Myocardial Electrode Implantation by the Subxiphoid Approach Using a Heart Stabilizer

Takeshiro Fujii MD, Yoshinori Watanabe MD, Noritsugu Shiono MD, Hiroki Yokomuro MD, Tsukasa Ozawa MD, Nobuya Koyama MD
Toho University School of Medicine, Department of Surgery, Division of Cardiovascular Surgery

During implantation of a pacemaker into a 15-year-old male (height: 155 cm, weight: 65 kg) suffering from complete atrioventricular block, it was difficult to exteriorize the myocardium by approaching from below the xiphoid process so an operative field was obtained by using a heart stabilizer. A myocardial electrode was fixed after confirming stable circulatory dynamics with no arrhythmia and good R wave amplitude and pacing thresholds. As the heart stabilizer is now a vital device for off-pump coronary artery bypass (OPCAB), we consider that it will also become a useful device for procedures other than OPCAB in the field of cardiac surgery.


Key words: Subxiphoid approach, Myocardial electrode implantation, Heart stabilizer

Introduction
In surgery implanting a myocardial electrode from below the xiphoid process, the area of the myocardial surface to be exteriorized, is limited and it is sometimes difficult to find a region for implantation with good threshold values. Especially for patients who have entered puberty, it is impossible to expand the operative field sufficiently, even if an incision is added in the sternal region, because the sternum has less plasticity than patients still in childhood. We conducted implantation surgery by expanding the operative field using a heart stabilizer for off-pump coronary artery bypass to treat a patient for whom implantation was difficult by approaching from below the xiphoid process, and we report on it here.

Case
A 15-year-old male with a height of 155 cm and weight of 65 kg complained of malaise and visited our institution. The electrocardiogram indicated complete atrioventricular block (heart rate 39 bpm) on Wenckebach block (Figure 1A, B), chest radiography indicated a cardio-to-thoracic ratio of 43%, and echocardiography indicated an ejection fraction of 67.7%. The Holter electrocardiogram indicated a total heart beat of 6865 beats and max pause of 5.2 s at night (Figure 1C). We considered that permanent pacemaker implantation was indicated and discussed whether the pacing lead should be endocardial or epicardial, the mode single or dual chamber. Because of his age and expected growth and possible complication of endocardial approach, i.e., tricuspid regurgitation due to use of several pacing leads, we
considered a myocardial, single-chamber pacing system to be the best option.

We made an 8 cm incision on the skin around the xiphoid process of the patient under general anesthesia, removed the xiphoid process, and approached the anterior surface of the right ventricle by pericardiotomy. However, we deemed it difficult to place a myocardial electrode after identifying the atrioventricular groove and thick fat tissue (Figure 2). We thought that conventional devices were not enough to gain an operative field and therefore we pulled and fixed the exposed part of the myocardium anterior to the right ventricle, which could not be seen from the incision field, by using an Octopus 4.3 Stabilizer (Medtronic Inc. USA). Then, we stitched a Steroid Myocardial Lead (CapSure Epi bipolar; Medtronic Inc. USA) on the region where the R wave amplitude was 5.0 mV, the pacing thresholds were 1.7 V, 0.5 ms, 1055 ohm (Figures 3 and 4), and placed a generator (Kappa KSR403; Medtronic Inc. USA) at the left upper abdominal quadrant. At 1 week after the surgery, the R wave amplitude was 5.6–8.0 mV and the pacing thresholds were 1.5 V, 0.5 ms, 461 ohm, these being normal values.

Discussion

For surgical procedures for myocardial electrode implantation into patients during childhood, median sternotomy, subxiphoid incision (incision just below
the xiphoid process,\textsuperscript{1)} left anterolateral thoracotomy,\textsuperscript{2)} partial sternotomy, etc have been reported, but it is suspected that these approaches cannot be applied to adolescent patients because they have less plasticity of the sternum and ribs than children and it is difficult to obtain a sufficient operative field. Especially, during the subxiphoid approach, due to the insufficient operative field it is often difficult to implant an electrode into the region with good threshold values. In this case it was difficult to expose the anterior surface of the right ventricle and it was impossible to gain stable threshold values in threshold measurements until we used the heart stabilizer.

The heart stabilizer we used in this case is an essential device for Off-Pump Coronary Artery Bypass (OPCAB) and its usefulness is well understood by cardiac surgeons who use it on a daily basis.\textsuperscript{3)} By using this device, we can obtain a sufficient the operative field from a small incision while keeping circulatory dynamics stable and without inducing myocardial failure or even arrhythmia.

As for the pacing mode in this case, ventricular pacing by a myocardial electrode was adopted, because 1) Complete atrioventricular block on Wenckebach block from bedtime to early morning was demonstrated; 2) the patient was an adolescent; and 3) atrial and ventricular pacing was considered to be necessary for a long time, but there was a possibility that a lot of unnecessary leads would remain inside the blood vessels and hearts. The pacing rhythm after setting pacing rate at 60/min was 30\%, mainly during the night.

In conclusion, as the heart stabilizer is now a vital device for OPCAB, it is expected that it will become a useful device also for procedures other than OPCAB in the field of cardiac surgery.

References