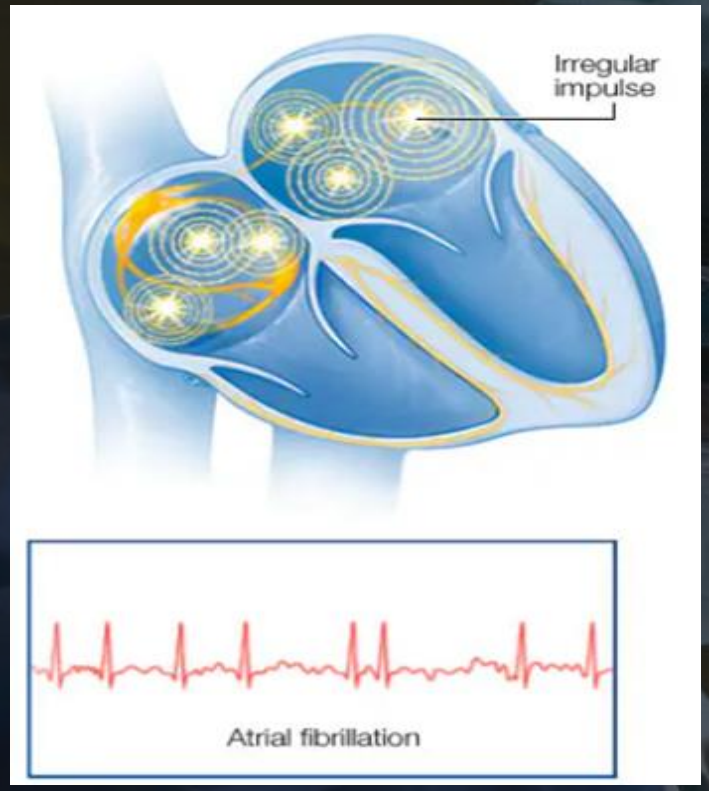
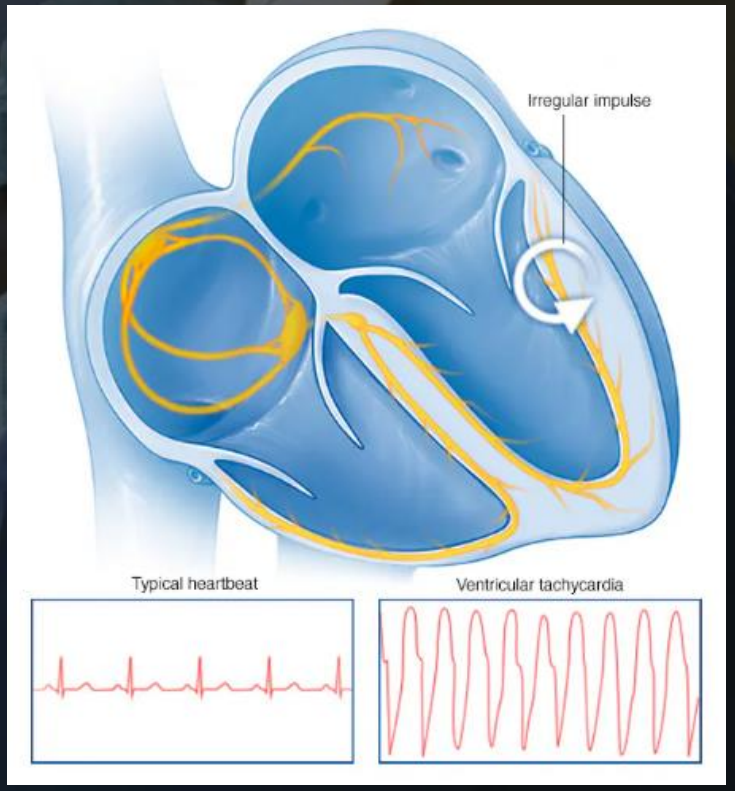
ARRYTHMIA SURGERY

SURYEUN CHUNG

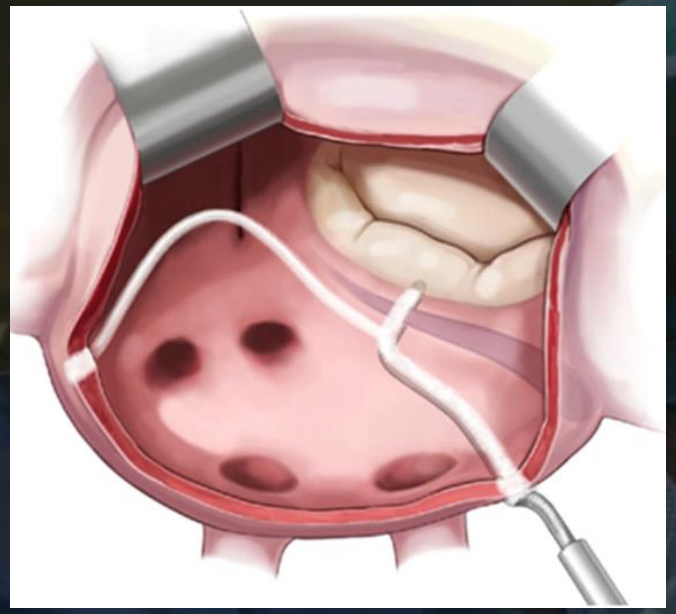
DEPARTMENT OF CARDIOVASCULAR SURGERY
SAMSUNG MEDICAL CENTER



WHAT IS ARRYTHMIA SURGERY ??

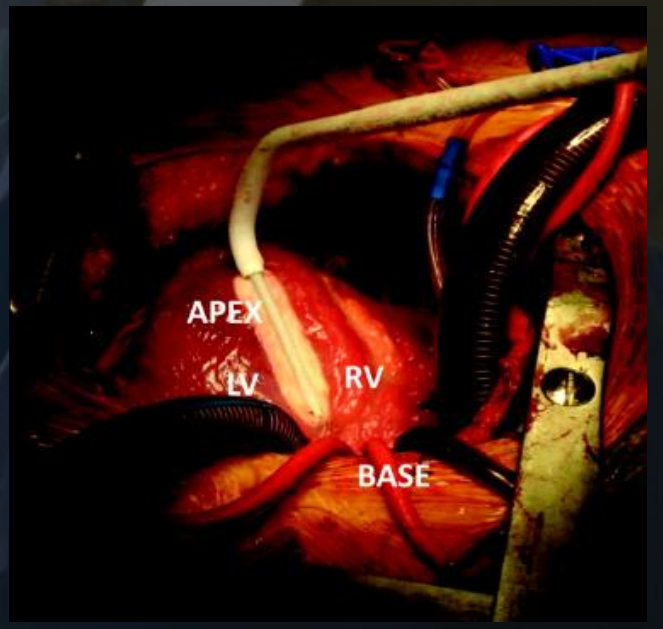


AGENDA



MAZE
OPERATION

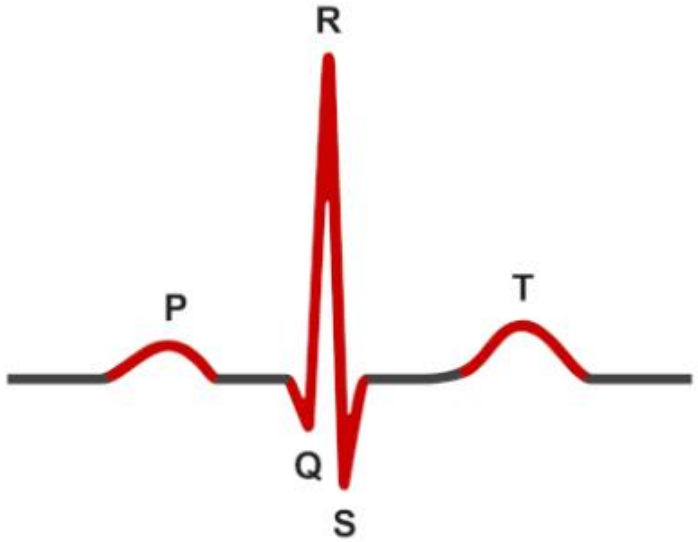
WHAT IS
ARRYTHMIA
SURGERY ??

