Precise mechanism of bradycardia after left atrial surgery using a superior transseptal approach

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Introduction

Bradycardia after left atrial surgery using a superior transseptal approach is common. However, the mechanism of bradycardia evaluated by electroanatomical mapping has rarely been reported.

Case report

An 80-year-old woman without any past medical history was admitted to our hospital for gradually deteriorating episodes of dizziness on exertion over 12 months. The electrocardiogram was normal. A left atrial myxoma was detected by transthoracic echocardiography and its size was 51 mm × 32 mm and was growing on the left atrial septum. With a superior transseptal approach, the myxoma was resected along with the atrial septum. The defect of the atrial septum was closed with a pericardial patch. The diagnosis of a myxoma was confirmed by histology. The electrocardiogram after surgery showed junctional rhythm with retrograde P waves and an incessant atrial tachycardia with negative P waves in leads II, III, and aVF. She suffered from fatigue during junctional rhythm and palpitations during atrial tachycardia (Figure 1). As the bradycardia and tachycardia persisted for more than 3 weeks after the surgery, we decided to perform an electrophysiologic study.

The coronary sinus potentials and posterior right atrial potentials were recorded with a duodecapolar catheter placed into the coronary sinus. A regular sinus rhythm (80 beats/min) potential was recorded on the posterior right atrial catheter. However, junctional rhythm with retrograde atrial potentials was observed on the coronary sinus catheter (Figure 2A). Then we performed pacing from the coronary sinus ostium. The coronary sinus was captured by pacing, and atrioventricular conduction was observed. Dissociated sinus rhythm potentials were still recorded on the posterior right atrial catheter during coronary sinus pacing. The existence of an intraatrial conduction block was suspected. Electroanatomical mapping during sinus rhythm was created using the CARTO 3 (Biosense Webster, Diamond Bar, CA). Sinus rhythm activation was observed in the right atrial lateral and posterior regions of the incisional line, including the sinus node (Figure 2B). However, a junctional rhythm activation was observed in the coronary sinus and on the right atrial tricuspid annulus side of the incisional line. Electroanatomical mapping during coronary sinus pacing was also created. Double potentials during sinus rhythm and a paced rhythm were recorded on the incisional line (Figure 3A). The coronary sinus and right atrial tricuspid annulus side of the incisional line were captured by coronary sinus pacing (Figure 3B). According to the activation map of the atrial tachycardia, a left atrial origin was suspected. The atrial tachycardia was suppressed by coronary sinus pacing. Therefore, ablation was not performed. The voltage map during coronary sinus pacing exhibited a normal voltage area of more than 1 mV on the lateral side of the tricuspid annulus. The pacing threshold of the normal voltage area was less than 1 V. A permanent pacemaker was implanted on a later date. The right atrial lead was placed on the lateral side of the tricuspid annulus using a locator stylet. The right atrial voltage was 1.5 mV and the pacing threshold was 0.625 V at 0.4 ms. The atrial tachycardia was suppressed after the pacemaker implantation. Her fatigue and palpitations disappeared after the pacemaker implantation.

KEY TEACHING POINTS

- The superior transseptal approach had a higher risk of clinically significant bradycardia after surgery.
- Intraatrial conduction block caused by the incisional line could be the mechanism of bradycardia after a left atrial surgery using a superior transseptal superior approach.
- The electrophysiologic study and electroanatomical mapping before pacemaker implantation were useful to determine the lead position, especially in the case where the existence of the intraatrial conduction was suspected.

KEYWORDS Bradycardia; Intraatrial conduction block; Left atrial surgery; Pacemaker; Superior transseptal approach
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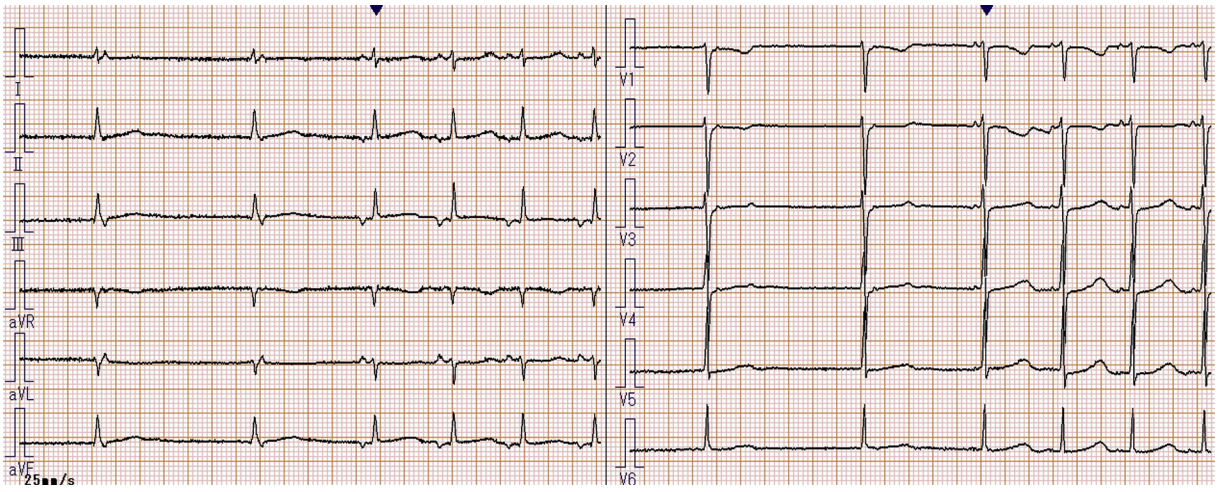

