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A Difficult Case Of Left Atrial Flutter

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Summary

A 55-year-old male was referred for a third ablation procedure because of recurrent atrial fibrillation. During re-isolation of the inferior right pulmonary vein the patient developed an atypical flutter with an clockwise activation pattern around the mitral annulus. Linear ablation at the left mitral isthmus transformed but did not terminate the tachycardia. The cavotricuspid isthmus proved to be a second critical isthmus and linear ablation at this site terminated the tachycardia.

Introduction

Single-loop reentry tachycardia is the most common form of atrial tachycardia. Dual-loop tachycardia has been observed frequently in ventricular tachycardia but is rare in atrial reentrant tachycardia. A few case reports and a limited number of studies including a few patients with dual-loop reentrant tachycardia have been published. These patients are most often postoperative and have a dual-loop or figure-of-8 reentrant tachycardia within the same atrium.[1] We describe a case report of a patient with a double-loop tachycardia using both atria.

Case Report

A 55-year-old male patient with no other medical history was referred for a third ablation procedure for recurrent atrial fibrillation. The patient had two prior pulmonary vein isolation (PVI) procedures, including a roofline in the first procedure and a mitral isthmus line during the second procedure involving re-isolation of the right pulmonary veins and confirmation of block of the roofline. A few months earlier, the patient had been admitted to the referring hospital with a recurrence of atrial fibrillation requiring electrical cardioversion (ECV). No electrocardiogram (ECG) of this event was available for review. The patient was treated with amiodarone and beta-blockers and referred to our centre. Prior to this third procedure an echocardiography and CT scan showed a normal left ventricle ejection fraction (60%), a dilated left atrium (45 mm) and normal anatomy of four pulmonary veins (PVs). The current procedure was performed under the guidance of a 3-dimensional mapping system (CARTO-3, Biosense-Webster, Inc., Diamond, CA, USA). A decapolar circular mapping catheter (Lasso) was used for PV mapping. All the PVs except the right inferior vein showed bidirectional conduction block, so re-isolation was performed. During the procedure, the patient developed an atypical atrial flutter with positive p-waves in the inferior leads and in lead V1. Group beating, probably due to a Mobitz type 1 second degree atrioventricular block, was observed (figure 1). The tachycardia cycle length (TCL) of the flutter was 275 ms. During activation mapping, a clockwise activation pattern around the mitral annulus was seen and entrainment pacing at several points around the mitral annulus showed entrainment with concealed fusion and good post-pacing intervals (PPI) within 30 ms. of the TCL (figure 2). We performed a linear radiofrequency ablation from the left inferior PV to the mitral isthmus including ablation from within the coronary sinus (CS). This failed to terminate the tachycardia, although a slight decrease in TCL (260 ms) and discrete change in p-wave morphology were observed (figure 3). Entrainment pacing once again around the mitral annulus now showed much longer PPI's with differences >30 ms compared to the TCL, so the mitral isthmus was no longer a critical part of the tachycardia circuit. No other conclusion could be made than that there was a second reentrant circuit of the tachycardia. No entrainment pacing anywhere in the left atrium could show entrainment with good PPIs, so we changed to the right atrium. A duo-decapolar catheter (halo) was positioned in the right atrium along the anterior-lateral right atrial wall with the distal tip in the proximal coronary sinus. A counterclockwise activation was observed, suggesting a typical right atrial flutter (figure 4). Entrainment pacing with the ablation catheter at the cavotricuspid isthmus (CTI) showed a post-pacing interval of 285 ms., a difference of 25 ms. compared to the TCL of 260 ms, confirming that the CTI was a critical part of the circuit. Linear ablation at this site terminated the tachycardia and bidirectional block was confirmed. Finally, pacing maneuvers confirmed complete block of mitral isthmus.

We concluded that this patient had a dual-loop, bi-atrial macro-reentrant tachycardia with a counterclockwise activation loop at the right atrium and a clockwise activation loop around the mitral annulus. Two critical isthmuses (mitral - and cavotricuspid isthmus) had to be ablated to terminate the tachycardia.

Disclosures:
None.

