IMAGES IN CARDIOLOGY

Post-PVI Left Atrial Flutter Managed with Pulmonary Vein Re-Isolation Using Cryoballoon Ablation

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Abstract

A case of left atrial flutter occurring after pulmonary vein isolation effected via cryothermic balloon ablation for atrial fibrillation is presented, which was successfully managed with pulmonary vein re-isolation. ***Rhythmos 2020; 15(1):11-13.***

Key Words: atrial fibrillation; atrial flutter; ablation; pulmonary vein isolation; pulmonary vein reconnection; cryoballoon ablation

Abbreviations: AF = atrial fibrillation; AFlu = atrial flutter; CTI = cavotricuspid isthmus; LA = left atrial; LSPV = left superior pulmonary vein; PV = pulmonary vein; PVI = pulmonary vein isolation; PVR = pulmonary vein reconnection; RF = radiofrequency

A 44-year-old gentleman with a 10-year history of paroxysmal atrial fibrillation (AF) (**Figure 1**) was referred for catheter ablation due to increased arrhythmia recurrences over the past one year despite medical treatment. He reported annual recurrences of his arrhythmia until one year ago, but the preceding year he sustained 4 episodes with each lasting 1-1 ½ hours despite receiving antiarrhythmic drug therapy with propafenone and bisoprolol. Past medical history was significant for sleep apnea syndrome (non-obese physique; body weight 85 kg) managed with use of a continuous positive airway pressure therapy.

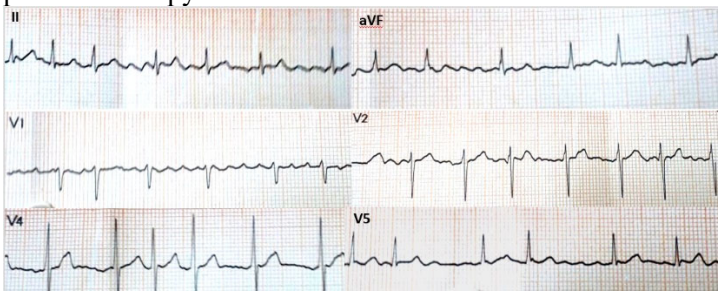

Figure 1

He underwent a first procedure of pulmonary vein (PV) isolation (PVI) 9 ½ months earlier with use of cryo-balloon ablation, where all four PVs were successfully isolated. An example of successful elimination of PV potentials in the left superior PV (LSPV) is presented in **Figure 2** (compare encircled recordings of PV potentials which are present in the left panel and absent in the right panel). However, one week after the procedure, the patient developed an arrhythmic episode which was managed with antiarrhythmic drugs (oral propafenone). ECG recording indicated a regular atrial tachycardia rhythm with an atrial rate of ~300 bpm and a 2:1 and often variable atrioventricular conduction, compatible with atrial flutter (AFlu), albeit with positive flutter waves in the inferior leads and in lead V1 suggestive of a clockwise, possibly isthmus-dependent, AFlu pattern (**Figure 3**). Thus, a repeat ablation procedure was scheduled with the intent to perform a cavotricuspid isthmus ablation after checking for and having ascertained the absence of any pulmonary vein reconnection (PVR).

