

ATRIAL FIBRILLATION ABLATION

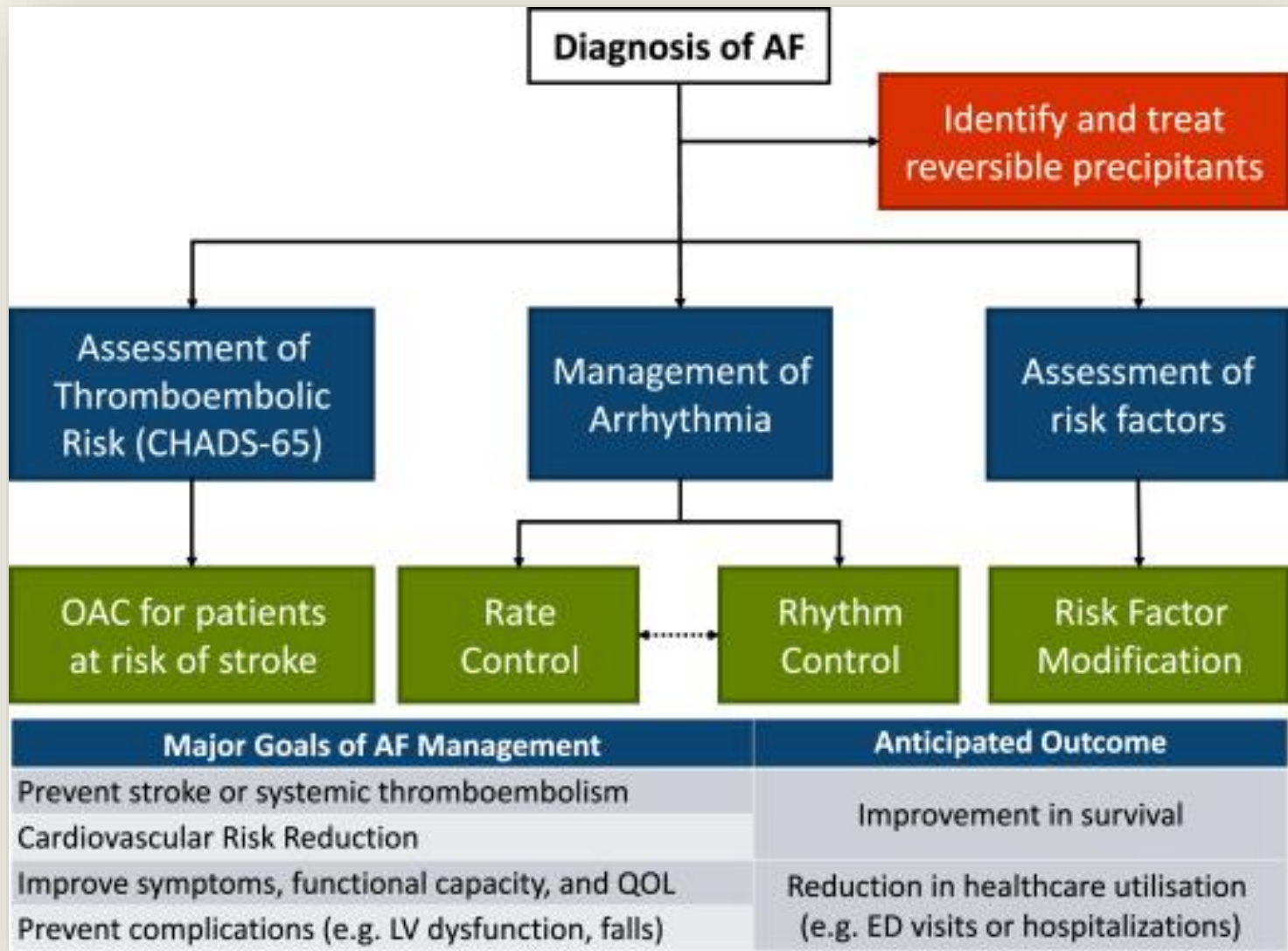
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Cardiology Day
25 September, 2021

Faculty/Presenter Disclosure

- **Faculty:** Clarence Khoo
- No financial disclosures or conflicts to declare.

Objectives

1. Understand the current hypotheses underlying the initiation and propagation of atrial fibrillation
2. Appreciate the rationale for existing techniques of atrial fibrillation ablation
3. Explore the role of differing methods of energy delivery in atrial fibrillation ablation
4. Touch on controversies and potential future directions with the ablation of atrial fibrillation



Alcohol and Tobacco

Limit to ≤ 1 standard drink¹ per day.
Complete abstinence from alcohol may be preferred in selected patients.

Target complete abstinence from tobacco-related products.



Sleep Apnea

CPAP for moderate-severe OSA (AHI ≥ 15 /hour)
Regular assessment of CPAP adherence.



Weight Loss

Target a weight loss of $\geq 10\%$ to a BMI of less than 27 kg/m^2 .



Diabetes

Target a HbA1c of $\leq 7.0\%$.



Exercise

1. Moderate intensity aerobic exercise ≥ 30 minutes a day at least 3-5 days per week (target ≥ 200 minutes weekly).
2. Resistance exercise 2-3 days per week.
3. Flexibility exercises at least 10 minutes per day at least 2 days per week in those >65 years of age.



Blood Pressure

Target $\leq 130/80$ mmHg at rest and $\leq 200/100$ mmHg at peak exercise.
ACE-I or ARB may be preferred.



¹defined as containing 14 g of alcohol; 44 mL (1.5 fluid oz.) of 80-proof liquor, 148 mL (5 fluid oz.) of wine or 355 mL (12 fluid oz.) of beer

Goals of AF Management

Rate Control

- Improve symptoms
- Improve clinical outcomes

Rhythm Control

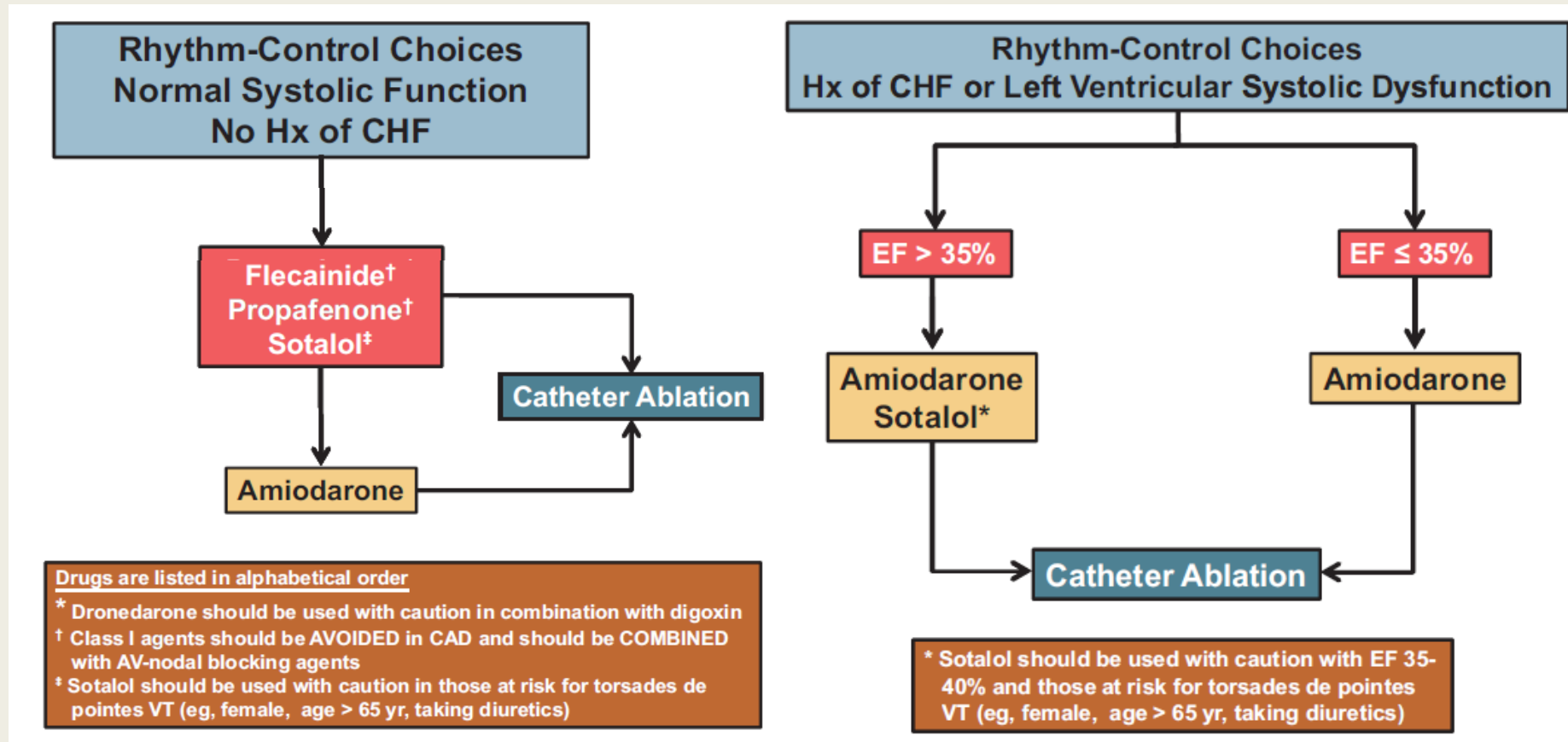
- Improve symptoms
- Improve clinical outcomes
- Does not require elimination of AF