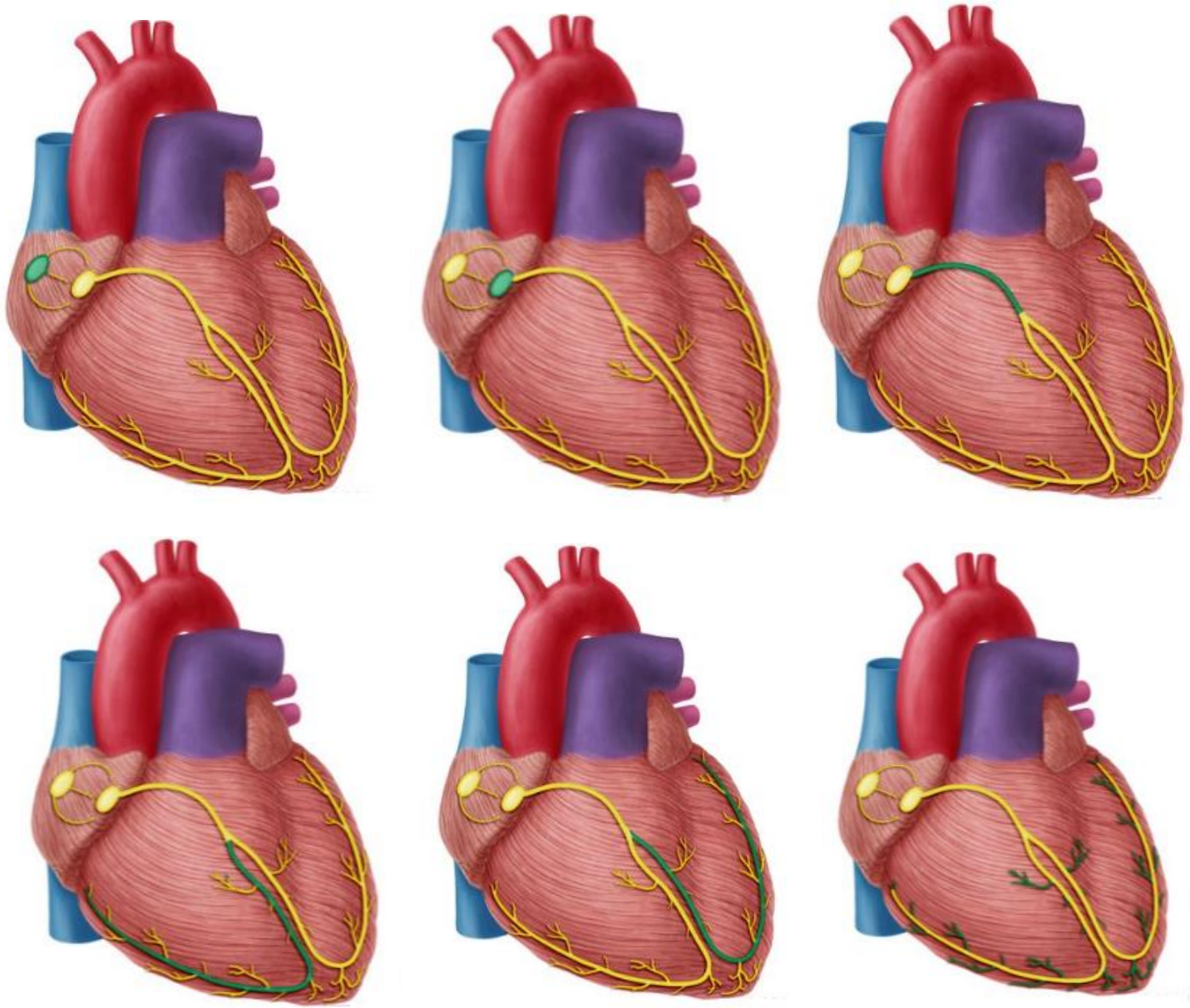


VT
ABLATION

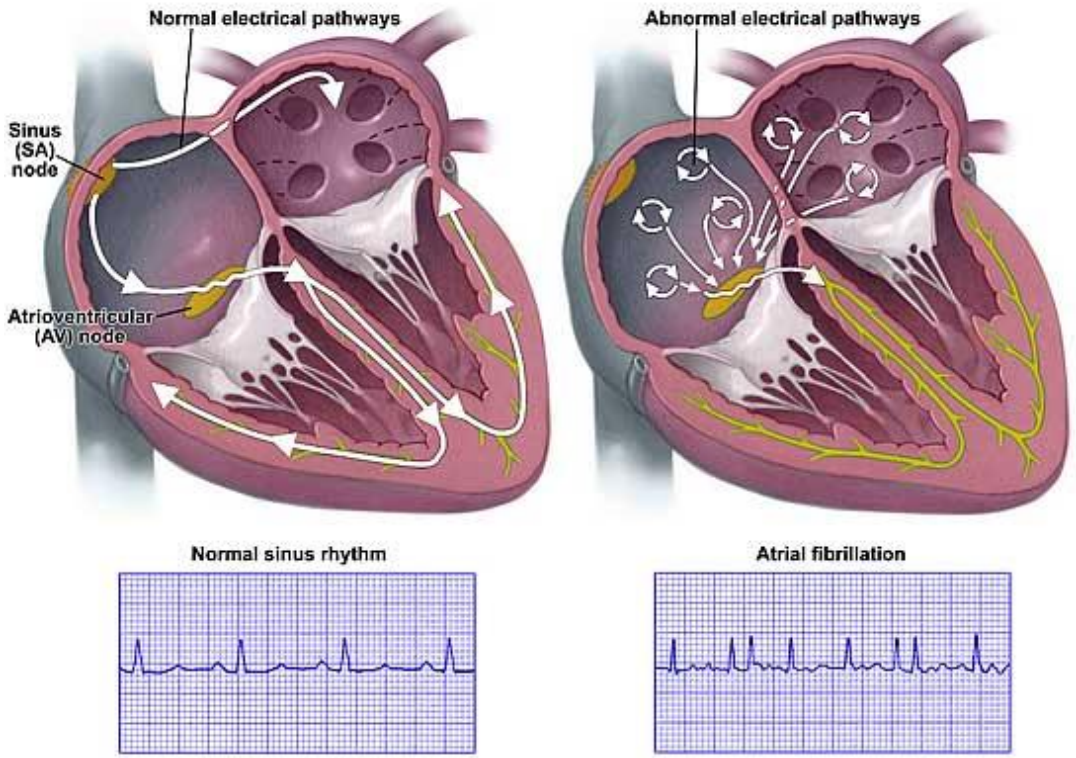
AGENDA

Normal cardiac rhythm

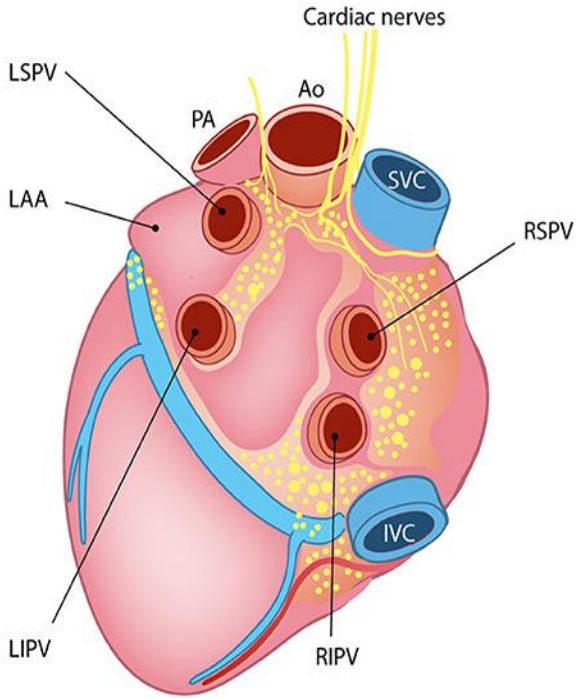


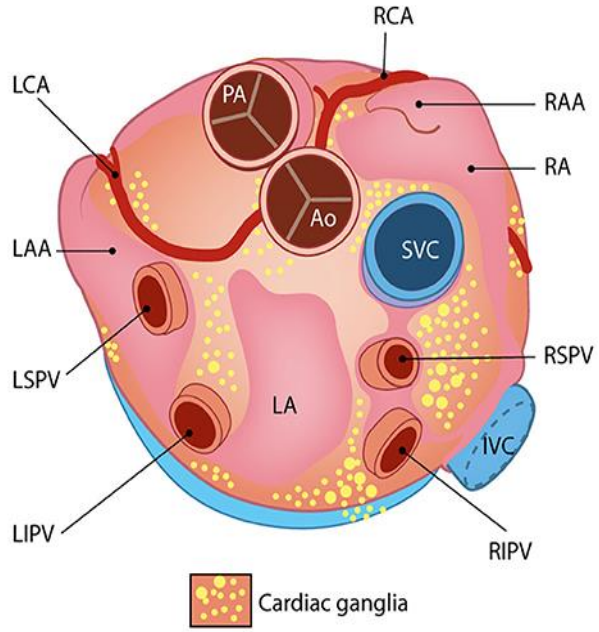


Atrial fibrillation



<Potential focus of Atrial arrythmia>

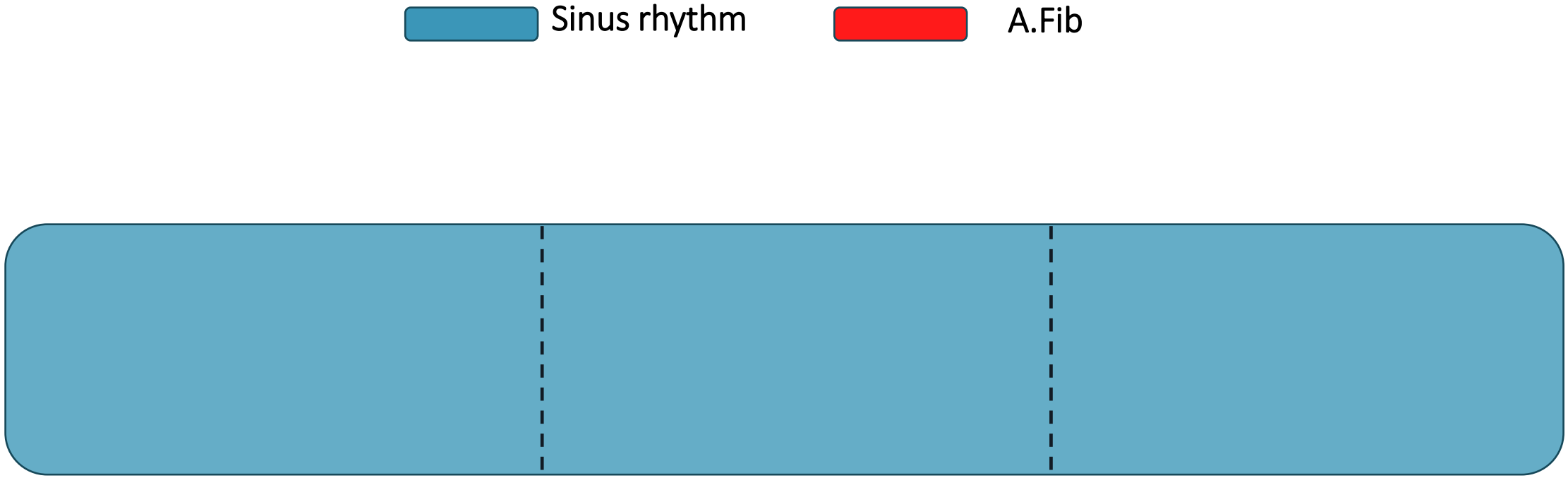




1. Pulmonary vein junction (70~80%)
2. Ganglionated flexus

(LA wall, LA roof, septum, IVC/SVC, coronary sinus, ligament of Marshall)

Time-based classification of A.fib



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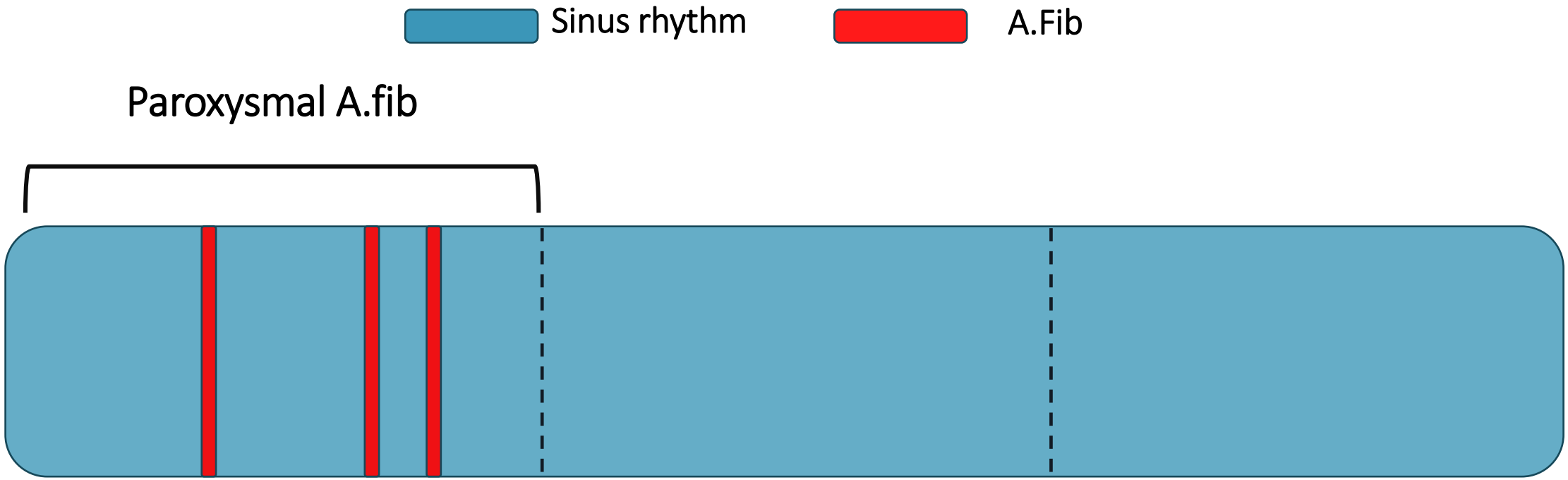
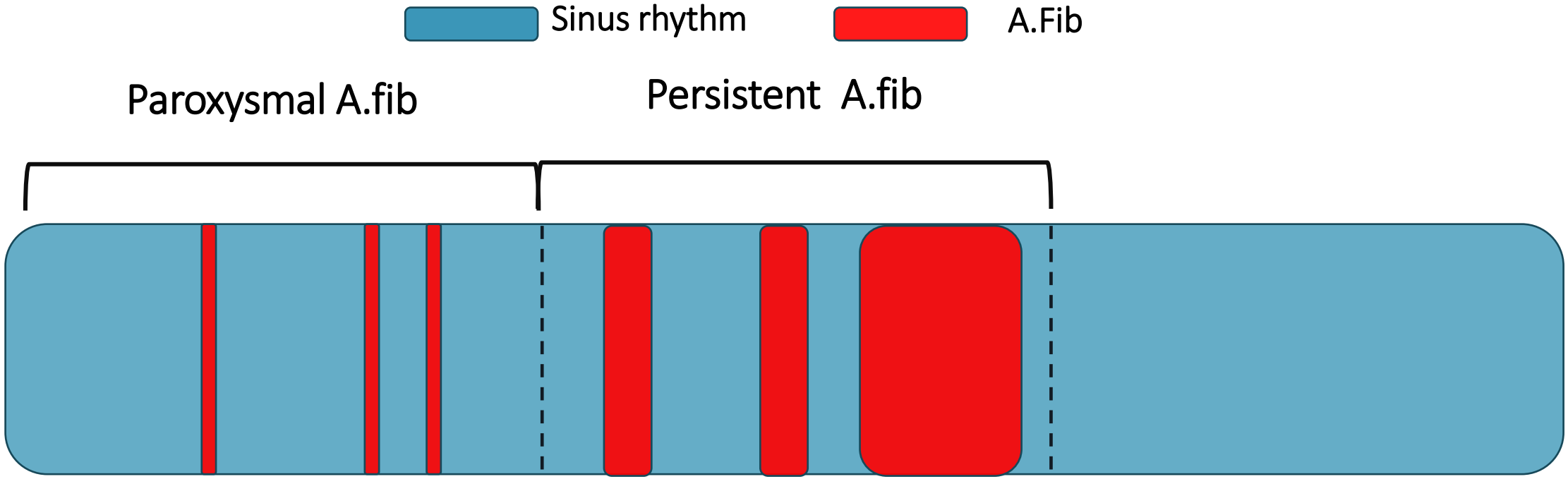


- **Paroxysmal A.fib** : Terminates spontaneously or with intervention **within 7 days** of onset

Time-based classification of A.fib



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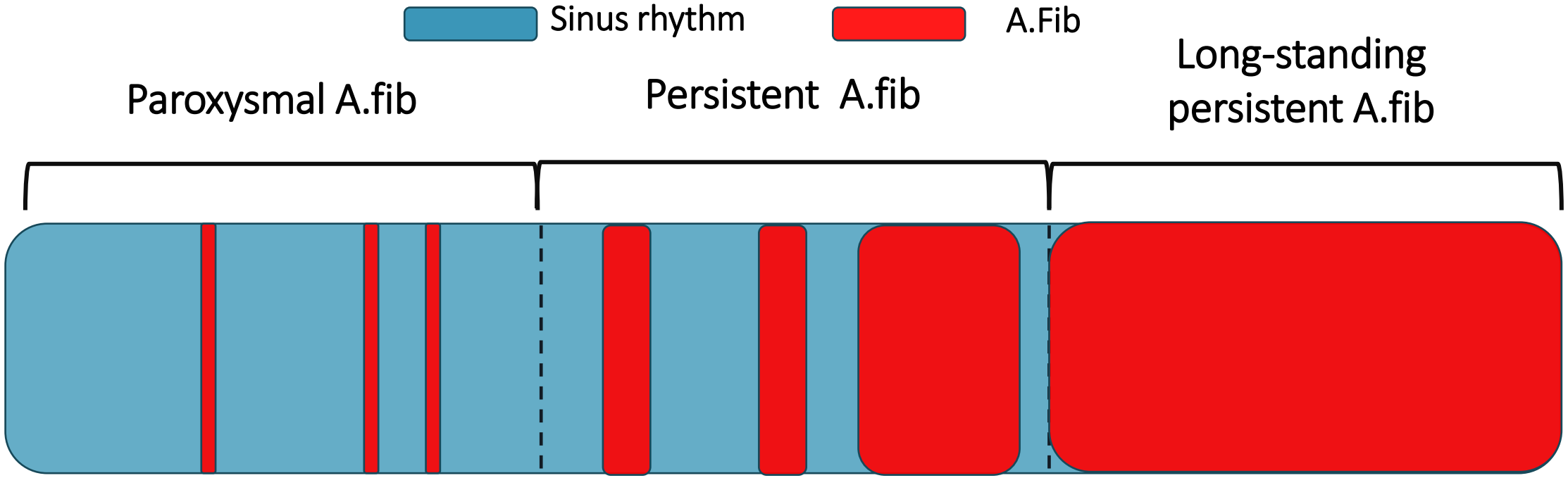
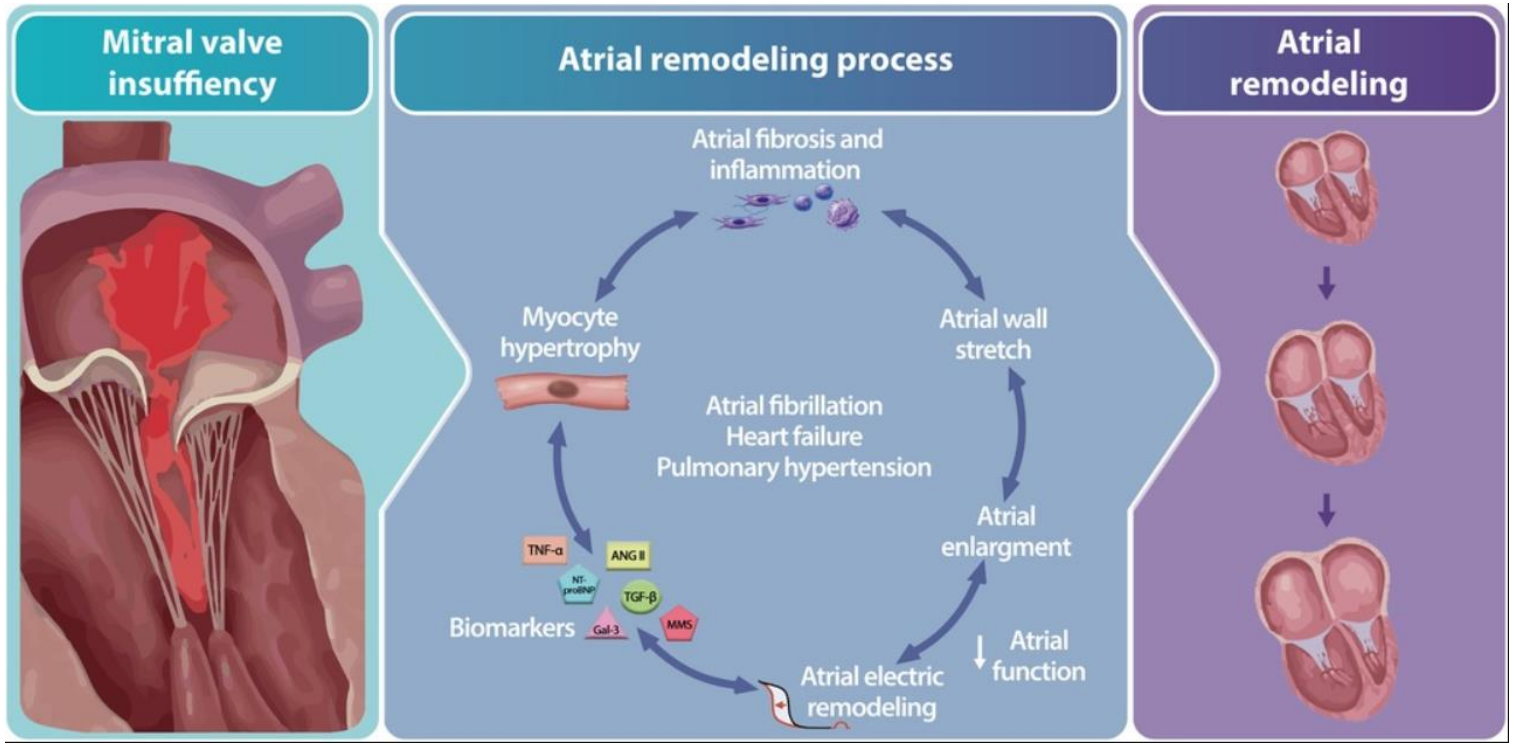


- **Paroxysmal A.fib** : Terminates spontaneously or with intervention **within 7 days** of onset
- **Persistent A.fib :** Lasts **more than 7 days** (need cardioversion)
- **Long-standing persistent A.fib :** Continuous atrial fibrillation lasting **≥12 months**.

