Atrial Fibrillation: Interventional Approaches

Tyler Taigen, MD
Eric Espinal, MD

Discussion Outline

- Review current treatment of atrial fibrillation
  - Pathophysiology
  - Risk assessment and treatment to reduce thromboembolic events
  - Rhythm control strategies
  - Review of evidence for catheter based ablation of AF
- New concepts
  - Alternative treatment options for persistent AF
  - Role of autonomic innervation in AF
  - Focal impulse and rotor modulation
  - Hybrid surgical/endovascular approach

Classification of AF

New Onset*:* First episode of atrial fibrillation of at least 30sec or is present through out the ECG.

Paroxysmal*:* > 1 Episode, Duration is < 7 days if self-limited, or <48 hours if cardioverted

Persistent*:* > *1* Episode which is sustained beyond 7 days, or requires cardioversion after >48 hours

Long standing persistent*:* Continuous AF despite efforts to restore sinus rhythm for more than 12 months. Note the term "*permanent AF*" is reserved for patient in whom the decision has been made to not attempt restoration of sinus rhythm.

Lone*:* Any type in a patient with structurally normal heart and younger than 60 yrs – term is no longer used in literature

Definitions from HRS consensus document on Catheter Ablation of Atrial Fibrillation.

AF Treatment goals

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Rate Control

Rhythm Control

Stroke Prevention

AF Treatment goals

SUMMA Health System

Rate Control

Pharmacologic
(goal resting HR < 110)
- BBlockers
- CCB
- Amiodarone

Nonpharmacologic
- AV node ablation and implantation of PPM, BiV if EF < 50% (Block-HF)

Rhythm Control

Pharmacologic
- First line for many patients with paroxysmal AF and most with persistent AF

Non-pharmacologic
- Catheter Ablation (PVI)
- Surgery (MAZE)
- Hybrid Procedures (Atricure, Convergent)

Stroke Prevention

Pharmacologic
- Warfarin
- NOAC (dabigatran, rivaroxiban, apixiban, endoxaban)

Non-Pharmacologic
- Surgical: LAA Ligation
- Interventional: LAA occlusion device (i.e. Watchman)

OAC: Scoring Calculators

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Risk of Stroke

CHADS2

- CHF (1)
- Hypertension (1)
- Age ≥ 75 years (1)
- Diabetes Mellitus (1)
- Prior stroke or TIA (2)

CHA_2DS_2-VASc

- CHF (1)
- Hypertension (1)
- Age ≥ 75 (2)
- Diabetes Mellitus (1)
- Prior Stroke or TIA (2)
- Vascular disease (1)
- Age 65-75 years (1)
- Female (1)

Risk of Bleeding

HAS-BLED

- Hypertension (1)
- Abnormal renal function (1)
- Abnormal liver function (1)
- Stroke (1)
- Bleeding (1)
- Labile INRs (1)
- Elderly (age > 65) (1)
- Drugs (1)
- Alcohol (1)

Board Question

A 48 year old man presents to the emergency department with palpitations and shortness of breath that had suddenly began 3 hours earlier. Following adminstration of IV metoprolol, the patient's rhythm converts to normal sinus rhythm and his symptoms resolve.

An echo demonstrates asymmetric septal hypertrophy (interventricular septal thickness 1.7cm, posterior wall thickness 0.9cm), mid systolic anterior motion of the mitral valve, mild left atrial enlargement and a 10mm Hg across the LV outflow tract at ret. LV systolic function is normal. A presumptive diagnosis of hypertrophic cardiomyopathy (HCM) is made.

Which of the following would be the next best step in management?

A. Warfarin for a goal INR 2-3

B. Aspirin 325mg daily

C. Holter monitor to decide AF burden

D. AV node ablation and DDD pacemaker

Board Question

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Which of the following would be the next best step in management?

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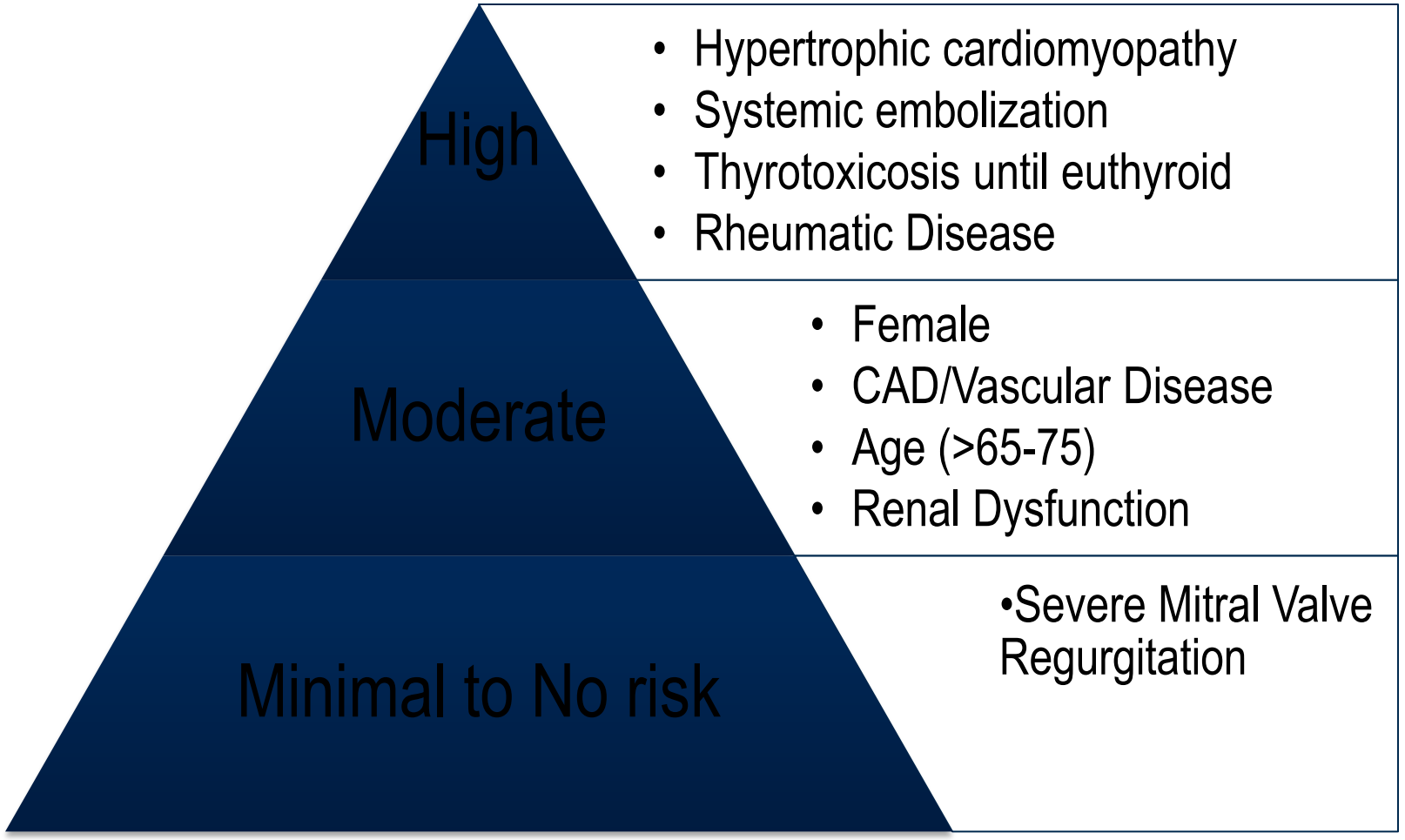
Answer

