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Atrial flutter after surgeries of congenitally corrected transposition of great arteries in total visceral inversion

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1 | INTRODUCTION

The number of patients with adult congenital heart disease (CHD) is rapidly increasing. Furthermore, the incidence of heart failure and arrhythmia has increased. Even after treatment with appropriate medications and surgery, arrhythmia often recurs within 2 to 3 years. Catheter ablation would be a good treatment option; however, there are few reports of ablation for supraventricular tachycardia (SVT) in patients with congenitally corrected transposition of the great arteries (ccTGA), especially after tricuspid valve replacement. Herein, we present our experience of atrial flutter (AFL) after ccTGA in a patient with total visceral inversus.

2 | CASE DESCRIPTION

A 51-year-old-man with ccTGA and visceroatrial situs inversus, D-loop ventricles, and D-transposition of the great arteries was referred to our department for palpitations due to SVT. At age 8, he underwent atrial and ventricular septal closure as a functional repair. Beginning in his late 40s, he experienced dyspnea with exertion. Echocardiography showed anatomical right heart failure, tricuspid regurgitation, aortic regurgitation, and persistent atrial fibrillation. At age 50, an artificial tricuspid valve was placed, and the aortic valve was repaired, adding a biatrial maze procedure. An incision was made from the superior vena cava to the inferior vena cava (IVC), and the transverse incision was extended to the mitral annulus in the posterior wall. A cardiac resynchronization therapy pacemaker was implanted with epicardial leads (Figure 1A). Three months after the surgery, he experienced palpitations, and electrocardiography showed SVT with biventricular pacing (Figure 1B). Pacemaker interrogation showed that the pacing mode was switched to DDIR due to SVT. Ablation was performed using CARTO3 system. A Fast-Cath Trio introducer (AF Division, Abbott, Minneapolis, MN) was inserted from the right femoral vein, and an 8-Fr long sheath (SL0; Abbott) and an Agilis NxT steerable introducer (Abbott) were inserted from the left femoral vein. A quadrupole electrode catheter was placed in the high right atrium and used as a reference for electroanatomical mapping. A PentaRay mapping catheter (1 mm electrode size, 2-6-2 mm spacing; Biosense Webster, Irvine, CA) was inserted into the right atrium. An activation map was created, which showed a macro-reentry circuit with clockwise rotation around the mitral valve (Figure 2). The intracardiac electrocardiogram (ECG), with an EPstar Snake eicosapolar electrode (Japan Lifeline, Tokyo) placed in the mitral annulus, also confirmed that it was AFL rotating along the mitral annulus (Figure 3). Postpacing intervals were measured at the various points on the mitral annulus and a macro-reentry around the mitral annulus was confirmed. Linear ablation between the mitral annulus and the IVC was performed to terminate AFL. We confirmed the bidirectional block after the termination of tachycardia. There has been no recurrence of AFL for more than 1 year. The patient provided written informed consent for the treatment and the publication of this report.

3 | DISCUSSION

We report a case of AFL after the surgical repair of ccTGA. Although there are previous reports on patients with ccTGA {I, D, D}, they

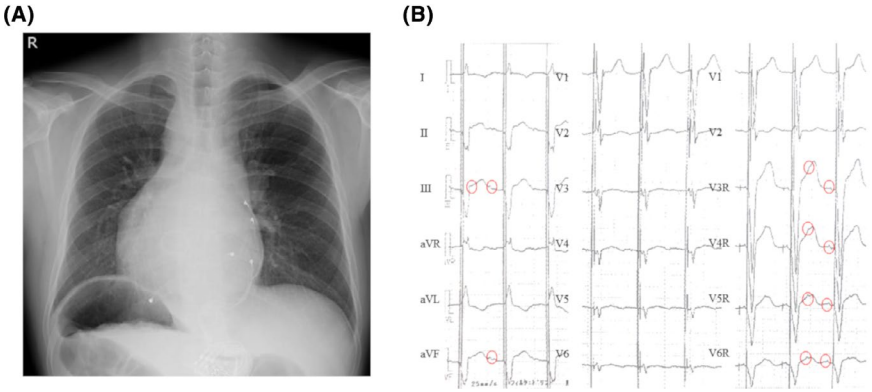

FIGURE 1 Electrocardiography and chest radiography. A: A chest radiograph shows visceral inversion, including the heart. B: P wave was positive in II, III, aVF, and V3–6 of the right-side chest leads, and the P rate was approximately 170 beats/min

