In this installment of our journal’s teaching rounds, Debruyne et al. provide an outstanding learning experience constructed on simple and logical teaching steps of what at first glance seems to be a complex and partially random observation. Their case and the findings they discuss highlight the difficulties in specifically targeting 1 of 2 structures living together on the true interatrial septum.

The True Interalatrial Septum

A true septum is a partitioning wall shared between 2 structures. The true interatrial septum is a relatively limited structure, which in the perianular region is referred to as the midseptum. The fossa ovalis and this midseptal region are the places where one can penetrate and can create an intracardiac connection between the 2 atria. More superiorly, the right and the left atria separate from each other with intervening fibrous tissue and pericardial fat. This is why transseptal puncture across the superior limbus (above the fossa) necessarily exits the heart before reentering the left atrium. More caudally, the coronary sinus and the pyramidal space constitute the so-called posterior septum. This region, however, is not a partition between the right and the left atria but a separate posterior pyramid-shaped space.

The midseptum is the place of residence for the compact A-V node. Although accessory pathways can occur anywhere on the annulus connecting the atrium to the ventricle, when they occur on the midseptum, unique features result. The proximity to the A-V node essentially makes it impossible with any degree of certainty to target the atrial insertion of midseptal pathways without injuring the A-V node. Furthermore, because this is a true septum, it becomes possible for pathways to have their atrial insertion in 1 atrium and the ventricular insertion in the contralateral ventricle.

An additional cause for difficulty with just recognizing the existence of these pathways is that we do not routinely place a mapping catheter on either the right or the left midseptum. The His bundle recording catheter is placed anterior to the midseptum, and electrodes in the proximal coronary sinus are posterior to the true septum. Thus, with retrograde conduction over an accessory pathway if there is near-simultaneous atrial activation on the His catheter and the proximal coronary sinus electrodes, then a right midseptal atrial connection for the accessory pathway should be suspected. Similarly, if there is near-simultaneous activation recorded on the proximal His electrodes and the midcoronary sinus electrodes, then a left midseptal atrial connection for an accessory pathway is suggested.

Anteroseptal Accessory Pathways

Although it is essentially impossible to ablate midseptal accessory pathways without risk to the A-V node, anteroseptal pathways, while often challenging, do give the operator clear options for high success rates and lower risk for injury to the compact A-V node. Because the compact A-V node is a midseptal structure, the anterior portions of the conduction system that may be damaged when ablating anteroseptal pathways are the fast pathway input to the A-V node behind the tendon of Todaro and the His bundle located in the membranous septum—a portion of the interventricular septum. Because of the fibrous insulation surrounding the His bundle, ablation on the membranous septum is associated with a relatively low risk of permanent damage to the His bundle, yet with a very high chance of eliminating the ventricular insertion of an accessory pathway in this region. The key for safety, however, is to not ablate on the atrial side of the annulus and not to allow the catheter to drift lower onto the midseptum where a very high risk of injury to the compact A-V node exists.

The cusps of the aortic valve and the aortic annulus separate the 2 atria in the anterior atrioventricular annular region. As a result, ablation of conducting pathways between either atria or either ventricle in the anteroseptal region is occasionally accomplished by ablation in the aortic cusps.

Posteroseptal Accessory Pathways

Because there is no posterior interatrial septum, posteroseptal pathways involve the coronary sinus and the pyramidal space. These may involve endocardial insertions for the atrial and the ventricular insertions or use the epicardially located myocardial sleeves on the proximal coronary sinus or one of its branches, such as the middle cardiac vein.

The Atrioventricular Septum

Because the tricuspid annulus is located relatively more caudal to the mitral annulus, a unique portion of the cardiac septum exists not part of either the interatrial or the interventricular septum. This atrioventricular septum separates the right atrium and the left ventricle (LV) with septal tissue that is composed primarily of LV myocardium with contribution from right ventricular myocardium and the right atrium.
The AV septum is contiguous with the true interatrial septum, and its regional anatomy is important for electrophysiologists to understand when avoiding inadvertent damage to the compact AV node. In general, if the ablation catheter is ventricular and not on the mid portion (anterior or posterior septum), delivering energy is usually safe. However, from the electrograms alone it is difficult to know when one has reached a safe position on the ventricular side of the annulus. Despite proximity to the AV node and actually laying on the right atrium, electrodes on the AV septum record a large ventricular signal from the basal LV and ventricular septum, which may fool the operator into thinking that the ablation electrode is in the ventricle with low risk of AV block should ablation energy be delivered. The proximity of the LV to this site is such that it has been suggested that permanent LV pacing might be achieved without crossing the tricuspid valve by inserting a deep intramyocardial pacing electrode in this location (Figure).4,5

Debruyne et al1 provide us the opportunity for layers of learning from the mechanism of a unique pattern of varying QRS morphology during atrial pacing to the anatomy of the interatrial septum and important points for mapping and safely ablating septal accessory pathways.

Disclosures
S.J. Asirvatham receives no significant honoraria and is a consultant with Abiomed, Atricure, Biotronik, Boston Scientific, Medtronic, Spectranetics, St. Jude, Sanofi-Aventis, Wolters Kluwer, Elsevier. W.G. Stevenson is coholder of a patent on needle ablation that is consigned to Brigham and Women’s Hospital.

References

Figure. Schematic representation of the complex regional anatomy of the cardiac septa. L indicates left coronary cusp; LBB, left bundle branch; MV, mitral valve; N, noncoronary cusp; and R, right coronary cusp.

Key Words: anatomy ■ electrophysiology
Editor's Perspective: The Interatrial Septum
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Circ Arrhythm Electrophysiol. 2013;6:e75-e76
doi: 10.1161/CIRCEP.113.000956

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