

Electrophysiology Study in AF and AFL

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CONTENTS

- 부정맥의 기전
- Anatomy
- Procedure AF and AFL

부정맥의 기전

1.Enhanced Automaticity(Disorder of impulse Formation)

2.Triggered Activity

3.Re-entry(Conduction Disturbances)

Automaticity

Enhanced

- 교감신경 흥분
 - 카페인
 - 갑상선 기능항진증
- ⇒ Sinus tachycardia

Abnormal

- Ischemic electrolyte imbalance
 - Acidosis
- => Ectopic tachycardia, AIVR

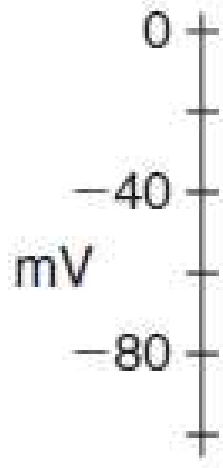
Trigger Activity(EAD/DAD)

EAD

- Hypokalemia
- Bradycardia
- LQTS(d/t drug)

DAD

- VT(d/t digitalis toxicity)
- Cathecholamine(stress)(CPVT)



erload

Re-entry

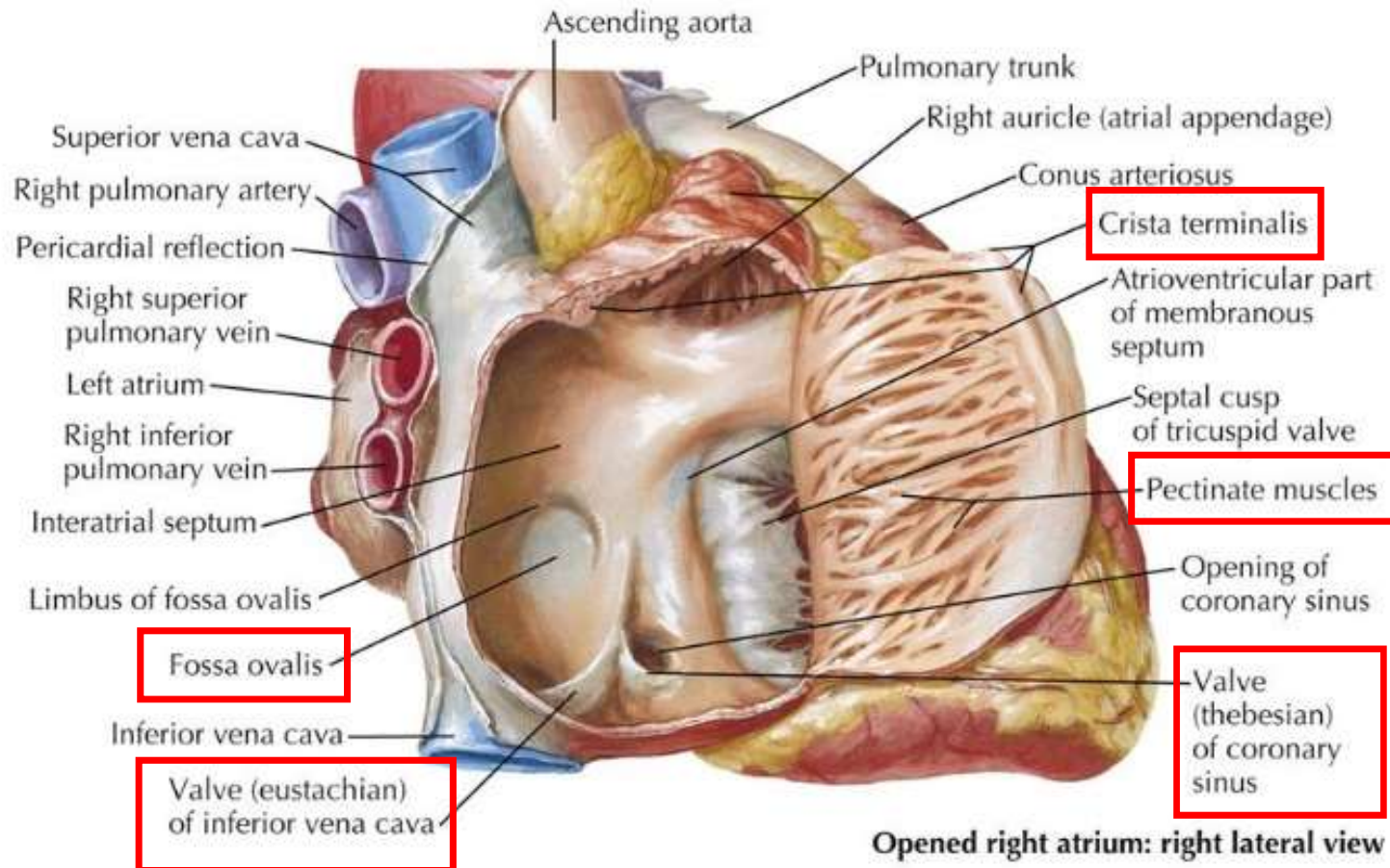
"Excitable gap"

1. Close loop

2. Unidirectional block

3. Slow conduction

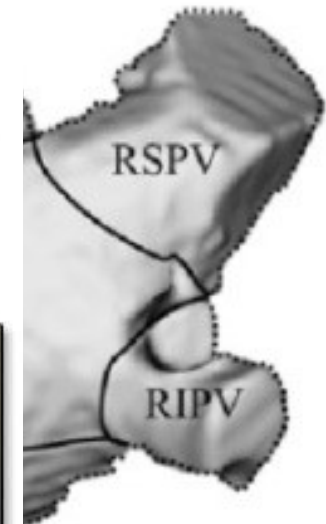
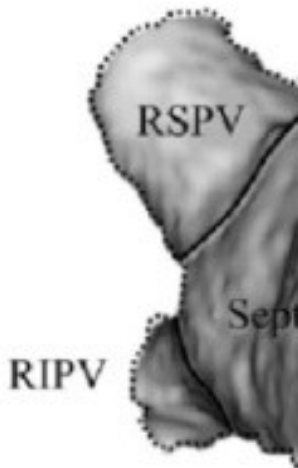
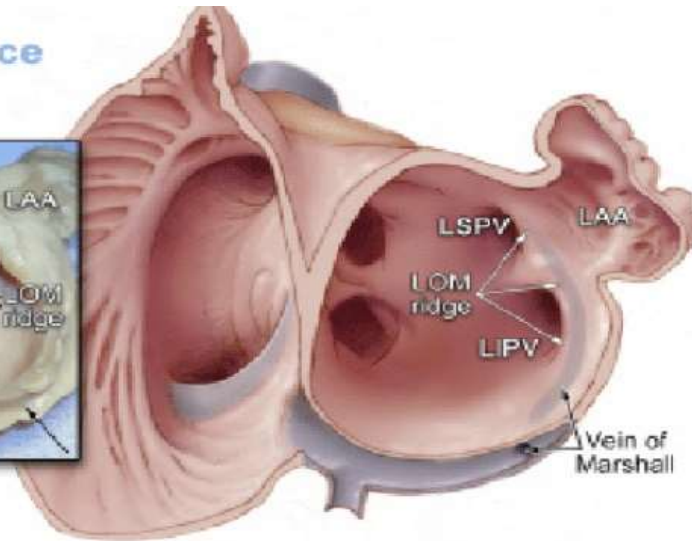
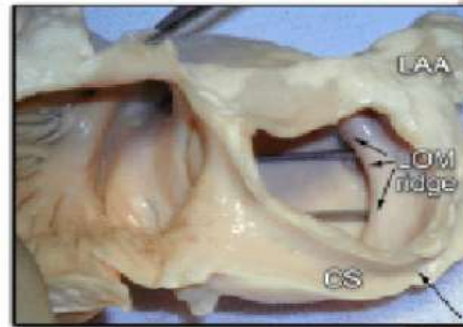
Anatomy(RA)



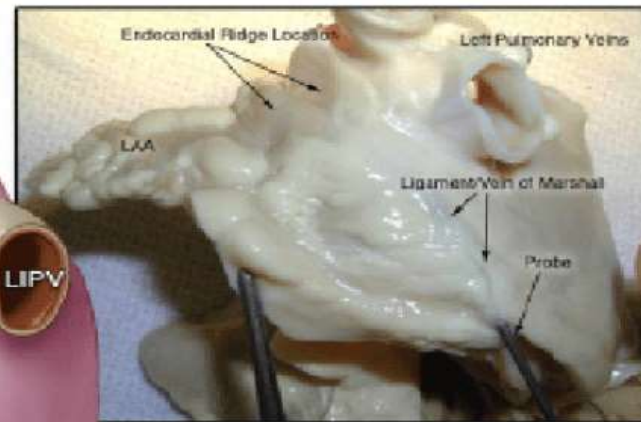
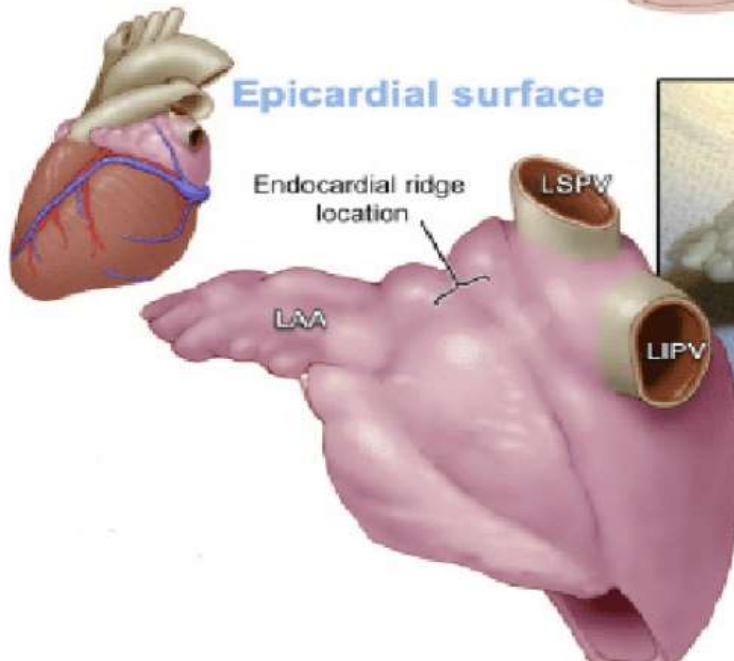
Anatomy(LA)

