

L'ECG BASALE NELLA PRATICA CLINICA

Tachicardie sopraventricolari: tachicardie atriali e flutter atriale

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Conflict of interest disclosure

- Prof. De Ponti has received :
 - fees for lectures and scientific collaboration by Johnson & Johnson Medical
- His Institution has received educational grants from:
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Classificazione delle aritmie

TABELLA I – Classificazione delle aritmie

Tachicardie		Bradicardie	Battiti prematuri
sopraventricolari	ventricolari		
Tachicardia sinusale (TS)	Tachicardia ventricolare (TV) • Tachicardia ventricolare sostenuta	Bradicardia sinusale	Battiti prematuri sopraventricolari • Atriali (BPA) • Giunzionali (BPG)
Tachicardia atriale (TA)	• Forme particolari	Blocchi seno-atriali (BSA)	
Flutter atriale (FI.A) • Tipico • Atipico	– TV da rientro branca-branca (TVRBB) – TV infundibulare (TVI) – TV fascicolare (TVF) – TV polimorfa (TVP) – Torsione di punta (TdP)	Blocchi A-V (BAV) • I grado • II grado – Wencheback – Mobitz 2 – 2/1 – Avanzato • III grado	Battiti prematuri ventricolari (BPV)
Fibrillazione atriale (FA) • Parossistica • Persistente • Permanente	Fibrillazione ventricolare		
	Ritmo idioventricolare accelerato (RIVA)		
Tachicardia da rientro nel nodo A-V (TR-NAV) • "Slow-fast" • "Fast-slow" • "Slow-slow"		Aritmia sinusale (AS)	
		Dissociazione A-V	
Tachicardia da rientro A-V (TRAV) • Da via accessoria manifesta (WPW) ortodromica • Da via accessoria manifesta (WPW) antidromica • Da via accessoria occulta • Da via accessoria a conduzione lenta (tipo Coumel) • Da fibre atrio-fascicolari o nodo-fascicolari (tipo Mahaim)			
Tachicardia automatica giunzionale (TAG)			

Classification of atrial flutter and regular atrial tachycardia according to electrophysiologic mechanism and anatomic bases: a statement from a Joint Expert Group from the WGA of the ESC and the NASPE

"...the term flutter will refer to a continuously waving pattern on the ECG, without isoelectric baseline in at least one lead, whatever the cycle length..."

"...the presence or absence of an isoelectric baseline contributes little to the underlying mechanism..."

"It should be noted that...macroreentry in the RA circuit responsible for atrial arrhythmias can produce atypical ECG patterns."

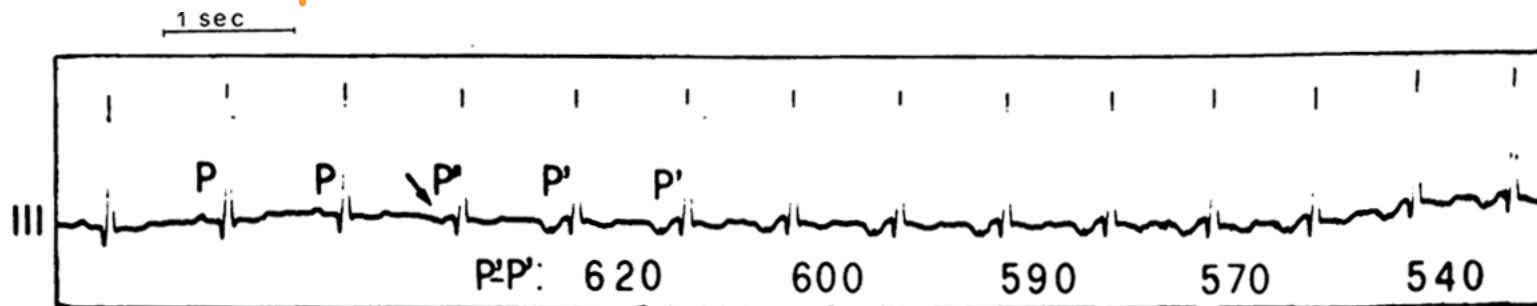
Saoudi et al. J Cardiovasc Electrophysiol 2001

TACHICARDIA ATRIALE e FLUTTER ATRIALE

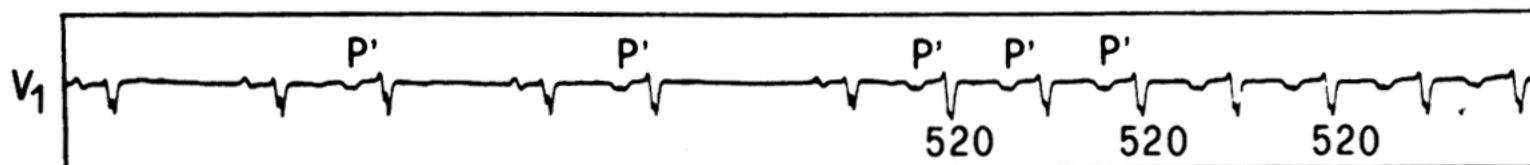
- Tachicardia atriale focale
- Tachicardia atriale da macrorientro
- Flutter atriale

TAF: presentazione clinica

permanente



iterativa



parossistica

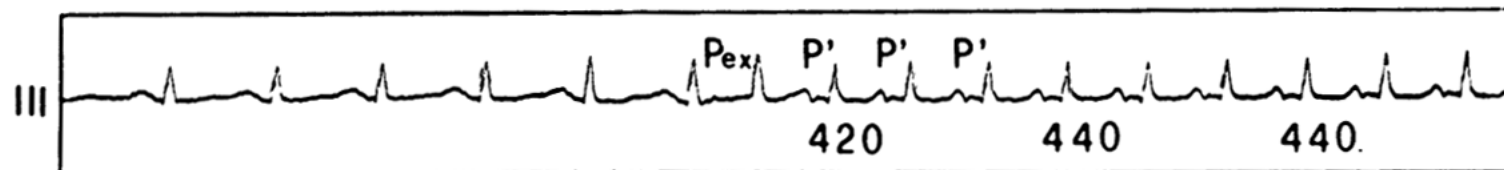


Fig. 1: Esempi delle 3 forme cliniche di tachicardia atriale ectopica:

A) tachicardia atriale ectopica **PERMANENTE** che ricompare dopo interruzione ottenuta con compressione seno-carotidea destra; il primo battito della tachicardia (indicato dalla freccia) è tardivo e ne deriva una fusione con il battito sinusale, si verifica quindi un progressivo accorciamento del ciclo della tachicardia (fenomeno del «warm-up»).

B) Innesco spontaneo di tachicardia atriale ectopica **ITERATIVA** con un battito atriale ectopico uguale ai successivi; la tachicardia presenta stabilità di ciclo.

C) Innesco di tachicardia atriale ectopica **PAROSSISTICA** con una extrasistole atriale precoce la cui morfologia è diversa sia dal sinusale che dai battiti della tachicardia; il ciclo della tachicardia presenta un iniziale allungamento, quindi rimane stabile.

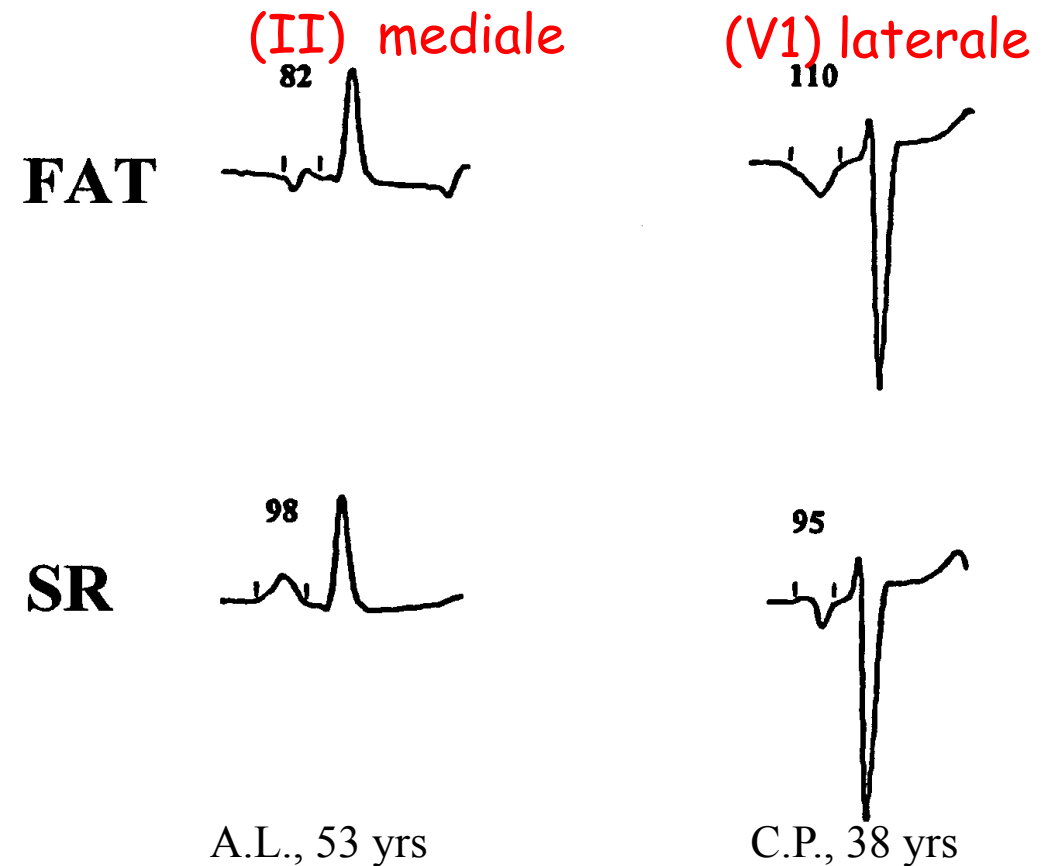
FAT- Durata dell'onda P: foci mediali vs. laterali

P2982 Site-dependence of A-P interval and P-wave duration in patients with focal atrial tachycardia

R. De Ponti, J.A. Salerno, A. Zardini, M. Tritto, C. Storti¹, M. Longobardi¹.
Univ. of Pavia, 2nd Medical School of Varese, Div. Cardiol. "Mater Domini"
Hospital, Castellanza (VA) and ¹"Città di Pavia" Hospital, Pavia, Italy

The aim of this study is to analyse whether, in pts with focal atrial tachycardia (FAT), the A-P interval (which is defined as the time interval between the earliest endocardial activation and surface P-wave onset) and the P-wave duration on FAT are in relation to the site of the atrial focus. To this aim, 49 pts undergoing radiofrequency catheter ablation of FAT were considered; among these pts, 4 with multiple foci and 2, who underwent an unsuccessful ablation, were excluded. The A-P interval was calculated at the site of successful ablation. The sites of FAT location were classified as follows: crista terminalis (CT), pulmonary veins (PVs), atrial septum (AS) and other (Ot); atrial septum as well as the right PVs were considered medial (M) sites, whereas the remaining locations were lateral (L). P-wave duration was calculated on 12-lead ECG by using electronic calipers. In order to obtain for each pt a value that can be used in an interpatient comparison, the P-wave duration index (PWDI) was calculated as P-wave duration on FAT (ms)/P-wave duration on sinus rhythm (ms) $\times$ 100. The location of FAT foci was: CT in 15 pts, PVs in 13, AS in 9 and Ot in 6. As to the A-P interval, there was no significant difference between the four groups: 28 ± 14 ms in CT, 38 ± 23 ms in PVs, 20 ± 15 ms in AS and 31 ± 10 ms in Ot. Conversely, there was a significantly higher value of the PWDI in pts with a L focus of FAT than in pts with a M focus (113 ± 8 in L vs. 84 ± 7 in M, $p < 0.001$). Thus, pts with a L focus show a longer P-wave on FAT than on sinus rhythm, while in pts with a M focus it is shorter on FAT than on sinus rhythm.

In conclusion: the value of the A-P interval does not depend on the location of the FAT focus, since pts with the same focus location show very different values. On the other hand, the P-wave duration on FAT is site-dependent, since in pts with a M FAT focus the P-wave is shorter than in those with a L focus. These findings may have important implications during endocardial mapping.



TAF - Morfologia dell'onda P 1

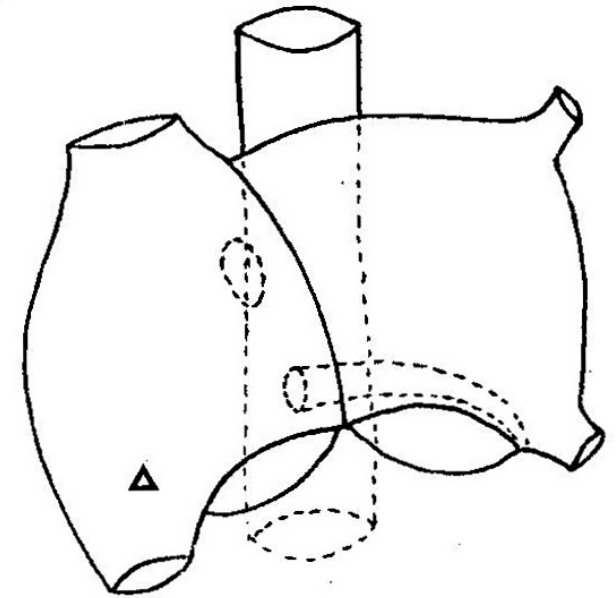
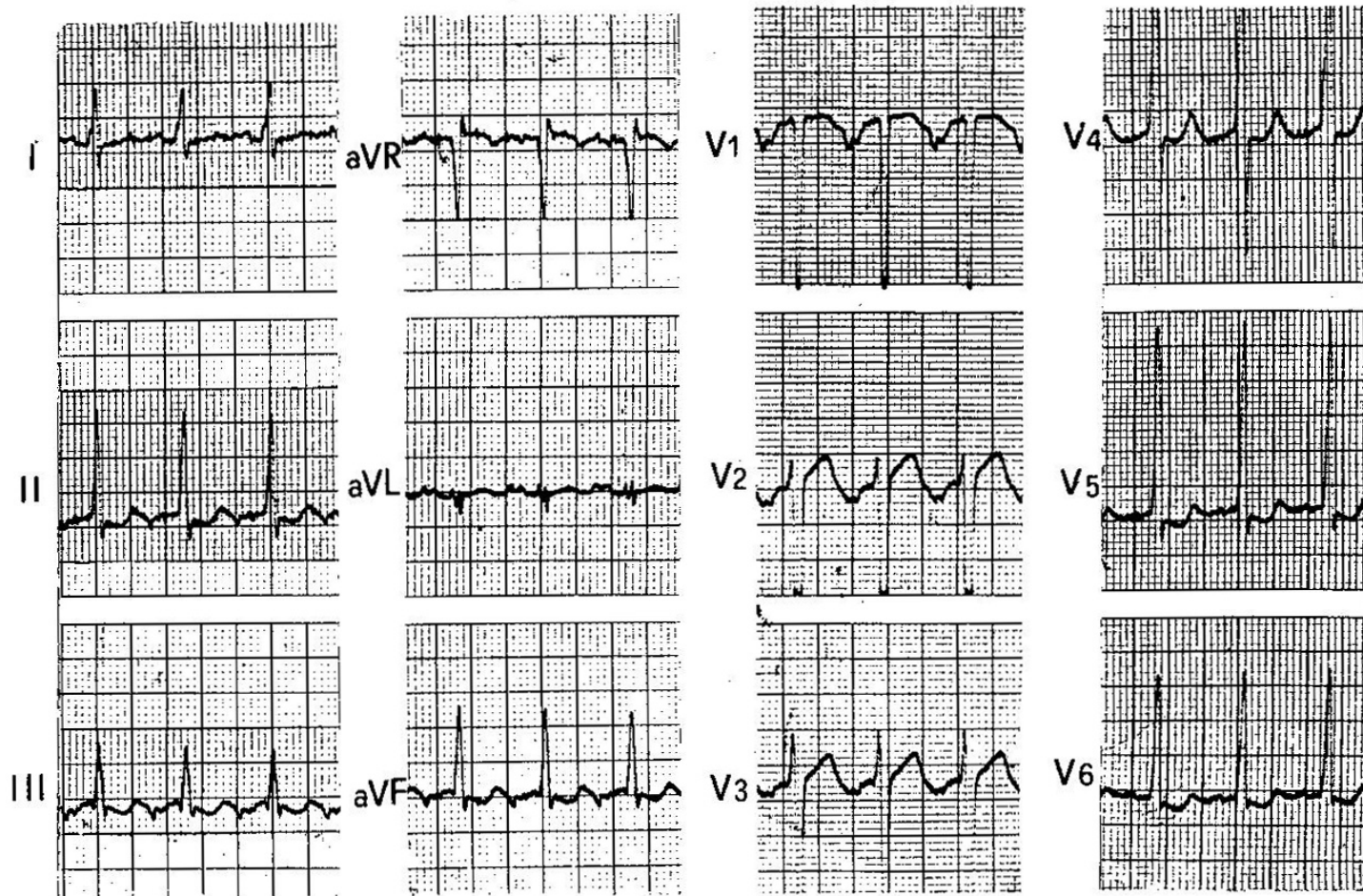
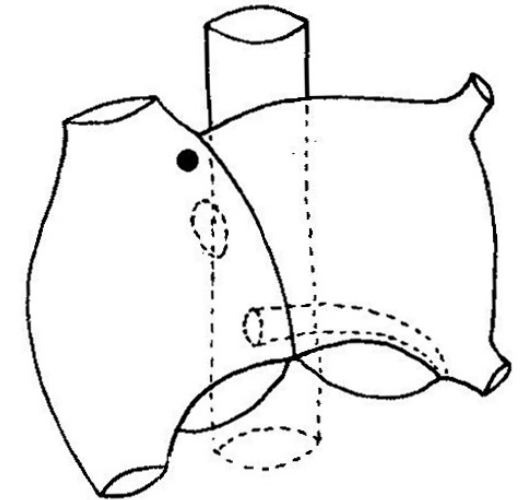
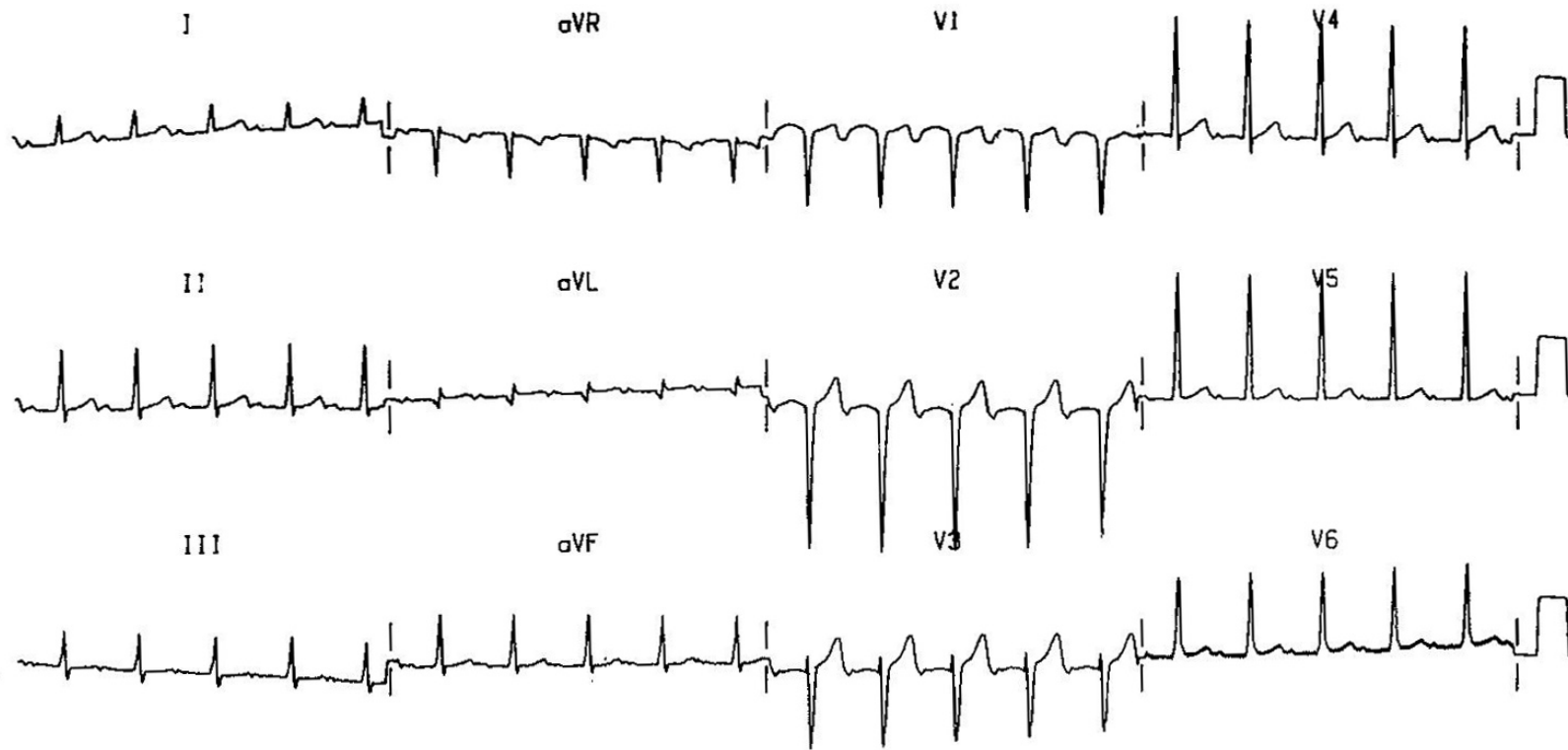