Rate Control

Rhythm
Control

Rhythm Control Options

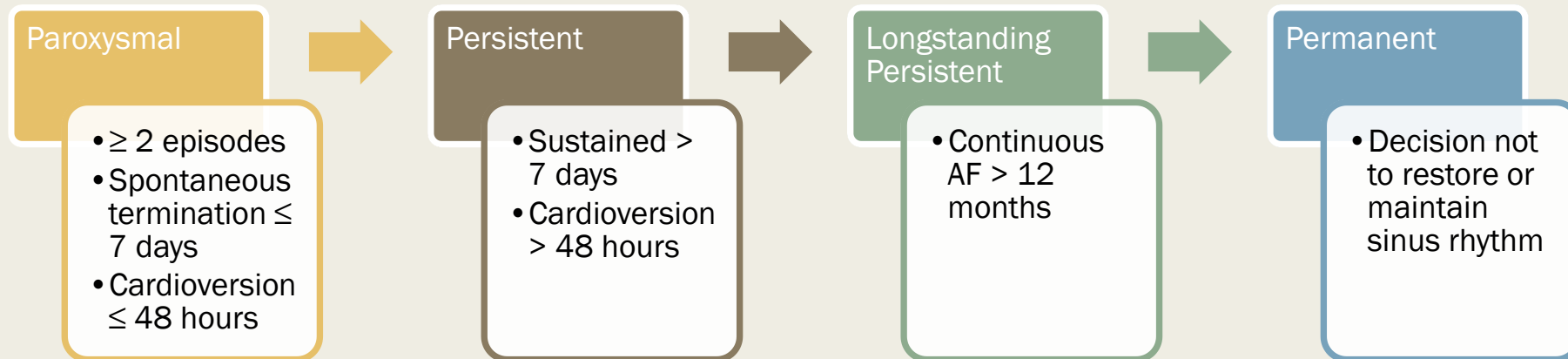


Favours Rate Control	Favours Rhythm Control
Persistent AF	Paroxysmal or New AF
Less symptomatic	More symptomatic
Age \geq 65	Age < 65
Hypertension	No hypertension
No CHF	CHF worsened by AF
Antiarrhythmic drug failure	No previous antiarrhythmic drug failure
Patient preference	Patient preference

Classification of Atrial Fibrillation

Atrial Fibrillation Episode

- *AF documented by ECG monitoring of ≥ 30 seconds, or continuous throughout ECG tracing*

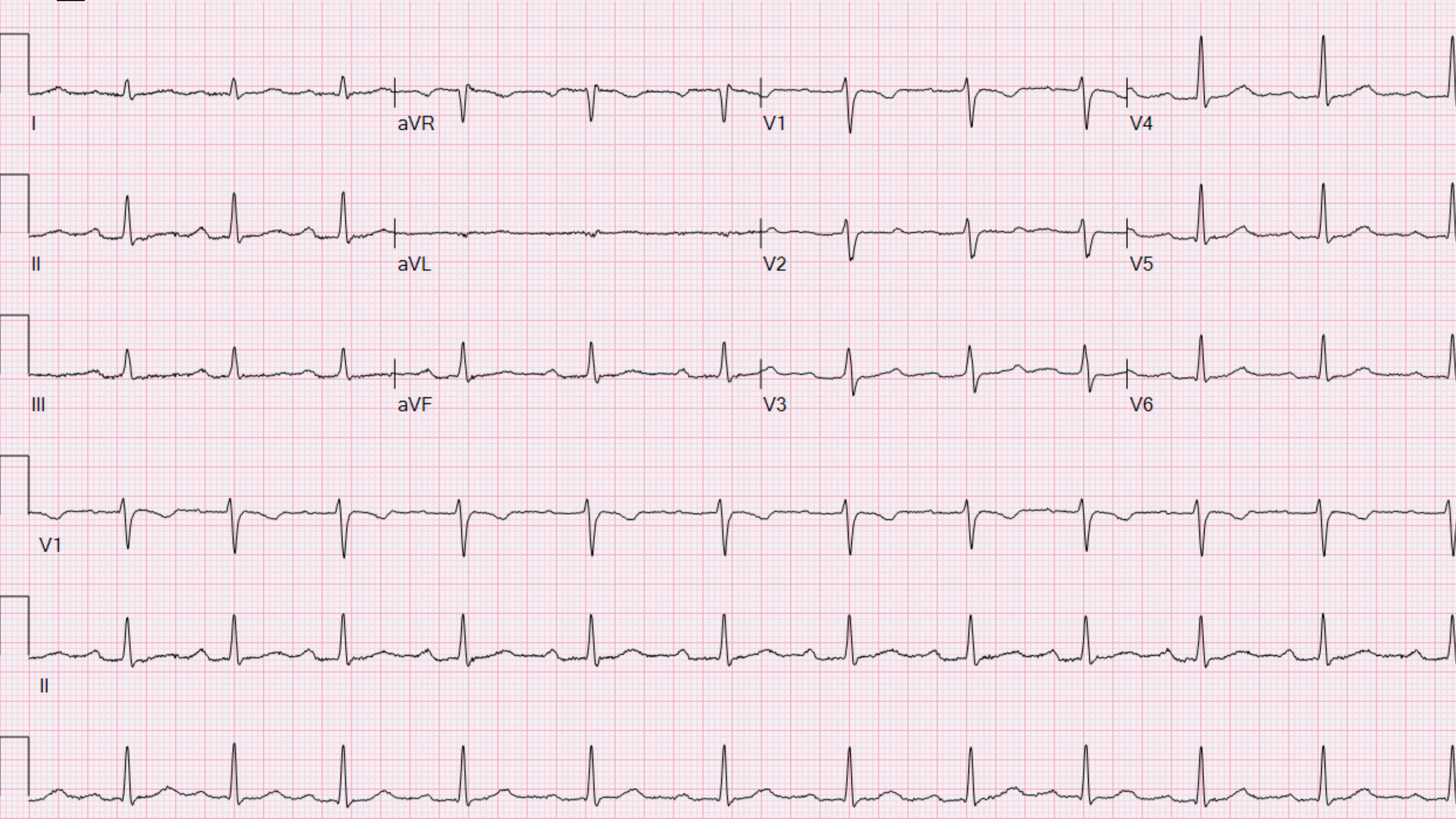


CASE #1



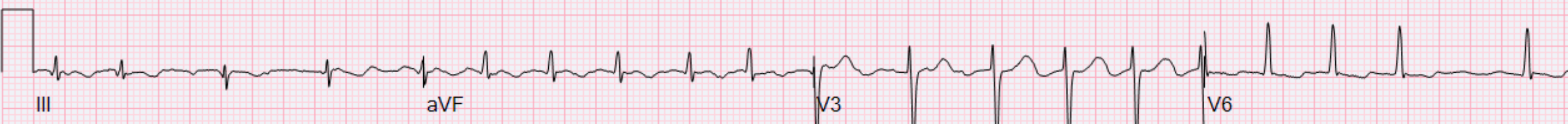
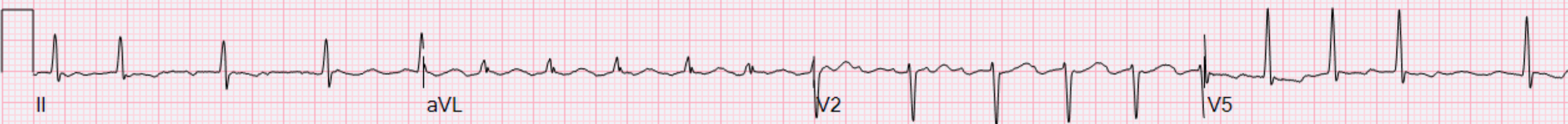
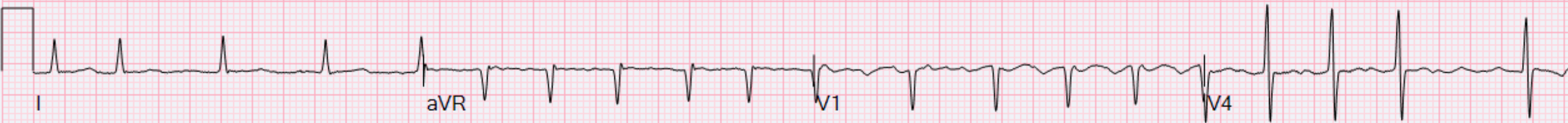
Case #1

- 46F presents to your office complaining of palpitations.
- She reports palpitations once a week, associated with feeling fatigued and short of breath. They last about 3 – 4 hours before they go away spontaneously.
- Medications include OCP.
- BP 114/80 mmHg, HR BPM and regular.
- An ECG is obtained.



Case #1

- Past medical history significant for previous ablation for SVT.
- Is able to go to get an ECG performed when she has another episode.

