

Arrhythmia mechanisms a practical perspective

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Arrhythmia mechanisms

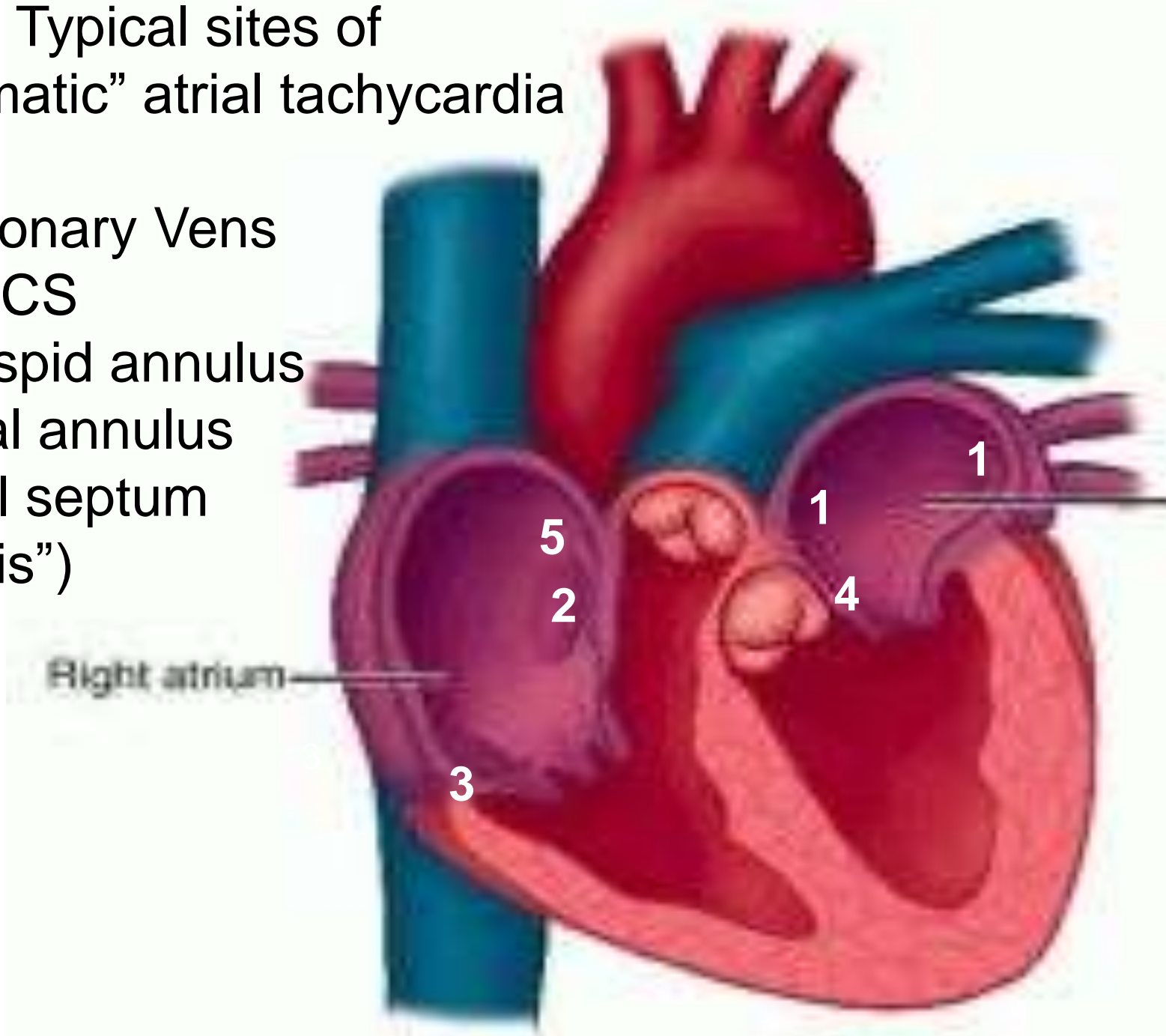
- Automatic
- Re-entrant
 - Micro
 - Macro
 - Triggered automaticity
 - Phase 4 re-entry
 - Delayed after depolarisations
 - Early after depolarisations

“Automatic” Arrhythmias

- Focal
- Atrial, ventricular (or rarely junctional)
- Usually start and stop spontaneously (not with programmed stimulation)
- May show “warm up”
- Typically catecholamine-dependent
- Respond to beta blockers
- Mapping techniques
 - Earliest activation
 - Pace map

Typical sites of “automatic” atrial tachycardia

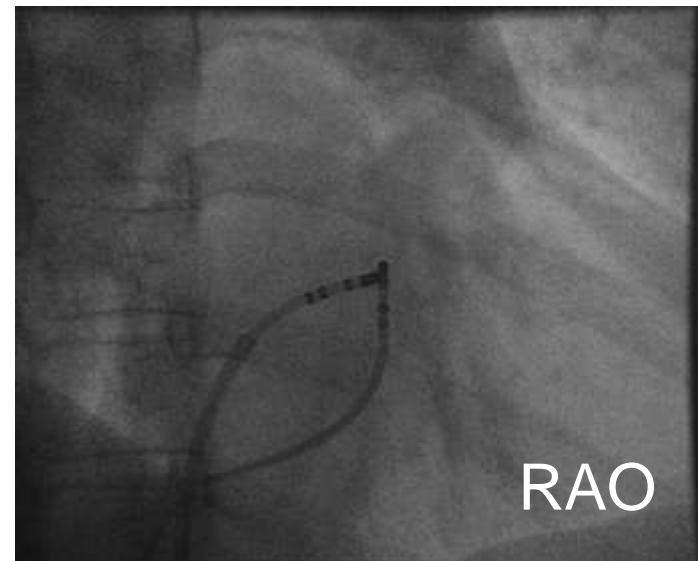
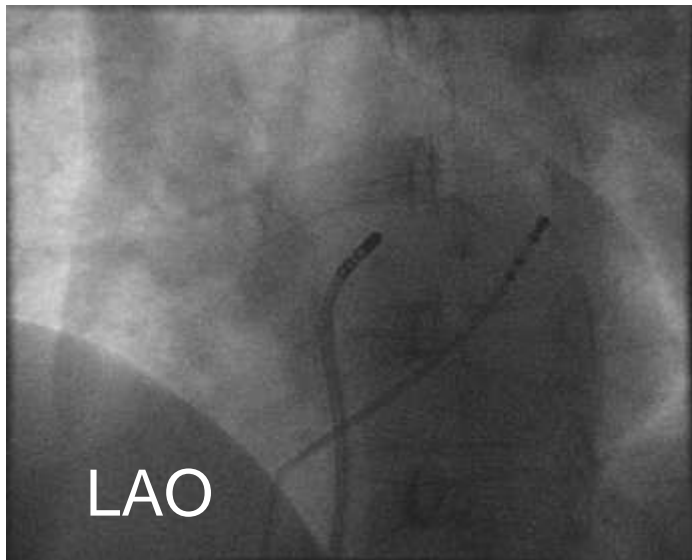
- (1) Pulmonary Vens
- (2) Prox CS
- (3) Tricuspid annulus
- (4) Mitral annulus
- (5) Atrial septum
 (“para-His”)