Etiology-based classification of A.fib

•**Valvular A.fib**: Associated with **moderate-to-severe mitral stenosis** or prosthetic valve

•**Non-valvular A.fib**: All other cases (including mild valve disease)



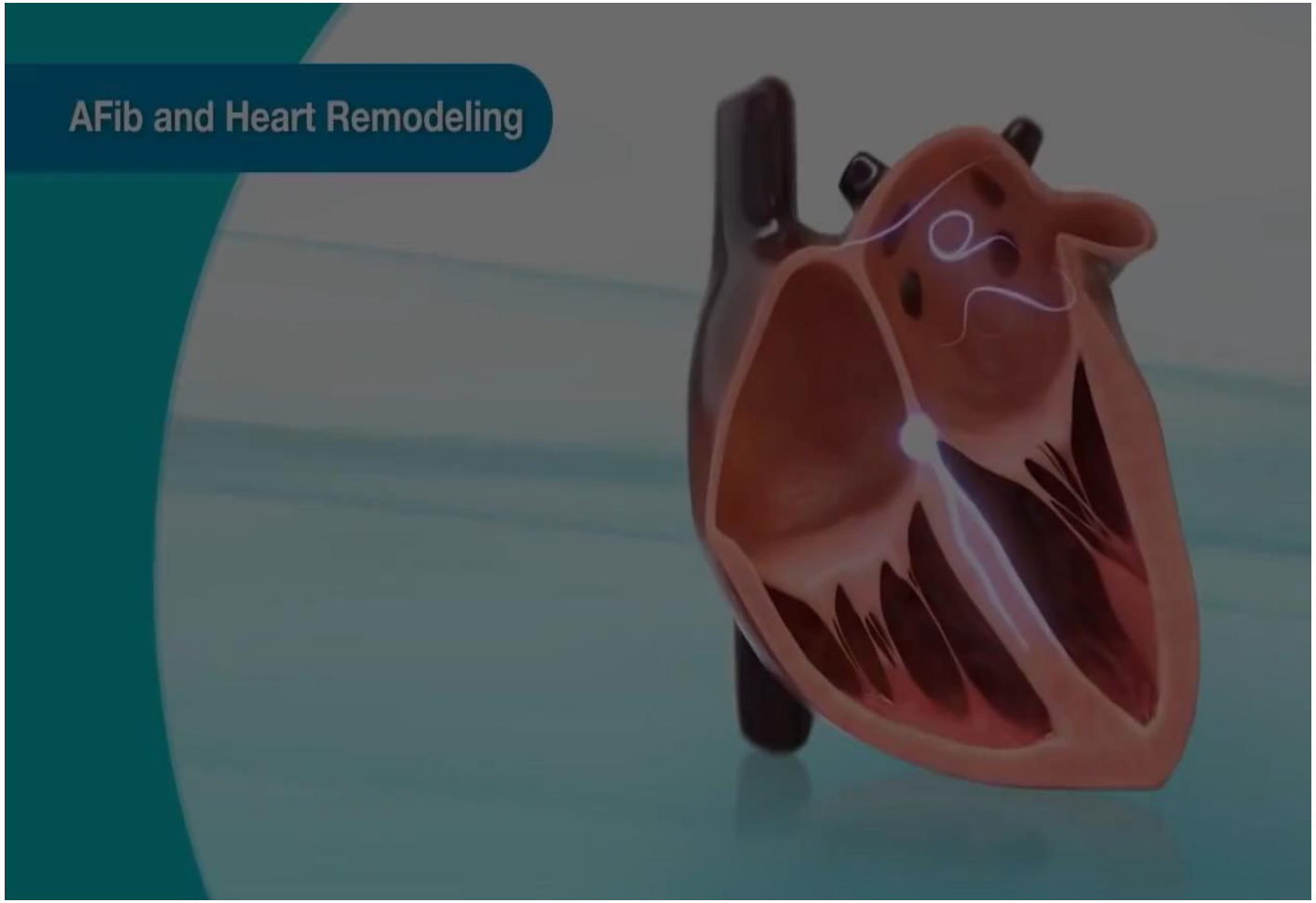
The role and implications of left atrial fibrosis in surgical mitral valve repair as assessed by CMR: the ALIVE study design and rationale

Why do we treat atrial fibrillation ??

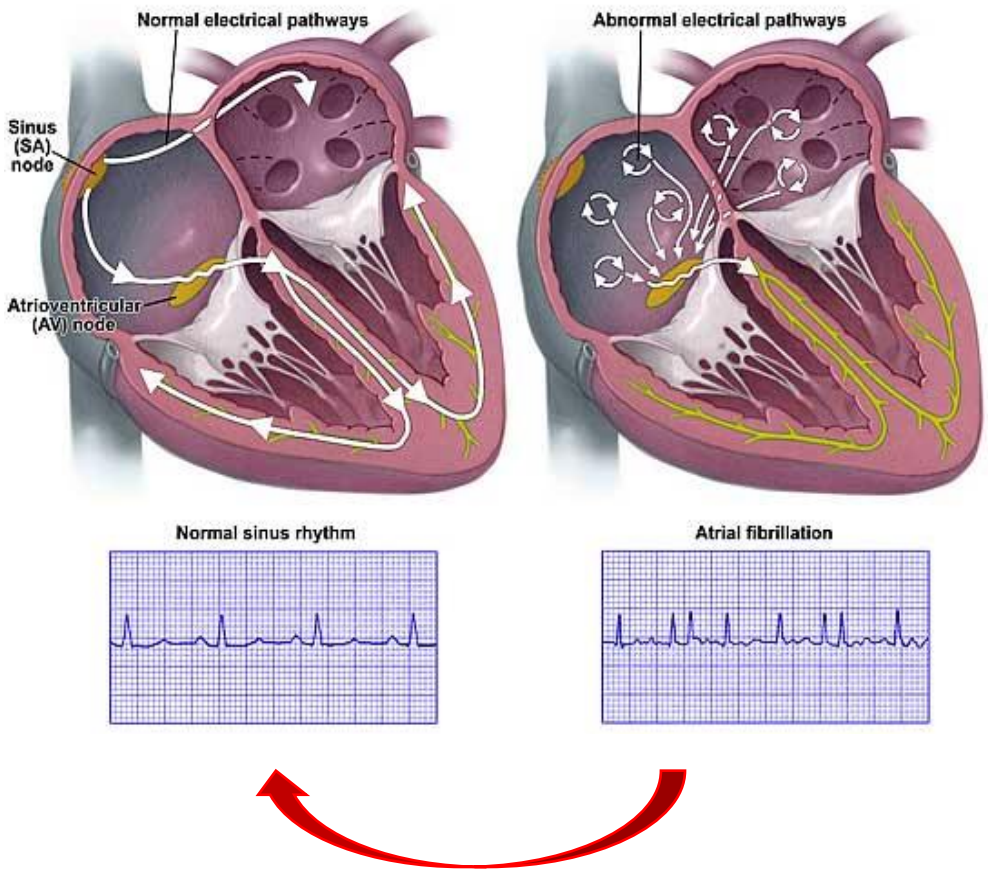
- Symptom control
  - Palpitation
  - Syncope
  - Dizziness

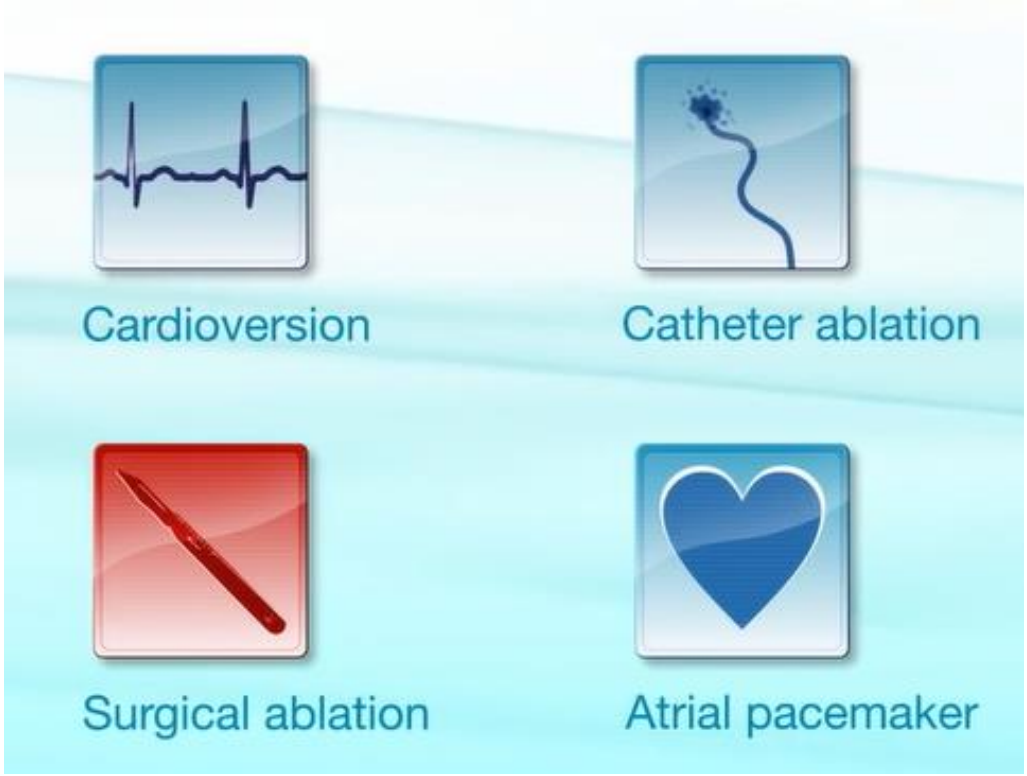
- Complication prevention
  - Stroke (4-5 times higher)
  - Prevent heart failure
  - Improve the survival rate

- Structure remodeling prevention



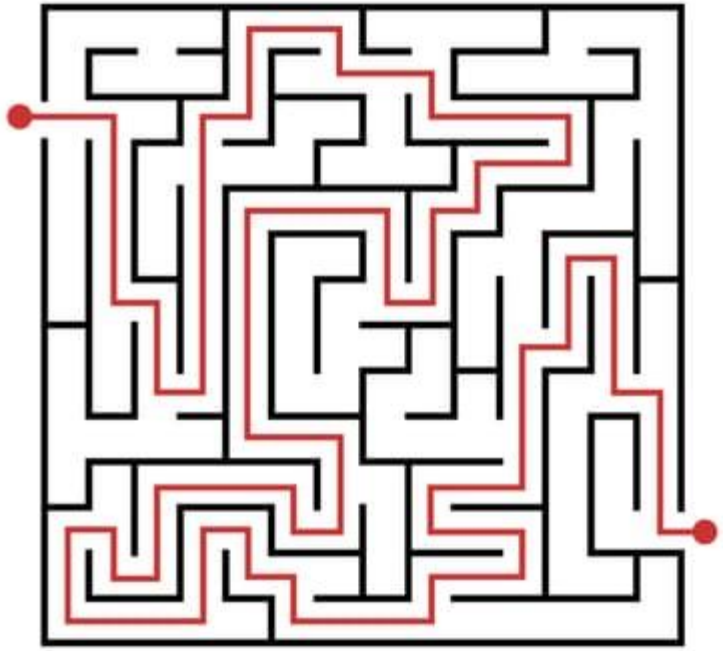
A.Fib Medical device and procedure





1. Rhythm control
2. Rate control
3. Anticoagulation (Prevention stroke)

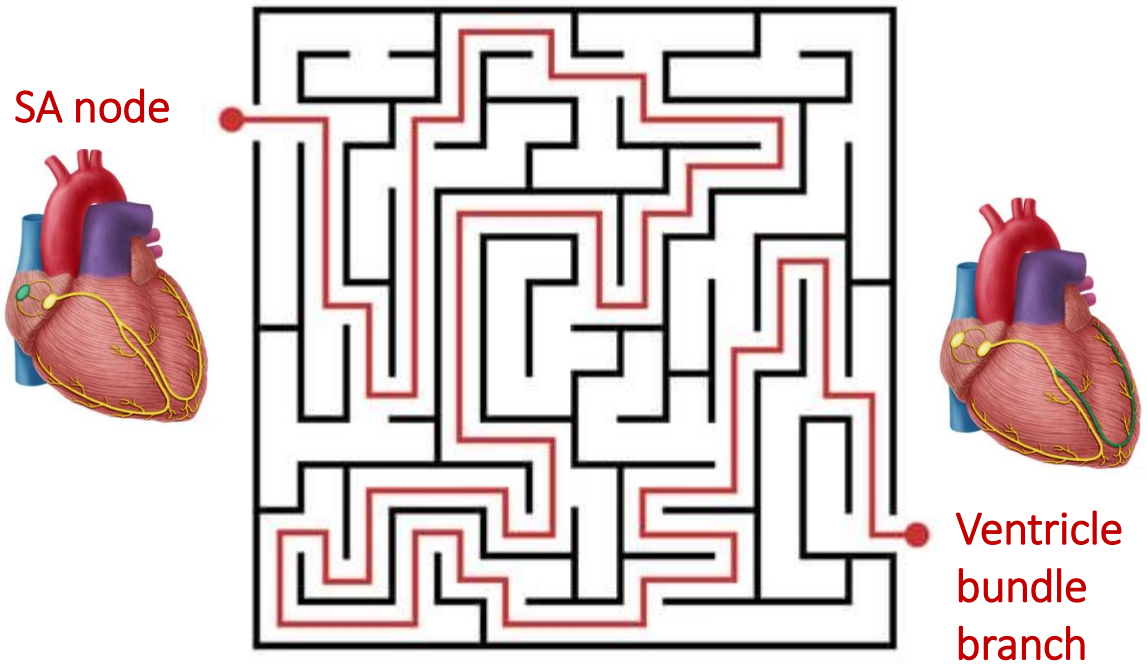
Cox-Maze operation ??



maze ★ ⊕

1. 명사 미로 (→labyrinth)
2. 명사 (규칙·내용 등이 많아서) 종잡을 수 없이 복잡한 것
3. 명사 美 미로 퍼즐

Cox-Maze operation ??



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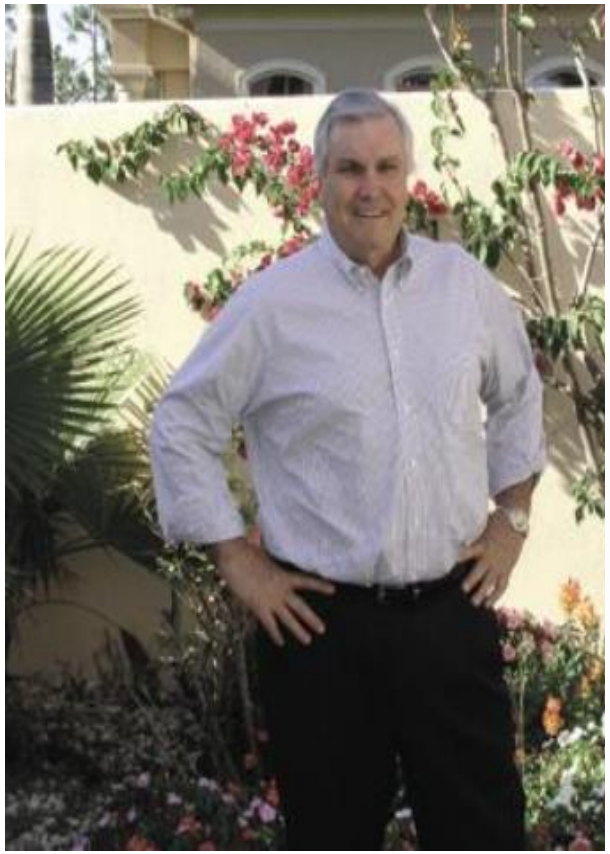
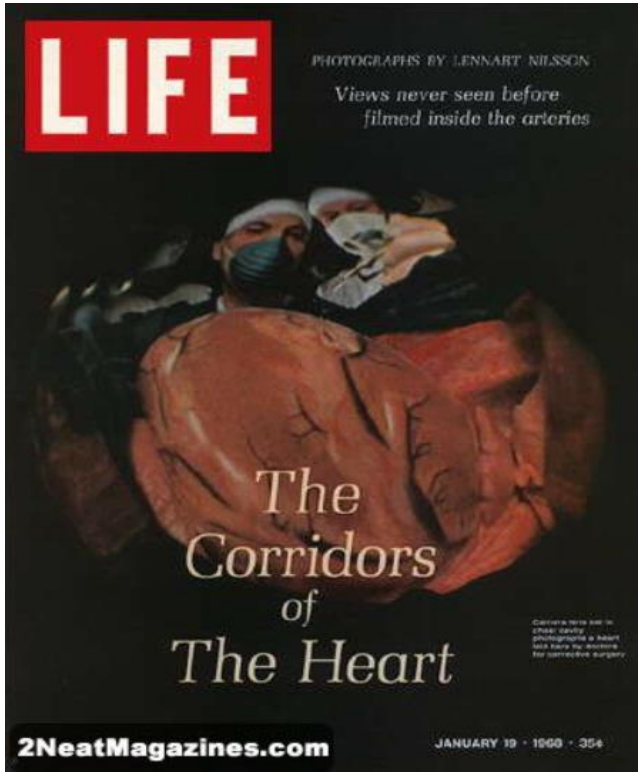
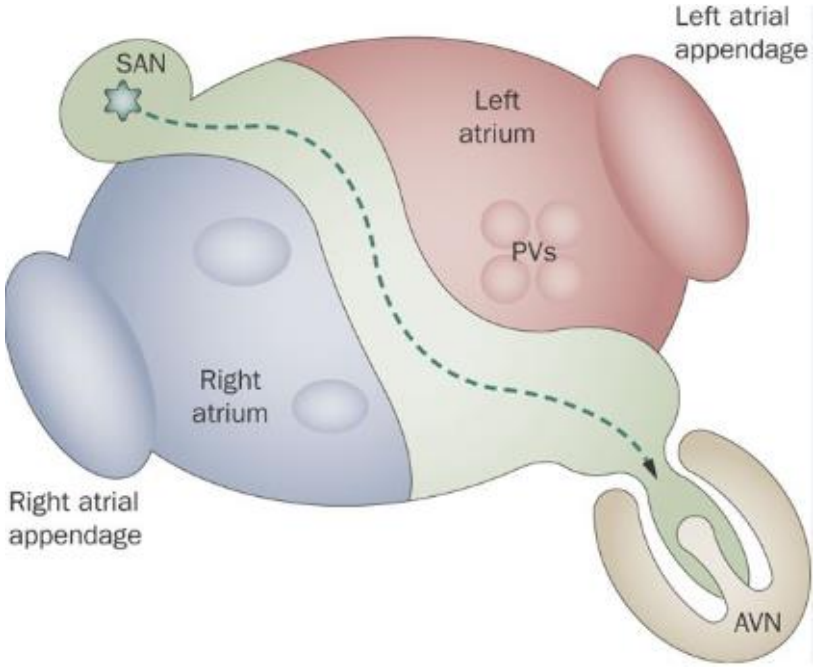