Fig. 47 : Tachicardia atriale ectopica permanente (stesso caso delle figure 18, 24 e 42). L'elettrocardiogramma standard a 12 derivazioni mostra onde P negative in V1 e positive in V5-V6 mentre l'asse di P nel piano frontale è orizzontale. Nello schema sulla destra è riportata la sede di origine della tachicardia valutata con mappaggio endocavitario nell'atrio destro anteriore basso.

TAF - Morfologia dell'onda P 2



T.R.

Fig. 46 : Tachicardia atriale ectopica permanente (stesso caso delle figure 12 e 23). L'elettrocardiogramma standard a 12 derivazioni mostra onde P negative in V1 e positive in V5-V6 mentre l'asse di P nel piano frontale è verticale. Nello schema sulla destra è indicata la sede di origine della tachicardia valutata con mappaggio endocavitario in atrio destro alto parasettale anteriore.

TAF - Morfologia dell'onda P 3

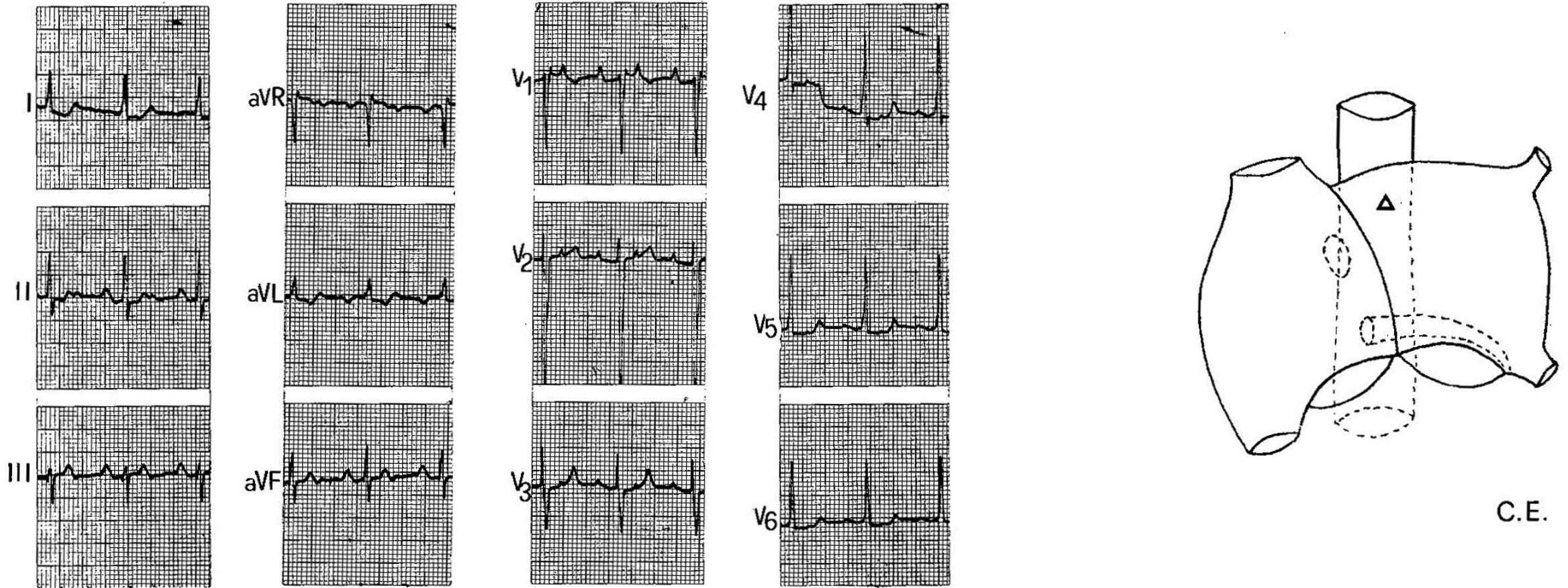


Fig. 49 : Tachicardia atriale ectopica permanente (stesso caso della figura 43). L'elettrocardiogramma standard a 12 derivazioni mostra onde P positive in V1 e di basso voltaggio in V5-V6 mentre l'asse di P nel piano frontale è deviato a destra (il paziente è in trattamento locidoloccante). Nello schema sulla destra è riportata la sede di origine della tachicardia valutata con mappaggio endocavitario nell'atrio sinistro laterale basso.

TAF - Morfologia dell'onda P 4

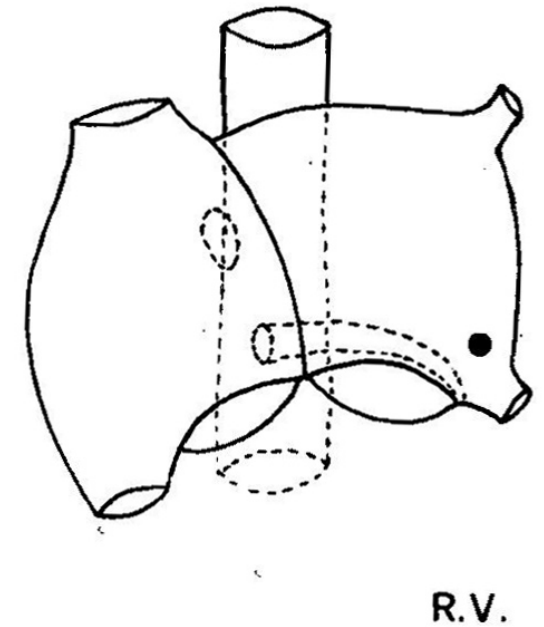
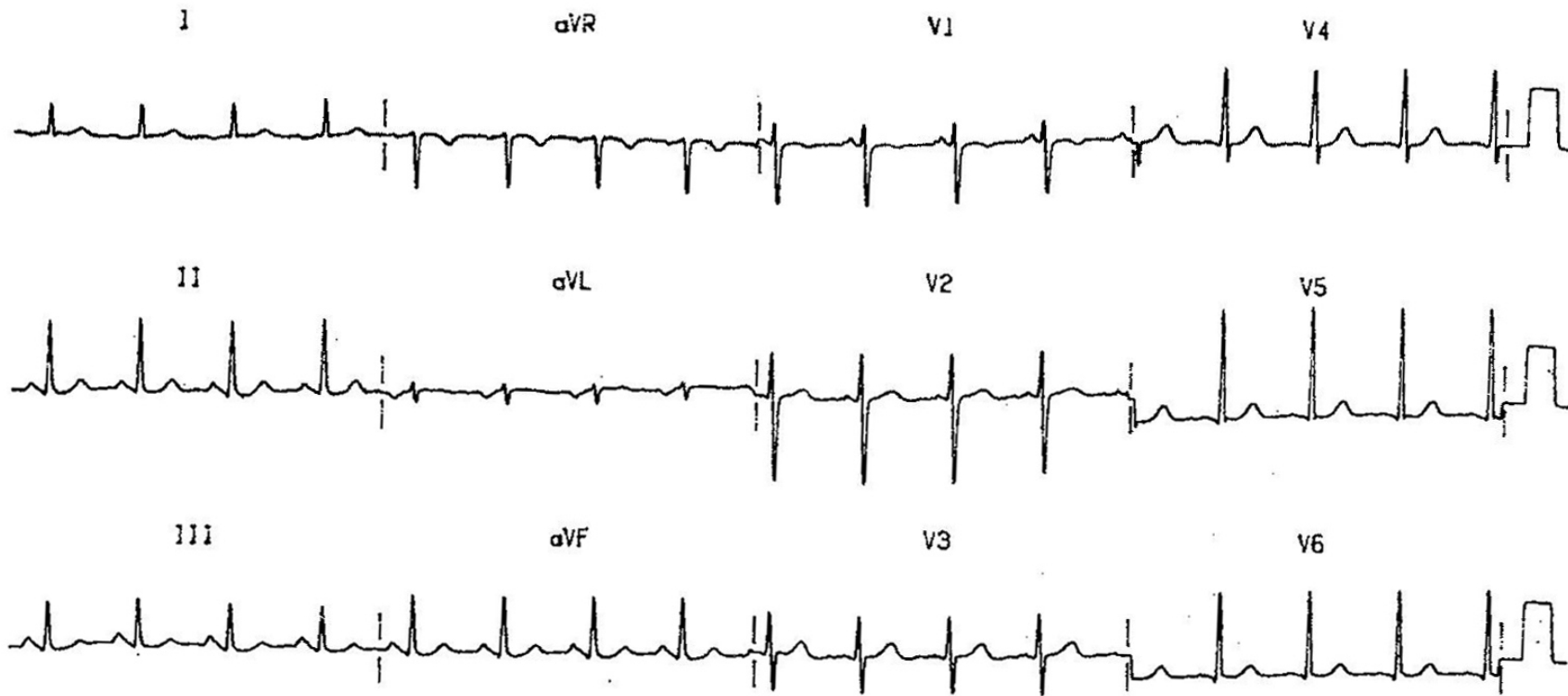
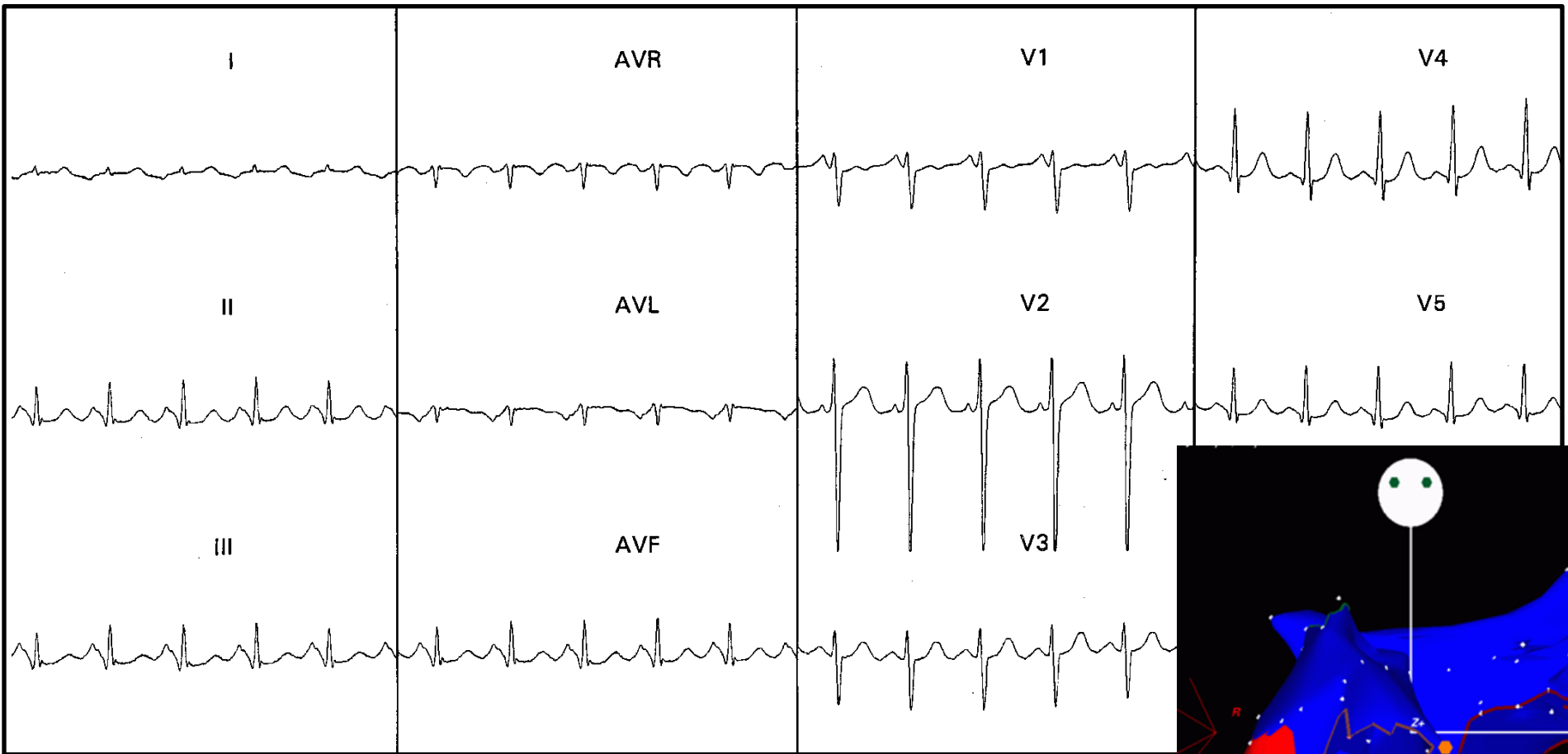
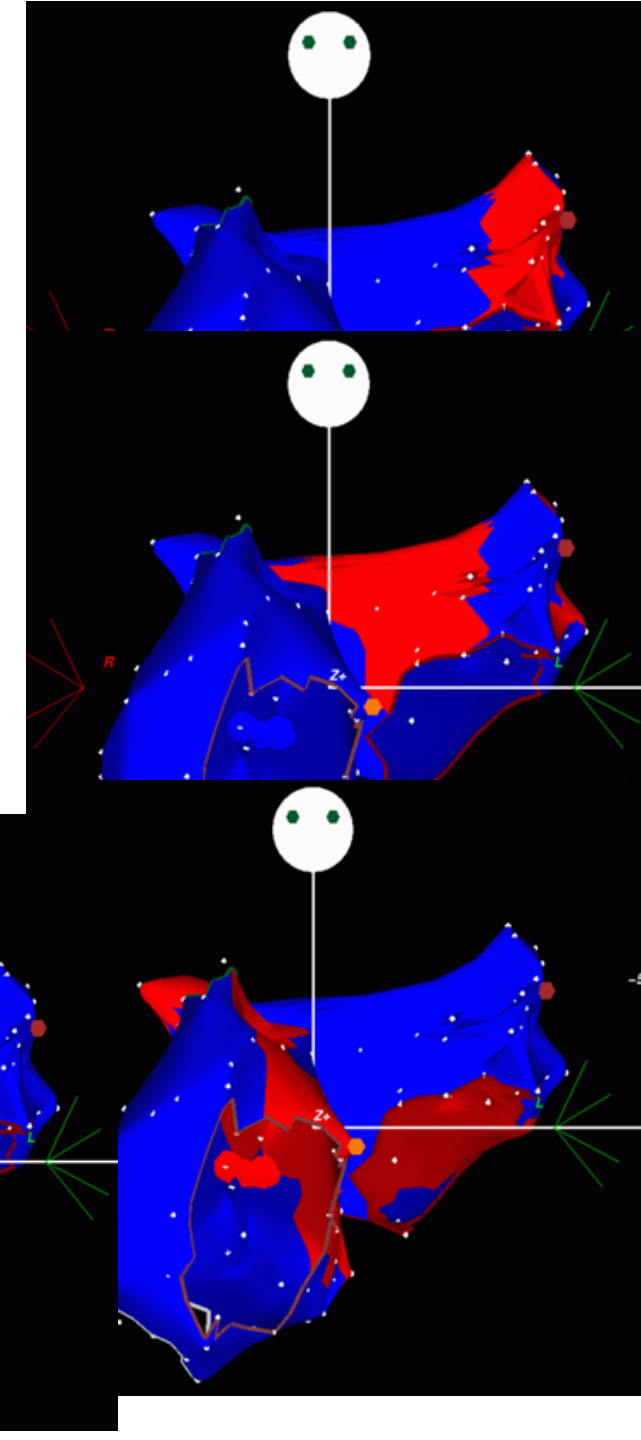


Fig. 49 : Tachicardia atriale ectopica permanente (stesso caso della figura 43). L'elettrocardiogramma standard a 12 derivazioni mostra onde P positive in V1 e di basso voltaggio in V5-V6 mentre l'asse di P nel piano frontale è deviato a destra (il paziente è in trattamento betabloccante). Nello schema sulla destra è riportata la sede di origine della tachicardia valutata con mappaggio endocavitario nell'atrio sinistro laterale basso.