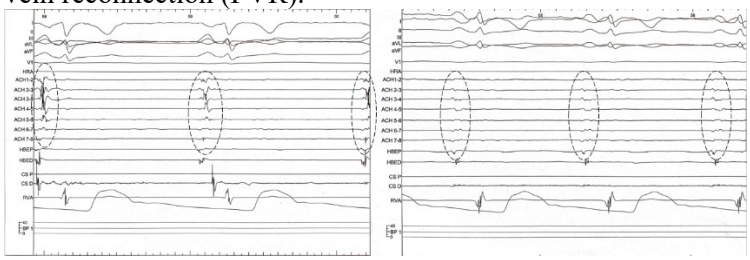

Figure 2

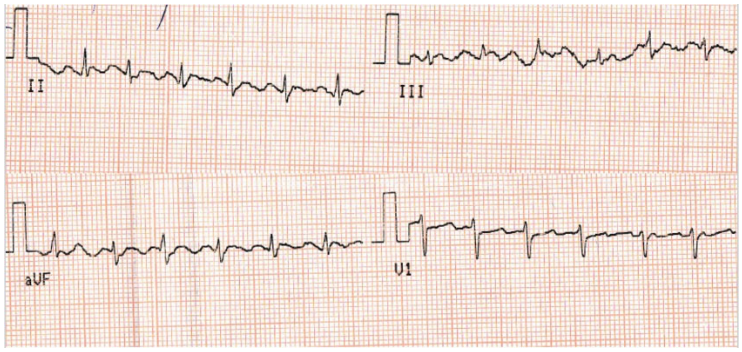

Figure 3

During the repeat procedure, access to the left atrium was obtained via a transseptal puncture and PVR was first explored. Indeed, PVR was detected in the LSPV and the right inferior PV (RIPV), while the right superior and left inferior PVs remained isolated. Thus, re-isolation was undertaken with use of a cryothermic balloon. During insertion of the lasso catheter into the RIPV, ambient atrial activity was noted, which intensified with the start of delivery of cryothermic energy in the antrum of the RIPV but ceased with further drop of the temperature. After the isolation of the RIPV, the guiding catheter was accidentally moved into the right atrium and it took a while until it could be re-inserted into the left atrium. During these maneuvers, the atrial tachycardia occurred. After repositioning the catheter into the left atrium, the RIPV was re-checked during the tachycardia but no PV potentials were recorded (**Figure 4**, left panel, encircled

recordings). However, when positioning the catheter into the LSPV, PV potentials were apparent (**Figure 4**, right panel, encircled recordings). Thus, cryoablation of the LSPV was initiated (**Figure 5**) and during the freezing process, these potentials were reduced (**Figure 6**, left panel) and when eliminated, the tachycardia was terminated and sinus rhythm was restored (**Figure 6**, right panel, arrow). At the end of the procedure a CTI line was also performed with use of radiofrequency ablation. The procedure remained uncomplicated and the patient was discharged home the next day. Over the subsequent 4 months the patient has remained free of arrhythmia recurrences.