James L. Cox (born at 1942~)

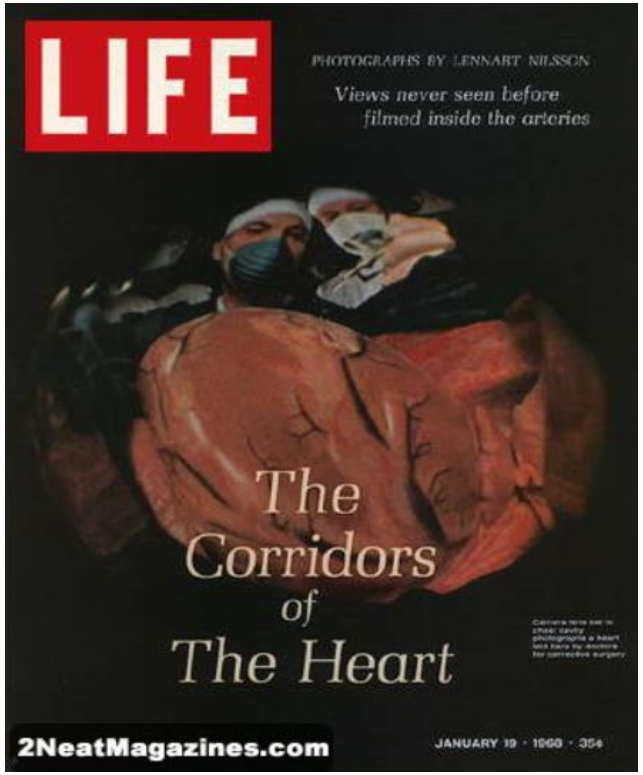
History of AF surgery

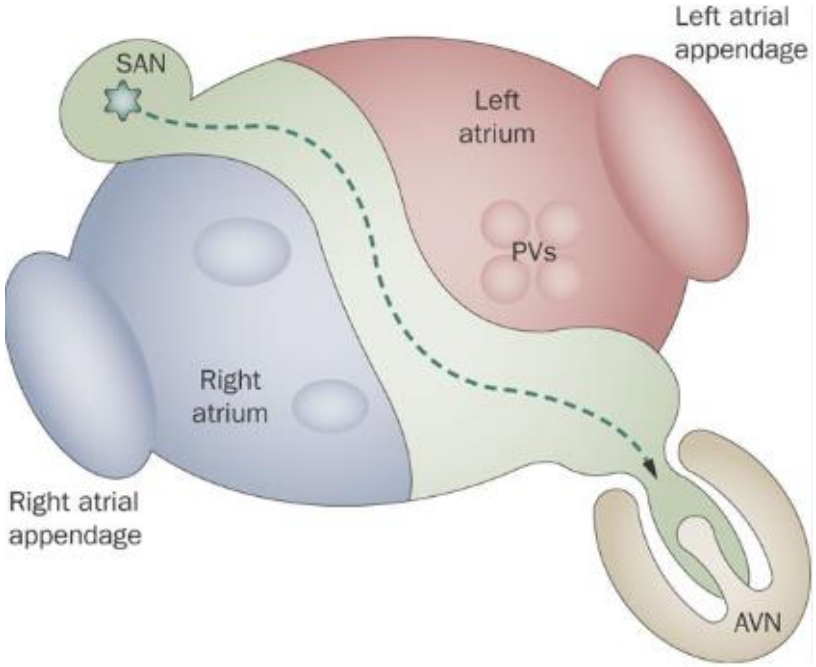




Developed in the 1980s as one of the first surgical attempts to treat AF.
Still Remained the AF and risk of thromboembolism
Loss of Atrial contractile contribution

History of AF surgery





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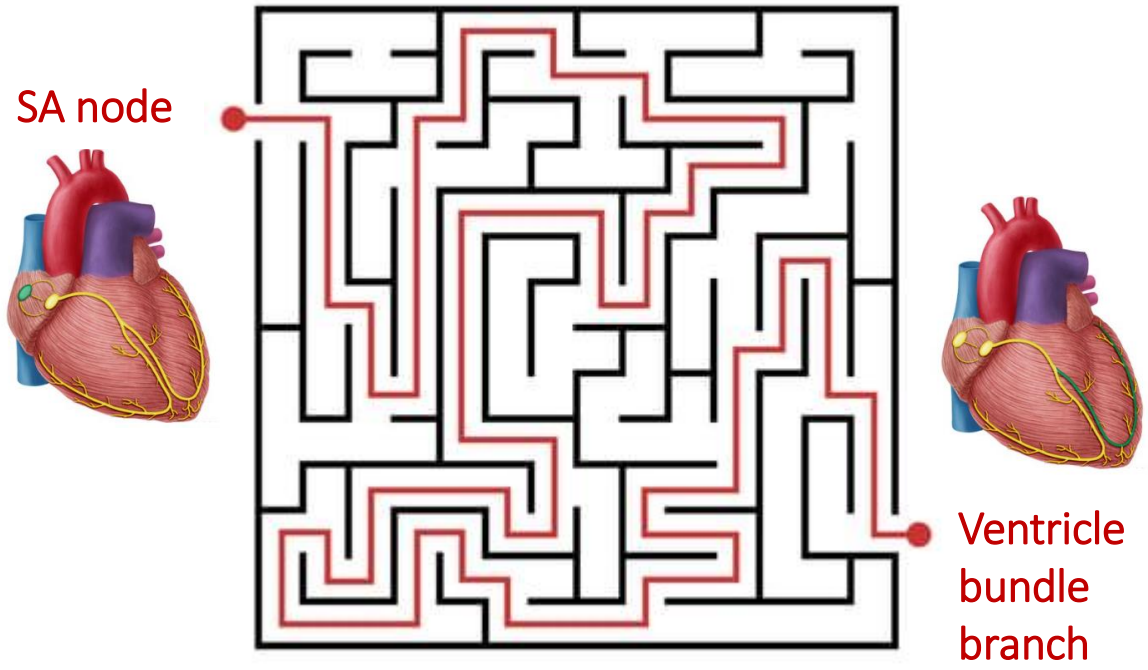
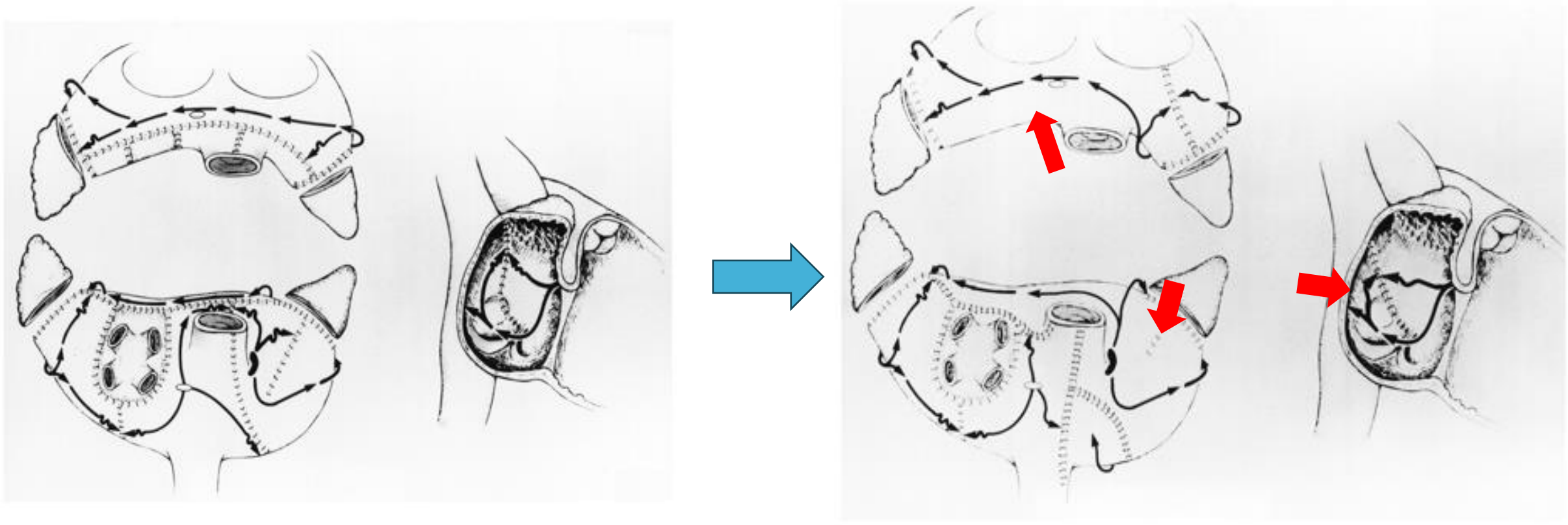
History of Maze surgery



Professor James L. Cox from St. Louis, USA, identified atrial trigger points in the electrophysiology laboratory and developed the maze lesion set to target them.

History of Maze surgery

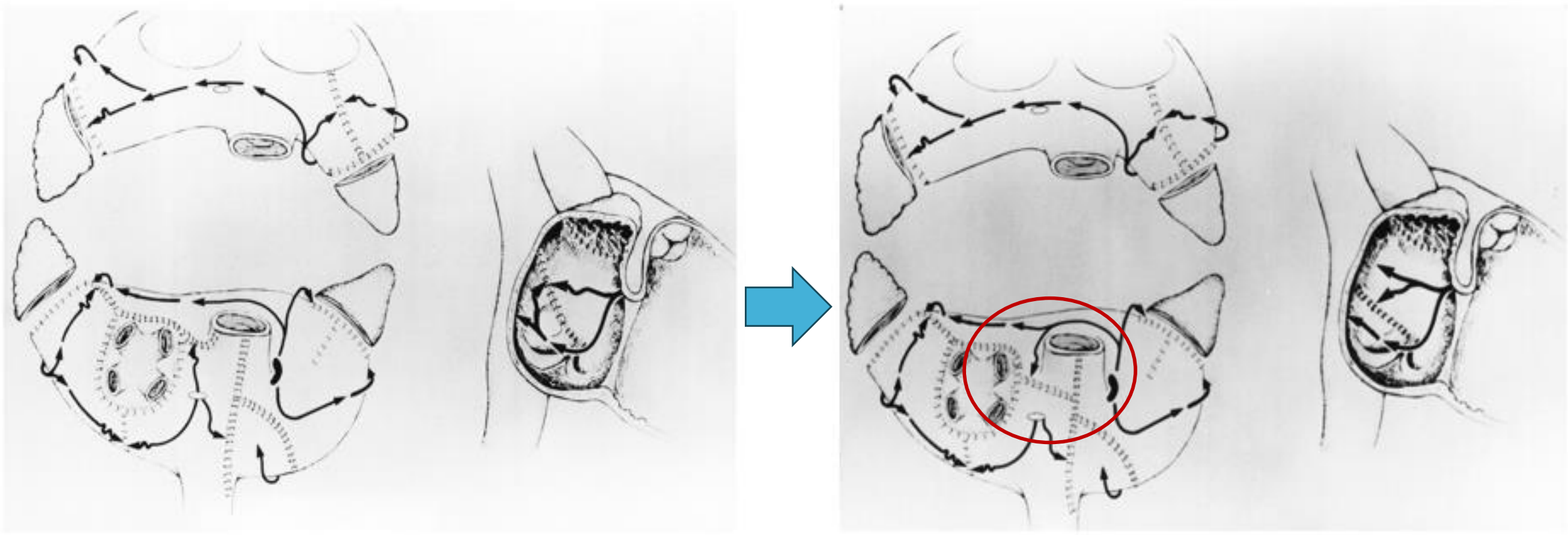


Cox-Maze I procedure
(Cut & Sawing technique)

1. intra-atrial conduction delay
   (Loss the LA contraction)
2. SA nod injury (chronotropic response)

Cox-Maze II procedure
(Cut & Sawing technique)

