

Imaging in Cardiology – Retraction of a Perforated Lead: Recognition and Natural Course

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Case Report

An 87-year-old female patient was referred to our hospital for a pacemaker implantation due to symptomatic bradycardia during atrial fibrillation. A pacemaker lead (Synox SX-60/BP, Biotronik, Germany) was introduced through the left cephalic vein. The tip of the lead passed the tricuspid valve, while the stylet in the lead was retracted for approximately 10 cm. After passage of the tricuspid valve, the stylet was advanced into the lead and the body of the lead was carefully moved forward to the right ventricular apex. When the position of the tip was stable, appropriate measurements were taken with respect to pacing and sensing. The pacing threshold determined using the ERA 300 (Biotronik) was high: 2.8 V at 0.5 ms pulse width. The R-wave was determined at 11.8 mV. X-ray examination revealed a stable position of the lead tip (Figure 1). The movement of the distal part of the lead and the position of the tip near the diaphragmatic ventricular wall aroused suspicion towards myocardial perforation. An intracardiac ECG confirmed the suspicion but showed no ST-elevation, which may be a sign of a lesion being present (Figure 2). The lead body and the tip were retracted under fluoroscopic control, whilst the intracardiac ECG was recorded. The lead tip was carefully retracted by 2 cm (Figure 4), and the intracardiac recording showed the disappearance of the negative T-waves and the appearance of the ST-elevation (Figure 3). At this position the pacing threshold was 0.4 V at 0.5 ms.

The further implantation was uneventful, however, the patient later experienced some chest discomfort, which was only provoked by deep inhalation. Echocardi-

graphic evaluation showed no pericardial fluid. An X-ray of the thorax that was taken on the following day also revealed no abnormalities.

Perforation by the tip of a pacemaker lead occurs seldom, and the severity of this complication depends on the amount of fluid in the pericardium [1]. It may lead to cardiac tamponade, which requires immediate diagnosis and treatment [2]; if left untreated, this condition may lead to hemodynamic shock and eventually to the death of the patient. On the other hand, the "natural"

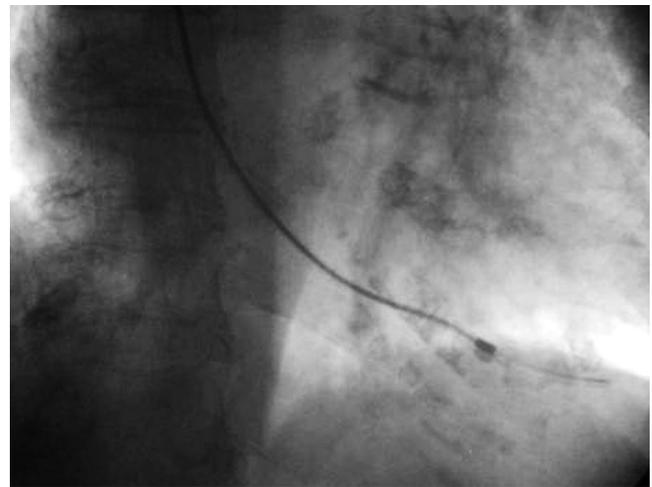


Figure 1. The stylet is introduced into the lead up to the plane of the tricuspid valve. The distal part of the lead is close to diaphragmatic wall contour of the heart. The distal part (between the proximal ring electrode and the distal tip) shows a notch in the lead (which is more pronounced in the moving images during fluoroscopy).



Figure 2. In the upper part of the ECG, the six limb leads of the scalar ECG are given. V1 represents the distal electrode (tip) on the ventricular lead, and the V6 represents the proximal electrode (ring). Note the deep negative T-waves in the distal electrode in the first three QRS complexes. The negative T-wave diminishes during traction at the lead tip (the last 3 QRS complexes).

course after perforation by a permanent pacemaker lead is often benign, or even uneventful. The most important factor is that it must be recognized by the implanting physician so that the hemodynamic status of the patient can be monitored. Echocardiographic evaluation may be extended to one week after implantation, because late cardiac tamponade has also been described [2].

Perforation should be suspected, when rigid positions of the lead tip and high pacing thresholds are seen. The (unipolar) intracardiac ECG is very informative with respect to the absence of ST-elevations and deep negative T-waves, as in this particular case. It has to be

