



Case Report

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Clinical Cases of Supraventricular Arrhythmia Related to Rooflines after AF Ablation

Dr M Belhameche PHD MD¹, Dr N Zarouf MD², Dr S Naccache MD³, Dr A Kovalchuk PHD MD⁴, Dr S Sioua MD⁵, PR Bouzelmat PHD MD⁶, Dr A Salhi PHD MD⁷

1,2,3,4,5,6,7. GHEF Marne le vallée Rhythmology Unit.

Corresponding Author: Dr M Belhameche, GHEF Marne le vallée Rhythmology Unit.

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Abstract

Background

In the literature, left atrial flutter or tachycardia are more and more frequent due to the act of ablation of AF, in particular, persistent AF and that whatever the strategy.

We will describe 3 cases of recurrence related to gaps on the roof lines that were made on previous AF ablation.

One recurrence in the form of AF, and two recurrences in the form of atypical flutter.

Method:

All the patients were symptomatic.

They were able, to benefit from, general anesthesia, and a transesophageal ultrasound, which allowed us both to eliminate an intra-auricular thrombus and to perform the transseptal puncture safely.

We had used the Rythmia system from Boston scientific.

One decapolar catheter was positioned in the coronary sinus.

Left atrial geometry and computer matrix creation were performed using the INTELLAMAP ORION™, and ablation was performed with the INTELLAVMIFI OI™ ablation catheter.

Goal:

Review the literature to try to understand the mechanisms and prevent them.

Abbreviations and Acronyms:

AF Atrial fibrillation,

AT atrial tachycardia,

F Flutter,

LA Left atrial,

LAA Left atrial appendage,

MI Mitral isthmus,

PV Pulmonary vein,

HBP High blood pressure,

NID Non-insulin-dependant diabetes,

SAS Sleep apnea syndrome,

BMI Body mass index,

EHRA European heart association,

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CS coronary sinus,

LVEF Left ventricular ejection fraction,

LAS Left atrial size,

IAS interatrial septum.

LV left ventricular,

VC Vena cava

First case:

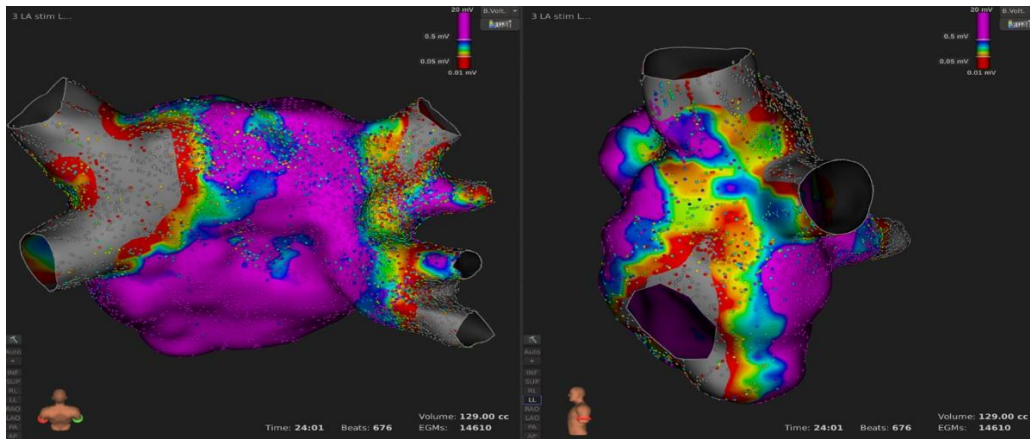
We present the case of a 62 years-old man, which has as risk factors: hypertensive, non-insulin-dependent diabetic, patient sleep apnea syndrome, and a body mass index of 29. Undilated LV cardiac ultrasound with 55% LVEF and 22 cm² OG size. With previous atrial fibrillation radiofrequency catheter ablation. He had undergone pulmonary vein (PV) isolation using RF and left atrial (LA) roof and mitral isthmus linear ablation for symptomatic and drug-resistant persistent atrial fibrillation (AF) in his first procedure 11 months earlier. He was referred for catheter ablation of a recurrent: ***Atrial fibrillation Symptomatic (level IIa B EHRA), and drugs refractory (Beta-blocker and Flecainide).*** (30)

The patient consented to follow institutional guidelines.

The patient had returned to sinus rhythm after induction of anesthesia.

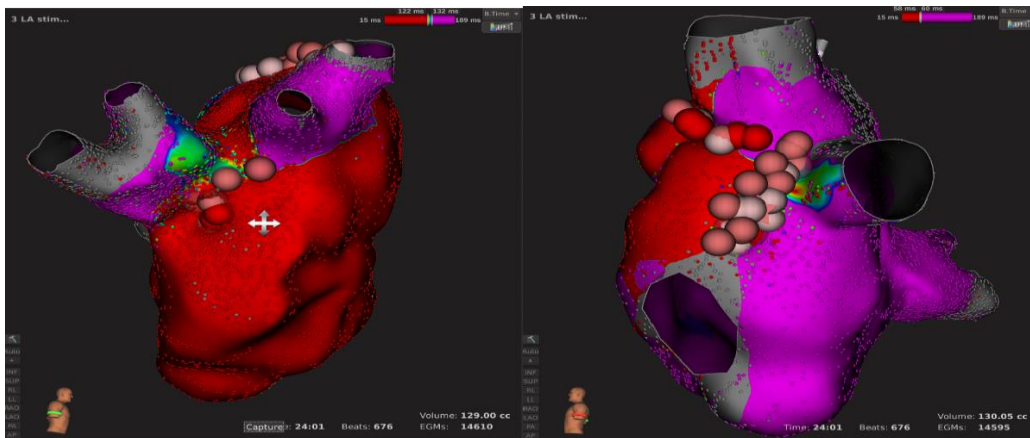
A left atrial (LA) map was done while pacing at 600 ms with the Intellanav Mifi OI catheter placed in the Left Atrial appendage (LAA).