Endocardial surface

A

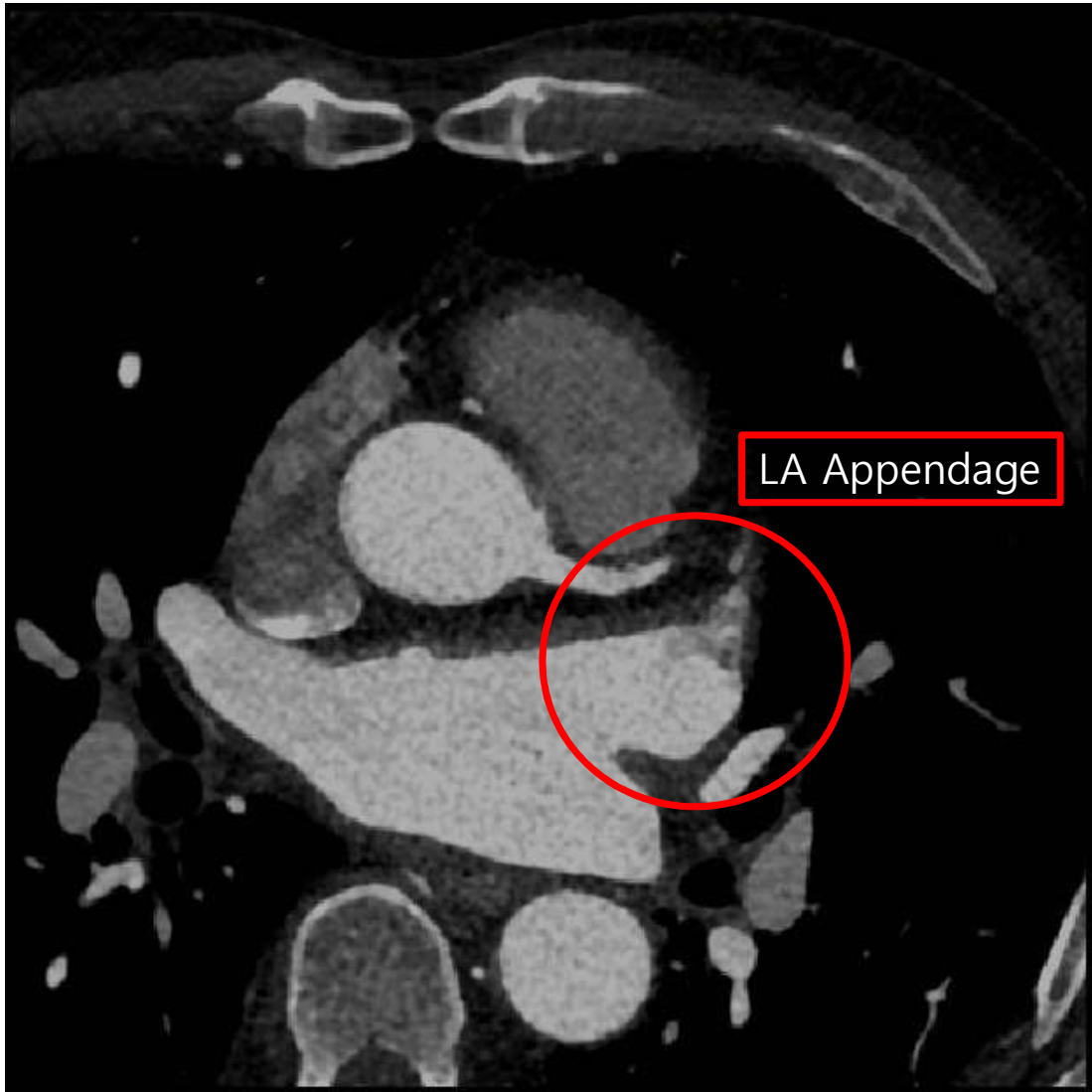


Epicardial surface

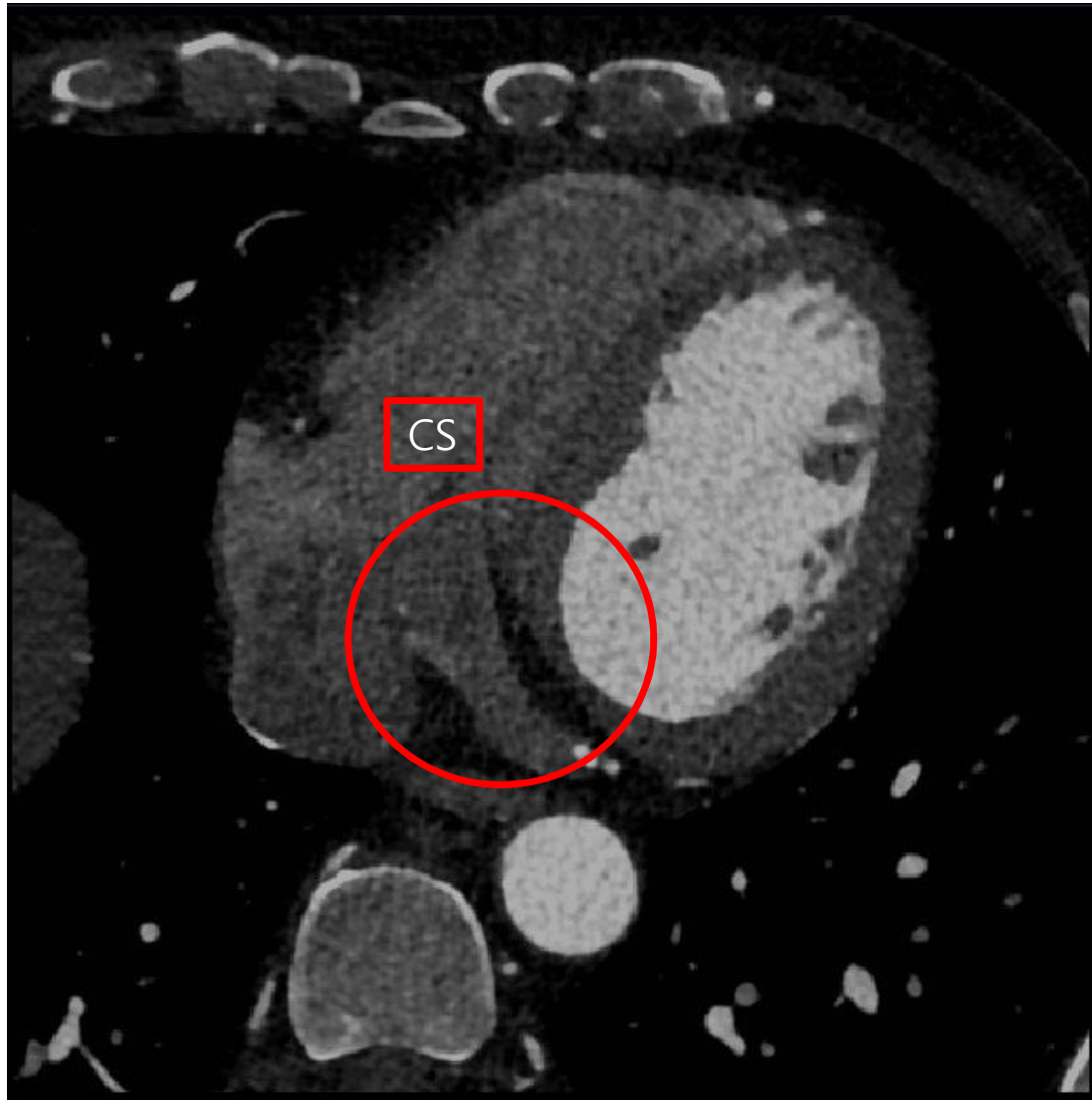


©2014
MAYO

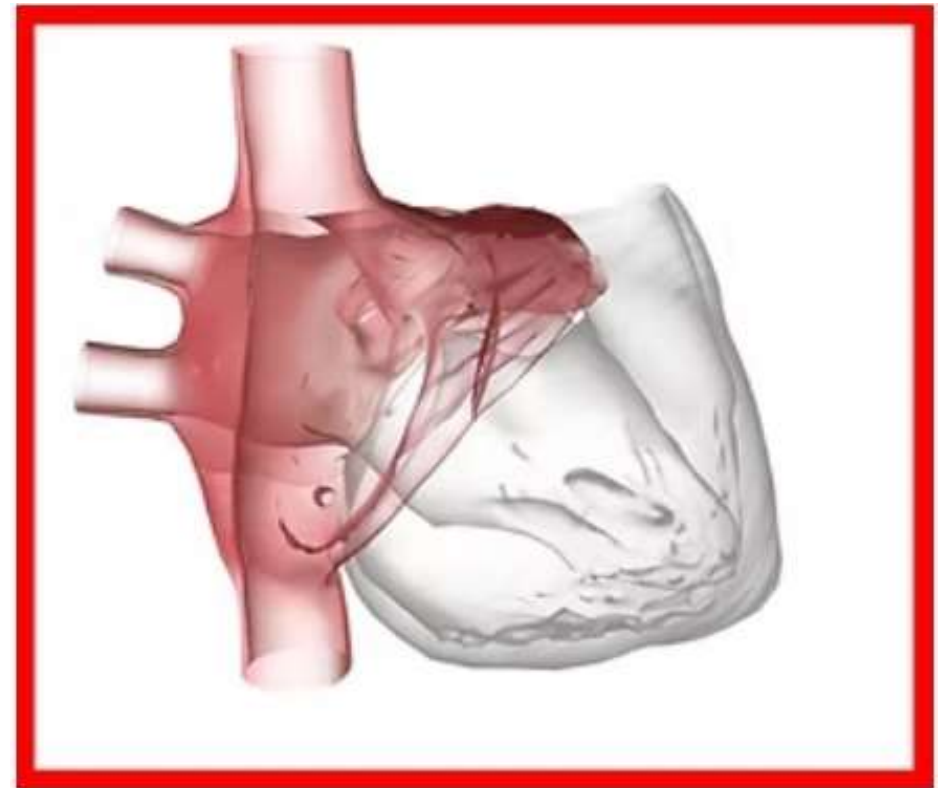
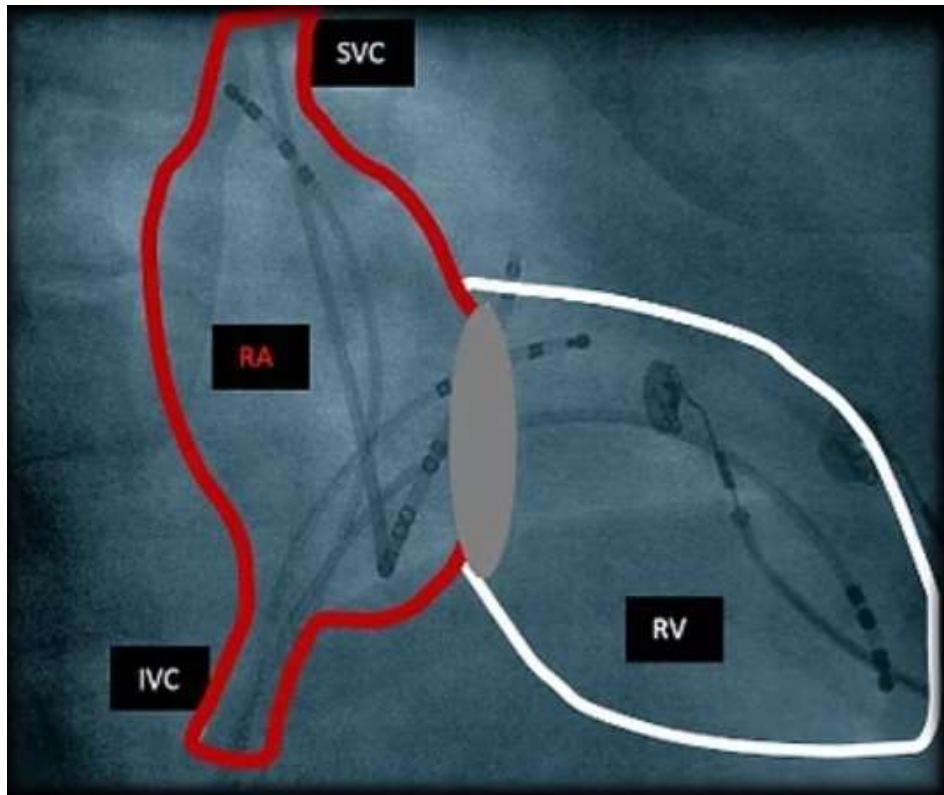




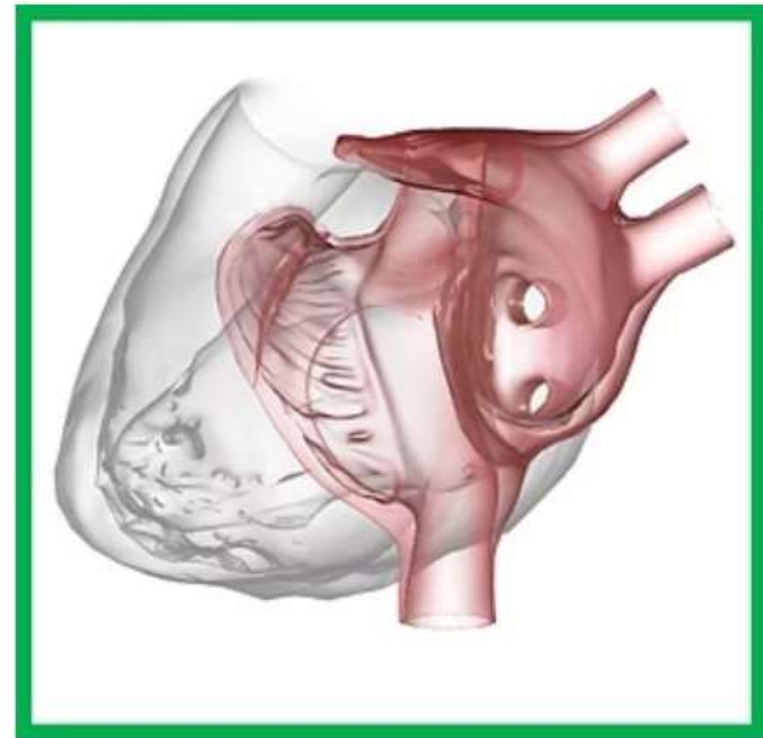
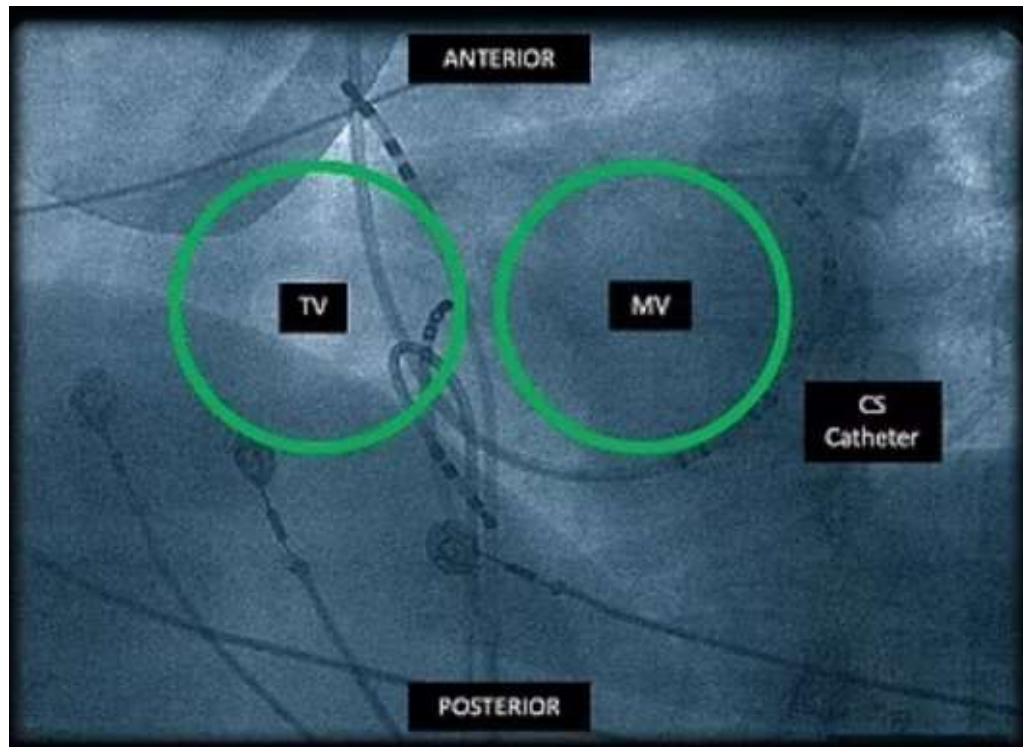




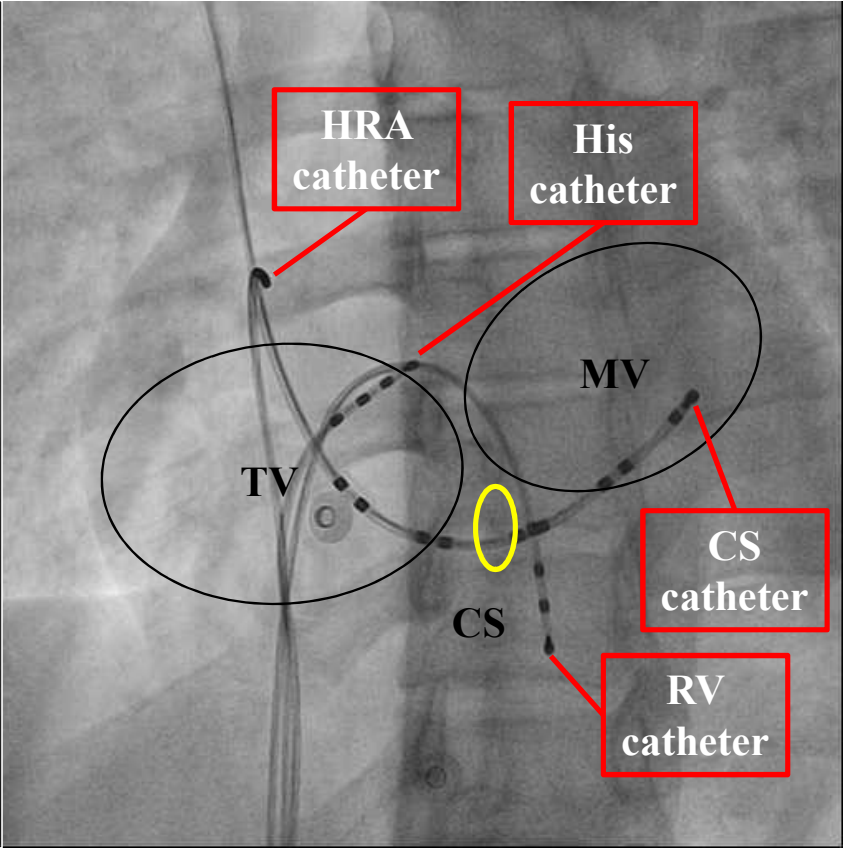
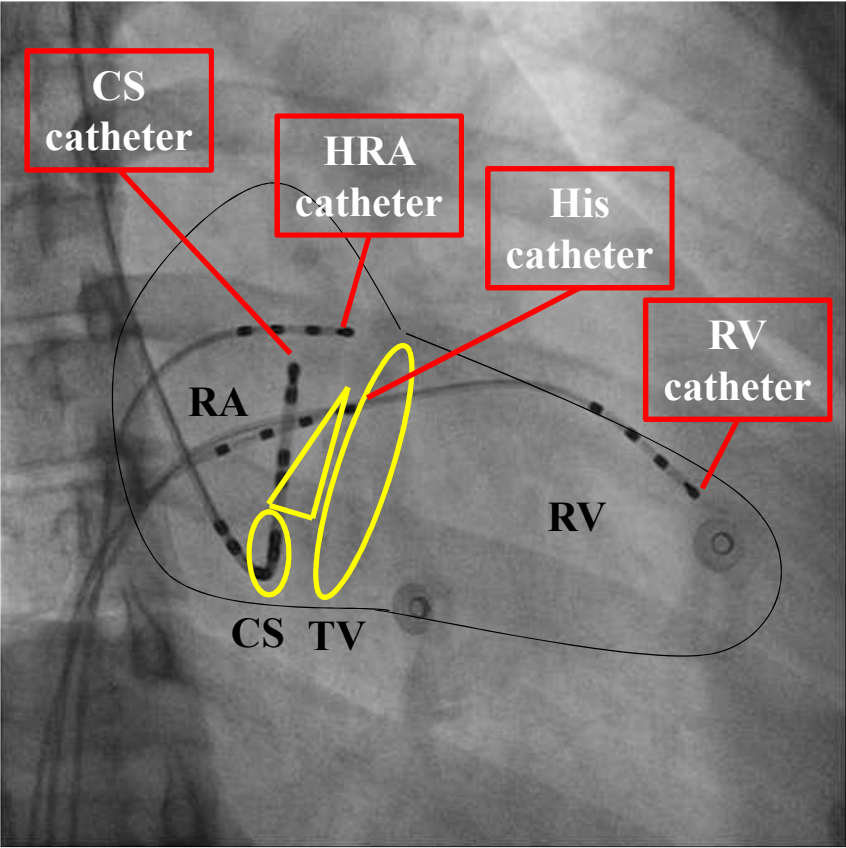
Catheter position(Fluoroscopy)



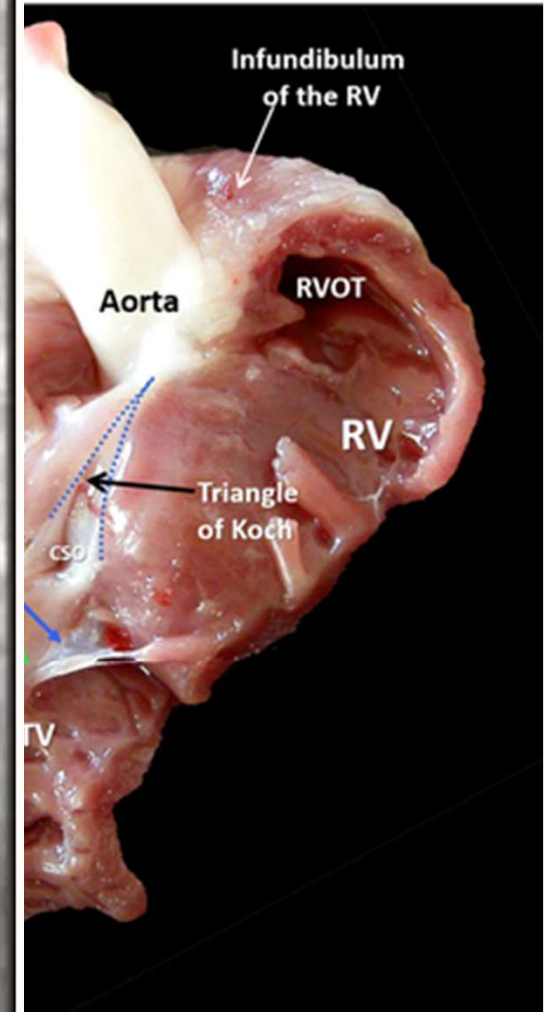
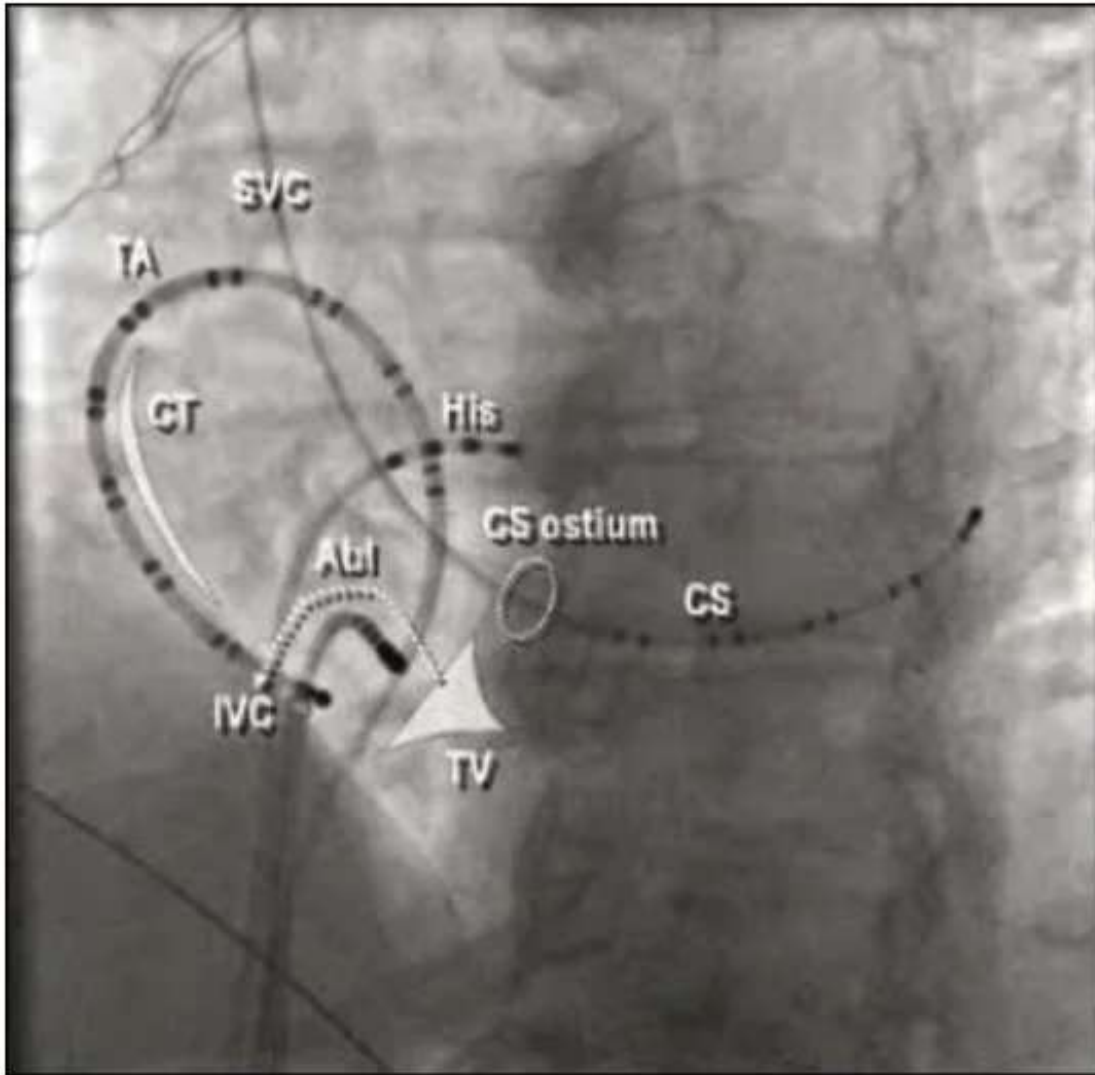
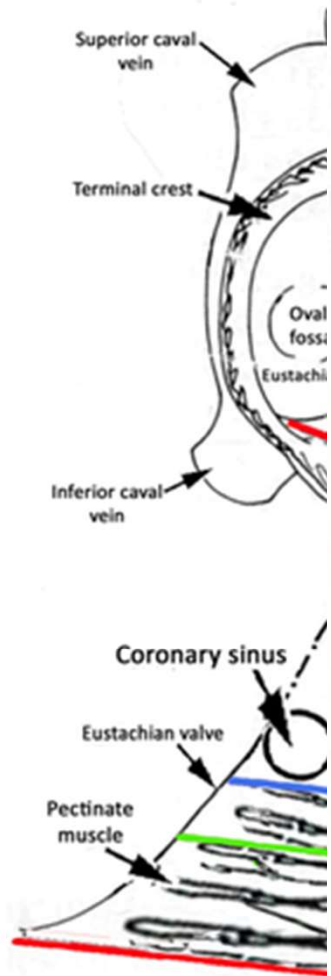
Catheter position(Fluoroscopy)