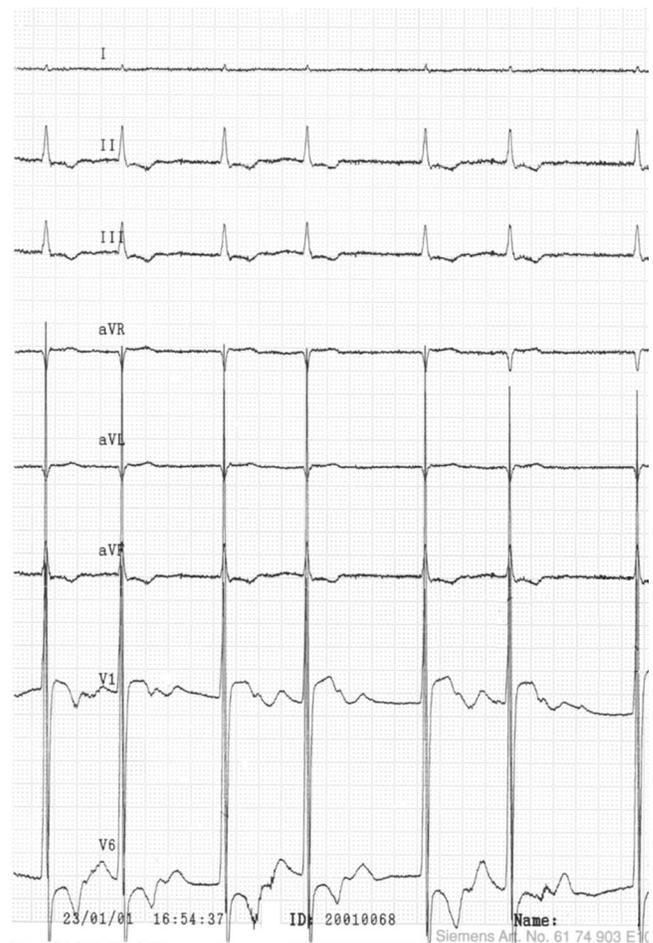


Figure 3. A pronounced ST elevation or lesion potential appears while the lead is retracted slowly.

stressed that the intracardiac ECG must be a unipolar and unfiltered ECG recording. The filtered ECG, which will be used for R-wave measurements, cannot reproduce the low frequencies of the ST segment elevation. The ERA 300 can display the unfiltered intracardiac ECG either on screen or on a paper printout. An alternative way of displaying the intracardiac ECG is to use one of the unipolar, precordial leads of the scalar, 12-lead ECG. Then, the limb leads must be attached to the patient.

Perforation by a lead tip seems to be independent of the size of the tip. However, it is theorized that a small tip may cause perforation more easily. Review of the liter-

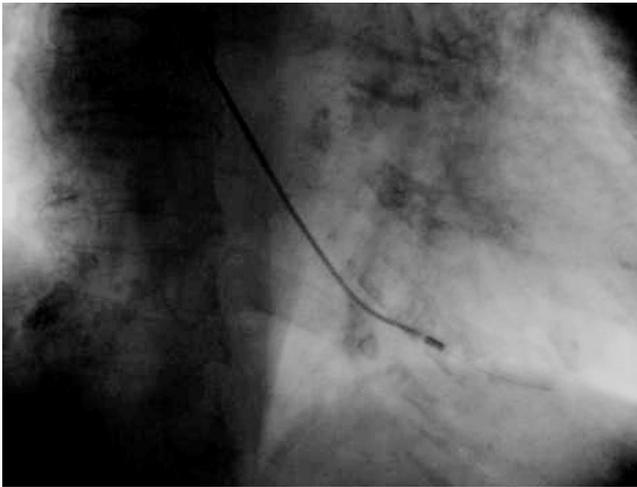


Figure 4. The tip of the lead is retracted to its final position.

ature does not offer substantial evidence [1,3]. The stiffness of the distal part of the lead may certainly play an important role. A perforation rate of 7 % has been reported with that type of lead [4]. It is also generally believed that the temporary lead may have caused the perforation. Treatment of the pericardial fluid itself usually is not necessary; in most cases it will resolve spontaneously [5]. Surgical therapy may be needed in case of extensive hemopericardium or reluctance to retract the tined lead through the perforation hole for fear of enlarging the hole in the myocardial wall [6].

Conclusion

Myocardial perforation by a lead tip must be suspected whenever a rigid yet fluoroscopically acceptable position has been achieved in the presence of a high stimulation threshold. Unipolar and unfiltered intracardiac ECGs may show the absence of lesion potentials. Simple retraction and consistent immediate and post-implant hemodynamic monitoring (and eventually treatment) are required.

References

- [1] Trigano JA, Paganelli F, Ricard P, et al. Heart perforation following transvenous implantation of a cardiac pacemaker. *Presse Med.* 1999; 28: 836-840.
- [2] Gershon T, Kuruppu J, Olshaker J. Delayed cardiac tamponade after pacemaker insertion. *J Emerg Med.* 2000; 18: 355-359.
- [3] Danilovic D, Breivik K, Hoff PI, et al. Clinical performance of steroid-eluting pacing leads with 1.2-mm² electrodes. *PACE* 1997; 20: 2799-2809.
- [4] Cameron J, Mond H, Ciddor G, et al. Stiffness of the distal tip of bipolar pacing leads. *PACE.* 1990; 13: 1915-1920.
- [5] Trigano AJ, Taramasco V, Paganelli F, et al. Incidence of perforation and other mechanical complications during dual active fixation. *PACE.* 1996; 19: 1828-1831.
- [6] Asano M, Mishima A, Ishii T, et al. Surgical treatment for right ventricular perforation caused by transvenous pacing electrodes: A report of three cases. *Surg Today.* 1996; 26: 933-935.

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