This map showed Right PVs Reconnection, LSPV reconnection, a gap on the mitral isthmus and another gap in the roofline.

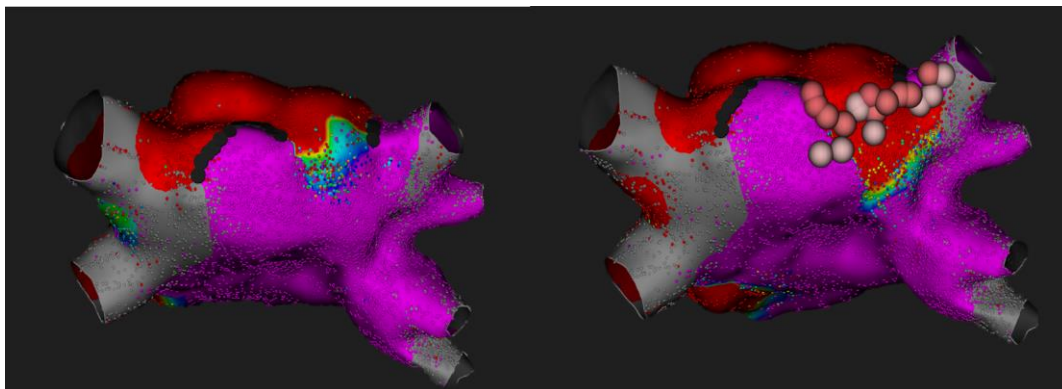


Map 1: LAA Pacing, voltage map

First, the PVs have been disconnected and the mitral line has been blocked.



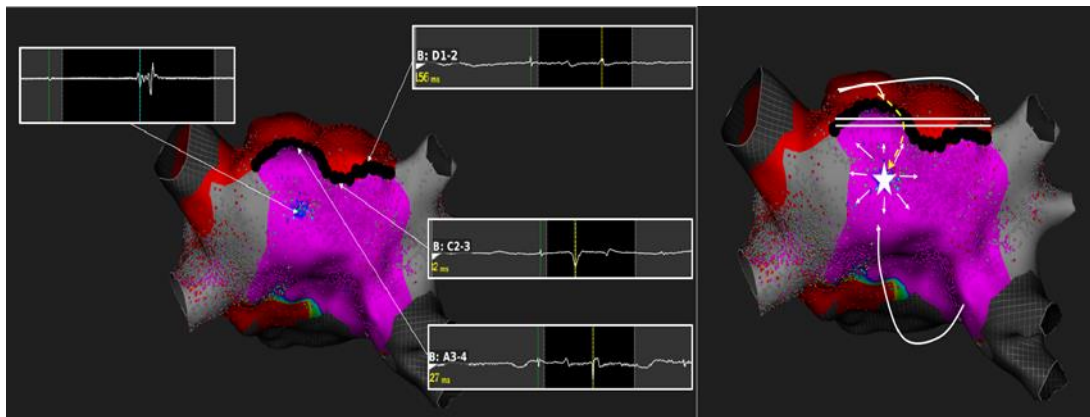
Activation Map 1 :a. Mitral isthmus passage + LSPV and MI ablation b. RPV ablation Finally, the gap on the roofline has been ablated.



-Activation map 1 : a. Endocardial gap on the roofline b. ablation on the roofline gap

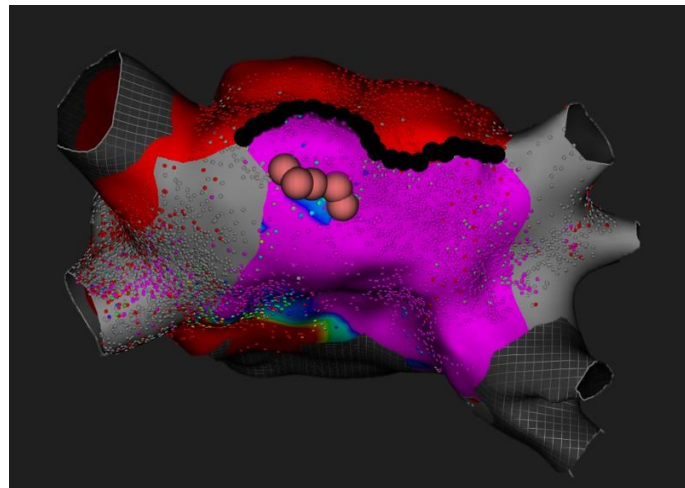
A verification map has been done to check the roofline block in pacing (600 ms) from LAA. This map shows an endocardial line of the block with double potentials all along the line.

However, we can clearly see on the activation map a breakthrough from the other side of the line, at the posterolateral wall by the region of the Bachmann bundle (or septopulmonary bundle ?). This is a sign of an epicardial bridge over the roofline.



