Cardiovascular Update

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Catheter Ablation of Ventricular Tachycardia in Patients with Structural Heart Disease

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Ventricular tachycardia (VT) is an abnormal heart rhythm that originates from one of the two lower chambers of the heart, the ventricles. During VT, the heart rhythm originates in the ventricle, and from there it propagates to the rest of the heart. VT can occur anywhere from 100 beats per minutes (bpm) up to 300bpm. It's a chaotic, hemodynamically unstable rhythm that, if sustained, may be potentially lethal. Although we divide VT into two different groups (patients with and without structural heart disease), in this discussion we'll be referring to VT in a patient with structural heart disease.

Ventricular tachycardia is most commonly seen in patients with weak or diseased heart muscle, typically referred to as cardiomyopathy.[1] Patients with cardiomyopathy are further categorized into two different groups: (1) ischemic cardiomyopathy (patients with weakened or scarred heart muscle as a result of a previous myocardial infarction or coronary artery disease) and (2) non-ischemic cardiomyopathy (patients with cardiomyopathy without any known history of ischemic heart disease or prior heart attack).[2] In the United States, approximately 450,000 patients die every year of sudden cardiac death (SCD).[3] SCD is most commonly caused by sustained VT that further degenerates into ventricular fibrillation (VF). VF is a lethal rhythm if not treated immediately.

Regardless of the etiology of the cardiomyopathy, most patients with cardiomyopathy eventually develop scar tissue within the heart muscle, predisposing them to VT. There are three different options in the management of VT: (1) implantable cardioverter defibrillators (ICD), (2) catheter-based ablation, and (3) antiarrhythmic medications. Most patients with VT require a combination of the three, or even all three of them, in order to successfully treat and prevent the arrhythmia. Although an ICD is the cornerstone therapy to prevent SCD, this therapy is aimed at treating the arrhythmia once it's already occurred. ICDs don't prevent arrhythmia, they prevent the arrhythmia from becoming lethal. Only antiarrhythmic medications and catheter-based ablation are aimed at preventing the arrhythmia from occurring or decreasing the arrhythmia burden. Although antiarrhythmic agents are useful in preventing arrhythmia, they often fail or aren't tolerated well by the patients due to multiple potential side effects. On patients that don't tolerate the medications or medications failed at preventing VT, then a catheter-based ablation is a useful additional treatment option.[4] Some recent studies suggest the use of catheter-based ablations before even starting antiarrhythmic medications.[5]

Catheter-based VT ablation has been used successfully for more than 30 years in the treatment of VT.[6] It's a procedure in which several catheters are advanced through a vein or artery, commonly through the groin, all the way into the heart in order to localize the origin of the VT. One of these catheters can deliver radiofrequency energy and produce a superficial burn in the endocardium, cauterizing the tissue that's causing the tachycardia. The other catheters, also known as mapping catheters, are used in conjunction with a 3-D electroanatomical mapping system, to help localize the tissue causing tachycardia. With these catheters, the electrophysiologist performs specific pacing maneuvers in order to induce the VT during the procedure. Once the arrhythmia is induced, the tissue causing the arrhythmia can be targeted for ablation.[7]

During a catheter-based ablation, the electrophysiologist uses a sophisticated 3-D mapping system to create multiple maps of the ventricle. The aim of an anatomical map is to identify dimensions of

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Upcoming Conference

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the ventricles, the location of its walls, as well as internal structures such as papillary muscles and valves. The mapping system is also able to create an electroanatomic map, which can help localize the abnormal heartbeat origin. Also, the mapping system can create a voltage map of the ventricles, identifying areas of scar tissue and differentiating them from healthy tissue. Scar tissue commonly gives rises to arrhythmias and therefore is targeted during ablations.[8] Figure 1 shows a voltage map of the left ventricle with a large inferior scar. Note the contrast between the healthy tissue (purple) and the scar tissue (red to blue).

The procedure may last from two to six hours. The number of energy deliveries or "ablations" varies from patient to patient and depends on the amount of scar tissue on the patient's heart as well as the number of ventricular tachycardias induced during the study. Figure 2 shows the same patient after the ablation, with the pink and red dots indicating the areas where energy was delivered.

In some instances, the tissue causing the arrhythmia is closer to the epicardium, and patients require an epicardial ablation.[9] Epicardial ablations are also useful; however, they require a different approach and are associated with a higher degree of complications. Therefore, they should only be considered in patients in whom endocardial ablation has failed.