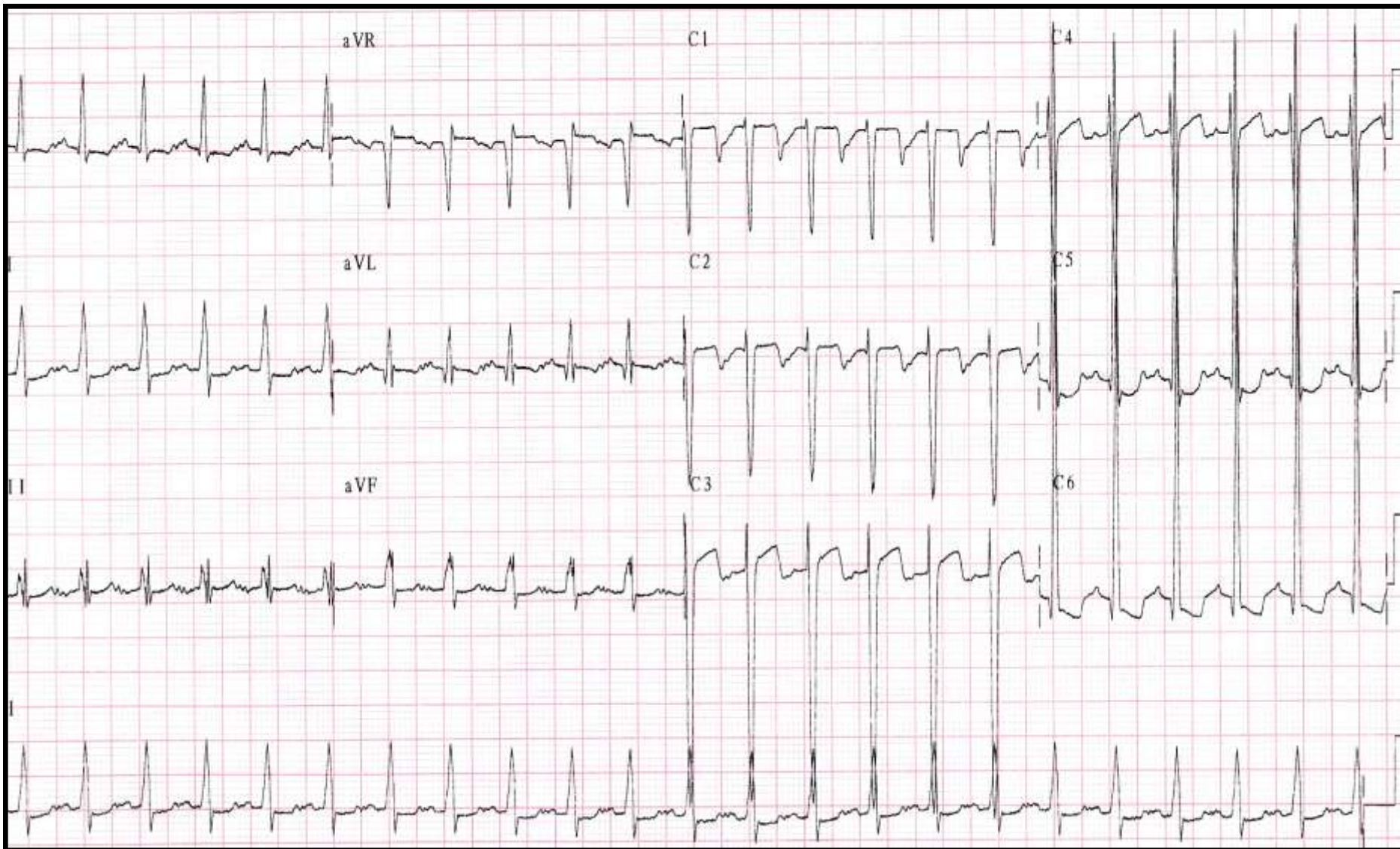
Example 1

46 yr old
woman,
normal
heart





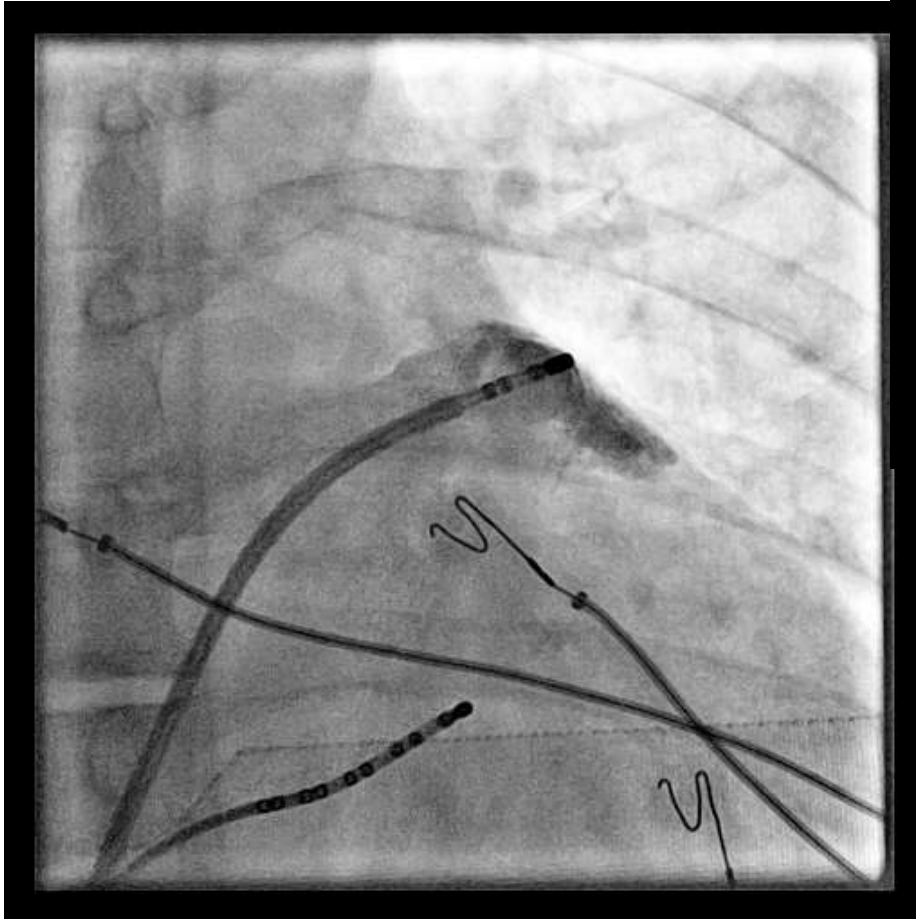
Mitral Annular tachycardia – activation mapping



**Example 2 16 year old girl referred for heart transplant
Tricuspid annular tach causing tachymyopathy
Distinctive P wave deeply negative V1-3**