History of lesion set at Maze surgery

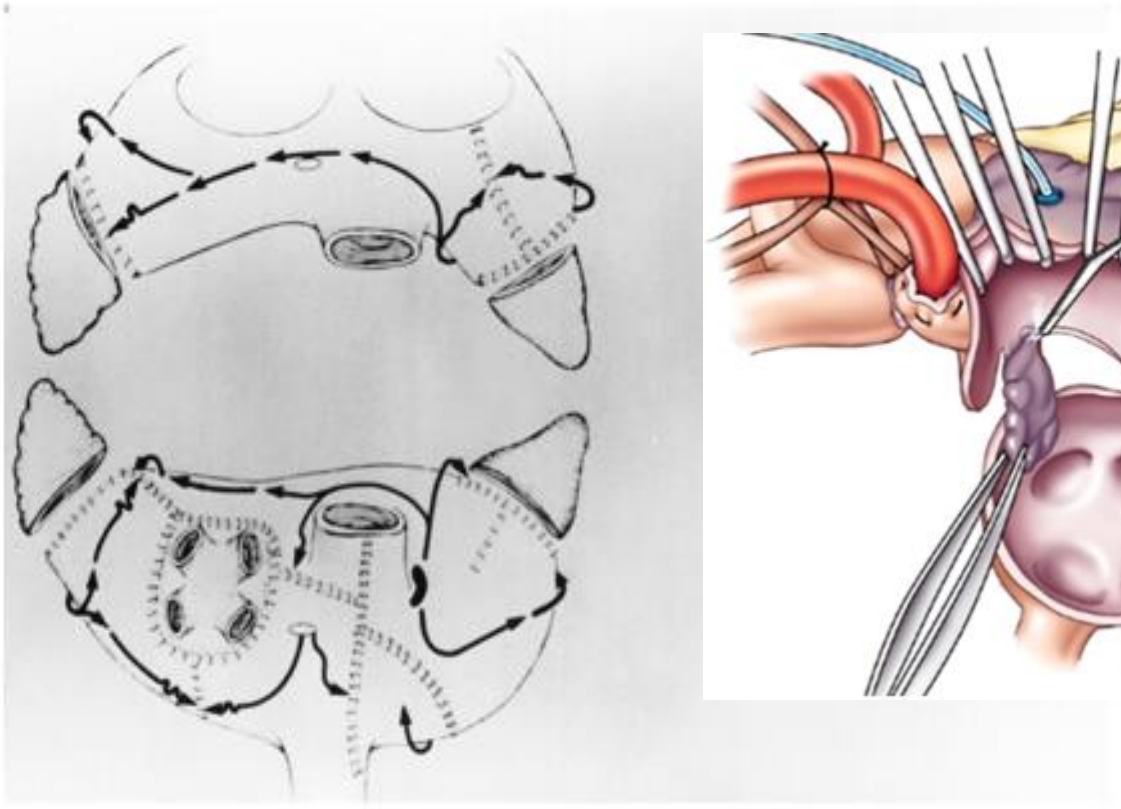


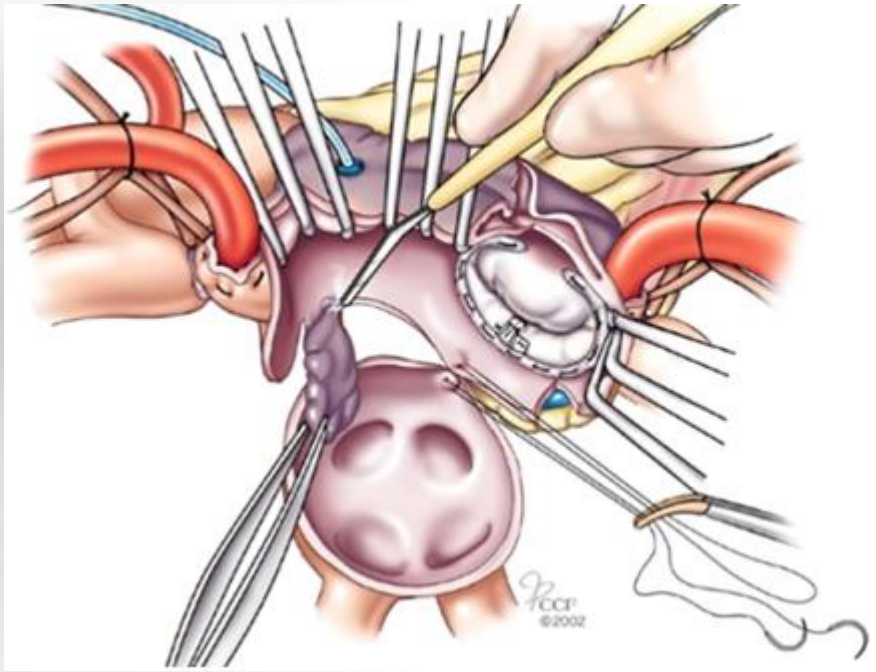
Cox-Maze II procedure
(Cut & Sawing technique)

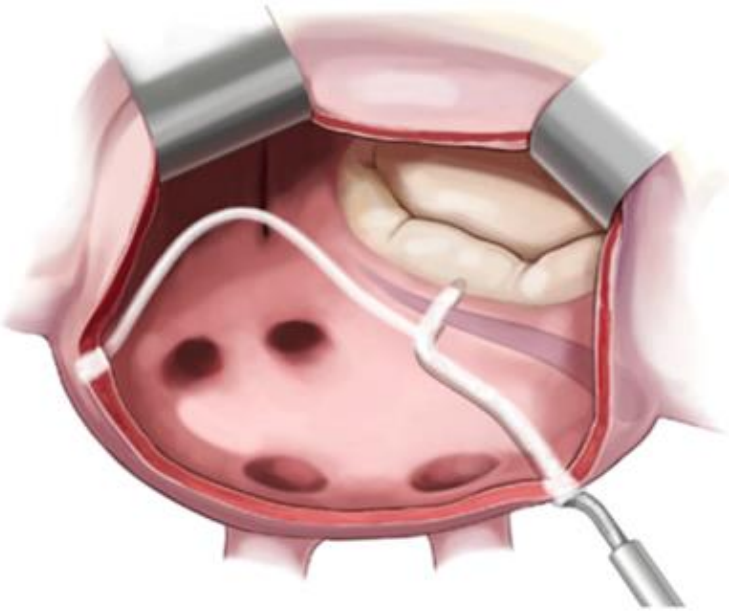
1. Too complex lesion (SVC cutted)
2. Long operation time
3. High risk of Bleeding

Cox-Maze III procedure
(Cut & Sawing technique)
Golder standard lesion set

History of lesion set at Maze surgery



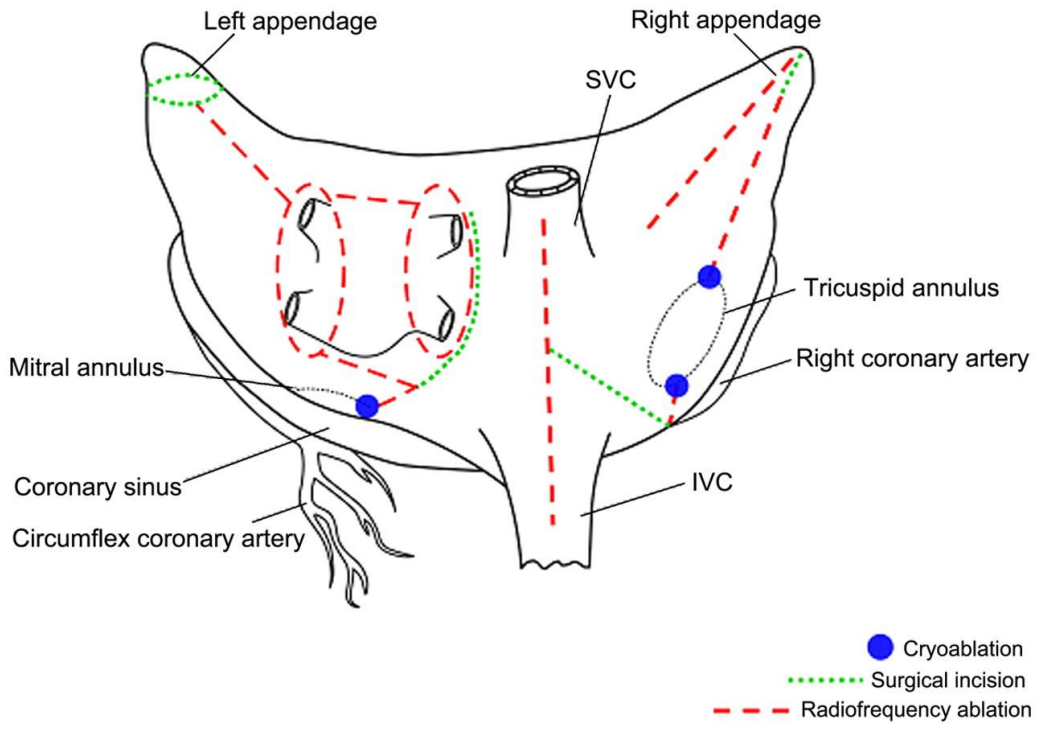




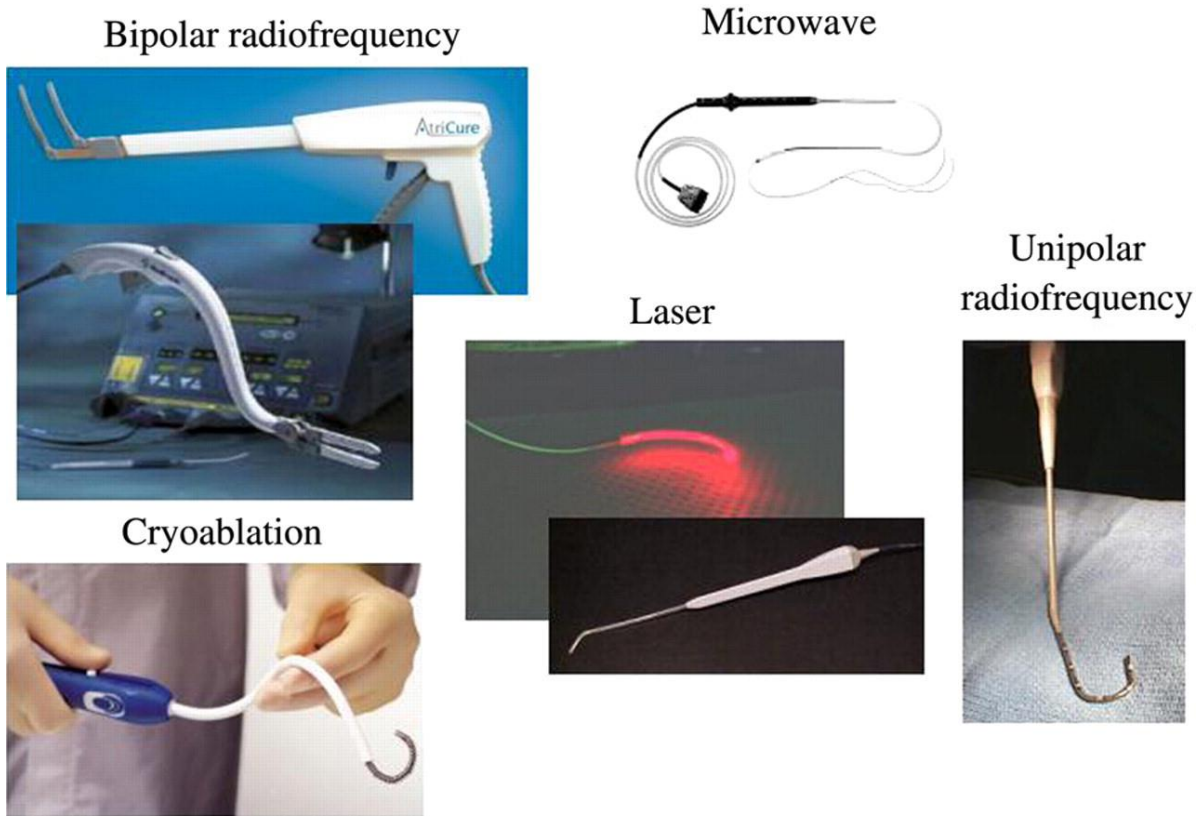
Cryoablation

Modified Cox-Maze III procedure
(Change the energy source (with cryoablation))
Faster / Easy / low risk of bleeding

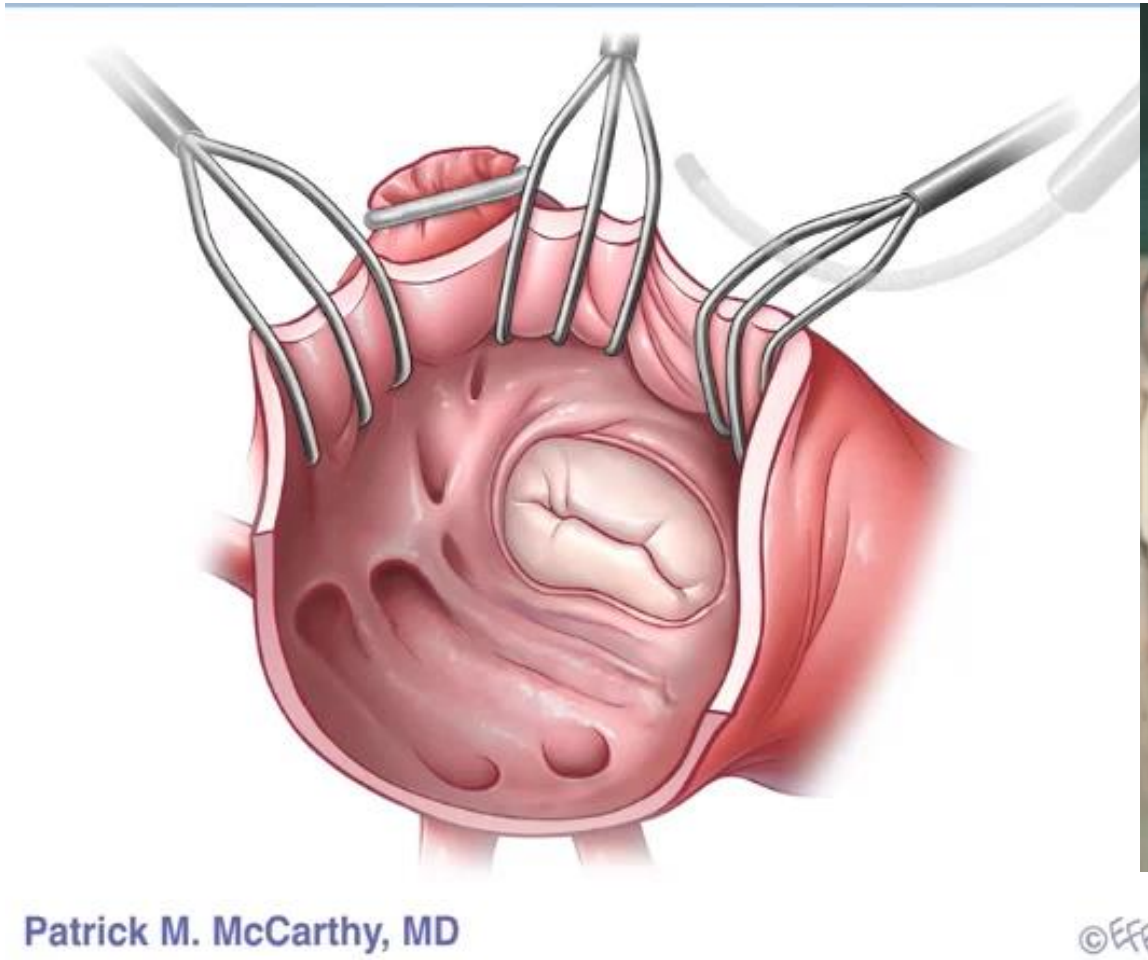
History of lesion set at Maze surgery



Maze IV procedure
(Multiple energy source + Less cutting line)

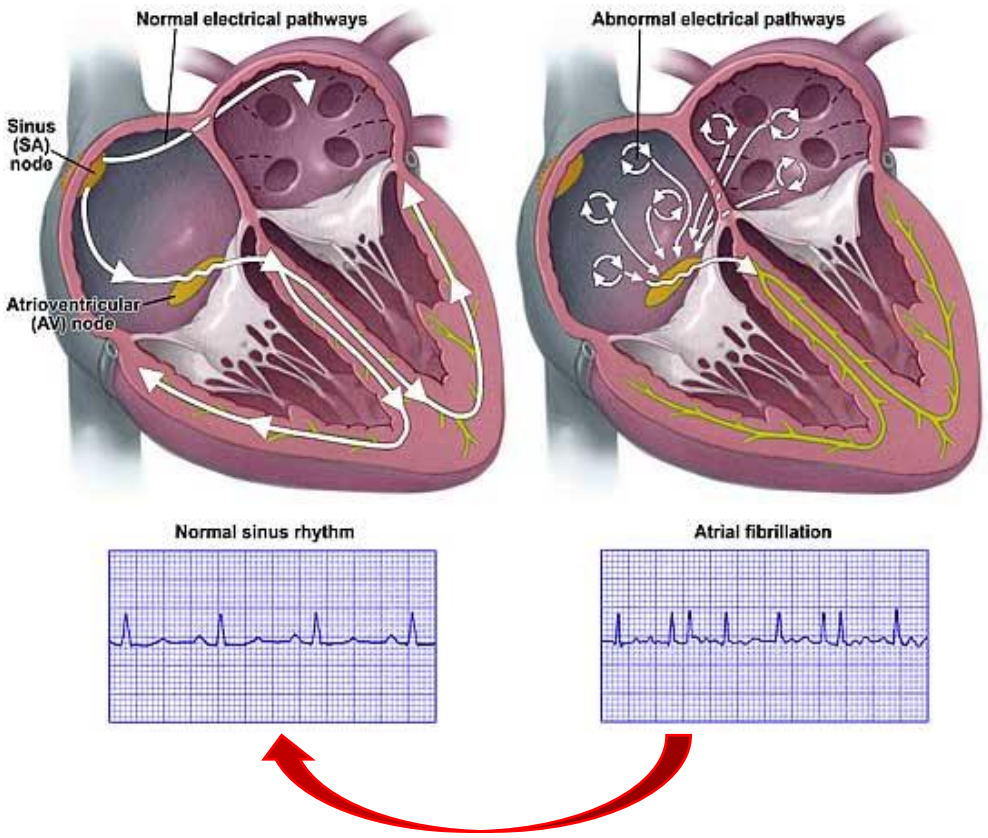


Modified Cox-Maze III operation



Simple But Effective Modifications to the Cox Maze Procedure Using Only Cryoablation