Position of the Catheters

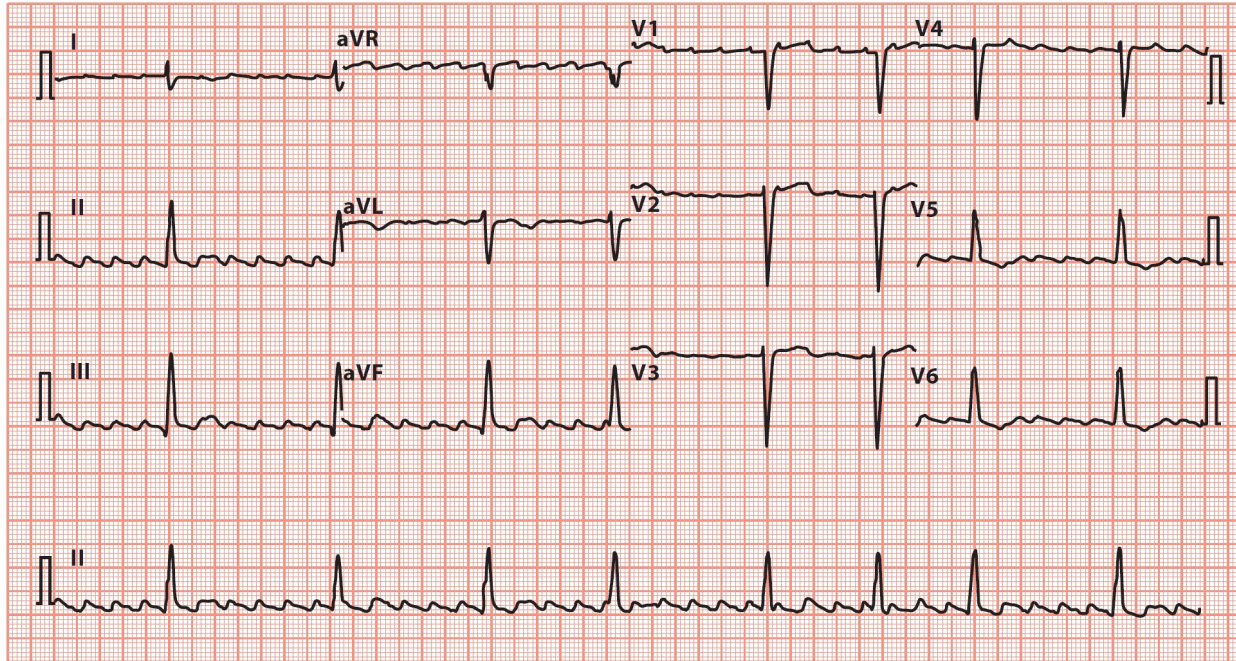


A



Procedure (Atrial Flutter)

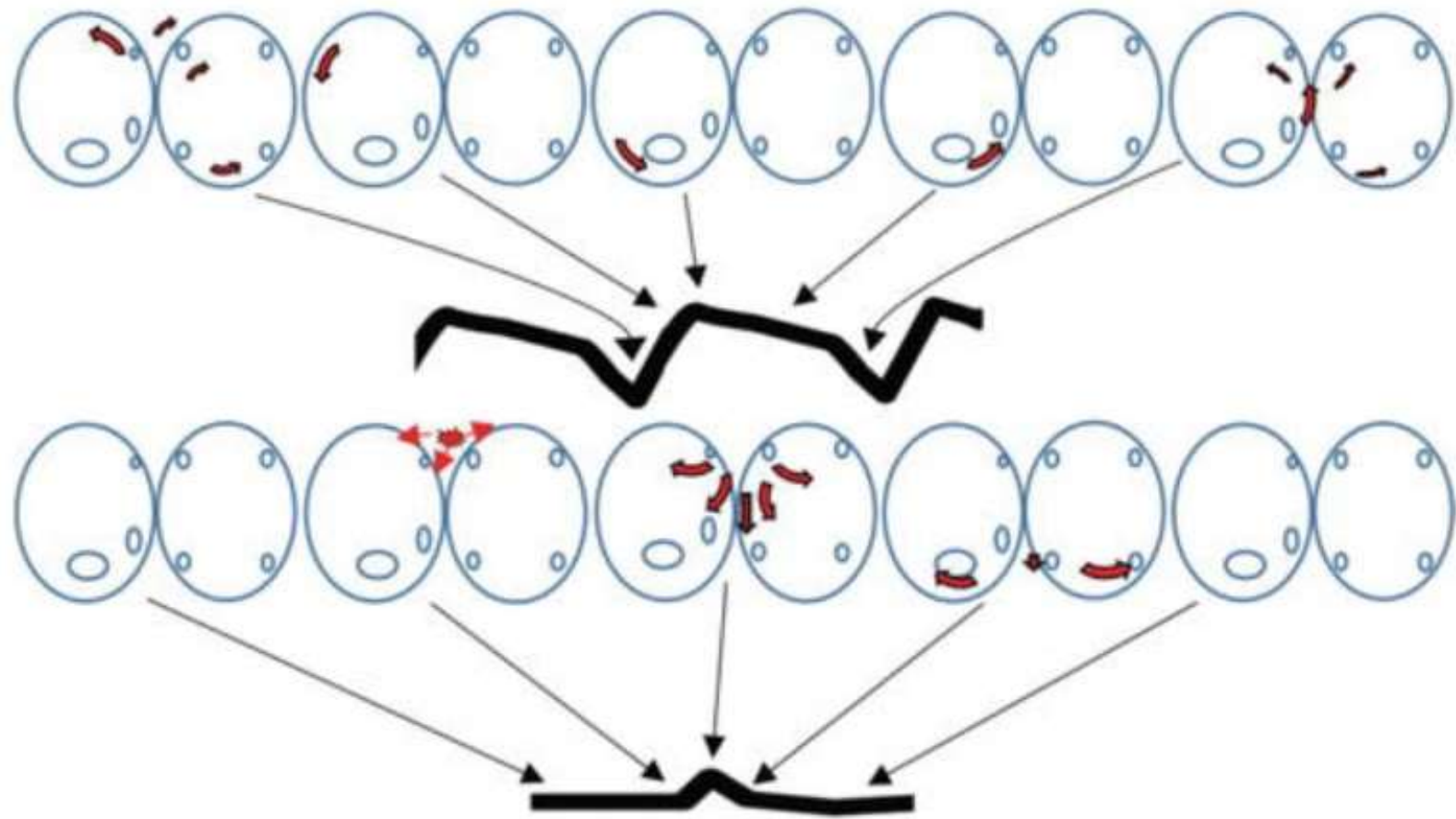
심방조동?



Atrial flutter is a type of cardiac arrhythmia (abnormal heart rhythm) in which the upper chambers of the heart (atria) beat very rapidly

Typically **250 to 350 times per minute** — due to a **re-entrant electrical circuit in the atrium**

Atrial flutter is often recognized by a characteristic **"sawtooth"** pattern of flutter waves (sometimes called **"F-waves"**) between QRS complexes.

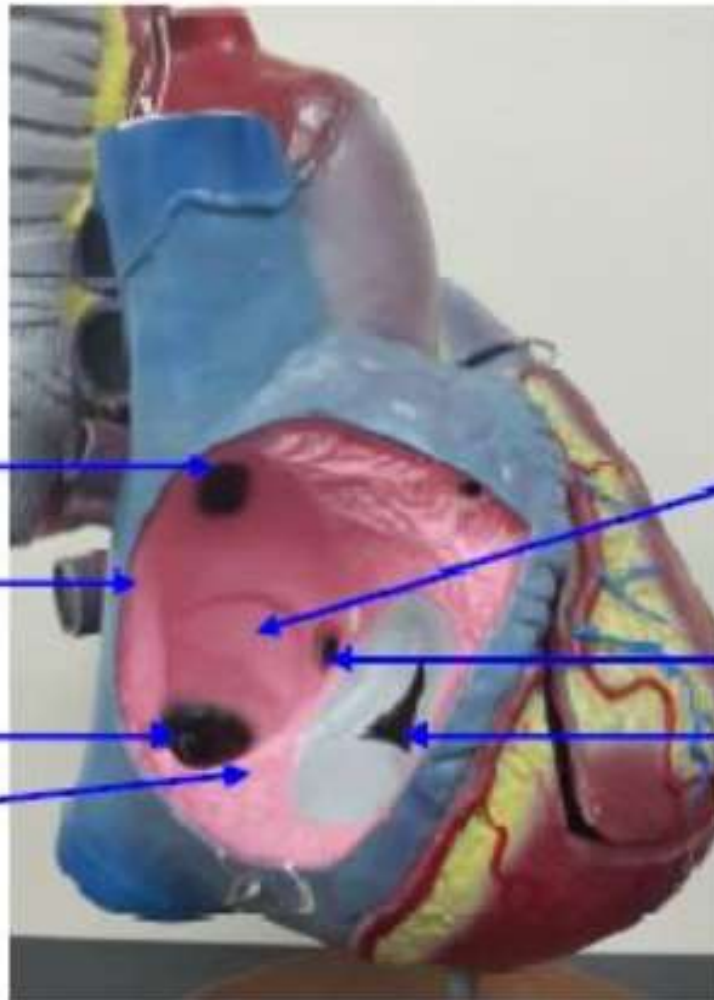


Superior Vena Cava

Crista Terminalis

Inferior Vena Cava

Eustachian Ridge



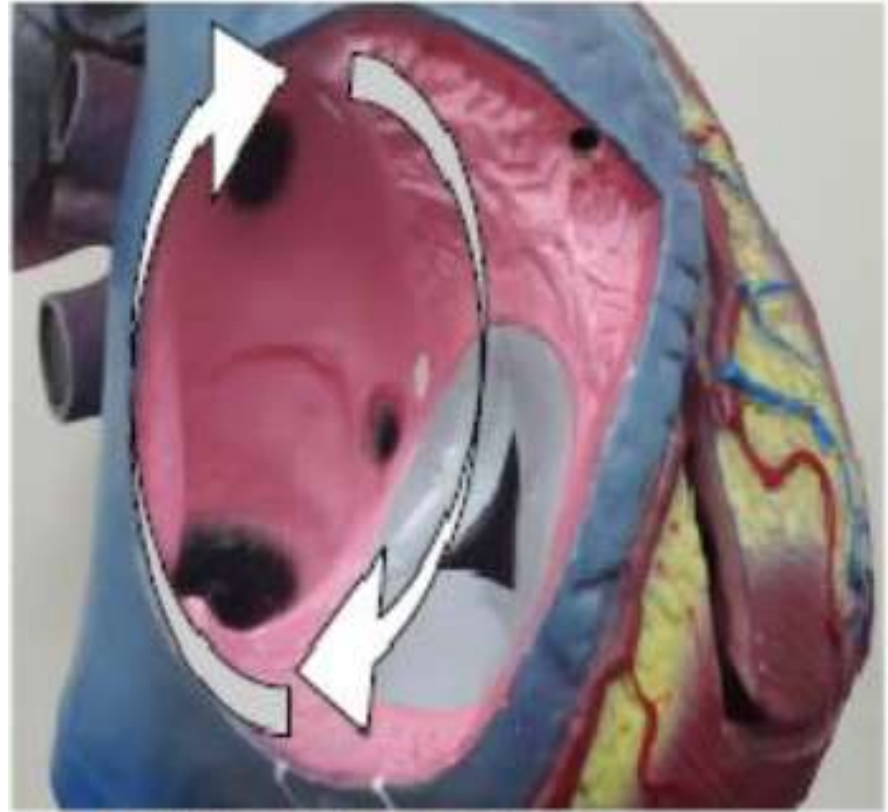
Fossa Ovalis

Coronary Sinus Ostium

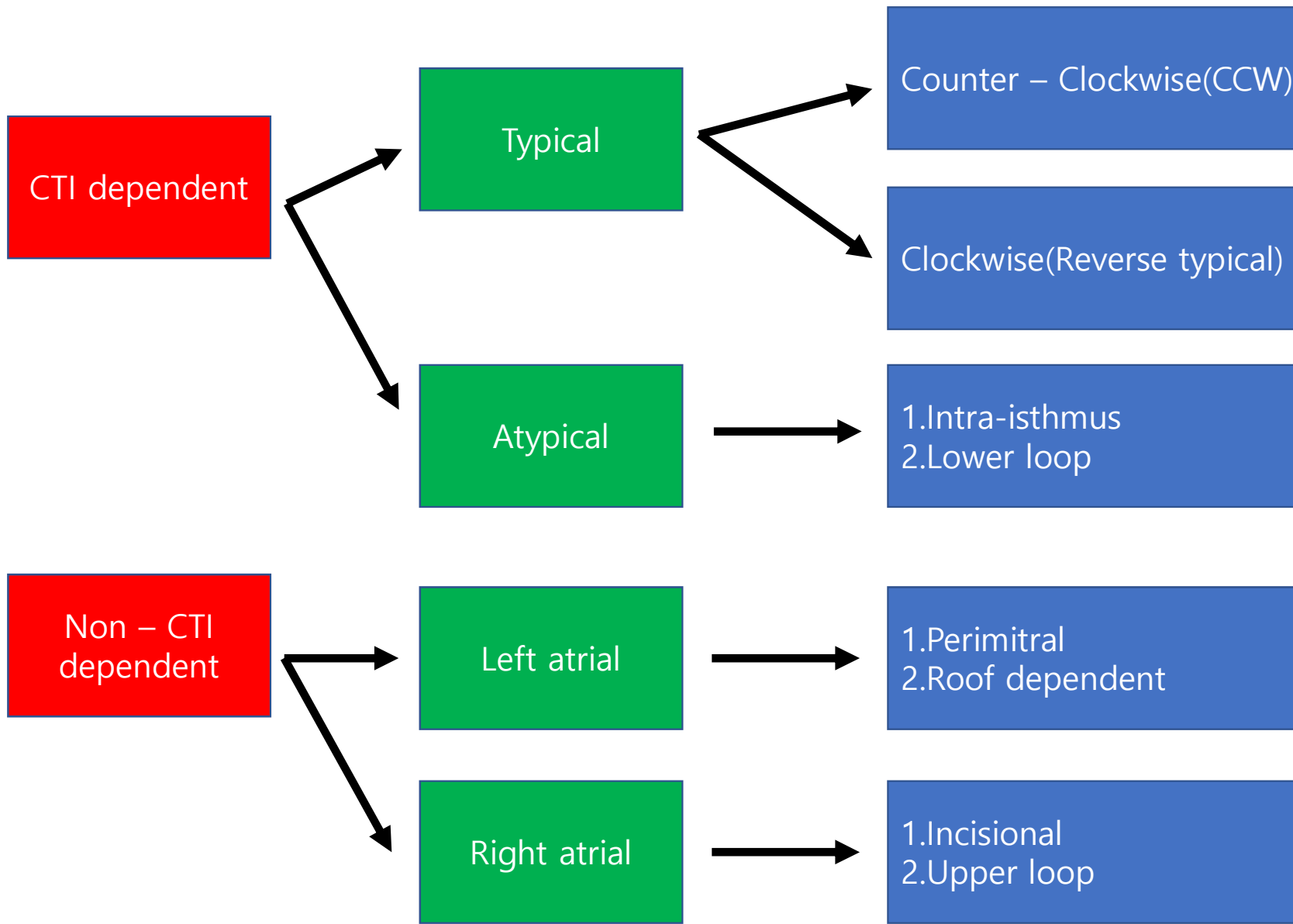
Tricuspid Valve



Typical (counter-clockwise) atrial flutter



Reverse Typical (clockwise) atrial flutter



How to confirm?