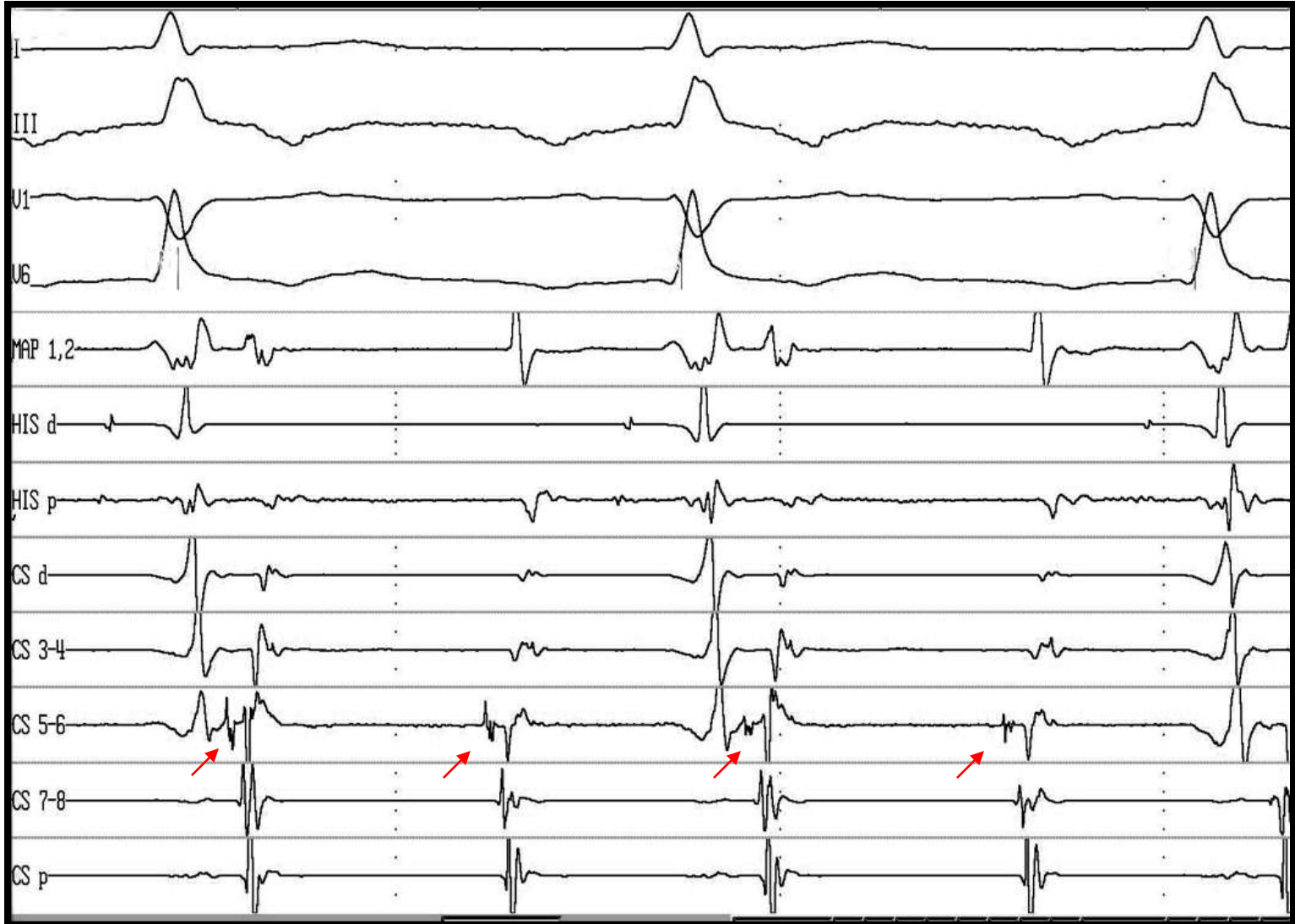
Example 3
19 yr old male

Left atrial appendage
tachycardia (rare)



