Cardiac Imaging

Severe Superior *Vena Cava* Obstruction: A Late Complication of Pacemaker Implantation

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An 80-year old man with a history of hypertension, atrial fibrillation and a VVIR pacemaker implanted 5 years before was admitted to our department for a routine annual follow up of the pacemaker system. His medications included an angiotensin-converting enzyme inhibitor, diuretic and aspirin. The patient had complained of episodes of dizziness and exhaustion during the last year.

The admission ECG revealed sinus rhythm at a rate of 45-50 /min (Figure 1), which was below the programmed minimum pacing rate of 60 /min. Pulse generator interrogation showed a totally depleted battery (End of Life state), normal lead impedance (bipolar mode, 855 Ω), a low ventricular sensing threshold (bipolar mode, 3.8 mV), and a high ventricular pacing threshold (bipolar mode, 5.5 V). Ventricular pacing and sensing thresholds were alike, even when re-measured after programming the system to a unipolar mode of lead function.

In the catheterisation laboratory, after removing the generator, we performed measurements on the ventricular lead and confirmed the preoperative findings. Since a high ventricular pacing threshold was found, we decided to implant a new ventricular lead. We punctured and very easily gained access to the right subclavian vein, and a conventional guidewire (Medtronic 0.035") was advanced parallel to the previous ventricular lead as far as the proximal part of the inferior *vena cava*, where we felt a "stop" (Figure 2). Since no further advancement of the guidewire could be achieved, we performed a venography of the superior *vena cava* (SVC) through the needle (Arrow 18G) of the puncture of the subclavian vein by infusing 20 ml of contrast agent (Iomeron). A subtotal occlusion of the SVC was then demonstrated (Figure 3).

We considered two alternative strategies: i) to refer the patient to a cardiac surgeon for epicardial placement of a new ventricular lead and implantation of a new generator; or ii) to attempt advancing a new ventricular lead again through the SVC. We decided to proceed with the less invasive second alternative, so we used a hydrophilic guidewire (Terumo 0.025"), which was advanced very easily through the SVC to the inferior *vena cava*. Subsequently, we advanced a sheath dilator over the hydrophilic guidewire to perform a predilatation at the stenotic point in the proximal third of the SVC (Figure 2), which effectively facilitated the insertion of a 7F sheath. We then advanced a 6F bipolar lead through the sheath and implanted it in the right ventricular apex (Figure 4), achieving excellent implantation parameters (sensing threshold 12 mV, impedance 850 Ω, pacing threshold 0.2 V).

Figure 1. The admission ECG revealed sinus rhythm at a rate of 45-50 /min.

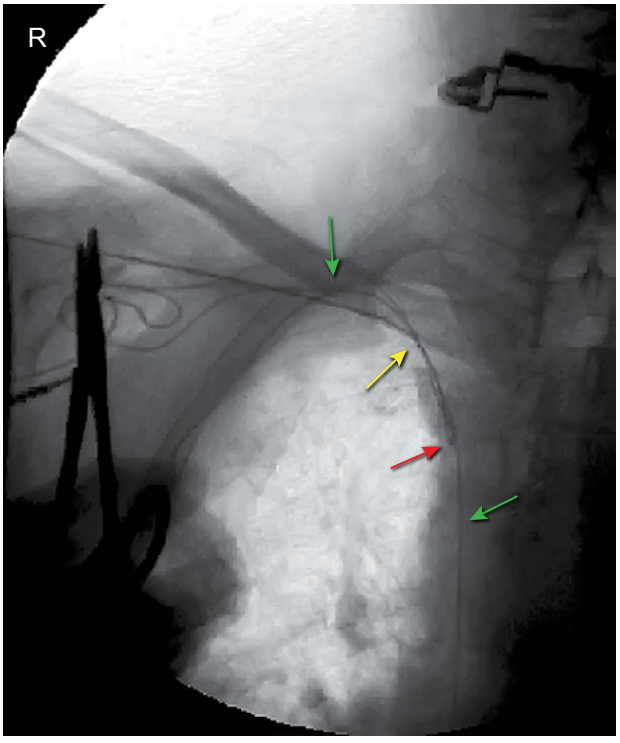

Figure 2. The right subclavian vein (yellow arrow) was punctured, and a guidewire was advanced parallel to the previous ventricular lead (green arrow) as far as the proximal part of the inferior *vena cava* (red arrow), where a "stop" was felt.

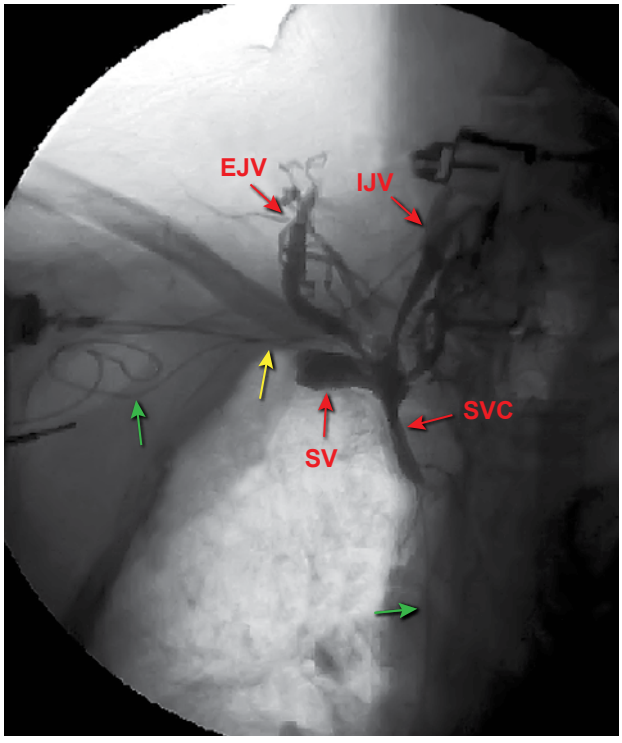

Figure 3. A subtotal occlusion of the superior *vena cava* was demonstrated (needle – yellow arrow; previous ventricular lead – green arrow). SV – subclavian vein; SVC – superior *vena cava*; EJV – external jugular vein; IJV –internal jugular vein.

Figure 4. A new lead was implanted in the right ventricular apex (red arrow – new lead; green arrow – old lead).

The entire procedure was completed uneventfully with the implantation of a VVIR pacemaker generator. The patient was advised to take lifelong oral anticoagulation therapy. Until today, the patient has remained totally asymptomatic after two years' follow up.

Central vein leads are known to predispose to SVC obstruction or stenosis.[1] SVC obstruction is a late complication of lead implantation, and it usually becomes a challenge only when patients come for system revision or upgrade. It seems that the incidence of SVC obstruction following a pacemaker or ICD lead implantation has been underestimated. In two systematic studies that aimed to quantify venous changes after pacemaker or ICD implantation, the incidence of new venous obstruction was 14%[2] and 25%.[3] Atrial fibrillation and biventricular pacemaker implantation were found to be independent predictors of venous obstruction. On the other hand, according to a review study,[1] it seems that neither the hardware characteristics (lead size, number and material) nor the access site choice (cephalic cut down, subclavian or axillary puncture) affect the rate of venous complications.

References

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