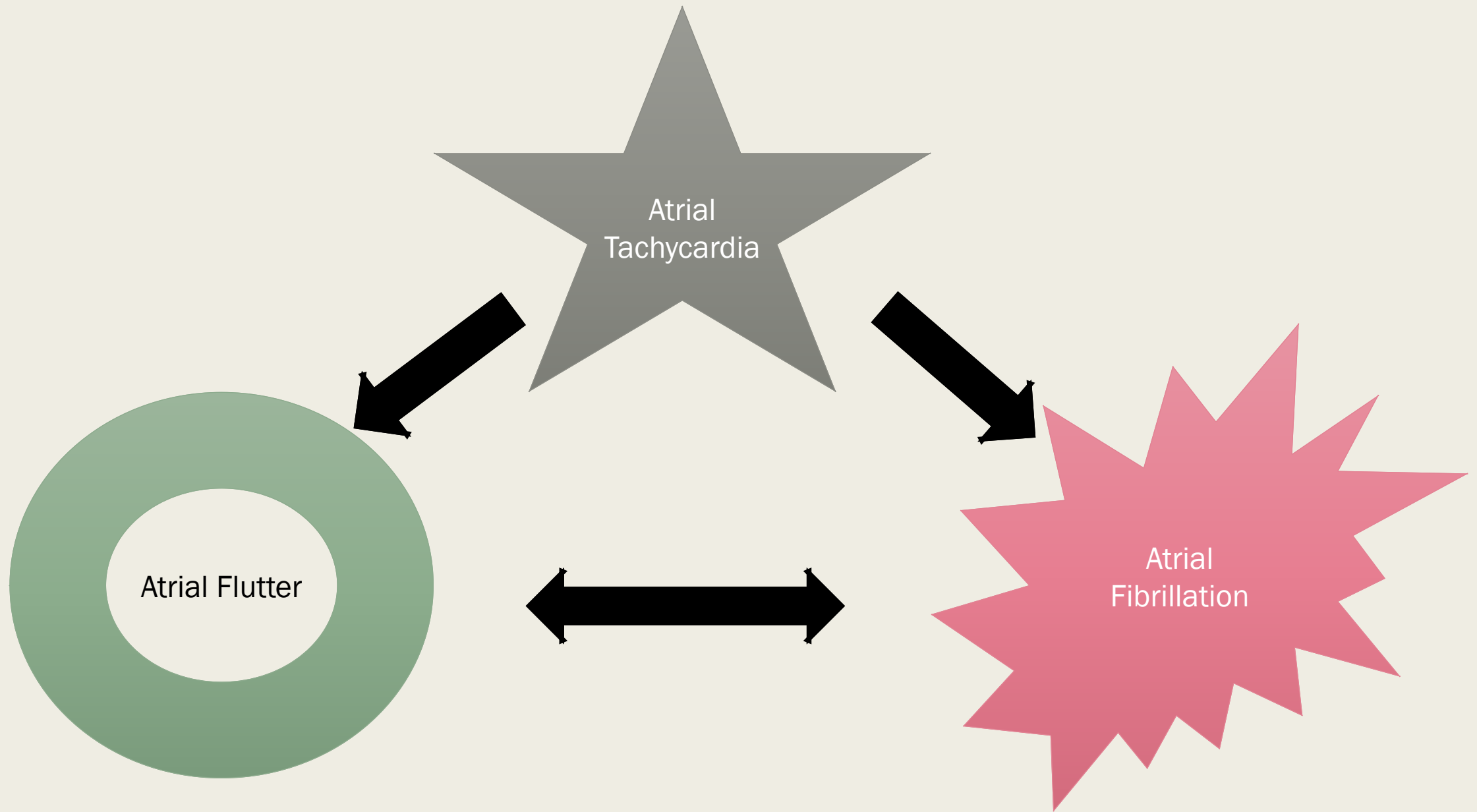


Case #1

- CBC/Lytes/Creat normal. TSH normal
- Echo:
 - LVEF 60%.
 - Left atrium 35 mm.
- Holter:
 - *Sinus rhythm with frequent PAC's (2%). Short runs of atrial ectopy (longest 10 beats long at 135 BPM).*

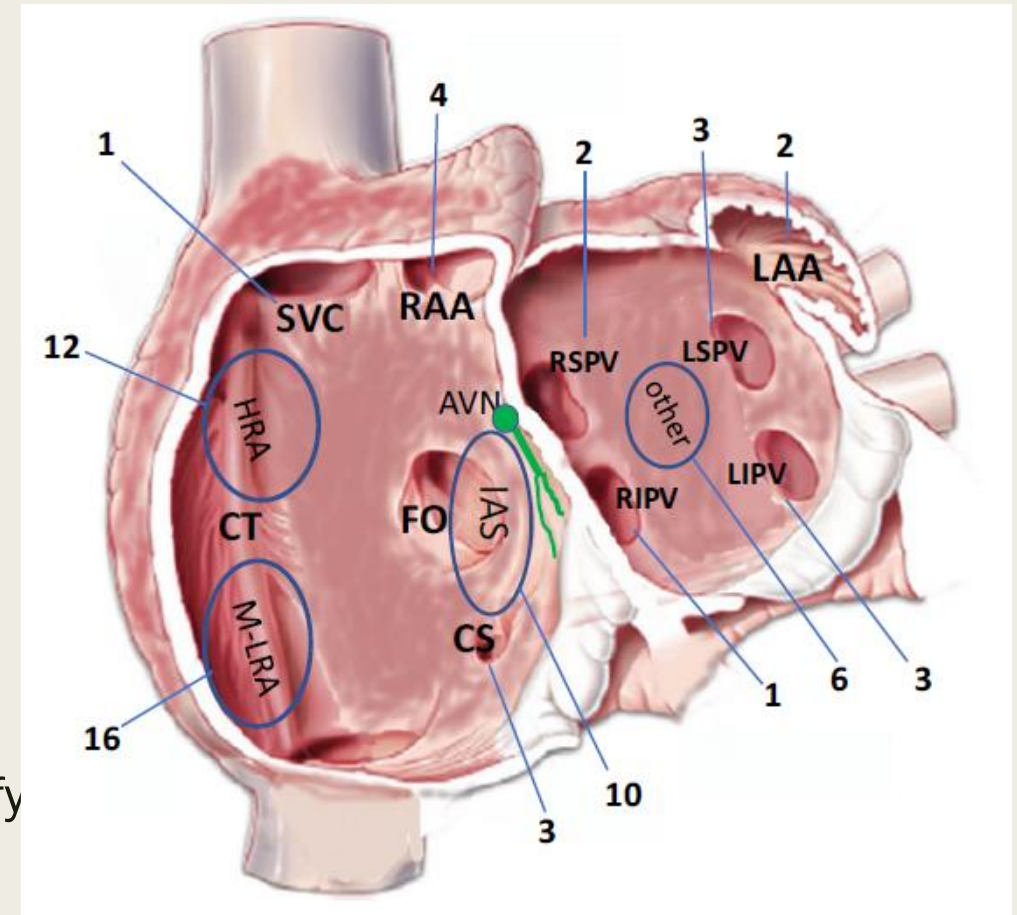
GOOD CANDIDATE FOR
ABLATION?



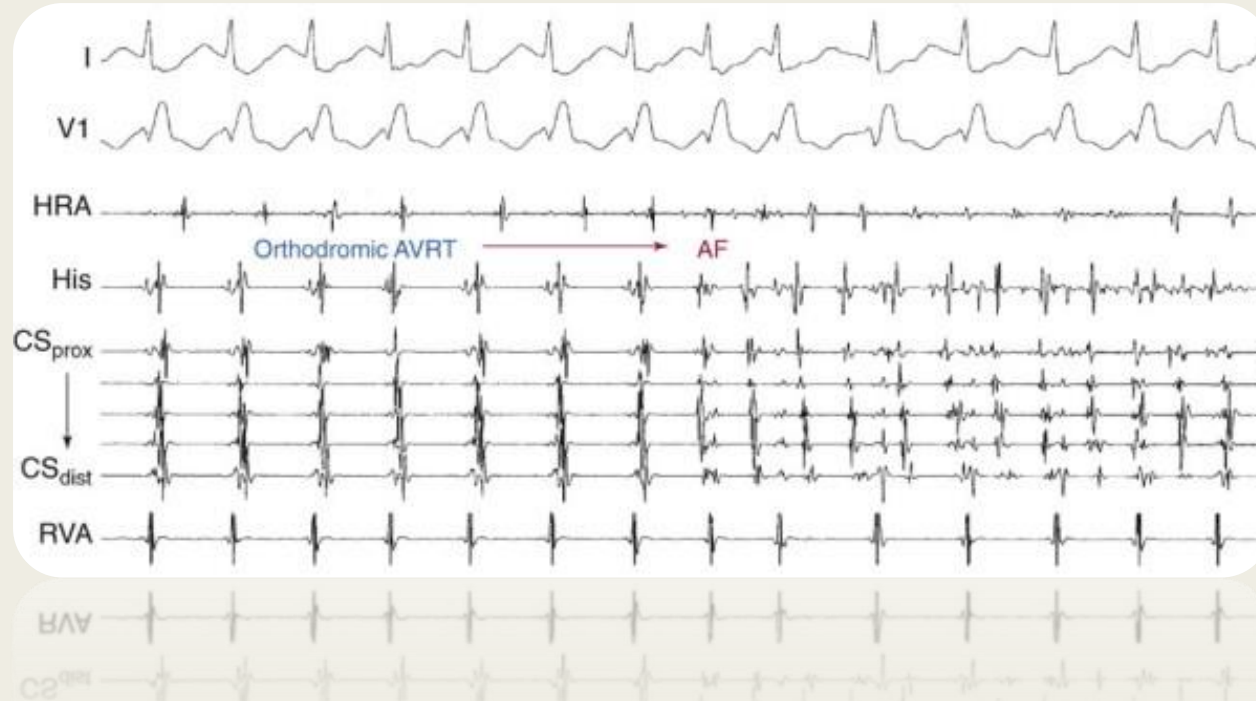


Possible Source of Atrial Tachycardias

- Site of atrial tachycardia:
 - *Pulmonary veins*
 - *Crista terminalis*
 - *Coronary sinus*
 - *Posterior left atrium*
 - *Superior vena cava*
 - *Left atrial appendage*
 - *Ligament of Marshall*
- Often require 3D electroanatomical mapping to identify precise site of atrial tachycardia.



