Catheter ablation for atrial tachycardia and pacemaker implantation in a patient with tachycardia-bradycardia syndrome after mitral and tricuspid valve replacement and the maze operation

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ABSTRACT
Atrial tachyarrhythmias and sinus node dysfunction are not uncommon after maze operations. However, the procedures including catheter ablation and pacemaker implantation could be challenging if the patients underwent multiple-valve replacement and had electrically isolated atria.

Key words: atrial tachycardia maze operation catheter ablation pacemaker

Case
A 48-year-old woman with dizziness and palpitations since four months was referred to the arrhythmia service of our hospital. She underwent mitral valve replacement surgery with a mechanical valve in 1998 and tricuspid valve replacement (TVR) due to severe tricuspid regurgitation in 2007. Operation procedures were leaflet preserving TVR, modified Cox maze III procedure with cryoablation, internal obliteration of the left atrial appendage, and left atrial reduction plasty. ECG and Holter recordings revealed that most of the patient’s rhythm was atrial tachycardia (AT) with 1:1, 2:1 or 4:1 conduction and her dizziness was associated with occasional sinus arrest following AT termination (Figure 1). AT was resistant to a full doses of amiodarone, thus we decided to perform catheter ablation as well as a pacemaker implantation. AT was macroreentrant tachycardia with a clockwise rotation around the mitral valve annulus. The ablation line was created in the posterolateral mitral isthmus between the left pulmonary vein-side maze operation line and the mitral valve annulus (Figures 2A and 2B). AT was terminated during ablation (Figure 2C) and a bidirectional conduction block was confirmed. After termination of AT, the patient’s rhythm was junctional with a heart rate of less than 30 bpm, although the sinus node activation was observed. The right atrium was electrically isolated, probably due to maze operation lines and multiple atrial scars. Pacing in the right atrium was impossible and stimulation at the peri-mitral area of the left atrium, including the coronary sinus, only could pace the heart (Figure 3). Permanent pacemaker implantation was performed after ablation. Atrial lead placement was not considered due to the inability of pacing in the right atrium.
Ventricular lead was inserted into the great cardiac vein due to post-TVR status (Figure 4) during coronary sinus pacing backup because of marked bradycardia (15-20 bpm). After catheter ablation and pacemaker implantation, the patient did not complain of any palpitation or dizziness during the two-year follow-up period.
Discussion

Both atrial tachycardia/flutter and sinus node dysfunction are relatively common in patients after the maze operation. Atrial tachyarrhythmias occurred in 43% of the patients. Among them, 41% cases had atrial flutter with/without atrial fibrillation. When we consider the fact that the incidence of atypical atrial flutter after atrial fibrillation ablation is known to be 30–50%, then the number of cases after the maze operation seems to be lower. This would be related to the completeness
Figure 3. Atrial pacing after ablation heart. Left atrial pacing using the coronary sinus catheter with 600 ms of cycle length could be captured and pace the heart (A). Pacing using the electrode catheter placed in the right atrium could not be captured. The electrograms show capture failure of the right atrium with 550 ms of stimulation during left atrial pacing with 600 ms (B).
of lines for the conduction block.
Observation without pacemaker implantation may be possible in some patients after catheter ablation if their bradycardias are always associated with atrial tachycardia and if they have a relatively good sinus node function. To determine an appropriate management plan, ECG with normal range of heart rate should be carefully examined in these patients because the rhythm may not be sinus rhythm but atrial tachycardia with a relatively slow ventricular response (eg. 4:1 conduction) and the P waves might be very small and have a different morphology.

Permanent pacemaker needs in patients that underwent maze operations are known to be 3.9~5.8% in meta-analysis reports⁴ and slightly higher in classical cut-and-sew Cox maze III than in modified maze procedure using RF, microwave or cryoenergy.⁴ According to the report from Dr. Cox’s institution, the incidence of pacemaker implantation

Figure 4. Pacemaker implanted state. Chest X-rays after pacemaker implantation (A,B). ECG shows a well-functioning pacemaker (C).
after the original Cox maze III was 9/112 (8.0%) and 20/86 (23.3%) in lone maze and concomitant (eg. 39 cases of mitral valve surgery and 33 cases of coronary bypass surgery) maze procedures, respectively. In the cases with pacemaker implantation after concomitant maze procedures, 9/20 patients (45%) had preoperative diagnosis of sick sinus syndrome. Therefore, 55% of the patients had newly-developed sinus node dysfunction requiring a pacemaker after the maze operation.

The incidence of atrial tachycardia/flutter and sinus node dysfunction are common as described above and TVR is also concomitantly performed in some patients. Therefore, patients requiring the left ventricular lead may be not so rare. Continuous pacing during the procedure would be essential in some patients with marked bradycardia like in the present case. However, the electrode catheter placed in the coronary sinus could not be removed when there are no other suitable pacing sites in the right atrium. Therefore the present case was challenging with regards to inserting the cardiac-vein lead during coronary sinus pacing and keeping the position of the inserted cardiac-vein lead during the sheath and coronary-sinus electrode catheter removal. The other optional method for pacing during the procedure could be left atrial pacing via trans-septal puncture. However the stability of the pacing catheter might be weaker than the coronary sinus catheter. Catheter ablation could be considered after pacemaker implantation. In that case, manipulation of the mapping and ablation catheters and the coronary sinus catheter placement should be also very carefully performed to avoid dislocation of the cardiac vein lead.

References