Case Report

3D Mapping and Ablation of Left Sided Atypical Atrial Flutter

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Abstract:

Atypical atrial flutter has become amenable to catheter ablation with remarkable improvement in the acute and long-term efficacy of this therapy for this macro reentrant atrial arrhythmia. Here it was described a case of atypical atrial flutter which arises from left atrium and demonstrates the importance of a systematic approach to mapping and ablating atypical atrial flutter to prevent a recurrence of symptomatic arrhythmia. We also highlighted importance of 3D mapping which is a key tool for analysis and successful ablation

Keywords: *Cardiac electrophysiology, Radiofrequency ablation, Atypical atrial flutter, 3D mapping.*

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Introduction:

Atrial flutter (AFL) is one type of macro-reentry atrial tachycardia. It accounts for 15% of all supraventricular arrhythmias and frequently coexists with or precedes AF (1–6). Depending upon whether Cavo tricuspid isthmus (CTI) is critical to re-entry circuit, it is divided into two categories- 1) CTI dependent macro re-entry tachycardia and 2) non-CTI dependent macro re-entry tachycardia. Atypical AFL falls into category of non-CTI dependent macro re-entry tachycardia. Atypical atrial flutter ECG usually showed a variable flutter wave morphology and faster atrial rates compared to typical atrial flutter (7-9). Because atypical atrial flutter does not necessarily have a fixed anatomically defined reentrant circuit, thus to find out the re-entry pathway and slow conduction zone - three-dimensional (3D) activation mapping is a key tool for analysis and successful ablation.

Case report:

A 74-year-old hypertensive woman presented with worsening shortness of breath on exertion and palpitations for 3 months which increased in last one week. ECG (Fig. 1) revealed atrial flutter with 2:1 conduction and a ventricular rate of 156 beats per minute with RBBB morphology in V1. Echocardiography showed normal left ventricular ejection fraction and left ventricular hypertrophy. Patient was referred for ablation. She arrived at the electrophysiology laboratory in fasting state. A deflectable decapolar catheter and a quadripolar catheter were placed into the coronary sinus (CS) and the right Ventricle, respectively. Adjustable duodecapole halo catheter placed around the tricuspid valve annulus and an ablation catheter placed on the cavotricuspid isthmus at the 6 o'clock position (Fig.2). All catheters were

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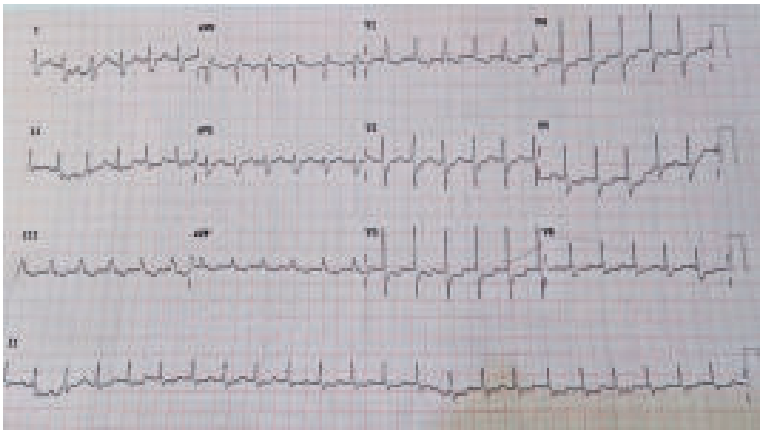

Fig.-1: *ECG showed atrial flutter.*

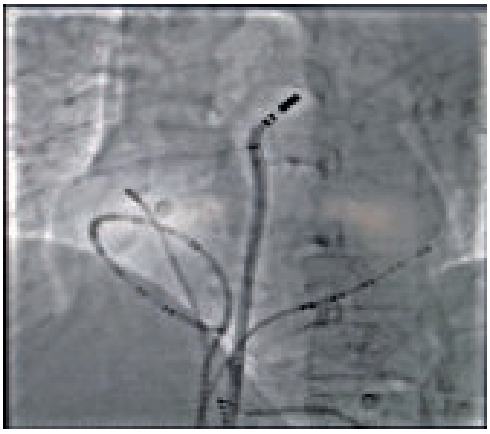

Fig.-2: *Location of catheters.*

introduced via the right femoral vein. The CARTO 5 Multi-Electrode Mapping (MEM) technology with high-resolution maps used for the HD coloring feature.

