Case Report

Retaining of PTCA guide wire in the left ventricular lead and subsequent application of epicardial electrode when CRT-D implantation in a patient with severe heart failure and persistent left superior vena cava: a case report

Pei-Pei Hou, Yu-Hong Liu, Hai-Bo Qu, Jin Meng, Qiang Li, Zhi-Lin Miao

Heart Center, The People’s Hospital of Liaoning Province, Shenyang 110016, P. R. China

Received May 28, 2015; Accepted July 20, 2015; Epub August 15, 2015; Published August 30, 2015

Abstract: Objective: One patient with severe heart failure (LV 92 mm, EF 28%) was treated by cardiac resynchronization therapy (CRT). Method: During the operation, it was found that double superior vena cava coexisted, and selective coronary venography cannot clearly show every branch. It was difficult to push ventriculus sinister electrode to sideward vein, so the electrode was released to far end of frontal septal branch along great cardiac vein. Result: However, because of insufficient braced force of ventriculus sinister electrode, 0.014 PTCA guide wire was detained in the electrode. 2 years later, two spots of PTCA guide wire retained in ventriculus sinister electrode broke in atrium dextrum, so the implantation of epicardial electrode was conducted. Conclusion: After the operation, heart failure was relieved. After 43 months, the battery of pacemaker depleted, so the pacemaker was changed. The effect since follow-up visit was good, LV decreased to 86 mm, EF increased to 32%, and SPWMD time limit shortened from 147 ms to 45 ms. The therapeutic experience of this patient indicated that the effect of detaining PTCA guide wire to enhance braced force in implantation of ventriculus sinister is unreliable and inappropriate to be advocated.

Keywords: Cardiac resynchronization therapy, persistent left superior vena cava, PTCA guide wire, epicardial left ventricular lead

Case report

The 46-year male patient was admitted to the hospital on January 18th, 2011 for complaints of palpitation, hard breath for 4 months, and paroxysmal nocturnal dyspnea for one week. In recent 4 months, the patient showed flustered and hard breath after activity. He was diagnosed as “dilated cardiomyopathy and congestive heart-failure” by other hospital. His symptoms did not turn significantly better after taking inotropic support and diuretic therapy. In recent one week, hard breath exacerbated significantly accompanying with paroxysmal nocturnal dyspnea and inability of prostration. Physical examination: blood pressure: 90/70 mmHg, conscious mind, and sitting position; bubbling sound could be heard at the bottom of both lungs; heart border expanded to the left, heart rate 98 times/min, regular heartbeat, and 3/6 level systolic murmur could be heard in apex of heart; liver enlarged to 3 cm lower of rib; both lower extremities showed mild pitting edema. The electrocardiogram showed sinus rhythm, complete left bundle branch block, and 197 ms of QRS wave width (Figure 1). Cardiac ultrasound showed LA 50 mm, LV 92 mm, and EF 28%; medium dose of regurgitation in valvula bicuspidalis and a little hydropericardium; 147 ms of septal to posterior wall motion delay (SPWMD), 229 ms of aortic pre-ejection interval (APEI), and 117 ms interventricular mechanical delay (IVMD). The cardiothoracic ratio in rabat was 0.81 (Figure 2). Dynamic electrocardiogram showed sinus rhythm, 95 times/min of average heart rate, 771 times of ventricular premature beat (VPB), one pair of ventricular couplet, and a burst of nonsustained ventricular tachycardia (continuous 8 ventricular beats). The patient walked 105 m in 6-minute walk.
test. Coronary arteriography on January 22nd, 2011 showed that the distal segment in left anterior descending branch of coronary artery narrowed by 60%. Diagnosis: dilated cardiomyopathy, whole heart failure, level IV cardio function, and arrhythmia (complete left bundle branch block, frequent ventricular beat, and nonsustained ventricular tachycardia). All these symptoms of this patient satisfied with adaptation of class I for CRT-D in 2008 Guidelines for Device-Based Therapy of Cardiac Rhythm [1] issued by ACC/AHA/HRS in May 2008. Therefore, treatment of cardiac effect, diuresis, and vascular dilation was given, and it was suggested to take implantation of CRT-D.