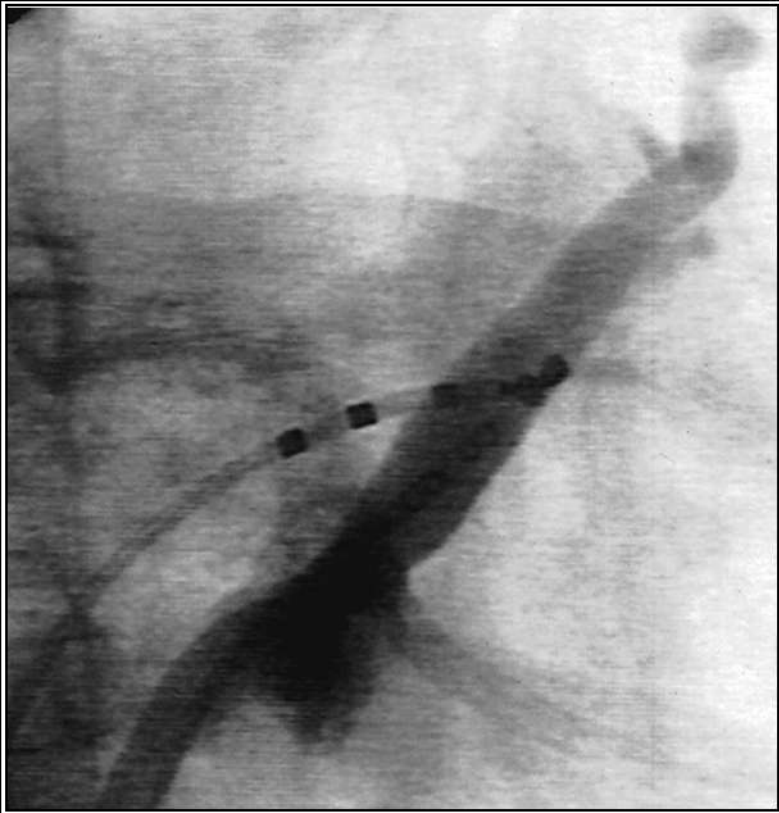
Example 4

2:1 AV block, early local atrial signal in coronary sinus

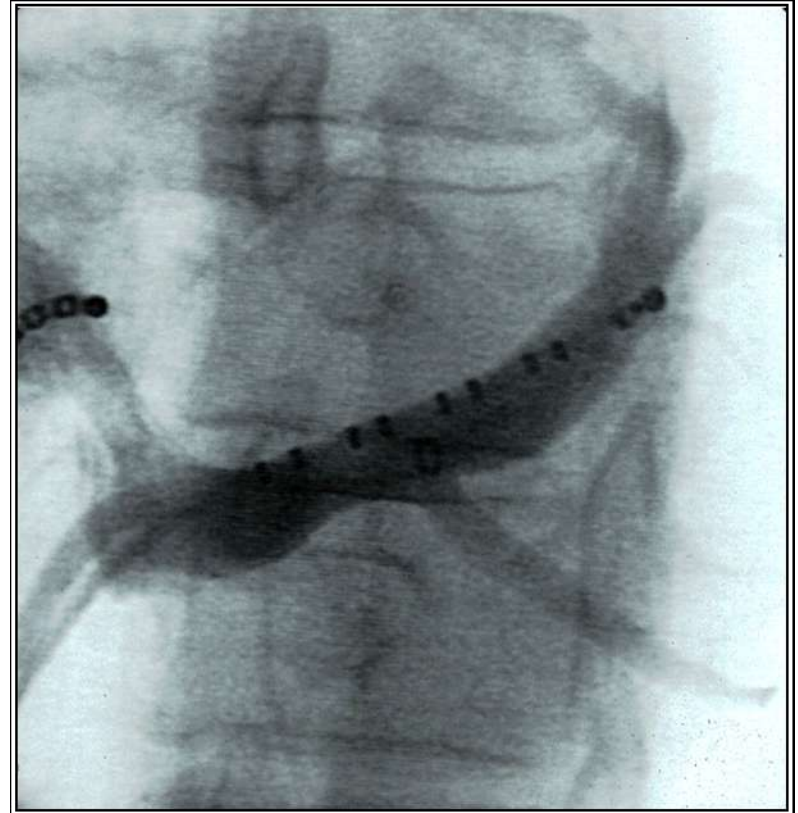


Example 4

Ligament of Marshall tachycardia
CS anatomy - no obvious Vein of Marshall

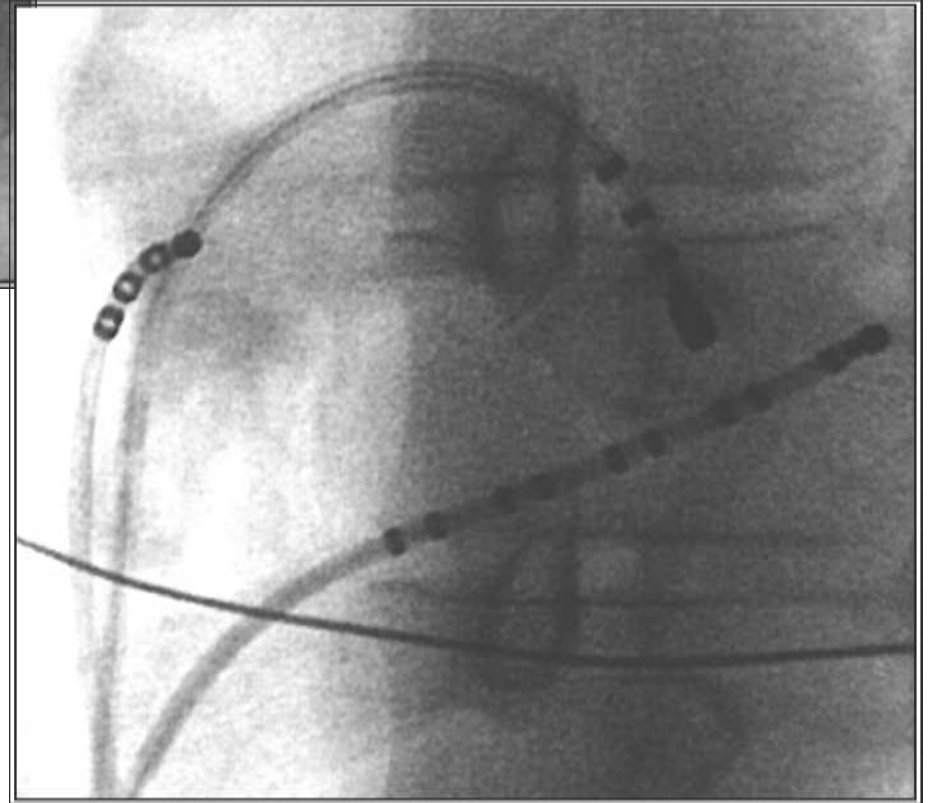
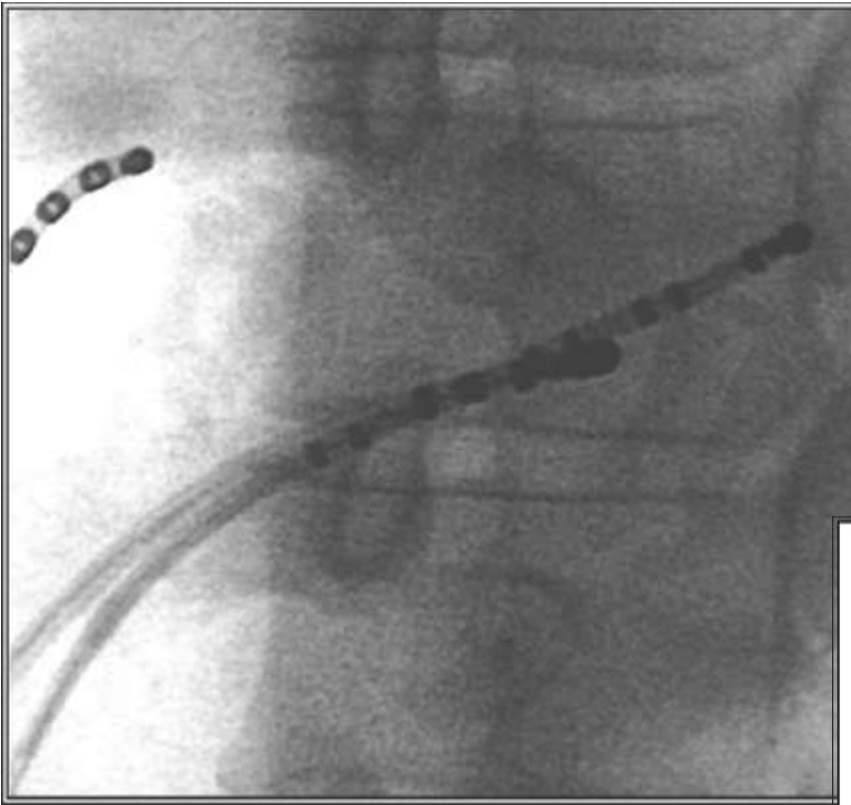


RAO



LAO

Mapping within
coronary sinus
and in left atrium



Termination of tachycardia during RFA within CS



OBLIQUE VEIN OF
L. ATRIUM (MARSHALL)

