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Case Report

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Implantation of Leadless Pacemaker in a Patient with Chronic Type A Aortic Dissection: A Case Report

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1. Abstract

1.1. Background: When implanted into a structurally normal heart, leadless pacemakers are more effective and safer than traditional pacemakers. There has been limited experience with leadless pacemakers in cases of severe right heart deformity.

1.2. Case Summary: We present a rare case of an 87-year-old female with deformed right heart caused by chronic type A aortic dissection (AD) implanted with a leadless Micra transcatheter pacemaker system. According to the preoperative CT image, the right atrium was compressed by the aortic aneurysm and the right heart rotating anticlockwise. The delivery system was adjusted repeatedly during the operation, and angiography confirmed that the delivery system was in the right ventricle before releasing the pacemaker.

1.3. Discussion: Having a good understanding of the cardiac structure is crucial to the safety of the operation. Cardiovascular perforation complications can be prevented with intraoperative angiography to determine the delivery system in the right ventricle before releasing the pacemaker.

2. Introduction

The Micra leadless pacemaker (Medtronic, Minneapolis, MN, USA) is a ventricular pacing system that was developed to overcome the limitations associated with conventional pacemakers, such as transvenous leads and the pulse generator pocket1. In recent years,there has been growing acceptance of leadless pacing as an alternative to traditional transvenous pacemakers in the treatment of bradyarrhythmia 2. Guideline recommends that leadless pacemakers may be an alternative to transvenous pacemakers in cases of limited upper extremity vein access or risk of device pocket infection2. A leadless pacemaker is efficient and safe when implanted in structurally normal hearts, compared with a traditional pacemaker. However, the implantation experience of leadless pacemakers in patients with a deformed right heart is limited. We present a case of the successful implantation of a Micra Transcatheter Pacing System in a patient with a deformed right heart caused by chronic type A aortic dissection (AD).

3. Case Report

An 87-year-old female was forwarded to our center due to a 2-day history of unexplained syncope. Her daughter told us that she had appeared in good condition and suddenly collapsed at home without any previous symptoms two days ago. The patient had been diagnosed with Alzheimers disease for 5 years. She had a 40-year history of hypertension and had been diagnosed with Stanford type A AD for 10 years, but she refused to undergo surgical treatment.She usually took valsartan (80mg/QD), atorvastatin(20mg/QD) and aspirin(100mg/QD). Holter monitoring documented frequent sinus pauses with a maximum pause duration of 3550 ms. The echocardiography revealed a dilatation of the ascending aorta and spontaneous thrombosis of the false lumen, with a measured ejection fraction of 58%. The contrast-enhanced computed tomography showed the dissection aneurysm at the root of the ascending aorta with a maximum diameter of 7.2cm, which compressed the right atrium, resulting in a small right atrium and clockwise

rotation of the right heart. Laboratory values were: serum troponin 18.9(normal 0-14ng/L), serum creatinine 85.00(normal 37-110 μmol/L), eGFR 53.24 (normal 56-122mL/min/1.73m2) and D-dimers 10.77 (normal<0.55mg/L).

Type A Stanford AD is a life-threatening emergency in the acute phase, but can become chronic after 90 days3. The current clinical guidelines recommend that surgical repair is appropriate when the diameter of the aortic aneurysm reaches 5.5 cm in chronic type A AD3. However, the patient and her family refused to undergo a surgical repair. Treatment with beta-blockers is the mainstay of first-line medical therapy for patients with AD4. Therefore, implantation of a permanent pacemaker was the better option for our patient with sick sinus syndrome, whose heart rate would be further reduced using beta blockers. Due to advanced age and complex comorbidities, the traditional pacemaker could increase the risk of infection, so our patient and her family finally chose to implant a leadless pacemaker.