Entrainment

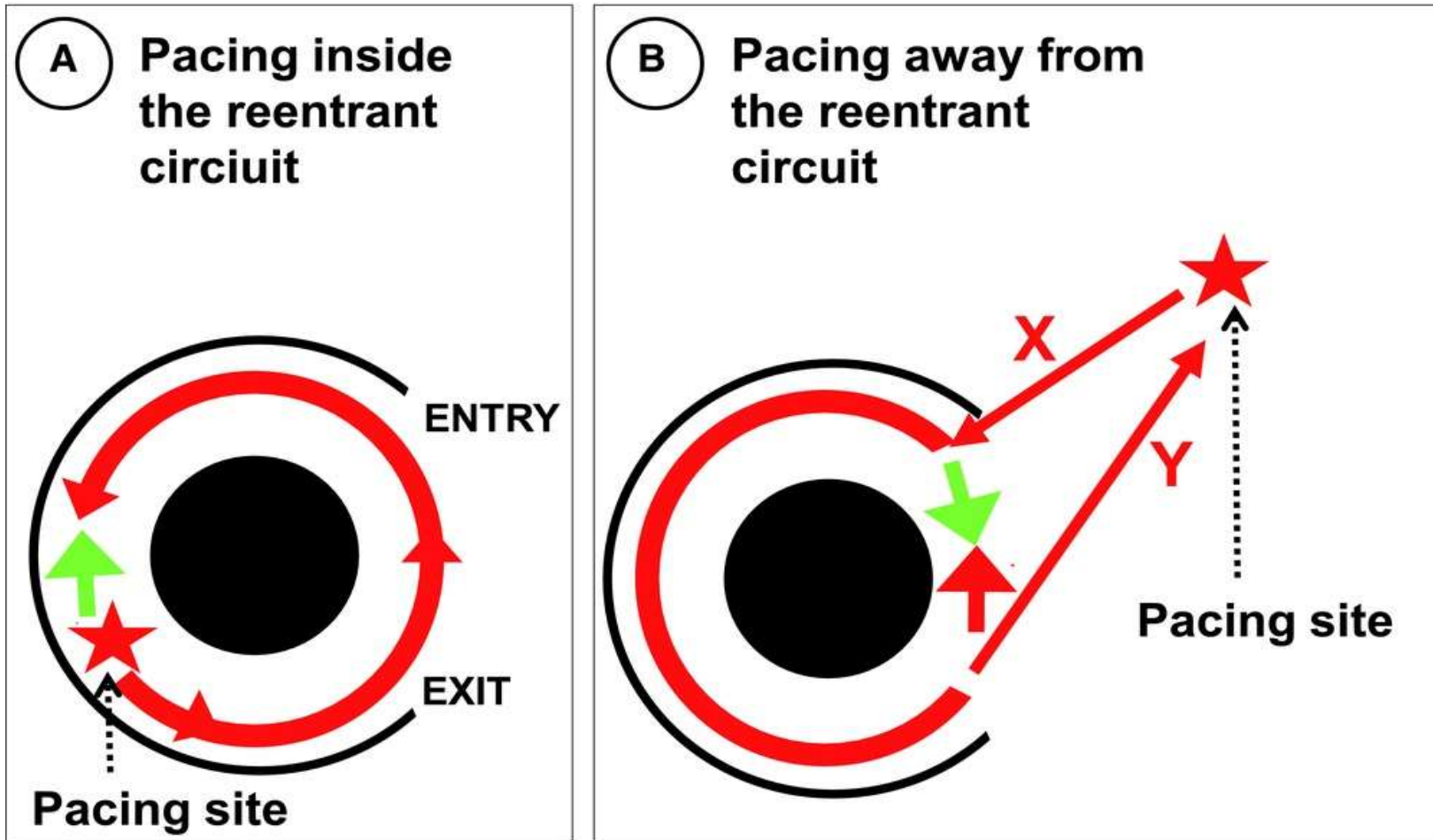
Reentry circuit 식제 조재하느지 여브 화이카

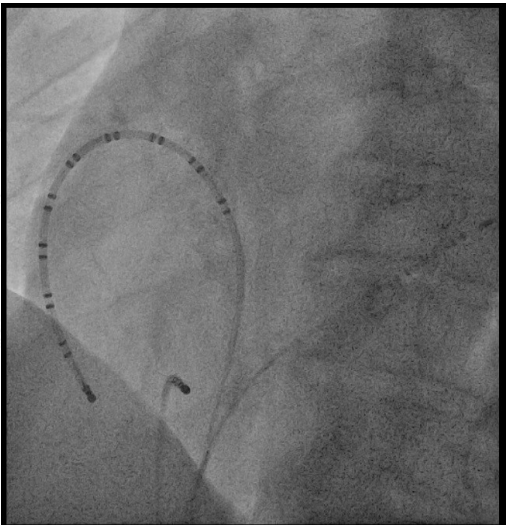
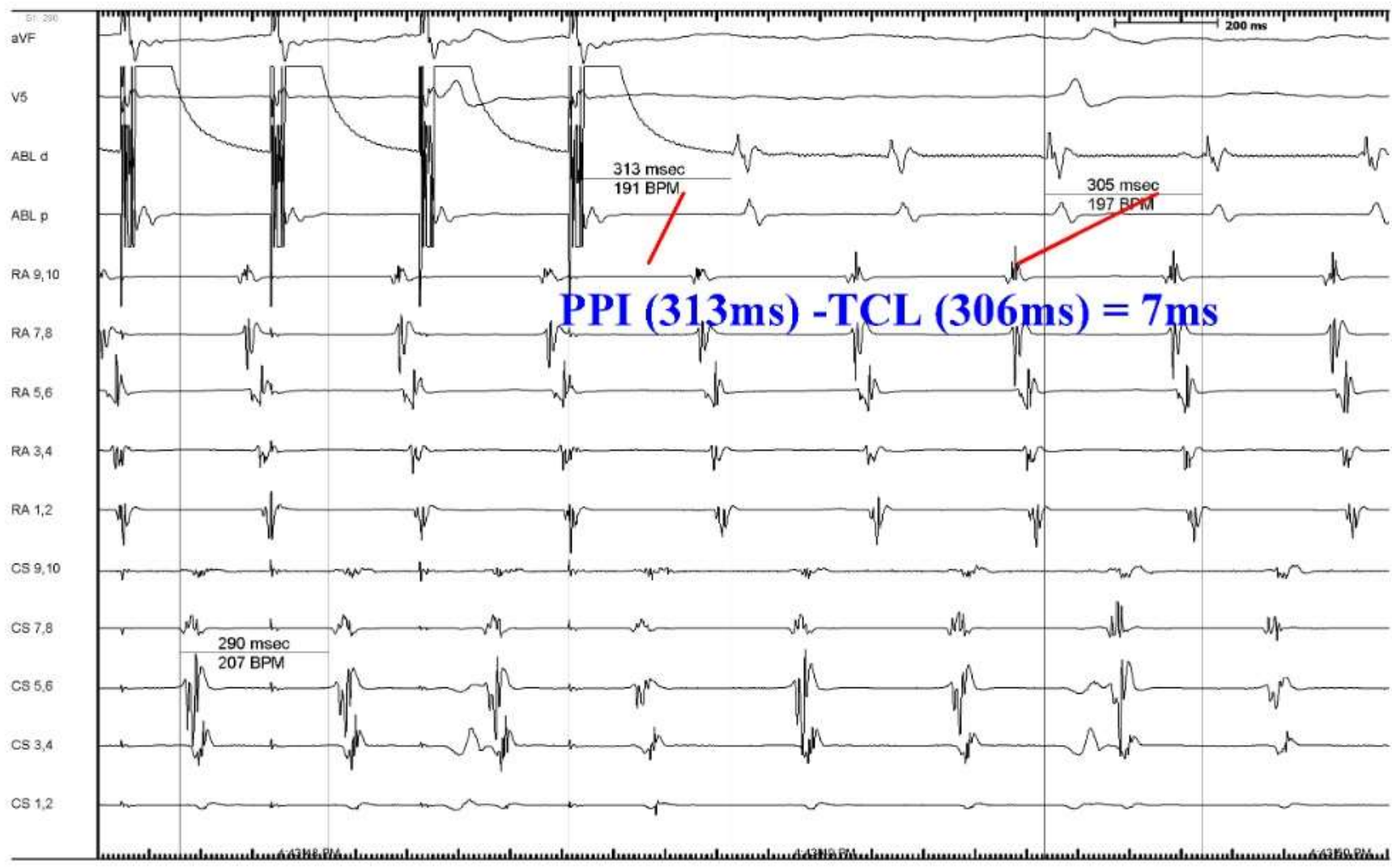
4 아주 쉽게 비유하면

- 원래 회전목마가 일정 속도로 돌고 있음 (flutter circuit) 🎠
- 옆에서 조금 더 빠르게 밀어줌 (pacing)
- 그러면 회전목마 속도가 잠깐 내가 미는 속도로 맞춰짐

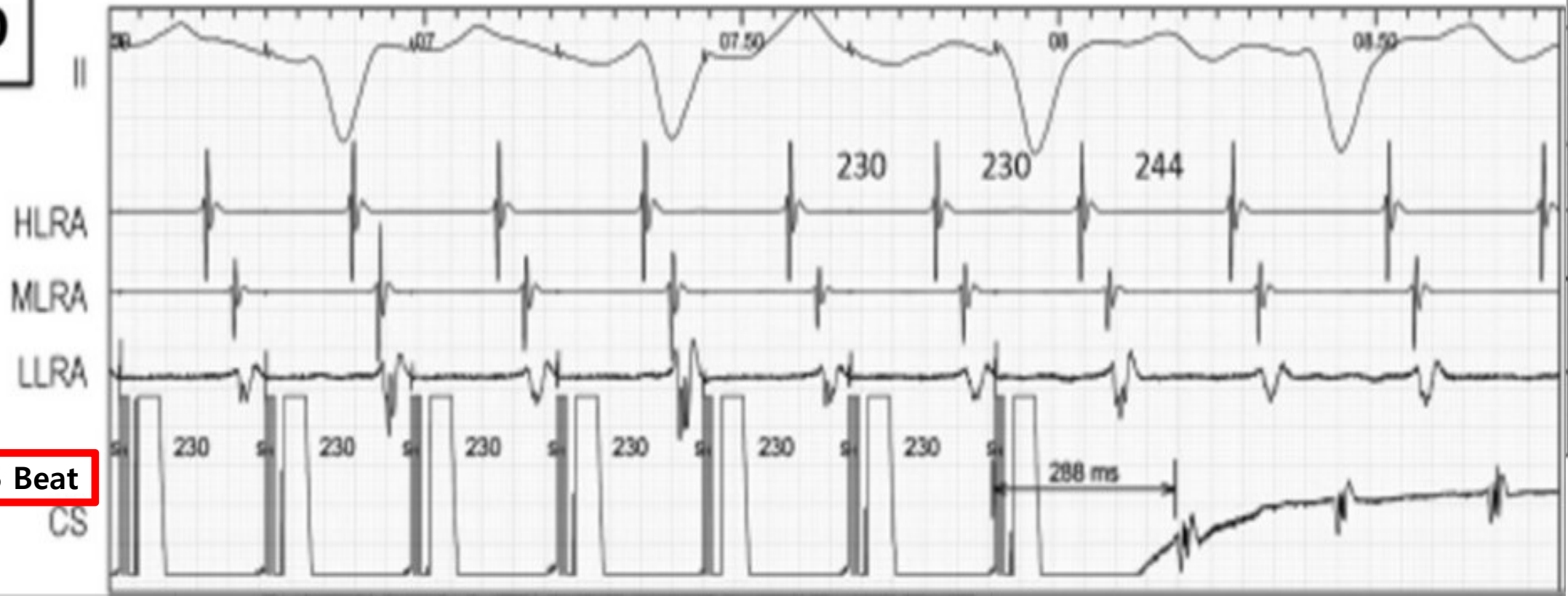
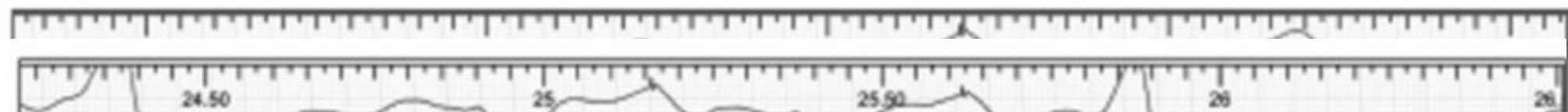
이게 **Entrainment**입니다.

Entrainment





A
B
D



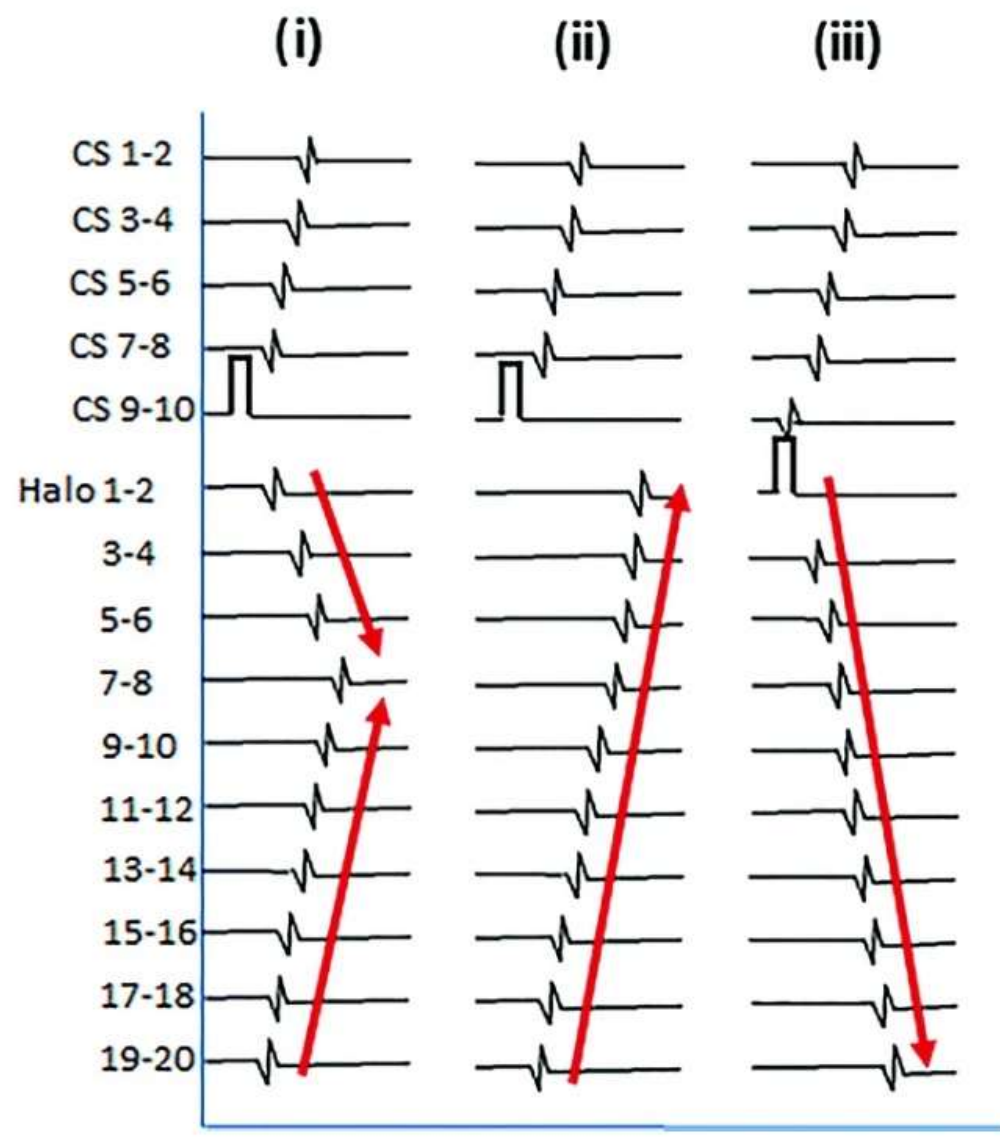
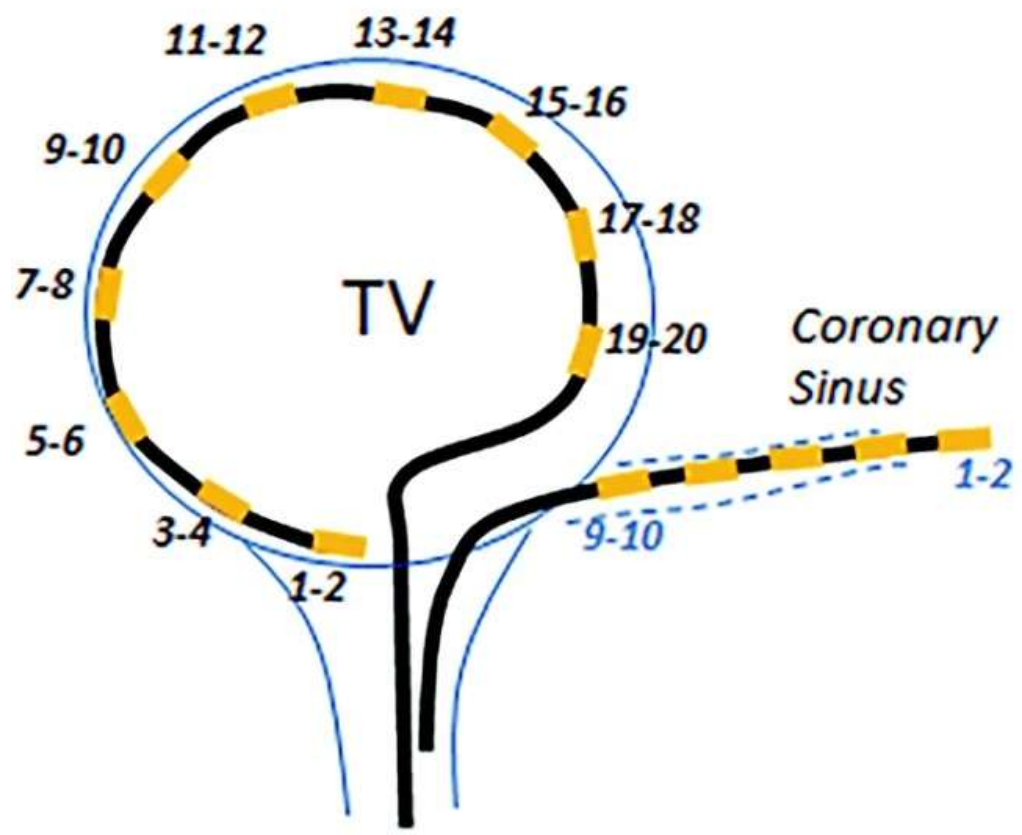
15 Beat

As explained in the diagram, **when the pacing site is out of the circuit, the post pacing interval is going to be longer than the tachycardia cycle length.** This is the central mechanism we use to identify a catheter position in relation to a re-entrant circuit.

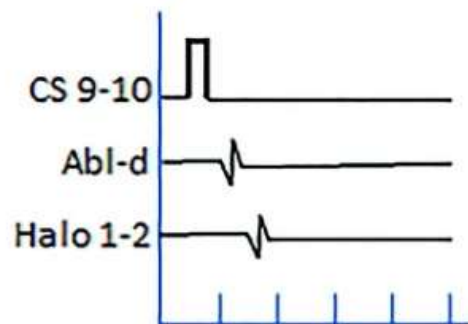
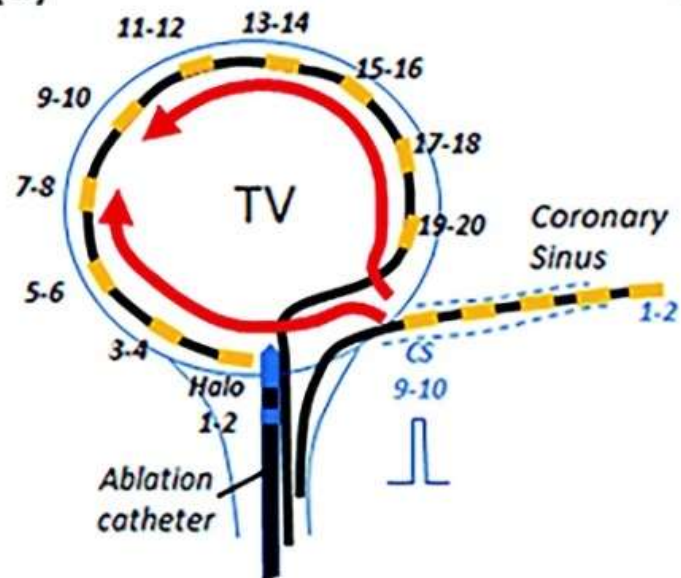
Take home message :

- **PPI = TCL , in circuit**
- **PPI > TCL out of circuit**
- **PPI >>> TCL waaay out of circuit !!**
- ***PPI < TCL you are doing something wrong***

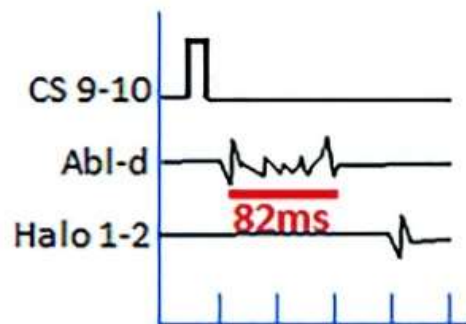
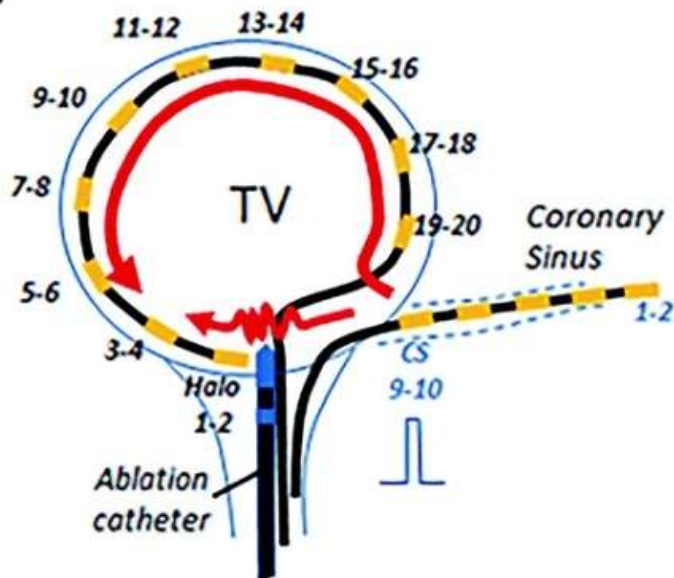
Post



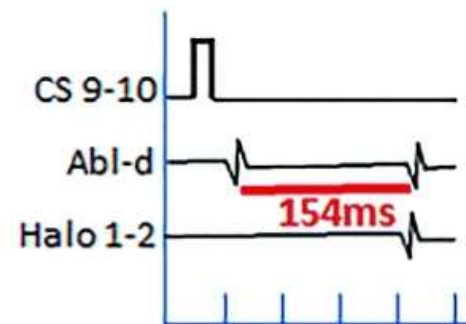
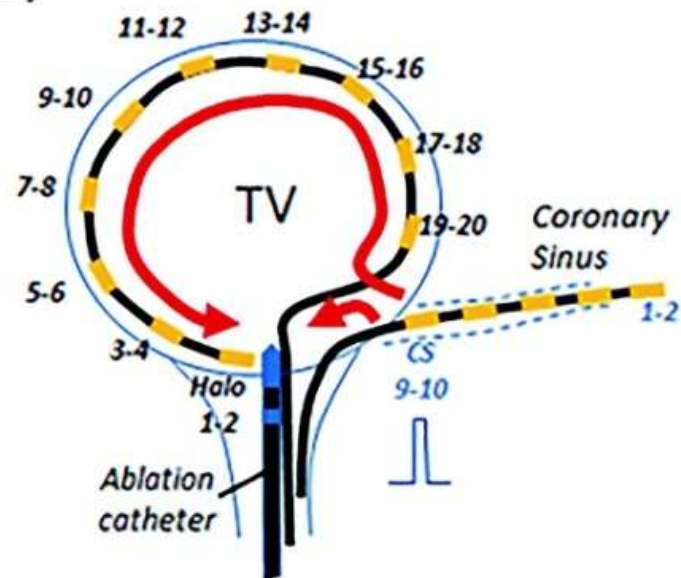
(a)