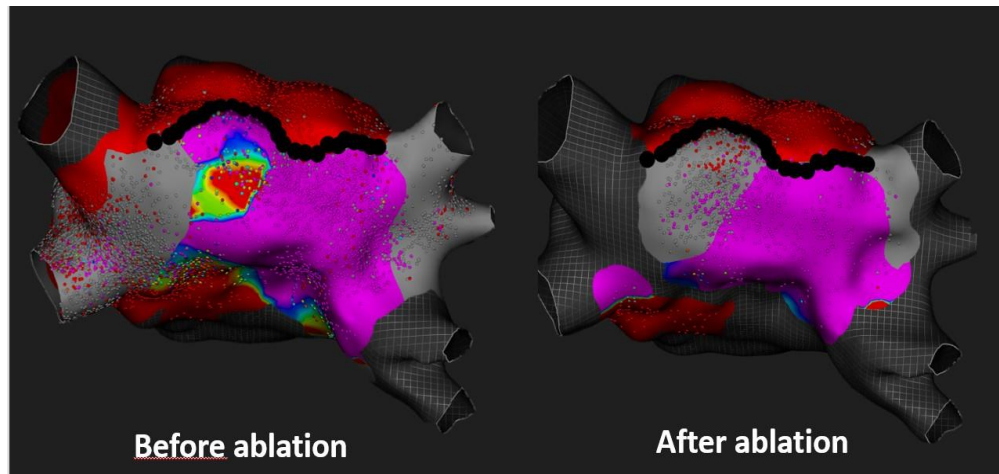
Activation Map 2 : a. endorectal roof line blocked + breakthrough b. Epicardial passage?

RF ablation has been done on this breakthrough :



Activation map 2: ablation on the breakthrough

Then, a final validation map has been done in LAA Pacing. In this activation map, the roofline is completely blocked. There isn't any passage over the endocardial line.



Activation Map 2 : epicardial breakthrough / b. Activation Map 3 : no more passage through the roofline.

The procedure lasted 125 min (ablation time 90 min, fluoroscopy 15 min),

The Bachmann bundle is an important anatomic structure that may be resistant to transmural ablation and can function as an epicardial bridge across the anterior wall of the left atrium

We report a case of AT with epicardial bridging over a previously blocked endocardial anterior linear lesion set.

Second case:

62-year-old patient as a risk factor for hypertension, dyslipidemia, stable coronary insufficiency and treated dysthyroidism hospitalized for an attack of heart failure:

NYHA III stage dyspnea, blood pressure 110/60 mmHg, HR 130 / min O₂ saturation at 92% under 5L/O₂. The ECG showed atypical flutter with HR of about 130 / min. its treatment includes ACE inhibitors, beta-blockers as well, DOA and Aldactone. Cardiac ultrasound showed undilated LV with overall hypokinesia and an estimated LVEF of 45%. The size of the LA was measured at 25 cm²

This patient had undergone AF ablation one year ago. The ablation procedure consisted of isolating the VPs, a line from the roof and a line on the mitral isthmus. The ablation procedure consisted of isolating the VPs, a line from the roof and a line on the mitral isthmus. The patient consented to following institutional guidelines.

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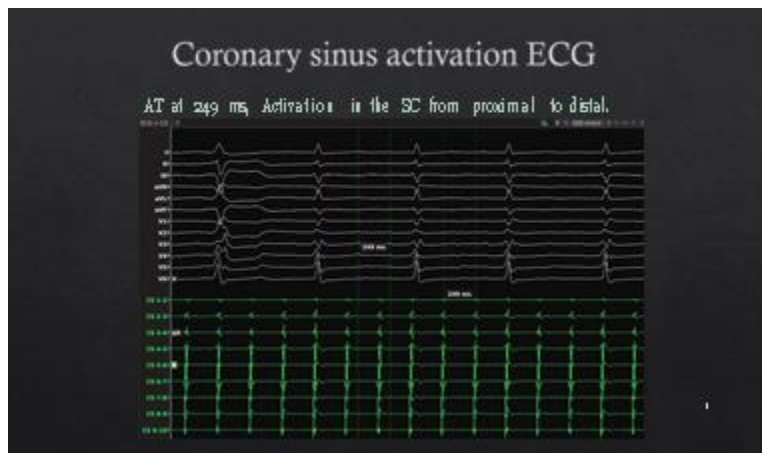
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He was referred for catheter ablation of a recurrent “**symptomatic atrial flutter (level IIa B EHRA)**”.(30)

ECG before ablation:

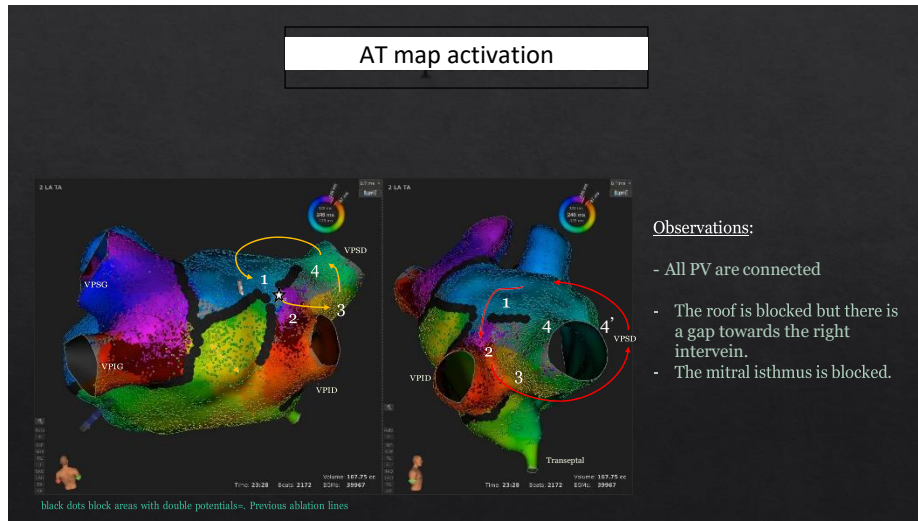


Endocavitary ECG

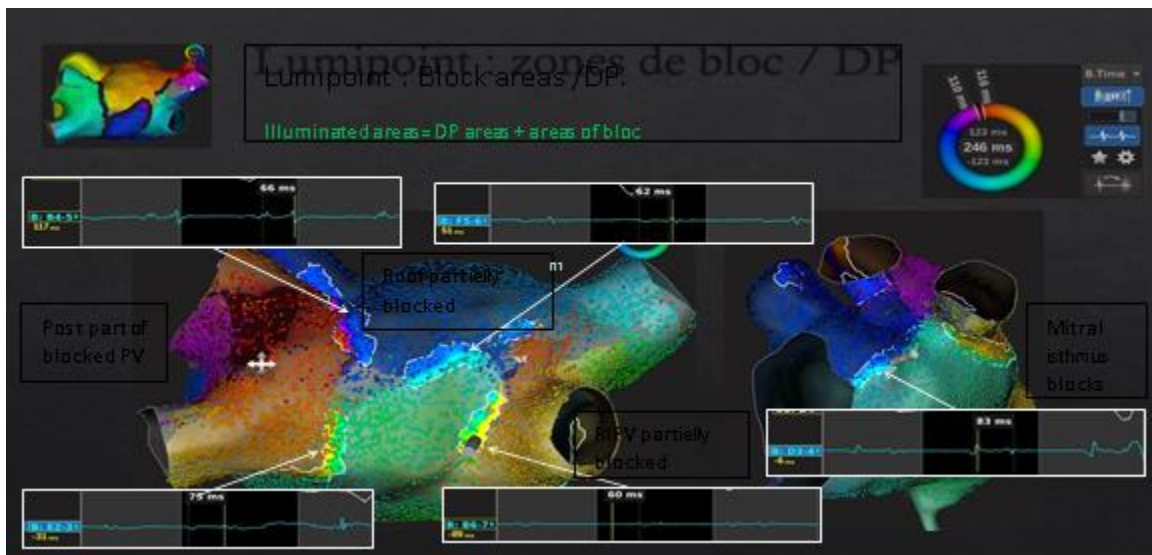


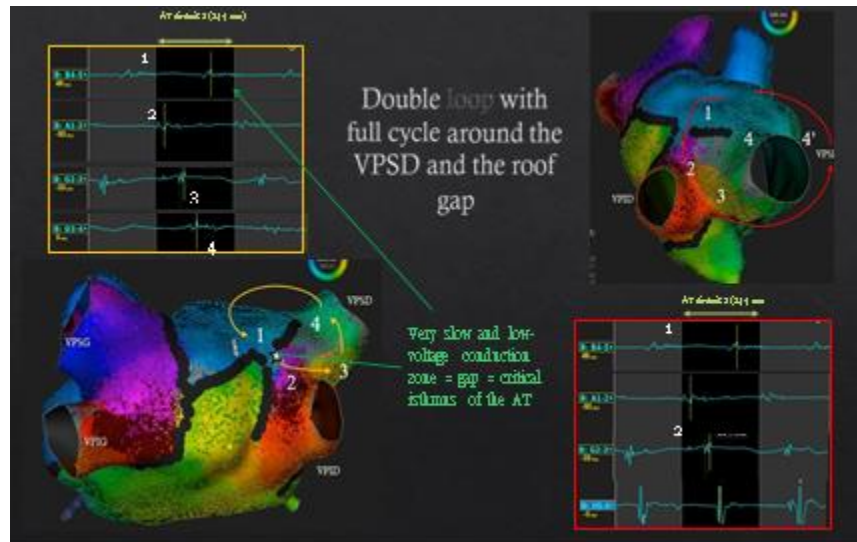
-Appearance of AT/F conducted in 3/1 with activation of the proximal to distal CS.

-The tachycardia cycle is 249 ms



- We had made an activation map in flutter. activation shows a dual circuit around the RSPV.
- All the PV where connected.
- The mitral isthmus is blocked