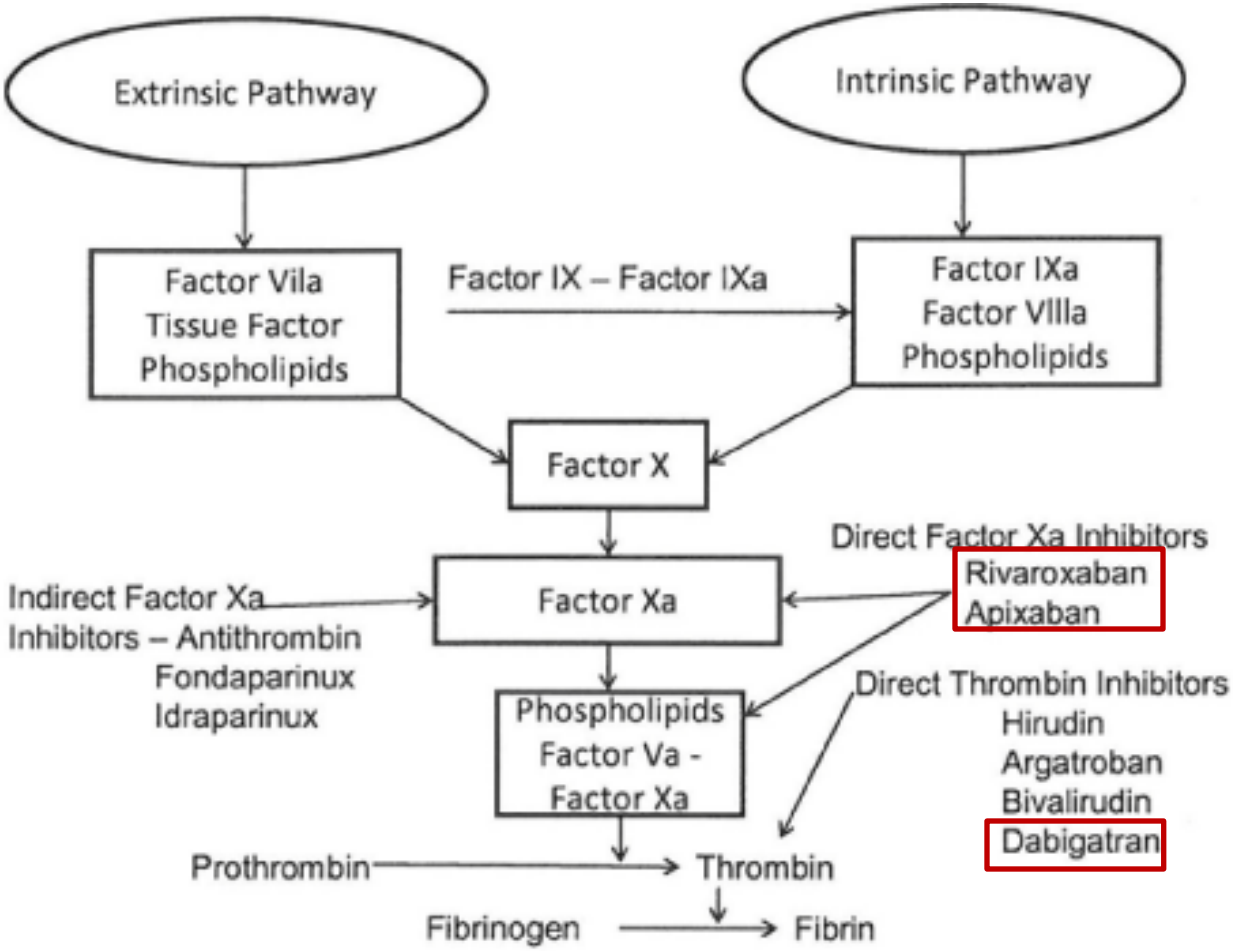
A. Warfarin for a goal INR 2-3

Patients with HCM and AF are at an increased risk of stroke and systemic thromboembolism and anticoagulation is recommended regardless of the CHADS-VASc score. In some series the risk of emobolic stroke is as high as 50% in HCM patients with AF.

Stroke Risk: Additional Considerations



New Oral AntiCoagulants (NOACs)



NOAC Trial Comparison

Trial	Patients (n)	CHADS2 (mean)	1° endpoint* (% / year)	Major Bleeding** (% / year)	Mortality (% / year)
RE-LY	n=18,113	2.1			
Dabigatran					
Warfarin					
ROCKET AF	n=14,264	3.5			
Rivaroxiban					
Warfarin					
ARISTOTLE	n=18,201	2.1			
Apixaban					
Warfarin					

NOAC Trial Comparison

Trial	Patients (n)	CHADS2 (mean)	1° endpoint* (% / year)	Major Bleeding** (% / year)	Mortality (% / year)
RE-LY	n=18,113	2.1			
Dabigatran			1.11 (p<0.001)		
Warfarin			1.69		
ROCKET AF	n=14,264	3.5			
Rivaroxiban			2.12 (p<0.001)		
Warfarin			2.42		
ARISTOTLE	n=18,201	2.1			
Apixaban			1.27 (p=0.011)		
Warfarin			1.60		

- 1° endpoint: Stroke or systemic embolism

NOAC Trial Comparison

Trial	Patients (n)	CHADS2 (mean)	1° endpoint* (% / year)	Major Bleeding** (% / year)	Mortality (% / year)
RE-LY	n=18,113	2.1			
Dabigatran			1.11 (p<0.001)	3.11 (p=0.36)	
Warfarin			1.69	3.36	
ROCKET AF	n=14,264	3.5			
Rivaroxiban			2.12 (p<0.001)	3.6	
Warfarin			2.42	3.4 (p=0.58)	
ARISTOTLE	n=18,201	2.1			
Apixaban			1.27 (p=0.011)	2.13 (p<0.001)	
Warfarin			1.60	3.09	

- 1° endpoint: Stroke or systemic embolism
- Major Bleeding: Reduction in hemoglobin of 2gm/dl, transfusion of at least 2 units of PRBCs, symptomatic bleeding in critical area, or death

