A 81-year-old man with 3-vessel coronary heart disease and a left ventricular (LV) aneurysm, who had been deemed unsuitable for coronary revascularization, was referred for cardiac resynchronization therapy. He was in New York Heart Association class III, and he had a LV ejection fraction of 20% and a left bundle-branch block (QRS duration of 148 ms). Late gadolinium enhancement cardiovascular magnetic resonance showed an apical aneurysm and transmural enhancement in 11 of 17 myocardial segments, including the mid and apical segments of the LV free wall (Figure 1).

At implantation, coronary sinus venography revealed a single posterolateral tributary as the only adequate vessel for LV lead deployment. A conventional bipolar LV lead (QuickSite XL model 1058T, St. Jude Medical) was deployed in a distal portion of this tributary, but unfortunately, unacceptable pacing thresholds (≥7 V at 0.5 ms) were obtained. More proximal lead positions were anatomically unstable. A multipolar LV lead (Quartet, St. Jude Medical) was subsequently advanced into this tributary, with its tip deployed in a distal portion.

As shown in Figure 2, the multipolar LV lead straddled an area of myocardial scar. Importantly, there was a marked variation in the pacing thresholds from the proximal to the distal poles, ranging from 1 V over nonscarred myocardium to ≥7.5 V over scarred myocardium (pole to right ventricular coil, at 0.5 ms). Interestingly, there was also a marked variation in the QRS duration as well as in QRS morphology on the surface ECG, which was right bundle-branch block-like in the proximal poles (A and B), subtending viable myocardium, and left bundle-branch block-like in the distal poles, subtending myocardial scar (C and D).

It is well recognized that scarring in the vicinity of a pacing stimulus leads to prolongation and fragmentation of the QRS complex and reduced myocardial excitability. It has also been shown that pacing viable myocardium during cardiac resynchronization therapy is associated with a better symptomatic response and clinical outcome in comparison with pacing scarred myocardium. This case illustrates how, combined with late gadolinium enhancement cardiovascular magnetic resonance, multipolar LV leads can be used to electronically optimize LV pacing parameters in the vicinity of myocardial scars.

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Figure 1. Steady-state free precession CMR scan showing an apical LV aneurysm, with marked thinning of its walls. The points marked A to D correspond to the LV pacing pole positions of the distal electrodes and to the corresponding short axis sections shown on the right. The panels on the right show myocardial scar (in white arrows) in short-axis late gadolinium enhancement CMR slices corresponding to the LV pacing poles. CMR indicates cardiovascular magnetic resonance; LV, left ventricular.
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References

Figure 2. A, A 30° right anterior oblique fluoroscopic view of the multipolar LV lead straddling the calcified LV aneurysm. B, The distal poles of the lead subendocardium (white arrows). C, Pacing over poles C and D was associated with a longer QRS duration, a higher pacing threshold, and a markedly different QRS morphology, compared with pacing from poles A and B. The exact positions of the poles were derived by superimposing the fluoroscopic views on the CMR views. CMR indicates cardiovascular magnetic resonance; RA, right atrial; RV, right ventricular; LV, left ventricular.
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