SVT's as a trigger for AF

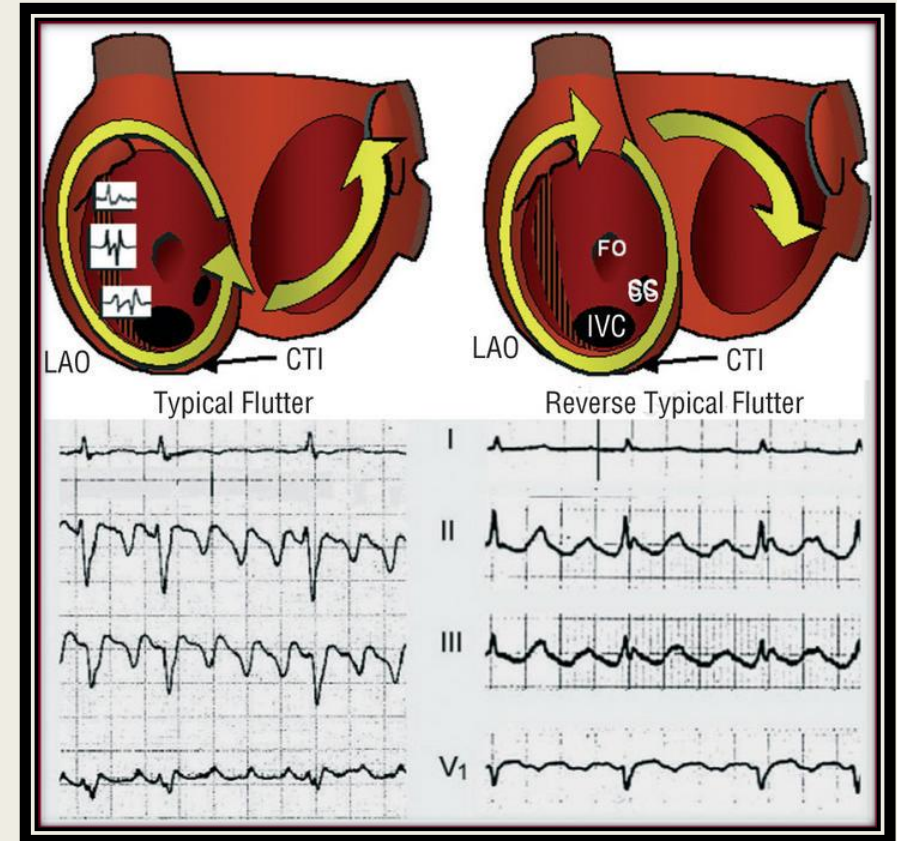


- *Atrial flutter and re-entrant SVT's (especially AVRT) may initiate AF*
- *Ablation of these arrhythmias may reduce the risk of further AF*

Ablation of Atrial Flutter

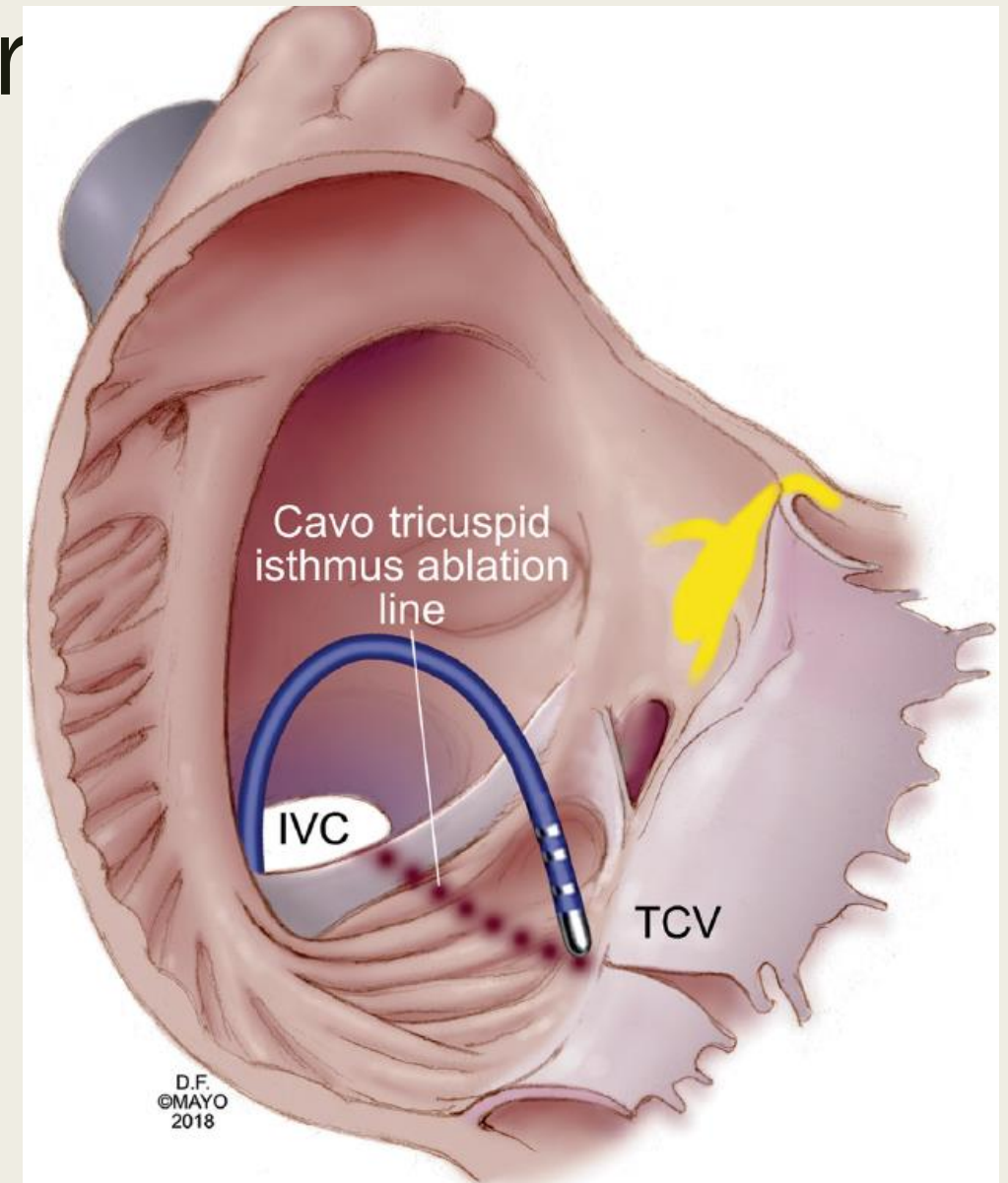
- Typical atrial flutter is a fairly fixed circuit that traverses the cavotricuspid isthmus (CTI)
 - *Bridge of tissue in the RA bound anteriorly by the tricuspid valve and posteriorly by the IVC.*

	II, III, aVF	V1
Typical (CTI, counterclockwise)	-	+
Reverse Typical (CTI, clockwise)	+	-
Non-CTI dependent	+	+
Non-CTI dependent	-	-



Ablation of Atrial Flutter

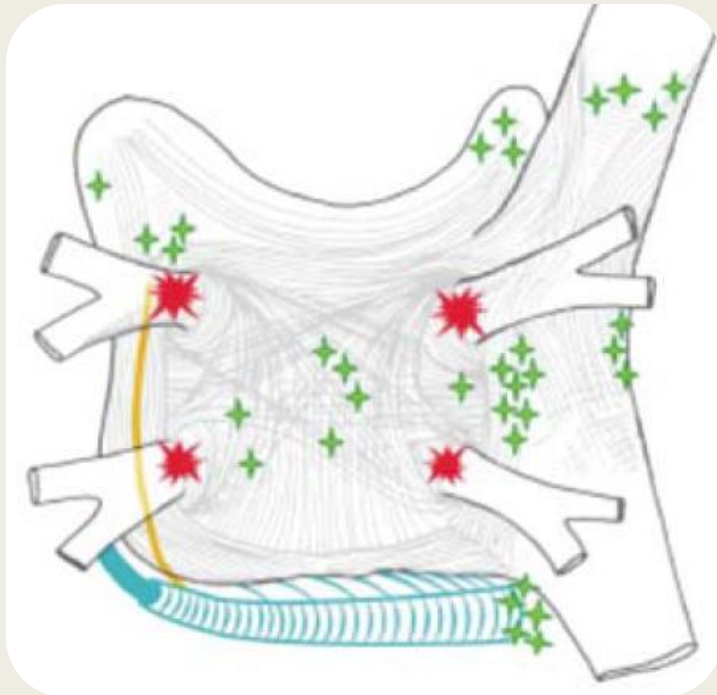
- If CTI-dependent, success rate is high:
 - *Acute success 97%*
 - *2 year success 90%*
- If not CTI-dependent, procedure is more challenging, with lower success rates:
 - *Up to 53% recurrence rates*
- Ablation of CTI dependent flutter is therefore first-line if symptomatic or refractory to drug therapy (Class I indication).



ATRIAL FIBRILLATION ABLATION



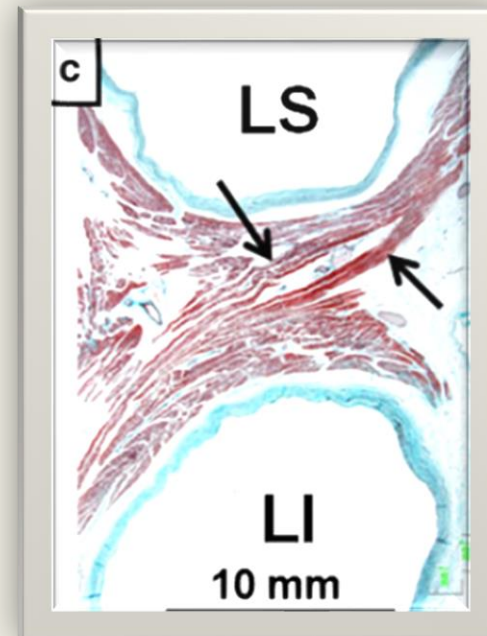
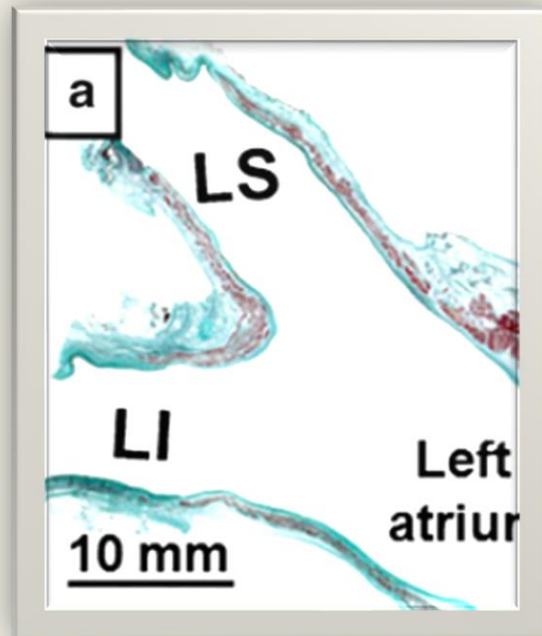
Triggers of AF



