Integrated Care for Management of Ventricular Arrhythmias: Can a Specialized Unit and Catheter Ablation Improve Mortality?

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In 1962, the term coronary care unit was first coined by a Kansas City cardiologist, Hughes Day, to describe a centralized unit with a specialized team trained to rapidly identify and resuscitate patients admitted with acute myocardial infarction. With the dedicated critical care, improved reperfusion strategies, evidence-based medical therapy, and implantable cardioverter-defibrillators, survival from myocardial infarction in the acute and healed stages has significantly improved over the past 50 years. At the present time, the spectrum of patients with ventricular arrhythmias in the coronary care unit includes an increasing number of patients with scar-mediated reentrant ventricular tachycardia (VT) seen late after infarct remodeling and from noncoronary causes of cardiomyopathy.

Catheter ablation of VT is perhaps one of the most challenging and complex procedures in interventional cardiology. Catheter ablation of scar-mediated VT requires preprocedural imaging, the ability to perform specialized procedures such as electroanatomic mapping, and, in select cases, percutaneous access into the pericardial space. These techniques allow the operator to explore the complex scar architecture that typically supports multiple morphologies of VT that are hemodynamically unstable in the vast majority of present-day cases. It is also not surprising that the average procedural duration is >5 hours, but what is most relevant to the morbidity and mortality associated with the procedure is the severity of the disease in the patients who develop recurrent VT. The clinical context and the backdrop of this disease state mandates a team approach to care (Figure).

Patients presenting with VT have multiple comorbid conditions including heart failure, coronary artery disease, peripheral vascular disease, and renal dysfunction. Heart failure specialists typically are involved early on in the care of these patients to establish up-front optimization and backup options in the event that VT ablation is only partially effective. Pulmonary artery catheterization to guide hemodynamic optimization and mechanical support (ie, intra-aortic balloon pump, extracorporeal membrane oxygenation, left ventricular assist device) are interventions preceding ablation when clinically indicated. Furthermore, the involvement of dedicated cardiac anesthesiologists for electrophysiological procedures can expedite the option to perform neuraxial modulation, with placement of a thoracic epidural catheter. Thoracic surgeons can also be part of this team for possible surgical stellate ganglionectomy in situations where VTs are thought to be functional, multiple, polymorphic, or refractory to ablation.

In this issue, Della Bella et al report outcomes after VT ablation in 528 patients of 616 referred to their specialized intensive care unit dedicated to the treatment of VT. This article reflects the hard and well-coordinated work of this group since 2007 and sheds light on the field with 2 predominant messages. First, the treatment of patients with VT, which is highly specialized, requires a generalized, multidisciplinary, and coordinated team approach to optimize the overall condition of the patient. Second, acute outcomes during the VT ablation procedure have prognostic implications, and successful ablation was associated with a reduction in cardiac mortality.

The current work by the authors exemplifies the potential value of a team approach to managing some of the sickest patients in cardiology units. It is also an important reminder that, although specialized training in electrophysiology requires focus on the nuances of a procedure, patients should be managed by a team of physicians, not just the group responsible for the procedural aspect of care.

The findings of the present study are also of great significance to the field of complex ablation, because it explores the relationship between acute VT ablation outcomes and long-term cardiac mortality. It is known that VT ablation is effective in arrhythmia control and improves quality of life. However, data showing that it is associated with mortality reduction has been lacking. Previous studies such as the Multicenter ThermoCool Ablation Trial highlight the severity of illness in patients with recurrent drug-refractory VT who have a significant risk for mortality despite ablation (18% at 1 year). Although not randomized, the present results presented by Della Bella et al suggest that patients who are rendered noninducible after catheter ablation have improved freedom from cardiac death. In the Substrate Mapping and Ablation in Sinus Rhythm to Halt Ventricular Tachycardia (SMASH-VT) trial, a nonsignificant trend toward improved mortality was seen in patients randomly assigned to preemptive ablation. With the emerging knowledge of the strong association between implantable cardioverter-defibrillator shocks and mortality, these results seem plausible biologically.

A broad range of the predictive value of inducibility of VT during programmed stimulation has been reported. Furthermore, induction of VT is probabilistic, and the intensity and rigor of how much induction is performed does...
Impact inducibility. In this study, 8.7% of patients did not undergo programmed stimulation after ablation because of complications or noninducibility. Stimulation from the left ventricle can increase the yield of induction when attempts from the right side fail (10%). Induction of VT when pace mapping within the scar has also been reported.12 Pacing closer to the scar substrate and within the scar can selectively induce the VT of interest. The extent to which programmed stimulation was performed in the left ventricle is not reported, but it may change the current findings. These points are supported by the fact that the outcomes of patients who were noninducible and noninducible had a VT recurrence rate of 33% and a mortality rate of up to 18%, which is similar to the results in group B that was defined as a partial success (ablation of previously documented VTs with persistent inducibility of nondocumented sustained VTs or ventricular fibrillation).

The end point for VT ablation is also a subject of major debate. Noninducibility in the acute setting is not always predictive of freedom from VT.11 Although the data are mixed, substrate-based strategies, such as elimination of all abnormal electrogams or scar homogenization, have been recently introduced as a new end point.13,14 Importantly, the current group has looked at a scar-and-electrogram–based end point with abolition of late potentials in comparison with inducibility and has found that that elimination of late potentials was more predictive than inducibility for VT recurrence.15

The generalizability of these results must be placed in the context of referral bias, because this dedicated unit model that accepts referrals throughout all of Italy is unique. In sharp contrast to larger programs in the United States, the majority of patients referred for ablation in this study had no previous history of ablation (87%). It is also worth noting that the majority of patients in this report had hemodynamically tolerated VT (63%), which is not consistent with the majority of published reports from other major centers that specialize in VT ablation. All patients that were deemed high-risk made it to ablation, and only 10 patients required mechanical ventilation, suggesting excellent optimization or the need for a more predictive stratification scheme. A combination of these factors may account for the low rate of mortality reflected in the article (22% at 26 months in group C [defined as acute failure]). In perhaps the second largest single-center experience, Sacher et al16 reported a higher mortality rate of 35% and 17% at a median of only 13 months in patients with ischemic cardiomyopathy and nonischemic cardiomyopathy after ablation.

Procedures were performed expeditiously at this center, which has a highly experienced team. Two of 3 procedures performed were endocardial only, and the average procedure duration was 3.6 hours, with 22 minutes of radiofrequency energy delivery. However, the average length of stay in the dedicated ventricular intensive care unit was 8±3 days, and overall hospitalization was 15±10 days, which is longer than typically accepted in the United States. The current study, however, does not test a dedicated unit as a randomized variable in comparison with care in other settings to convincingly demonstrate this as the main factor responsible for the outcomes observed. The longer inpatient stays allowed for the early identification of recurrence and the ability to intervene again. In this study, 13% of patients experienced recurrence of VT during the index hospitalization and required repeat procedures. Of note, almost half of the patients that had in-hospital recurrence were in class A (complete success, noninducible after the first ablation); this highlights the inherent limitations of the predictive value of programmed stimulation.

The authors should be congratulated for their dedicated and skillful care of a large number of patients with careful attention to clinical follow-up (only 9% lost to follow-up). Indeed this is the largest published experience of patients with structural heart disease undergoing VT ablation. The results of this study favorably advance the field by reinforcing the need for coordinated and integrated care to optimize the outcomes of patients with recurrent VT. Although the ablation of VT has long been shown to improve quality of life by decreasing implantable cardioverter-defibrillator shocks, we hope that future studies, observational and randomized, will provide evidence of an all-cause mortality benefit.

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References

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