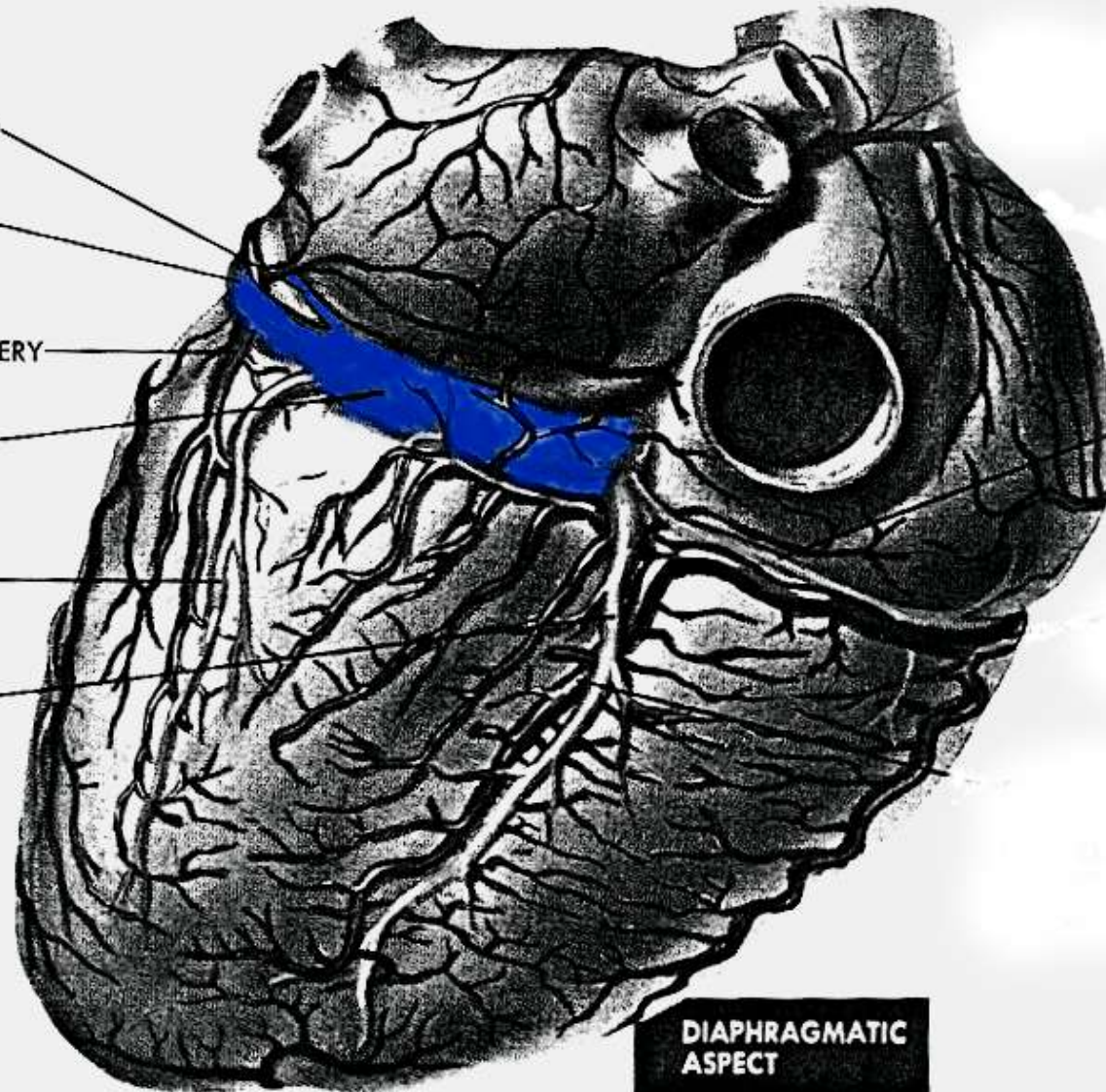
GREAT CARDIAC VEIN

CIRCUMFLEX BRANCH
OF L. CORONARY ARTERY

CORONARY SINUS

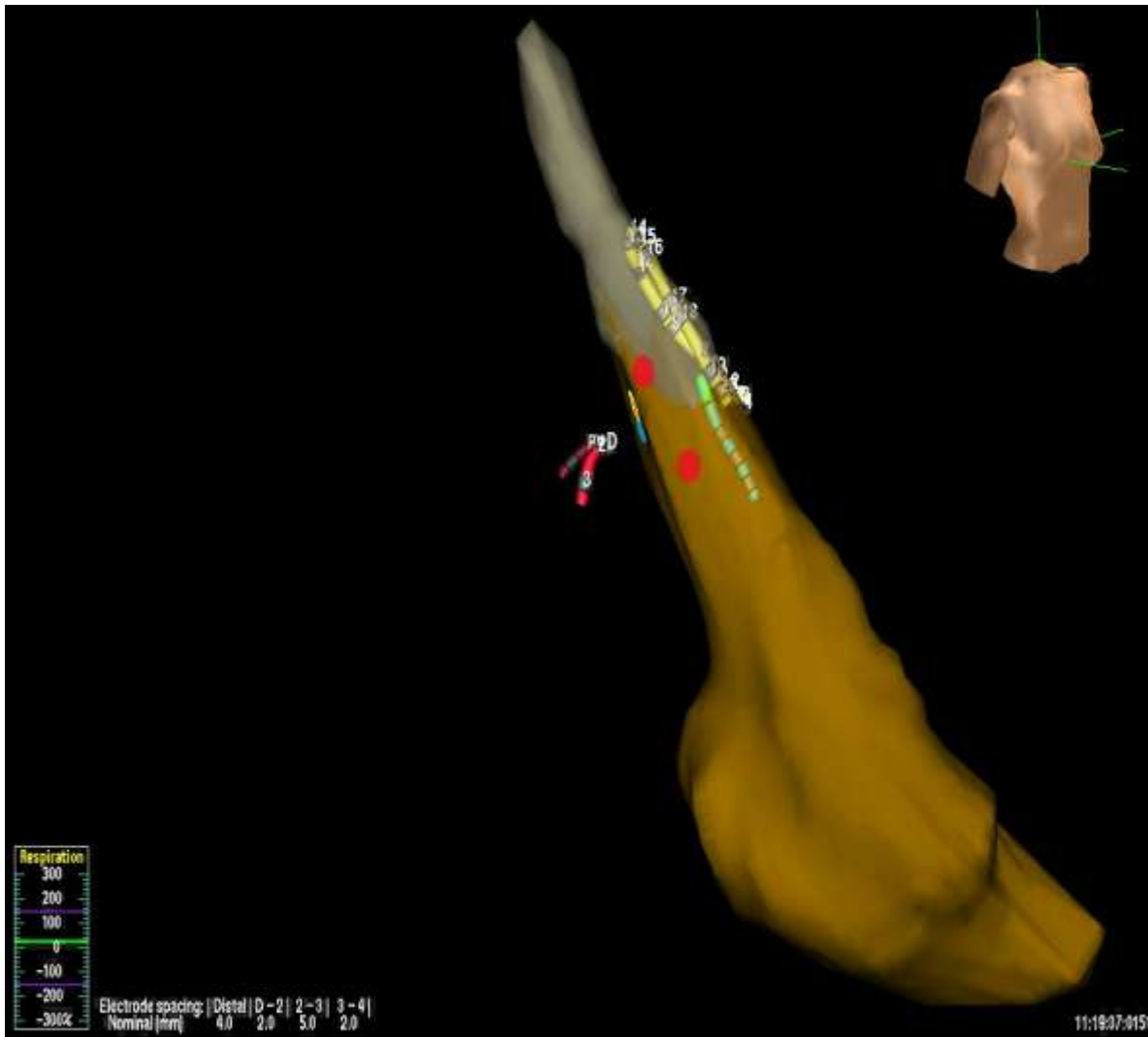
POSTERIOR VEIN
OF L. VENTRICLE

MIDDLE
CARDIAC VEIN