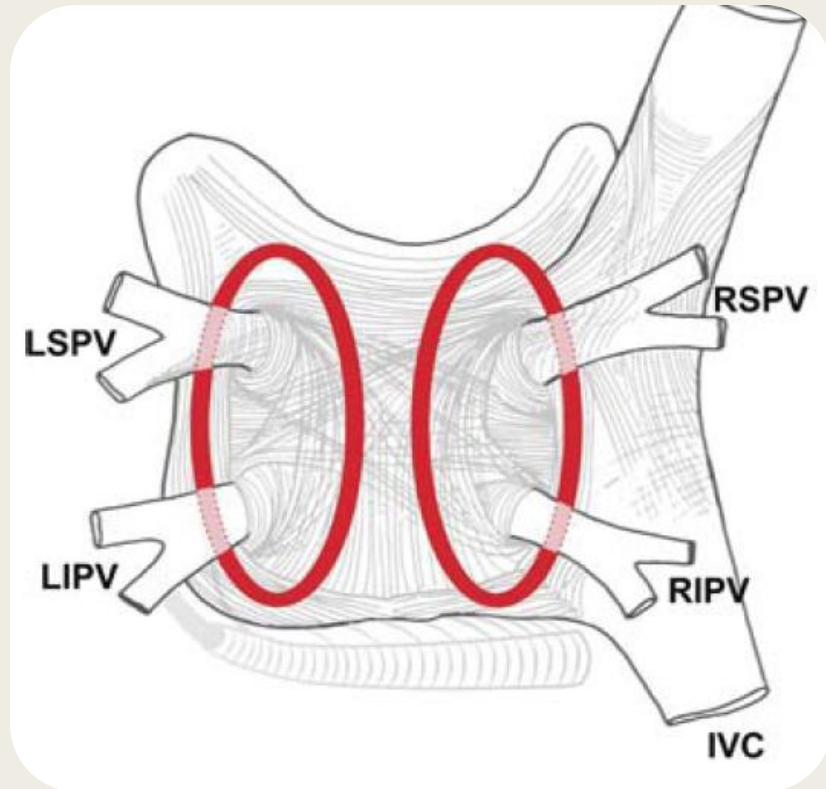
- Haïssaguerre et al. (1998)
 - *Triggers located deep within pulmonary veins (PV)*
 - *Ablation of these foci resulted in elimination of AF at a median of 7 months of follow-up in 62% (28/38 patients)*

Why are Pulmonary Veins potential triggers?

- Pulmonary veins share the same embryologic origin as other conduction tissues – atrial muscle extends into the PV's

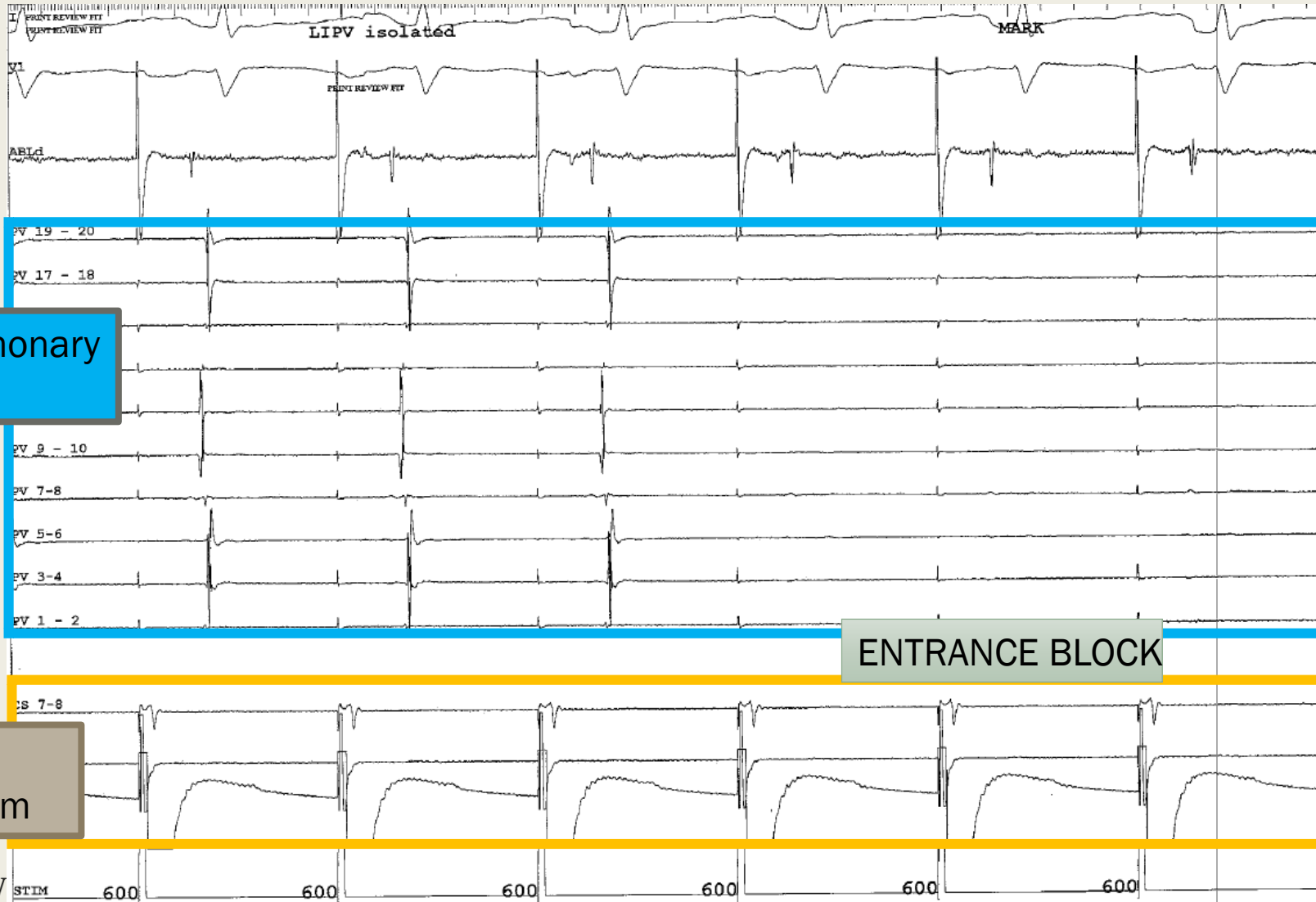


Strategies for Catheter Ablation



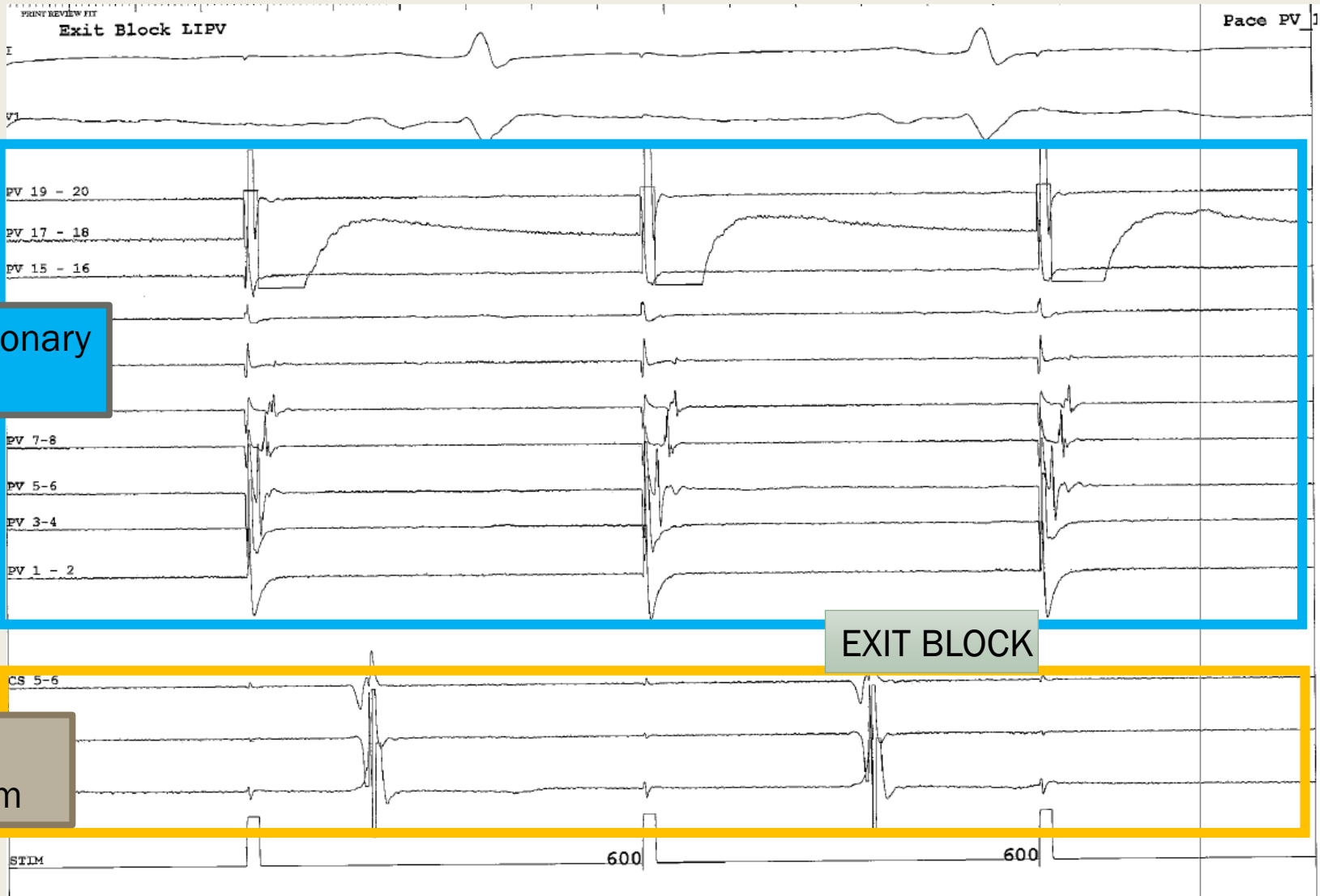
- Wide circumferential ablation around PV's is most commonly performed procedure
 1. *Electrically isolates PV's and other potential sources → eliminates triggers*
 2. *Modification of substrate around PV's*
 3. *Debulking of atrial mass*
 4. *Interruption of ganglionated plexi*

