CASE REPORT

Temporary leadless pacing in a patient with severe device infection

Alexander Kypta,¹ Hermann Blessberger,² Michael Lichtenauer,³ Clemens Steinwender²¹Cardiovascular Division, Linz General Hospital Johannes Kepler University School of Medicine, Linz, Austria²Linz General Hospital Johannes Kepler University School of Medicine, Linz, Austria³Clinic of Internal Medicine II, Paracelsus Medical University of Salzburg, Salzburg, Austria

Correspondence to

Dr Alexander Kypta, alexander.kypta@gmail.com

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SUMMARY

A 64-year-old patient underwent implantation of a transcatheter pacing systems (TPS) for severe lead endocarditis. The patient experienced fever after a dental procedure. On the transoesophageal echocardiogram (TEE), vegetations were attached to the leads. Because the patient was pacemaker dependent, a temporary pacing lead had to be placed. After removal, however, he did not improve. A second TEE showed new vegetations. Ventricular fibrillation occurred spontaneously; so isoprenaline had to be stopped and a new lead was implanted. Vegetations appeared soon after the new temporary lead was placed. We used a TPS as a bridging device, followed by implantation of a resynchronisation system, and explantation of the TPS. After the Micra TPS was implanted, the patient recovered noticeably. All inflammation parameters were negative and an additional ¹⁸F-fluorodeoxyglucose-positron emission tomography/CT imaging also proved to be negative. So a CRT-D device was then implanted, and the TCP was removed.

BACKGROUND

This is the first report of a patient with severe device infections who received a leadless pacemaker after system explantation as a bridging device.

We think this case is interesting for device specialists as it shows the benefits of this new technology in this special patient group who are not easy to handle in clinical practice.

The technology of leadless pacemakers is innovative and very effective. It offers device specialists new possibilities to treat their patients.

CASE PRESENTATION

The technology of transcatheter pacing systems (TPS) has recently been introduced for clinical investigation to overcome pocket-related and lead-related complications frequently associated with conventional pacing systems.^{1–3} The Micra TPS is a 0.8 cc, 2.0 g capsule with 25.9 mm in length and an outer diameter of 6.7 mm that has features of a single-chamber pacemaker system. It is implanted in the right ventricular apex via a steerable transfemoral catheter delivery system using a 23 French introducer.

We report the case of a 64-year-old patient who underwent implantation of a transcatheter pacing system (Micra, Medtronic Inc, Minneapolis, Minnesota, USA) for recurrent severe lead endocarditis. The patient had previously undergone heart surgery with implantation of a biological aortic

valve due to aortic stenosis and coronary artery bypass grafting in 2012. In the aftermath of the surgery, the patient developed a total atrioventricular-block, and so a dual chamber pacemaker was implanted. The implantation procedure and the further clinical course were uneventful.

In January 2016, the patient experienced fever of 40°C with severe chills after a dental surgical procedure. He was referred to our institution for transvenous lead and generator removal because of suspected lead infection. Clinically, there was evidence of a systemic infection. On admission, the patient had a shortness of breath, diffused abdominal pain, and an altered mental status. Laboratory results showed elevated inflammation markers (C reactive protein (CRP), leucocytes) as well as a decreased platelet count. Urine output was severely reduced (mL/24 h) with correspondingly elevated retention parameters (Crea/glomerular filtration rate). Blood cultures proved positive for *Haemophilus aphrophilus*. On the transoesophageal echo, multiple vegetations of up to 10 mm in size were attached to the pacemaker leads (figure 1). All these findings mandated a full device removal. As the patient was pacemaker dependent with an escape rhythm of 20 bpm only, a temporary pacing lead was placed via the jugular vein into the right ventricle before the planned lead extraction through removal of the device.

Then, the dual chamber pacemaker system was explanted under general anaesthesia in a cardiothoracic operating room, with a cardiopulmonary bypass pump on standby. After skin dissection, box removal and lead exposure, a lead-locking stylet Liberator (LR-OFA01 Liberator Locking Stylet, Cook Medical, Bloomington, Indiana, USA) was introduced into both leads followed by the use of a mechanical rotation extraction device Evolution (Cook Intravascular Inc, Leechburg, Pennsylvania, USA). The Evolution system, which uses no electricity and is hand-powered, consists of an outer and inner sheath fitted with a stainless steel tip at its distal end, and is connected to a handle and trigger that rotates it. With this technique, the ventricular anchor lead as well as the atrial lead could be completely extracted.

After device and lead removal, the patient's clinical status did not improve. As inflammation parameters remained elevated, another TEE was performed. This second TEE examination confirmed the strong suspicion of new vegetations being attached to the temporary pacing lead. We now sought to remove the temporary pacing lead

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Figure 1 Echo showing vegetation attached to pacemaker leads (arrow points to vegetation). LA, left atrium; RA, right atrium.

as it was a new source of systemic infection. Therefore, the patient was set on a continuous isoprenaline infusion in order to generate a stable escape rhythm. As a stable escape rhythm of 50 bpm could be maintained on isoprenaline, it was possible to remove the temporary lead.