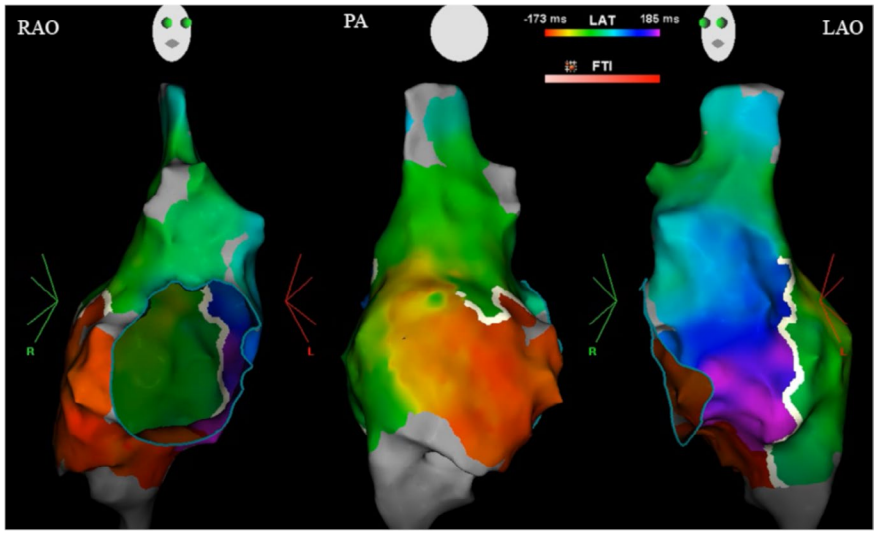

FIGURE 2 Activation mapping of CARTO system. The patient was diagnosed with atrial flutter, which turned the mitral annulus clockwise, as shown in the mapping performed using CARTO system. Tachycardia turns around the mitral valve, but it is considered that the part with a delayed conduction site turns the posterior wall of the left atrium. The white line is a visual representation of the conduction block between two adjacent points. LAO: left anterior oblique view, PA: posteroanterior view, RAO: right anterior oblique view

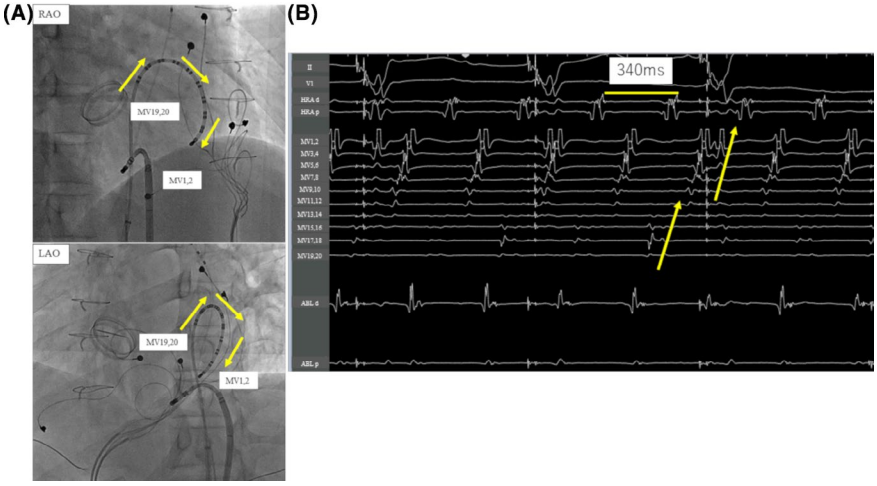

FIGURE 3 Intracardiac electrophysiology. Fluoroscopic view of intracardiac catheters. The yellow lines show the propagation of the excitation along the mapping catheter. B: Intracardiac electrocardiogram during tachycardia. Biventricular pacing was observed. AA interval was 340 msec

are all reports of AVNRT and AVRT with either atrial septal defect (ASD) repair only or no previous surgery; there are few reports on macro-reentry in the atrium. Our patient had ASD and ventricular septal defect repaired during childhood, and AVP, TVR, maze procedure, etc., were performed in adulthood, which results in a more complicated situation. Furthermore, a three-dimensional (3D) mapping system was used to diagnose AFL, which we were able to ablate successfully. Patients with CHD who have undergone an atrial incision may experience intra-atrial reentrant tachycardia after the surgery. Previous reports showed that tachycardia occurs in 30%–50% of the patients who have undergone Senning/Mustard or Fontan surgeries. Our patient did not undergo such operations, and the maze procedure converted persistent atrial fibrillation to sinus rhythm. Despite the surgery, the patient seemed to have a common type of AFL. The

reentry circuit was found along the mitral annulus. This phenomenon could be partly due to the enlarged right atrium caused by heart failure exacerbation and partly due to reconnection of the ablation line created in the surgery. Since atrial reentrant tachycardia associated with CHD has a slower atrial rate than that without anatomical abnormalities, 1:1 nodal conduction is likely to occur, resulting in a high risk of sudden death. In this patient, the F-F interval was 340 ms, which is slower than that of common AFL (around 200 ms). However, the presence of nodal conduction disturbance prevented rapid ventricular response. Intra-atrial tachycardia associated with CHD forms a complex reentry circuit because of the morphological abnormalities and the presence of surgical incision lines and scar tissue. Few reports of ccTGA cases have been published. It is difficult to estimate the origin of the tachycardia given the P wave morphology of surface ECG. Thus, a 3D mapping system is very useful for patients undergoing catheter ablation. Indeed, the success rate of ablation was low in the past, but it has improved considerably with the advent of 3D mapping systems. Although catheter ablation has come to play an important role in the treatment, the recurrence rate is still high and ventricular tachycardia occurs in some cases; thus, serial follow-up might be necessary.

In conclusion, we succeeded in the catheter ablation of mitral AFL using a 3D mapping system after the surgical repair of ccTGA.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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