Simultaneous conduction disturbance of an atrioventricular accessory pathway and nodal pathway after a mitral valve replacement: A case report

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Introduction

Although postsurgical atrioventricular (AV) block is a well-known complication of cardiac surgery,[1] a simultaneous conduction disturbance of an AV nodal and AV accessory pathway (AcP) is not common.

Case report

A 28 weeks pregnant 26-year-old woman had a fever and sore throat for which she was treated with antibiotics at a clinic. She had persistent symptoms for over a week, and hence she was referred to our clinic to perform examinations including echocardiography. The patient had been previously found to have preexcitation via an anteroseptal AcP on the electrocardiogram (ECG); however, she had never felt any palpitations before the presentation. She was evaluated and diagnosed as having infective endocarditis based on the presence of a vegetation detected on echocardiography and a positive blood culture growth of *Streptococcus viridans*. A mobile vegetation 20 mm in length was located on the middle portion of the posterior leaflet of the mitral valve. Untreated dental caries were deemed to presumably be the entrance of the pathogen. Her left ventricular function was within normal limits and no apparent dyssynchrony was detected by transthoracic echocardiography. Magnetic resonance imaging of the brain revealed multiple small high-intensity lesions. The potential risk of a large embolic stroke was considered to be high. Thus, an emergency cesarean section was successfully performed, followed by mitral valve surgery. Since the infection had spread to the posterior mitral valve leaflet and posterior annulus, a valvuloplasty was impossible. Therefore, a mitral valve replacement (MVR) with a bioprosthetic valve was performed. No intraprocedural electrophysiological mapping or interventions were performed because there was no history of any supraventricular tachycardia (SVT). Twelve days after the surgery, she reported having palpitations. A short RP′, narrow QRS SVT without any ventricular preexcitation at 160 beats per minute was repeatedly recorded during the palpitations (Figure 1A). The QRS had no delta waves but the P wave was distinct from the QRS during the SVT, as shown in Figure 1B. The morphology of the P wave during the SVT was different from that of sinus rhythm, whereas PR interval was similarly prolonged. Orthodromic AV reentrant tachycardia (AVRT), AV nodal reentrant tachycardia (AVNRT), and atrial tachycardia without any AcP conduction were considered in the initial differential diagnosis. The recent onset of the SVT may be explained by an incisional intra-atrial reentrant tachycardia related to the atrial surgical scar, while the absence of delta waves during the SVT also suggested AVRT or AVNRT. Her presurgical ECG exhibited a wide QRS complex accompanied by delta waves, of which the width was 131 ms. The polarity of the preexcitation

KEY TEACHING POINTS

- Atrioventricular conduction can often be affected by valvular interventions.
- A simultaneous conduction disturbance of both an atrioventricular accessory pathway and a nodal pathway after valvular surgery is rare.
- Underlying causes of a new supraventricular tachycardia may be estimated by reviewing the chronological alterations of the electrocardiogram during sinus rhythm.

KEYWORDS Atrioventricular accessory pathway; Atrioventricular conduction block; Atrioventricular reentrant tachycardia; Kent bundle; Mitral valve surgery; Wolff-Parkinson-White syndrome