NOAC Trial Comparison

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Trial	Patients (n)	CHADS2 (mean)	1° endpoint* (% / year)	Major Bleeding** (% / year)	Mortality (% / year)
RE-LY	n=18,113	2.1			
Dabigatran			1.11 (p<0.001)	3.11 (p=0.36)	3.64 (p=0.013)
Warfarin			1.69	3.36	4.13
ROCKET AF	n=14,264	3.5			
Rivaroxiban			2.12 (p<0.001)	3.6	1.9 (p=0.07)
Warfarin			2.42	3.4 (p=0.58)	2.2
ARISTOTLE	n=18,201	2.1			
Apixaban			1.27 (p=0.011)	2.13 (p<0.001)	3.52 (p=0.047)
Warfarin			1.60	3.09	3.94

- 1° endpoint: Stroke or systemic embolism
- Major Bleeding: Reduction in hemoglobin of 2gm/dl, transfusion of at least 2 units of PRBCs, symptomatic bleeding in critical area, or death
- GI bleeding: Trend toward less only in apixiban

PVI Anticogulation protocol

- Conflicting data on peri-procedural use of NOACs
  - May have higher incidence of bleeding with dabigatran

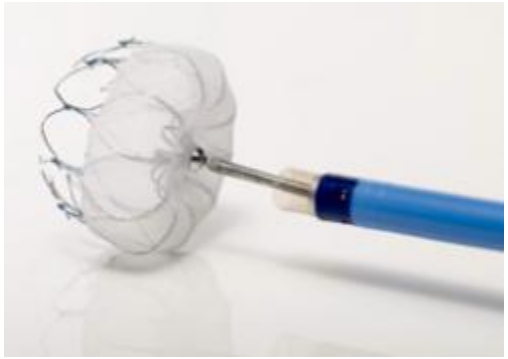
- Summa protocol:
  - Patient takes last dose of NOAC 24 hours prior to ablation then receives dose within 2 hours after sheath pull following PVI
  - Continue coumadin, uninterrupted with INR 2-3
  - All patients continue anticoagulation for minimum of three months following PVI
  - Decisions regarding anticoagulation > 3mos post ablation are based on stroke risk independent of rhythm control strategy (ie CHADS2VASC score)

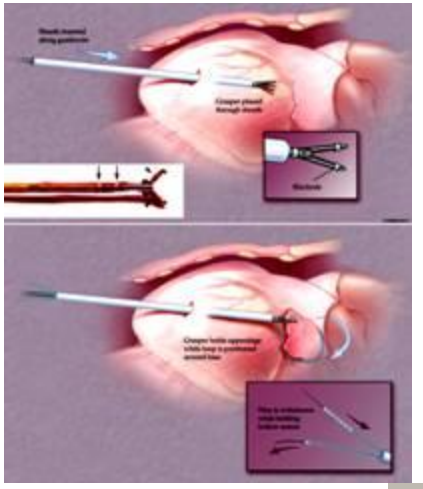
Alternative option?

What if patient can't take anticoagulation?

Emerging technology to occlude the left atrial appendage

1. Surgical ligation (good evidence, longest track record)
2. Watchman (FDA advisory panel approved, again…)
3. Amplatzer device
4. Lariet suture delivery device





Watchman Trial

FDA approval for alternative in patients with indication for anticoagulation for prevention of thromboembolic events

Rhythm Control

Strategies for rhythm control in patients with paroxysmal* and persistent AF.†

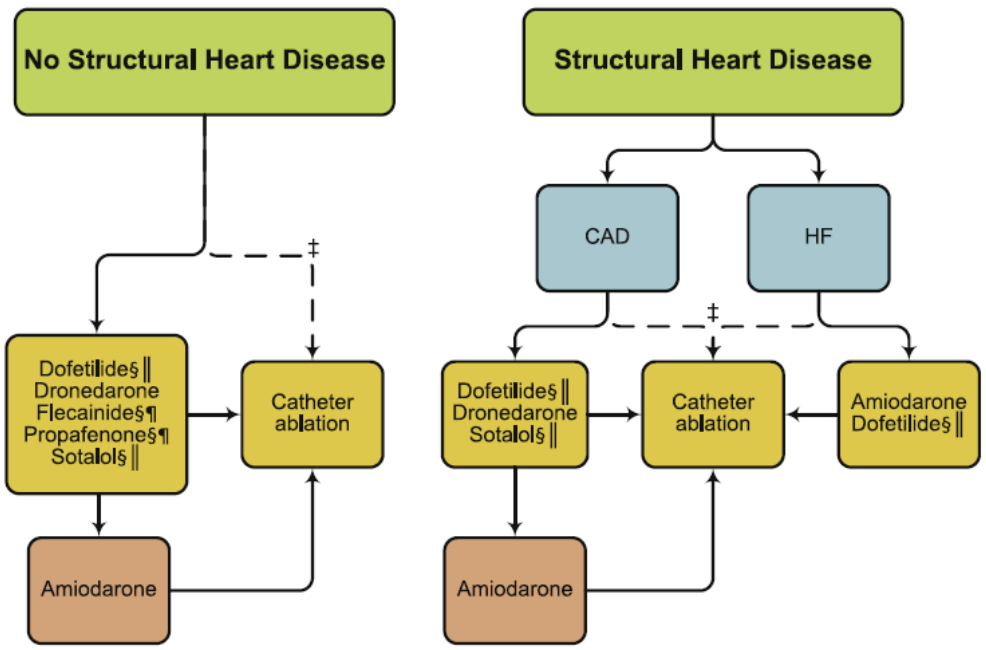


FIGURE 2 **Strategies for rhythm control in patients with paroxysmal* and persistent AF.†**

*Catheter ablation is only recommended as first-line therapy for patients with paroxysmal AF (Class IIa recommendation).
†Drugs are listed alphabetically.
‡Depending on patient preference when performed in experienced centers.
§Not recommended with severe LVH (wall thickness >1.5 cm).
‖Should be used with caution in patients at risk for torsades de pointes ventricular tachycardia.
¶Should be combined with AV nodal blocking agents.
AF indicates atrial fibrillation; AV, atrioventricular; CAD, coronary artery disease; HF, heart failure; and LVH, left ventricular hypertrophy.