After successfully conducting left subclavian venipuncture on January 24th, 2011, it was found as persistent left superior vena cava (PLSVC) when sending guide wire. Then, after successfully conducting right subclavian venipuncture, it was found as double superior vena cava (DSVC) (Figure 3). It was difficult to conduct selective coronary venography along right subclavian vein, and all branches cannot be clearly shown. It was difficult to send 0.14 PTCA guide wire (Rinato, ASAHI INTECC CO., LTD., Japan) to sideward vein and send Medtronic 4193 along guide wire, so electrode was sent to the far end of frontal septal fasciculus along great cardiac vein. Left anterior oblique showed that the pace-making position was located on lateral wall of left ventricle, pacing threshold for test was 0.7 V, impedance was 846 Ω, R wave amplitude was 18 mv, and no diaphragm beat in 10 V pace-making. Medtronic 6944 defibrillation electrode was

Figure 1. Electrocardiogram in admission (January 18th, 2011).

Figure 2. DR diagram of chest PA in admission (January 18th, 2011).
sent to right ventricular apex along right subclavian vein, Medtronic 5076 electrode to the auricular appendix of atrium dextrum. When testing biventricular pacing, QRS wave narrowed. When removing the long sheath and guide wire of left ventricular electrode, the electrode dislocated repeatedly for the insufficient braced force of left ventricular electrode. At that time, the patient refused to take implantation of epicardial electrode, so 0.014 PTCA guide wire was retained in left ventricular electrode to fix the electrode and connect with Insync Sentry 7285 pacemaker (Medtronic Inc., U.S.A). After operation, the symptoms of chest distress and hard breath significantly improved, and the activity tolerance increased. One week after operation, cardiac ultrasound showed LA 45 mm, LV 91 mm, and a little regurgitation of valvula bicuspidalis; EF value increased to 33%; SPWMD shortened to 47 ms, APEI to 142 ms, and IVMD to 21 ms. The chest radiography showed the podoid shrunk, and pulmonary congestion reduced. The patient was not readmitted to the hospital for cardiac failure in half a year after operation.

In January 2012, the pacemaker alerted. Program control showed that the impedance of left ventricular electrode was larger than 2500 Ω, and the function of pacemaking and perception was normal. The electrode showed no dislocation and fracture under X ray, while the guide wire retained in left ventricular electrode was broken at two spots in atrium dextrum, which may cause electrode wear at these spots (Figure 4). In October 2012, the patient was readmitted to the hospital for chest distress, hard breath, and inability of prostration. Program control found that the pace-making function of ventriculus sinister electrode had lost, and the pacing electrocardiogram was the diagram of one right ventricle pacemaker (Figure 5). During AV extension, QRS download diagram occurred. Under X ray, two broken spots of 0.014 guide wire retained in left ventricular electrode could be seen in atrium dextrum, but the electrode did not break. After discussion, it was decided to put the left ventricular electrode aside, and conduct epicardial electrode implantation with heart beating under general anesthesia to implant Medtronic epicardial electrode on left ventricular lateral wall. The test parameters were good,
Cardiac resynchronization therapy for patient with severe heart failure

The implant was connected to the original pacemaker through the subcutaneous tunnel (Figure 6). After operation, the symptom of heart failure relieved, and activity tolerance significantly improved. In July 2014, the battery of pacemaker depleted in the examination of conventional follow-up, but the pace-making and perceptive parameters were good. The guide wire in original left ventricular electrode put aside had been broken under X ray (Figure 7). Medtronic Maximo II D284TRK pacemaker was replaced successfully, and the effect was good until now in follow-up visit. The patient can move 350 m in 6 min walk test, LV decreased to 86 mm, EF maintain at 32%, and SPWMD was 45 ms.

Discussions

With the gradually mature technology of cardiac resynchronization therapy (CRT), CRT has become an important method of non-medicine treatment for patients with cardiac failure in later period at present [2]. The key to CRT operation is the implantation of left ventricular electrode [3, 4]. Currently, the left ventricular electrode is always implanted into the far end of lateral branch [5] in coronary vein to make left
ventricular pacing. Affected by anatomical structure of precava, vessel arrangement and distribution of coronary vein, and if the arrangement is tortuous or not, the implantation of left ventricular pacing is sometimes difficult, and may even cause operation failure.