An ECG pattern (Fig.1) with a negative F wave in leads II, III, aVF and V1, and positive in aVL was found which gave rise of suspicion of atypical form of atrial flutter. The tachycardia cycle length (TCL) was measured to 250ms, with a concentric atrial activation (Fig. 3-proximal-to-distal CS activation). Excluded RA atypical flutter circuit based on RA activation time as determined by sequential conventional mapping (evenly distributed points) accounting for <50% of the arrhythmia cycle length and post pacing interval (PPI) in the RA longer than the cycle length by >20 ms in different points in the RA, including the Cavo tricuspid isthmus and RA free wall but excluding coronary sinus os. Also, it took relatively longer time to entrain the circuit from CTI.

Direct LA mapping by NaviStar ablation catheter (Biosense Webster) was done (Fig.4). A transseptal puncture (Brockenbrough needle and Daig sheath) was required. The electrogram at this site was usually of low amplitude, fragmented signals were recorded in a wide area of the roof of left atrial to left atrial appendage (LAA). Propagation mapping also showed impulse travelling from LA roof to LA appendage to downward direction. The location of the ablation site was obtained by concealed entrainment, by the demonstration of a poststimulation cycle that did not exceed the flutter cycle by more than 20 ms, demonstration of slow conduction area and zone of block; which was a line between upper left pulmonary vein to os of LAA.