2014 AHA/ACC/HRS Guideline for the Management of Patients With Atrial Fibrillation: Executive Summary

Evidence for rhythm control with RFA

Solid evidence for PVI in paroxysmal atrial fibrillation:

Following failed antriarrhythmic medication:

- APAF Trial *J Am Coll Cardiol* 2006;48:2340-7
- Thermocool AF Study *JAMA*. 2010;303(4):333-340
- STOP-AF Trial *J Am Coll Cardiol* 2013;61:1713-1723

As first line treatment:

- MANTRA-PAF *NEJM 10/2012;Vol367,No17*
- RAAFT -2 *JAMA. 2014;311(7):692-700*

The APAF Trial

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Journal of the American College of Cardiology
© 2006 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 48, No. 11, 2006
ISSN 0735-1097/06/$32.00
doi:10.1016/j.jacc.2006.08.037

EXPEDITED REVIEW

A Randomized Trial of Circumferential Pulmonary Vein Ablation Versus Antiarrhythmic Drug Therapy in Paroxysmal Atrial Fibrillation

The APAF Study

Carlo Pappone, MD, PHD, FACC,* Giuseppe Augello, MD,* Simone Sala, MD,* Filippo Gugliotta, BENG,* Gabriele Vicedomini, MD,* Simone Gulletta, MD,* Gabriele Paglino, MD,* Patrizio Mazzone, MD,* Nicoleta Sora, MD,* Isabelle Greiss, MD,* Andreina Santagostino, MD,* Laura LiVolsi, MD,* Nicola Pappone, MD,† Andrea Radinovic, MD,* Francesco Manguso, MD, PHD,* Vincenzo Santinelli, MD*

Milan and Telese Terme, Italy

APAF Trial: Study Design

198 patients age 18-70 presenting with paroxysmal atrial fibrillation >6 months and qualifying atrial fibrillation burden >2 episodes per month despite AAD

Randomized.

33% female, mean age 56 years, mean follow-up 12 months

Circumferential pulmonary vein ablation (CPVA)
n=99

Antiarrhythmic medical therapy
n=99

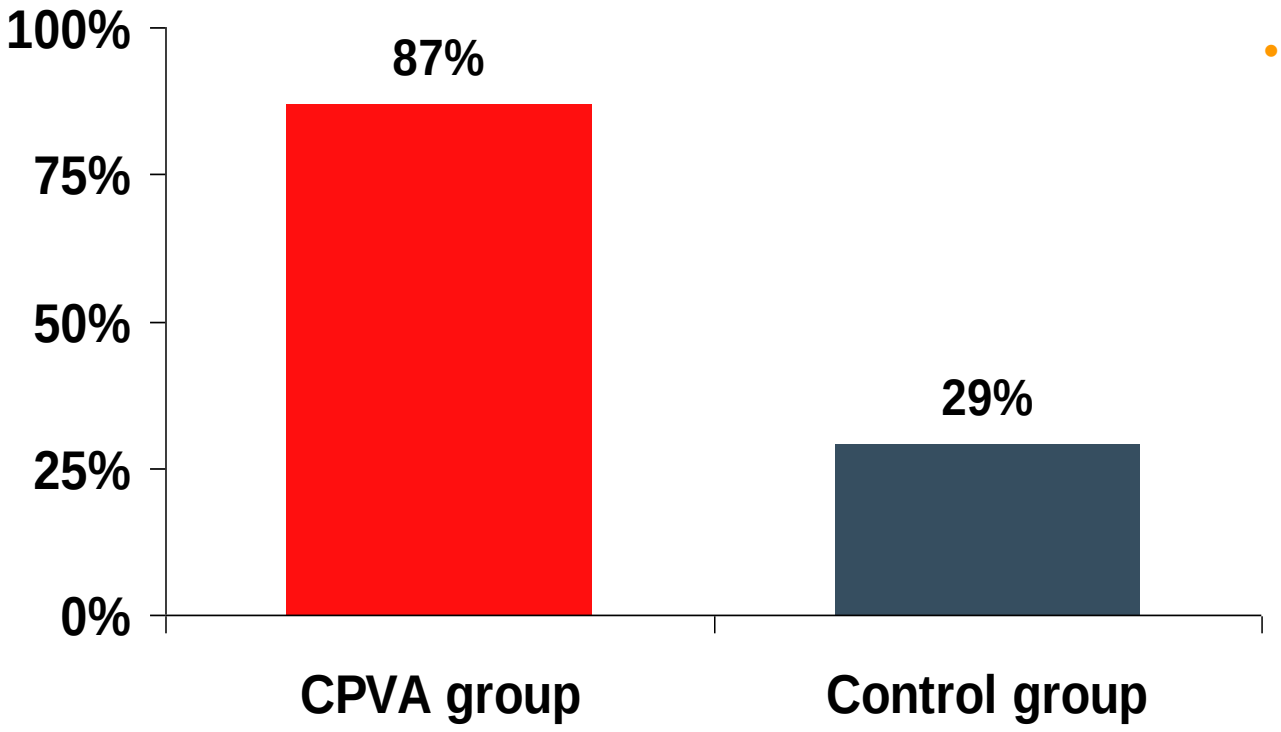
with flecainide (n=33)
with sotalol (n=33)
with amiodarone (n=33)

Following a 1-month run-in phase to uptitrate antiarrhythmic medical therapy in both arms, ablation was performed in patients randomized to CPVA to encircle all 4 PVs with 3 additional lines to prevent atrial tachycardias (ATs) using either a 8mm or a 3.5mm irrigated tip catheter and with the guide of CARTO or NavX system. Medical therapy was discontinued in the CPVA group. Crossovers were allowed after 3 months.

- Primary Endpoint: Freedom from recurrent atrial arrhythmias

APAF Trial: Primary Endpoint at 9 months

Freedom from recurrent AF and AT at 9 months (%)
p<0.001



- **At 9 months, a greater number of patients in the CPVA group were free from recurrent AF and AT (all CPVA patients in the absence of antiarrhythmic drug therapy) (87% vs 29%; p<0.001)**

Cryoablation of AF: STOP AF Trial

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Journal of the American College of Cardiology
© 2013 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 61, No. 16, 2013
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2012.11.064

