INNOVATIVE COLLECTIONS

COMPLEX CASE STUDY

Atrial Fibrillation Ablation: An Antiarrhythmic Turn or a Proarrhythmic Bump?

SHINSUKE MIYAZAKI, MD and ASHOK J. SHAH, MD

Hôpital Cardiologique du Haut-Lévêque and the Université Victor Segalen Bordeaux II, Bordeaux, France

KEYWORDS. Atrial fibrillation, atrial tachycardia, catheter ablation.

This case report describes the unique localized conduction disturbance in the context of atrial fibrillation (AF) ablation.

Case report

A 67-year-old man underwent pulmonary vein (PV) isolation and left atrial (LA) linear ablation of mitral isthmus and roof for symptomatic, drug-refractory persistent AF 9 months ago. The asymptomatic atrial tachycardia (AT) recurred 3 weeks later, and palpitation appeared due to frequent ectopic beats 6 months after the procedure. He was referred for the second ablation procedure for incessant AT on ongoing amiodarone therapy. He had no structural heart disease and the echocardiographic LA size was 54 mm on the parasternal view.

A steerable decapolar catheter was inserted in the coronary sinus (CS), and an externally irrigated ablation catheter (Thermocool, Biosense Webster, Diamond Bar, CA) was advanced into the LA via patent foramen ovale. Deductive mapping, including activation and entrainment mapping of the tachycardia at cycle length of 260 ms, revealed centrifugal activation from the inferior LA. Single radiofrequency application at this site converted clinical AT into another one that terminated inadvertently during entrainment from the proximal CS. Atrial activity slower than in the surrounding areas (Figure 1a, red arrows) was observed at the posterior LA roof, which was just above previous linear lesion during clinical AT and was suggestive of localized conduction block. Further mapping during sinus rhythm showed an 8:6 pattern of localized conduction (group beating) (Figure 1b) involving the same area. In other words, two consecutive beats were blocked (Figure 1b, green arrows) in alternation with 1:1 conduction of the subsequent six beats into the local area. The reconnected right inferior PV was successfully reisolated by further application.

Discussion

Persistent and longer lasting forms of AF necessitate extensive atrial tissue ablation to restore sinus rhythm, the optimal endpoint of catheter ablation. Despite improvement in the ablation strategies, a relatively high volume of tissue is ablated. Together with structural remodeling of the chamber, ablation leads to inhomogeneity in the electrophysiological properties (conduction and refractoriness) of the ablated chamber. In this case, impulse conduction to an island of tissue on the high posterior LA was irregular during tachycardia (Figure 1a), when 1:1 conduction was present elsewhere in the atria. Interestingly, the irregular pattern of conduction during AT transformed into an intermittent and regular pattern of block during sinus rhythm. We analyzed 36 consecutive sinus beats with the catheter positioned at the same site. P wave morphology, PP interval (592 ± 5 ms), PR interval (192 ± 4 ms), and P-CSs interval (160 ± 2 ms) were constant. However, the average conduction delay from the onset of P wave to the local electrogram recorded on the island of tissue during six consecutively conducted beats showed significant beat-to-beat variation (first beat,
Figure 1: a Observation at posterior LA roof; b Observation of two consecutive beats blocked.
129 ± 5 ms; second beat, 137 ± 4 ms; third beat, 92 ± 8 ms; fourth beat, 97 ± 2 ms; fifth beat, 110 ± 11 ms; sixth beat, 116 ± 6 ms; ANOVA p<0.0001) despite recording constant delay for each beat over the observed time period. These findings provide evidence towards the presence of localized conduction disturbance in the zone leading to this island of tissue amidst uniform atrial conduction elsewhere. Such a pattern of impulse conduction is similar to the conduction of the atrioventricular nodal approaches involving more than one fascicle with different electrical properties (refractory period, conduction velocity, etc.). This finding also elucidates the potential proarrhythmic role of ablation through the modification of electrophysiological properties of the substrate.

References