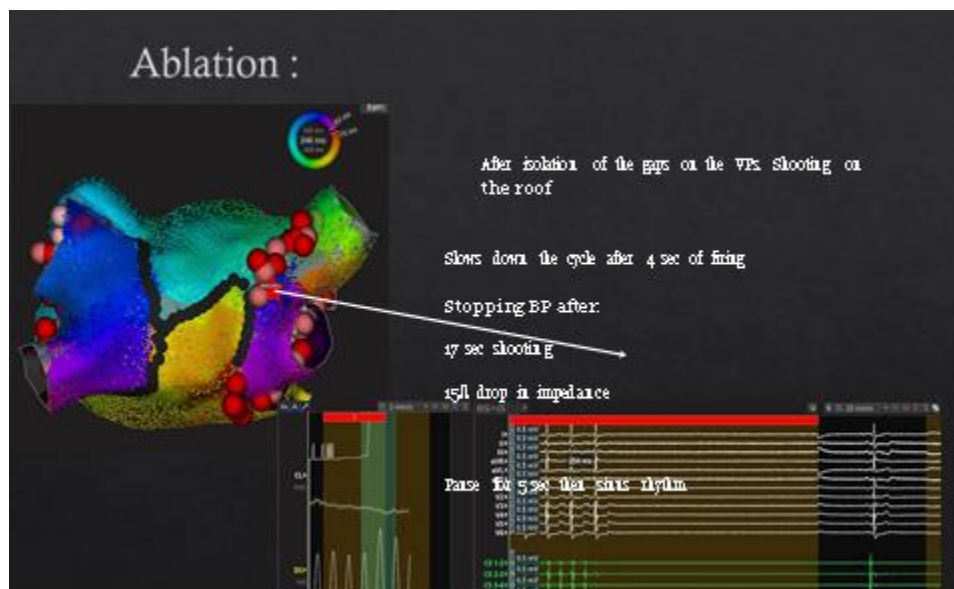




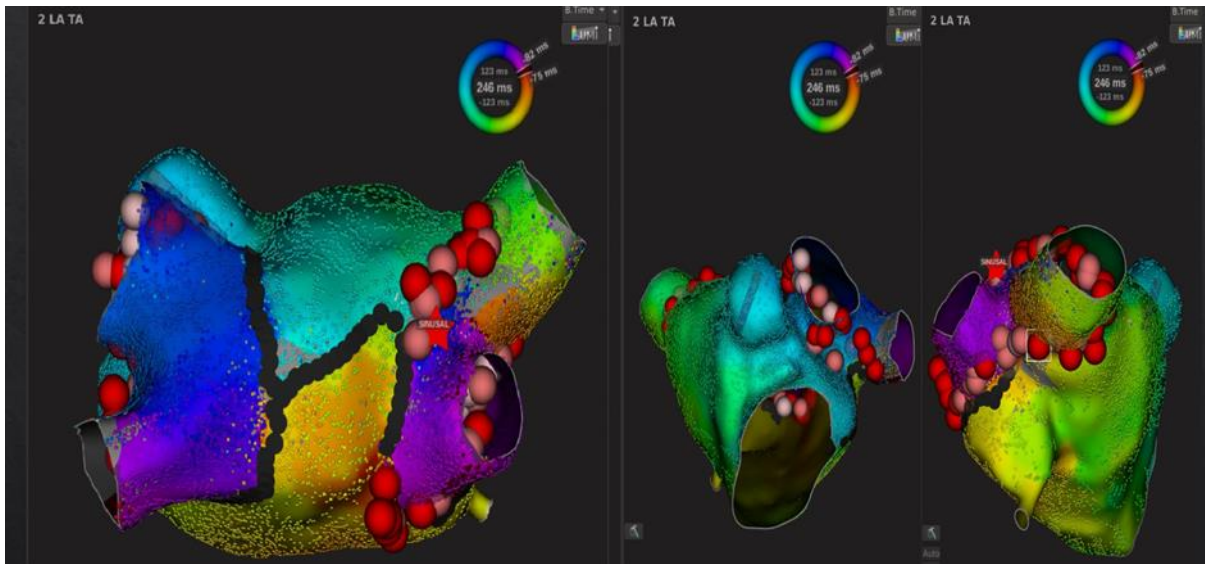
-This map view illustrates the double loop around the RSPV with a gap on the roof

- Very slow and low voltage conduction zone

=Gap = critical isthmus of the AT



After the isolation of the VPs, in particular the RSPV, a shot at the gap area on the roof allowed the return to RS.



Removal of gap areas around the veins:

- Ablation at 40W on the ridge to isolate the VPGs (image 2)
- Ablation at 30W on the two posterior gaps of the VPDs (image 1)
- Then at 35W on the anterior rim (image 3)

Control shows vein insulation and a full two-way block on the roof.

The procedure lasted 115 min (ablation time 80 min, fluoroscopy 15 min).

Third case:

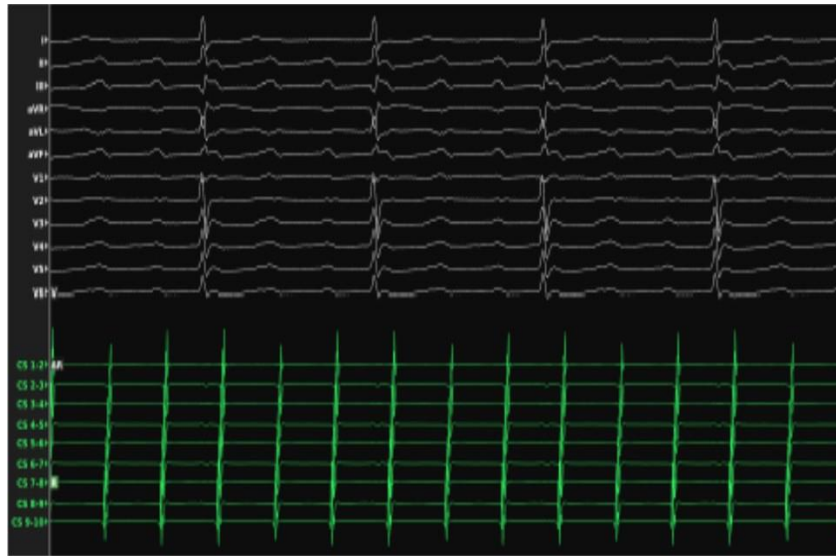
Clinical history:

This is a 65-year-old patient with hypertension and coronary artery disease and BMI 27. He had benefited from 2 ablations for FA in the past.

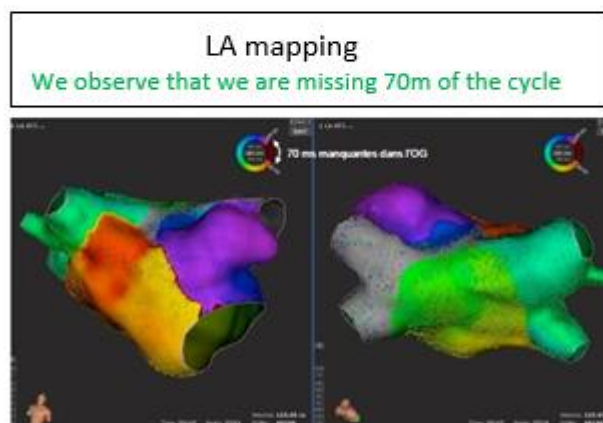
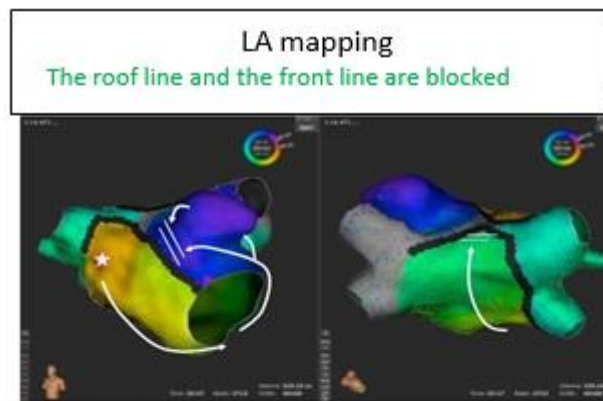
-The first ablation was to isolate the VPs and fragmented potentials.