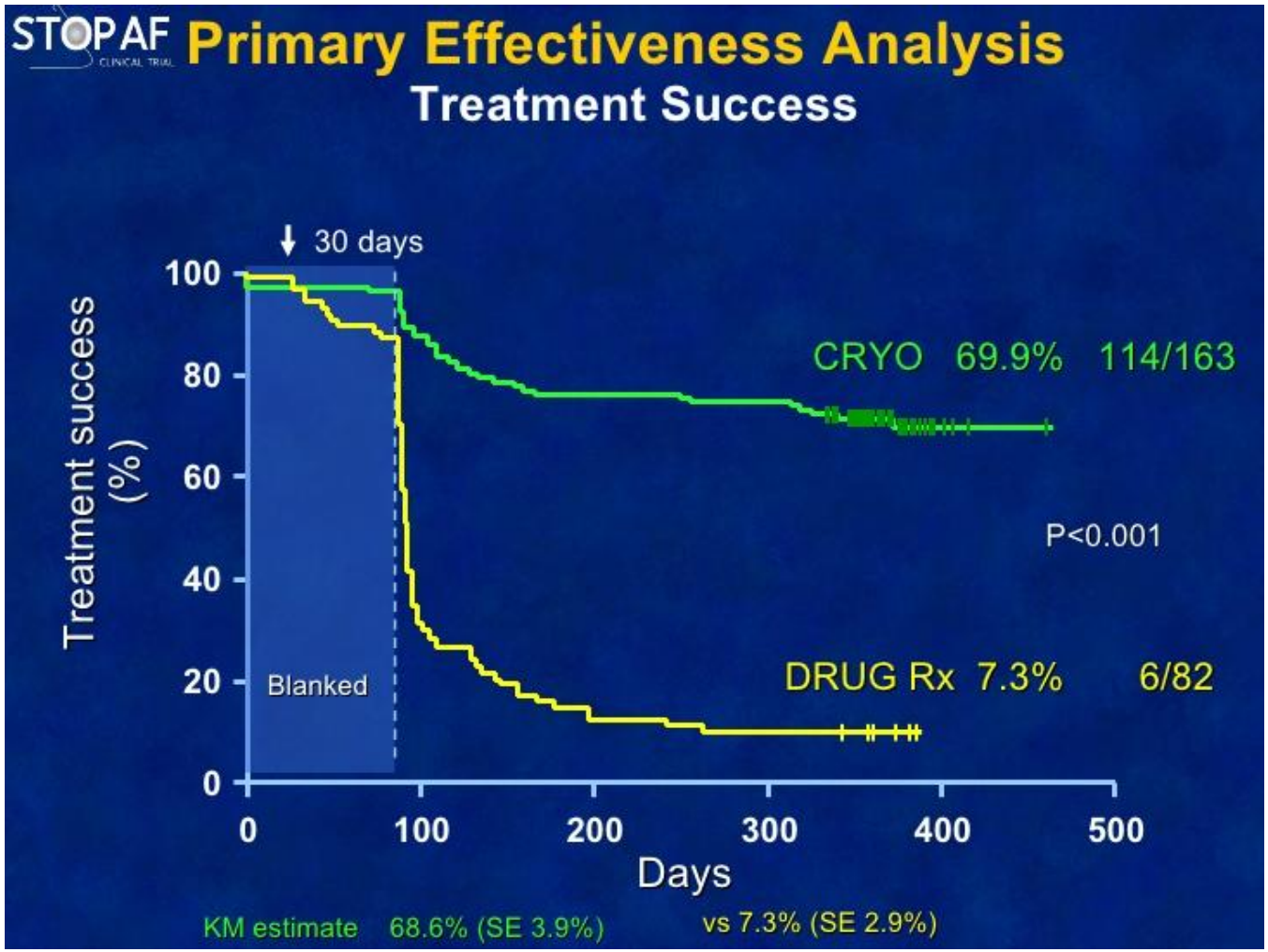
Cryoballoon Ablation of Pulmonary Veins for Paroxysmal Atrial Fibrillation

First Results of the North American Arctic Front (STOP AF) Pivotal Trial

Douglas L. Packer, MD,* Robert C. Kowal, MD,† Kevin R. Wheelan, MD,† James M. Irwin, MD,‡ Jean Champagne, MD,§ Peter G. Guerra, MD,‖ Marc Dubuc, MD,‖ Vivek Reddy, MD,¶ Linda Nelson, RN,# Richard G. Holcomb, PHD,** John W. Lehmann, MD, MPH,†† Jeremy N. Ruskin, MD,‡‡ for the STOP AF Cryoablation Investigators

Rochester, Minnesota; Dallas, Texas; Tampa, Florida; Quebec, Canada; New York, New York; Minneapolis, Minnesota; and Wayland and Boston, Massachusetts

Cryoablation PVI: STOP AF Trial



Adverse events in STOP AF

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Table 2 Summary of Adverse Events On-Treatment Analysis

Type of Adverse Event	Drug Treatment (N = 82) No. of Events	%	Cryoablation (N = 163) No. of Cryoablation Events	%	All Cryoballoon-Treated (N = 228) All Events	%
Stroke	0	0.0	4	2.5	5	2.2
TIA	0	0.0	3	1.8	4	1.8
Tamponade	0	0.0	1	0.6	2	0.9
Myocardial infarction	0	0.0	2	1.2	2	0.9
Hemorrhage requiring transfusion	1	1.2	3	1.8	3	1.3
New atrial flutter	12	14.6	6	3.7	8	3.5
Atrial esophageal fistula	0	0.0	0	0.0	0	0.0
Death	0	0.0	1	0.6	1	0.4
New or worsened arteriovenous fistula	0	0.0	2	1.2	2	0.9
Pseudoaneurysm	0	0.0	1	1.6	2	0.9
Phrenic nerve palsy	0	0.0	22	13.5	28	12.3
Persistent phrenic nerve palsy	0	0.0	4	2.5	4	1.8
PV stenosis	0	0.0	5	3.1	7	3.1

PV = pulmonary vein; TIA = transient ischemic attack.