FAT: P-R interval



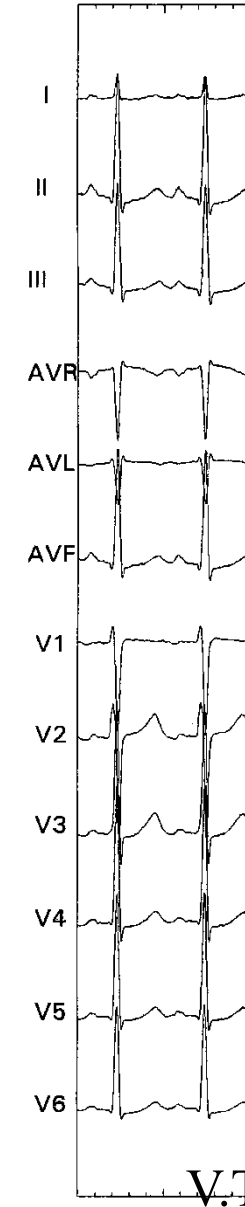
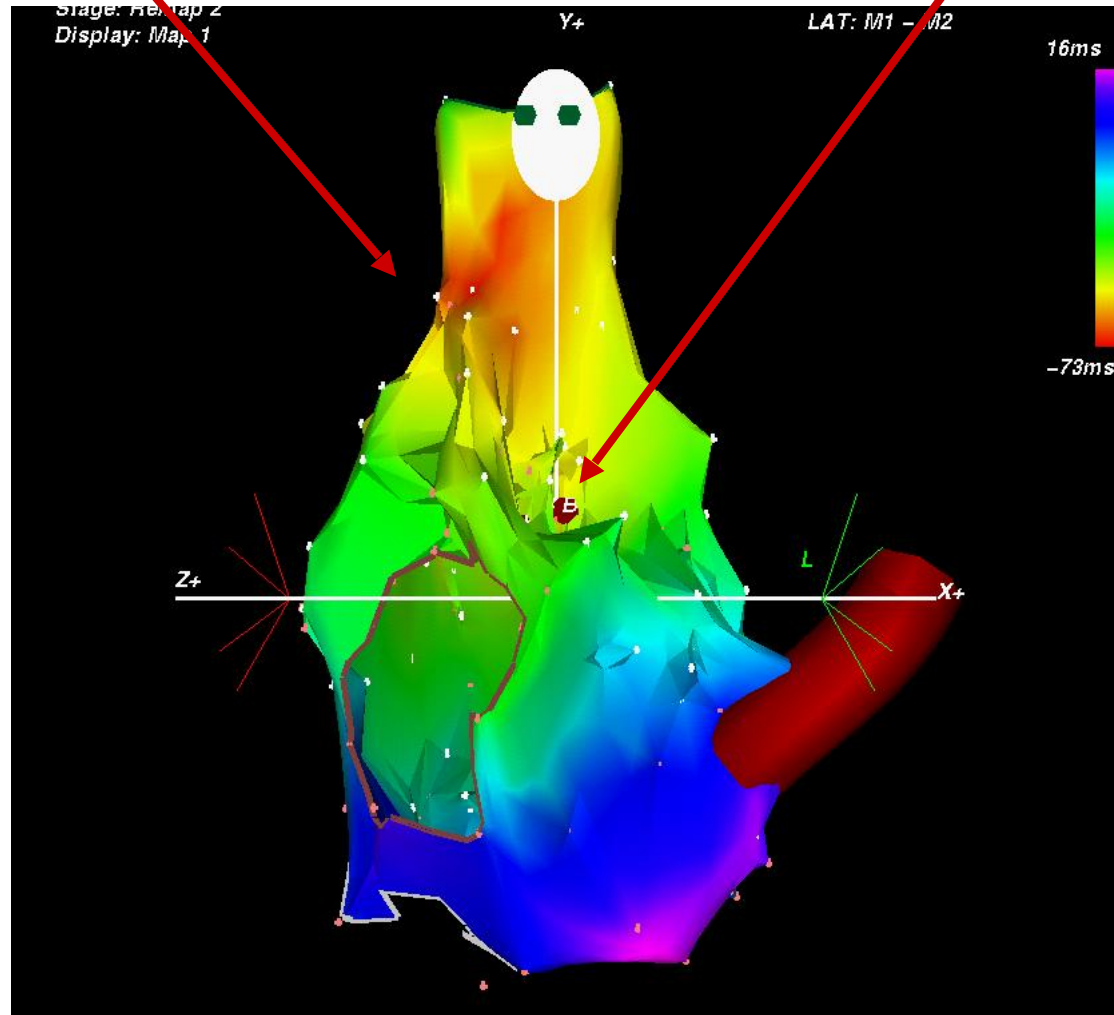
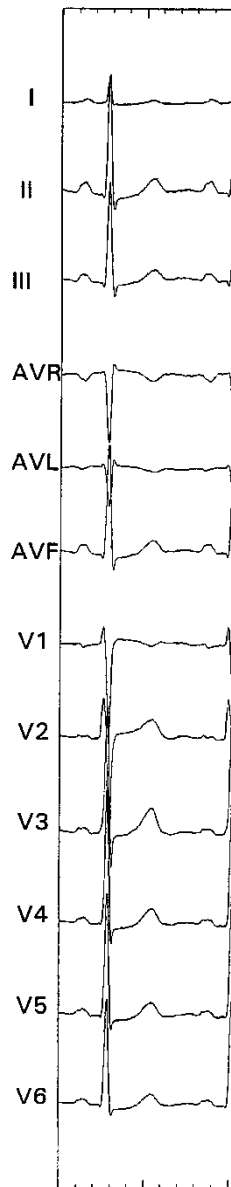
25 mm/sec



TAF: differente onda P rispetto al RS

RS 85 bpm

TAF 125 bpm



Trend di frequenza cardiaca nelle 24 ore



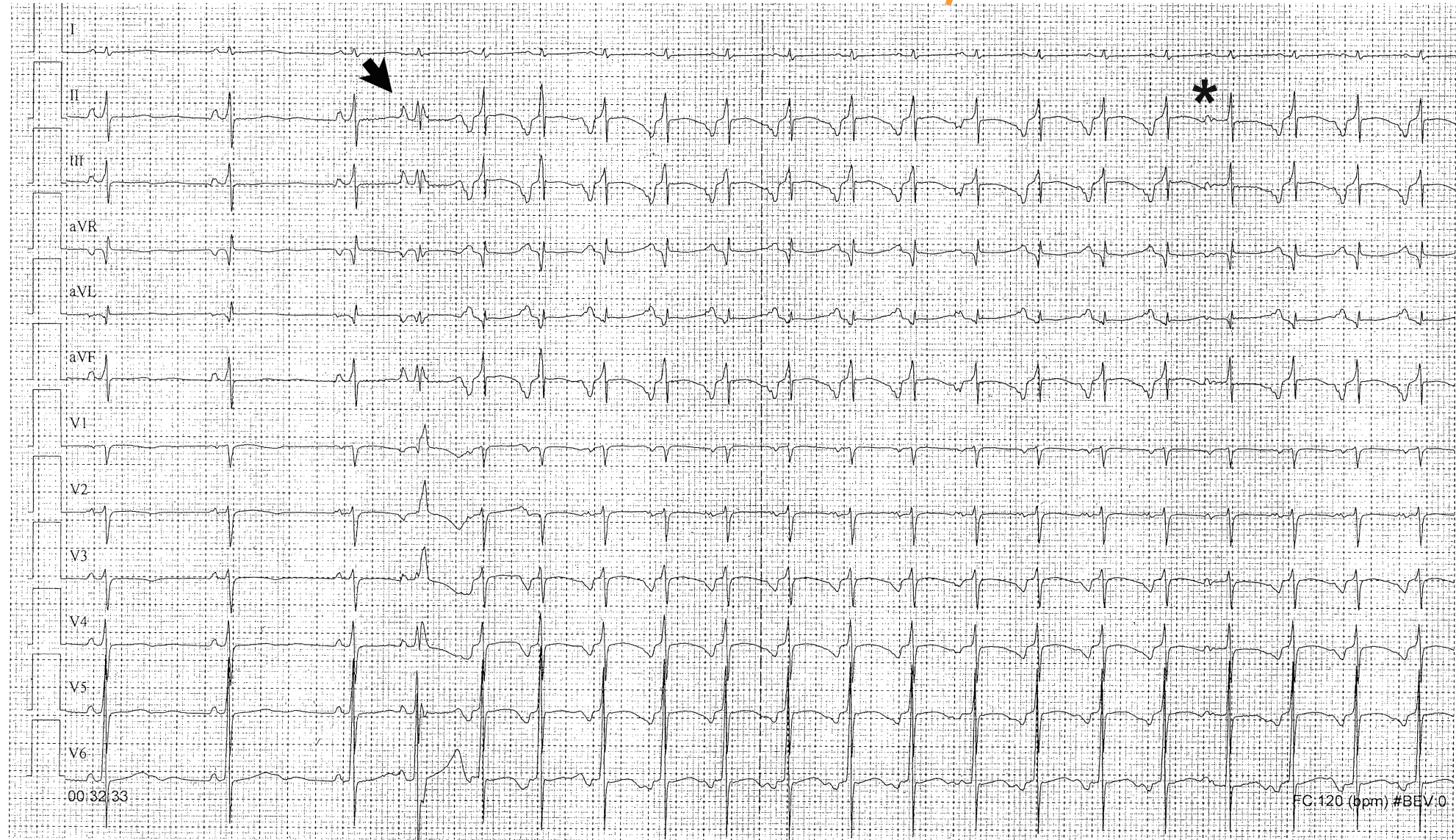
Fig. 5: Tachicardia atriale ectopica quasi permanente con conduzione atrio-ventricolare 1:1 (stessa caso della figura 2).

a) Brevi accessi di tachicardia atriale ectopica interrotti da isolati battiti sinusali;

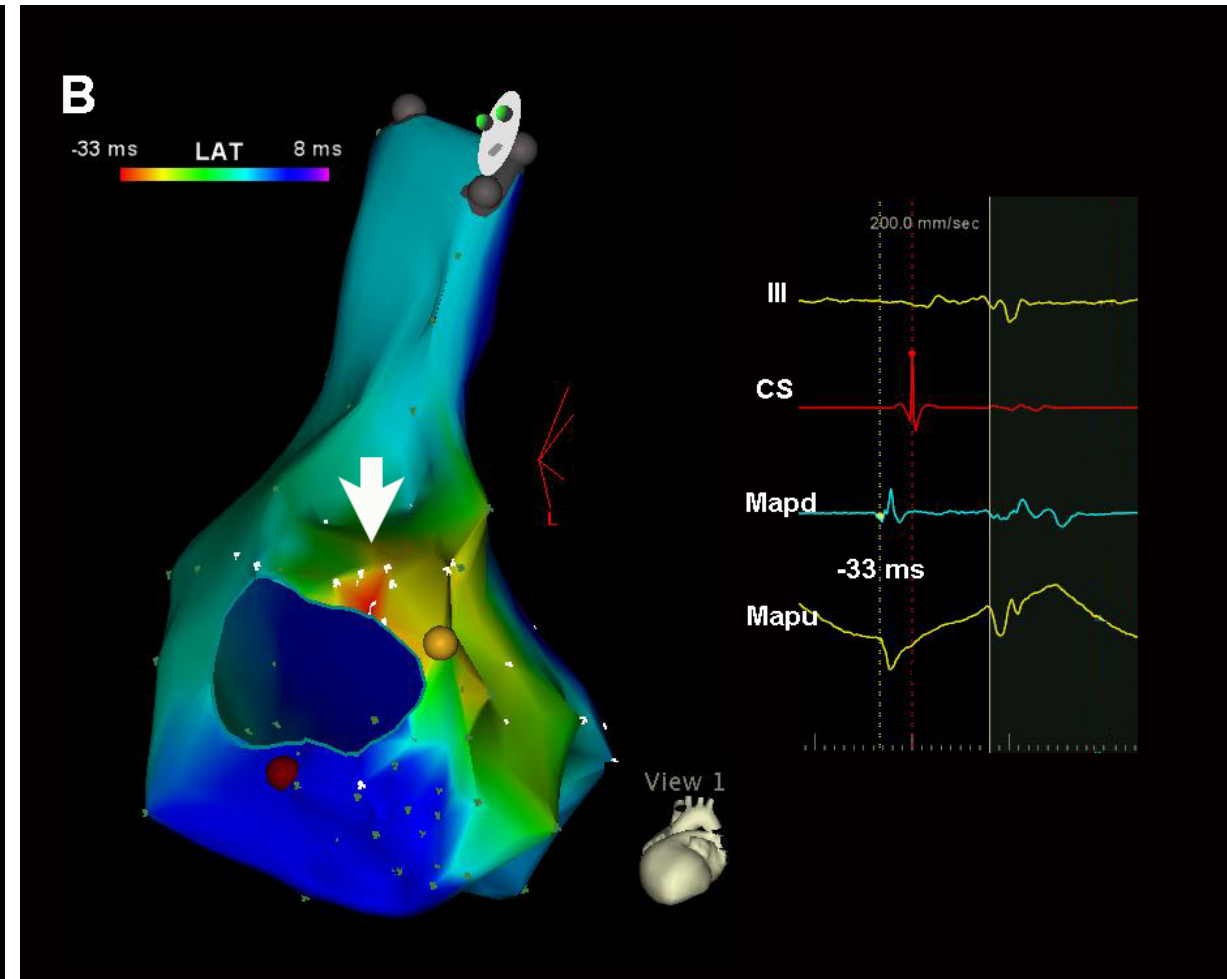
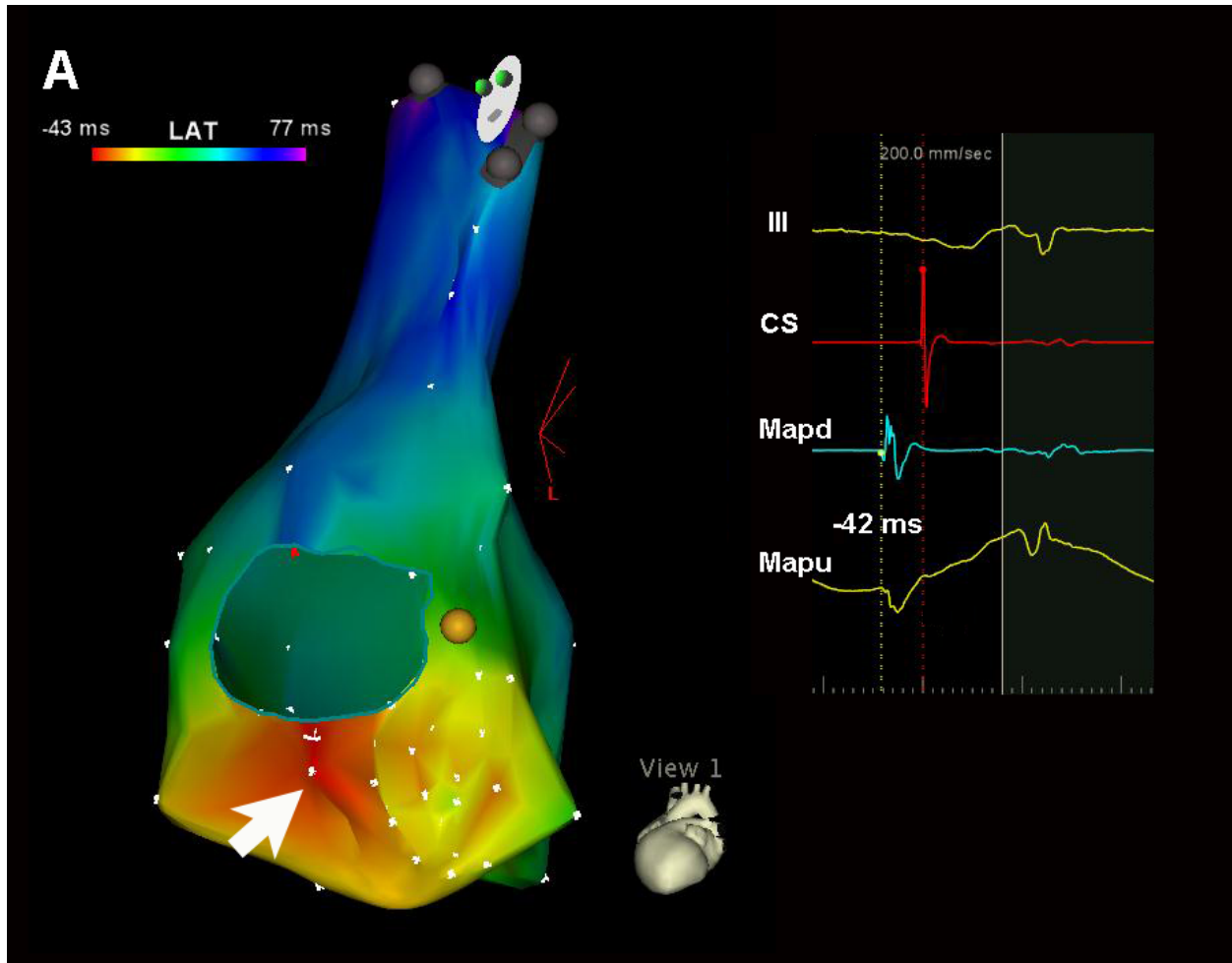
b) fase di accelerazione della tachicardia con scomparsa dei battiti sinusali;

c) l'andamento della frequenza cardiaca nelle 24 ore di registrazione presenta solo lievi oscillazioni rimanendo sempre su valori elevati.