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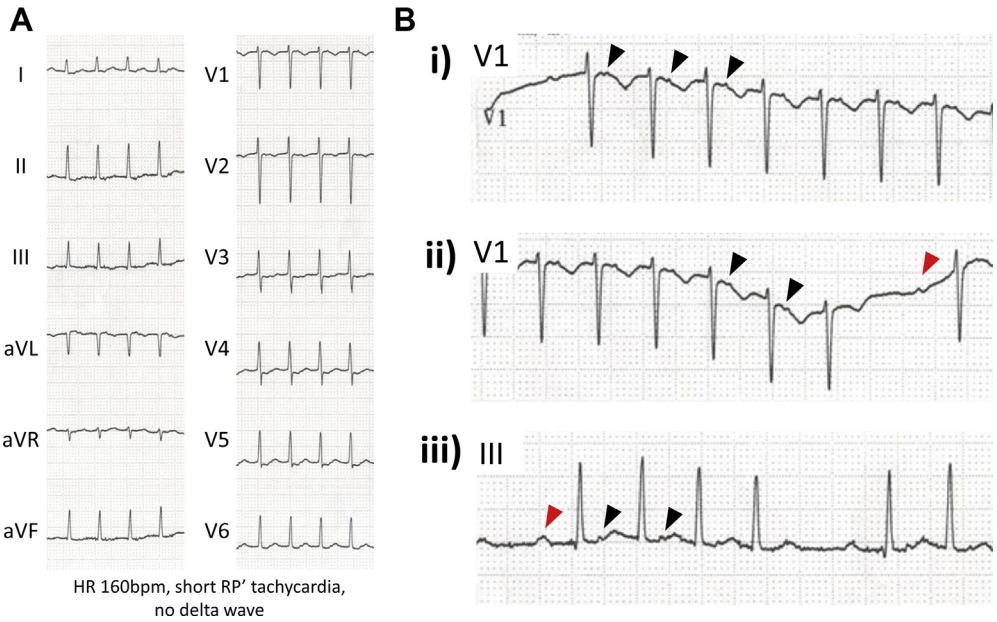

Figure 1 **A:** A narrow QRS supraventricular tachycardia (SVT) with a short RP′ interval at 160 beats per minute was observed 12 days after the surgery. **B:** Electrocardiograms showing (i) the onset of the SVT in lead V_1, (ii) the termination of the SVT in lead V_1, and (iii) a short SVT in lead III. The morphology of the P waves during the tachycardia (black indicator) differed from that during sinus rhythm (red indicator), whereas the PR interval was almost unchanged.

(negative in lead V_1, positive in aVF, and R/S ratio >1) suggested that the AcP was located on the anterior septum close to the native conduction system.[2] Although the presurgical 12-lead ECG showed only a fusion waveform of the conduction through both the AcP and AV node (Figure 2A), the postoperative ECG revealed both intermittent conduction through the AcP and a prolonged PR interval (270 ms) without any preexcitation (Figure 2B). In addition, the QRS accompanied by delta waves had a length of 154 ms, which was longer than that before the surgery. Her electrolyte levels were normal and no other metabolic abnormalities including hyperthyroidism were observed. Verapamil hydrochloride was intravenously administered, but an incessant SVT was still observed. Because the intravenous verapamil did not provoke any wide QRS tachycardia and beta-blockers are a class IIa indication for AVRT, oral bisoprolol fumarate 5 mg per day was started, which also did not completely suppress the SVT. She remained hemodynamically stable and the SVT was infrequent, so a catheter ablation was scheduled 6 months after the surgery. The PR interval had normalized at the time of the second admission (Figure 2C). The oral beta-blocker was discontinued a week before the procedure. In order to perform a cardiac electrophysiological study, 3 sheaths were introduced into her right femoral vein. Multipolar electrode catheters were positioned in the right atrial appendage, His bundle, coronary sinus, and right ventricular apex. The recordings of the His bundle and the right ventricle were obtained by 1 integrated catheter. Programmed atrial/ventricular stimuli revealed no antegrade/retrograde conduction via the AcP. The result of para-Hisian pacing also suggested that retrograde conduction was via the AV node. There was no evidence of AV nodal dual pathways. No sustained SVT was induced by atrial burst pacing and programmed stimuli, even after the administration of isoproterenol. Therefore, we assumed that AVNRT and atrial tachycardia were less likely to have existed. The possible diagnosis for the SVT was AVRT conduction through the AcP, which had gradually become dissociated owing to the MVR-related degeneration. Therefore, she received no additional therapeutic intervention and was discharged. During 8 months of follow-up, her ECG showed no preexcitation and she has been free from any palpitations, significant mitral regurgitation, and infection. In addition, the neonate grew up without major problems.

Discussion

To the best of our knowledge, there have been no previous reports that have demonstrated a spontaneous conduction disturbance of both an AcP and nodal pathway after cardiac surgery. In the present case, we found that (1) the antegrade conduction through the AcP had gradually become impaired after the procedure, (2) the prolonged native AV conduction had normalized during the remote phase of the surgery, and (3) SVT was observed for a limited period after the surgery.