MANTRA-PAF Trial

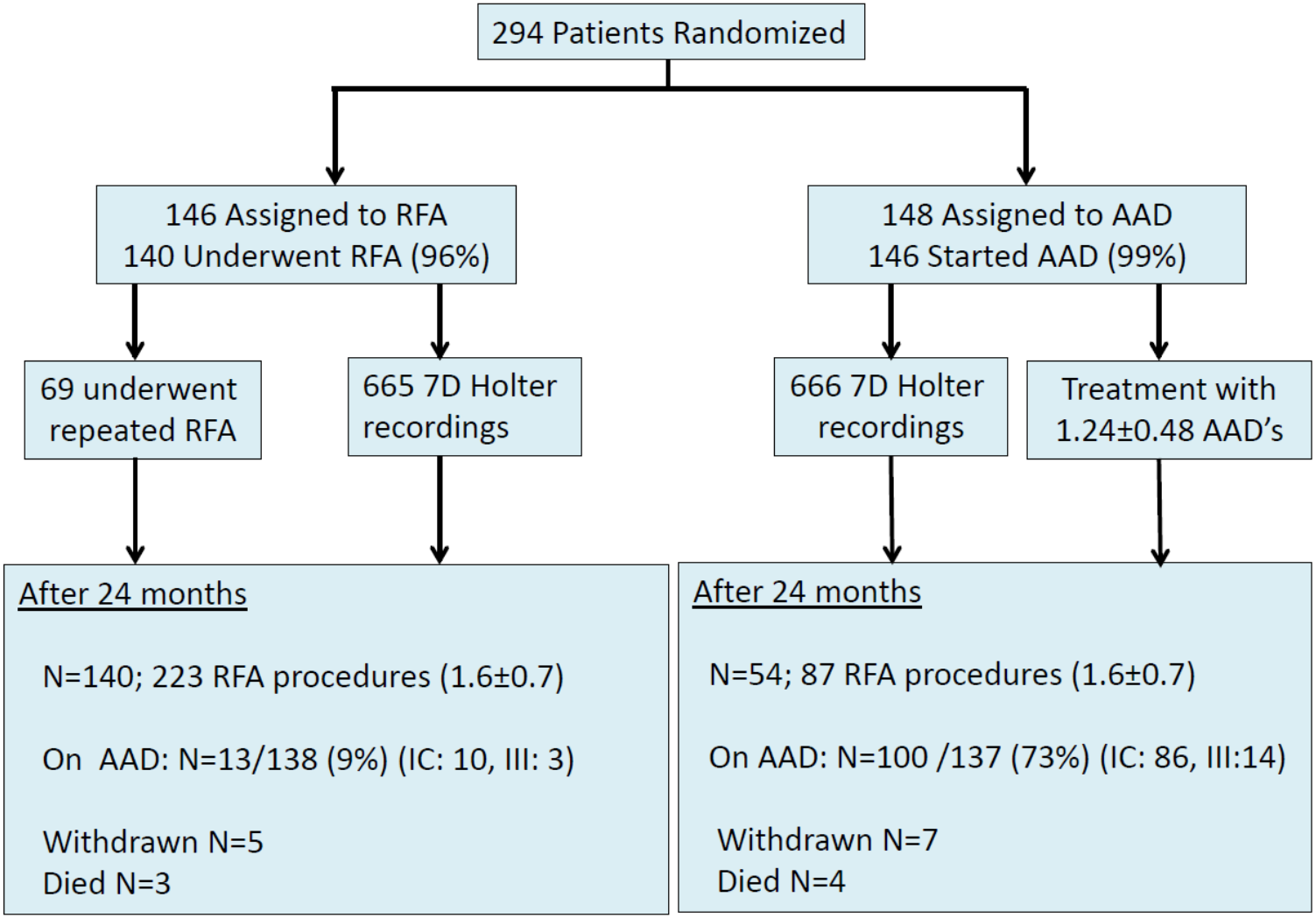
The NEW ENGLAND JOURNAL of MEDICINE

ESTABLISHED IN 1812 OCTOBER 25, 2012 VOL. 367 NO. 17

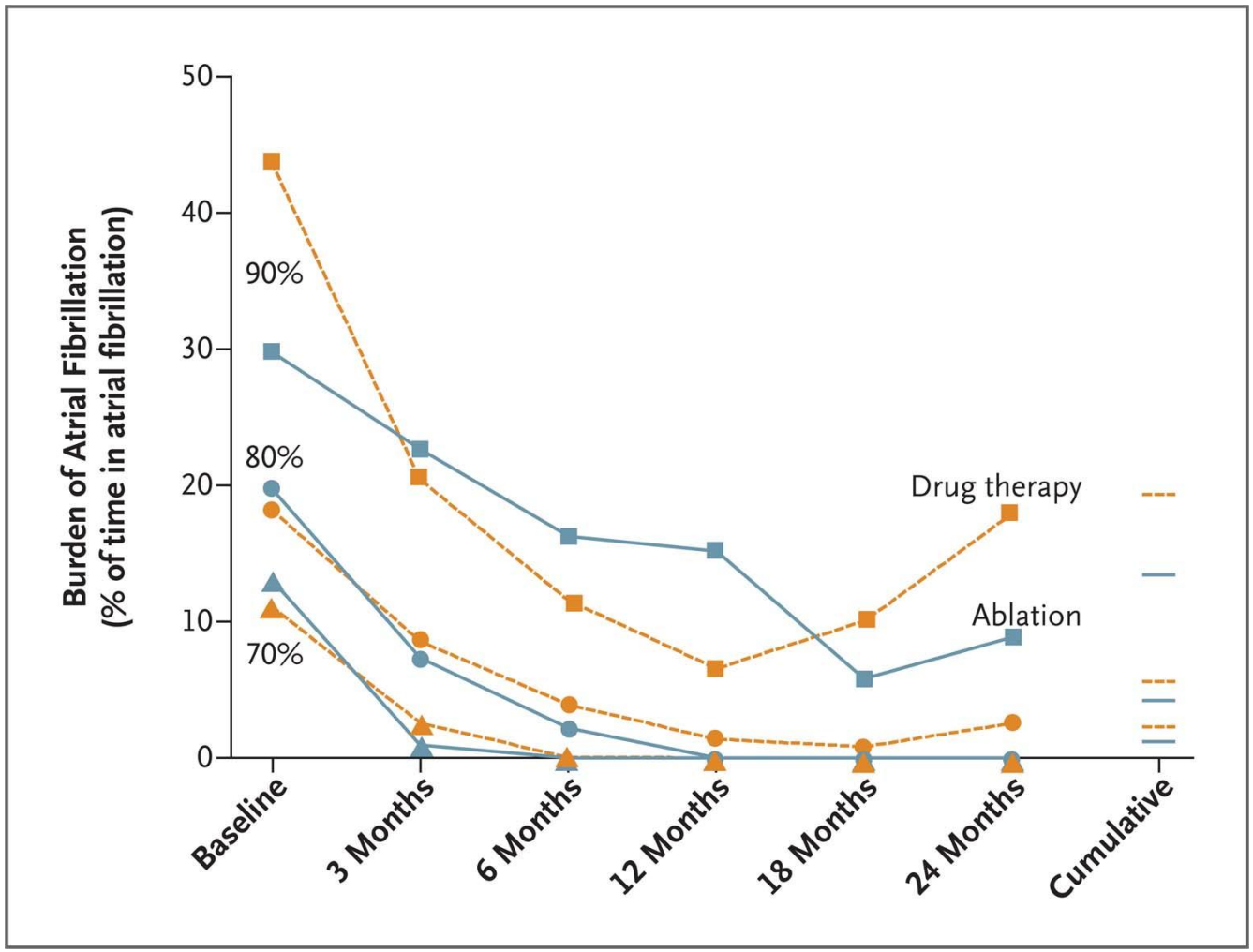
Radiofrequency Ablation as Initial Therapy in Paroxysmal Atrial Fibrillation

Jens Cosedis Nielsen, M.D., D.M.Sc., Arne Johannessen, M.D., D.M.Sc., Pekka Raatikainen, M.D., Ph.D., Gerhard Hindricks, M.D., Ph.D., Håkan Walfridsson, M.D., Ph.D., Ole Kongstad, M.D., Ph.D., Steen Pehrson, M.D., D.M.Sc., Anders Englund, M.D., Ph.D., Juha Hartikainen, M.D., Ph.D., Leif Spange Mortensen, M.Sc., and Peter Steen Hansen, M.D., D.M.Sc.

