

Open surgery for ventricular tachycardia following failed stereotactic radiation treatment: A bailout when a parachute hasn't helped



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"One never notices what has been done; one can only see what remains to be done."

Marie Skłodowska-Curie

In this issue of *Heart Rhythm Case Reports*, Hayase and colleagues¹ present the complex treatment journey of a patient with a left ventricular (LV) apical aneurysm who suffered from recurrent ventricular tachycardia (VT). The unfortunate gentleman underwent 4 endocardial catheter ablation procedures, then a failed attempt at percutaneous epicardial ablation owing to pericardial adhesions, followed by a minimally invasive surgical hybrid cryoablation and then by surgical stellate ganglionectomy. When the VT recurred despite all this, his seventh intervention involved noninvasive stereotactic body radiation therapy (SBRT) targeting the LV apical aneurysm. Unfortunately, the clinical VT refused to go away, and the gent ultimately underwent a hybrid open-chest VT surgery and addition of an LV pacing lead to the defibrillator to allow resynchronization. Mapping showed the presence of extensive local abnormal ventricular activities and late potentials, whose elimination with the surgical cyoprobe led to a favorable midterm outcome.

The authors use the report to highlight the potential limitations of SBRT as a treatment for VT, as extensive arrhythmic substrate was still identified at a subsequent open-chest ablation procedure performed several months later. SBRT sparked a huge interest in the electrophysiology community when encouraging initial results suggested that it

could provide an effective alternate modality to treat VT, especially in patients in whom the substrate is inaccessible to percutaneous ablation.^{2,3} However, the initial excitement has been tempered somewhat by the modest efficacy seen in subsequent reports.^{4,5} Differences between reported outcomes could well be due to differences in the radiation delivery platform used, ie, a more compact linear accelerator mounted on a robotic arm (Cyberknife) rather than a gantry-based one. Cyberknife radiation plans typically have more heterogeneous dose distribution and longer procedure times, which in turn have implications in terms of patient immobilization and respiratory motion management. The use of noninvasive electrocardiographic body surface mapping to more precisely localize VT circuits may also be an important step to optimize outcomes.²

The impact of SBRT on the electrophysiological VT substrate has not yet been systematically studied. As such, Hayase and colleagues should be commended for taking the opportunity during surgical epicardial access to perform high-definition substrate mapping, and for sharing their findings with us. They describe extensive residual areas of abnormal electrograms in the border zone regions of the LV aneurysm, which is similar to the previous report of Gianni and colleagues,⁵ who showed persistence of low-amplitude, fractionated electrograms in areas treated by SBRT. However, it is worth bearing in mind that these limited reports may paint an excessively gloomy picture, as by definition only those patients would have undergone remapping who had failed SBRT therapy. The histopathologic effect of SBRT is also not understood fully. The almost instantaneous benefit seen with SBRT in previous case series^{2,3} suggests against scar homogenization by fibrosis as the likely explanation. As the authors themselves speculate, the rapid fall-off in SBRT dose delivery between the targeted area and surrounding tissues may be invaluable in enhancing its safety profile, but also means possible sparing of the all-important scar border zones.

A related question from this interesting case report arises on the impact of the LV parachute device on the failure of previous multiple ablation attempts. Percutaneous

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deployment of a parachute device within an LV apical aneurysm aims to achieve ventricular restoration and reduction of LV volume. Although the efficacy of this device in terms of improving heart failure itself remains debated, one real concern is decreased accessibility to the possible endocardial arrhythmia circuits during catheter ablation should these patients develop scar VT down the line.⁶ In the future, diagnostic tools such as noninvasive programmed stimulation⁷ or 3D scar dechanneling techniques⁸ may help to identify VT-vulnerable patients who could benefit from preventive catheter ablation of VT or who may be candidates for alternative LV restoration methods.⁹

Although it is disappointing that SBRT failed in this patient, we must appreciate that this procedure is still very much in its infancy. We do not yet fully understand the dose required, the ideal tissue targeting protocol, or indeed even the underlying mechanism of action. As SBRT is taken up by more centers, it will inevitably continue to evolve, and observations such as provided here by Hayase and colleagues will be invaluable in driving that evolution.

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