Success rate and predictor after Maze operation



Success rate : 80-90% after Maze III operation

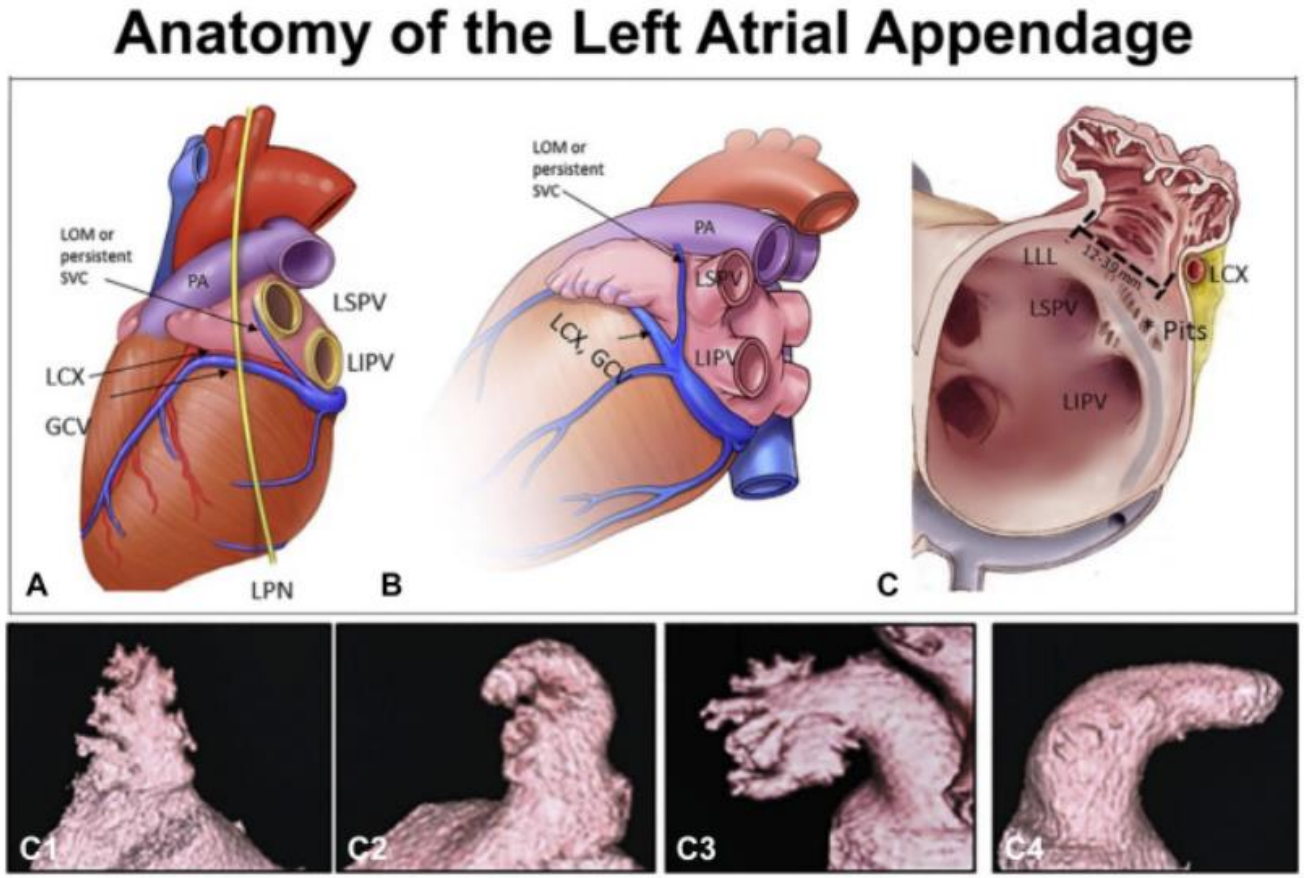
Long duration of A.fib (Paroxymal >> Long-stading persistent)

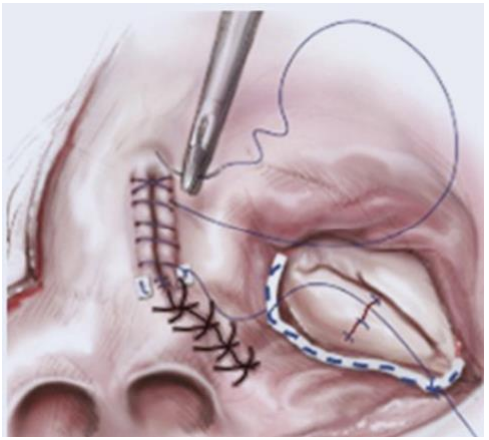
Huge LA diameter (LA fibrosis remodeling)

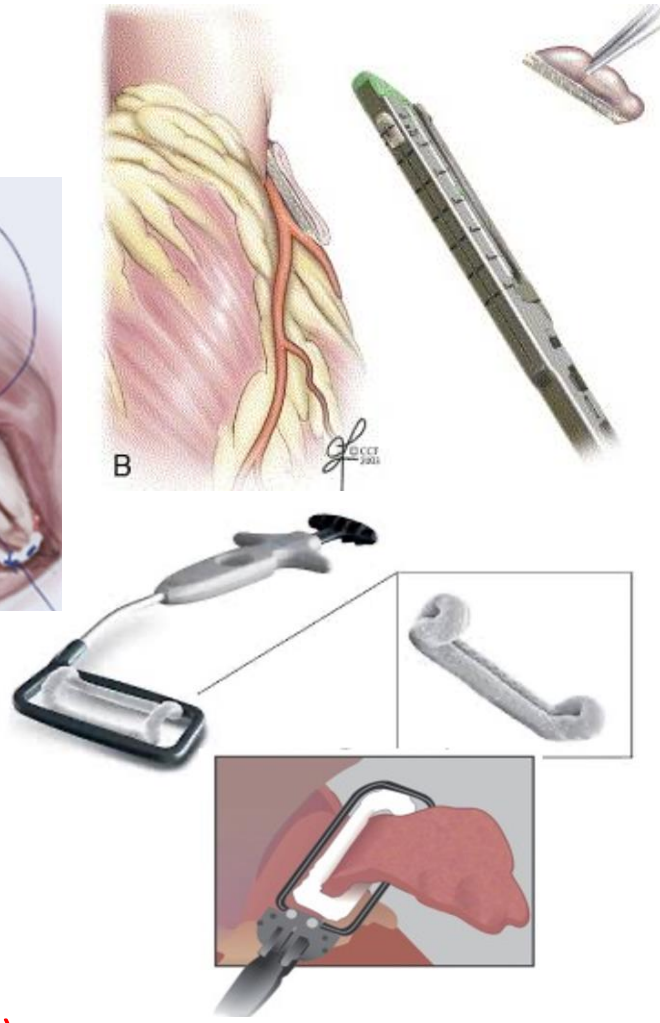
Expert surgeon skill (Lesion set completeness)

The long-term outcomes and durability of the Cox-Maze IV procedure for atrial fibrillation (J Thorac Cardiovasc Surg 2022;163:629-41)

LAA control during procedure



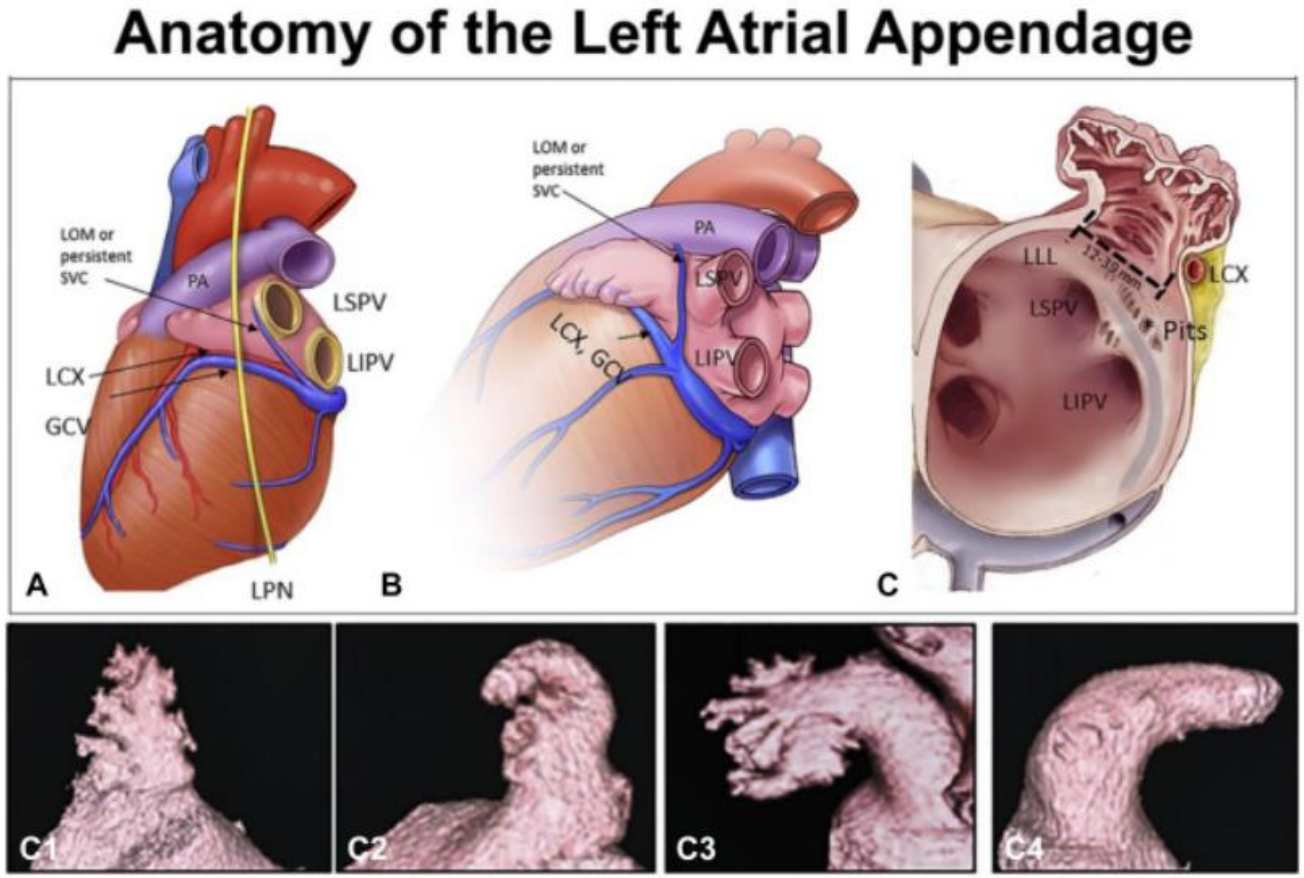


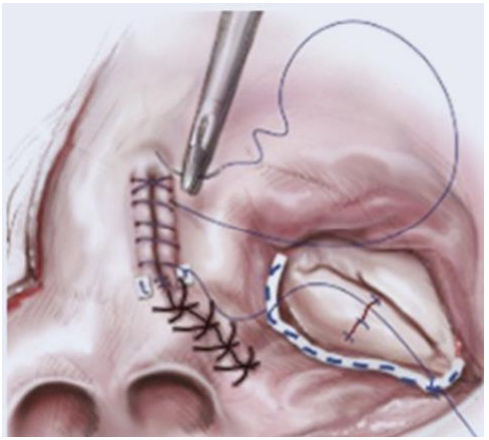


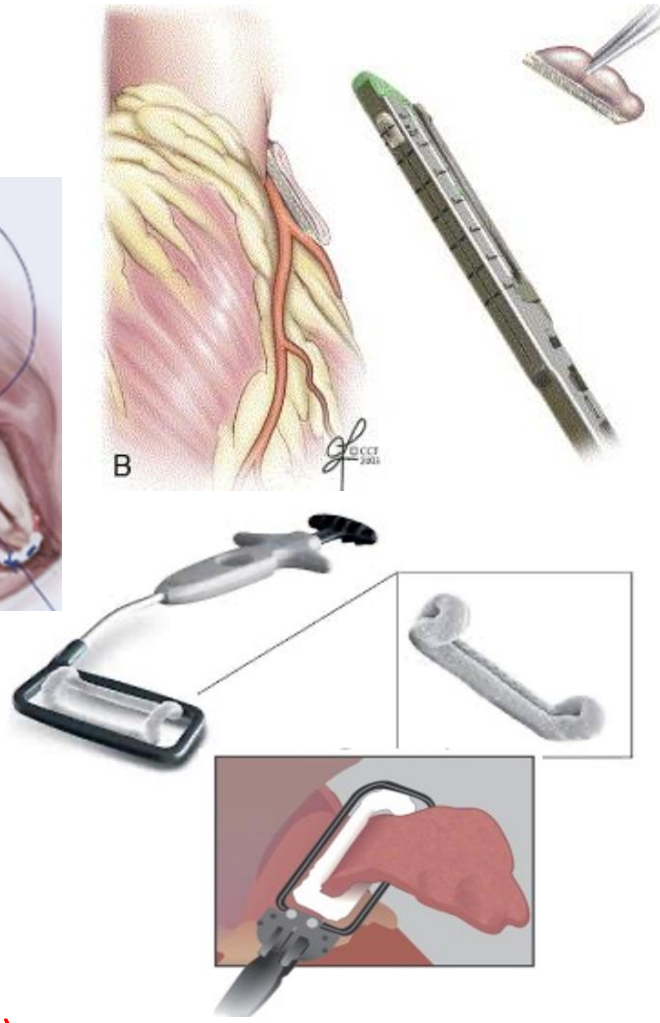
"cactus" "windsock" "cauliflower" "chicken wing"

Cauliflower > Windsock >Cactus> Chicken wing (Risk of thromboembolism)

LAA control during procedure







"cactus" "windsock" "cauliflower" "chicken wing"

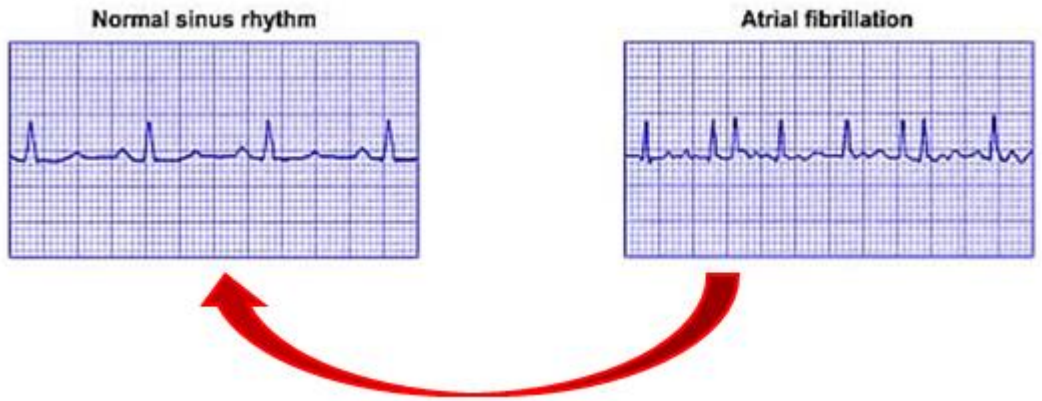
Cauliflower > Windsock >Cactus> Chicken wing (Risk of thromboembolism)

Management after Maze operation

- **Recommendation with Level of Evidence**

a. Surgical AF ablation is recommended in patients with AF undergoing a surgical procedure requiring an opening of the left atrium, such as mitral valve surgery. (Class I, Level of Evidence: B)

b. Education, training, and proctoring are recommended to enhance uptake and improve outcomes. (Class I, Level of Evidence: C)



- "Window period " after Maze operation
  - Blanking period (3months after surgical ablation)
  - Inflammation reaction , atrial remodeling, and healing of ablation/incision lines.
  - Transient atrial arrhythmias (such as atrial fibrillation, atrial flutter, or atrial tachycardia)
  - Do not necessarily indicate failure of the operation.