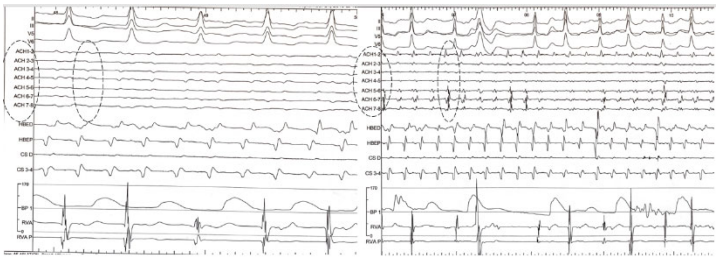

Figure 4

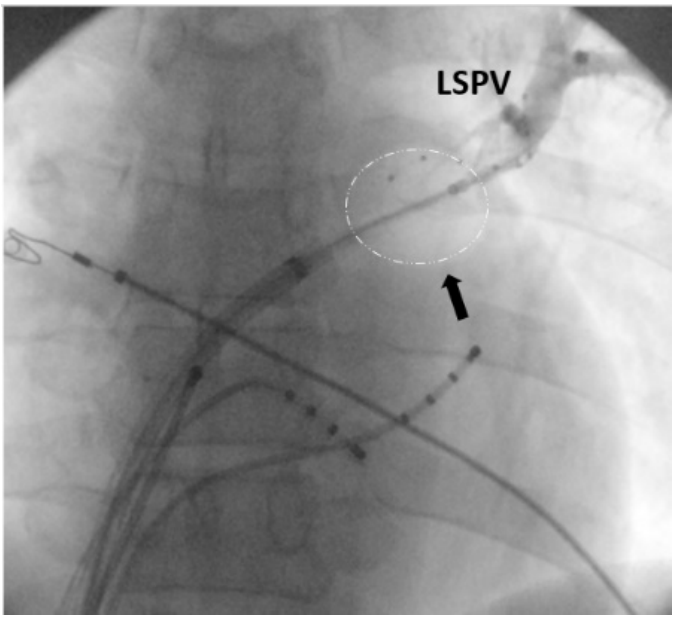

Figure 5

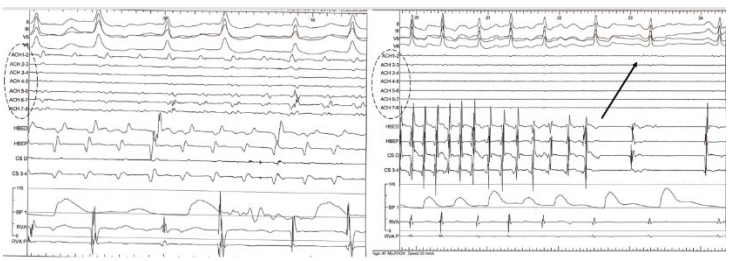

Figure 6

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Pulmonary vein (PV) isolation (PVI) using cryoballoon ablation, as a single-shot technique, has been increasingly employed to treat patients with atrial fibrillation (AF), successfully rivaling the conventional approach with point-by-point radiofrequency (RF) ablation. [1, 2] Both techniques have high rates of successful PVI achieved acutely, however, both are plagued by increased rates of PV reconnection (PVR) [3] responsible for recurrences of AF and other atrial arrhythmias, such as atrial flutter (AFlu). In patients undergoing PVI, if AFlu was present before AF ablation, one may expect AFlu to recur after ablation, unless cavotricuspid isthmus (CTI) ablation has been concurrently performed.[4] However, there are cases, as in our patient, where AFlu presents for the first time after AF ablation. Whether AFlu occurrence after AF ablation is also associated with AF recurrence has not been clear. Some investigators have suggested that AFlu emerging after PVI may be more frequent in patients with extrapulmonary sources of AF, but in our patient, AF foci were all located in the PVs.

Typical CTI-dependent AFlu accounts for 7– 10% of all post-AF ablation atrial tachycardias.[5] In the majority (80%) of patients it has a counterclockwise pattern. However, some atypical (altered) ECG characteristics have been identified in this particular subgroup in comparison to patients with typical CTI-dependent AFlu who have not undergone prior PV isolation. [6] Specifically, the F-waves in the inferior leads may be upright in as many as 60% of patients with prior LA ablation due to reduction in bipolar LA voltage and altered LA activation together with craniocaudal activation of the RA free wall. Thus, the initial thought was that the AFlu in our patient was probably of an isthmus-dependent type, either counterclockwise with altered ECG features, as explained, or clockwise that would better fit this ECG pattern (Fig. 3). However, in cases of newly emerging AFLu after PVI, as in our case, one has to look for PV-related left atrial flutters,[7] It has been suggested that certain ECG characteristics may aid in differential diagnosis, for example, a negative component in lead I, when present, may be best at differentiating counterclockwise flutter from left PV-atrial tachycardias, while a positive F-wave in lead I, as in our case (not shown), is best at differentiating clockwise left AFlu from typical counterclockwise right AFlu.[8]

In patients with post-PVI atrial tachycardias, PVR has been found as a dominant mechanism which can be successfully eliminated by re-isolation. [7] Indeed, this turned out to be the arrhythmia mechanism in our patient, as the AFlu was promptly terminated with re-isolation of

the LSPV (Fig. 5), thus obviating additional electrophysiological maneuvers, such as entrainment and/or activation mapping.

In a prior series from our center comprising 67 patients undergoing PVI, 6 (9%) patients subsequently developed AFlu. Typical CTI-dependent counterclockwise AFlu was observed in 5 of these 6 patients who subsequently underwent additional CTI ablation, while in 1 patient with left AFlu, re-isolation of the PVs abolished the arrhythmia, as demonstrated in the present case.[4]

Importantly, re-isolation of a PV responsible for a postablation PV-dependent AFlu is commonly achieved using focal RF ablation to target gaps along the previous encircling lesions. [9, 10] Use of cryoballoon ablation to treat PV-dependent AFlu after catheter ablation has been scarcely reported; an advantage of cryoablation relates to the fact that it obviates the need for precise localization of gaps.[11] We could only find a case series of 3 out of 4 patients with post-PVI AFlu where cryoballoon ablation was successfully applied.[11] Thus, to the best of our knowledge, this is actually the fourth case reported to date in the literature of post-PVI left AFlu due to PVR successfully managed with PV re-isolation with use of a cryoballoon.

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