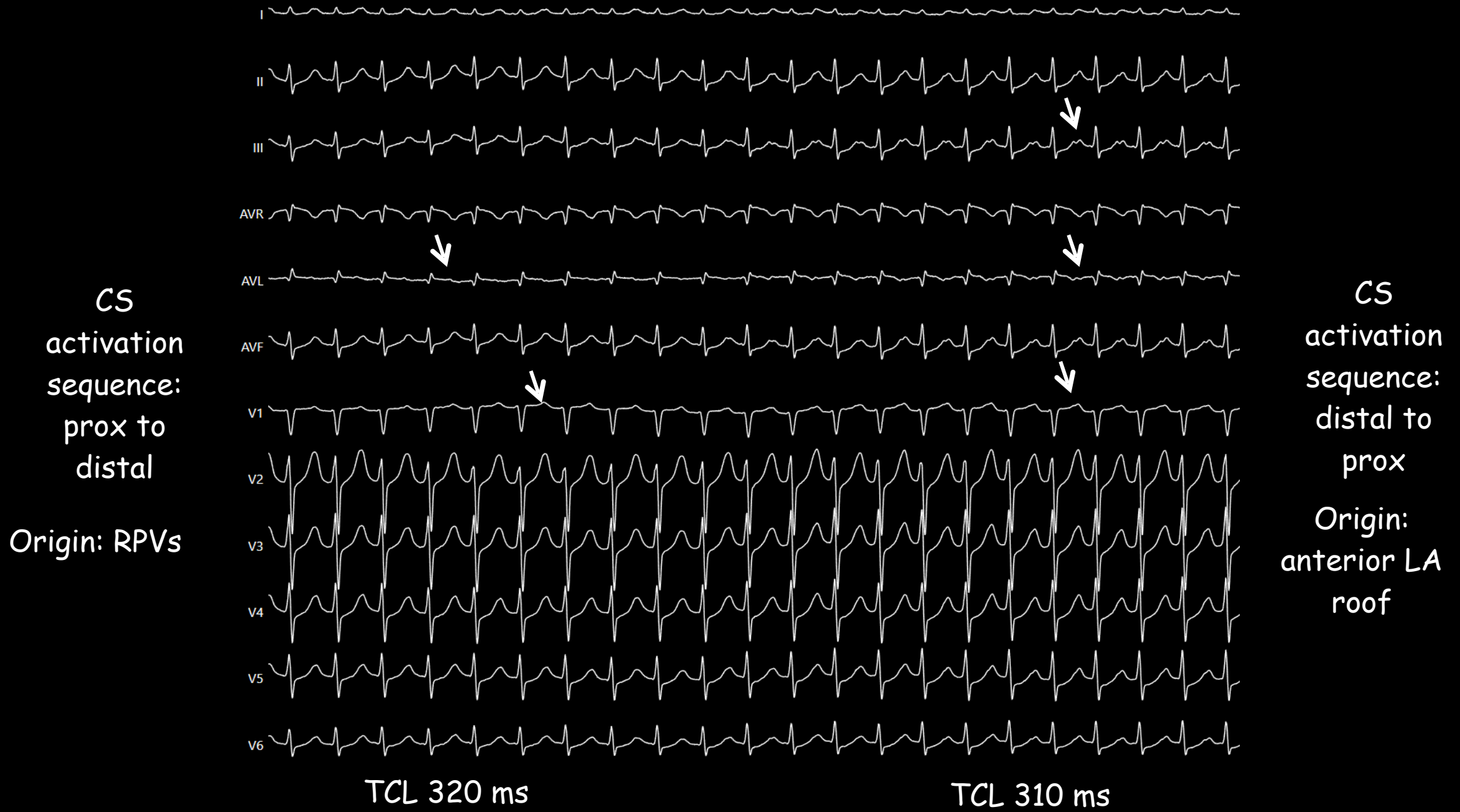
Multifocal atrial tachycardia



Multifocal atrial tachycardia



Simultaneous multifocal focal atrial tachycardia

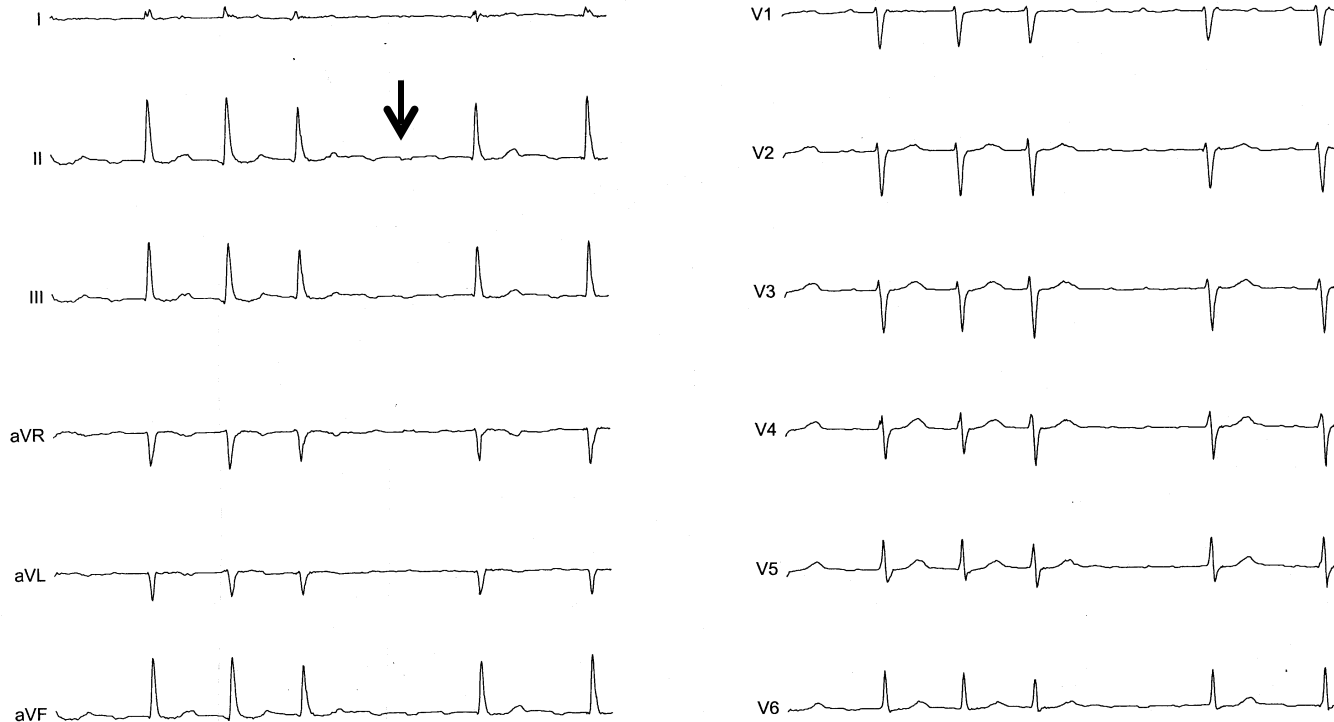


TACHICARDIA ATRIALE e FLUTTER ATRIALE

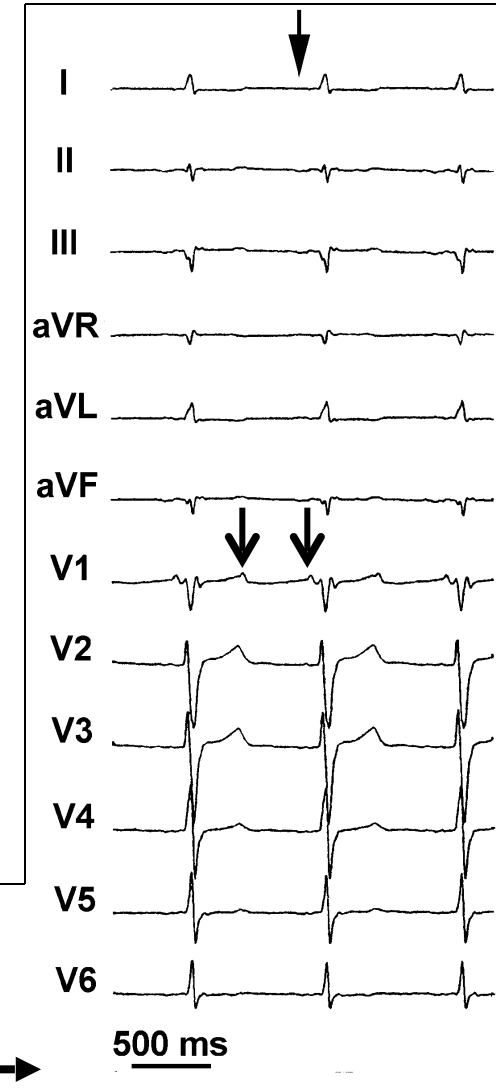
- Tachicardia atriale focale
- Tachicardia atriale da macrorientro
- Flutter atriale

Macroreentrant atrial tachycardia

Pt. PO, 81 yrs; hypertensive heart disease;
critical isthmus between the right PVs ↓



Pt. SA, 66 yrs; prior mitral surgery and PV
ablation; critical isthmus between the right PVs →



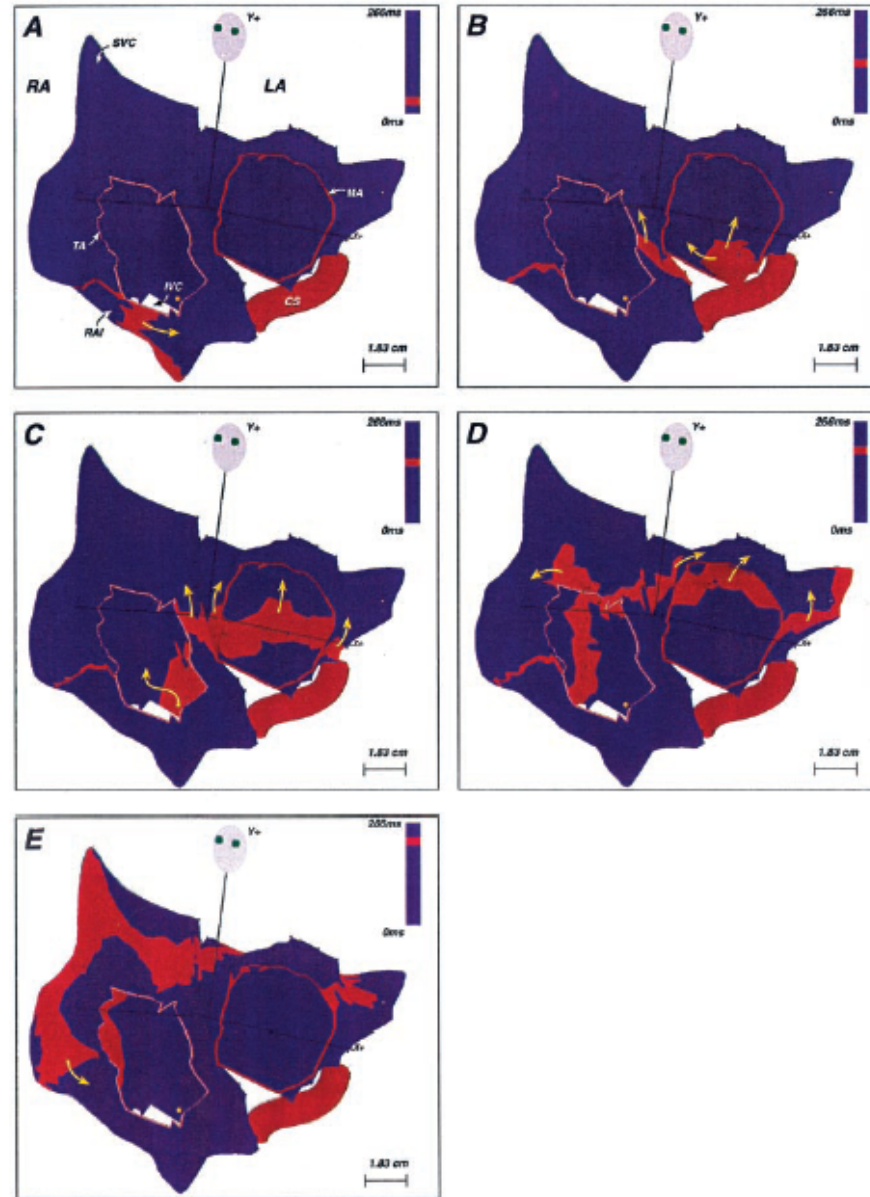
TACHICARDIA ATRIALE e FLUTTER ATRIALE

- Tachicardia atriale focale
- Tachicardia atriale da macrorientro
- Flutter atriale

AFLs: tentative classification

- Typical isthmus-dependent AFL
 - Counter-clockwise
 - Clockwise (reverse)
- Pseudo-typical AFL
 - Same ECG, but non isthmus-dependent
- Pseudo-atypical AFL
 - Different ECG, but isthmus-dependent
- Atypical AFL
 - right AFL with different ECG and circuit
 - left atrial flutters

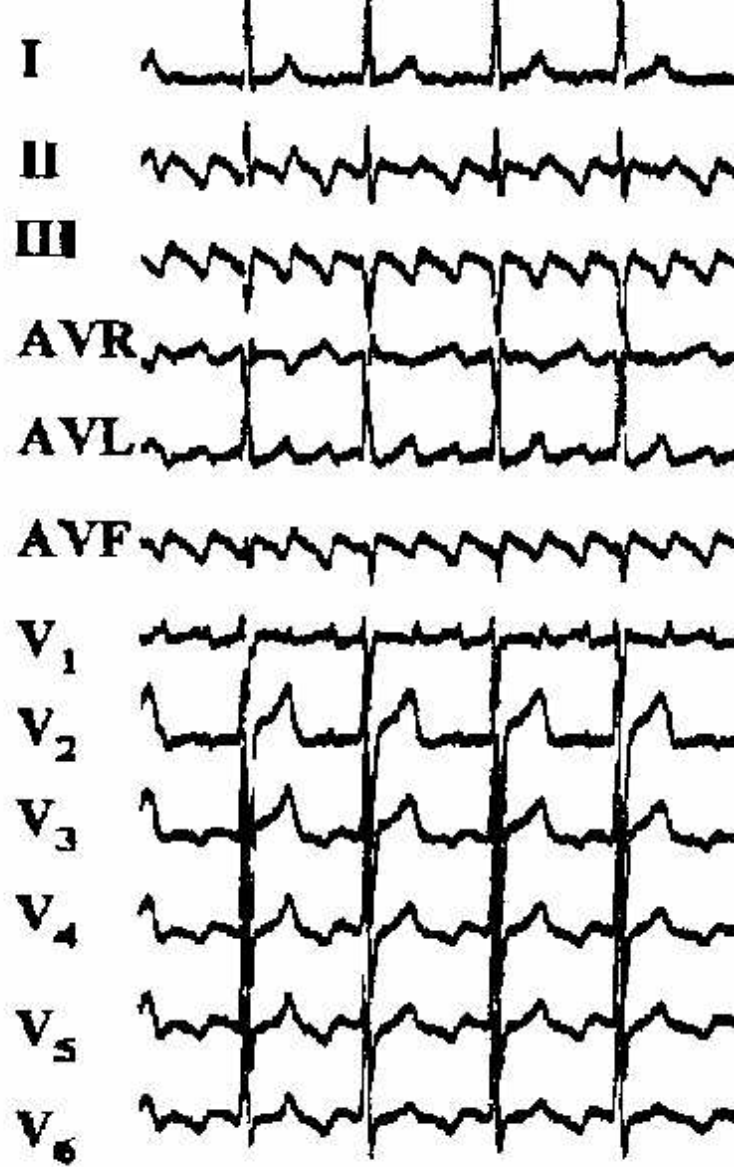
Biatrial activation in isthmus-dependent atrial flutter