According to postmortem pathologic investigations, the mechanisms of postoperative conduction block of native AV pathways are considered to be direct trauma (debridement, stitching), tissue remodeling (edema, hemorrhage), and ischemia.[3] The intraprocedural view during the MVR in the present case is shown in Figure 3A, where multiple sutures were observed on the left atrial septum. AV block after an aortic valve replacement usually appears immediately

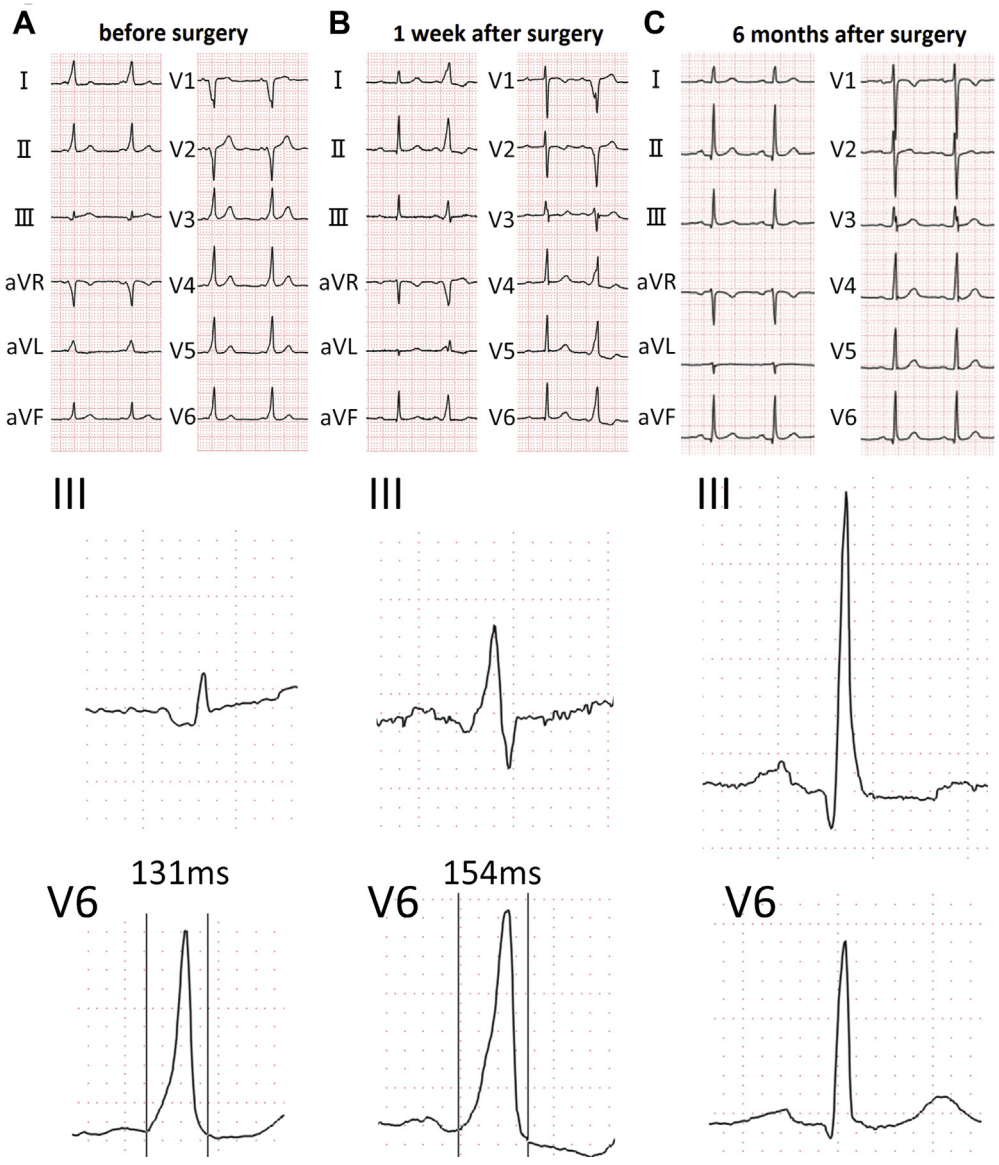

Figure 2 **A:** Preoperative electrocardiogram (ECG). Constant anteroseptal preexcitation was observed. The QRS width was 131 ms. **B:** Postoperative ECG. Intermittent conduction of the accessory pathway and a prolonged PR interval (270 ms) without any preexcitation were observed. The preexcited QRS had a length of 154 ms. **C:** No delta waves were observed and the PR interval normalized to 196 ms.