-The second ablation consisted of making a roofline, an anterior line and the mitral isthmus which allowed the return to sinus rhythm. **symptomatic atrial flutter (level IIa B EHRA)**".(30)

This patient was readmitted for dyspnea and palpitations in connection with a recurrence of flutter conducted in 3/1. the echocardiogram showed undilated LV with 60% LVEF and moderately dilated OG with an area of 23 cm².



Endocavitary ECG with 323ms cycle and proximal to distal CS activation.

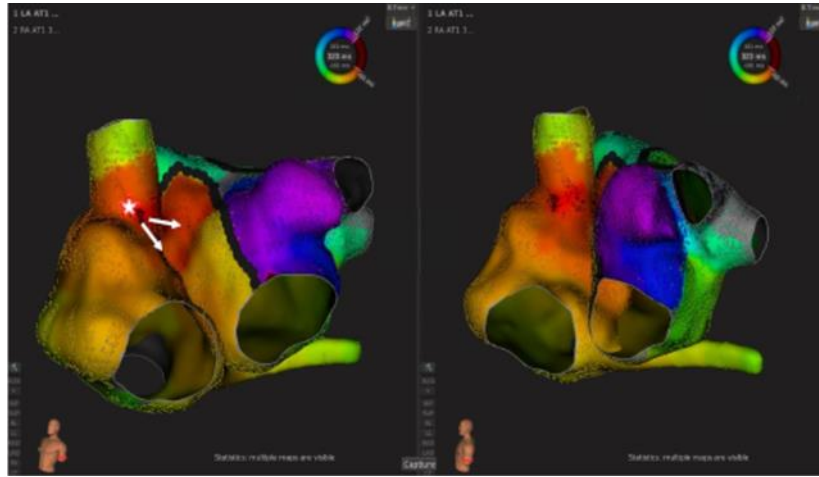


So, we made an OD activation card that allowed us to complete the cycle and understand the circuit of this flutter.

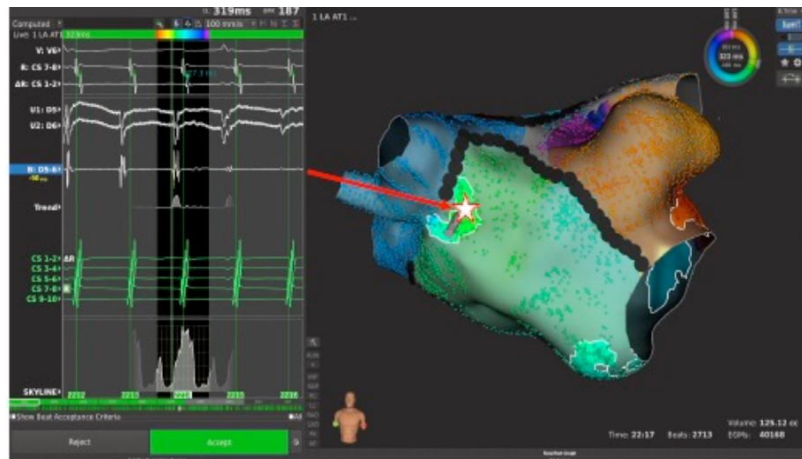
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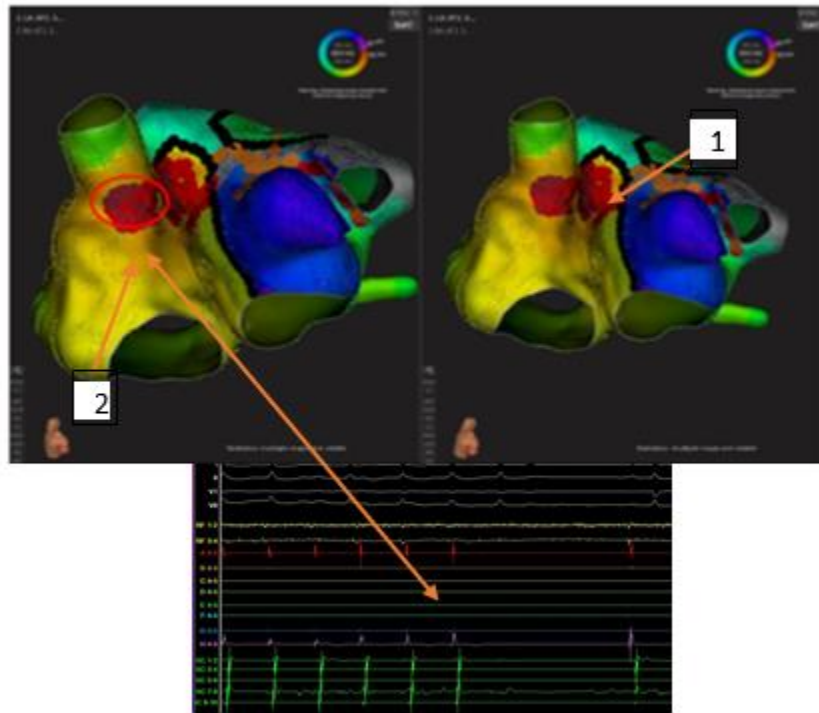
We observed that the activation blank once after depolarizing the OG disappears in the DO and reappears on the AIS to depolarize the OG again as shown by the Lumipoint.



we observed that once the signal is lost in the LA, it reappears in the RA and depolarizes the IAS and then the LA again.



