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CASE REPORT

Marked ST-segment elevation during permanent pacemaker implantation

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Key Clinical Message

Some acute complications are known during permanent pacemaker implantation such as pneumothorax, lead perforation, lead dislodgement, and hemorrhage. ST-segment elevation in electrocardiogram during implantation is rare, but it might indicate critical complication like myocardial ischemia or ventricular perforation. Physicians should pay attention about ST-segment change during pacemaker implantation.

Keywords

Current of injury, myocardial ischemia, permanent pacemaker implantation, ST-segment elevation, ventricular perforation.

Case Presentation

A 72-year-old woman presented to our department with symptomatic sick sinus syndrome. She experienced recurring syncope due to bradycardia, and electrocardiography (ECG) indicated a 4.5-second-long pause. She had no history of cardiac disease or surgery. Hence, she was scheduled to undergo DDD pacemaker implantation. During surgery, the left subclavian vein was punctured under ultrasonographic guidance and a sheath was inserted. Then, a right ventricular (RV) lead (Tendril MRI LPA1200M-52, St. Jude Medical) was inserted and placed on the ventricular septum; we checked the lead position in the left anterior oblique (LAO) projection. Moreover, we ensured that R-wave sensing, capture threshold, and impedance were appropriate (no data recorded). Then, we extended the screw to stabilize the lead. After 2 min, we observed that the ST segments were elevated in the V1–V4 leads (Fig. 1B), compared with the control ECG (Fig. 1A). However, she did not have any chest pain or discomfort, and her blood pressure was stable. Moreover, transthoracic cardiac echocardiography did not show any wall motion asynergy or pericardial effusion. The ST-segment elevation diminished during transthoracic cardiac echocardiography. After 5 min, we found that the ST segments were elevated again, which was sustained for approximately 60 sec. Thus, the RV lead was removed by screwing back the helix. Then, we placed the RV lead in the apex and screwed it in again. At this point, pacemaker implantation was completed. After replacing the RV lead, we did not observe any changes in the ST segments. Moreover, transthoracic cardiac echocardiography did not indicate any wall motion asynergy or pericardial effusion after implantation, and her plasma troponin level was not elevated.

Discussion

Some complications related to RV lead insertion and stabilization are well known, including right heart perforation, lead displacement, and migration in the coronary sinus, but ST-segment elevation during RV lead implantation is rare. In the present case, the ST segments (V1–V4) were found to be significantly elevated immediately after screw extension; removal of the lead diminished the ST-segment change. Even though the underlying cause was