after the operation; however, it is reported that some cases exhibit AV block in the late postoperative period.[1] Some studies have reported AV block after an MVR.[4] In a prospective cohort of 1200 patients who underwent cardiac surgery, the incidence of AV block was similar between an MVR and aortic valve replacement performed as a therapy for infective endocarditis, whereas the odds ratio of an aortic valve replacement causing AV block was significantly the highest of the entire cohort.[1] In our case, the AcP was considered to be located on the anterior septum based on the preprocedural ECG, as shown in Figure 3B. There was no evidence of a septal mitral annular abscess, and hence, it was more likely that the block of the native AV pathway and AcP was due to the surgical intervention and the consequent tissue remodeling. Fortunately for the patient, the native AV conduction recovered, whereas the AcP conduction was completely blocked. Of note, the temporarily prolonged native AV conduction time may have provided an adequate excitable gap for the new onset of AVNRT/AVRT. Absence of AV dual nodal pathways may support AVRT. According to a previous report, a prolongation of the native conduction time owing to left bundle branch block could lead to the development of AVRT.[5] Since a significant percentage of postsurgical AV block can improve in the late phase, electrocardiographic follow-up may be suggested to see if the AcP spontaneously dissociates after an MVR.

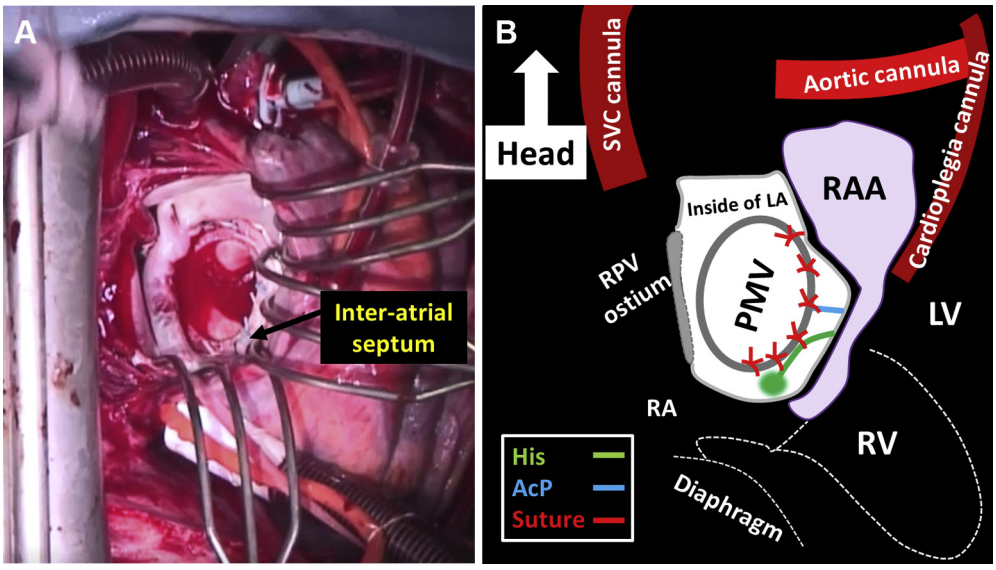

Figure 3 **A:** The intraprocedural scene immediately after the fixation of the prosthetic valve. The left atrial approach was performed between the confluence of the right pulmonary veins and interatrial groove. The interatrial septum is located at about 6 o'clock. **B:** A scheme to describe the orientation of the anatomy. The presumed location of the His bundle and accessory pathway (AcP) is shown by the green and blue lines, respectively. LA = left atrium; LV = left ventricle; PMV = prosthetic mitral valve; RA = right atrium; RAA = right atrial appendage; RPV = right pulmonary vein; RV = right ventricle; SVC = superior vena cava.

Conclusion

Spontaneous conduction block of an AcP that develops gradually is a rare phenotype of an electrophysiological disturbance after an MVR.

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