In addition, it was observed that the septal emergence comes from the anterior block line as confirmed by the Lumipoint



1/After having fired at the level of the AIS in the LA and at the level of the Ridge the AT was realized but without stopping.

2/It was finally the shots in the RA at the exit of the Bachmann Faisseau which finally stopped the TA

The procedure lasted 185min (ablation time 120 min, fluoroscopy 25 min).

Discussion and mechanisms:

What do we know about the treatment of AF:

1 / The control of the rhythm and superior to the frequency control (1,2,3,4).

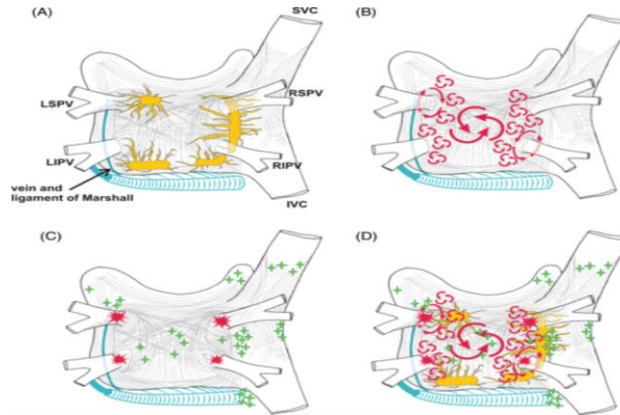
2 / The AF catheter ablation is superior to medical treatment since A4 and APAF study (5,6).

3 / We know that there are risk factors that expose you to more recurrences . These risk factors are age(7,8), hypertension(7,8,9) Obesity(10), SAS(11),heart disease(6,7,8),size of the atrium(7), alcohol(12).

4/ since we do the ablation of the AF with the lines or ablation of fragmented potentials we ourselves create circuits of flutter or AT (27,28)

5/ We also know that there are internal structural mechanisms that generate and maintain of AF (13,14,15,16,18). There are also genetic factors, external factors such as sport through the autonomic nervous system but also by dilation of the atrium

Electrophysiological mechanism of AF (17,18,19)



A/Rapid ectopic focus.

B/Reentry with conduction fibrillatory.

C/ Reentry wavelets multiple.

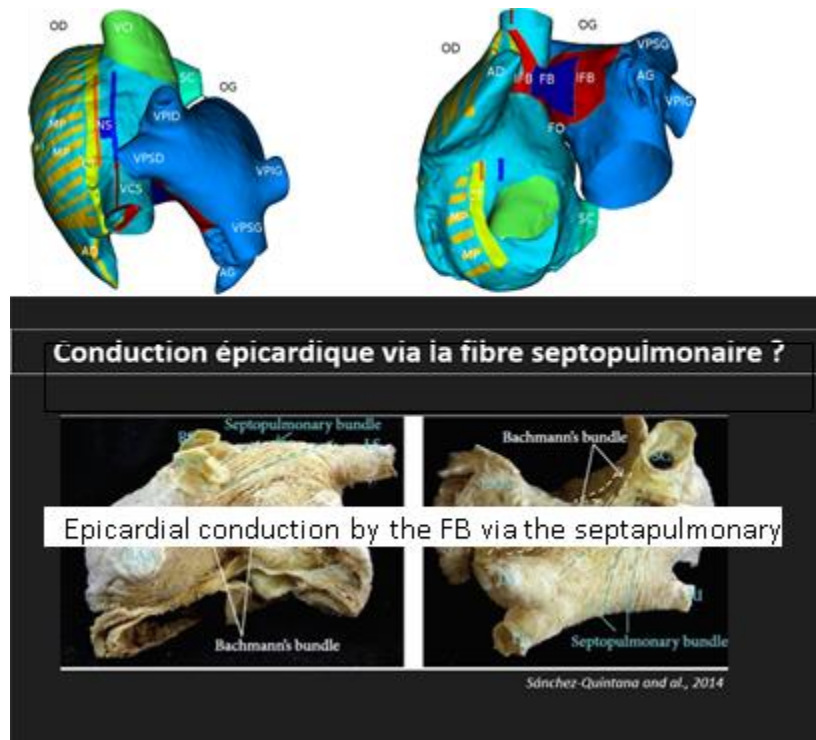
D/association of all mechanisms.

We have seen 3 clinical cases in which the arrhythmia recurrence occurred through the roof of the LA.

- the first case was a recurrence in the form of AF with both a partial reconnection of the PV and a gap on the roof. This is the most frequent mechanism that we find during reoperations for ablation.

- In the other 2 clinical cases what is very interesting is the role that the Bachmann beam played to maintain this flutter. This mechanism is rare but described by some authors and will explain the difficulty in restoring a sinus rhythm in this form of arrhythmia.

The Anatomy of the atria



Anatomy of the auricles in sky blue RA in dark blue LA.

-At the RA level we see the VCS and VCI. The right appendage, the sinus node, the crista terminalis, and the pectineus muscle.

-At the level of the LA we see(26) VPs, the left appendage.

- Between the 2 we see the insertion of the Bachmann vessel, the fossa ovalis and the CS (23)

There are 3 activation modes:

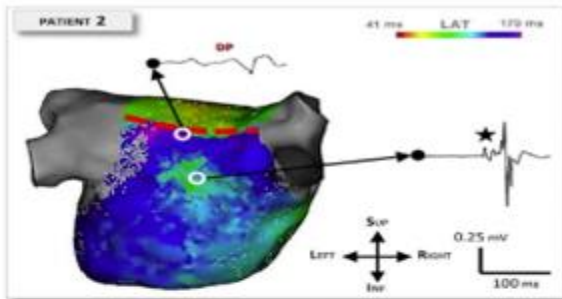
A: Focal and generates an AT.