Figure 1 The electrocardiogram after surgery showing junctional rhythm with retrograde P waves and an incessant atrial tachycardia with negative P waves in leads II, III, and aVF.

Discussion

The precise mechanism of bradycardia after a left atrial surgery using a superior transseptal superior approach was revealed in this case report. Intraatrial conduction block caused by the incisional line was observed. There are 2 major approaches to perform left atrial surgery: a superior transseptal superior approach and a left atrial approach. The incidence of bradycardia after surgery has been reported. The superior transseptal approach was reported to have a higher risk of clinically significant bradycardia after surgery. Lukac and colleagues[1] reported 9 patients (6%) with a pacemaker implantation because of sinus node dysfunction and 8 (5.3%) because of atrioventricular block. Berdajs and colleagues[2] reported that the mechanism of the sinus node

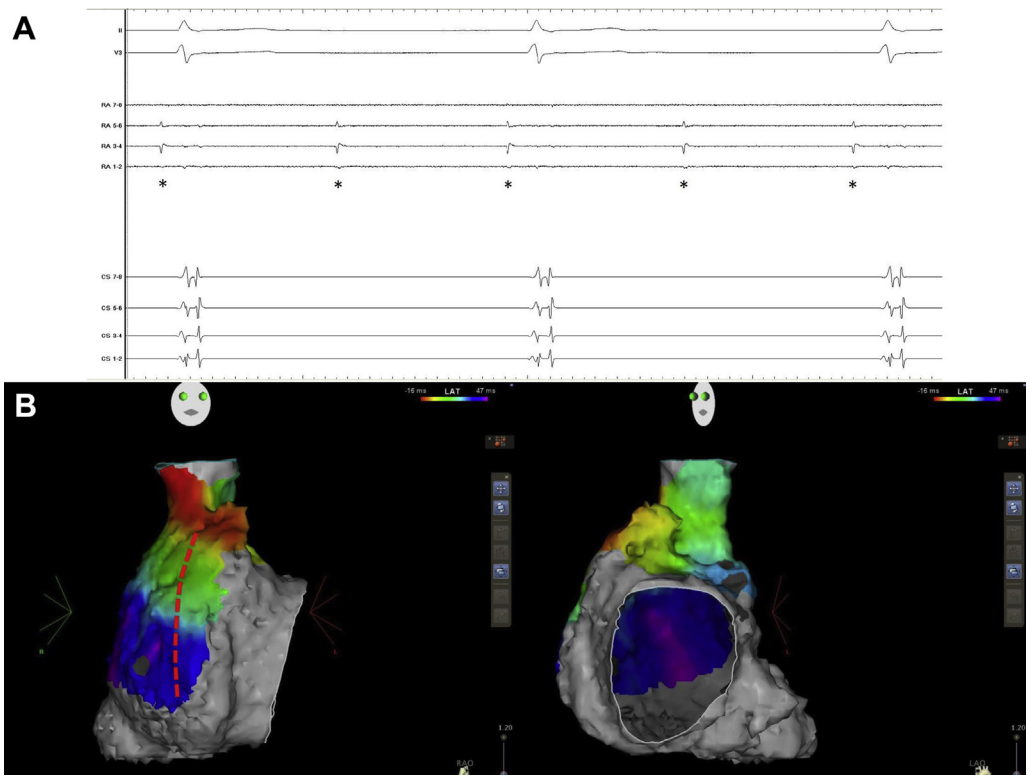

Figure 2 **A:** The coronary sinus potentials and posterior right atrial potentials were recorded. Regular sinus rhythm potentials at 80 beats/min were recorded on the posterior right atrial catheter (*). However, junctional rhythm with retrograde atrial potentials were observed on the coronary sinus catheter. **B:** Electroanatomical activation mapping during sinus rhythm was created by using the CARTO 3 (Biosense Webster, Diamond Bar, CA). Sinus rhythm activation was observed in the right atrial lateral and posterior regions of the incisional line, including the sinus node. The *red dotted line* indicates the incisional line.