Rodriguez et al. Circulation 2001

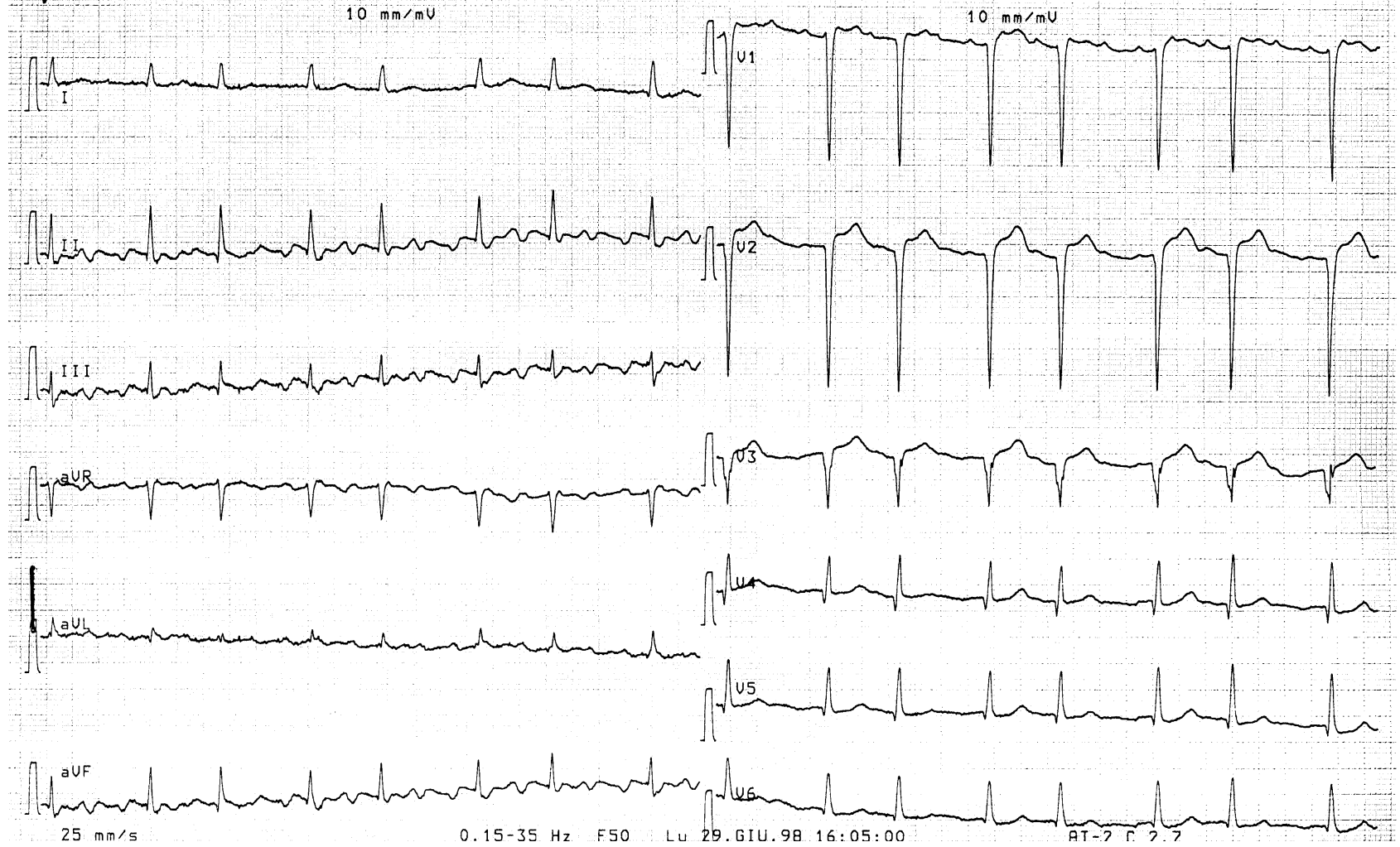
Typical CCW AFL

AFL cycle length 200-250

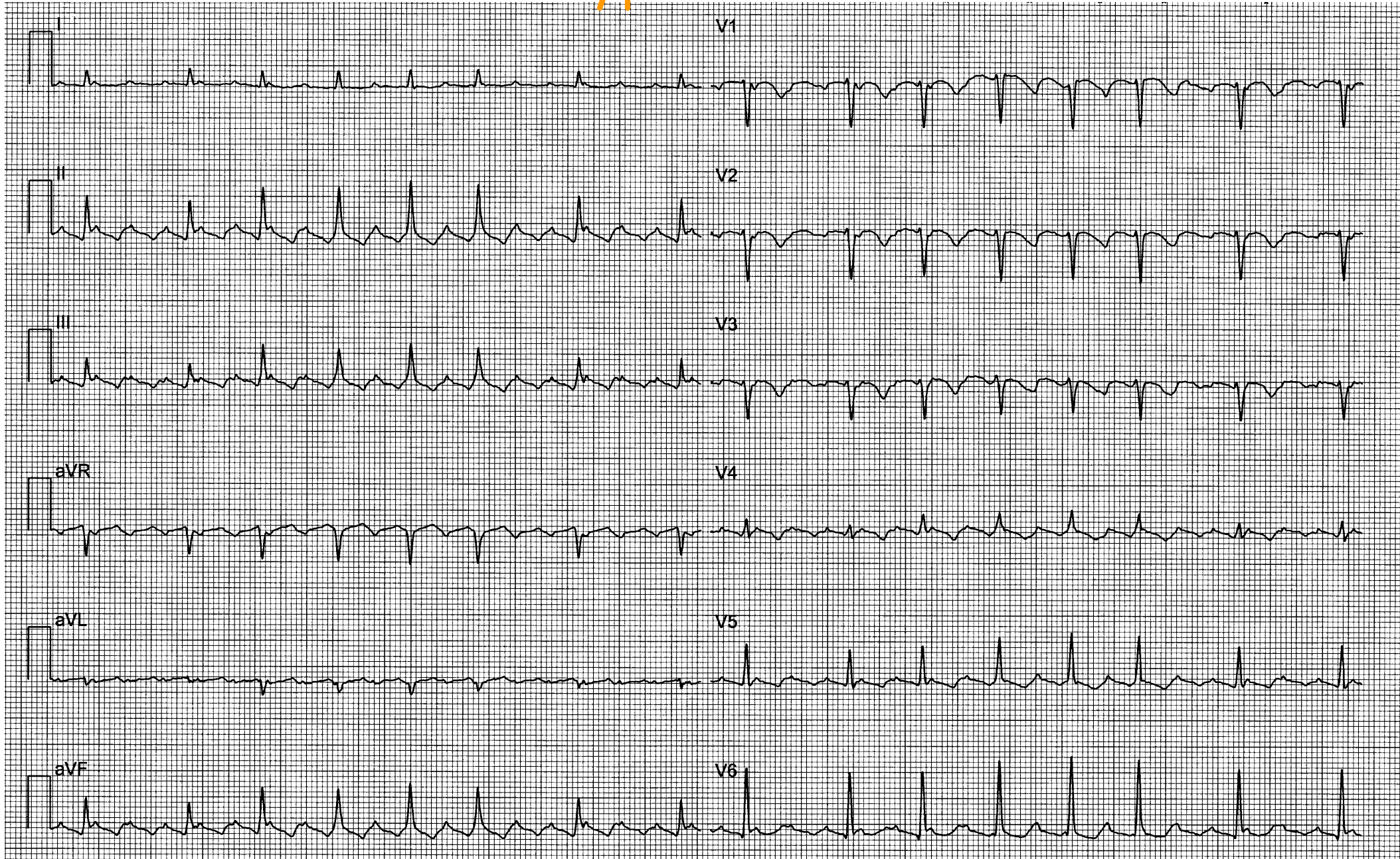


Less typical CCW AFL

AFL cycle length 280 ms

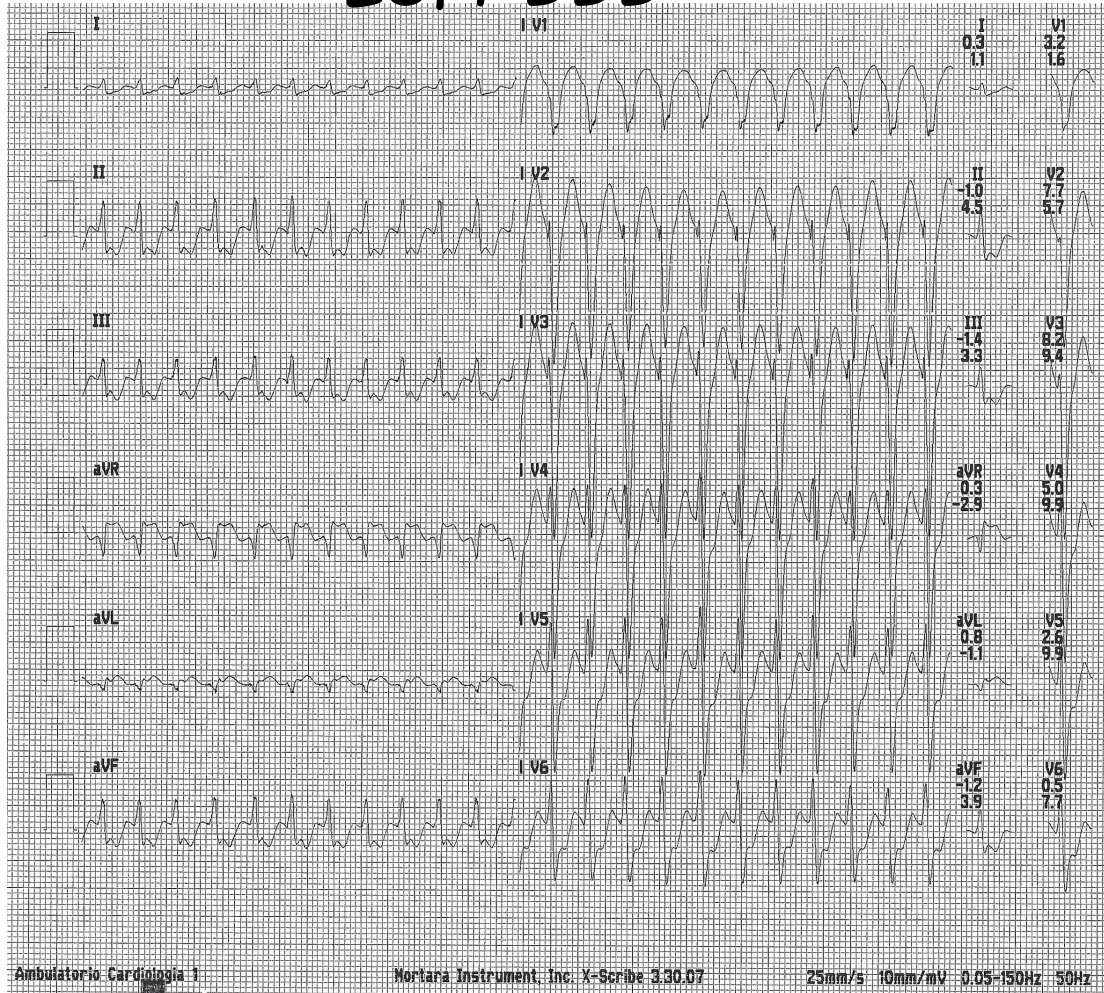


Reverse typical atrial flutter

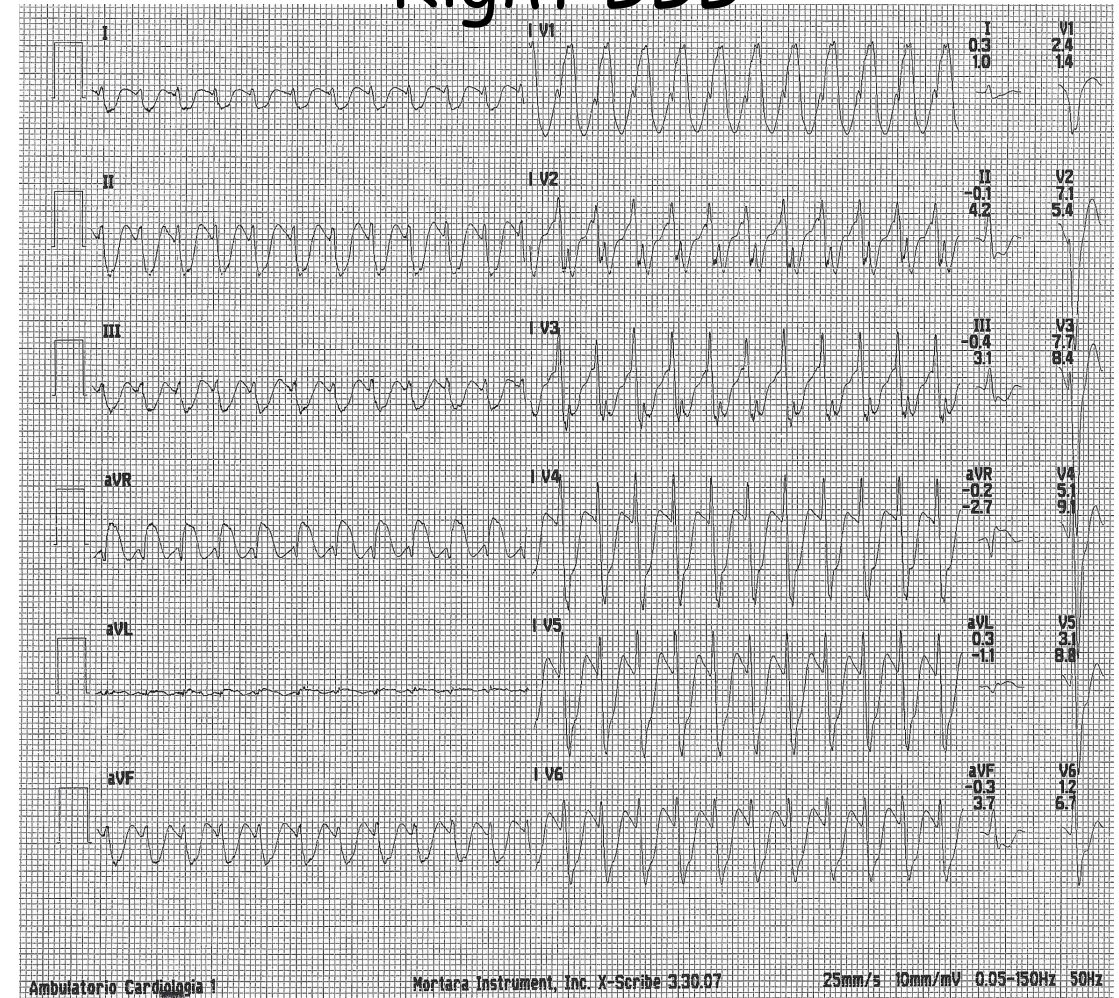


Typical atrial flutter 1:1 AV conduction

Left BBB



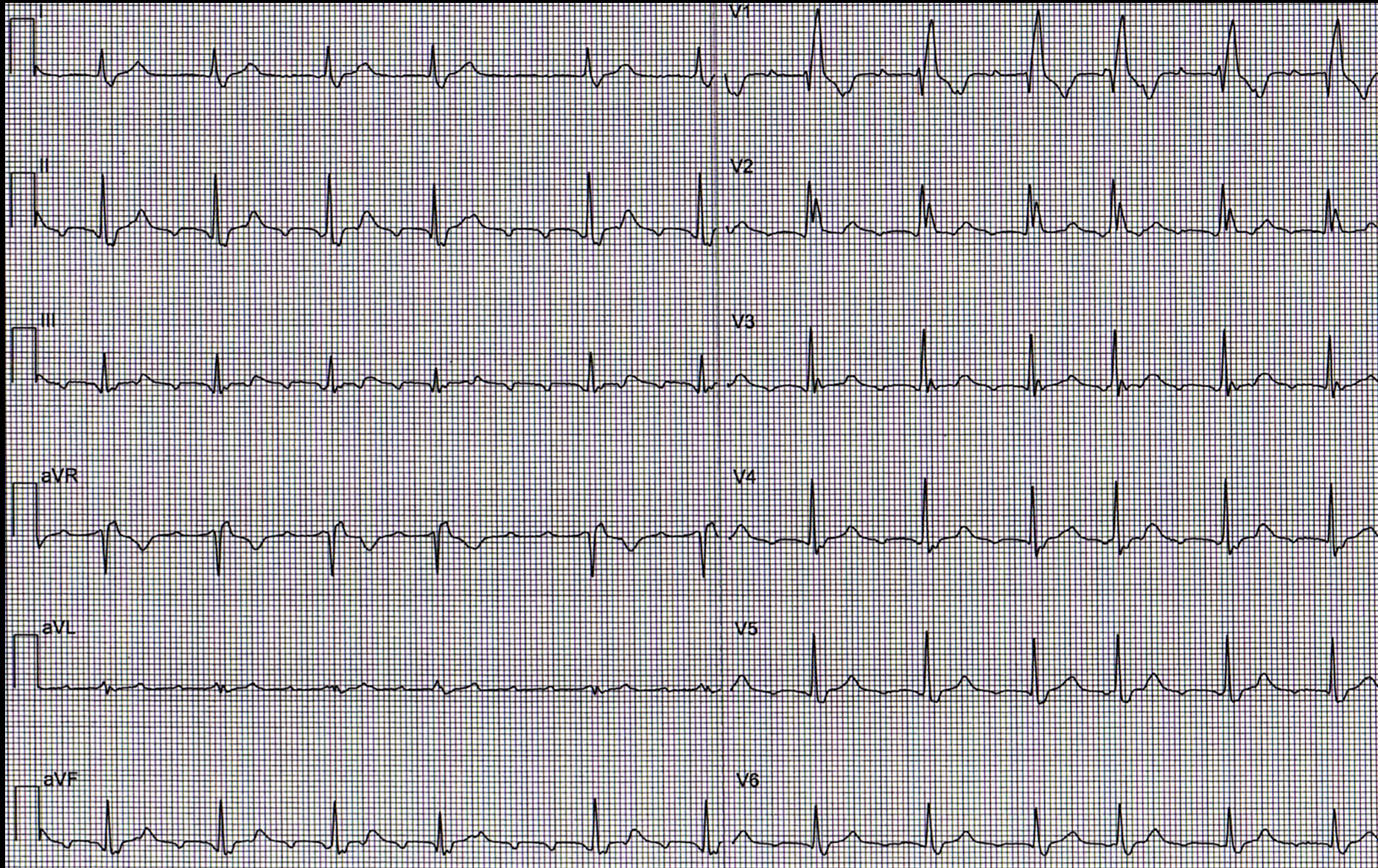
Right BBB



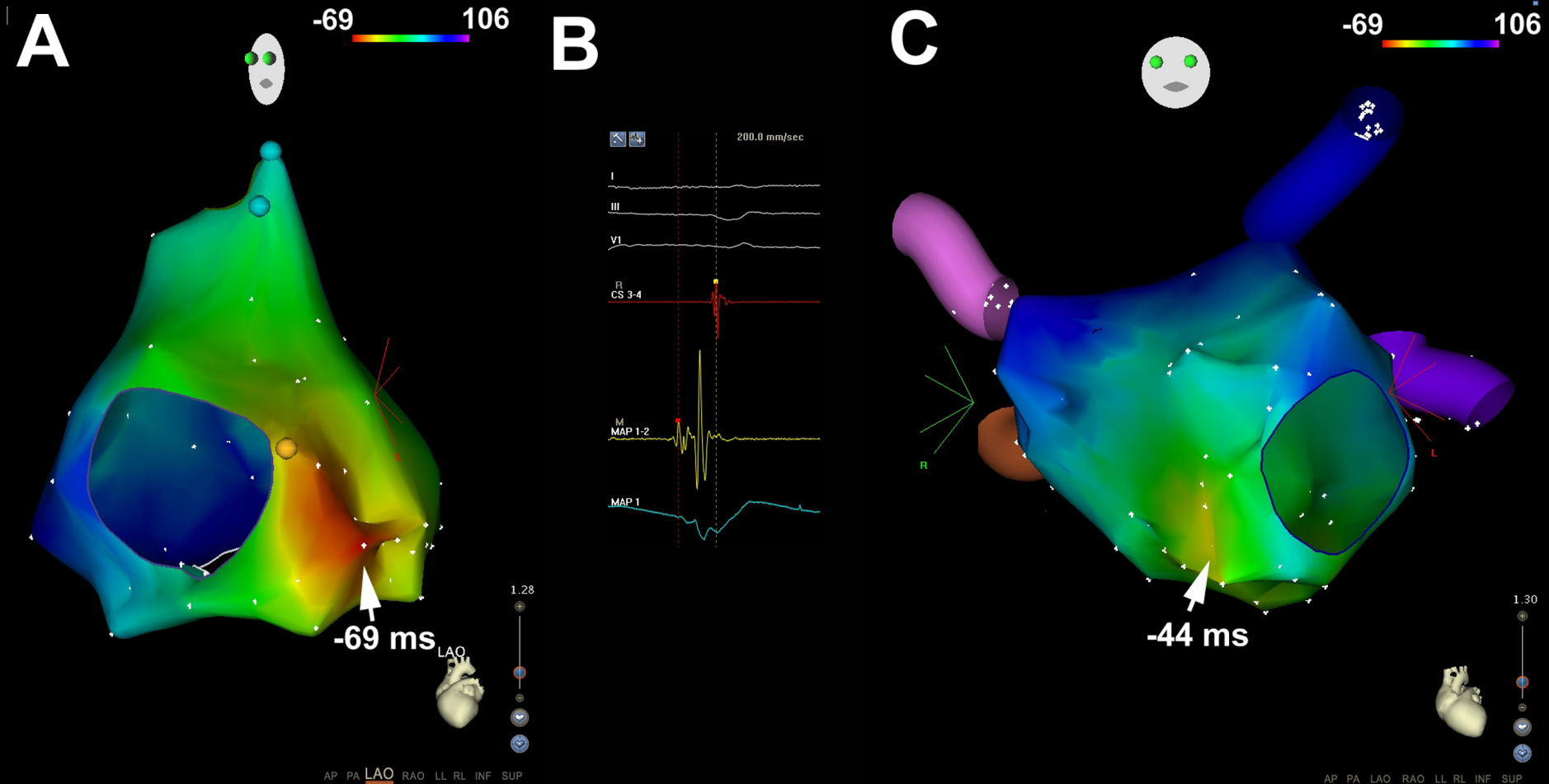