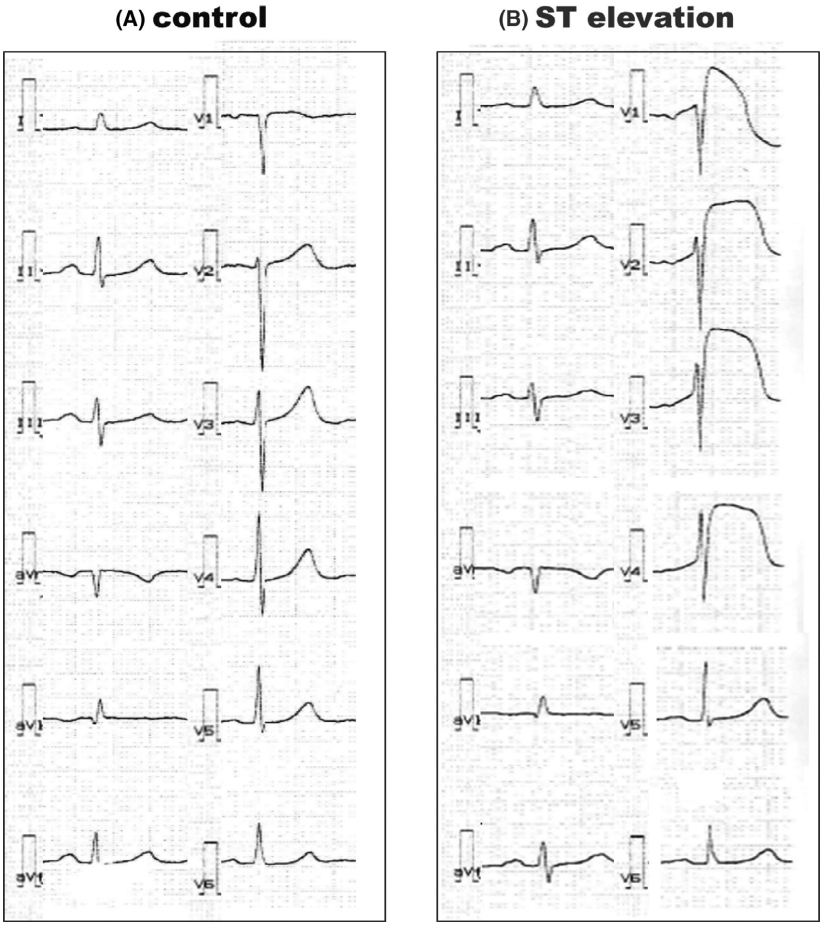

Figure 1. (A) Control electrocardiogram at the start of surgery. (B) Twelve-lead electrocardiogram during permanent pacemaker implantation, showing marked ST-segment elevation in segments V1–V4.

unclear, we speculated on the following possibilities. The most likely explanation is that the RV lead perforated the RV wall and that the extended screw stimulated the epicardium or accidentally the RV lead contacted precordial ECG leads. A previous case report [1] described focal ST-segment elevation in a patient with epicardiac pacing after cardiac surgery. The authors reported that a similar change was observed on direct epicardial ECG. Thus, they concluded that the pacing wire caused the current of injury and ST-segment elevation seen on surface ECG. During pericardiocentesis, the needle for centesis is connected to the precordial lead of the electrocardiogram [2]. Therefore, when the needle touches the myocardium, the ST segment of the electrocardiogram will be elevated due to the current of injury. In the previous case report, ECG was recorded directly from an epicardial lead. In our case, we speculated that the pacemaker lead perforated the RV wall and might have contacted the pericardium. Consequently, surface ECG detected the "epicardial current of injury" as well as the direct epicardial lead. Therefore, according to the focal surface leads, the ST segment was elevated without reciprocal changes. The epicardial current of injury can be caused by pericarditis or transmural ventricular ischemia. Although transmural ischemia is unlikely based on the presence of intact ventricular wall motion, it cannot be excluded completely due to the lack of reciprocal ECG changes. On the other hand, pericarditis can be excluded based on the clinical time course of ST-segment elevation and the lack of pericardial effusion.

A less likely explanation is that we extended the screw to the anterior wall, which is located between the septum and RV free wall; this could have compressed or caused a spasm in the left anterior descending (LAD) artery, which could have induced myocardial ischemia. Removal of the lead may have reduced such ischemia. The LAD artery runs along the epicardial surface of the heart within the interventricular groove, superficial to the interventricular septum. Several septal branches derived from the LAD artery are responsible for perfusing the septum. Hence, there is a risk that the pacemaker lead may be implanted

close to the LAD artery, which could cause spasm or compression of the artery [3]. Therefore, physicians should carefully ensure that the lead does not fix against the anterior wall. Use of the LAO view is recommended to differentiate the RV free, anterior, and septal walls during assessment of the lead tip position [4, 5]. In the present case, we confirmed the posterior orientation of the lead tip prior to screw extension. The 90° left lateral view also is recommended for this purpose [6].

In the present case, we could immediately detect an ECG change via monitoring of the precordial leads. However, we did not detect any remarkable changes in the limb leads. Thus, we believe there might be some cases in which ECG abnormalities are detectable only in the precordial or limb leads during pacemaker implantation. Therefore, 12-lead ECG monitoring during pacemaker implantation may be useful for physicians to avoid such complications as RV perforation and myocardial ischemia.

Conflict of Interest

None declared.

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