Twelve hours after initiation of the isoprenaline infusion, ventricular fibrillation occurred spontaneously which could be terminated with an external defibrillator. As we had to immediately stop the catecholamine infusion at this point, a new temporary pacing lead was implanted into the right ventricle via the right groin.

Unfortunately, vegetations again appeared 2 days after the new temporary lead was placed. The physical as well as the mental status of the patient further deteriorated. In our opinion there were two remaining options left to treat this patient:

Option #1: Epicardial leads (left atrial, left and right ventricular) could have been implanted through two mini-

Figure 2 PET scan showing no evidence of infection around the implanted TPS (Arrow points to Micra). PET, positron emission tomography; TPS, transcatheter pacing systems.

Figure 3 Ventricular ICD lead, coronary sinus lead and snared TPS. ICD, implantable cardioverter defibrillator; TPS, transcatheter pacing systems.

thoracotomies with a new pacemaker generator in the left pectoral position. The disadvantage of this procedure would have been a loss of defibrillator function.

Option #2: Use of a TPS as a bridging device in a first step, followed by implantation of a resynchronisation system (cardiac resynchronisation therapy-defibrillator (CRT-D)), and explantation of the TPS in a second step after proved absence of infection.

After discussing the case with our heart team and in awareness of the previous history and the clinical presentation we decided to go in for option #2.

The TPS was implanted on the mid-ventricular septum from a femoral approach using the TPS introducer and delivery system. The implantation went smoothly with good electrical parameters. The sensing amplitude shows an R wave of 10.2 mV with a pacing threshold of 0.38 Volts.

In the following weeks, the patient recovered noticeably. After 1, 2 and 4 weeks all inflammation parameters (CRP, differential blood count) as well as blood cultures were negative. To definitively exclude the presence of ongoing infection, an ^{18}F -fluorodeoxyglucose-positron emission tomography/CT imaging was performed using a Siemens Biograph TruePoint PET/CT (Siemens Healthcare), which also proved to be negative (figure 2).

A CRT-D device was then implanted in a second step (figure 3). After placing the ventricular lead and the coronary sinus lead, the TPS was finally removed in a last step using a 18 French steerable Agilis NxT Steerable Introducer sheath (St. Jude Medical, Inc, St. Pauls Minnesota, USA) with a 7 mm One Snare inside (Merit Medical Systems Inc, Utah, USA). The Agilis was introduced via a 23 French introducer sheath into the right femoral vein. It took 10 min to snare the proximal retrieval feature on the TPS, pull it out of the right ventricle and put it back into the 23 French sheath. After explantation of the TPS, the atrial lead was placed.

The postinterventional course was uneventful, and the patient was discharged 2 days after the procedure. During a follow-up at 6 weeks, he stayed free of infection and recovered totally.

DISCUSSION

This is the first report of a temporary TPS placement in a patient with severe device infection with an unstable escape rhythm. The Micra trial as well as the Leadless trial excluded patients who had undergone transvenous lead extraction.¹⁻³

Furthermore, patients who were pacemaker dependent or had a pre-existing medical electrical device implanted were not included in the Micra trial.

In our case, the TPS was successfully implanted without any complications. No infection was present after 4 weeks despite the fact that our patient obviously had an ongoing infection when the TPS was implanted.

In the literature, infection rates range between 0.5% and 1% for new implants and for replacement devices.⁴ This is in contrast with a rate of <1 in 719 patients implanted in the Micra clinical trial in which no infections were observed. One reason

for this may be the small size of the Micra that appears to limit its ability to participate in any ongoing infection. The second reason may be the composition of the TPS surface that is not very viable for bacteria. The TPS case is made from titanium that is covered with a polymer for insulation (Parylene) except on the ring. The fixation tines are made from Nitinol. Overall, the contact surface of the TPS is small as compared with a conventional pacemaker system. In pacemaker-dependent patients or patients with an unstable escape rhythm—like in our patient's case—the avoidance of polyurethane or silicon leads for temporary pacing may additionally decrease the risk for maintaining a present infection.

Contributors AK drafted the manuscript. HB edited the English spelling and draft manuscript. ML undertook the picture processing. CS drafted the manuscript.

Competing interests None declared.

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Learning points

- ▶ According to current trends, infections in patients with implantable cardiac electronic device appear to be an increasing problem in the implantable device patient community.
- ▶ In rare circumstances, some patients do not recover with standard therapy only (lead extraction and device removal followed by courses of antimicrobial therapy), especially when a temporary lead is necessary.
- ▶ A transcatheter cardiac pacemaker could be an alternative bridging modality, as well as a permanent solution, for this type of patients.

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