Reuse of a 20-year-old lead: An abandoned lead reactivated

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Introduction
Lead extraction is a high-risk procedure with potential serious complications, such as vascular avulsion, cardiac tamponade, and death. When a patient is referred for lead extraction, a careful assessment of any alternatives should be undertaken. When lead malfunction is the issue, the risks and benefits of lead extraction versus implantation of additional leads should be considered. Often overlooked is the possibility of reusing old or abandoned leads. We report a case where it was possible to avoid both lead extraction and addition of a new lead by reusing a previously abandoned pace/sense (P/S) lead, with an excellent clinical result.

Case report
A 68-year-old woman presented for reconfiguration of her cardiac device system owing to fracture of the P/S part of her single-coil defibrillator lead (model 6943; Medtronic, Inc, Minneapolis, MN), which was implanted in 1999. In 1994, the patient had a dual-chamber pacemaker implanted for sick sinus syndrome with an atrial lead (model 4058M; Medtronic) and a right ventricular (RV) pacing lead (model 4058M; Medtronic). Five years later, her device was upgraded to a dual-chamber defibrillator in the setting of hypertrophic cardiomyopathy with a decrease in ejection fraction to 30% and a syncopal episode. At that time, the single-coil defibrillator lead was implanted (model as detailed above) and the prior ventricular P/S lead was capped and abandoned. Currently, 15 years after the device upgrade, device interrogation on a routine visit showed evidence of fracture in the P/S part of the single-coil defibrillator lead with noise and impedance increase.

The patient was referred for laser lead extraction of the implantable cardioverter-defibrillator (ICD) lead and new lead implantation. Before extraction of the defibrillator lead was attempted, the previously abandoned RV pacing lead (implanted 20 years earlier) was uncapped and pacing and sensing parameters were measured. This showed excellent sensing, R-wave = 11.5 mV, but relatively high pacing threshold, 3 V at 0.6 milliseconds, and normal impedance = 551 ohms. It was decided to reactivate this lead for sensing and pacing in the right ventricle (Figure 1), given the excellent sensing, and despite the relatively high pacing threshold, since the patient had less than 0.1% ventricular pacing per device log. Besides avoiding a high-risk laser lead extraction (15-year-old defibrillator lead in an elderly patient), this approach was further beneficial to the patient because the implantation of a new left-sided right defibrillator lead would not have been possible without extraction owing to total occlusion of the left subclavian vein on venogram. The patient recovered well after the procedure and was discharged home after 1 day. Follow-up has shown that the ICD system continues functioning normally.

Discussion
The management reported in this case was possible only because of the abandonment of a redundant lead in 1999. The presence of an isolated surplus lead represents a class II indication for lead removal in the 2009 Heart Rhythm Society Consensus Statement1 but remains controversial.2 A survey conducted in 2009 involving 376 physicians from 28 countries showed that 52% of the operators usually abandon a sterile failed ICD lead while 48% usually explant it.3 This divergence in the approach shows the lack of solid data regarding how best to manage noninfected redundant leads. The case in favor of extraction is that the abandoned leads increase vascular burden and risk of venous occlusion and infection and, if these leads need to be removed in the future, they will be older and more difficult to extract.2 It is also possible that abandoned leads can cause noise in the active leads. The argument in favor of leaving abandoned leads in place claims that extraction is a known high-risk procedure and that there is no solid study supporting that extraction of abandoned leads pose an additional risk of complications or

KEYWORDS Lead reuse; Abandoned lead; Lead extraction; Lead malfunction; Pacing failure

ABBREVIATIONS ICD = implantable cardioverter-defibrillator; P/S = pace/sense; RV = right ventricular

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interfere with the functionality of the active leads.\textsuperscript{4} With regard to the use of magnetic resonance imaging in patients with abandoned leads, there have been few validated in vivo studies; one recent study suggests this may be feasible when performed under careful monitoring.\textsuperscript{5} Currently there is no comprehensive study to tell us which approach (abandonment versus extraction) is the best. Thus the risks of abandoning versus extracting surplus leads should be considered in each particular case, as currently both strategies appear acceptable.\textsuperscript{6}

Special consideration should be given to the management of functioning but no-longer-needed RV P/S leads at the time of upgrade from a pacemaker to an ICD system. As shown in our case report, this lead may be used in the future if there is a problem with the P/S part of the defibrillator lead, and a simple change of leads in the generator pocket can solve the problem. Another possibility, as discussed by Henrikson,\textsuperscript{7} is to initially use the chronic RV P/S lead as the P/S lead for the ICD, as the chronic P/S lead has more stable parameters and less risk of dislodgment. In this scenario, the P/S part of the ICD lead could be used in the future in case of malfunction of a chronic RV P/S lead. In patients with the currently used DF-4 ICD system, these strategies would not be possible owing to the single connection between the ICD lead and the device, but appropriate adaptors/splitters may become available in the near future.\textsuperscript{8}

Other potential approaches in cases similar to this would be the implantation of a new ICD lead with or without the extraction of malfunctioning ICD lead. Both these approaches entail additional risk: in one case, the risks of lead extraction; and in the other, the risk of lead crowding with potential development of superior vena cava syndrome. Close follow-up of the reused lead in clinic or with home monitoring is essential, and in our patient has shown stable function. In summary, by reusing an “old” lead, an excellent outcome was achieved with low cost and minimal risk to the patient.

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**Figure 1** Reconfiguration of patient’ s cardiac device system. A: In 1994, patient had a dual-chamber pacemaker implanted with a right atrial (RA) and a right ventricular (RV) pace/sense (P/S) lead. B: In 1999, the device was upgraded to a dual-chamber implantable cardioverter-defibrillator (ICD), a single-coil ICD lead was implanted, and the RV P/S lead was capped and abandoned. C: In 2014, after evidence of fracture in the P/S part of the ICD lead, the previously abandoned RV P/S lead was uncapped and reactivated and the P/S part of the ICD lead was abandoned.
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