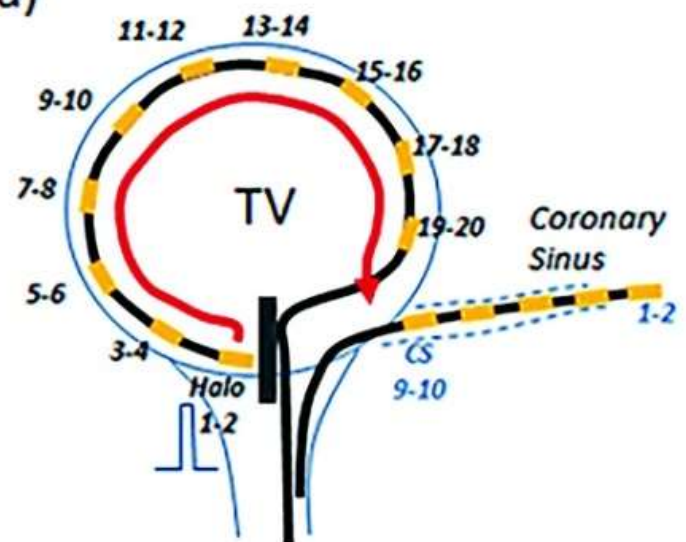
(b)



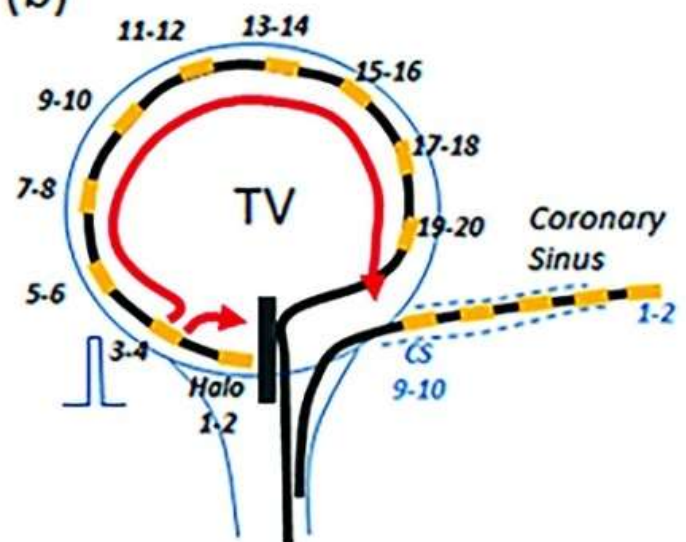
(c)



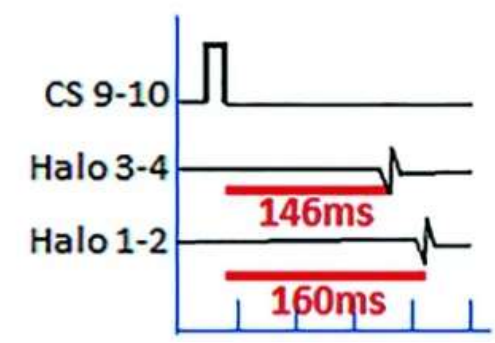
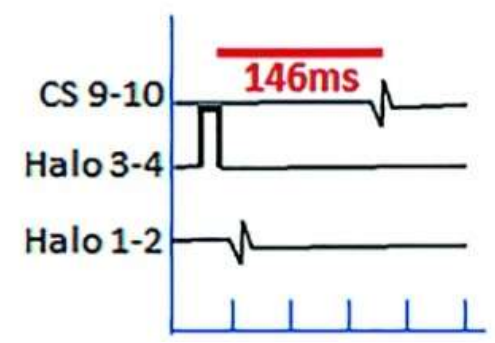
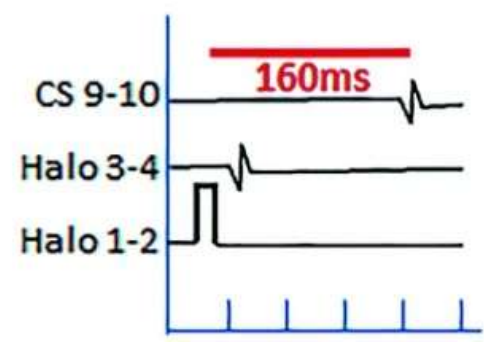
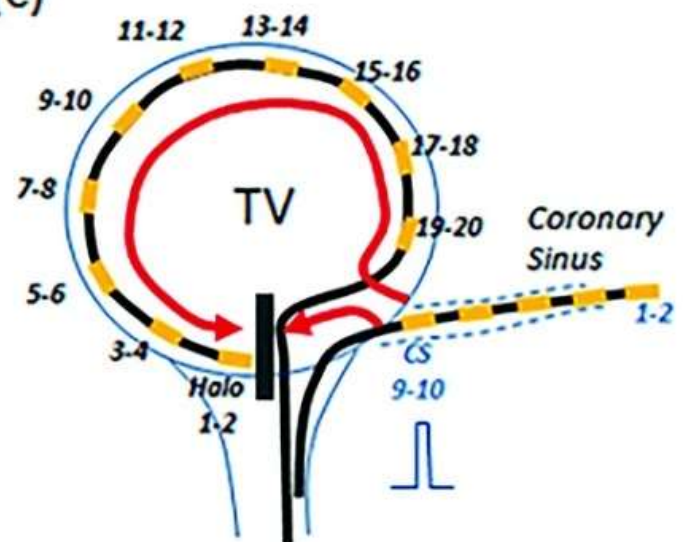
(a)



(b)



(c)



Procedure (Atrial Fibrillation)

What is AF?

- A supraventricular tachyarrhythmia with uncoordinated atrial electrical activation and consequently ineffective atrial contraction.

Electrocardiographic characteristics of AF include:

- **Irregularly irregular R-R** intervals (when atrioventricular conduction is not impaired),
- **Absence of distinct repeating P** waves, and
- **Irregular atrial** activations

Classification of AF

AF pattern	Definition
Fist diagnosed	AF not diagnosed before, irrespective of its duration or the presence/severity of AF-related symptoms.
Paroxysmal	AF that terminates spontaneously or with intervention within 7 days of onset
Persistent	AF that is continuously sustained beyond 7 days , including episodes terminated by cardioversion (drugs or electrical cardioversion) after >AF that terminates spontaneously or with intervention within 7 days of onset7 days.
Long-standing persistent	Continuous AF of >12 months' duration when decided to adopt a rhythm control strategy.
Permanent AF	AF that is accepted by the patient and physician, and no further attempts to restore/maintain sinus rhythm will be undertaken . Permanent AF represents a therapeutic attitude of the patient and physician rather than an inherent pathophysiological attribute of AF, and the term should not be used in the context of a rhythm control strategy with antiarrhythmic drug therapy or AF ablation. Should a rhythm control strategy be adopted, the arrhythmia would be re-classified as 'long-standing persistent AF'.

심방세동 치료 필요성

1. Stroke

- 심방 떨림으로 인해 혈액이 정체(특히 LA appendage)
=>혈전 생성 후 떨어져 나가면 Ischemic stroke

2. HF

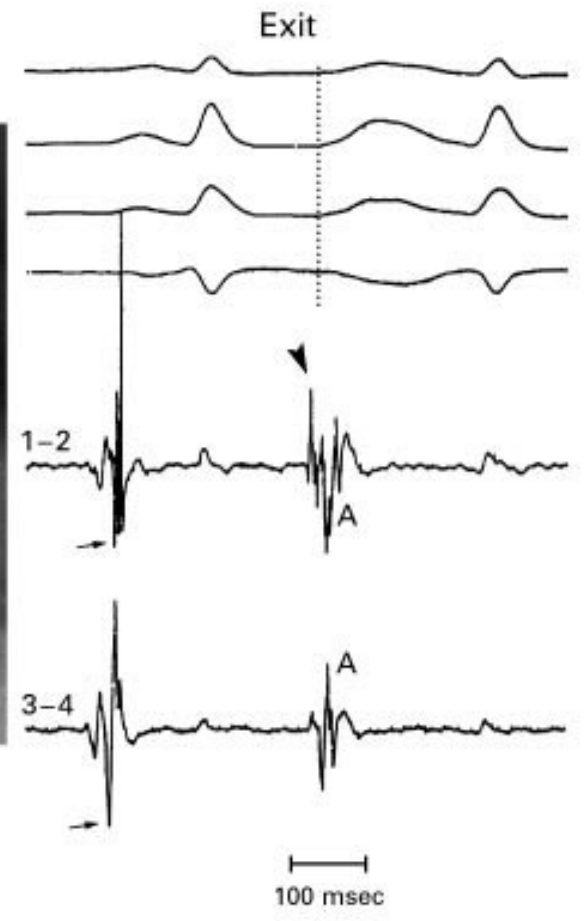
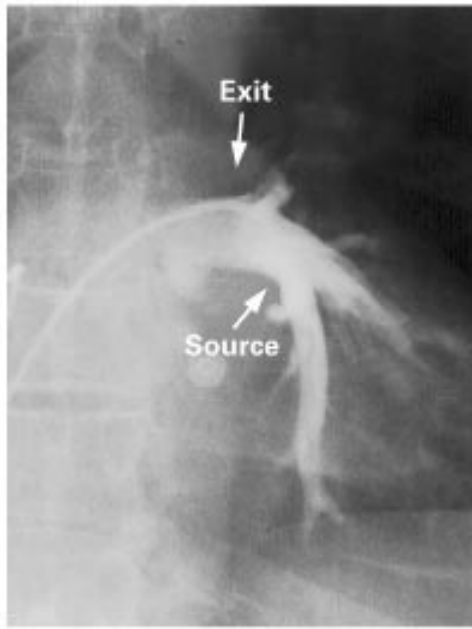
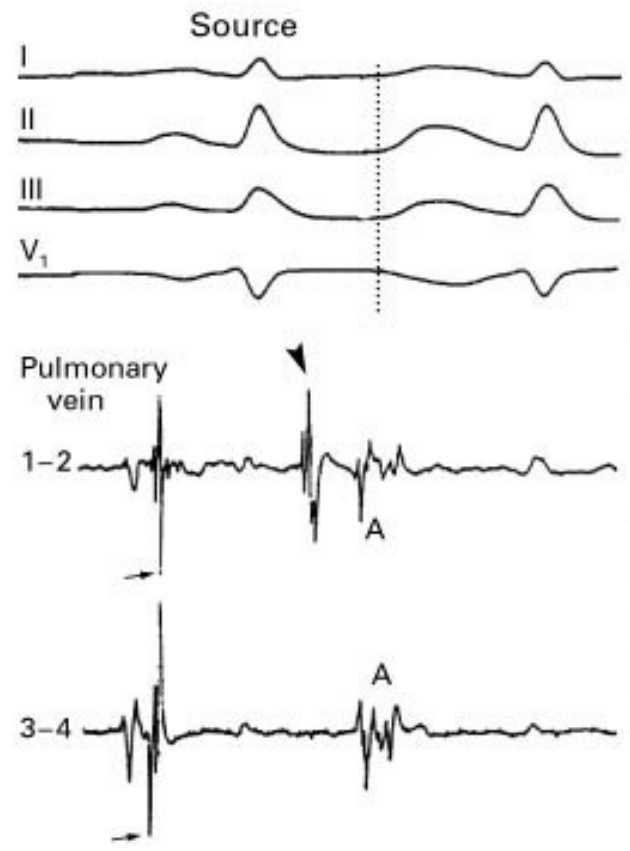
- 심방수축이 사라짐(Atrial kick소실)
- 심박수가 빠르고 불규칙

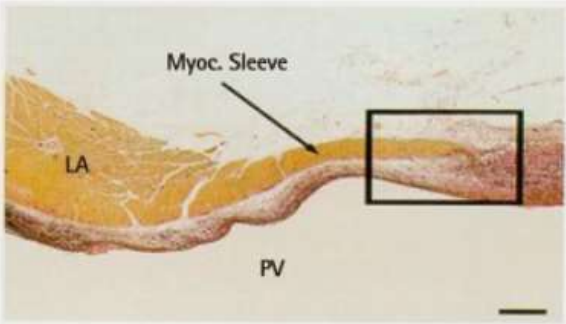
증상

발작성 : 두근거림, 숨참, 어지러움, 운동능력 감소, 피로

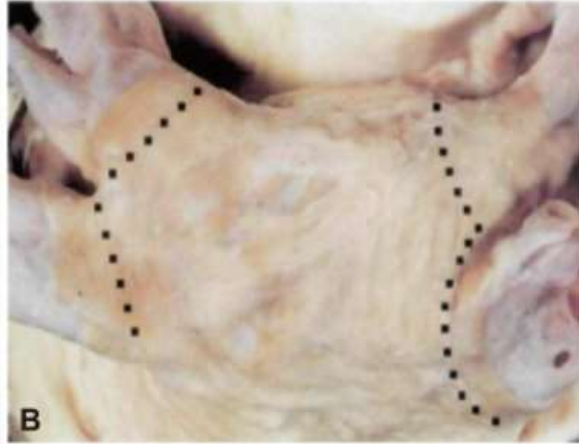
만성 : 발작성과 같은 증상이 있을수도 있고 없을 수도 있다.

Why?

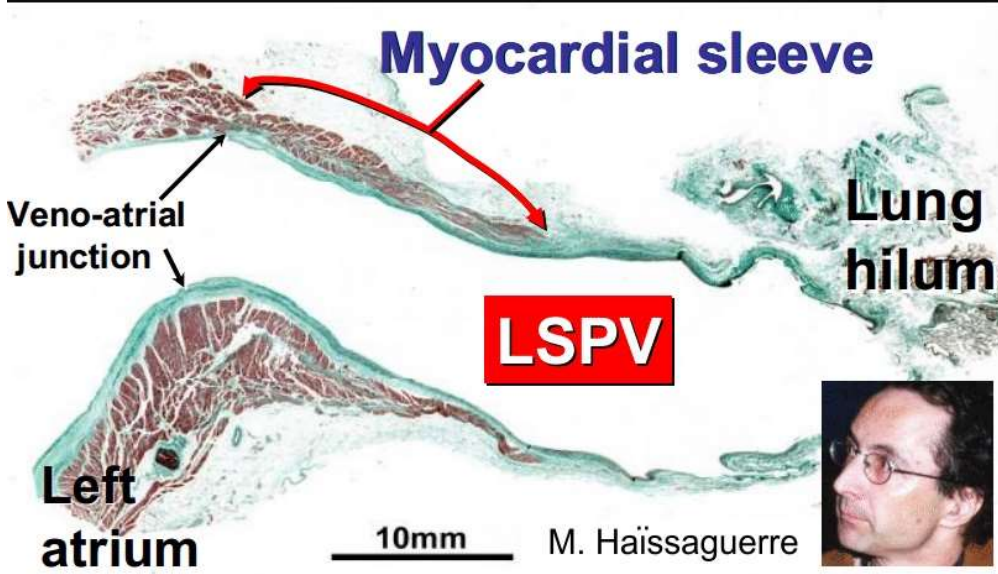
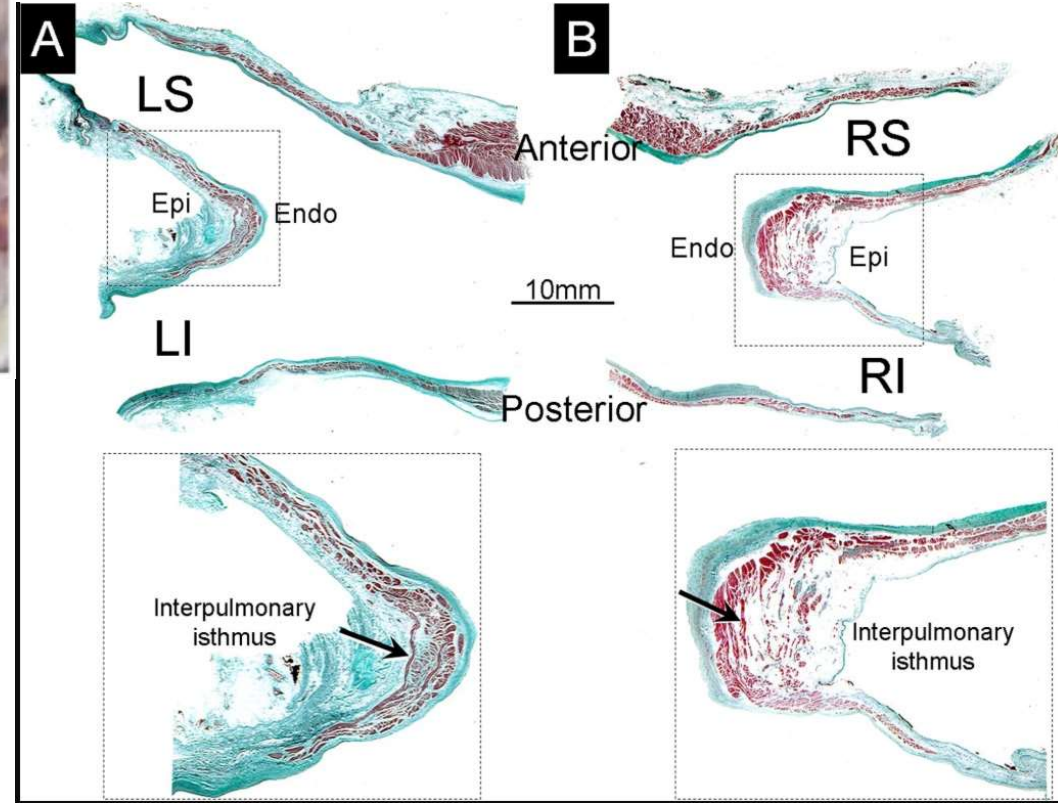