2023 APHRS expert consensus statements on surgery for AF

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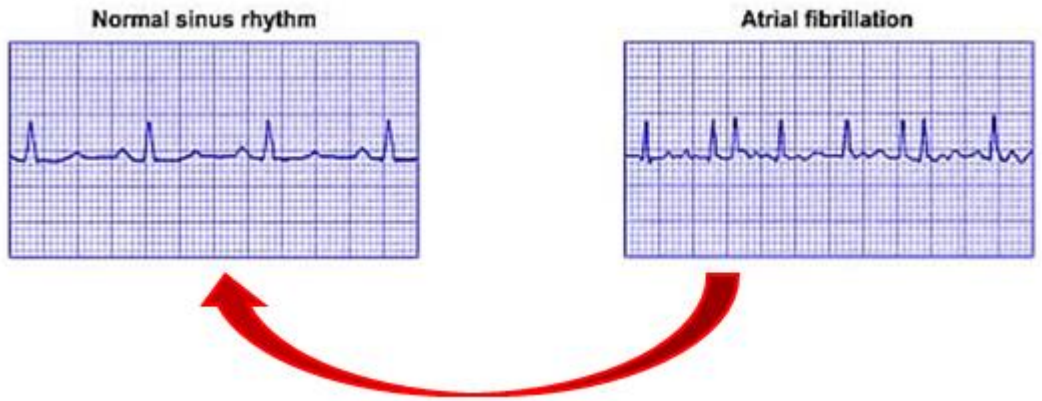

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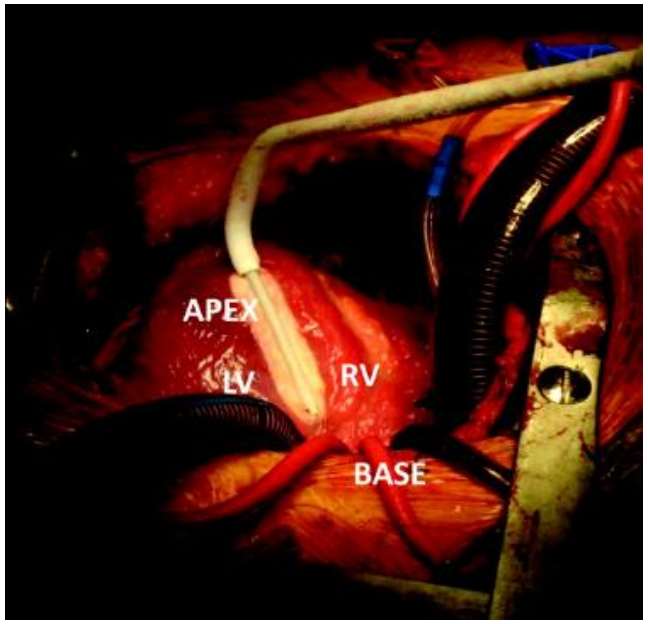
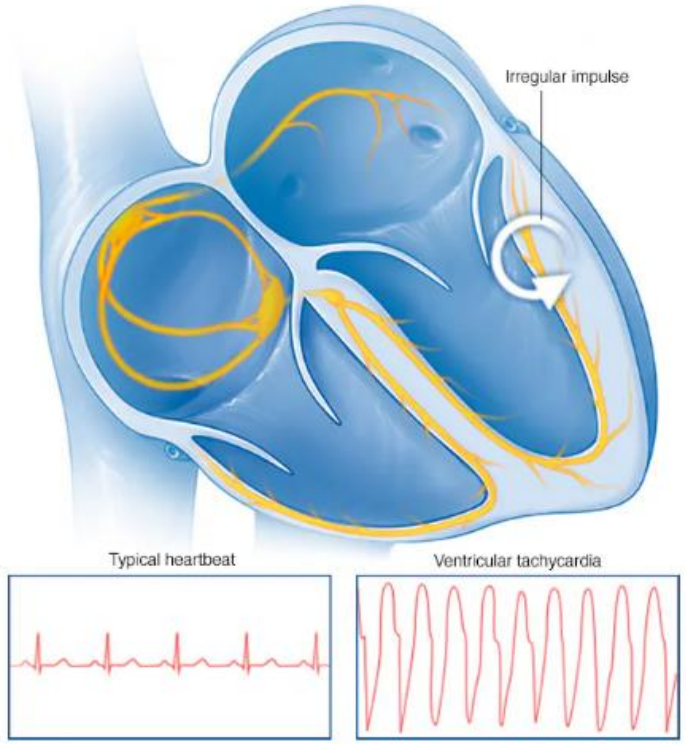
Maintain the antiarrhythmic drug (AAD) and anticoagulation medication according CHA2DS2-VASc score.

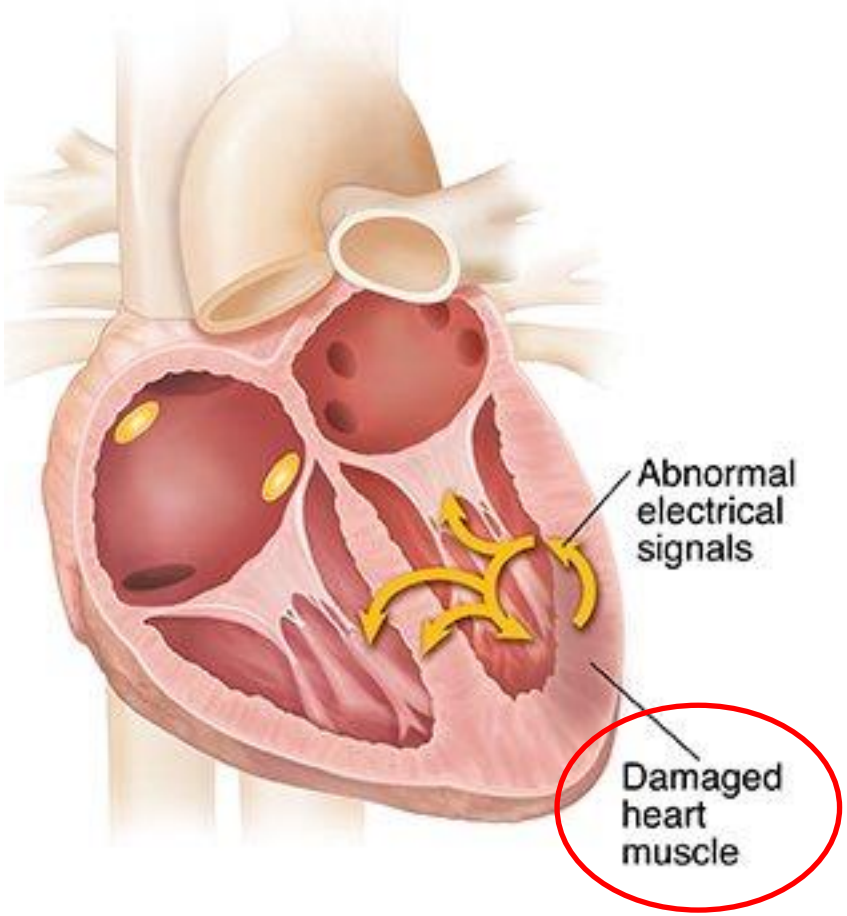
2023 APHRS expert consensus statements on surgery for AF

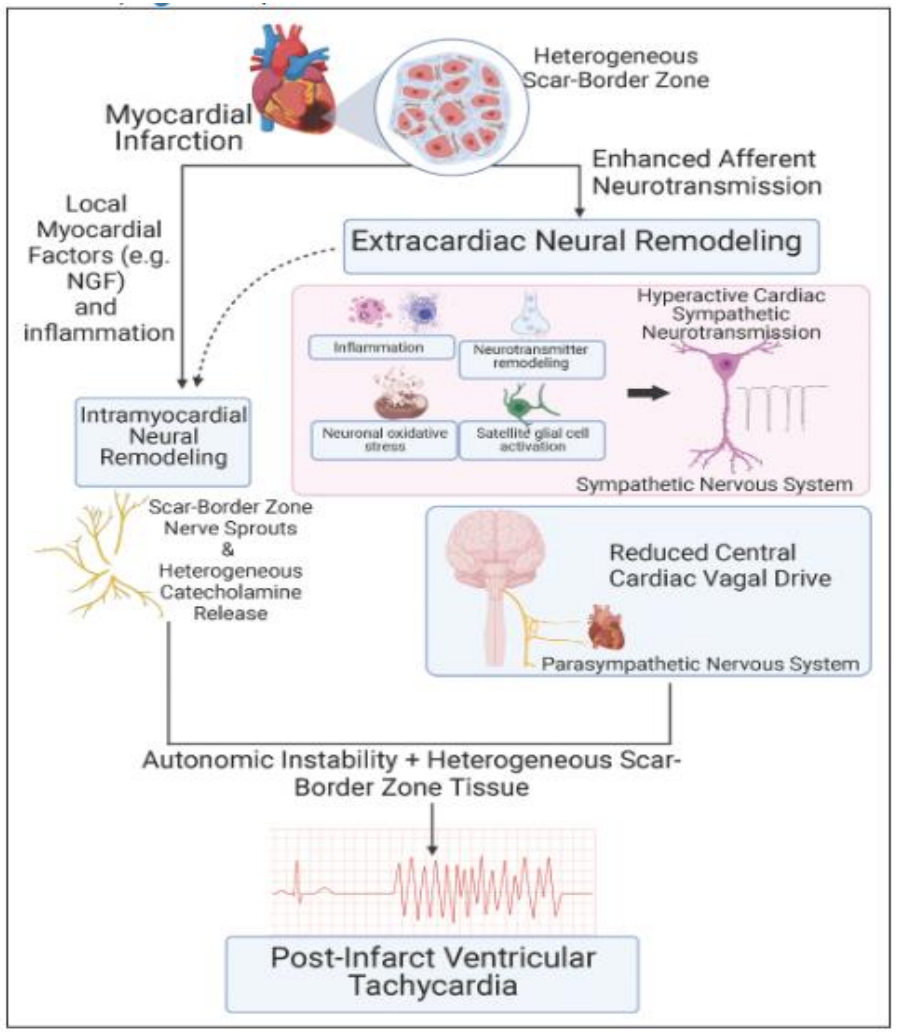
VENTRICULAR TACHYCARDIA (VT) ABLATION





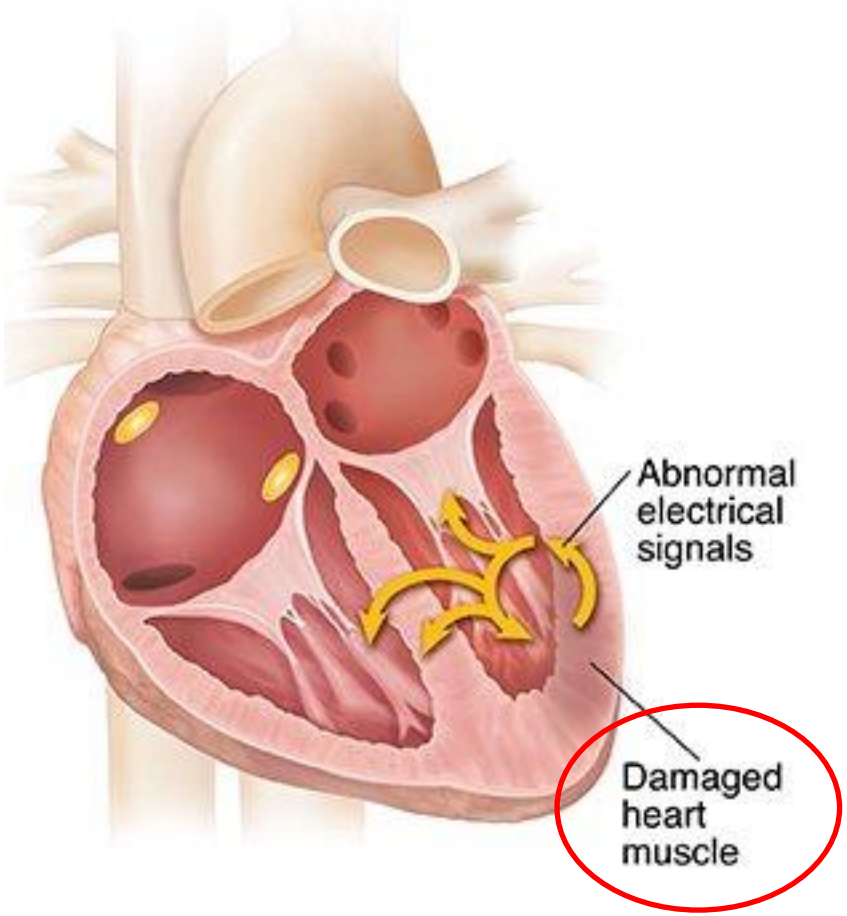
Refractory Ventricular Tachycardia





Mechanism of Ventricular Tachycardia Occurring in Chronic Myocardial Infarction Scar

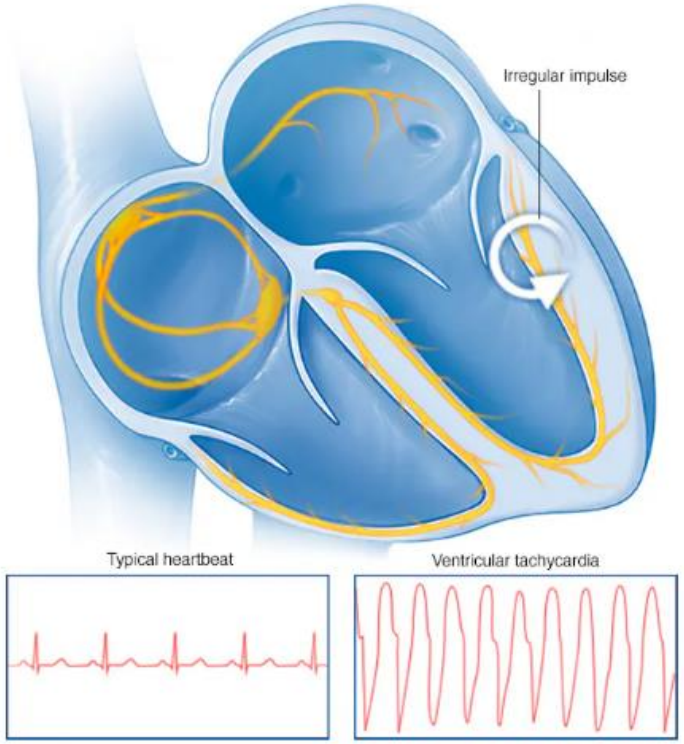
Refractory Ventricular Tachycardia



Acute (수시간~수일이내)	Chronic (수주~수개월 후)
Ischemia (+) Electrolyte unbalanced (Na/K) Unstable of Depolarization Catecholamine (++) Sympathetic tone (++)	Between scar and normal tissue Slow conduction Unidirectional block at scar Reentry VT DCMP
Polymorphic VT Ventricular fibrillation	Monomorphic sustained VT

Mechanism of Ventricular Tachycardia Occurring in Chronic Myocardial Infarction Scar

Treatment of refractory VT



Monomorphic VT

Structural Heart Disease?

YES

→ **Amiodarone**

- when ineffective:
  add **Mexiletine**
  OR add **Ajmaline**
- if contraindication to Amiodarone:
  → **Ajmaline**
  → **Lidocaine**
  → **Sotalol** if ARVC

NO

- Focal VT:
  → **Flecainide**
- Fascicular VT:
  → **Verapamil**
- 2nd choice for both:
  → **Amiodarone**

Polymorphic VT

Structural Heart Disease?