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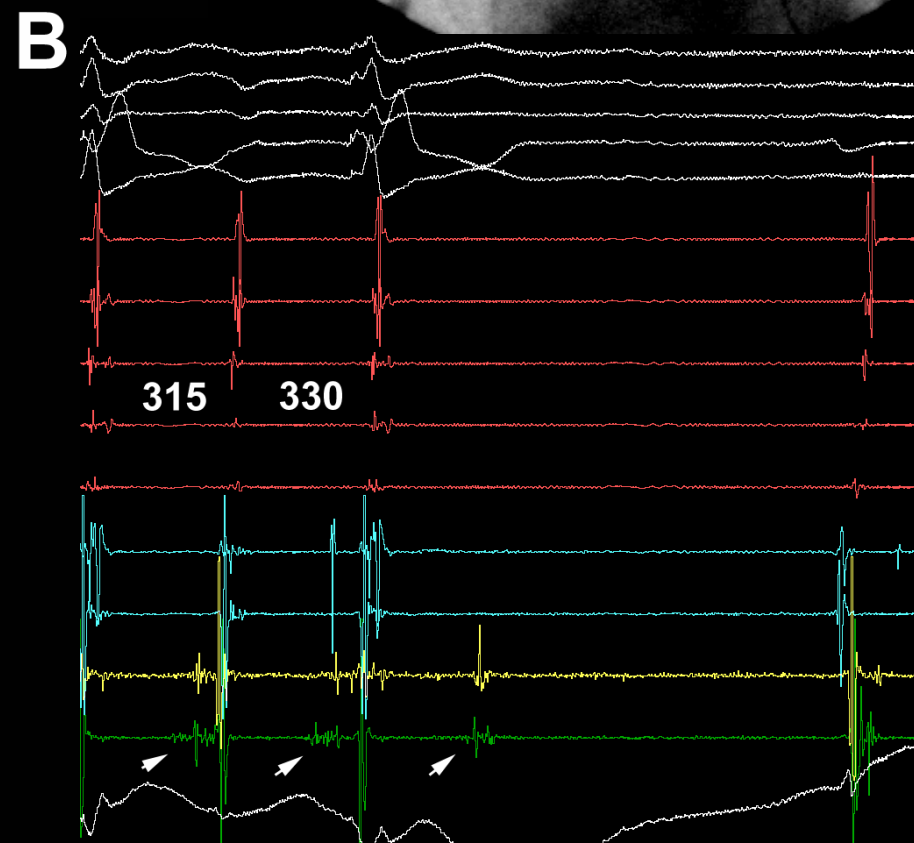
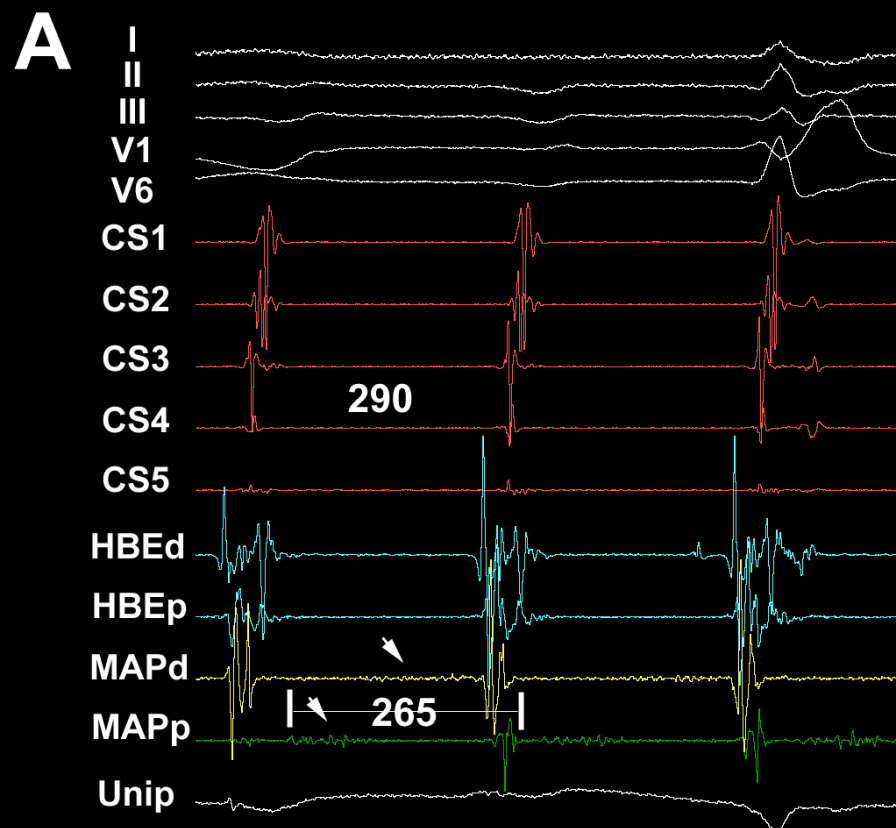
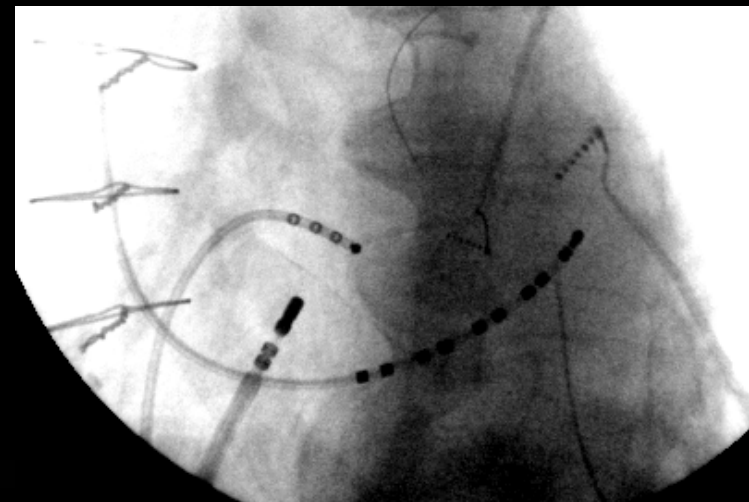
An atypical case of typical atrial flutter in a patient with prior CABG



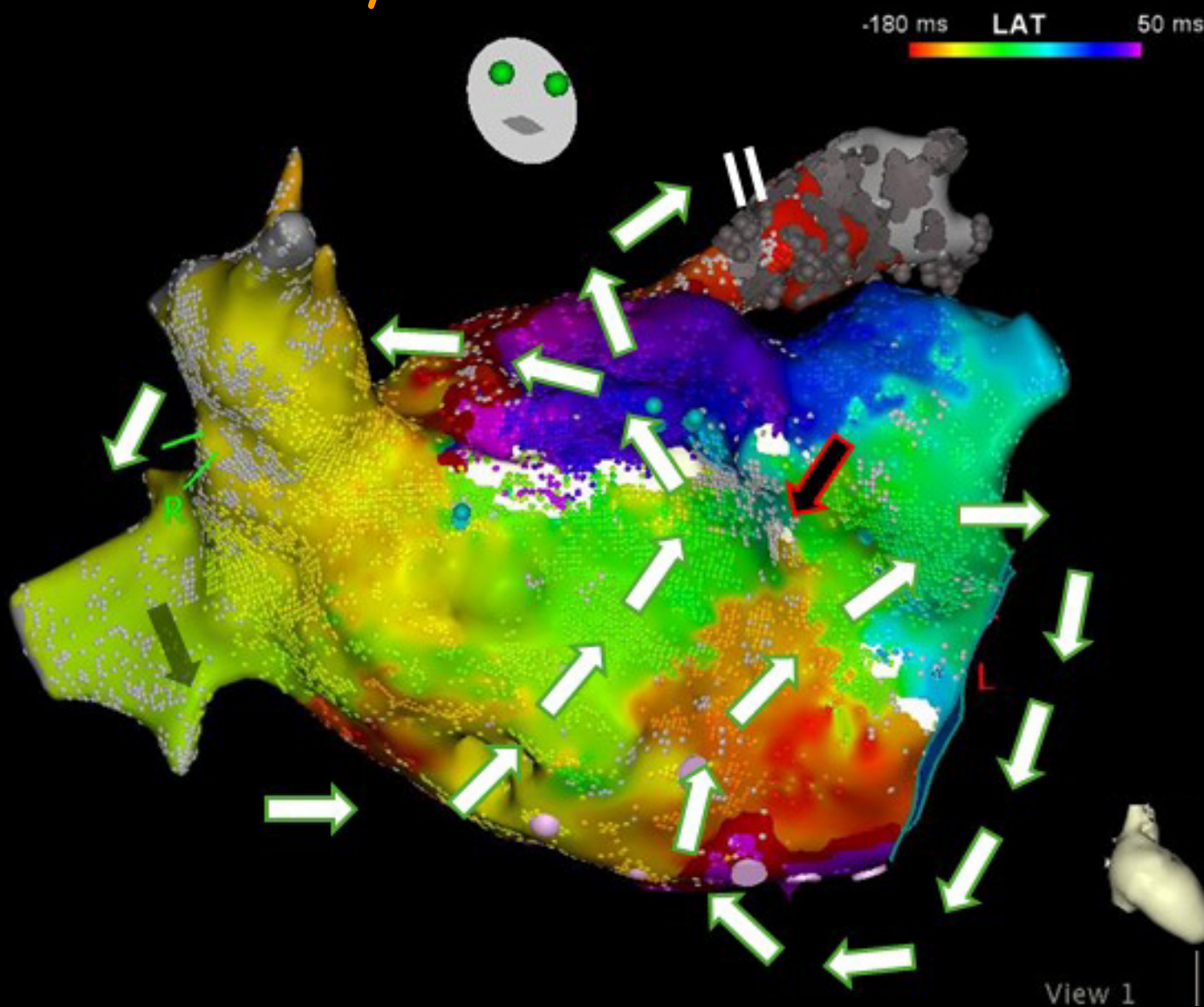
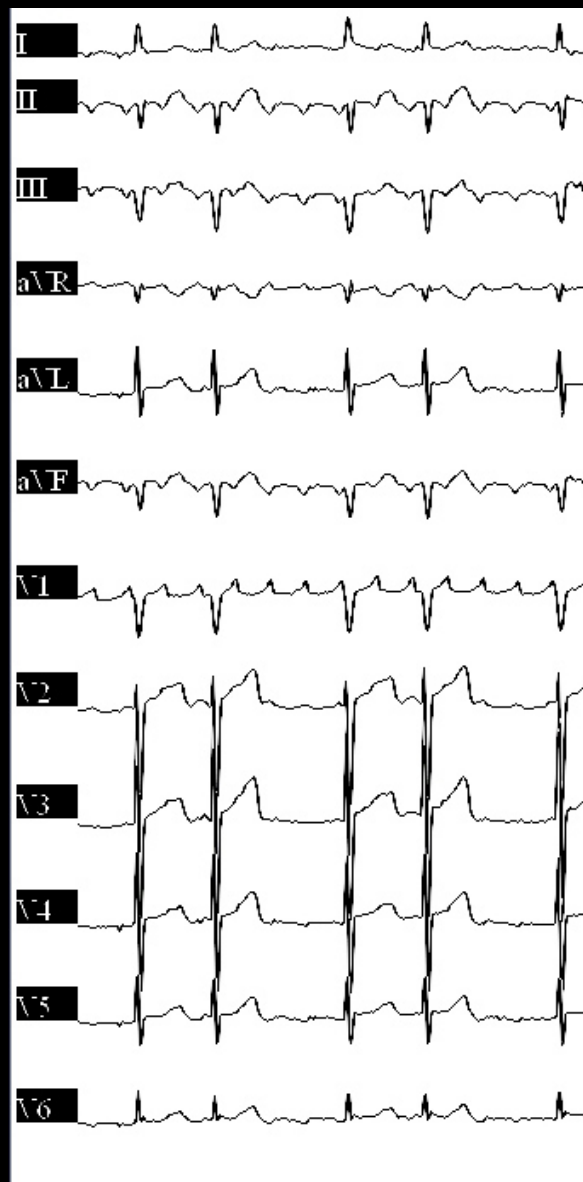
Right and left electroanatomic activation pattern



Mapping and ablation at the coronary sinus os



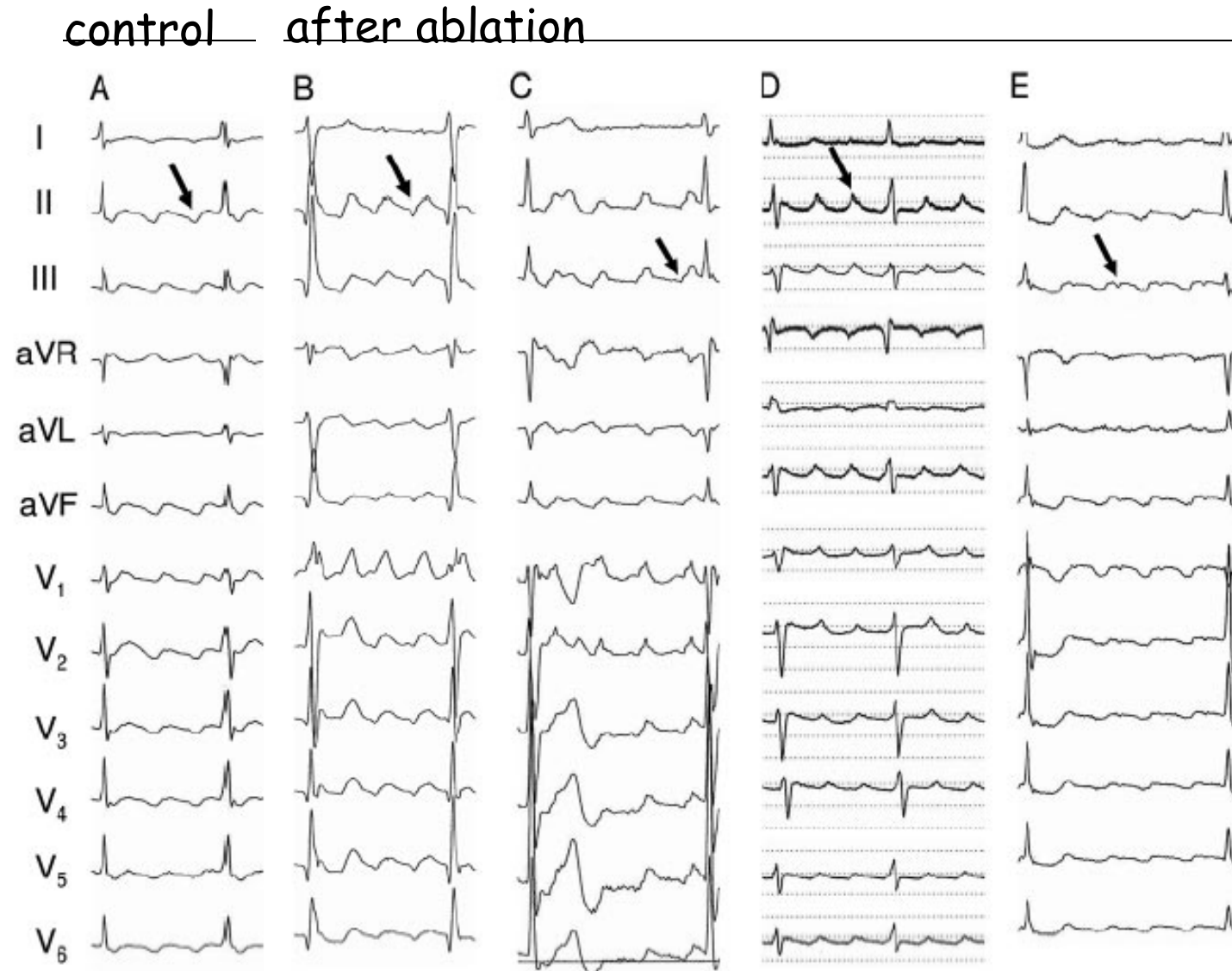
Two independent loops in the left atrium+incomplete loop+focal activity



