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EDITORIAL

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Cryoablation: A useful tool in selected cases

In this issue of the Journal of Arrhythmia, Kajiyama et al describe the ablation of a monomorphic ventricular extrasystole (VE) coming from the left-sided conduction system.[1] The authors present a detailed multipolar map of the VE and demonstrate that the earliest activation was in fact from a fascicular signal with local activation that preceded the earliest myocardial activation and QRS onset by 30 milliseconds. The narrow QRS morphology was also consistent with an origin for the VE that had rapid access to the left anterior fascicular system. As the earliest location correlated with a site that seemed to be in proximal left fascicle, they also mapped the left-sided Purkinje system in the sinus rhythm to delineate where this ran. Given the location and concern of conduction system injury, the authors elected to perform ablation with the 4 mm cryoablation catheter (Freezor, Medtronic) and to target a site a few millimeters apically to the site of earliest site of activation. Here, ablation resulted in suppression of the VE when the catheter hit the target temperature (identifiable by the noise on electrograms in Figure 2).[1]

The authors are to be commended for their careful mapping and fine use of the cryoablation catheter. Focal cryoablation for ablation of AV nodal reentrant tachycardia[2] and substrates near the AV node[3] have been well-described and used primarily for safety as this generally results in a smaller ablation lesion size and there is more time before irreversible ablation damage is done; this allows one to immediately warm the catheter at the first sign of any unwanted injury and usually results in rapid and full recovery of the tissue.

In addition to this, cryoablation further results in the catheter tip adhering to the tissue once target temperature has been hit, which eliminates catheter instability. This provides a more focal lesion at the site of interest that may be both safer and more effective when there is difficulty with contact or stability with a radiofrequency ablation catheter. Cryoablation of VE from the papillary muscles has now been well-described as a useful primary tool[4], and in our institution, we have had excellent results using this as an adjunctive tool even when prior radiofrequency ablation has failed.[5]

While we find that cryoablation is a useful tool, it provides its own unique challenges. There are three versions of the catheter that are commonly used: a 7F 4 mm tip, which provides the smallest lesion size, a 7F 6 mm tipped version (Freezor Xtra), and a 9F 8 mm tipped version (Freezor Max). The catheters are powered by the Cryoconsole using nitrous oxide, which can cool the tip to around −80 degrees centigrade (Medtronic, Minneapolis, US). The catheters are unidirectional, and much more cumbersome to manipulate compared to the current radiofrequency ablation catheters available. They are stiffer and have a longer tip beyond the radius of curvature (particularly the 6 mm and 8 mm tip versions), making it more challenging to loop the catheter in descending aorta for retrograde access to the left ventricle. The 9F catheter is also too large to fit through many of the standard sheaths used for ablation. In our experience, aortic trauma may be caused by manipulating the catheter, and we have adopted a strategy of using long sheaths both transseptal and retrograde aortic to access the ventricles when ablating with these catheters.[5]

While the catheter can adhere nicely to the tissue once it is cooled, getting the catheter to the correct site may still be challenging. The location projection may not be as accurate as radiofrequency ablation catheters, particularly when compared to magnetic electroanatomic mapping systems. Furthermore, the refresh rate from an electroanatomic mapping system or low frame rate fluoroscopy may not provide adequate information to determine where the tip is. The catheter must have enough tissue contact when cooled to adhere to the site of interest—here the authors describe attempts at a test lesion of −30 degrees, which did not successfully cool, most likely because of catheter instability precluding adherence until a colder temperature was used. To overcome these hurdles, we find the use of intracardiac echocardiography (ICE) and high frame rate fluoroscopy provide indispensable supplemental information to electroanatomic mapping to determine what to target, and if the cryoablation catheter has adhered to the correct site. If we determine the catheter has adhered to the wrong site, the catheter can immediately be warmed, and the correct site targeted again. To achieve permanent ablation, a freeze-thaw-freeze cycle with 3-4 minute lesions to the same site is recommended.

As the authors report here, cryoablation can be a very useful tool in regions where stability is challenging and precision is important. These catheters present their own unique benefits and limitations and understanding these differences can help achieve success where radiofrequency ablation may result in too much collateral damage.

CONFLICT OF INTERESTS

The authors declare no conflict of interests for this article.

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REFERENCES

1. Kajiyama T, Kondo Y, Nakano M, Miyazawa K, Nakano M, Hayashi T, et al. Successful cryoablation of ventricular extrasystoles originating from the vicinity of the left anterior fascicle. J of Arrhythmia. 2020;36:518–21.
2. Santangeli P, Proietti R, Di Biase L, Bai R, Natale A. Cryoablation versus radiofrequency ablation of atrioventricular nodal reentrant tachycardia. J Interv Card Electrophysiol. 2014;39:111–9.
3. Insulander P, Bastani H, Braunschweig F, Drca N, Gudmundsson K, Kenneback G, et al. Cryoablation of substrates adjacent to the atrioventricular node: acute and long-term safety of 1303 ablation procedures. Europace. 2014;16:271–6.
4. Rivera S, Ricapito MdlP, Tomas L, Parodi J, Bardera Molina G, Banega R, et al. Results of cryoenergy and radiofrequency-based catheter ablation for treating ventricular arrhythmias arising from the papillary muscles of the left ventricle, guided by intracardiac echocardiography and image integration. Circ Arrhythm Electrophysiol. 2016;9:e003874.
5. Gordon JP, Liang JJ, Pathak RK, Zado ES, Garcia FC, Hutchinson MD, et al. Percutaneous cryoablation for papillary muscle ventricular arrhythmias after failed radiofrequency catheter ablation. J Cardiovasc Electrophysiol. 2018;29(12):1654–63.