The procedures were done under local anesthesia in a cardiac catheterization laboratory. According to the manufacturer's recommendation, implantation was performed through the right femoral vein. After successful puncture, the femoral vein was gradually dilated, and then a 27-Fr introducer was utilized to access the right atrium via the femoral vein. Through the introducer, the delivery system and device were advanced and positioned in the right heart. To confirm the correct apposition of the delivery catheter in the right heart, the contrast agent was routinely administered. An angiography of the left anterior oblique showed that the pacemaker was firmly adhered and pointed towards the ventricular septum, but the contrast agent was backflowing and there were no muscle trabeculae. Therefore, the delivery system was suspected not in the right ventricle but in the coronary sinus or in the right atrium. The delivery system was repositioned, and the contrast agent was also found to be backflowing in the left anterior oblique angiography. At the same time, an image like a coronal sinus was observed with backflow of contrast agent under the left anterior oblique. Considering that the patient's preoperative CT image, we thought that the delivery system was still not in the right ventricle. Attempt to access the right ventricle across the tricuspid valve again by repositioning the delivery system from a lower position. The angiography of the left anterior oblique and anteroposterior views showed the pacemaker was well adhered to the myocardial wall, and the nearby muscle trabecula were abundant, which confirmed that the delivery system was in the right ventricle. Then the delivery catheter was withdrawn several centimeters, and the fixation was verified by a 'pull and hold' test. At the time of implantation, the pacing threshold was 0.25 V @ 0.24 ms, the sensing was 2.8 mV and the impedance was 840 Ohm. The tether and delivery system were removed after adequate electrical measurements had been obtained. The patient was discharged after 2 days without any complications.

The patient did not experience syncope at 1 month's follow-up. She had no complications related to the leadless pacemaker, and pacing parameters were stable (impedance, 660 Ohm; R wave, 16.7 mV; and threshold, 0.5 V at 0.24 ms).

4. Discussion

This is the first case reported of successful implantation of a leadless Micra pacemaker in a patient with chronic type A AD, whose right atrium was compressed by the dissected aneurysms at the root of the ascending aorta and right heart was rotated clockwise.

The leadless cardiac pacing system has emerged as an attractive therapeutic alternative to conventional transvenous pacing systems that offer bradyarrhythmia patients a treatment option [5]. It has been well demonstrated that leadless pacemakers are safe [6,7], but there is little experience with implanting and delivering leadless pacemakers to patients with a deformed right heart. In this case, preoperative dissection artery CT showed that a huge dissection aneurysm at the root of the aorta compressed the right atrium, which resulted in a small right atrium and the right heart rotating anticlockwise, making it difficult to manipulate the delivery system through the tricuspid valve and find appropriate right ventricle pacing. At the beginning of the operation, the contrast agent was not flowing to the pulmonary artery and had reflux. Thus, the delivery system suspected to be in the right atrium or coronary sinus. Before releasing the pacemaker, the delivery system was adjusted repeatedly until it was accurately placed in the right ventricle.

The incidence of major complications is low in the Micra transcatheter pacing system, but cardiac perforation remains a major safety concern [7,8]. According to a meta-analysis of 28 clinical studies involving 60744 patients, the incidence of complications from perforation and pericardial effusion with conventional pacemakers was 0.82%, and 1.52% with leadless pacemakers [9]. Study has shown that implantation of leadless pacemaker in the ventricular septum can effectively avoid cardiac perforation [10-12]. However, Implanting a leadless pacemaker in a heart with a deformed right heart is challenging because it is difficult for the delivery catheter to cross the tricuspid valve to the right ventricle. Chen X et al. reported a case of cardiac perforation caused by accidently placing a Micra transcatheter pacing system into the coronary sinus in a patient with low body mass index [13]. Our case highlights that [1]. A comprehensive comprehension of the cardiac structure is imperative for ensuring the safety of the operation [2]. The use of intraoperative angiography to determine the delivery system in the right ventricle before releasing the pacemaker can effectively avoid the occurrence of cardiac perforation complications. Successful application of preoperative imaging and intraoperative angiography can help patients with a deformed right heart implant Micra leadless pacemakers.

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