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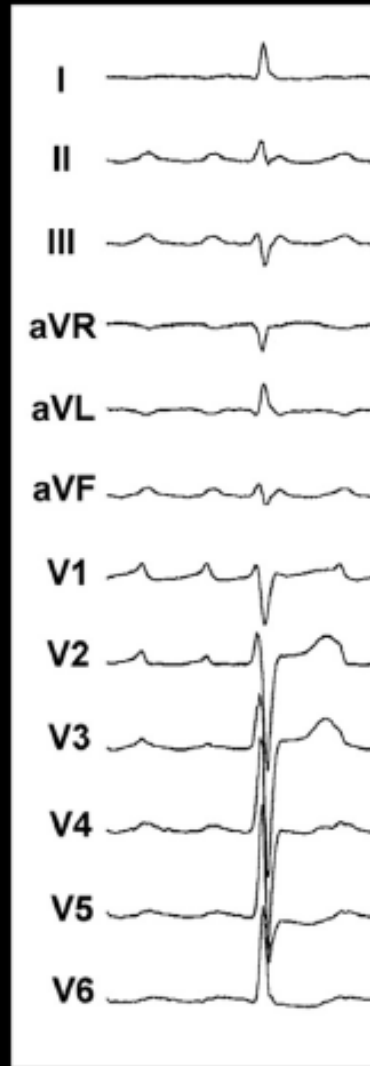
Modification of surface ECG pattern during CCW CTI dependent AFL after left atrial ablation



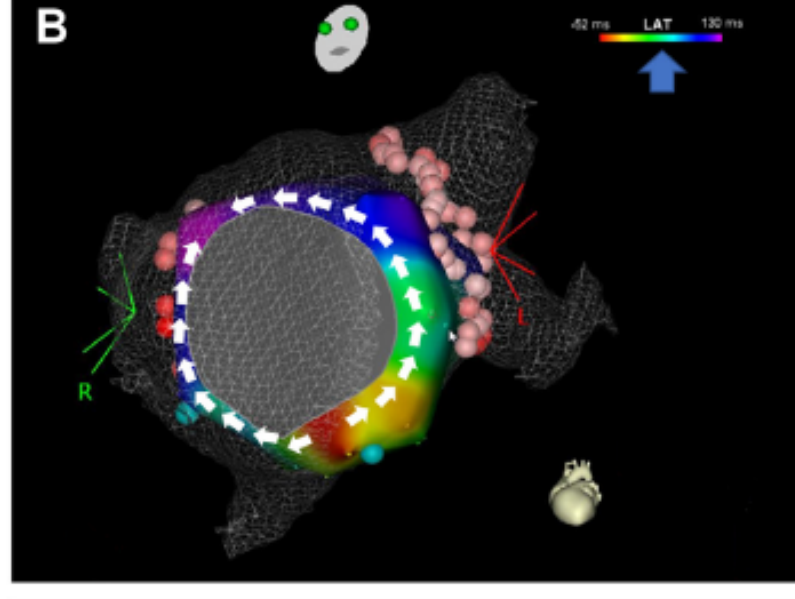
Chugh et al. Circulation 2006

Pseudo-atypical CTI-dependent AFL - 2

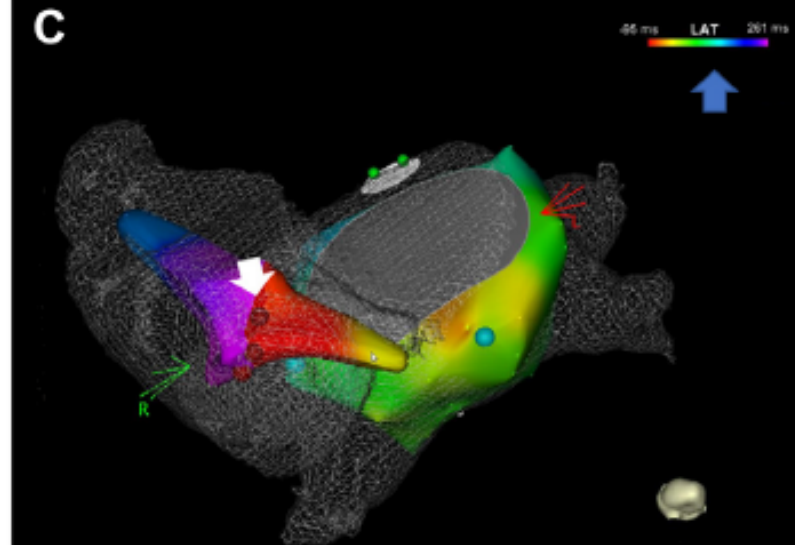
A



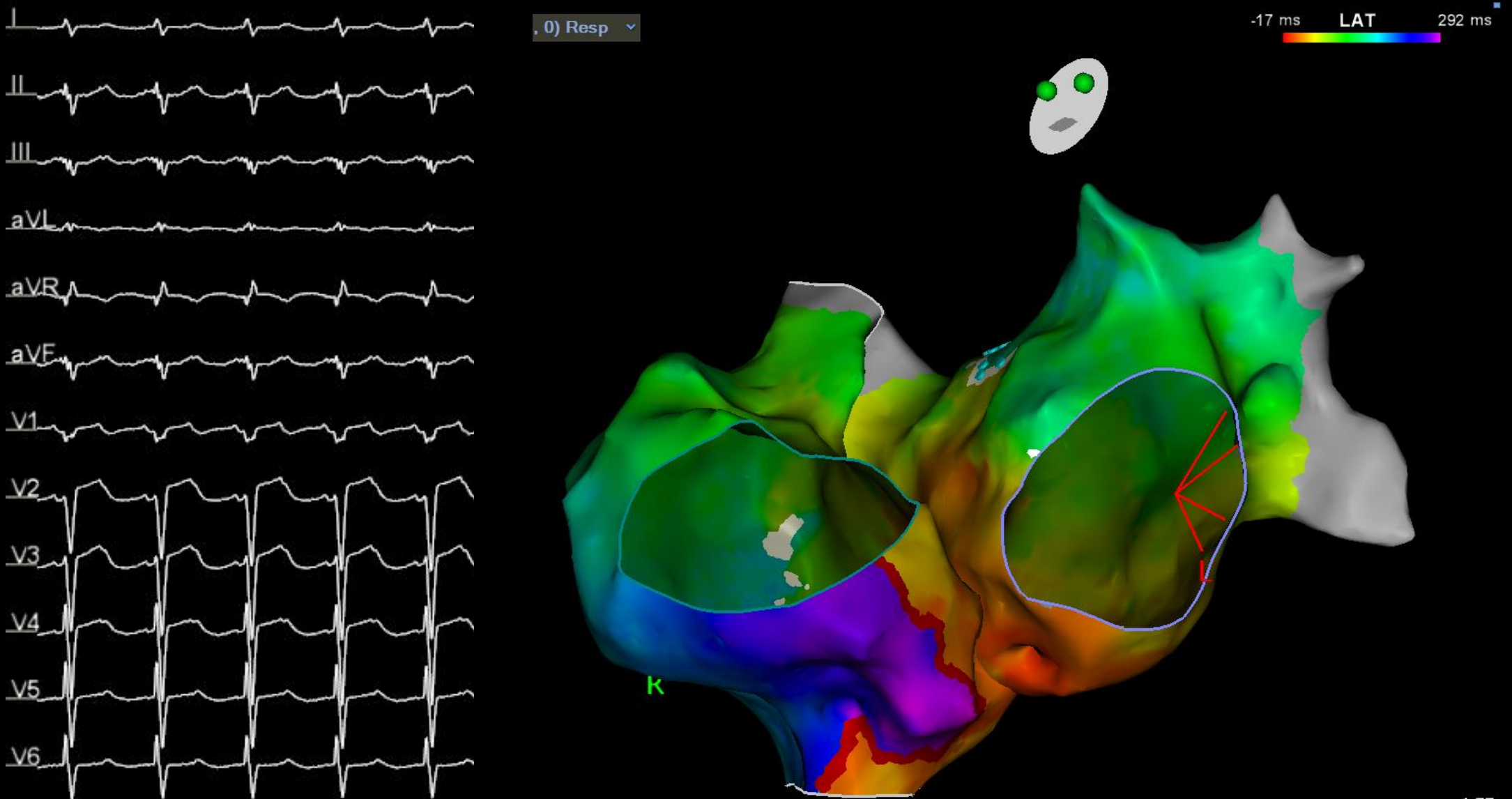
B



C



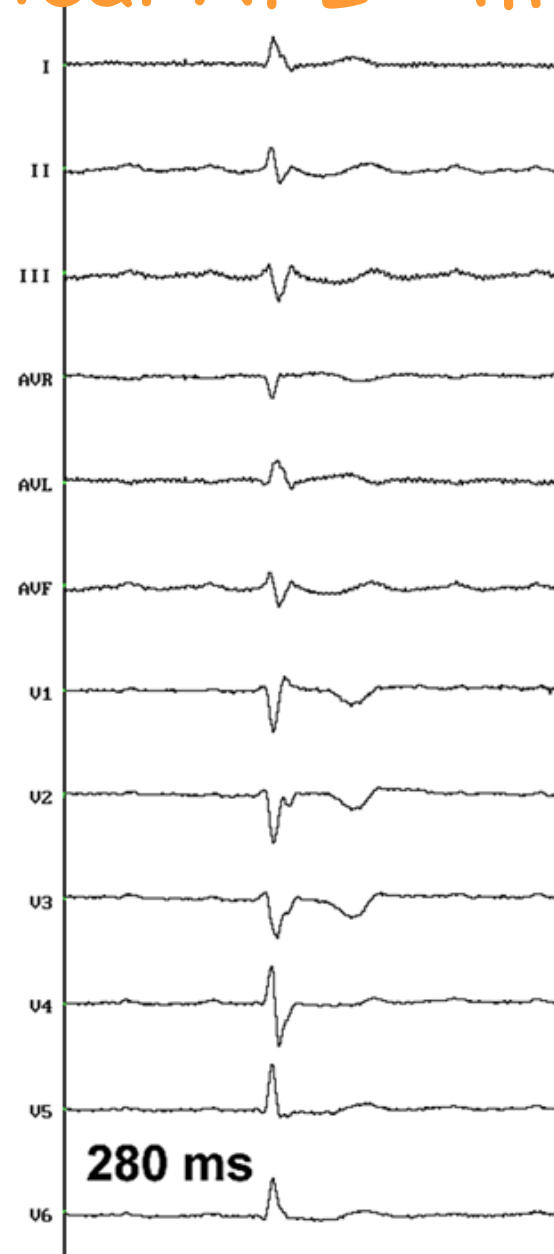
Pseudo-atypical CTI-dependent AFL - 3



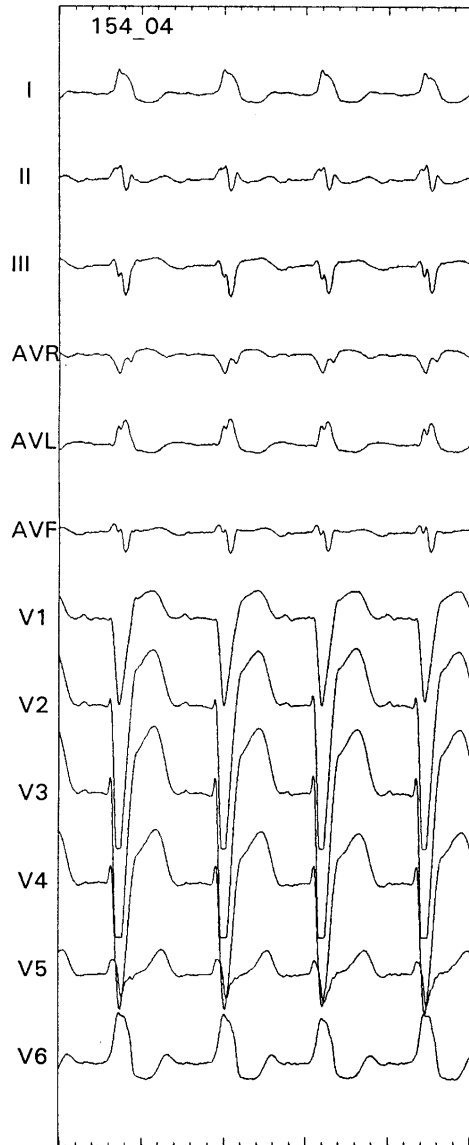
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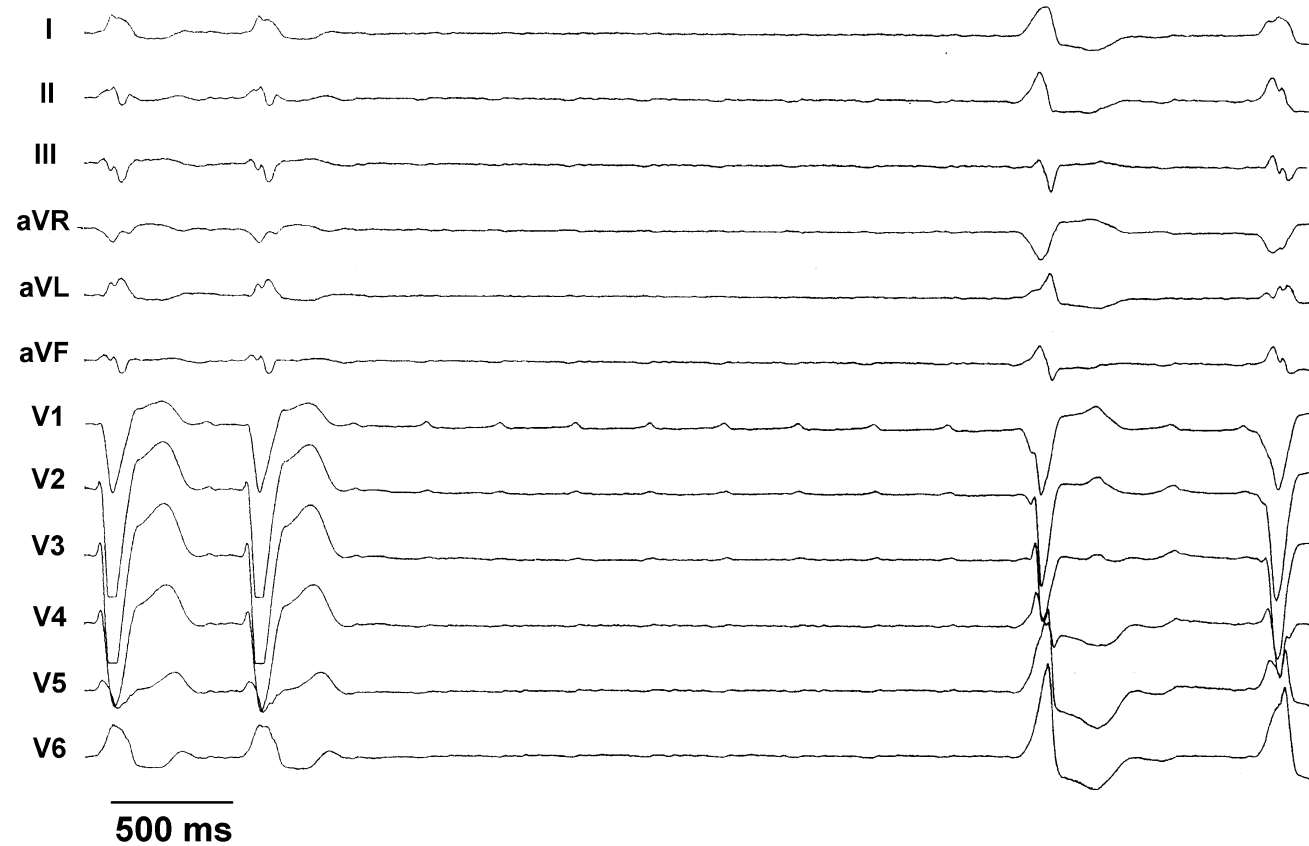
Left atypical AFL - morphology 1



Left atypical AFL - morphology 2



CL 305 ms



Considerazioni conclusive - 1

Le tachicardie atriali si differenziano principalmente dal flutter atriale per la morfologia all'ECG a 12 derivazioni dell'attivazione atriale più che dal ciclo o dal meccanismo aritmogenetico

Nelle tachicardie atriali focali senza cardiopatia organica, la morfologia di P è indicativa della sede del focus, mentre nella tachicardia da macrorientro spesso associate a cardiopatia non lo è

La morfologia del flutter atriale tipico è caratteristica e ben riconoscibile; alterazioni del substrato atriale però possono condizionare variazioni importanti della morfologia

Il flutter atriale tipico con conduzione atrioventricolare 1:1 ha complesso QRS largo per presenza di blocco di branca (dx o sx)