Radiofrequency catheter ablation of VT reduces implantable cardioverter-defibrillator shocks and VT episodes and improves quality of life.[10,11] Another study showed that certain patients had a lower risk for combined death, excessive ventricular tachycardia and appropriate ICD shock with ablation.[12]

A recent study this year demonstrated that catheter ablation seems to reduce hospitalization and overall health care utilization in VT patients with an ICD. After VT ablation, median annual cardiac rhythm-related medical expenditures decreased by more than $5,000. Also, the same study showed that the percentage of patients with at least one cardiac rhythm-related hospitalization and ER visit decreased from 53 percent and 41 percent before ablation, to 28 percent and 26 percent after ablation, respectively.[13] BayCare has multiple electrophysiology labs equipped with state-of-the-art, sophisticated electrophysiology equipment, in which this type of procedure is done often, as well as multiple other types of ablations for different cardiac rhythm disturbances.

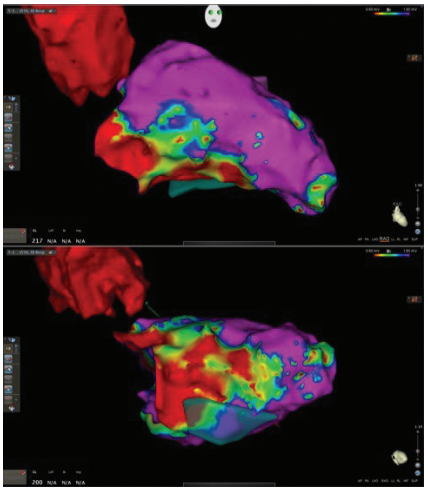

Figure 1

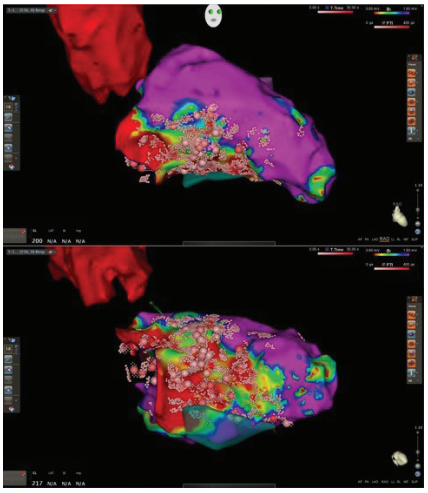

Figure 2

References:

1 Josephson, M.E., Clinical Cardiac Electrophysiology: Techniques and Interpretations, in Solution. 2008, Lippincott Williams and Wilkins.

2 Mathuria, N., R. Tung, and K. Shivkumar, Advances in ablation of ventricular tachycardia in nonischemic cardiomyopathy. Curr Cardiol Rep, 2012. 14(5): p. 577-83.

3 Tung, R., N.G. Boyle, and K. Shivkumar, Catheter ablation of ventricular tachycardia. Circulation, 2010. 122(3): p. e389-91.

4 Richardson, A.W. and M.E. Josephson, Ablation of ventricular tachycardia in the setting of coronary artery disease. Curr Cardiol Rep, 1999. 1(2): p. 157-64.

5 Sapp, J.L., et al., Ventricular Tachycardia Ablation versus Escalation of Antiarrhythmic Drugs. N Engl J Med, 2016. 375(2): p. 111-21.

6 Wilber, D.J., Catheter ablation of ventricular tachycardia: two decades of progress. Heart Rhythm, 2008. 5(6 Suppl): p. S59-63.

7 Hutchinson, M.D. and H.K. Garza, Contemporary Tools and Techniques for Substrate Ablation of Ventricular Tachycardia in Structural Heart Disease. Curr Treat Options Cardiovasc Med, 2018. 20(2): p. 16.

8 Oza, S. and D.J. Wilber, Substrate-based endocardial ablation of postinfarction ventricular tachycardia. Heart Rhythm, 2006. 3(5): p. 607-9.

9 Hsia, H.H., Epicardial ventricular tachycardia ablation an evolution of needs. J Am Coll Cardiol, 2010. 55(21): p. 2373-5.

10 Marchlinski, F.E., et al., Long-Term Success of Irrigated Radiofrequency Catheter Ablation of Sustained Ventricular Tachycardia: Post-Approval THERMOCOOL VT Trial. J Am Coll Cardiol, 2016. 67(6): p. 674-683.

11 Vergara, P., et al., Successful ventricular tachycardia ablation in patients with electrical storm reduces recurrences and improves survival. Heart Rhythm, 2018. 15(1): p. 48-55.

12 Santangeli, P., et al., Early Mortality After Catheter Ablation of Ventricular Tachycardia in Patients With Structural Heart Disease. J Am Coll Cardiol, 2017. 69(17): p. 2105-2115.

13 Winterfield, J.R., et al., Impact of ventricular tachycardia ablation on health care utilization. Heart Rhythm, 2018. 15(3): p. 355-362.

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