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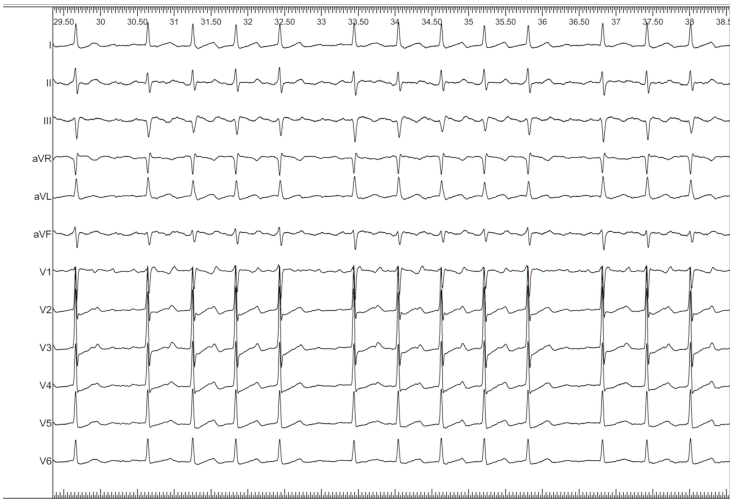

Figure 1: ECG

Discussion

The most common complication following PV ablation is the development of regular atrial tachycardias (AT) or flutter. These arrhythmias can occur in 2.6% to 31% of patients and are often incessant and difficult to treat with antiarrhythmic drugs. Focal atrial tachycardia originating from a reconnected PV is frequently seen and requires re-isolation of this vein. The next most common AT is mitral annulus flutter. The presence of such a flutter can be proven with entrainment pacing at different sites at the mitral annulus as well as an activation time around the mitral annulus that is similar or equal to the TCL.[2] Both criteria could be observed in our patient, which was enough evidence to perform a mitral isthmus ablation line. When this did not terminate, but transformed the tachycardia, the presence of a dual-loop tachycardia was suspected. Previous reports have been published about dual-loop tachycardias.[1,3,4] All of these patients had single atrial, right-sided dual-loop reentrant tachycardias and all had previously undergone cardiac surgery. Shah et al. analyzed 5 patients with a dual-loop tachycardia after surgical closure of an ostium secundum atrial septum defect. All of these patients had a reentrant loop around the lateral atriotomy scar and a second loop around the tricuspid valve. Radiofrequency ablation of the CTI resulted in a transformation of the tachycardia without terminating it. An ablation of a second isthmus (between the lower end of the scar and the inferior vena cava) was required in all patients.[1] P. Ott[3] presented a case of a patient with a dual-loop tachycardia after coronary bypass surgery. After ensuring that the tachycardia was CTI-dependent, ablation was performed at this site but did not terminate the tachycardia; rather, it transformed the tachycardia into one with a reentrant circuit located in the right atrial free wall, possibly related to scar post-surgery. A second ablation at the right free wall was performed and the tachycardia was noninducible thereafter. Seiler et al.[4] analyzed 40 patients with intra-atrial reentrant tachycardia (IART) after open-heart surgery. Eight of these patients had a dual-loop IART. All of these were right sided and showed one reentrant loop to be CTI-dependent and a second loop related to the incisional scar of the right atrial free wall. In three patients the ablation procedure was unsuccessful. In five patients successful termination was achieved after ablation of at least two critical isthmuses. Transformation of the tachycardia without termination after ablation of the first critical isthmus was considered to be the gold standard in proving the presence of a dual-loop tachycardia in all eight cases. In our case we provide evidence that the first tachycardia was mitral isthmus-dependent and transformation into another tachycardia was observed after linear ablation. After ensuring this tachycardia had a right-sided, CTI-dependent reentrant circuit, ablation at this site successfully terminated the tachycardia. Two possible mechanisms could be responsible for the changes in TCL and p-wave morphology after ablation at mitral isthmus: the presence of a dual-loop reentrant tachycardia and an incomplete peritricuspid loop that became complete after mitral isthmus was blocked. We did not perform entrainment pacing of the ¨first¨ tachycardia at the right atrium, because we did not suspect an involvement of the right atrium after entrainment mapping at the mitral annulus. Thus, an incomplete peritricuspid loop that became complete after mitral isthmus was blocked cannot be ruled out. Only after having performed the ablation line at the mitral isthmus, transforming the tachycardia without termination, was a dual-loop tachycardia suspected. This suspicion, and the presence of a second critical isthmus, was confirmed with entrainment pacing and successful ablation of the CTI. We did not search for a common isthmus, connecting the left sided circuit with the right-sided one, because of the initial lack of suspicion of a dual-loop tachycardia. However, in light of the cases described in the literature, in which all dual-loop tachycardias required ablation of at least two critical isthmuses, the approach we used to terminate the tachycardia probably would not have been different if we had conducted a search for a common isthmus.