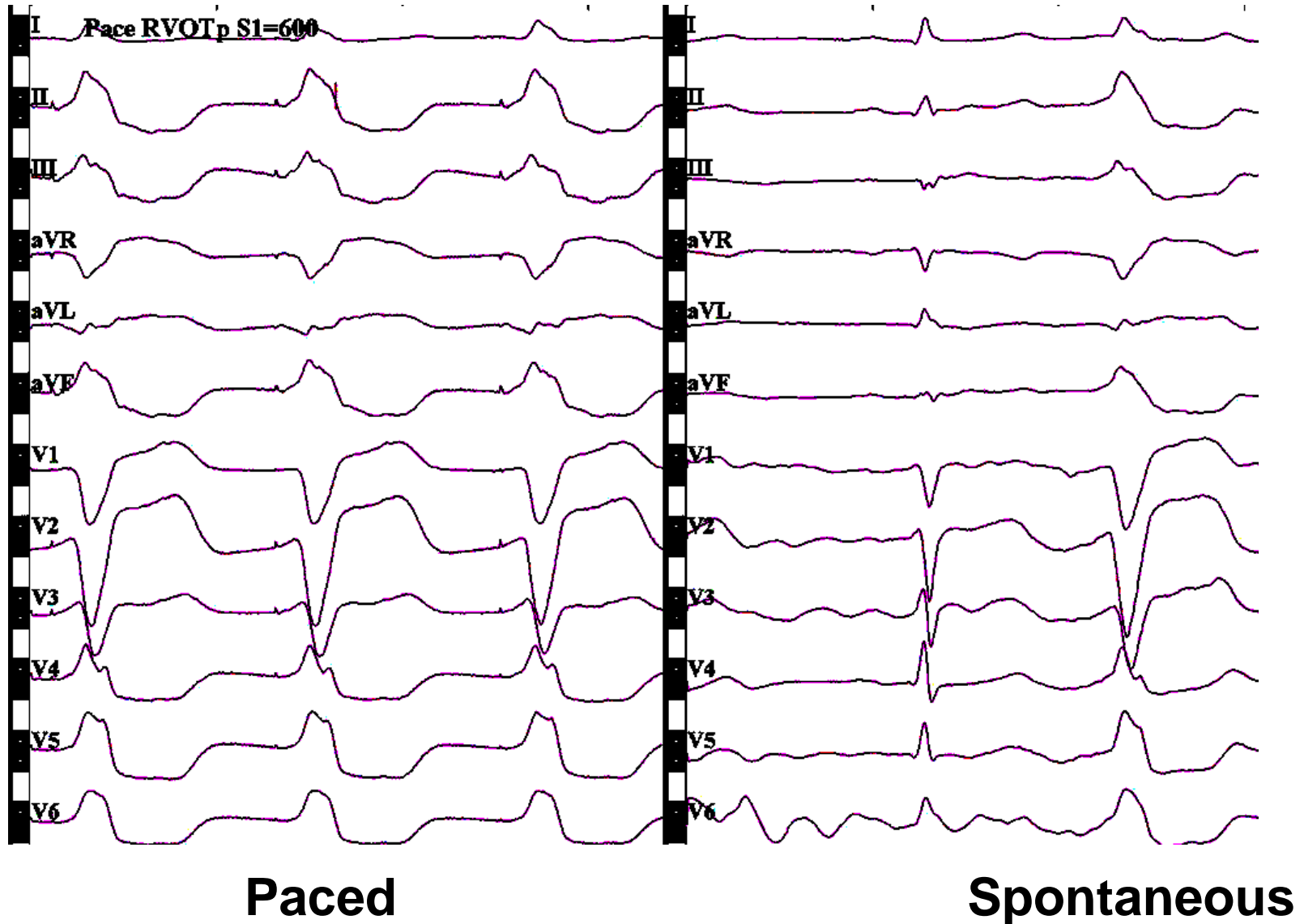


**DIAPHRAGMATIC
ASPECT**

Automatic ventricular tachycardia from RVOT



Pace map RVOT ectopics

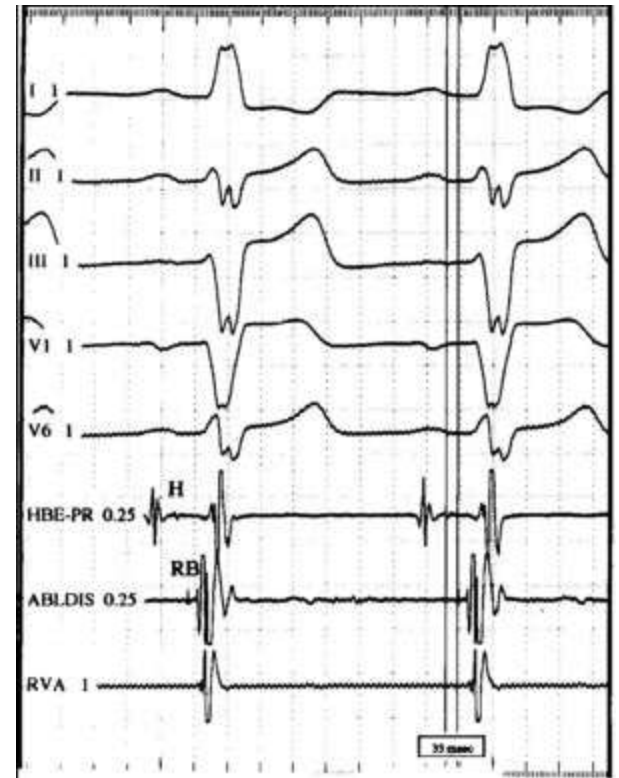
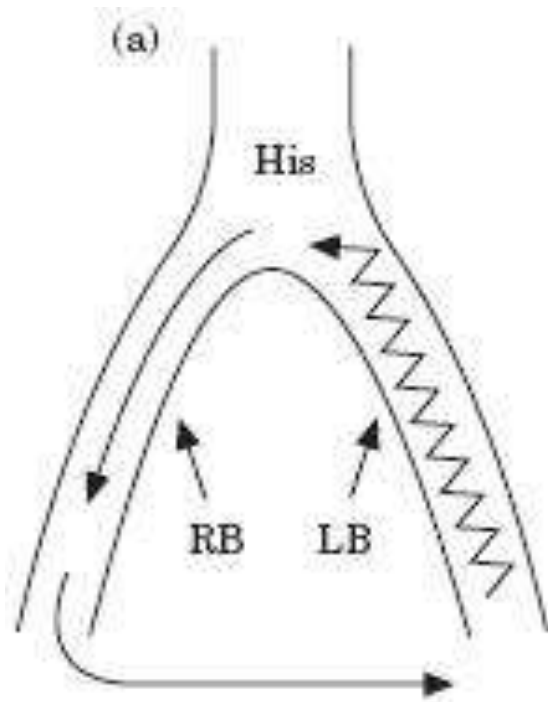