In this case, the coexistence of persistent left superior vena cava makes CRT implantation quite difficult. According to literature reports, normal left superior vena cava gradually closes in embryonic development, and finally imports into coronary sinus [6]. The left superior vena cava directly introduced into coronary sinus accounts for 0.5% in normal population [7]. Among these population, 10-15% have right superior vena cava absent. Generally, retrograded coronary venography is conducted by blocking off the trunk of coronary vein with coronary sinus radiography saccule to obtain a better image of every branch vein [8-10]. In this case, the patient cannot display coronary vein branch by conventional method for the return of left superior vena cava. If special big balloon block the left superior vena cava off, a better image can be obtained. By delay imaging of coronary arteriography, lateral branch of coronary vein can be seen. However, 0.014 PTCA guide wire was sent to lateral branch of coronary vein. Because the branch was small, 4193 left ventricular electrode was abandoned because it cannot enter into far end, and finally, it reached left ventricular lateral wall through great cardiac vein branch. In this case, PTCA guide wire was retained to fix left ventricular electrode because of the bad retention stability of left ventricular electrode and there was no other active electrode.

Following lessons are concluded according to this case:

1. Pace-making point of left ventricular electrode should be located in the most delayed part for left ventricular activation (lateral branch of coronary vein). In this case, however, the left ventricular electrode could not enter into the lateral branch of coronary vein smoothly (may be because this branch vein was maldeveloped and small). Finally, great cardiac vein branch reached to left ventricular lateral wall. QRS wave group narrowed by biventricular pacing, which verifies that this pace-making point is also the delayed part of left ventricular activation. It is remaindered that in CRT iatrotechnics, it should be considered that if the activated pace-making in delayed part can be reached through far end of other vessels without good lateral vessel selection to realize the function of free-running biventricular movement.

2. In this case, PTCA guide wire was retained to fix left ventricular electrode because of the bad retention stability of left ventricular electrode and there was no other active electrode. One year later, the left ventricular electrode alerted and impedance increased. Under X ray, the retained guide wire was curved in atrium dextrum and at the corner of entrance of coronary sinus. Considering that the guide wire wore the electrode, the electrode impedance increased. After 9 months, retained guide wire was broken at the corner under X ray, which may be related to long-term heartbeat. Therefore, the method of retaining guide wire in electrode is unreliable and inappropriate to be advocated. According to the case reports on CRT/CRT-D implantation
Cardiac resynchronization therapy for patient with severe heart failure

in coexisted persistent left superior vena cava, the implant was sent by traffic branch of persistent left superior vena cava and precava, or implanted in epicardium electrode cable by thoracotomy or thoracoscope [11-15]. If 4195 electrode of left ventricle was implanted by PLSVC and connected with the right side through subcutaneous tunnel, the stability of left ventricular electrode can be ensured and the risk brought by retained guide wire can be avoided.

3. The primary way to implant the left ventricular electrode by CRT is to send the implant into cardiac vein branch through coronary vein entry. This method is featured with small trauma, independent operation by cardiologists, and high success rate. However, about 2-10% patients cannot take the implantation of left ventricular electrode by vein because of individual difference of cardiac vein anatomical structure for congenital or acquired factors, including malformation of coronary vein open mouth, valve, obvious angle of target vein, small or absent target vein, instable fixation, high threshold, or diaphragm activation [16-18]. In this case, left ventricular electrode cannot be implanted by intervention after losing pace-making function. Therefore, epicardium electrode implantation was conducted immediately to implant epicardium electrode on side wall of left ventricular sinister to recover the pace-making function of left ventricular electrode, correct out-sync motion of left and right ventricle, and improve heart function of patients. In addition, the epicardium electrode guide wire can obtain better haemodynamic effects because the left ventricular electrode can be placed in the latest activation part shown according to ultrasound technology, etc. [19, 20] after thoracotomy. Therefore, epicardium electrode should be implanted by surgery when left ventricular electrode cannot be implanted by cardiac vein or reach appropriate pace-making position, or the pace-making parameters are not satisfied.

Disclosure of conflict of interest

None.

Address correspondence to: Zhi-Lin Miao, Heart Center, The People’s Hospital of Liaoning Province, Shenyang 110016, China. Tel: +86-024-24016226; E-mail: zhilinmiaodoc@yeah.net

References


Cardiac resynchronization therapy for patient with severe heart failure


[18] Larsen AI, Nilsen DW. Persistent left superior vena cava. Use of an innominate vein between left and right superior caval veins for the placement of a right ventricular lead during ICD/CRT implantation. Eur Heart J 2005; 26: 2178.