What we look for in a PVI

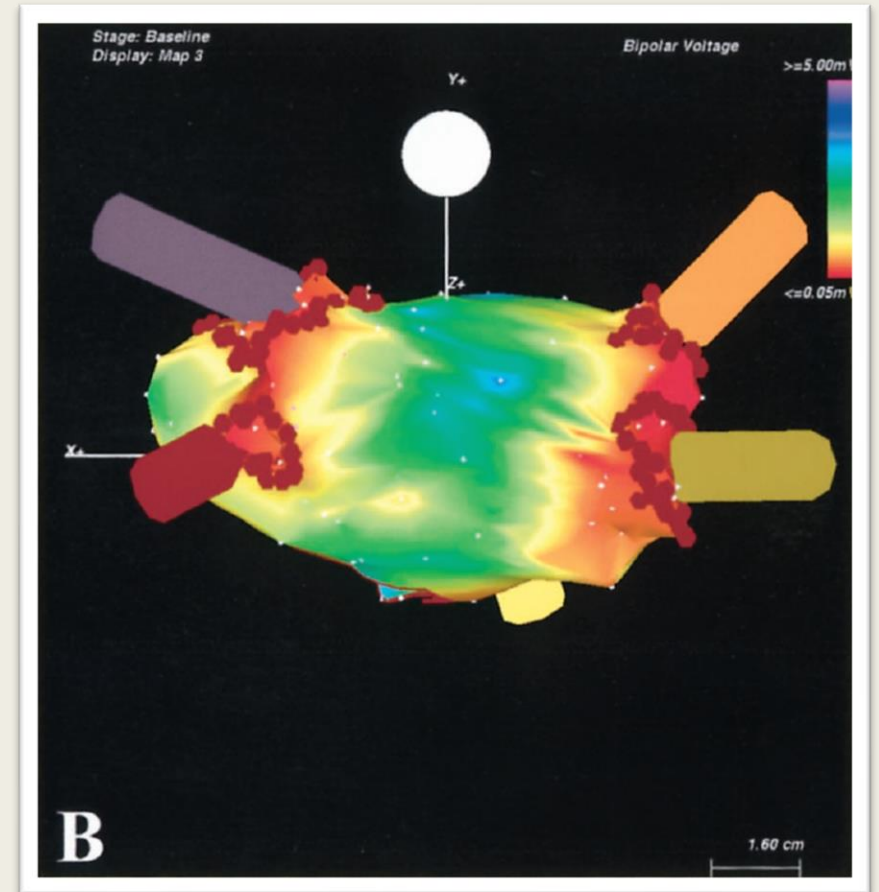
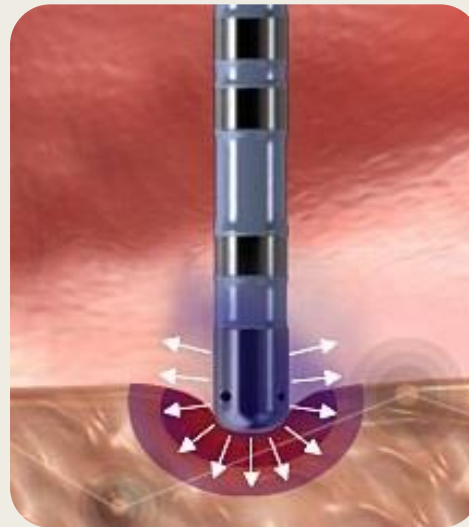
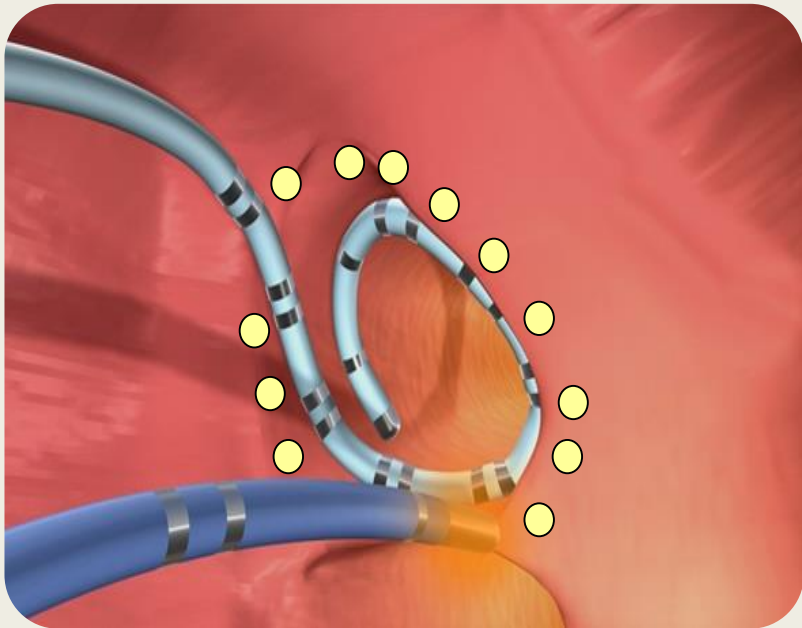


Pulmonary Vein

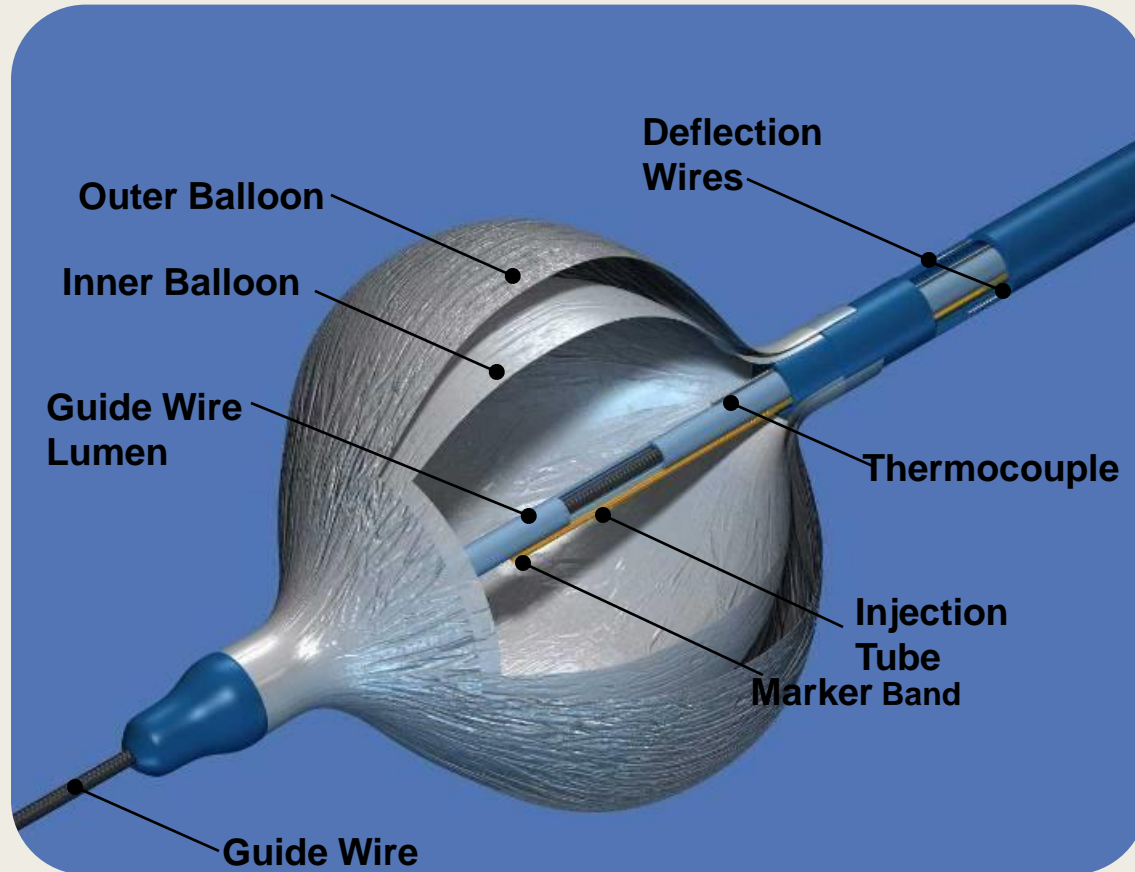
Left Atrium



Wide Antral Circumferential Atrial Ablation - Radiofrequency ablation



Cryoballoon for AF Ablation



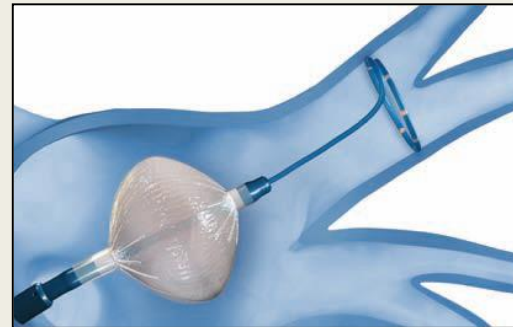
- Inflatable balloon designed to wedge into pulmonary veins and deliver cryoablation to the antrum of the veins
- Liquid N_2O is delivered through a completely contained circuit into the balloon resulting in rapid cooling of the balloon and the surrounding tissue