A Myocardial Sleeve in Pulmonary Vein



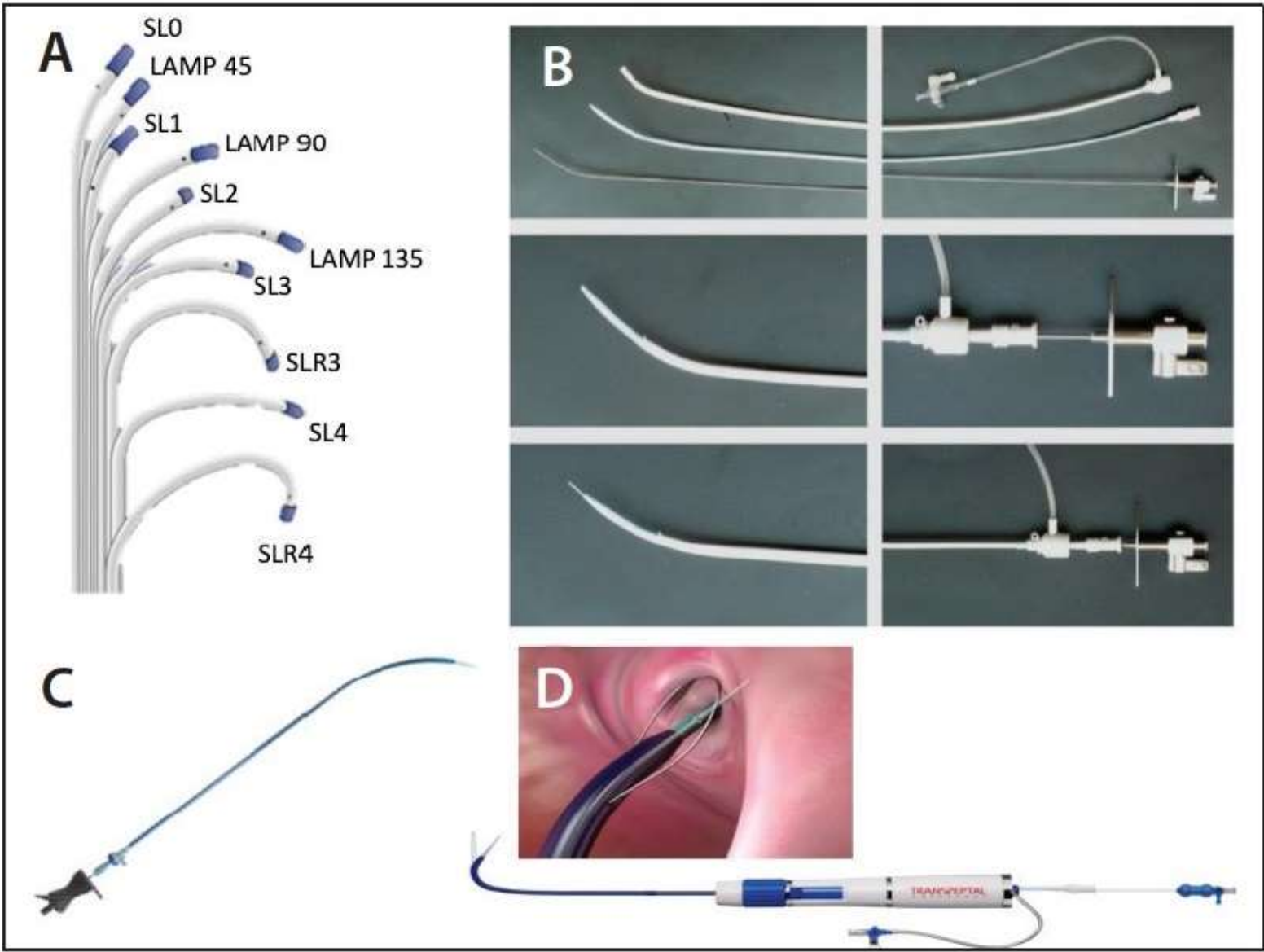
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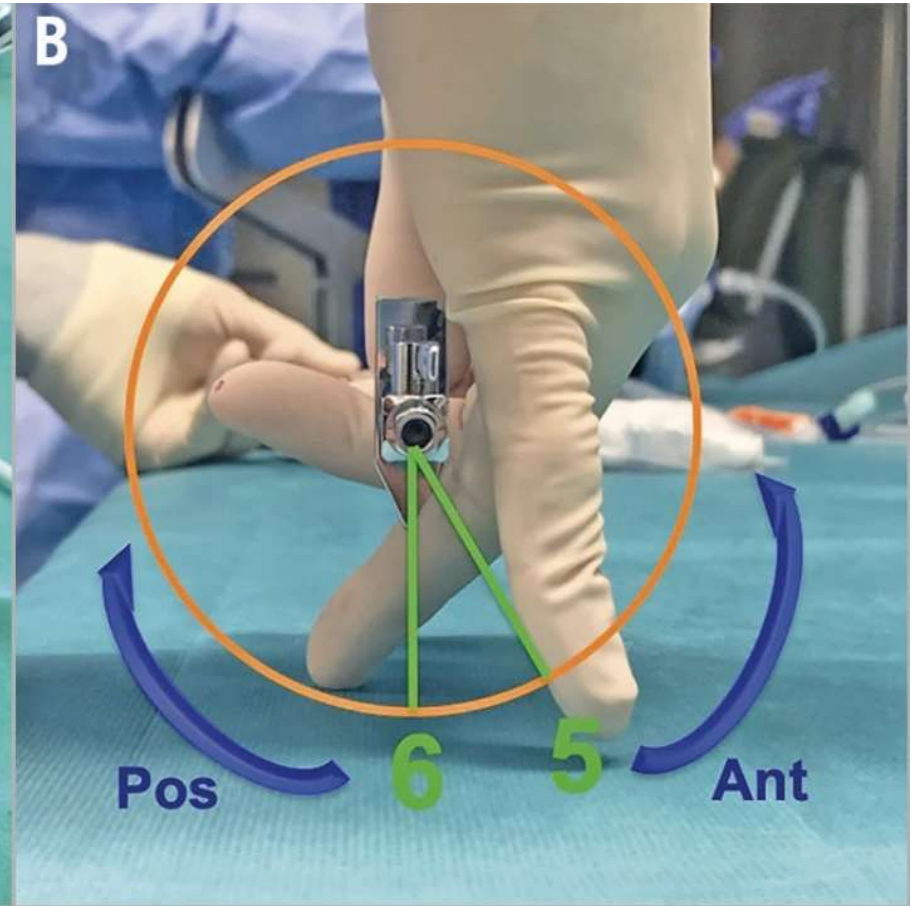
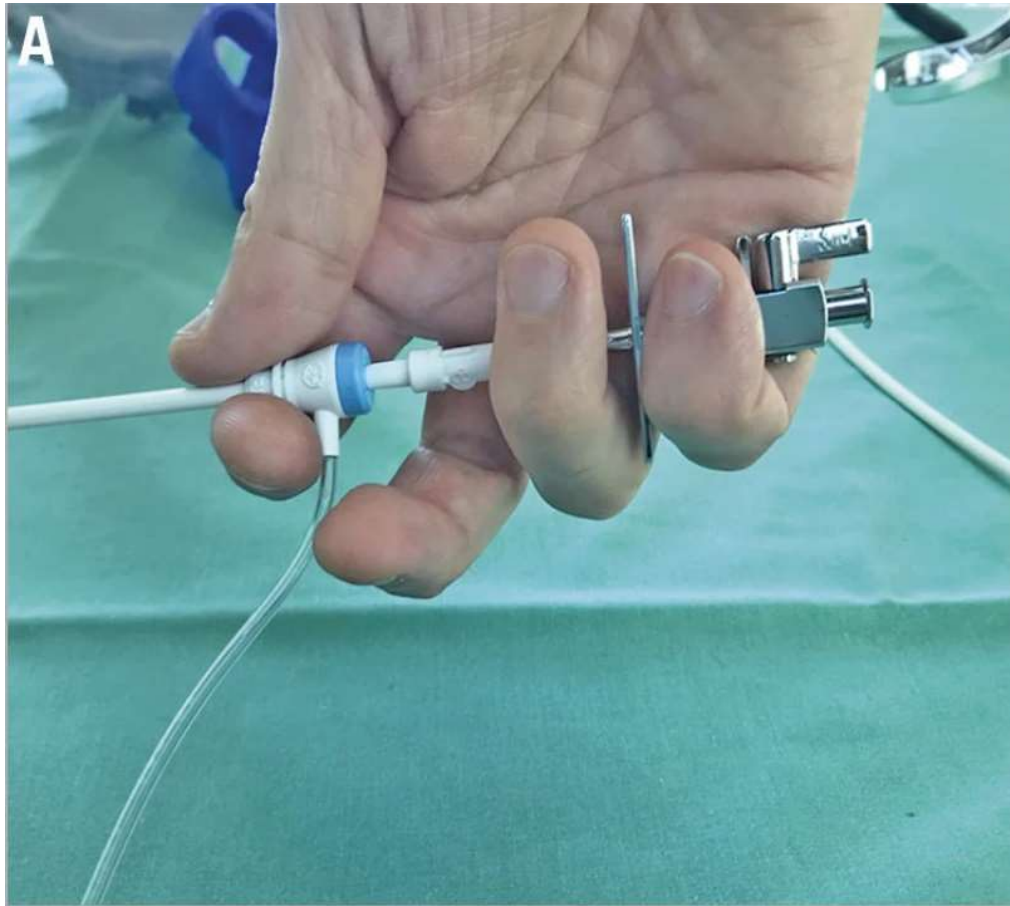


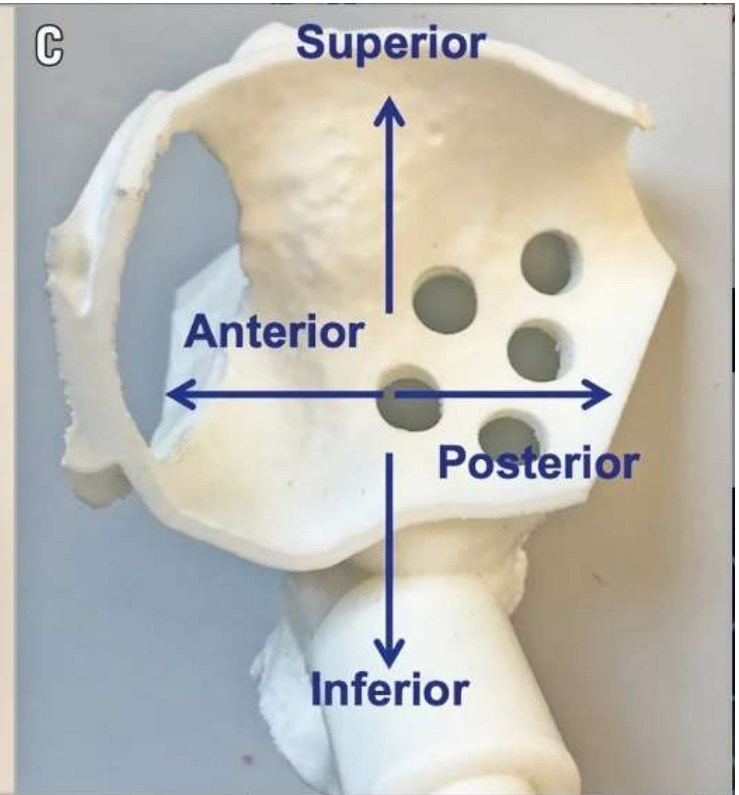
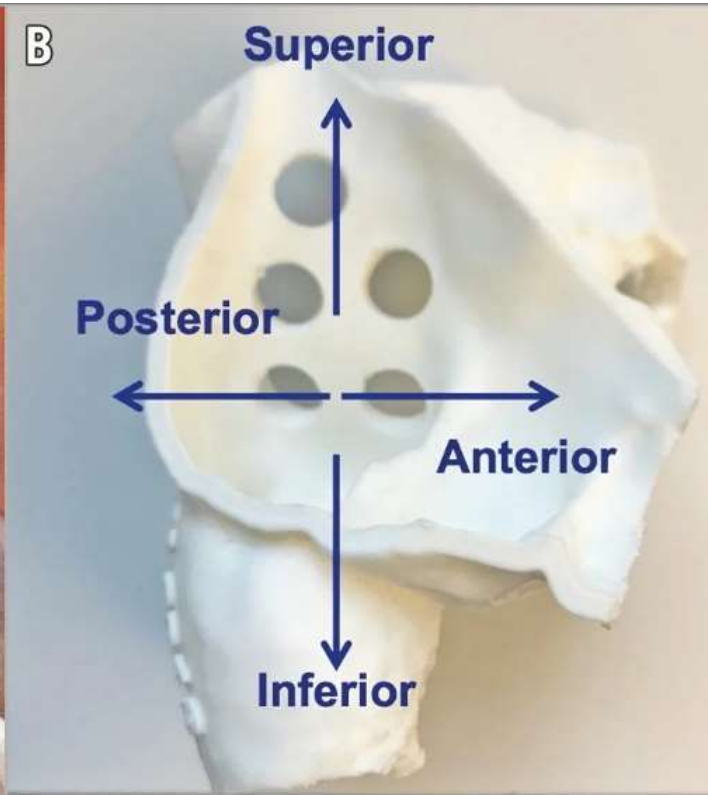
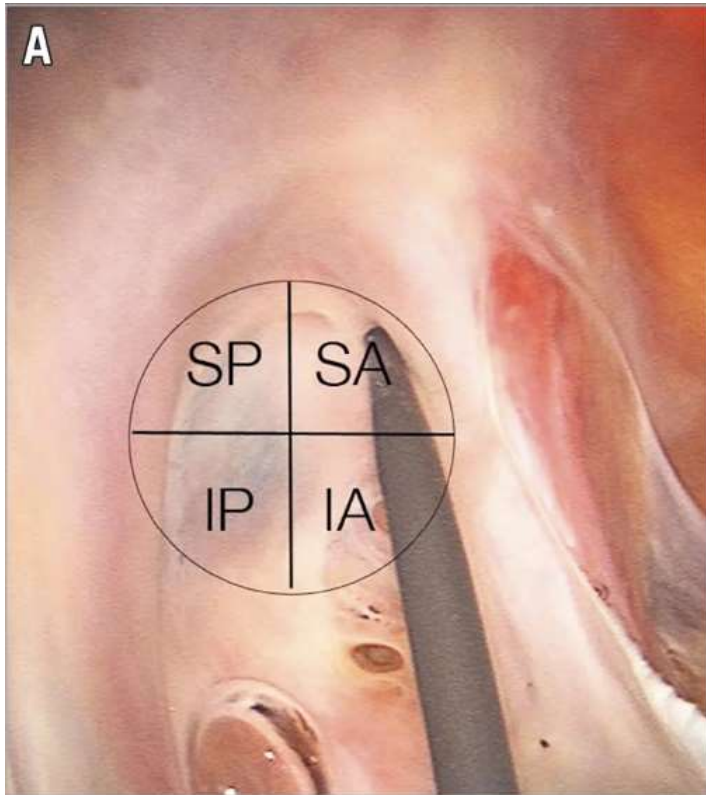
M. Haïssaguerre