Macro-reentry

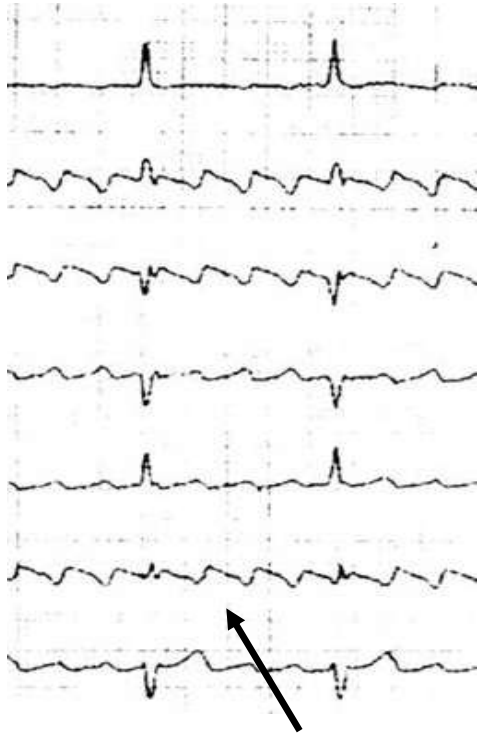
- Involving specialised conduction system
 - AVNRT
 - AVRT
 - Bundle branch re-entry VT
- Involving myocardium
 - Atrial flutter
 - Scar related VT

Bundle-branch reentry

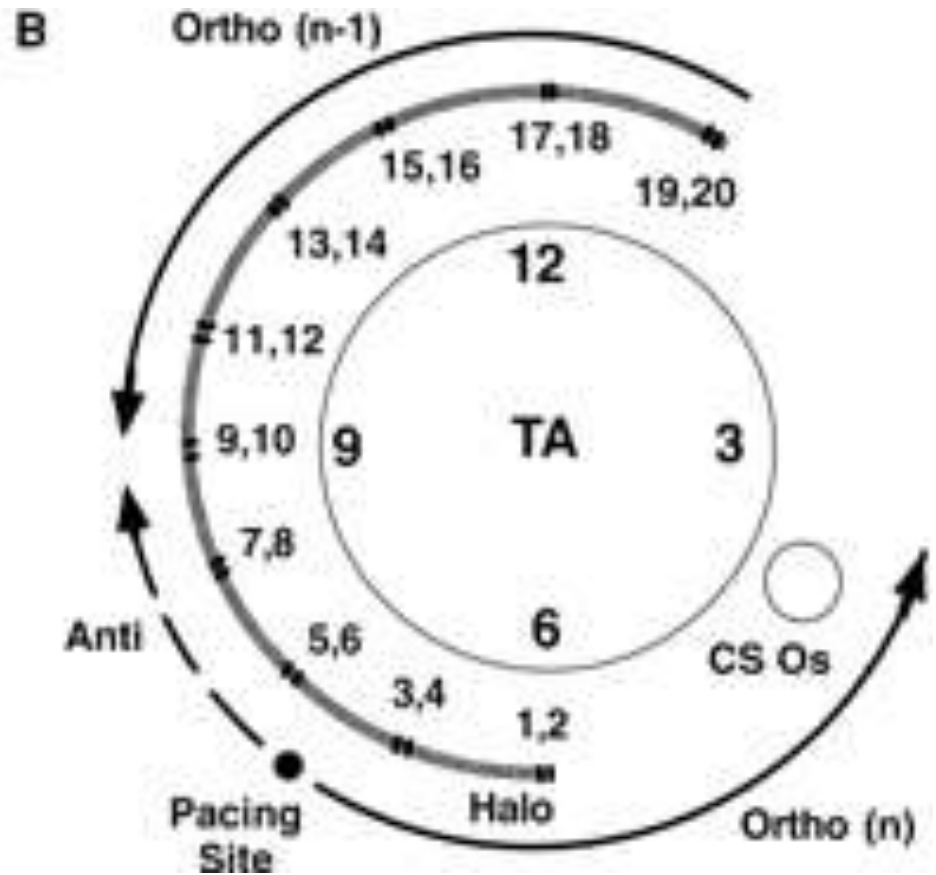
Usually occurs with diffuse conduction tissue disease
(DCM or IHD)
Long H-V



Macro-reentry Atrial flutter



Saw-tooth" pattern due to
Continuous atrial activity



Right atrial flutter

Atrial electrograms in RA cover >90% of Tachy CL (From His a to TV annulus)

