A 56-year-old man with atrial fibrillation refractory to treatment with antiarrhythmic medications underwent catheter ablation. He arrived at the electrophysiology laboratory in sinus rhythm. During circumferential ablation around the right pulmonary veins, entrance block was established by the elimination of pulmonary vein potentials recorded by a circular mapping catheter positioned within the right inferior pulmonary vein. However, spontaneous depolarizations within the pulmonary vein were observed to exit the atrium, resulting in atrial premature depolarizations (Figure 1, Panels 1 and 2). Pacing around the circular mapping catheter confirmed that exit block was not present (Figure 1, Panel 3). With further ablation, exit block was established (Figure 1, Panel 4).

Entrance block in the absence of exit block has been reported to occur in 40% of pulmonary veins following ablation. There are three possible explanations for the occurrence of entrance block without exit block. First, bidirectional conduction may be present between the pulmonary vein and atrium, but the operator may mistakenly conclude entrance block is present. It can be difficult to distinguish pulmonary vein potentials from far-field potentials recorded from adjacent structures, such as the right atrium or left atrial appendage.

Second, both entrance and exit block may be truly present, but pacing the circular mapping catheter at high output may directly capture the right atrium or left atrial appendage. This can be recognized by examining the P-wave morphology and intracardiac activation sequence.

Finally, unidirectional conduction at the pulmonary vein–atrial border likely occurs and this is the most plausible explanation for our observations, as there are no signals whatsoever recorded by the circular mapping catheter that could possibly represent entrance conduction and the P-wave morphology and atrial activation sequence are not consistent with direct right atrial capture (positive P wave in lead V1, and HRA electrograms not particularly early with respect to the surface P-wave or coronary sinus electrograms).

While two series have described very favorable outcomes following pulmonary vein isolation using entrance and exit block as the endpoint, both studies are limited by lack of comparison to a group using entrance block only as the endpoint. Still, given that assessment of entrance block can be challenging and that the purpose of pulmonary vein isolation is to prevent ectopic firing within the pulmonary vein from exiting to the left atrium and initiating atrial fibrillation, we consider exit block to be an objective, important endpoint in pulmonary vein isolation, in addition to entrance block.

References

Figure 1: Surface electrocardiogram and intracardiac recordings. HRA = high right atrium; Lasso = circular mapping catheter; CS = coronary sinus. Sweep speed is listed above each panel.