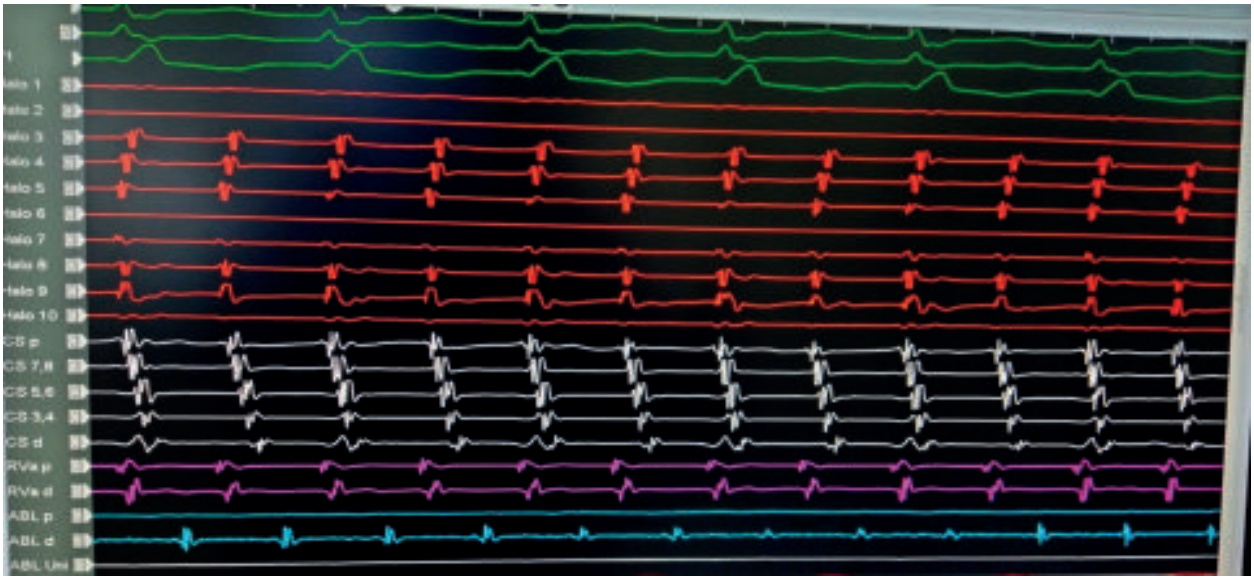

Fig.-3: *Intracardiac EKG of AFl.*

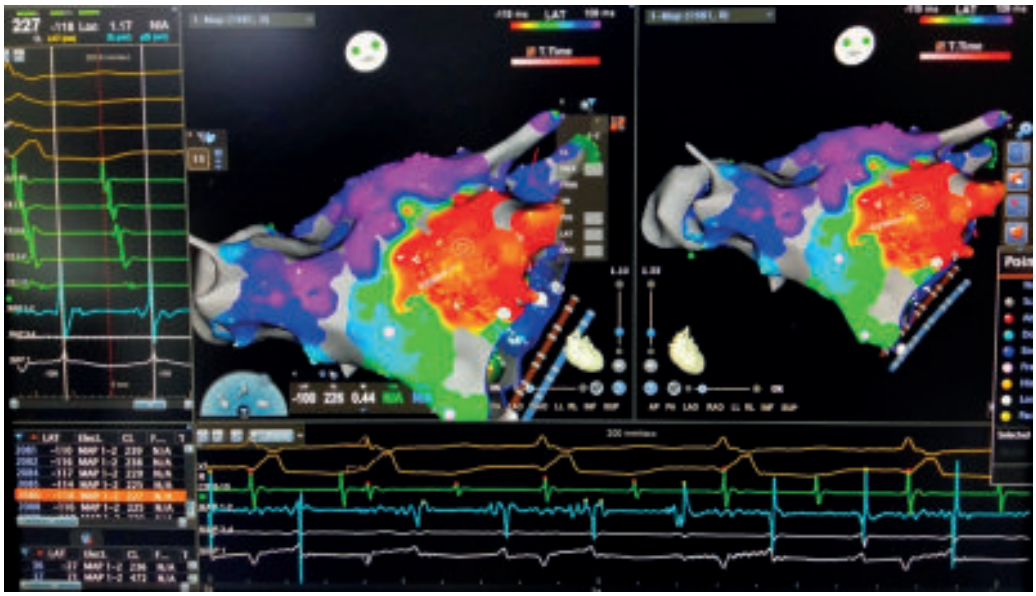

Fig.-4: *showing 3D mapping of left atrium and low amplitude slow conduction signal.*

Based on the 3D mapping, the ablation strategy was to complete conduction block. Therefor radiofrequency energy was applied, power output of 35 watts and temperature 55 degree Celsius. The ablation terminated the flutter and a complete block was achieved within 30 minutes. Patients' rhythm converted into sinus (Fig.5). Repeated atrial stimulations, on and off isoproterenol infusion, with atrial programmed stimulation and burst down to the atrial refractory period demonstrated no inducible atrial arrhythmia. Post-procedure, the patient recovered well with no complications.