MANTRA-PAF


294 Patients Randomized
146 Assigned to RFA
140 Underwent RFA (96%)
148 Assigned to AAD
146 Started AAD (99%)
69 underwent repeated RFA
665 7D Holter recordings
666 7D Holter recordings
Treatment with 1.24±0.48 AAD's
After 24 months
N=140; 223 RFA procedures (1.6±0.7)
On AAD: N=13/138 (9%) (IC: 10, III: 3)
Withdrawn N=5
Died N=3
After 24 months
N=54; 87 RFA procedures (1.6±0.7)
On AAD: N=100 /137 (73%) (IC: 86, III:14)
Withdrawn N=7
Died N=4

MANTRA-PAF: Response according to Rx



RAAFT-2 Trial

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Research

Original Investigation

Radiofrequency Ablation vs Antiarrhythmic Drugs as First-Line Treatment of Paroxysmal Atrial Fibrillation (RAAFT-2)
A Randomized Trial

Carlos A. Morillo, MD, FRCPC; Atul Verma, MD, FRCPC; Stuart J. Connolly, MD, FRCPC; Karl H. Kuck, MD, FHRS; Girish M. Nair, MBBS, FRCPC; Jean Champagne, MD, FRCPC; Laurence D. Sterns, MD, FRCPC; Heather Beresh, MSc; Jeffrey S. Healey, MD, MSc, FRCPC; Andrea Natale, MD; for the RAAFT-2 Investigators

IMPORTANCE Atrial fibrillation (AF) is the most common rhythm disorder seen in clinical practice. Antiarrhythmic drugs are effective for reduction of recurrence in patients with symptomatic paroxysmal AF. Radiofrequency ablation is an accepted therapy in patients for whom antiarrhythmic drugs have failed; however, its role as a first-line therapy needs further investigation.

OBJECTIVE To compare radiofrequency ablation with antiarrhythmic drugs (standard therapy) in treating patients with paroxysmal AF as a first-line therapy.

DESIGN, SETTING, AND PATIENTS A randomized clinical trial involving 127 treatment-naive patients with paroxysmal AF were randomized at 16 centers in Europe and North America to received either antiarrhythmic therapy or ablation. The first patient was enrolled July 27, 2006; the last patient, January 29, 2010. The last follow-up was February 16, 2012.

INTERVENTIONS Sixty-one patients in the antiarrhythmic drug group and 66 in the radiofrequency ablation group were followed up for 24 months.

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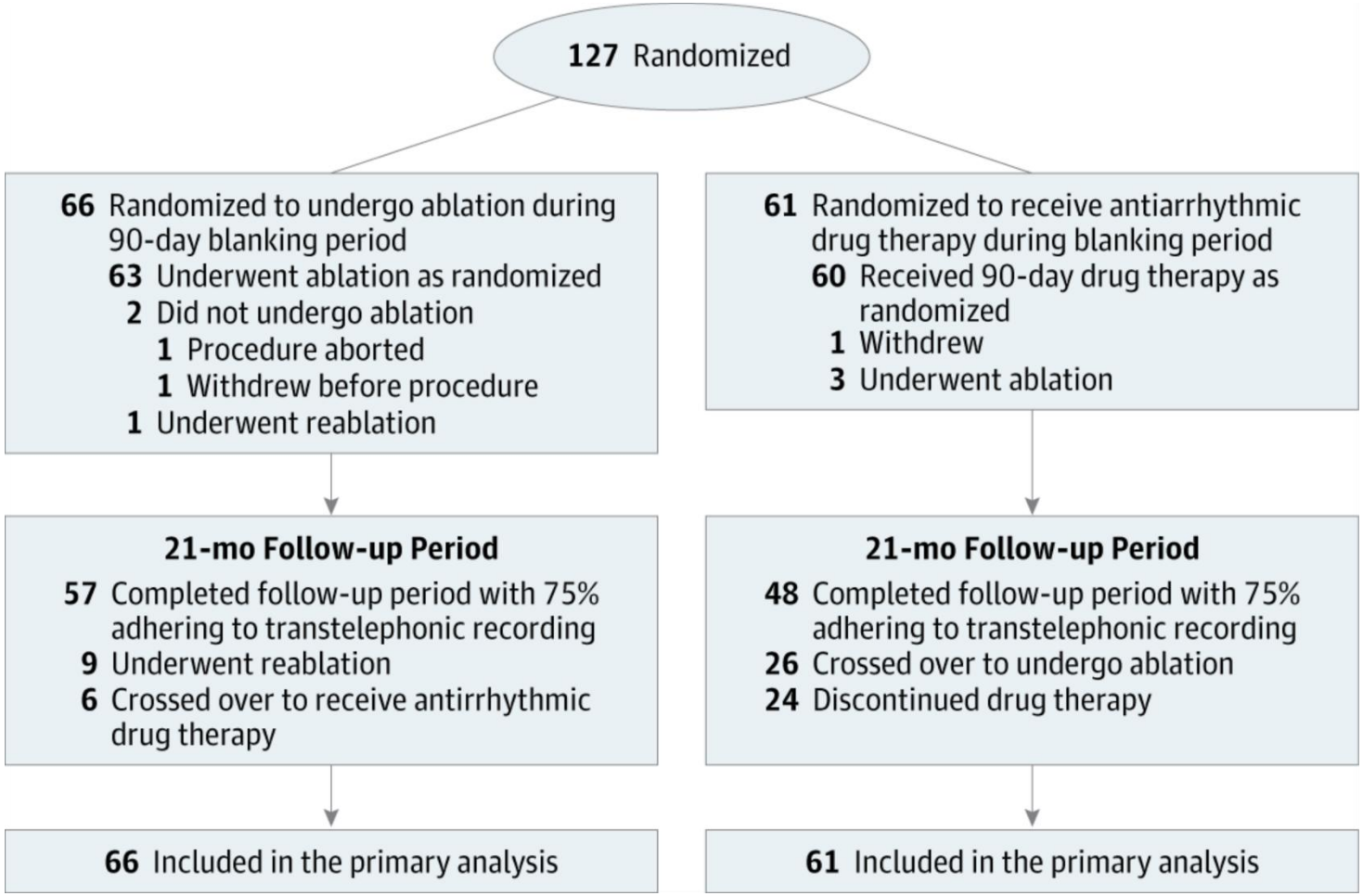
Supplemental content at jama.com