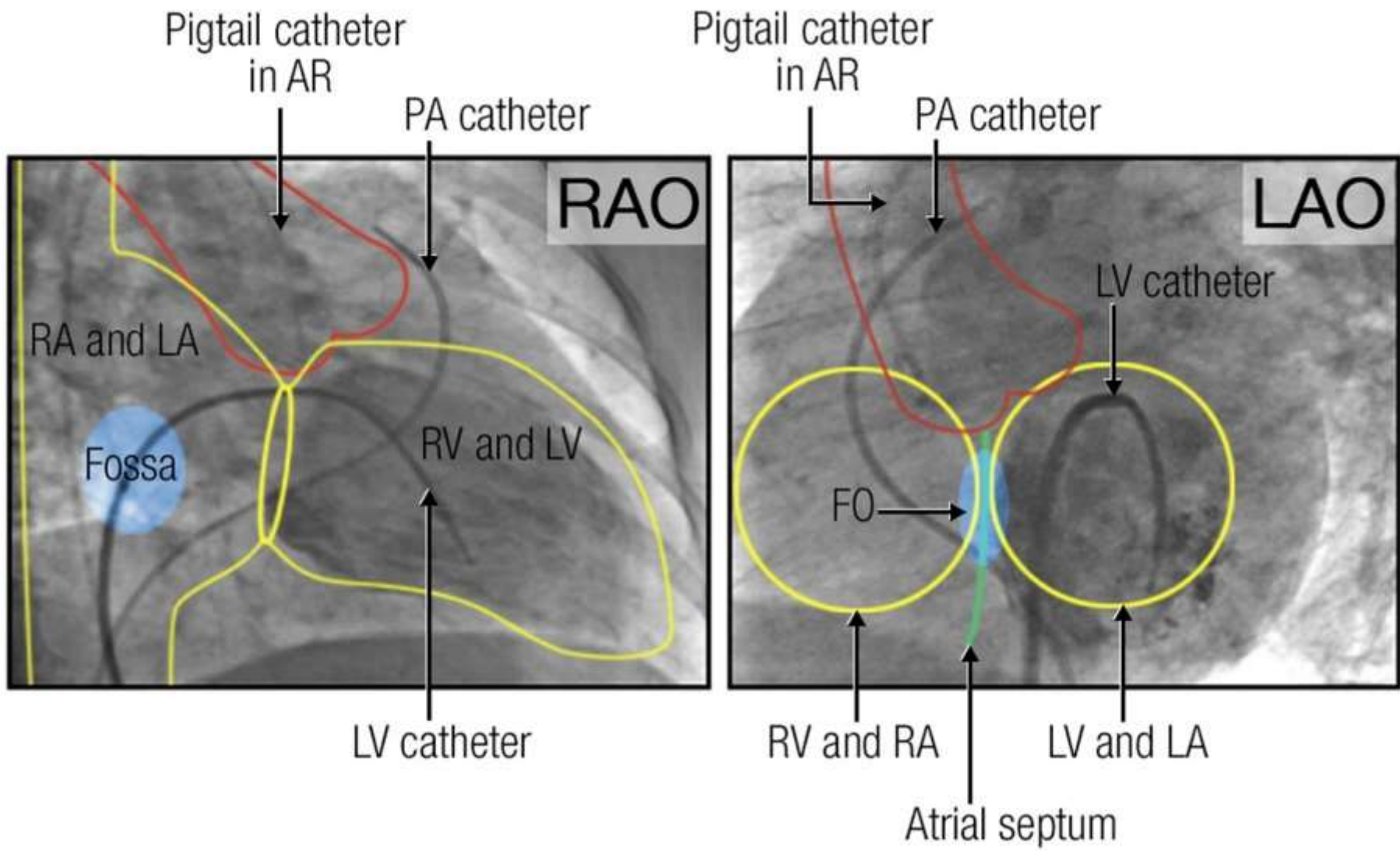
Pre

Septal puncture







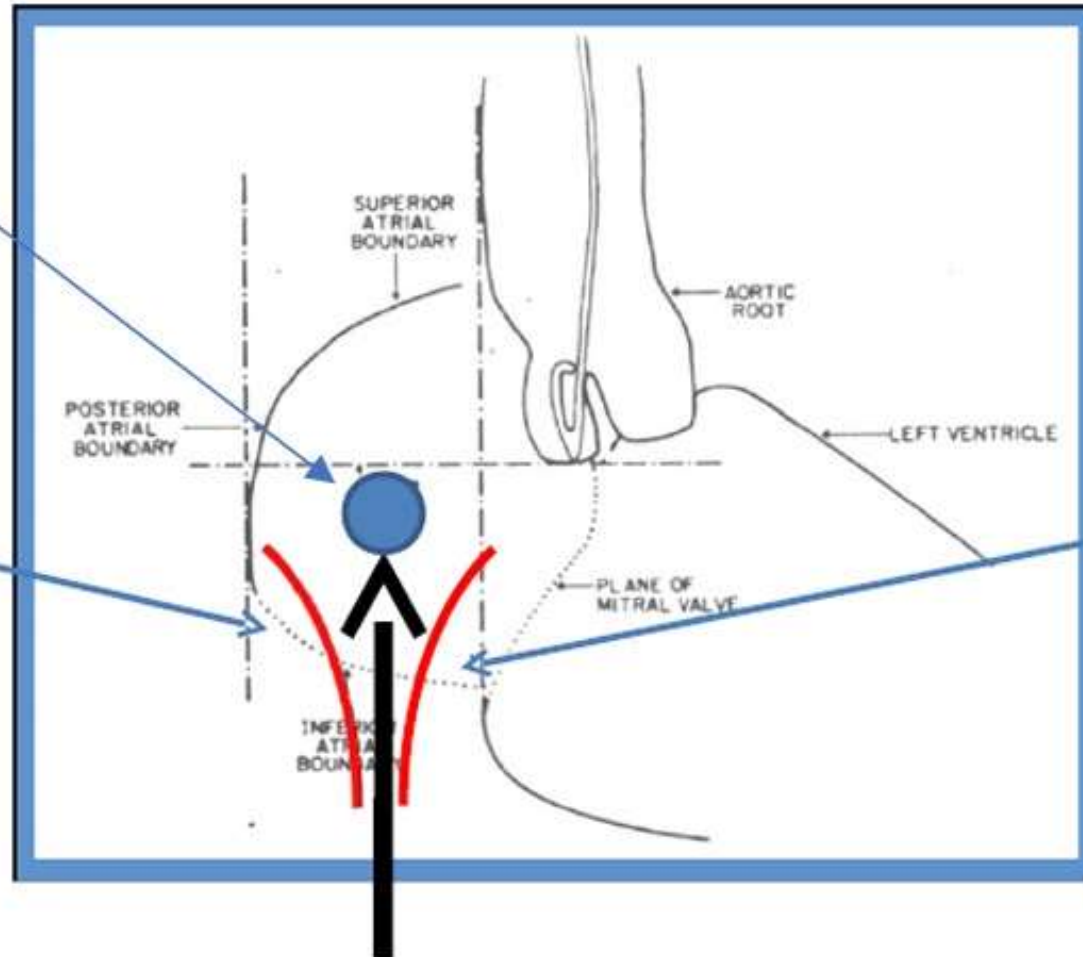


RAO 30-40

Sweet spot

Too posterior
--RA, Pulm
vein

Too anterior
--Ao, PA, RV,
RA

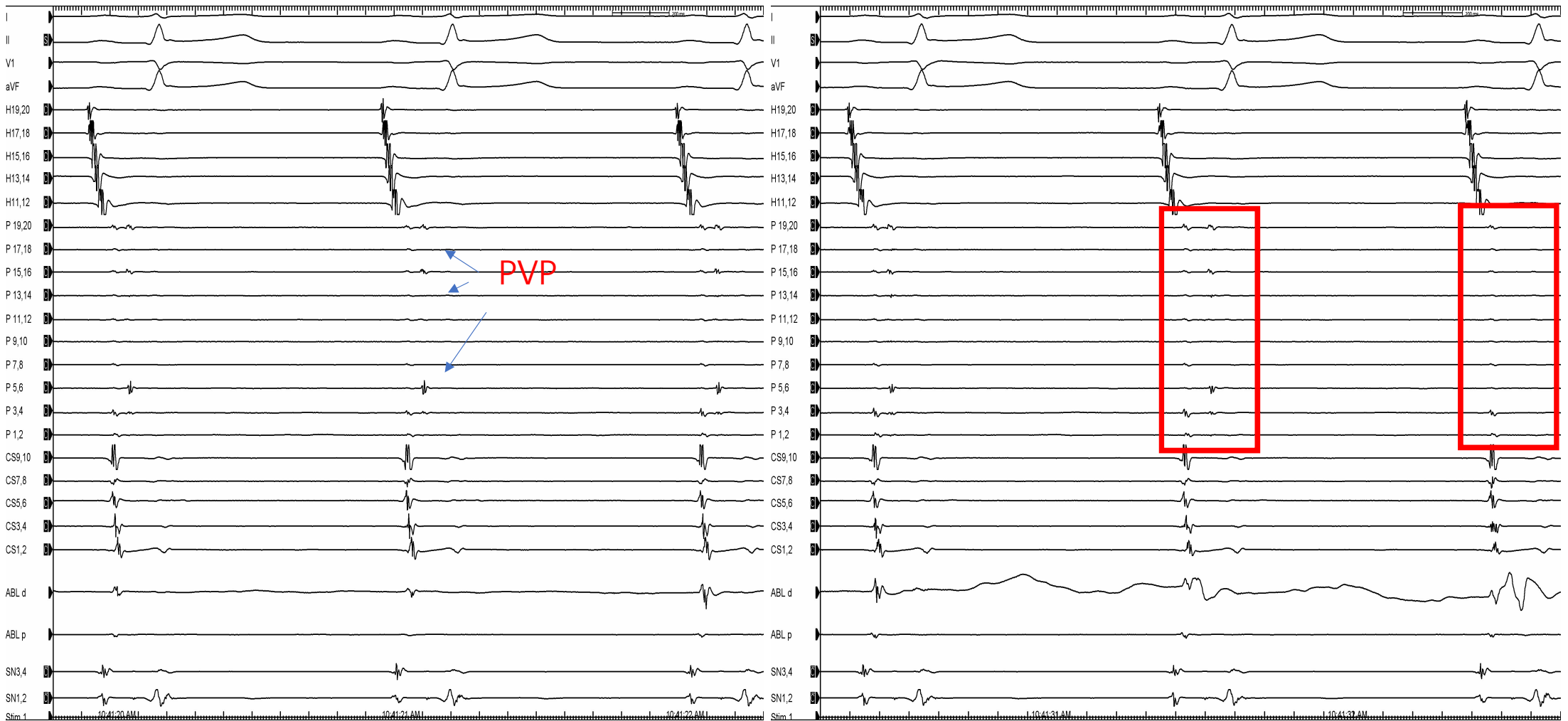


Post

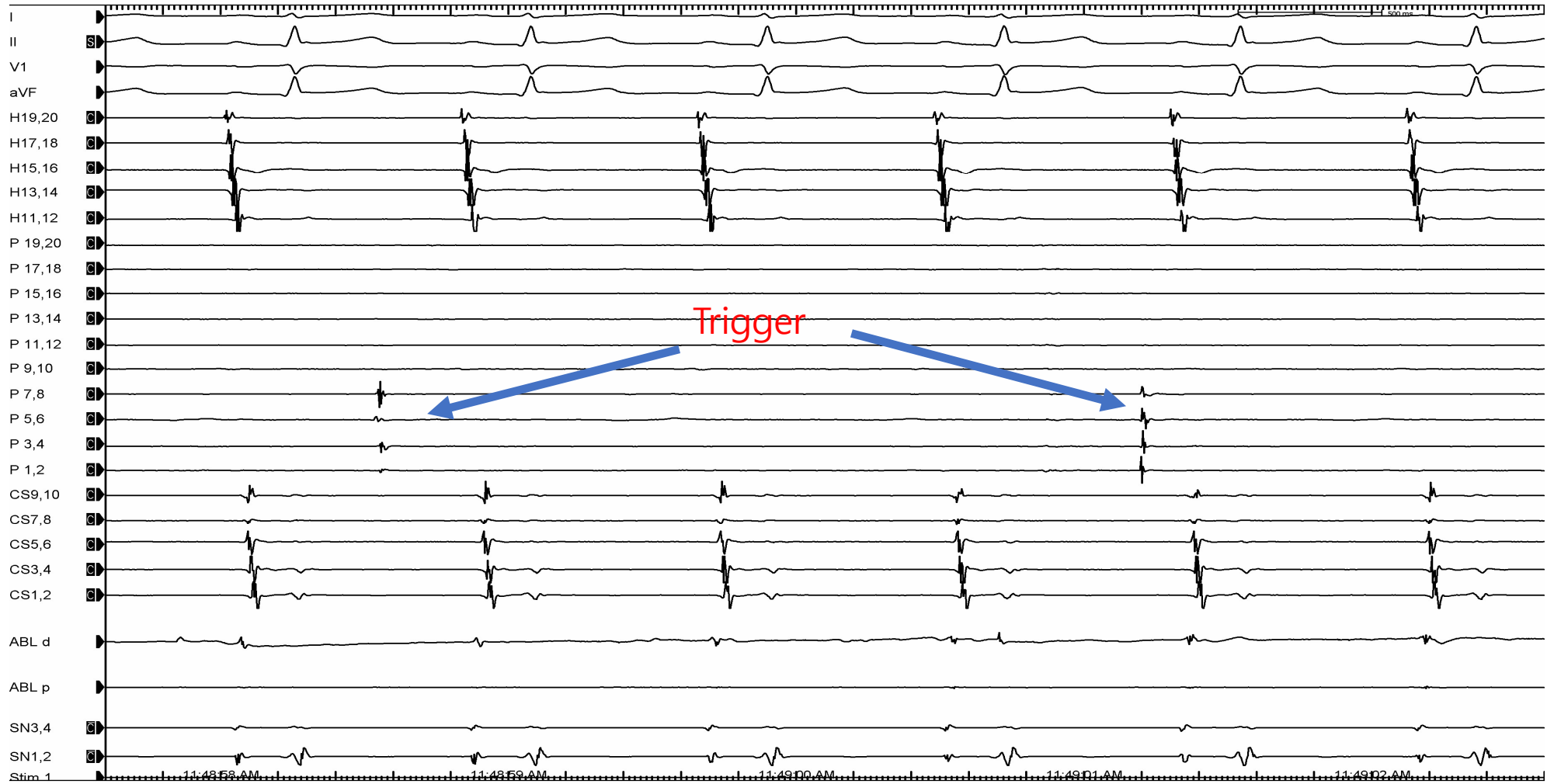
Entrance Block

Pre

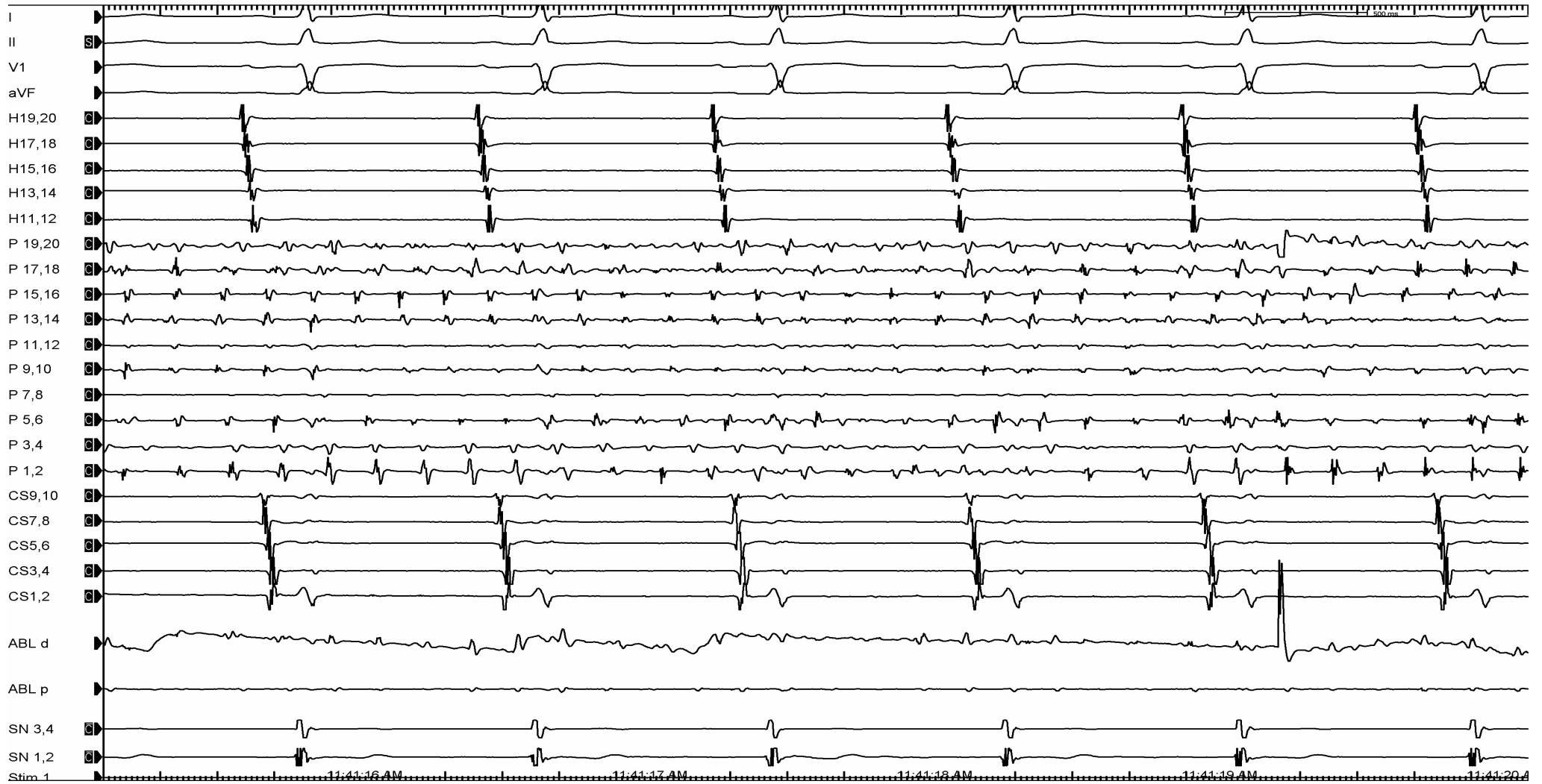
During Ablation



Exit Block



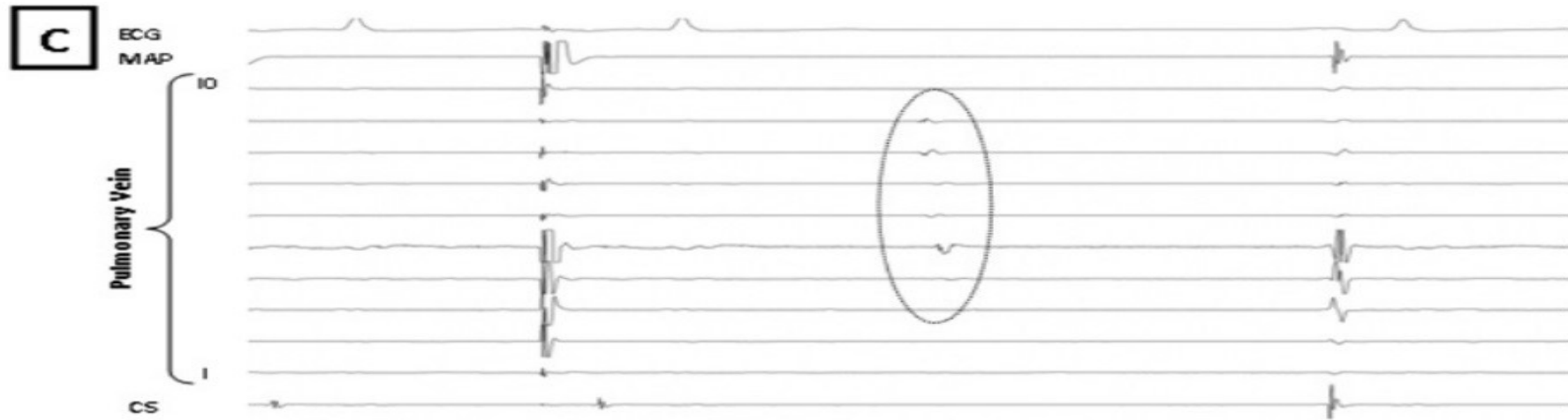
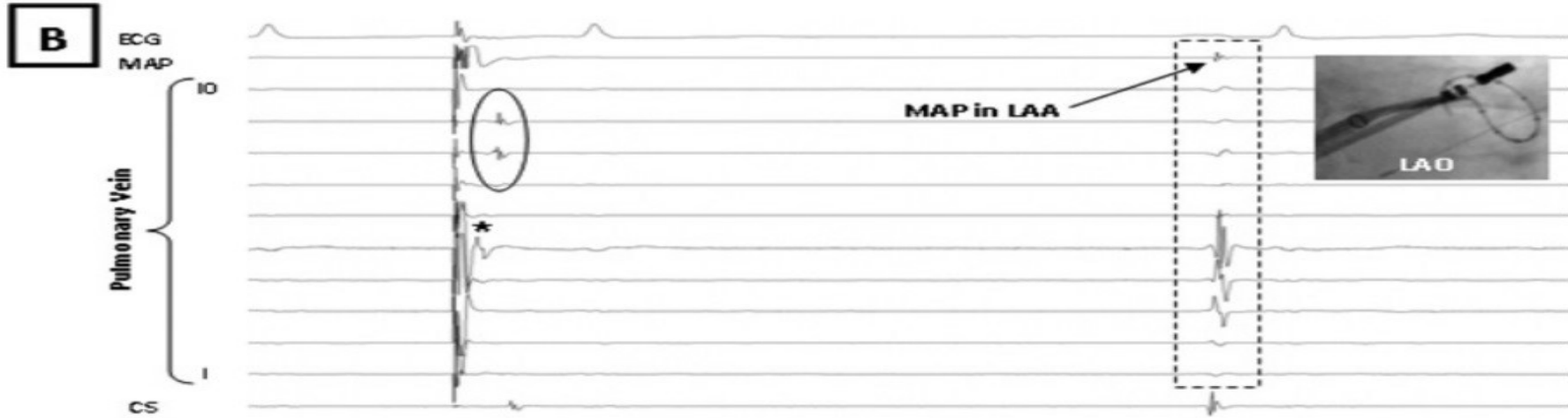
Exit Block