YES

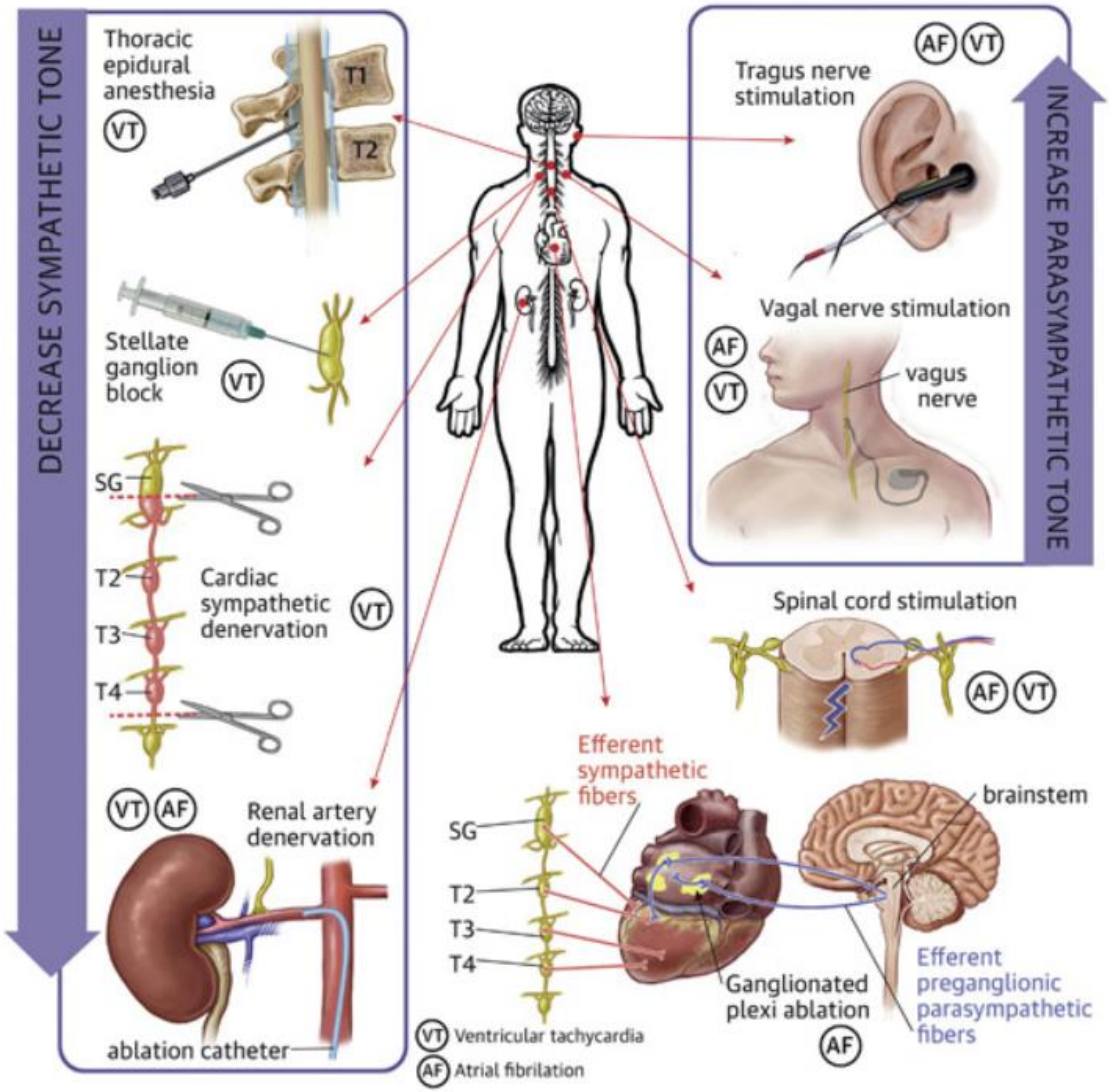
- Ischemic Trigger:
  → **Lidocaine**
- PVC-Trigger:
  1st choice: **Quinidine**
  2nd choice: **Ajmaline**
  3rd choice: **Amiodarone**

NO

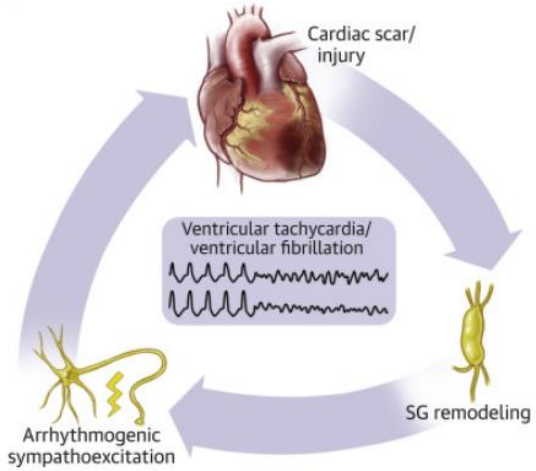
- CPVT:
  → **Flecainide**
- Brugada-Syndrome:
  → **Isoprenaline**
  → **Quinidine**

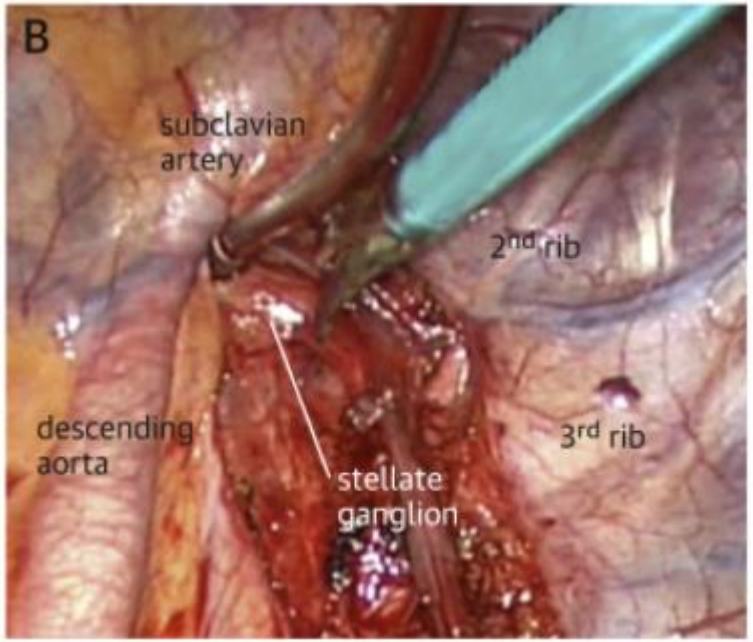
Expert consensus on acute management of ventricular arrhythmias – VT network Austria

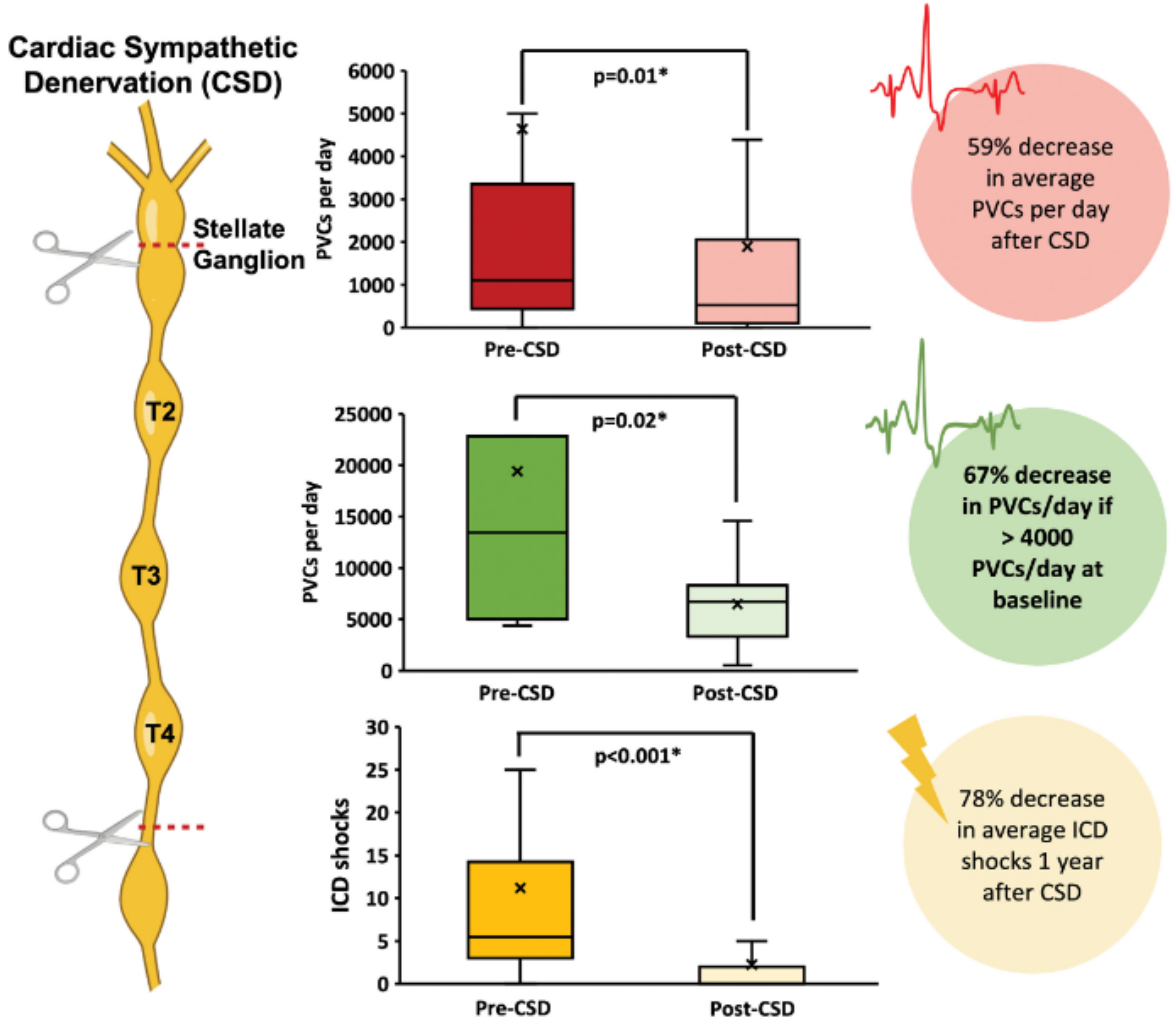
Neuromodulating for arrythmia



Bilateral Sympathectomy for VT







Effect of Bilateral Cardiac Sympathetic Denervation on Burden of Premature Ventricular Contractions

Guideline of refractory VT

Recommendations – Ablation Therapy	Class	Level	Ref.
VT ablation is recommended to be performed as soon as possible for monomorphic VT in ischemic cardiomyopathy, refractory to adequate medical treatment.	I	A	[25,46,55–58]
VT ablation should be considered for monomorphic VT in non-ischemic cardiomyopathy, refractory to adequate medical treatment. For the primary procedure, an endocardial or a combined endo-/epicardial approach may be chosen.	IIa	B	[46,47,57,63]
For the treatment of drug refractory VT / VF in ARVC, a combined endo-/epicardial or a primary epicardial ablation should be considered.	IIa	B	[52–54]
For the treatment of drug refractory VT / VF in Brugada syndrome, an epicardial ablation in the area of the RVOT may be considered.	IIb	B	[49,64]
VT ablation may be considered for polymorphic VT / VF, which is idiopathic or occurring after myocardial infarction, and refractory to adequate medical treatment.	IIb	C	[48,50,59–62]

Recommendations – Bail-out Strategies	Class	Level	Ref.
It is recommended that emergency cardiac surgery is available within a delay of 60 min from all secondary VT ablation centers, for the management of potential complications, and for the possibility of ECMO-implantation.	I	C	this panel of experts
In patients with electrical storm, mechanical circulatory support (e.g. ECMO, LVAD, etc.) should be considered to stabilize the patient before or during an ablation procedure, in particular in patients with a high risk score (e.g. PAINESD, I-VT).	IIb	B	[75–79]
Stellate ganglion blockade may be considered in the treatment of electrical storm, to reduce sympathetic activity.	IIb	C	[65,71,72]
Surgical sympathetic denervation, to reduce permanently sympathetic activity, may be considered in the treatment of refractory electrical storm or in frequent VT recurrence despite medical therapy.	IIb	C	[67,73,74]
High urgent cardiac transplantation may be considered in patients with VT / VF, refractory to all employed therapies, depending on the patient's condition before the event, age and comorbidities.	IIb	C	this panel of experts

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Surgical indication of VT

- Failure of antiarrhythmic drug therapy
- Recurrent VT despite multiple catheter ablations
- Surgically accessible scar with favorable anatomy
- Consideration of cardiac sympathetic denervation in high-risk cases
- Combined surgery during LVAD or on –pump cardiac surery

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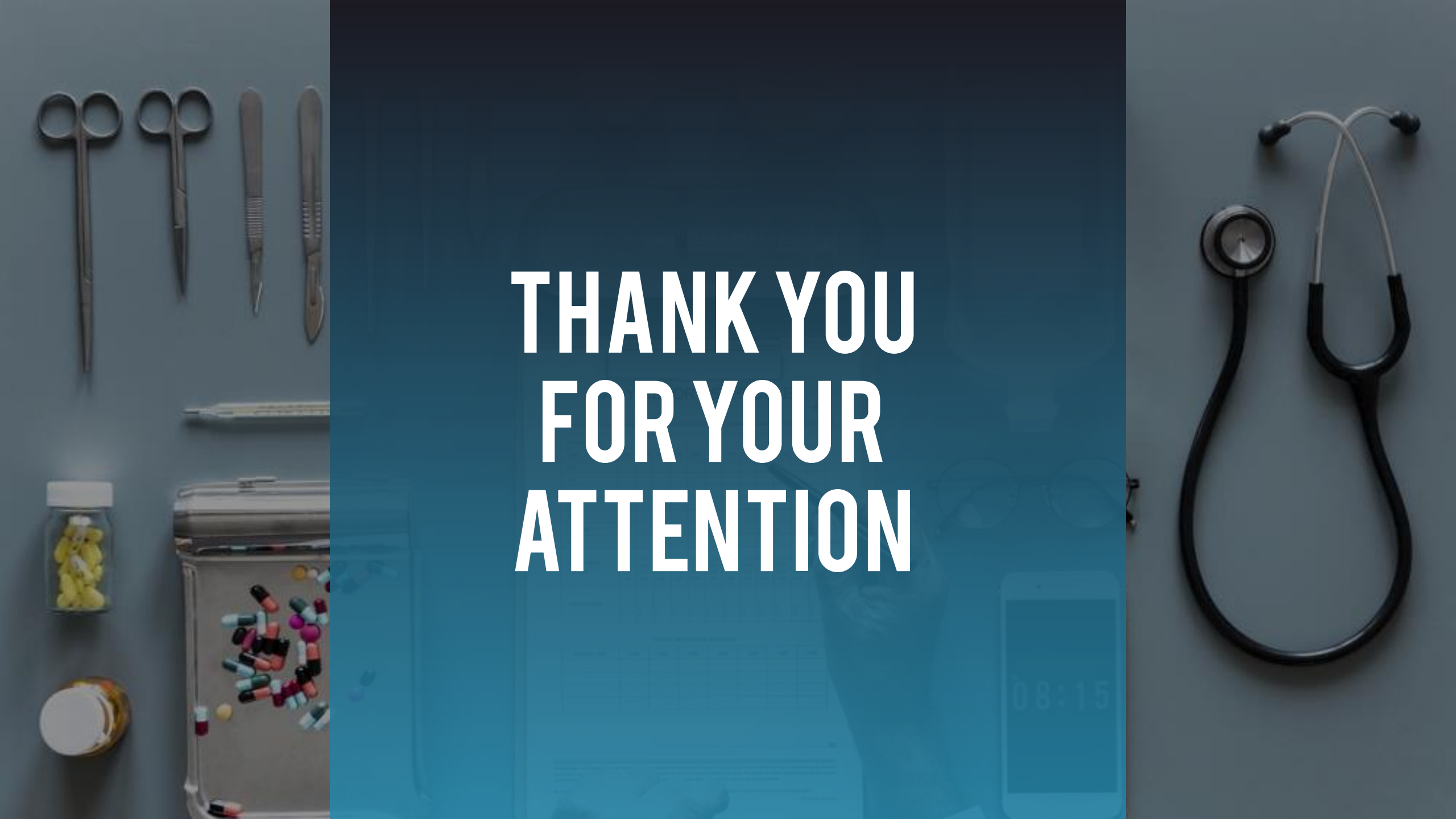
THANK YOU
FOR YOUR
ATTENTION