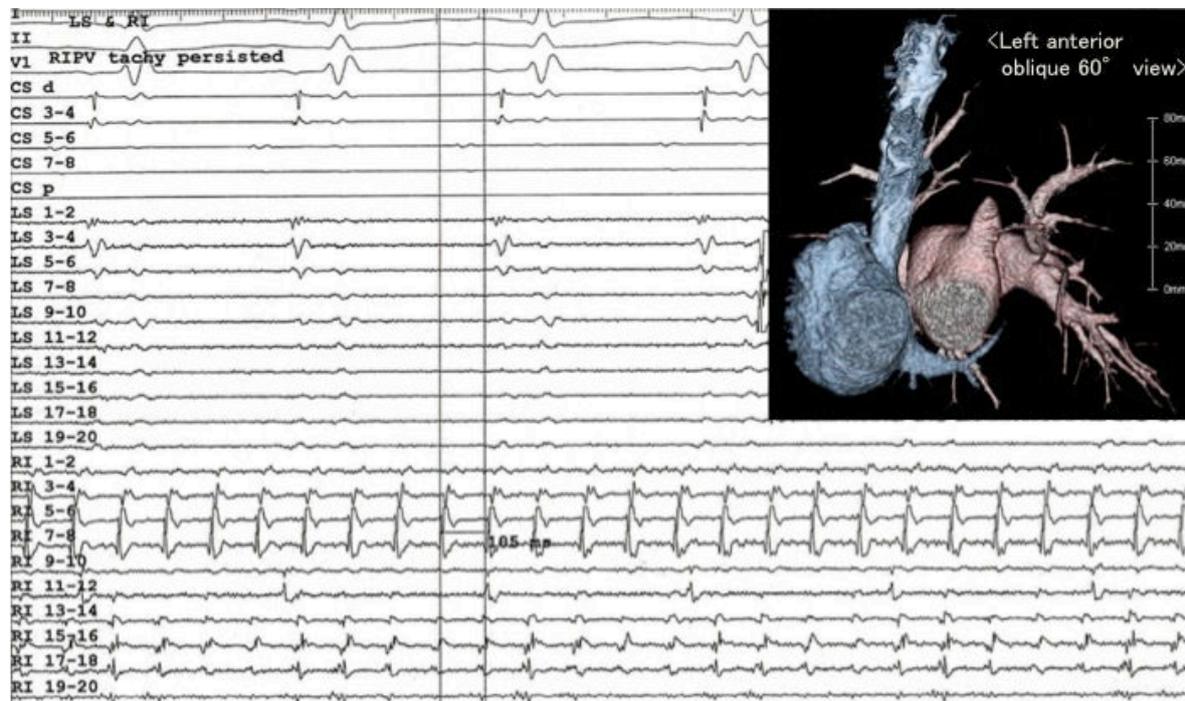
### Case Report

The substrate for atrial fibrillation (AF) in young patients with repaired congenital heart disease could be heterogeneous. Here we report for the first time a 24-year old patient demonstrating sustained pulmonary vein tachycardia (PVT) after pulmonary vein isolation (PVI) for persistent AF. He underwent the patch closure for atrial septal defect (ASD) and the commissurotomy for valvular pulmonary stenosis when he was 1 year old. The echocardiography revealed no dilation of the left atrium (parasternal dimension 33 mm). As shown in Figure 1 (inset), the right atrium was dilated due to residual regurgitation from the repaired pulmonary and dysplastic tricuspid valves. He had a history of typical atrial flutter (AFL) when he was 18 years old, and spontaneous transition to AF was observed at the age of 20 years. Thereafter, AF persisted for 4 years. At the first session, cavo-tricuspid isthmus (CTI) ablation was performed after electrical cardioversion of AF. However, AF recurred in a few days. In patients with ASD, right atrium and ventricle are prone to the stretch-related remodeling consequent upon volume overload. This patient also had residual regurgitation from the repaired pulmonary and dysplastic tricuspid valves. Furthermore, during the previous surgical procedure, the incision line at the antero-lateral wall of right atrium was made, thereby yielding a substrate for macroreentrant circuits. Therefore, we planned the second session assuming that the arrhythmogenic substrates were present in the dilated and incisional right atrium. However, we confirmed that the block line of CTI was completed and

that the low voltage zone (<0.5 mV) was limited in the right atrium. In addition, any tachycardia originating from right atrium was not induced. Then, we attempted the transeptal puncture to perform the PVI. Although the recent reports suggested that the radiofrequency-assisted transeptal needle was useful for electrophysiology procedures in children and adults with the repaired congenital heart diseases [1], transeptal puncture was successful using the conventional Brockenbrough needle in this patient despite the presence of the patch at the atrial septum. Following the circumferential isolation of ipsilateral PVs, dissociated PVT (cycle length: 100-120ms) in right pulmonary vein was induced when confirming the exit block by pacing at the right PVs. It persisted more than 20 minutes (Figure 1), and required cardioversion for its termination. Without any additional substrate modifications in both right and left atriums, the patient has been free of AF for one year.

### Discussion

The rate of the PVT after PVI for AF was reported to be 6.4% in 110 patients [2]. Because of the decrement conduction property and short refractory period in pulmonary veins, the reentrant mechanism was proposed to be responsible for the genesis of PVT [2]. In another report, incidence of the PVT was higher in patients underwent circumferential PVI (9.0 %) than segmental PVI (2.3 %) [3]. Regarding its origins, the PVT with exit block to the left atrium was present most frequently in left superior PV, and its prevalence was second in left inferior PV, third in right superior PV, and fourth in right inferior PV [4]. However, these data were obtained in elderly patients without congenital heart diseases.



**Figure 1:** Intracardiac recordings during the right pulmonary vein tachycardia. (Inset) Left anterior oblique view of three-dimensional computed tomography image of atriums is given. Note that the right atrium is markedly dilated and the size of the left atrium is normal. CS: coronary sinus; LS: Left superior pulmonary vein; RI: right inferior pulmonary vein.

Although radiofrequency catheter ablation of AFL occurring late after surgical ASD repair reported to be effective, there was a high late incidence of AF (30%) and its mechanisms were unknown [5]. The present case report would underscore the important contribution of PVs for occurrence of AF not only as a trigger but also a driver in our patient. Despite the presence of the dilated right atrium after the surgical repair of ASD and valvular pulmonary stenosis, the PVT originating from right PV may have played an important role in maintaining persistent AF in this young patient.

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