Case Summary

A 47-year-old male with a 4-year history of symptomatic, drug-resistant lone paroxysmal atrial fibrillation (AF) was referred for a first ablation procedure. He suffered from daily AF episodes that lasted a maximum of 8 h. Episodes of AF always started following monomorphic atrial ectopy (Fig. 2.1).

A decapolar catheter (Xtrem, ELA Medical, Le-Plessis-Robinson, France) was inserted inside the coronary sinus (CS) while the ablation catheter (Thermocool Biosense Webster, Diamond Bar, CA) and a decapolar circumferential M. Haissaguerre
Department of Cardiology and Electrophysiology, CHU de Bordeaux, Hospital Cardiologique de Haut Leveque, Avenue de Magellan, Pessac 33604, France

---

Fig. 2.1 Twelve-lead ECG. Sinus rhythm and short coupling atrial ectopies (with functional left bundle branch block [LBBB])
catheter (Lasso, Biosense Webster, Diamond Bar, CA) were introduced through a long sheath in the left atrium (LA). The circumferential catheter was placed in the left superior pulmonary vein (LSPV) and recorded venous and atrial potentials (Fig. 2.2).

What mechanism is illustrated and what action is required?

Case Discussion

Figure 2.1 shows a recording of atrial ectopics with a short coupling interval (also note the functional left bundle branch block [LBBB]). The P-wave morphology during ectopy is flat in the lateral leads, positive in the inferior leads and in lead V1, suggesting they originate from the LSPV. Endocardial tracings from the LSPV (Fig. 2.2) show two separated potentials during sinus rhythm (Fig. 2.2, first complex). The first potential (white star) represents activation of the adjacent LA and is synchronous with the second half of the P-wave (in the right PVs it should be the first part of the P-wave). The second potential reflects local activity from the PV striated musculature (black star). When ectopy occurs in the PV (Fig. 2.2, second complex), there is a reversal of the described activation sequence, with the PV potential preceding the atrial potential. This pattern of reverse activation in a dead-end structure during ectopic triggered AF evidence for the arrhythmogenic potential of that PV. Mapping of the earliest site of activity during ectopy allows identification of discrete sites inside the vein, while the atrial exit site is dependent on the anatomy of the PV-LA connecting fascicles.

Given that arrhythmia recurrence can occur from either the pulmonary vein that is active at the time of the procedure or any other PV, complete electrical isolation of all PVs has to be carried out with a series of coalescent RF applications using a dedicated PV circumferential catheter to help with mapping. Ablation is performed outside the vein (within 1–2 cm of the PV ostia) for right PVs and for the posterior part of the vein.
of the left PVs; however, due to the ridge between the left pulmonary veins and the left atrial appendage (LAA), catheter stability is an issue for ablation of the anterior aspect of the left PV’s, and ablation is often within 1 mm of the veins.

In this case, ablation was started at the low anterior LSPV (pole 5) where the earliest activity was located and where a reverse in PV polarity was observed, both criteria pointing at a local anatomical connection (Fig. 2.3, panel A). Ablation at this point delayed the venous potentials (Fig. 2.3, panel B), and a second anatomical breakthrough was subsequently ablated at the upper part of the vein (pole 1). The ectopic beats stopped (Fig. 2.3, panel C) and the venous potentials became dissociated (Fig. 2.4). Ablation of the left inferior PV (LIPV) was performed in the same way. For the right veins, segmental or circumferential ablation with a continuous circular lesion can be performed depending on the operator’s preference. When doing continuous circumferential lesions, it is unusual to achieve PV isolation without further ablation targeting the earliest PV activity or sites of reverse PV polarity as recorded on the circumferential mapping catheter, as in Fig. 2.2, indicating a residual anatomical connection on the line of ablation.

After ablation, nine attempts at induction (with bursts up to a cycle length of 200 ms) at three different places (CS and both appendages) could not induce sustained arrhythmia, predicting a favorable clinical outcome.

This case illustrates a typical ablation of paroxysmal AF where it was clearly demonstrated that the arrhythmogenic ectopic beats triggering AF originated from the LSPV.

Fig. 2.3 Endocardial tracings recorded during sinus rhythm from the left superior pulmonary (LSPV) vein. Recording from a decapolar circumferential catheter inserted inside the LSPV (PV 1–2 to PV 9–10) and a decapolar catheter inserted into the coronary sinus (CS 1–2 to CS 9–10). During ablation targeting the earliest venous potential (black star), progressive slowing of the conduction to the vein (panel A and B) to the complete block (panel C)
Fig. 2.4 Endocardial tracings recorded during sinus rhythm from the left superior pulmonary vein (LSPV). Recording from a decapolar circumferential catheter inserted inside the LSPV (PV 1–2 to PV 9–10) and a decapolar catheter inserted into the coronary sinus (CS 1–2 to CS 9–10). Dissociation of the venous potential (black star) with a slow automatic activity.

Bibliography


Cardiac Electrophysiology
Clinical Case Review
Natale, A.; Al-Ahmad, A.; Wang, P.J.; DiMarco, J. (Eds.)
2011, XIX, 667 p., Hardcover