CASE REPORT

Dawn of a new era: the completely interventionally treated patient

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SUMMARY

A frail 75-year-old woman with permanent atrial fibrillation and angina pectoris was admitted to our department for further evaluation. Echocardiography revealed concurrent severe aortic valve stenosis. Furthermore, significant coronary artery stenoses were identified on the coronary angiogram. We chose the following treatment strategy: first, two drug eluting stents were implanted successfully in the left anterior descending and circumflex artery, respectively. Second, a 23 mm Core Valve bioprosthesis (Medtronic Inc, Minneapolis, Minnesota, USA) was implanted without complications within the same session. Two weeks after hospital discharge, the patient showed up at our outpatient department, with a symptomatic complete atrioventricular-block with an escape rhythm of 35 bpm. Thus, finally, a leadless pacemaker Micra (Medtronic Inc) was implanted via a transvenous transfemoral access without any complications.

BACKGROUND

Drug eluting stents (DES) as well as transcatheter aortic valve implantation (TAVI) have revolutionised the treatment of patients with cardiovascular diseases. Studies have shown that these interventional techniques are not inferior to corresponding standard surgical procedures, and that they increase overall survival rates in patients who cannot undergo surgery due to a high-perioperative risk.^{1 2}

Now there is a new technology arising in the field of transcatheter therapies. Leadless pacemakers—implanted by interventional cardiologists—are the next step on the ladder of evolving interventional techniques.³ This is the first report of a single patient who underwent three different transcatheter procedures.

CASE PRESENTATION

A 75-year-old Caucasian woman with angina at rest and severe dyspnoea was admitted to our department. ECG revealed permanent atrial fibrillation while echocardiography showed concurrent severe aortic valve stenosis, moderate mitral regurgitation and moderate pulmonary hypertension. The left ventricular ejection fraction was preserved (65%) with no signs of regional wall motion abnormalities. Furthermore, significant coronary artery stenoses in the left anterior descending and in the circumflex artery were identified. Besides these conditions, the patient's history comprised only of hypercholesterolaemia.

First, the patient underwent coronary artery stenting. Two drug eluting stents (Resolute Integrity Medtronic Inc, Minneapolis, Minnesota, USA) were implanted successfully in the left anterior descending and circumflex artery, respectively. Second, after treatment of the coronary stenoses, a 23 mm Core Valve bioprosthesis (Medtronic Inc, Minneapolis, Minnesota, USA) was implanted without complications within the same session.

After 2 weeks, the patient showed up in our outpatient department due to fatigue and bradycardia. The patient had developed a symptomatic complete atrioventricular-block with an escape rhythm of about 35 bpm after the Core Valve implantation (figure 1A). A complete heart block is a class I indication for pacemaker implantation according to current guidelines. After discussing the different treatment options with the patient, she gave written informed consent to be enrolled into the Micra study. As the escape rhythm was stable and the patient was not haemodynamically compromised, we refrained from placing a temporary pacing wire. The patient was continuously monitored in our intensive care unit until she received her permanent pacemaker.

Finally, the leadless pacemaker, Micra (Medtronic Inc), was implanted via a transvenous transfemoral access under sedoanalgesia, with no complications, in 23 min total procedure time. The patient was on phenprocoumon, clopidogrel, bisoprolol, digitoxin, pravastatin, furosemid and pantoprazol at the time of Micra implant. Electrical parameters such as R-wave sensing (>20 mV) and pacing threshold (0.4 V) were within normal ranges. The patient was discharged on the second day after the procedure. The ECG after pacemaker implantation is presented in figure 1B.

OUTCOME AND FOLLOW-UP

After 1 year, the patient was free of angina. Her physical capability had improved significantly. The leadless pacemaker shows perfect electrical measurements by 100% of pacing.

DISCUSSION

This patient epitomises the benefits of the three modern transvascular devices that have become available in the past decade to reduce morbidity and mortality in patients deemed to be at high-surgical risk. As the population ages in many countries, more and more of these patients will require invasive therapy. The primary benefits of stents compared to coronary bypass surgery are a much

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Figure 1 ECG (A) before and (B) after Micra implantation.

shorter hospital and intensive care unit stay, and a significantly shorter recovery time. However, the need for reintervention has proved to be higher with the use of drug eluting stents compared with bypass surgery, whereas overall mortality has not been influenced by the means of coronary revascularisation.⁴ However, in younger patients who might require multiple revascularisation attempts, bypass surgery might be a better first option in some cases.

Aortic stenosis is the most frequent valvular disease in the elderly. Transfemoral implantation of an aortic valve has similar advantages to stents with regard to length of hospital stay and recovery time compared with open-heart surgery. However, follow-up data of patients after TAVI implantation are still limited and thus transfemoral aortic valve implantation in patients younger than 70 years is indicated under special circumstances only. Improved survival after 2 years could be shown in the US PIVOTAL trial with the use of the Core Valve revalving system in high-risk patients.⁵

While current pacemaker systems are very reliable, they still suffer from complications relating to the lead and the pocket. Leadless pacing is the next step to overcome these problems and clinical experience with these systems is rapidly emerging.⁶ Currently, methods for extracting these systems are limited but evolving, and not all pacing modes are available (only VVIR at

the moment). However, for patients with permanent atrial fibrillation with a slow conduction and/or pauses, or patients at high risk of infection, or with limited subclavian access, these devices are likely to provide improved outcomes or potentially be the only option. There are still issues to consider about use of these devices, such as end of battery life and infection, especially in the young. Until now, no case of Micra infection has been reported to the best of our knowledge. The Micra pacemaker itself is not as much prone to infection as a conventional pacemaker, as it has no leads and contains no polyurethane and no silicone components, which tend to become inhabited by bacteria. However, in both these scenarios—end of battery life as well as infection—Micra removal may be necessary, and extraction devices are under development at the moment. If infection occurs within 30 days after implantation, the device will not have become tissue covered yet and can be re-captured with a snare that is guided by either a leadless cardiac pacemaker delivery system or a steerable sheath. Until now there are no data available on extractions after this time period.

In the case of battery depletion, the implantation of a second Micra device into the right ventricle is another feasible option. Extraction of the first Micra after placement of the second is an option. However, in our experience, the right ventricular apex is large enough to house another device and the risk of extraction may by far outweigh the benefits.

While all of the aforementioned interventional techniques will be further developed within the next decades, this particular patient avoided three surgeries and yet has the same therapy as though she underwent three separate operations (figure 2). So in such cases, these new technologies are providing a significant benefit.

Nowadays, a large number of cardiac treatments can be performed by means of a minimal invasive interventional strategy. The main advantages of using the interventional approach are the avoidance of scars and pain as well as shorter postoperative recovery times. Our patient impressively showed the feasibility of completely interventional management of a patient treated

Figure 2 Postinterventional X-ray.

Learning points

- Treatment of cardiac diseases with the use of transvascular devices has shown to reduce morbidity and mortality in patients deemed to be at high surgical risk.
- Combination of such interventional techniques is safe and feasible and may yield a significant benefit for the patient.

for three different cardiovascular conditions. In our opinion, leadless pacemaker implantation will be a powerful new tool in the armamentarium of interventional cardiology in the near future.

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