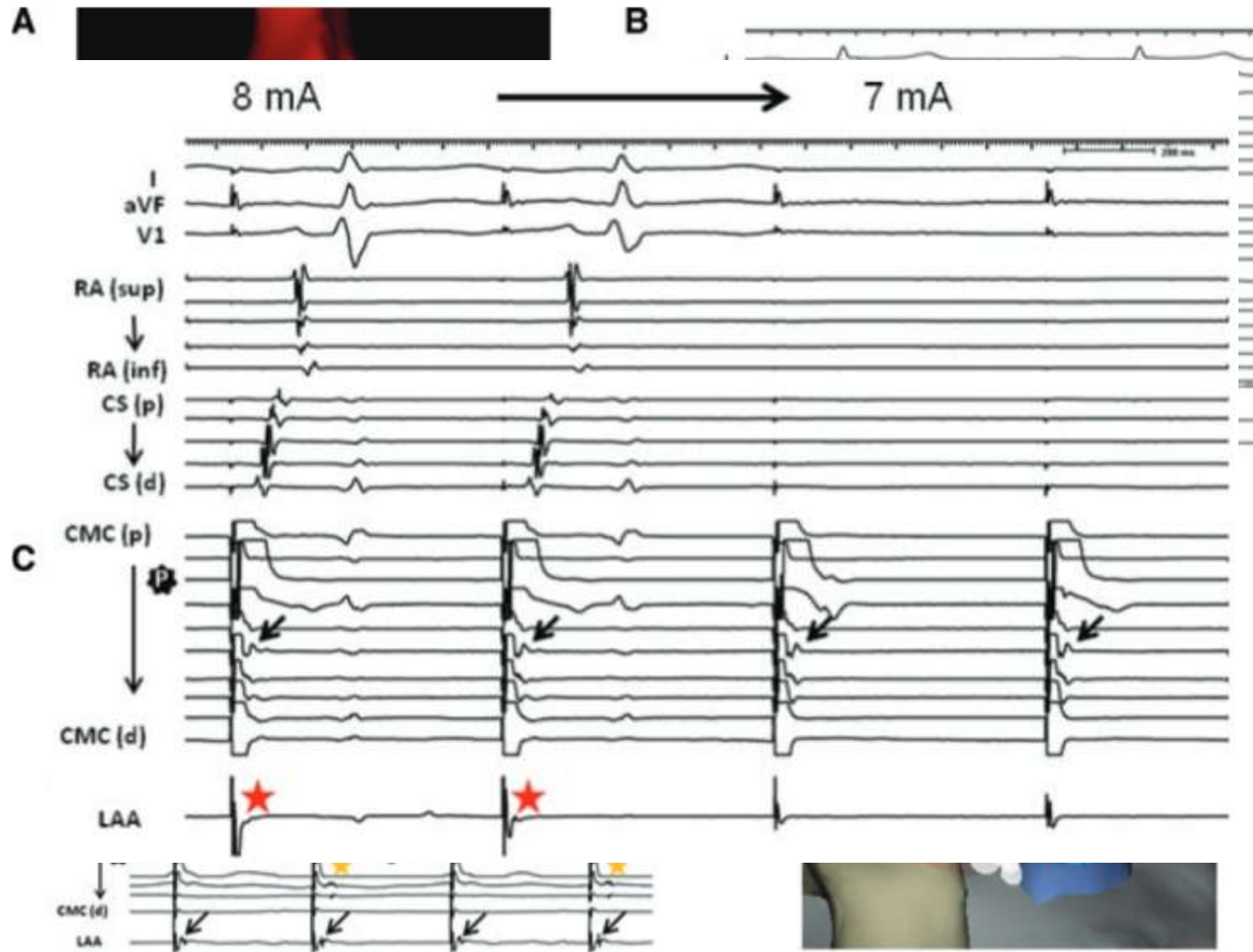
Exit Block



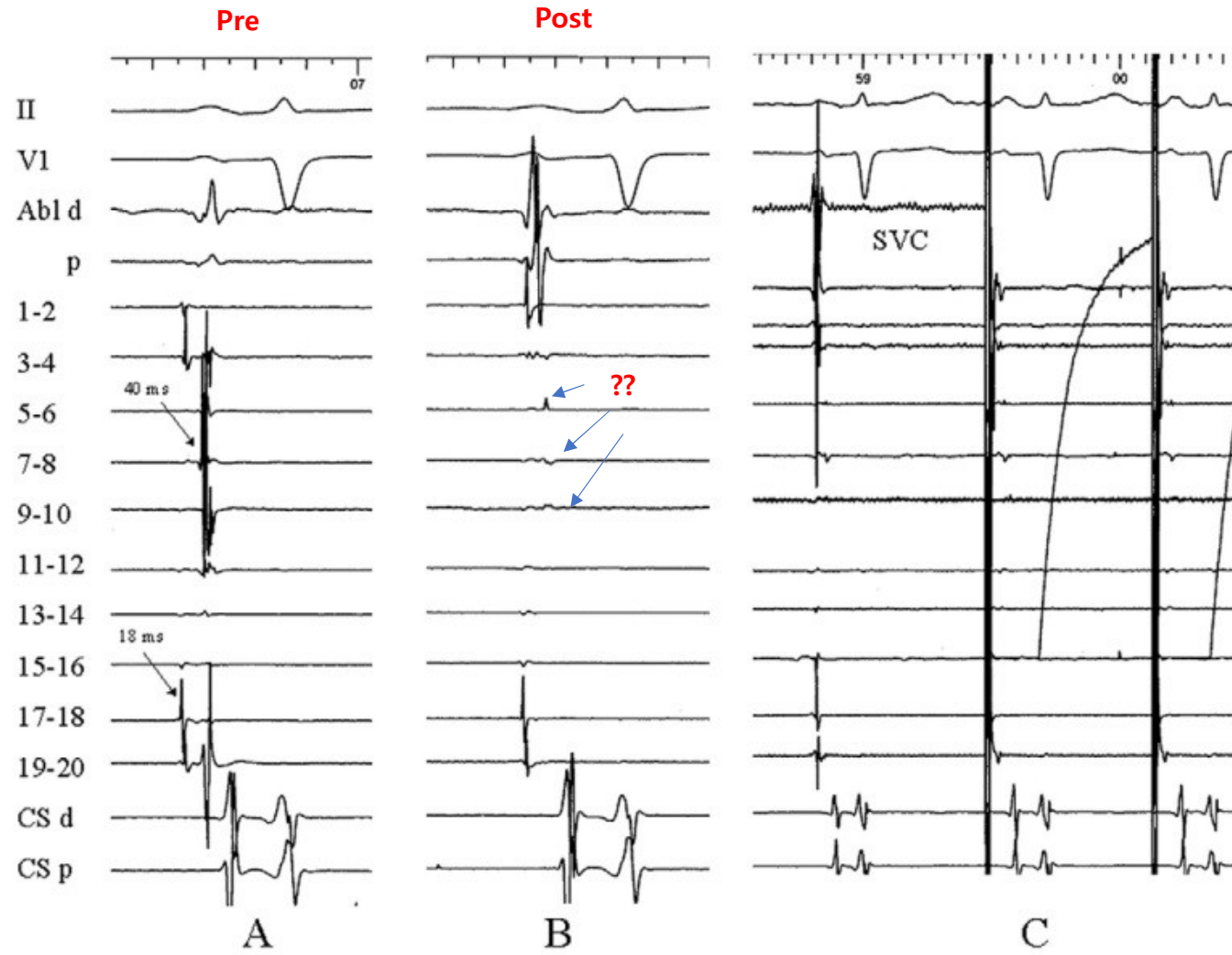
LSPV - LAA



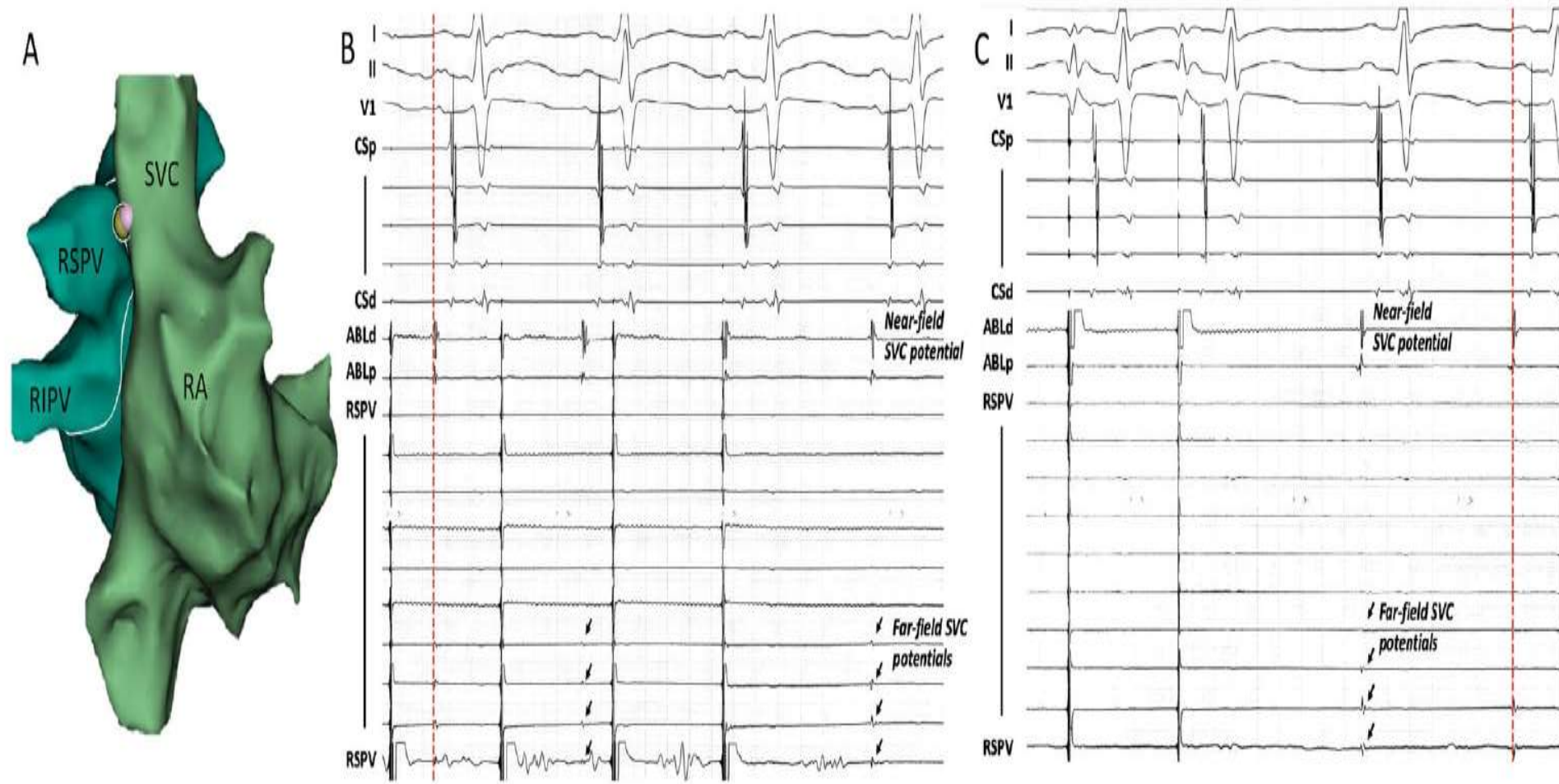
LSPV - LAA



RSPV - SVC

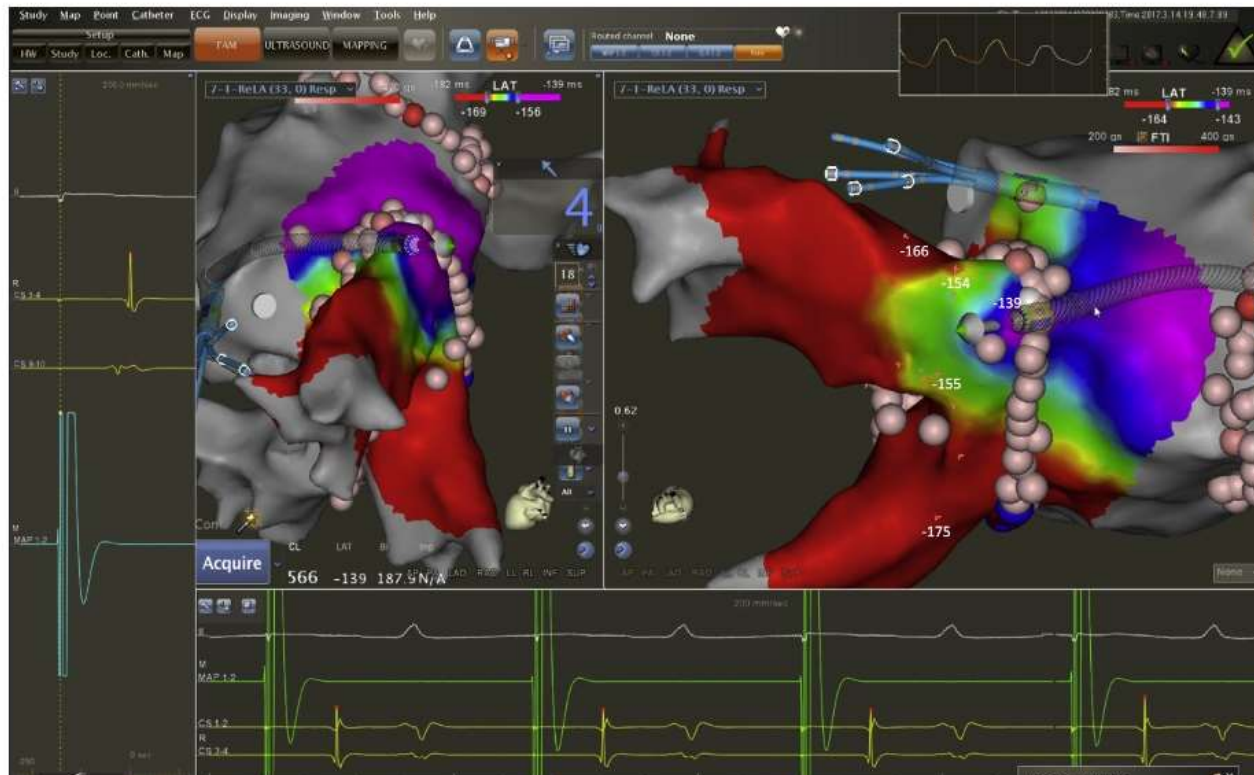


RSPV - SVC

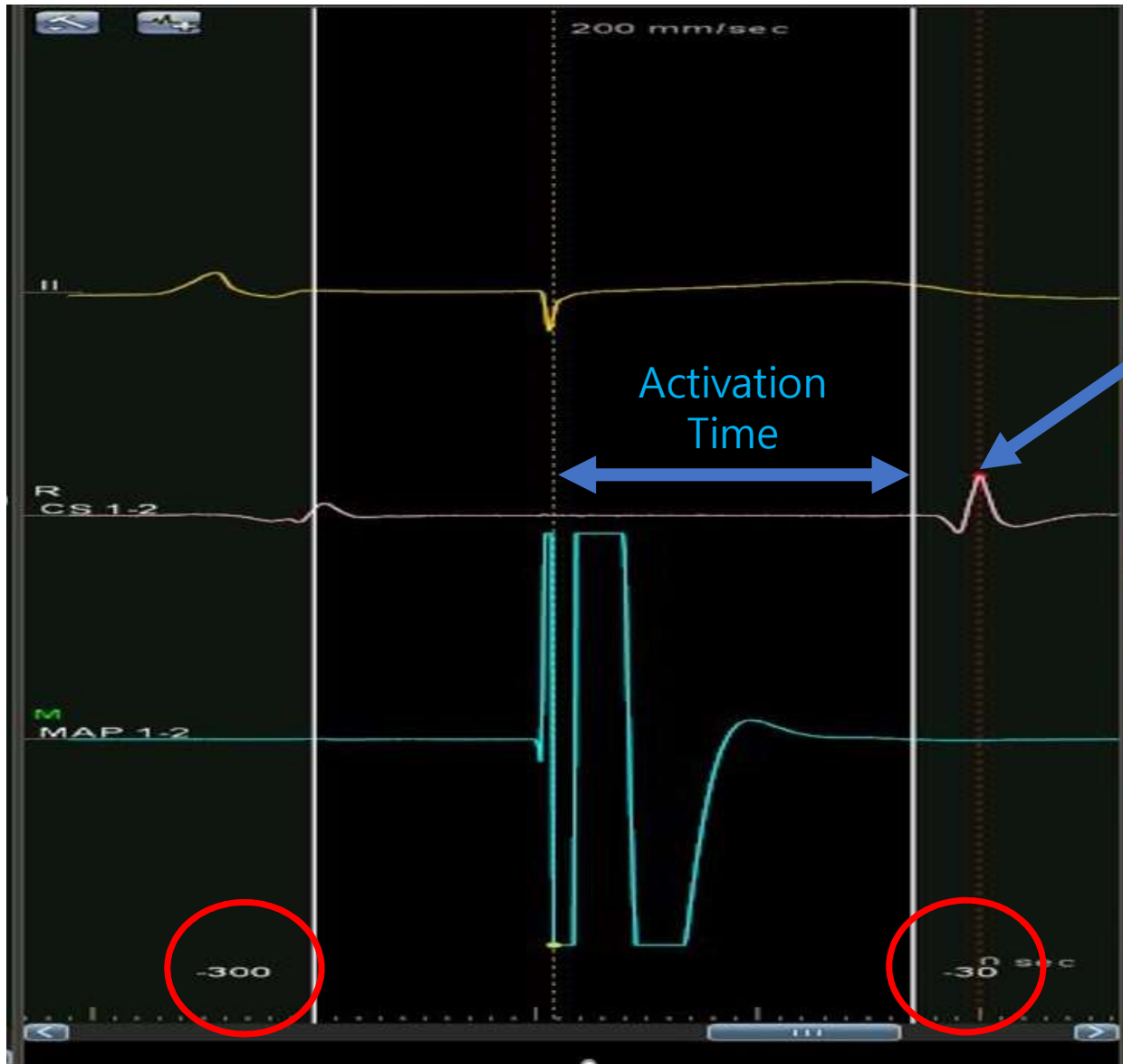


E
R
U
Fel

FIGURE 1 PV Escape Map



Whereas an operator is accustomed to looking for **red** regions as the earliest region of activation, in this technique, the colors are reversed. Pacing within the pulmonary vein (PV) circumferential lesion set will demonstrate the ablation gap in **purple**, denoting the shortest time to the mid-coronary sinus reference signal. Whereas multielectrode catheters are frequently placed deeper in the PV to check for the entrance and exit block, pacing with the ablation catheter allows for more proximal assessment of the exit block. This reduces the error of assessing inert distal PV tissue and allows for rapid identification of the ablation gap at an antral location. Additionally, this eliminates the need to use a second catheter to look for gaps. In the figure, the ablation catheter is capturing antral tissue, which is conducting to the reference catheter after 139 ms. Other points within the left veins demonstrate longer conduction times as evidenced by larger negative local activation time values. Ablation at this region of the ablation line eliminated the ablation gap. [Online Video 1](#) demonstrates escape mapping of an additional ablation gap after ablation of the above gap.



How to use AF and A Flutter induction?(post)

1. Induction test

- Burst atrial pacing
- Extra-stimuli -> A Flutter(Re-entry)

2. Drug -> Isoproterenol 0.6mcg/ NS 100ml

Complication

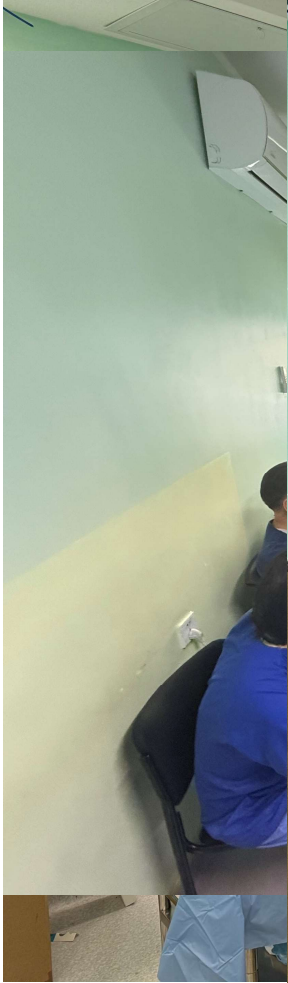
1. Cardiac Tamponade.
2. AV Block.
3. Puncture site(Pseudo Aneurysm, Hematoma)
4. Atrium – Esophageal Fistula
5. Phrenic nerve palsy.

Take home message.

1. 해부학적 위치 감각 => “지금 카테터가 어디에 있는지”를 머릿속에 그림으로 그릴 수 있어야 함
2. 기본적인 전기 신호 이해 => 복잡한 해석보다 “지금 리듬이 바뀌었는지”를 알아차리는 것이 중요
3. 시술 흐름을 아는 것 (AFL, AF) => 다음 단계 예측 가능 → 의사와 팀의 스트레스 감소
4. 안전에 대한 감각 => “괜찮겠지”가 아니라 조금이라도 이상하면 즉시 공유
5. 커뮤니케이션 능력 => 짧고 명확하게 보고 추측보다 관찰 사실 전달 타이밍을 놓치지 않는 소통
6. 침착함과 팀워크 => 응급상황에서도 차분함 유지 혼자 해결하려 하지 않기 팀 전체의 흐름을 우선

부정맥 시술은 팀 스포츠





감사합니다