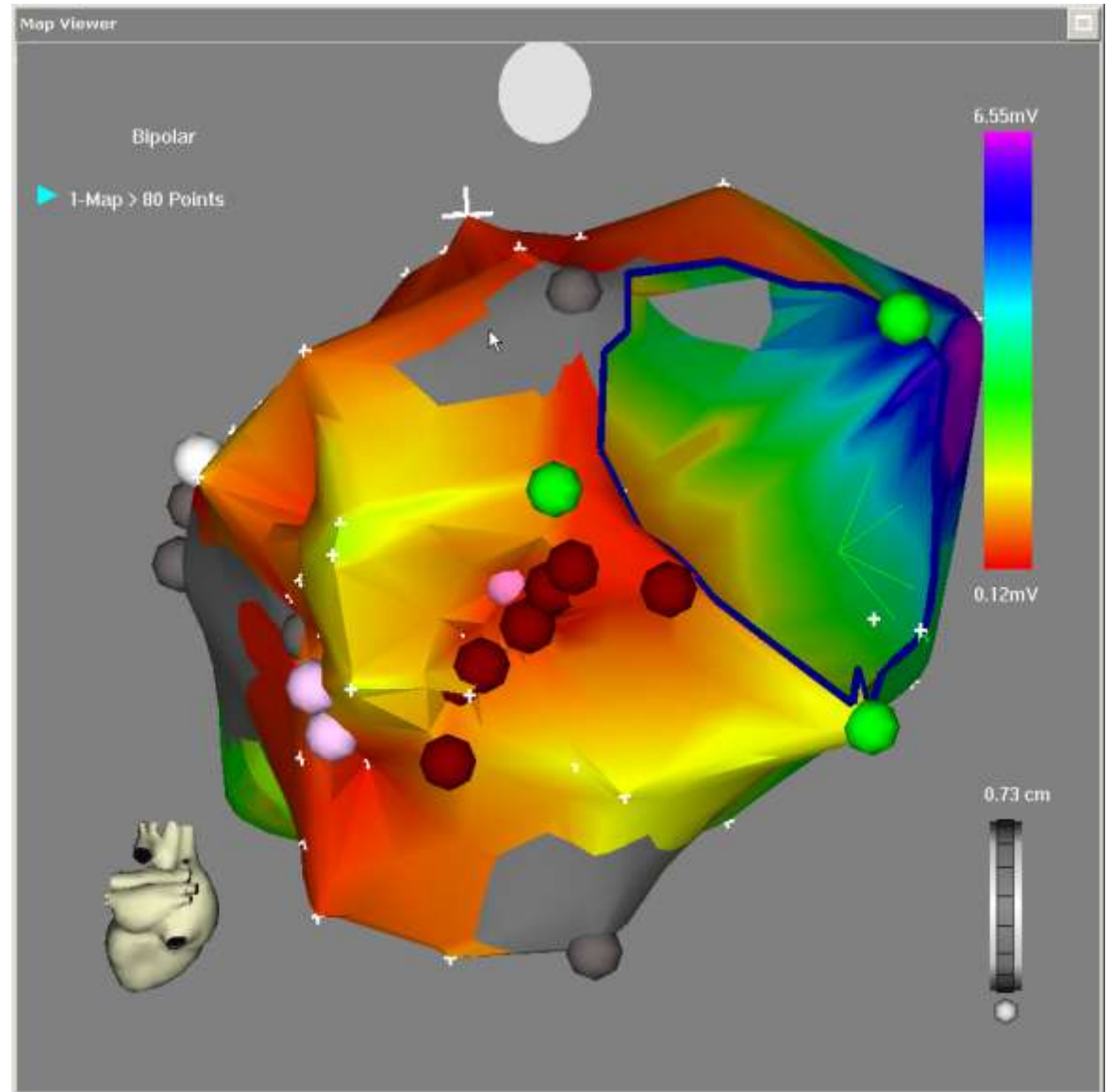
PPI = TCL

Concealed entrainment from TV-IVC isthmus

- 17- TA 1,2
- 18- TA 3,4
- 19- TA 5,6
- 20- TA 7,8
- 21- TA 9,10
- 22- TA 11,10
- 23- TA 13,10
- 24- TA 15,10
- 25- TA 17,10
- 26- TA 19,20
- 27- ABL 1,2
- 28- ABL 3,4
- 29- CS 5,6
- 30- CS 7,8
- 31- CS 9,10
- 35- HIS 1,2
- 36- RUA
- 32- STIM A2
- 34- HRA
- 37- I
- 38- II
- 43- V1
- 48- V6

Macro-reentry

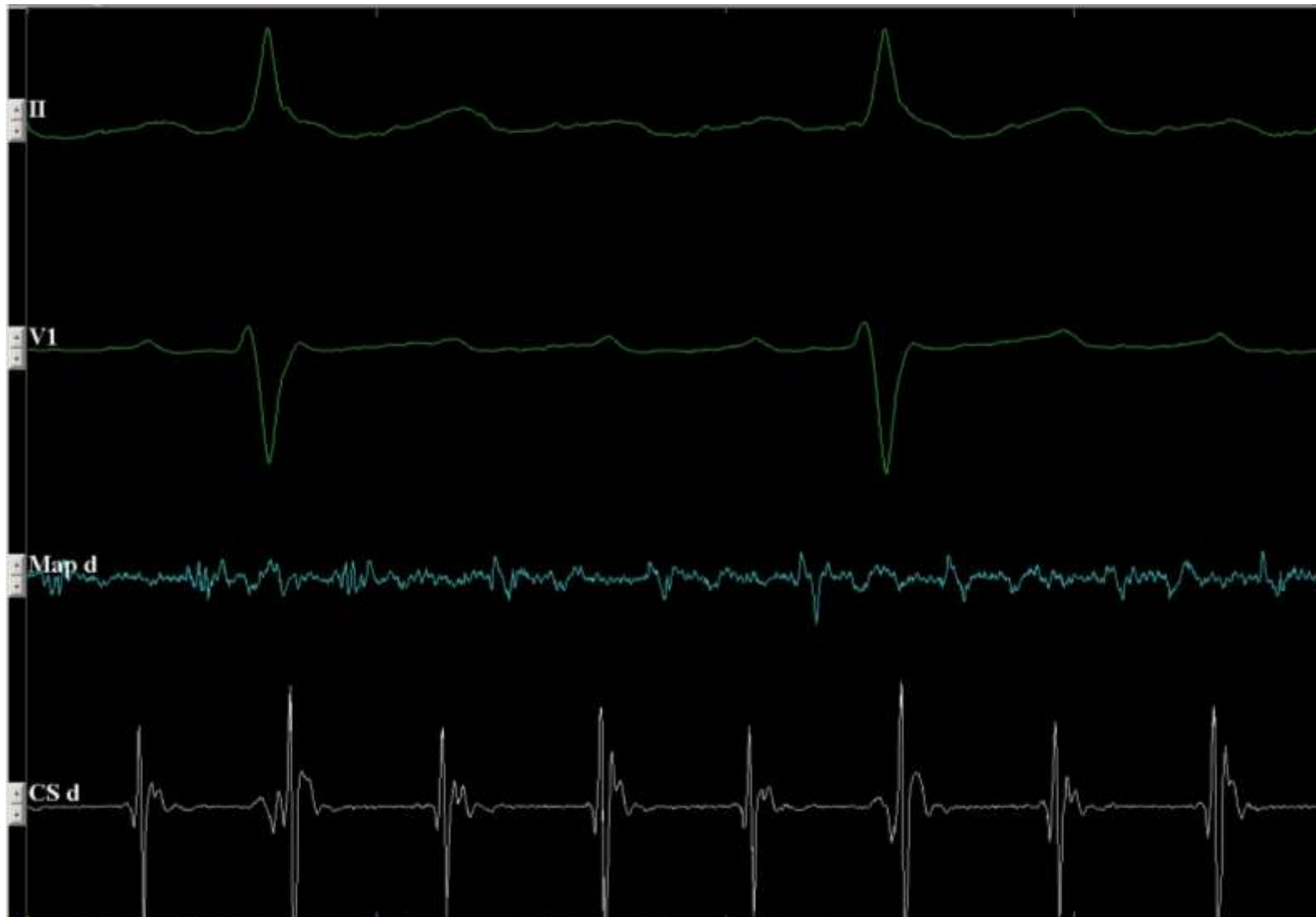
Ventricular
Tachycardia
around MV
annulus
(prev MI)



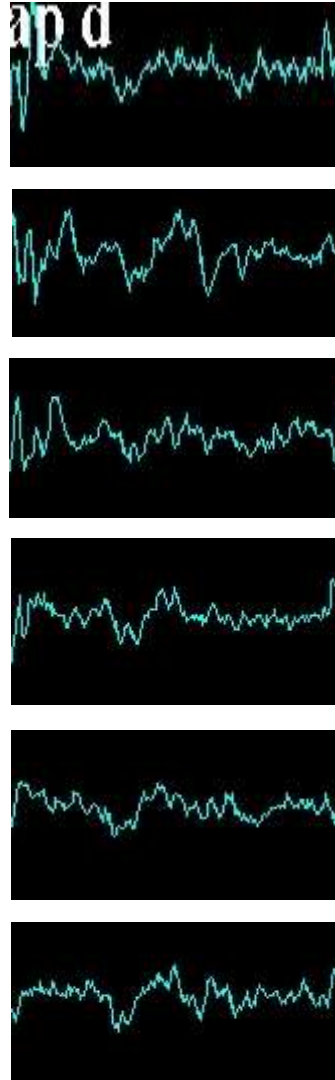
Micro-reentry

- Occurs due to local conduction block
 - Scar from ACHD, prev RFA
 - Anatomic - Crista Terminalis
- Often looks like focal tach on mapping system

Example of micro-reentry
LA flutter (prev LA RFA) – Map catheter inferior to LIPV



Diastolic atrial activity (consecutive cycles)



Low signal:noise ratio as gains
turned up
but some consistent activity
throughout cardiac cycle

RF at this site terminated tach
after 10 secs

Summary

From a practical perspective most arrhythmias can be categorised as:

- Automatic
- Re-entrant
 - Macro v Micro