Integrated Electroanatomic Mapping with Three-dimensional Computed Tomographic Images for Real-time Guided Ablations.

Summary by Ericka Weeks

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As approaches to treatment of complex arrhythmias have evolved, a clinical need has emerged for integrated electroanatomic mapping systems that guide placement of ablation lesions at correct predetermined anatomic locations by merging three-dimensional computed tomography (CT) or magnetic resonance images (MRI) with real-time electroanatomic cardiac maps. Conventional electrophysiologic mapping systems can only estimate cardiac anatomies because they are reconstructed from several endocardial catheter electrode readings and are not able to provide the same degree of detailed cardiac architecture as CT or MRI. In this study, investigators evaluated the first integrated mapping system (CartoMerge™ Module, Biosense Webster, Inc.) to determine the true accuracy of its image integration in each cardiac chamber, to assess its ability to aid ablation procedures and to compare different image registration techniques.

After entering the chest cavity, 2.3-mm CT fiducial markers were attached to the epicardial surface of each of the cardiac chambers in nine mongrel dogs. Intricate three-dimensional anatomy of cardiac chambers and vascular structures was reconstructed from the CT images with the Carto™ XP System and registered on to the electroanatomic map using a combination of landmark and surface registration techniques. To assess the accuracy of the image integration, targeted ablations were performed at each of the CT markers guided only by the registered images. At autopsy, the overall position error of the targeted CT marker ablation sites was 2.2±1.1 mm. In the individual cardiac chambers, the position error in the right atrium was 1.9±0.9 mm, 2.7±1.2 mm in the right ventricle, 1.8±1.0 mm in the left atrium and 2.3±1.1 mm in the left ventricle. Ablations of the cavotricuspid isthmus (n=4), fossa ovalis (n=4), and pulmonary veins (n=6) were also performed to evaluate the integrated mapping system's ability to guide more complex clinical ablation techniques, resulting in position errors of 1.8±1.5 mm, 2.2±1.3 mm, and 2.1±1.2 mm respectively. Retrospective analysis suggests a combination of landmark registration with surface registration resulted in consistent accuracy in each cardiac chamber of <3 mm.

Based on these findings, the investigators concluded that the integration of pre-acquired CT images using the Carto™ XP System and CartoMerge™ Image Integration Module allowed for accurate placement of anatomically targeted ablations in each cardiac chamber. The CartoMerge™ Image Integration Module can be successfully used to guide complex ablation procedures and may prove especially beneficial for anatomically based ablation strategies.

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