Deployment of Cryoballoon

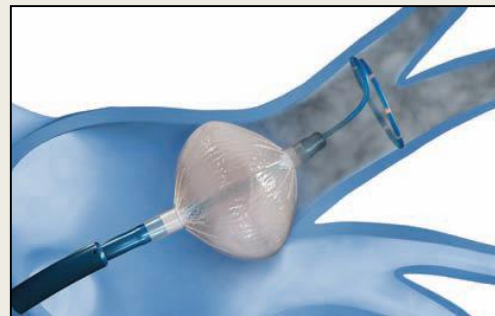
1. Access targeted vein



2. Inflate and position



3. Occlude and ablate



4. Assess PVI

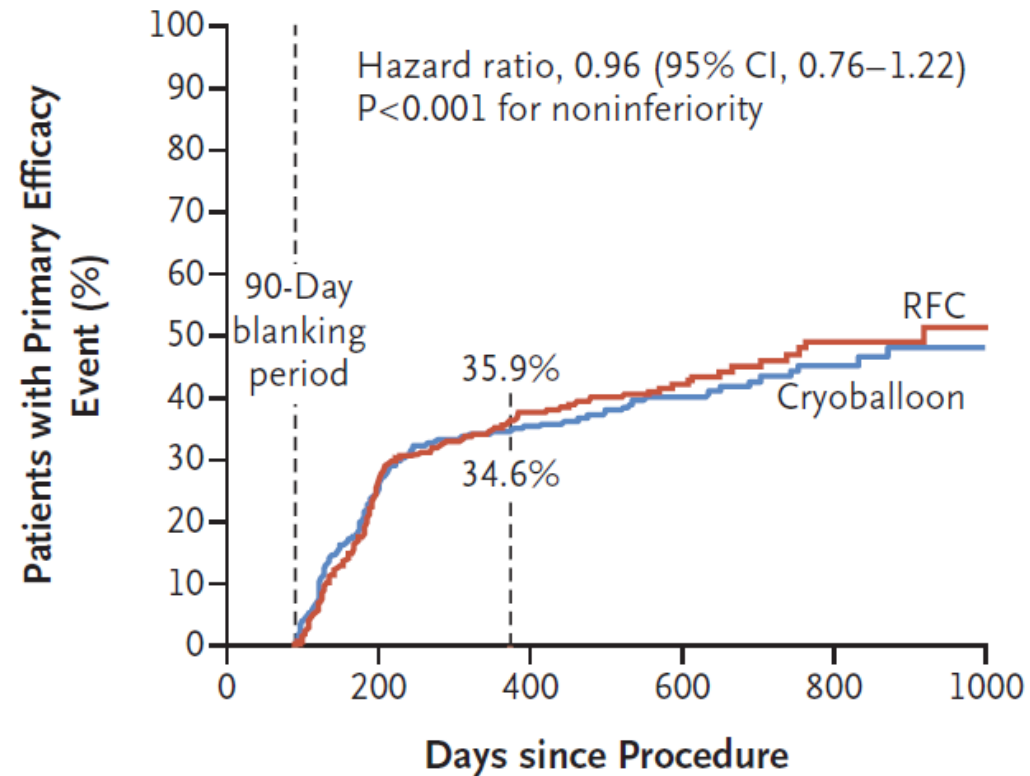


Fire & Ice Trial

- 762 patients with paroxysmal AF randomised to cryoballoon vs. RF ablation, followed for 1.5 years
 - *Non-inferiority study, primary endpoint of time to first documented clinical failure (recurrence of atrial tachyarrhythmia, use of antiarrhythmic drugs or repeat ablation)*

Fire & Ice Trial

A Primary Efficacy End Point



No. at Risk
Cryoballoon
RFC

374	338	242	194	165	132	107	70	57	34	12
376	350	243	191	149	118	93	58	44	25	12

- No significant difference in primary end point or safety
- Shorter procedure time and left atrial dwell time with cryoballoon; longer fluoro time



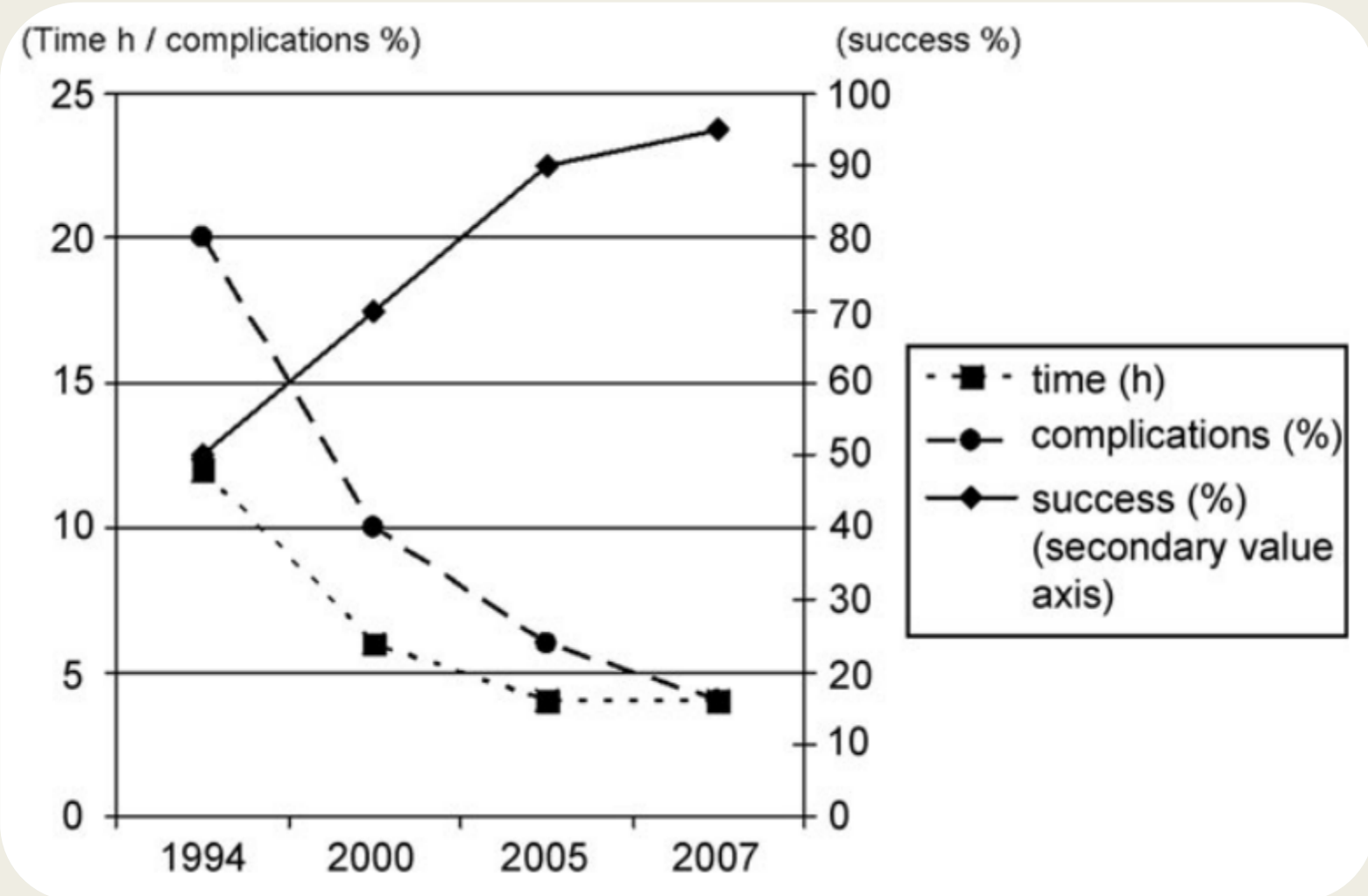
Risks and Benefits of AF Ablation

70 – 80% freedom from AF within 1st year

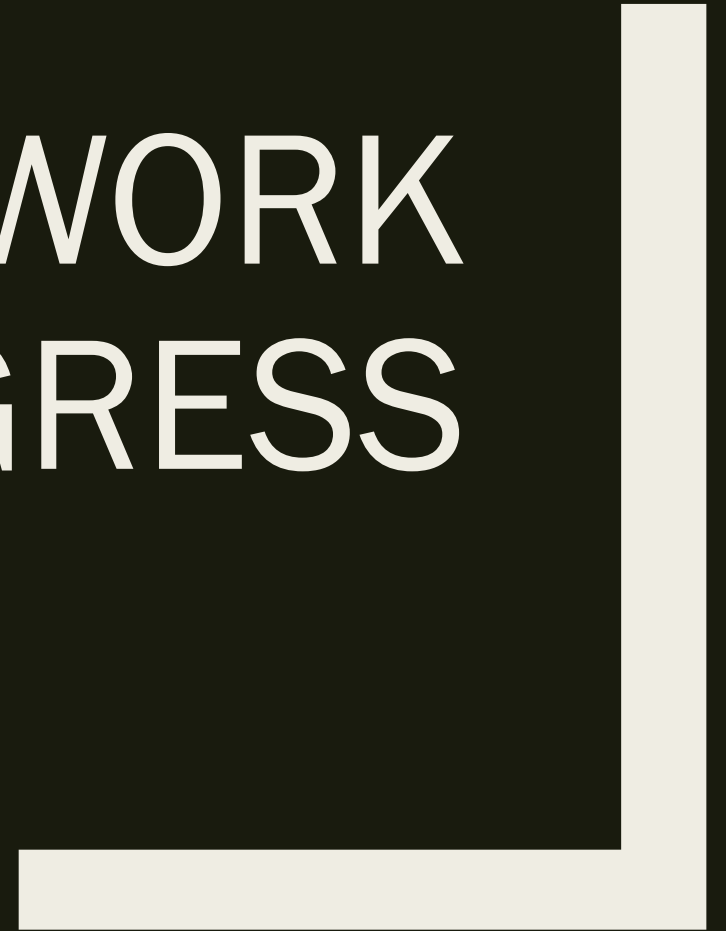
■ Acute complication rate: 2.9%

- Vascular: 1.4%
- Tamponade: 1.0%
- Stroke/TIA: 0.6%
- PV stenosis: 0.5%
- Phrenic nerve injury: 0.4%
- Atrioesophageal fistula: 0.08%
- Death: 0.06%