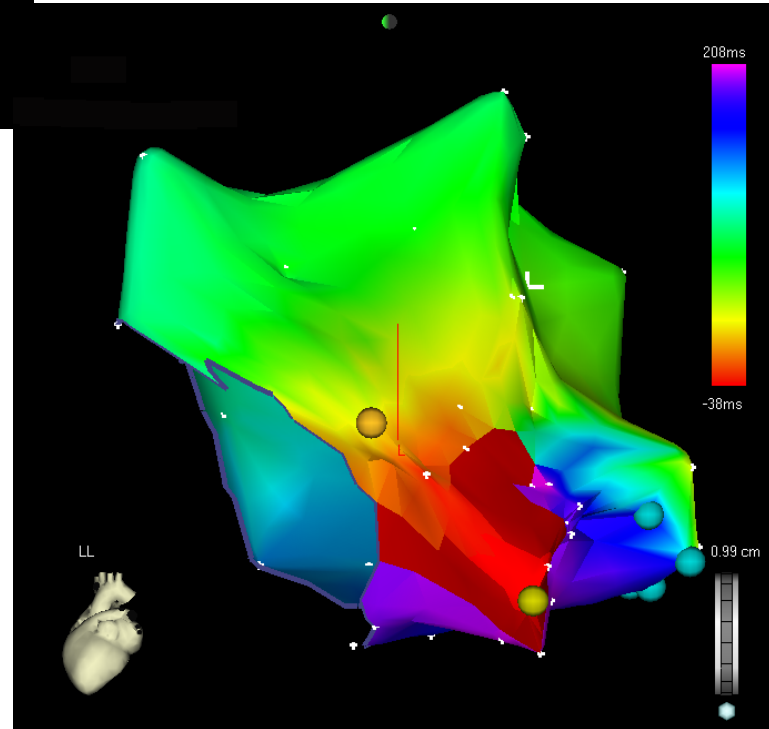
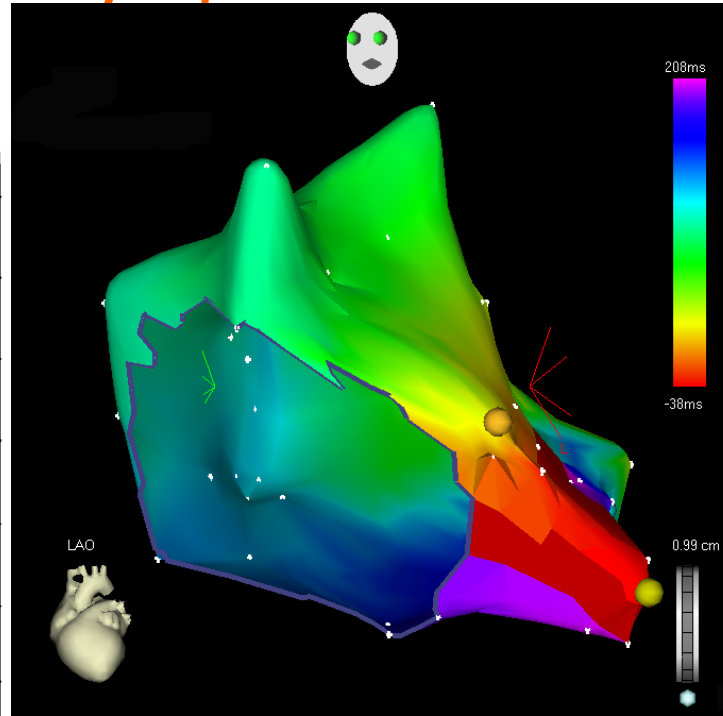
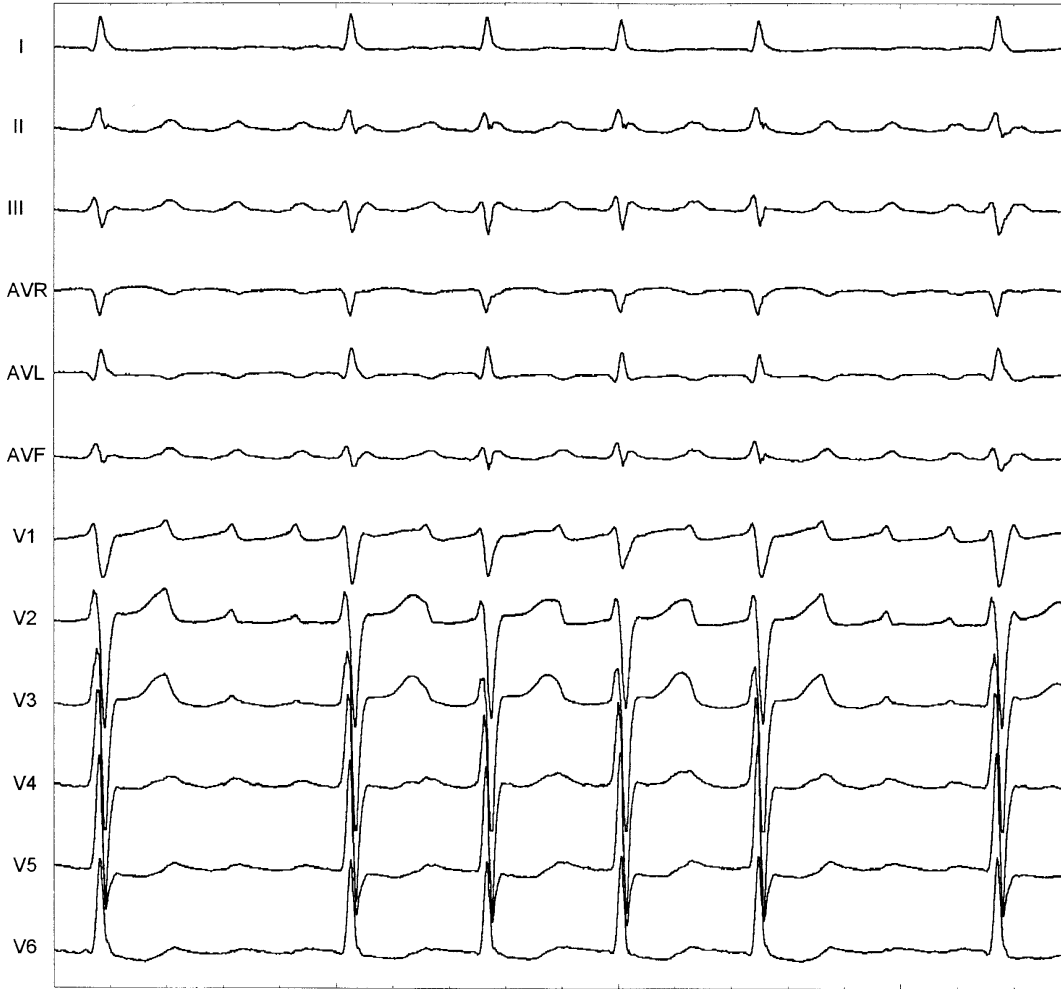
Considerazioni conclusive - 2

Ci possono essere forme «pseudotipiche» o «pseudoatipiche» di flutter atriale che possono avere impatto sulle procedure ablative

Il flutter atriale sinistro generalmente si caratterizza per onde P positive nelle derivazioni inferiori e precordiali o per onde P positive in V1 e di basso voltaggio in tutte le altre derivazioni

Atypical atrial flutter in a 79-yo patient with no prior intervention

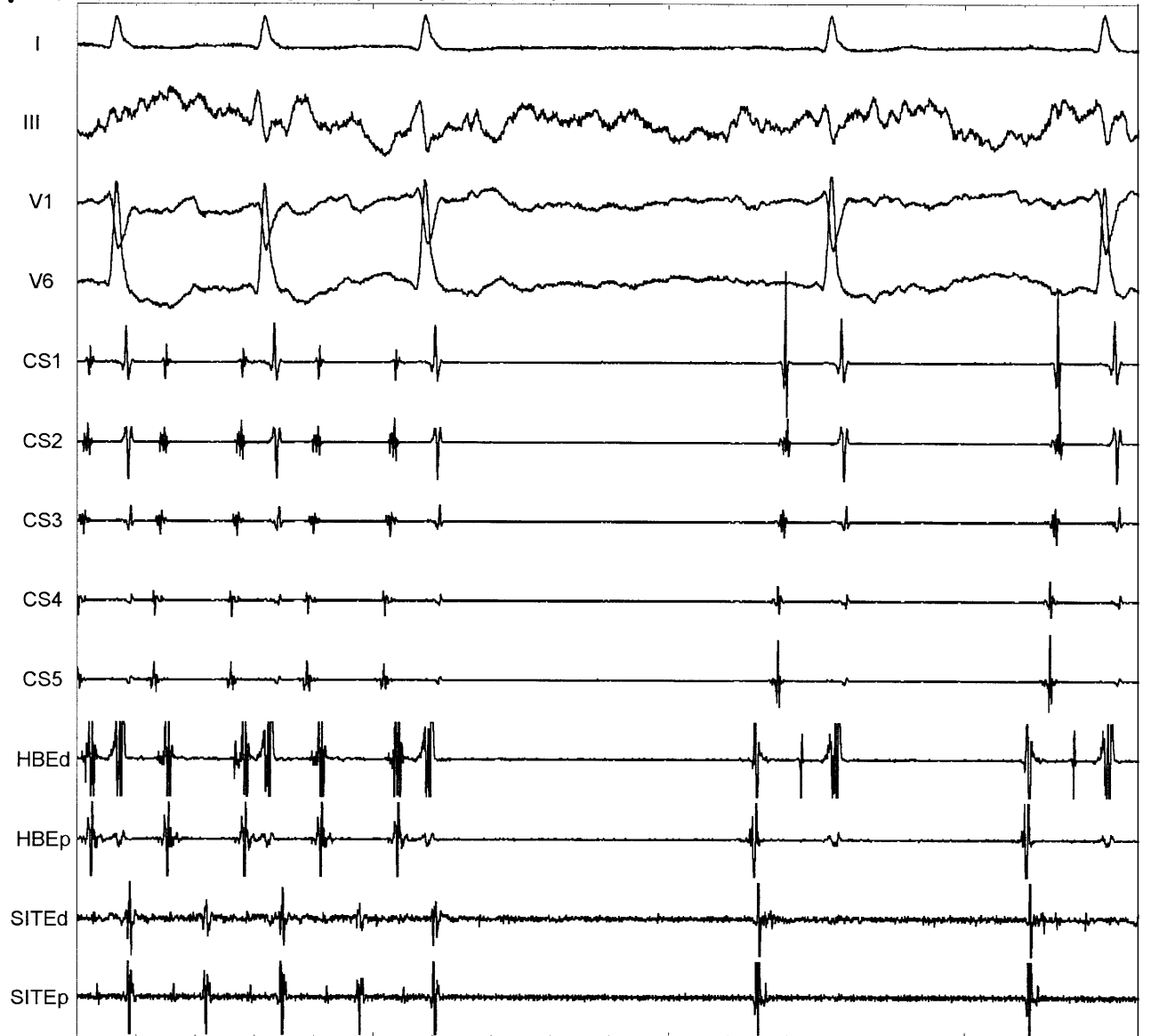
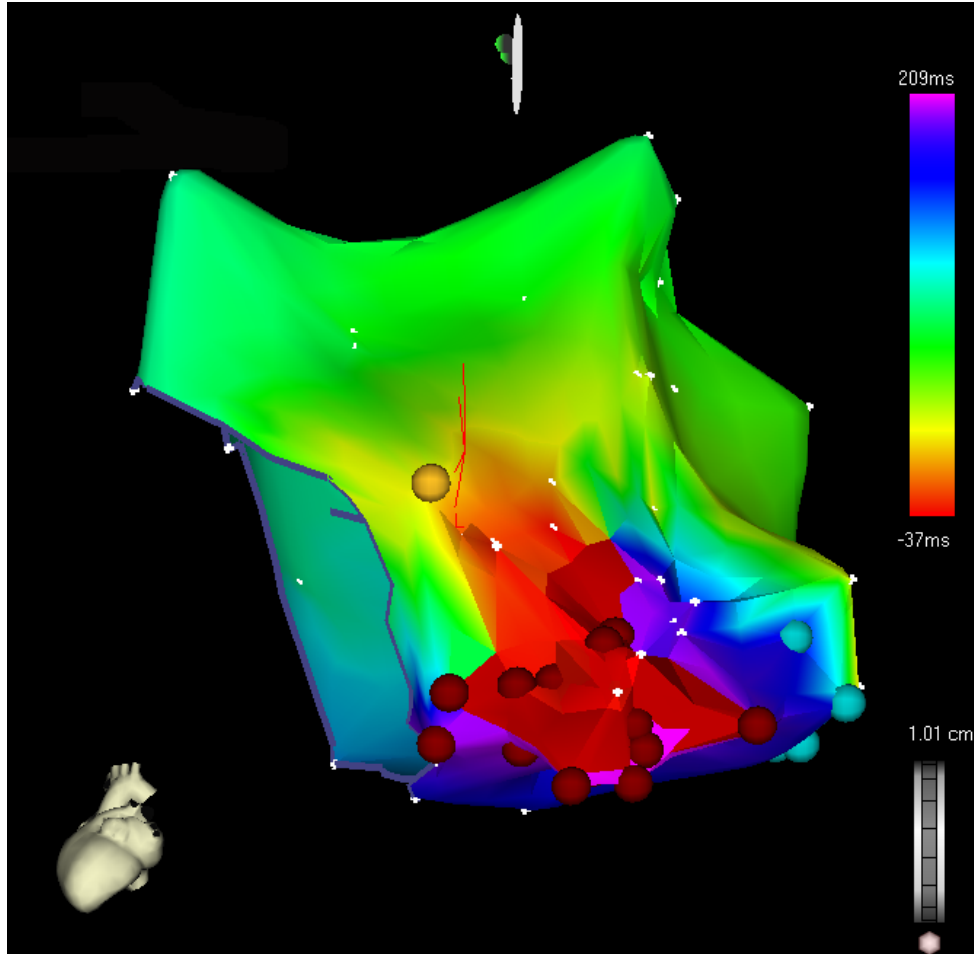
250 ms CL



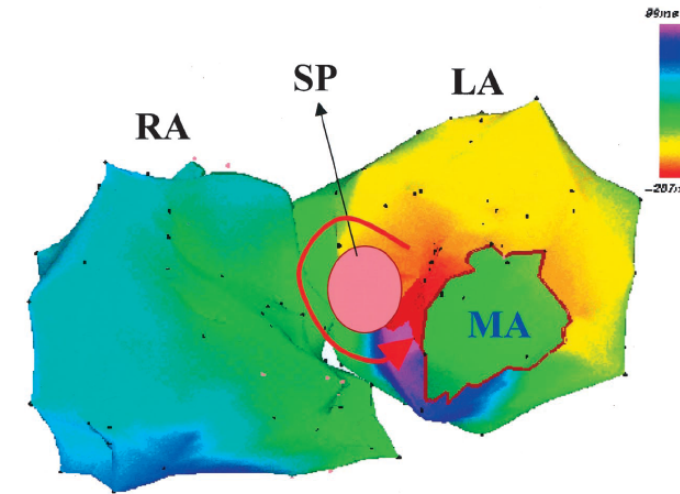
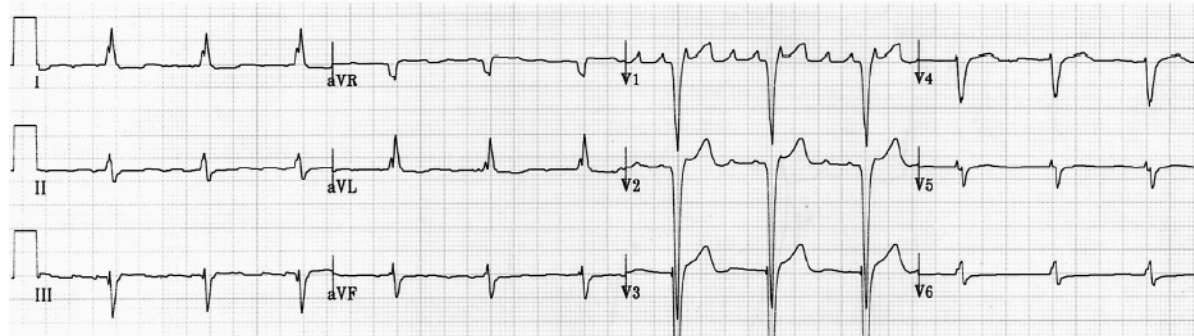
De Ponti From Signals to Colours 2007

"Pseudo-atypical" CTI-dependent AFL

Ablation of the CTI conduction



Left septal atrial flutter: electrophysiology, anatomy , and results of ablation



Clinical and Electrophysiological Characteristics of Left Septal Atrial Flutter

Pt	Age, y	Sex	SHD	Hx of AF	LA Size, mm	Antiarrhythmic Drugs (Preablation)	LVEF, %	Atrial Flutter Cycle Length, ms	CW vs CCW	P Wave in V ₁	Site of Ablation	Success
1	82	M	No	Yes	41	Amiodarone	60	245±10	CCW	Positive	Posterior	Yes
2	72	M	Yes	Yes	43	Sotalol	60	250±15	CW	Negative	Posterior	Yes
3	59	F	No	Yes	40	Amiodarone	60	225±16	CW	Negative	Posterior	No
4	64	M	No	Yes	42	Amiodarone	55	255±21	CCW	Positive	Posterior	Yes
5	80	M	Yes	No	50	None	40	335±11	CW	Negative	Posterior	Yes
6	65	M	No	Yes	42	Amiodarone	55	255±15	CW	Negative	Anterior	Yes
7	59	F	Yes	No	52	None	60	230±10	CCW	Positive	Anterior	Yes
8	64	M	No	Yes	40	Amiodarone	60	290±12	CW	Negative	Anterior	Yes
9	54	F	Yes	No	48	Sotalol	45	300±11	CW	Negative	Anterior	Yes
10	66	M	No	Yes	42	Amiodarone	60	340±12	CCW	Positive	Anterior	Yes
11	52	F	No	Yes	50	Sotalol	60	280±10	CW	Negative	Anterior	Yes

Pt indicates patient; SHD, structural heart disease; Hx of AF, history of atrial fibrillation; LVEF, left ventricular ejection fraction; CW, clockwise circuit; and CCW, counterclockwise circuit.