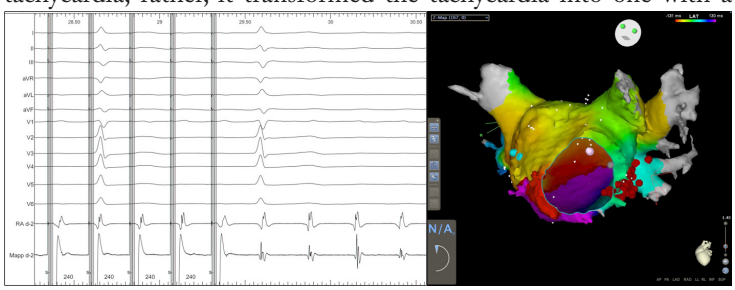

Figure 2: Left panel shows entrainment pacing with concealed fusion and a good post-pacing interval. Right panel shows a clockwise activation pttern of the mitral annulus.

Interestingly and in contrast to the previously described cases, this

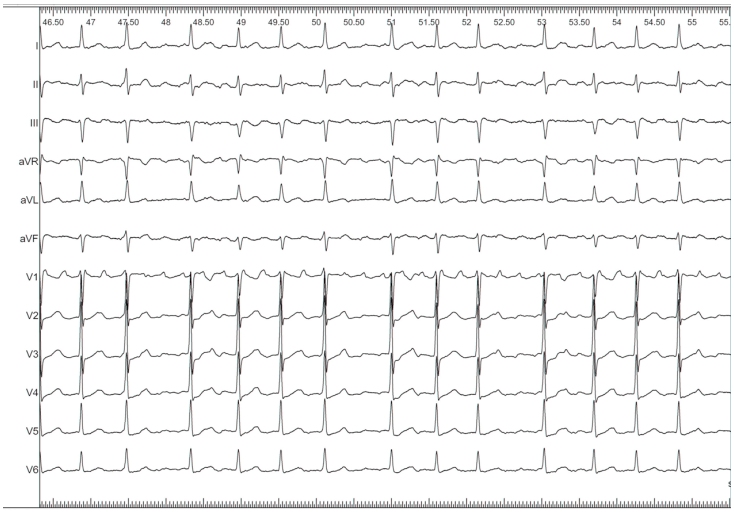

Figure 3: ECG

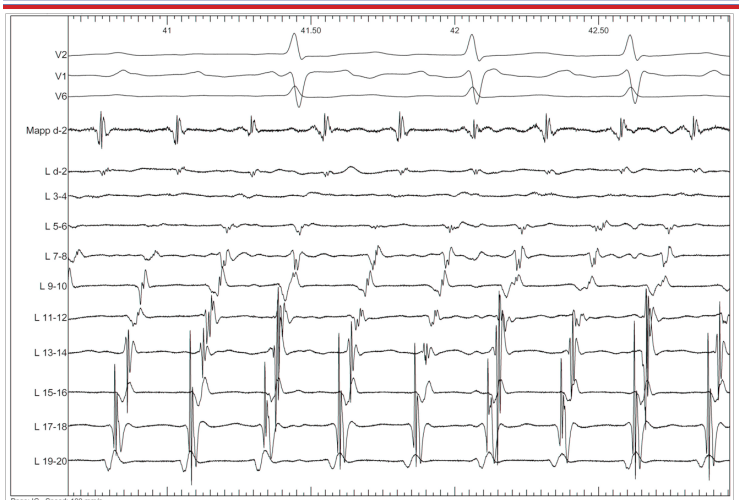

Figure 4: **Endocardial activation during counterclockwise flutter with surface ECG leads V1-V2 and V6. Electrograms are recorded around the tricuspid annulus using a 20-pole halo catheter with distal pole (Ld-2) positioned at the septal isthmus.**

case presents a dual-loop tachycardia in a non-postoperative patient after PV ablation. Moreover, the tachycardia showed a bi-atrial dual-loop tachycardia. Only one other case report describes a bi-atrial dual-loop tachycardia, which developed during a first procedure of PVI and had a reentrant circuit around the inferior vena cava and around the mitral annulus. Post-pacing intervals at both the CTI and the mitral isthmus were long, which is uncommon for a true dual-loop tachycardia. The authors suggested that this was probably due to the interference of two relatively independent reentry loops.[5]

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