B: Leak activation mode which rather generates an aspect of flutter.

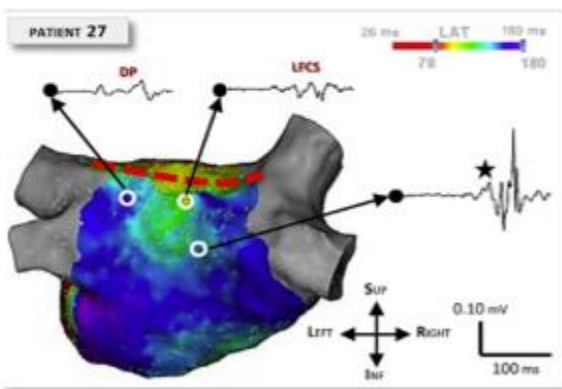
C: Mode wave activation mode which also generates an aspect of flutter

In the first case the activation mode was LEAK and generated a roof flutter but with an epicardial passage

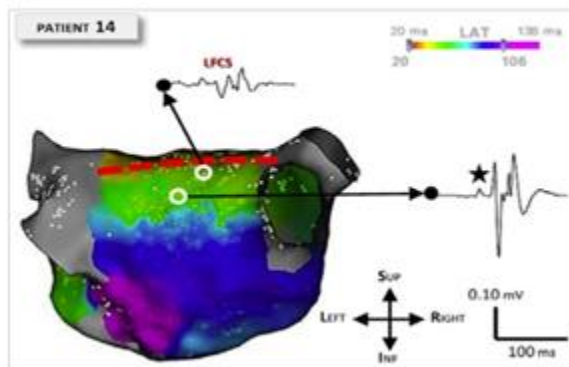
A « FOCAL » ACTIVATION PATTERN



B « LEAK » ACTIVATION PATTERN

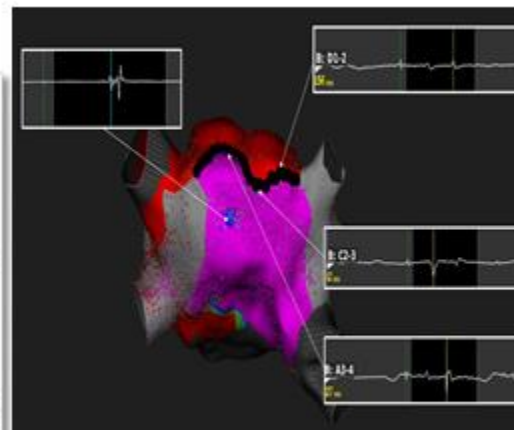
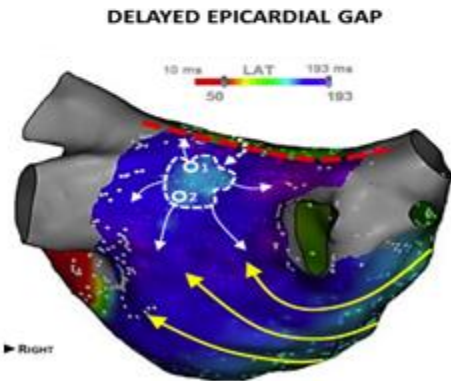


C « WAVE » ACTIVATION PATTERN



- (24,25,26,27,28,29)

There are 3 activation modes:
A: Focal and generates an AT.
B: Leak activation mode which rather generates an aspect of flutter.
C: Mode wave activation mode which also generates an aspect of flutter
In first case the activation mode was LEAK and generated a roof flutter but with an epicardial passage

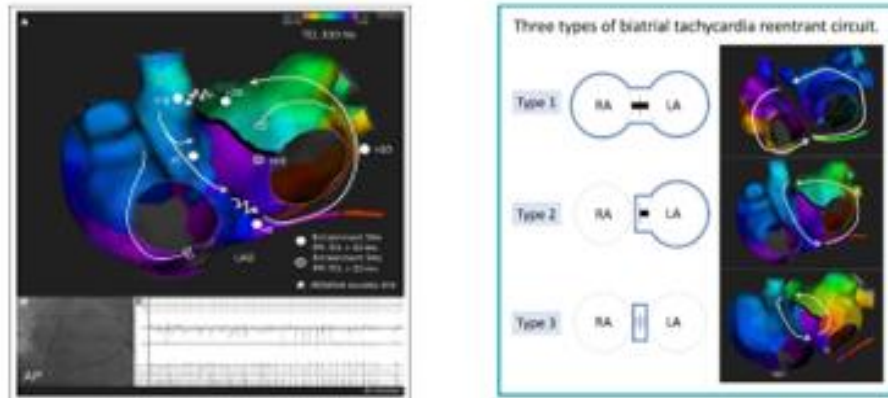


The mechanism described by Kitamura in circulation and Chengye in the journal of electrocardiography (13,14)

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RA and LA mapping This activation is linked to the bi-atrial mechanisms

Characteristics of a single-loop macroreentrant biatrial AT identified by ultrahigh resolution mapping system



Three types of biatrial tachycardia

Conclusion

There is no consensus on what to do for the ablation of persistent aFA. Rhythmologists try to reproduce the MAZE type ablation performed by surgeons with very complete ablation (VP, roofline, line on the mitral the alcoholization of the marschall vein and the coronary sinus to reach the epicardium. from this, they remove the cavotricuspid isthmus.

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