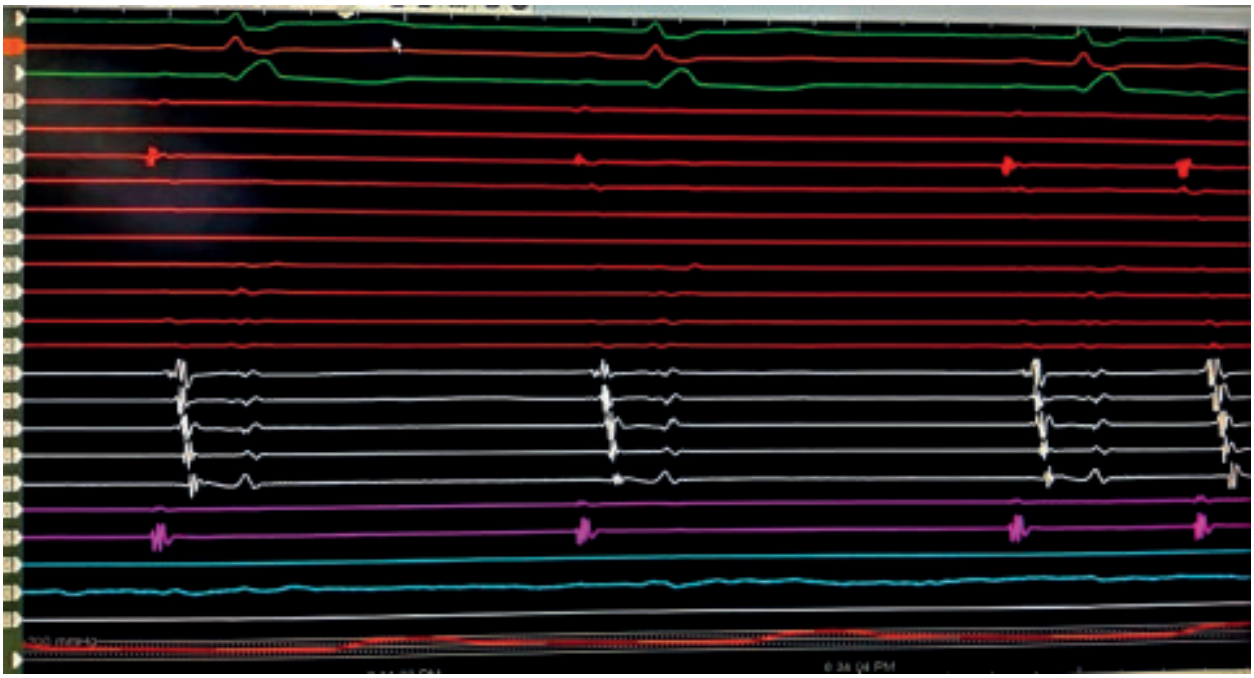

Fig.-5: *showing rhythm was converted back to sinus after successful ablation.*

Table-I

Classification of atypical atrial flutter (10).

Right sided atypical atrial flutter
• Lower loop reentry (isthmus-dependent)
• Double wave reentry (isthmus-dependent)
• Intra-isthmus reentry (isthmus-dependent)
• Upper loop reentry
• Scar-related macroreentrant atrial tachycardia
• Scar-related MAT without prior cardiac surgery
• Complex right atypical atrial flutter
Left sided atypical atrial flutter
• Left septal atrial flutter
• Perimitral atrial flutter
• Scar- and pulmonary vein-related atrial flutter
• Coronary sinus atrial flutter

Discussion:

The simplified way to understand the atypical atrial flutter is any atrial reentry which does not circle around the tricuspid valve and does not use the Cavo tricuspid isthmus as a critical zone of slow conduction is called atypical atrial flutter. However, there are three isthmus-dependent atrial flutter forms which fall under the umbrella of atypical atrial flutter.[10] Table1 showed the types of atypical flutters.

Jaïs P et al study showed eleven electrically silent areas were noted, among them 50% were located in posterior LA. The posterior silent area was of varying dimensions, extending to the roof and septum. Zones of block were identified in various locations, where 35% in block at the ostium of the left PV, 15% at right PV and 22% at base of the appendage.[12] In this case also showed silent area located in roof; conduction is situated in-between left pulmonary vein and base of LAA.

Ablation is a definitive therapy for atrial flutter. However, successful procedures as well as complications rates are different depending of the location of the circuit. It's truer in case left sided Afl in terms of complication. Conventional pacing combined with 3D electroanatomic mapping was an effective method to differentiate between typical and atypical atrial flutter.[11]

Conclusion

Atypical atrial flutter represents a versatile dimensions of macro reentrant atrial tachycardias in both the right and the left atrium. The combined use of 3D mapping and entrainment pacing provides insight about the reentrant circuit and helps to identify the target zones for potential ablation. Thus, atypical atrial flutter has become amenable to catheter ablation with remarkable improvement in the acute and long-term efficacy of this therapy for this macro reentrant atrial arrhythmia.

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