Removal of a Chronically Infected Bipolar Pacemaker Electrode

— A Successful Case Report —

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A chronic infected bipolar pacemaker electrode with a fin tip was successfully removed 7 years and 9 months after its original implantation from a 72-year-old Japanese man, using the Cook pacemaker lead extraction system. The locking stylet could not advance to the lead tip over the positive pole because of firm adhesions. Because the scar tissue between the positive pole and myocardium could not be freed by the inner sheath, it was disrupted by the slanted end of the outer sheath. The firmest adhesion was on the positive pole, not on the fin tip. The complete extraction success rate of bipolar tined or fin leads is worse than for other types of leads. When extracting a bipolar pacemaker lead, dissection of the positive pole from scar tissue should be taken into account in addition to the lead tip. Rotating the slanted end of the outer sheath is a useful technique when dissecting firm adhesions. (*Jpn Circ J* 2000; 64: 452–454)

Key Words: Bipolar lead; Fin tip; Infected pacemaker; Lead extraction; Tined tip

An pacemaker complicated by sepsis or infected endocarditis becomes an extremely serious complication resulting in high mortality. We report the successful removal of a chronically infected bipolar electrode with a fin tip, 7 years and 9 months after the original implantation, using a lead extraction system.

Case Report

A 72-year-old Japanese man was admitted with swelling of the left upper extremity and a left subclavian pocket infection where a permanent cardiac pacemaker (pacemaker: Siemens Elema 2034T; electrode: Siemens Elema 1010T/60) had been implanted via the left subclavian vein at the age of 64 years for complete atrioventricular block. When the man was 70 years old, he underwent coronary artery bypass grafting for angina, 5 months after which, pacing failed when the electrode disconnected. A cardiac pacing system was reimplanted via the same route with the previously implanted pacing lead in place. The pocket infection was noticed 7 months after reimplantation. The pacemaker generator was removed, but the electrode was not. Another pacing system was implanted via the right subclavian vein, but the left subclavian pocket became recurrently infected, exposing the electrode. The man suffered from a low-grade fever and swollen left upper extremity 15 months after the electrode was exposed.

The patient was 149 cm tall and weighed 52 kg. His

blood pressure was 106/66 mmHg and his pulse rate was 55 beats/min and regular. The patient's temperature on admission was 37.2°C. Blood examination disclosed a white blood count of 7,200 cells/ μ l and C reactive protein of 8.6 mg/dl. Chest X-ray showed a normal cardiac shadow with a cardiothoracic ratio of 48% and a functioning pacemaker via the right subclavian vein and a nonfunctioning electrode via the left subclavian vein (Fig 1). Chest computed tomography suggested a left subclavian vein thrombosis. He was given antibiotics intravenously and extraction of the lead using the Cook pacemaker lead extraction system (Cook Pacemaker Corporation, Leechburg, PA, USA) was planned. The electrode to be removed was a bipolar lead, 2.0 mm in diameter, covered with silicone and polyurethane, and fixed in place with a fin tip.

The patient was informed of the necessity of the electrode's removal and of the risk of potentially life-threatening complications (ie, cardiac tamponade, hemothorax, etc). Under general anesthesia on percutaneous cardiopulmonary support (PCPS) standby, an incision was made in the left subclavian pocket and the locking stylet inserted into the coil lumen of the pacing lead. Under fluoroscopic monitoring, the locking stylet was passed to the positive pole (indifferent electrode), but the adhesion between the lead and scar tissue was so firm that the lead was bent and could not be aligned with the locking stylet, which then could not be passed over the positive pole (Fig 2). The outer and inner sheaths were easily passed over the lead through the superior vena cava, but still could not be advanced over the positive pole because of the scar tissue adhering firmly to the electrode. The slanted end of the outer sheath is not usually applied in this area but, because the scar tissue had not been disrupted by the inner sheath and the lead had begun to break, the slanted end of the outer sheath was used. The sheaths were rotated slowly, keeping tension on the stylet, and eventually broke through

(Received November 8, 1999; revised manuscript received January 27, 2000; accepted March 14, 2000)

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Fig 1. Preoperative chest X-ray. Two electrodes, one functioning via the right subclavian vein and the other, nonfunctioning, via the left subclavian vein.

Fig 2. The route of the stylet. The locking stylet could not be passed over the positive pole, which is fixed to the scar tissue.

Fig 3. Electrode removed with scar tissue adhering to the positive pole. The distal portion of the lead is broken.

the scar tissue. As soon as the positive pole was caught in the sheaths, the tip electrode was included and the lead extracted completely (Fig 3). The postoperative course was uneventful, the left upper limb edema subsided, and the man continues to do well.

Discussion

Progress in pacemaker leads has improved the results of pacemaker implantation. Bipolar leads are usually used because of the greater signal-to-noise ratio, lower myopotential interference sensitivity and prevention of muscular twitching.¹ Good fixation to the myocardium occurs with tined or fin leads^{2,3} but these benefits may be seriously compromised when leads must be extracted.⁴

Infection is one of the most feared complications in pacemaker use. Once it proceeds to septicemia or endocarditis, it becomes life-threatening. Rettig et al reported 4 patients who died from septicemia among 6 whose infected leads were not removed.⁵ The only effective treatment is complete removal of the entire pacing system (pacemaker and leads).^{5,6}

Conventional traction or countertraction was frequently unsuccessful and the Cook pacemaker lead extraction system was designed to explant chronic transvenous pacemaker leads.⁷ Results are excellent, but some conditions lower the success rate (eg, leads insulated with polyurethane rather than silicone, ventricular leads using tines or fins for fixation, longer duration of the implant, and extraction by inexperienced personnel).^{4,8}

Bipolar leads are themselves controversial. Fearnot et al reported that 121 of 147 unipolar leads (82.3%) were completely extracted, compared with 73 of 81 bipolar leads (90.1%).⁴ In Japan, complete extraction succeeded in 83.3% (35/42) of unipolar tined leads vs 69.3% (95/137) of bipolar tined leads (Paramedic Co, Ltd, Cook Pacemaker Corp, Japan: personal communication). Bipolar leads have positive poles (indifferent electrodes) not used in unipolar leads and are generally thicker. The major cause of failed extraction is the scar tissue between the leads and myocardium, which increases with the duration of the implant.⁸ Passive lead-tip fixation with tines or fins involves entanglement in the trabeculae of the right ventricle and extraction is difficult due to such firm adhesion. In the present case, the most difficult maneuver was freeing the

lead of the positive pole because of the failure to pass the stylet over the positive pole. The greatest cause of broken leads is that the locking stylet could not be passed to the distal tip,⁶ and the poor success of bipolar lead extraction in Japan suggests that many surgeons have difficulty in dissecting the adherent scar tissue from the positive pole.

Smith et al reported fatal or near-fatal complications in 2.5% of 2,195 patients.⁸ Hemopericardium was the most frequent major complication, with an incidence of 1.2%. Most complications occurred when dissecting the leads from scar tissue. To avoid such complications, adequate tension must be maintained on the stylet when advancing the sheaths. Although the adhesion in the present case was firm, the leads were freed without complication due to adequate countertraction.

Conclusion

We emphasize that the difficulty of dissecting the scar tissue on the positive pole should not be underestimated when extracting of bipolar pacemaker leads, but the technique of rotating the slanted end of the outer sheath was useful in the present case.

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