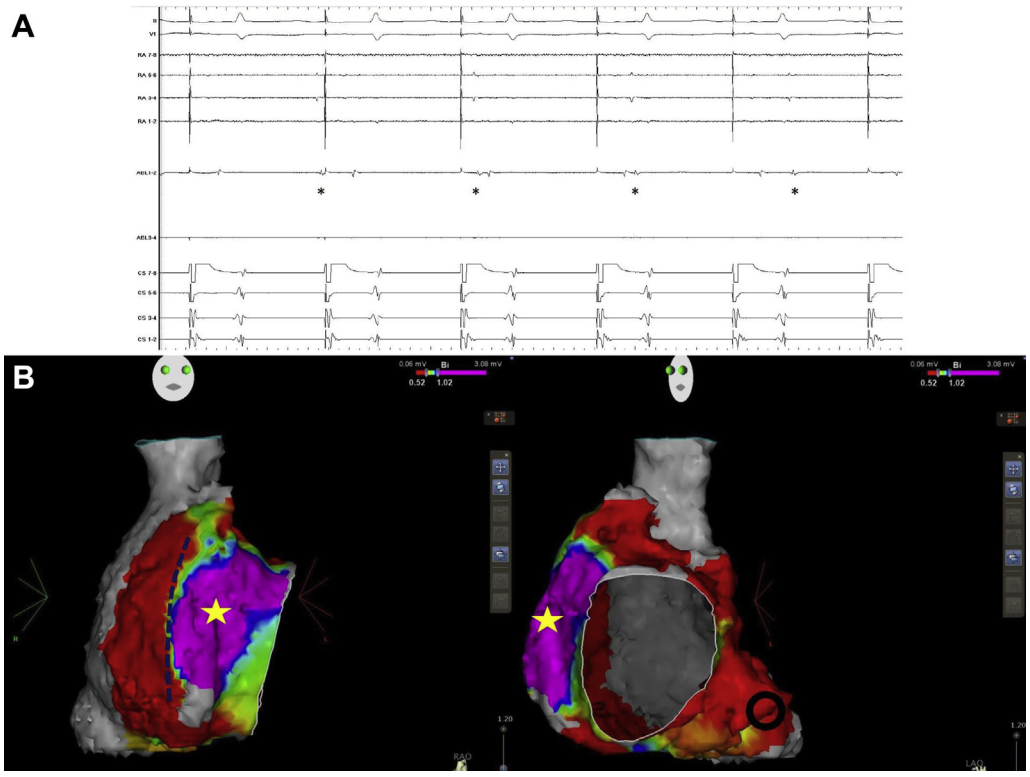

Figure 3 **A:** The intracardiac electrograms were recorded during coronary sinus ostium pacing. The coronary sinus was captured by the pacing and atrioventricular conduction was observed. Dissociated sinus rhythm potentials were still recorded on the posterior right atrial catheter during coronary sinus pacing. Double potentials during sinus rhythm and a paced rhythm were recorded on the incisional line (*). **B:** Electroanatomical voltage mapping during coronary sinus pacing was created. The coronary sinus and right atrial tricuspid annulus side of the incisional line were captured by the coronary sinus pacing. The *purple area* represents a normal voltage (>1.0 mV). The *red area* is a low-voltage area (<0.5 mV). The *black dotted line* indicates the incisional line. The *black circle* indicates the pacing site. The *yellow stars* indicate the targeted right atrial lead position.

dysfunction was thought to be injury to the sinus node artery. However, intraatrial conduction block is caused by another mechanism during surgery with the superior transseptal approach. It is difficult to distinguish sinus node dysfunction from intraatrial conduction block by means of the surface electrocardiogram. Electroanatomical mapping was useful to determine the right atrial lead position. If the right atrial lead was blindly placed close to the sinus node, atrial pacing could fail and a pacemaker implantation might be very difficult. Pacemaker lead positioning depending on the prior surgical procedure is required.

Conclusion

Intraatrial conduction block caused by the incisional line was the mechanism of bradycardia after a left atrial surgery using a superior transseptal superior approach in our case.

References

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