The Evolution of AF Ablation



AF ABLATION – A WORK
IN PROGRESS



AF Ablation & Quality of Life

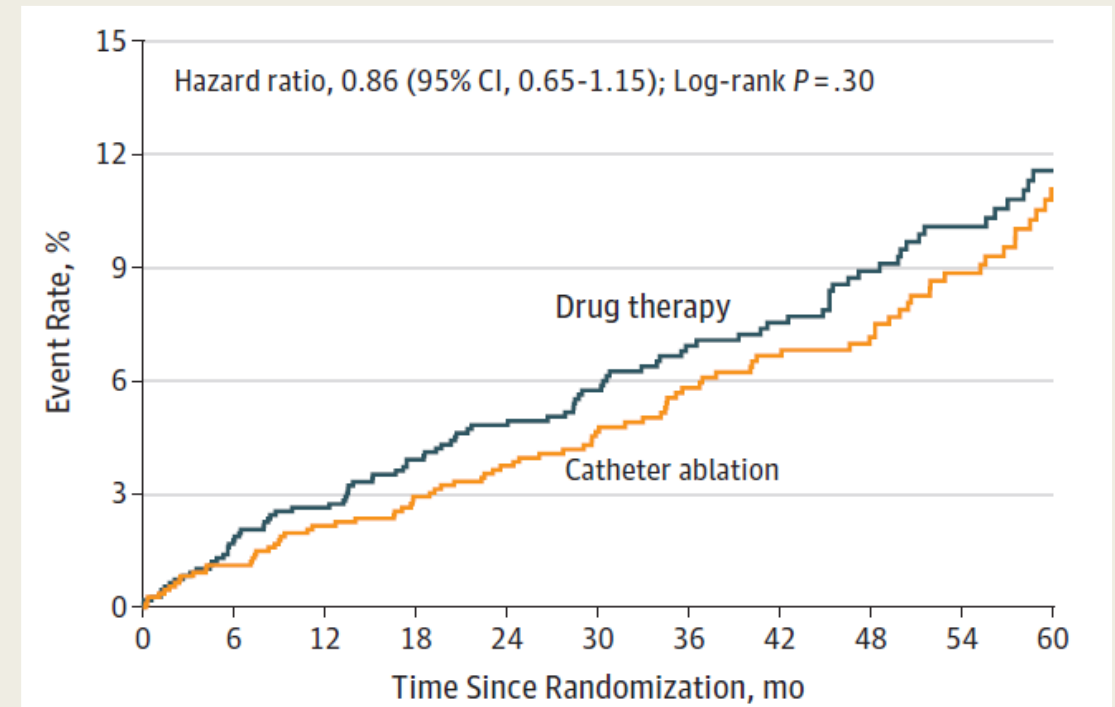
Table 4. Quality of Life Assessment*

Short-Form 36 Subscale	Mean (SD)				Corrected Difference in Mean Change at 6 mo (95% CI)	P Value
	Pulmonary Vein Isolation Group (n = 32)		Antiarrhythmic Drug Group (n = 35)			
	Baseline	Follow-up	Baseline	Follow-up		
General health	57 (2)	9 (1)	57 (2)	68 (2)	11 (8 to 14)	<.001
Physical functioning	71 (3)	97 (3)	69 (2)	75 (7.5)	20 (13.2 to 24.2)	.001
Role physical	73 (5)	71 (2)	51 (5)	53 (3)	14.9 (9.9 to 19.9)	.047
Bodily pain	71 (3)	97 (1)	70 (3)	90 (3)	6 (1.5 to 9.5)	.004
Mental health	65 (4)	65 (2)	64 (2)	68 (3)	-4 (-3.5 to -7.5)	.62
Social functioning	78 (3)	93 (3)	76 (3)	82 (2)	9 (7.5 to 11.5)	.004
Role emotional	70 (1)	76 (1)	70 (1)	75 (1)	1 (-4.0 to 4.3)	.90
Vitality	52 (4)	65 (1)	51 (1)	60 (2)	4 (1.7 to 5.7)	.21

- Single-centre study comparing first-line AF ablation vs. drug therapy
- 6 month QoL improvement significantly better in ablation group

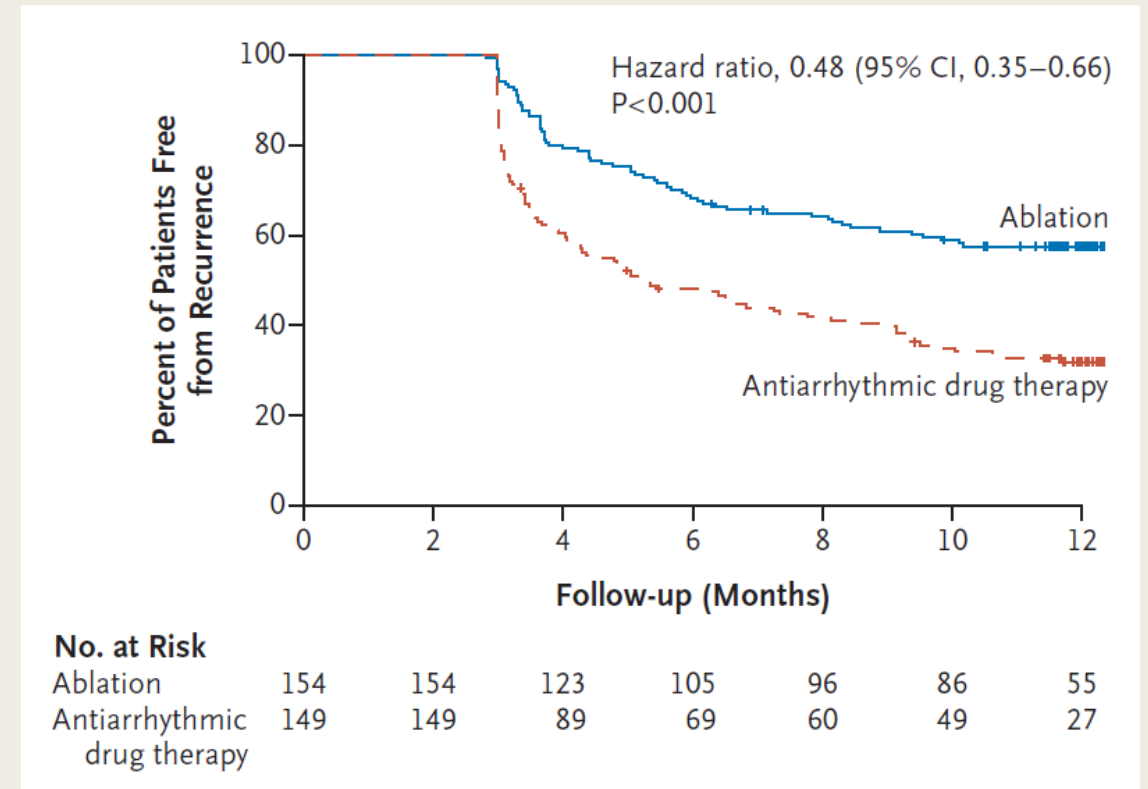
CABANA

- Multicenter RCT randomising 2204 patients with AF to AF ablation vs. antiarrhythmic drugs alone.
- Primary composite endpoint of death, stroke, serious bleeding, cardiac arrest.
- Crossover was not insubstantial:
 - 9.2% of ablation arm did not receive ablation
 - 27.5% of drug arm received an ablation



Is it better to intervene earlier?

- EARLY-AF trial
- 303 patients with symptomatic PAF, no therapy, randomised to either cryoballoon ablation vs. antiarrhythmics.
- Reduction in 1 year recurrence of atrial tachyarrhythmia (HR 0.39, 95% CI 0.22 – 0.68).
- Adverse events – 3.2% of ablation, 4.0% of antiarrhythmics.



Who to refer for Ablation of AF?

RECOMMENDATION

We recommend radiofrequency ablation of AF in patients who remain symptomatic following adequate trials of antiarrhythmic drug therapy and in whom a rhythm-control strategy remains desired (Strong Recommendation, Moderate-Quality Evidence).

Values and preferences. This recommendation places a high value on the decision of individual patients to balance relief of symptoms and improvement in QOL with the small but measurable risk of serious complication with catheter ablation.

CCS-SAF Score

CCS SAF score	Effect on quality of life
<i>Class 0</i>	Asymptomatic with respect to AF
<i>Class 1</i>	Symptoms attributable to AF have minimal effect on patient's general quality of life: <ul style="list-style-type: none">• minimal and/or infrequent symptoms, or• single episode of AF without syncope or heart failure
<i>Class 2</i>	Symptoms attributable to AF have a minor effect on patient's general quality of life: <ul style="list-style-type: none">• mild awareness of symptoms in patients with persistent/permanent AF, or• rare episodes (eg, less than a few per year) in patients with paroxysmal or intermittent AF
<i>Class 3</i>	Symptoms attributable to AF have a moderate effect on patient's general quality of life: <ul style="list-style-type: none">• moderate awareness of symptoms on most days in patients with persistent/permanent AF, or• more common episodes (eg, more than every few months) or more severe symptoms, or both, in patients with paroxysmal or intermittent AF
<i>Class 4</i>	Symptoms attributable to AF have a severe effect on patient's general quality of life: <ul style="list-style-type: none">• very unpleasant symptoms in patients with persistent/paroxysmal AF, and/or• frequent and highly symptomatic episodes in patients with paroxysmal or intermittent AF, and/or• syncope thought to be due to AF, and/or• congestive heart failure secondary to AF

Take-Aways

- Know the difference between atrial flutter and atrial fibrillation. Have a low threshold for referral of atrial flutter ablation.
- Rhythm control strategy (including AF ablation) is beneficial largely for symptom benefit. Be familiar with the CCS-SAF score.
- AF ablation – 60 – 80% suppression of AF within 1 year, but reduces to 50% in 5 years. 3 – 4% risk of complications (some can be fatal).
- AF ablation should be reserved for young, highly-symptomatic, AF patients who are not coping well with medical therapy.

QUESTIONS?