JAMA. 2014;311(7):692-700. doi:10.1001/jama.2014.467

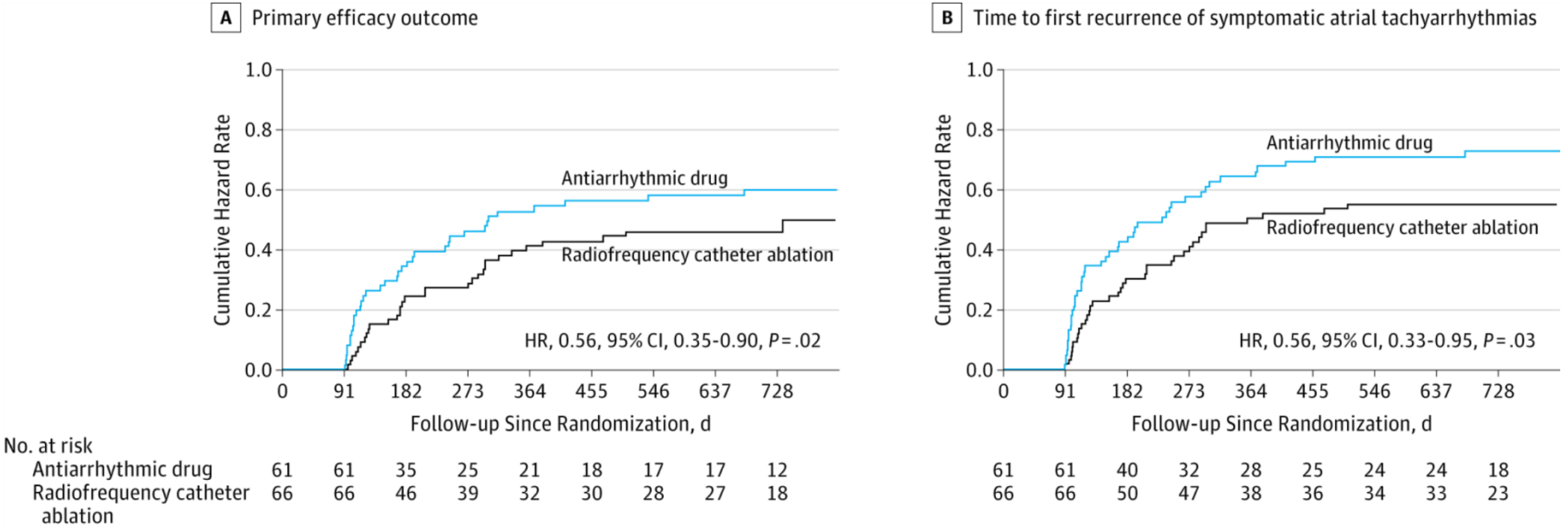
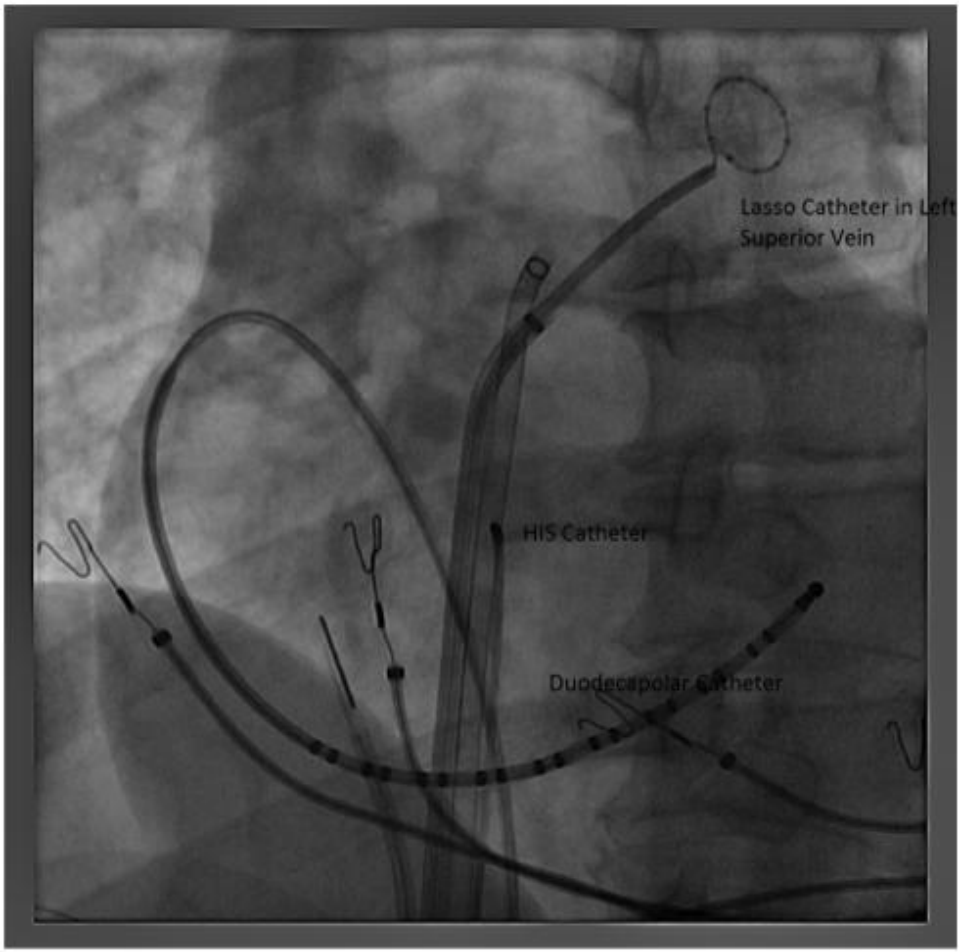


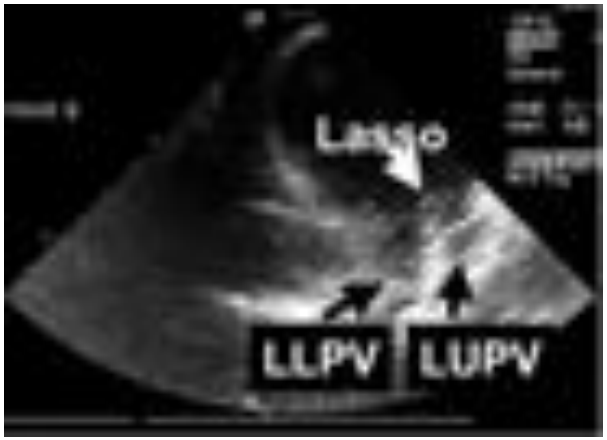
Figure Legend:

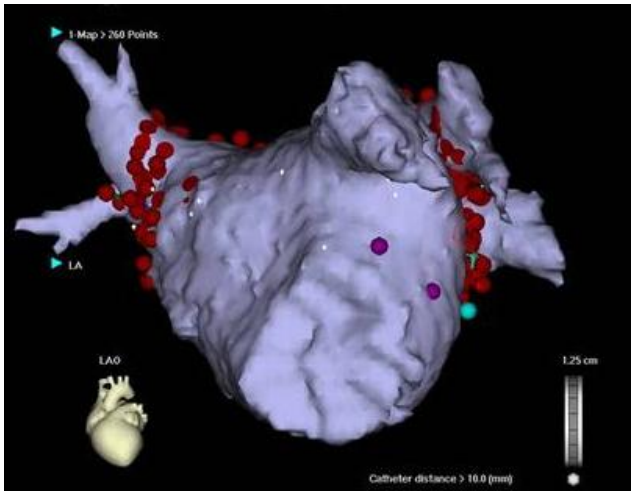
Kaplan-Meier Curves of Time to First Recurrence of Any Atrial Tachyarrhythmias (A) and Time to First Recurrence of Symptomatic Atrial Tachyarrhythmias (B)Tachyarrhythmias include atrial fibrillation, tachycardia, and flutter. HR indicates hazard ratio.

JAMA. 2014;311(7):692-700. doi:10.1001/jama.2014.467

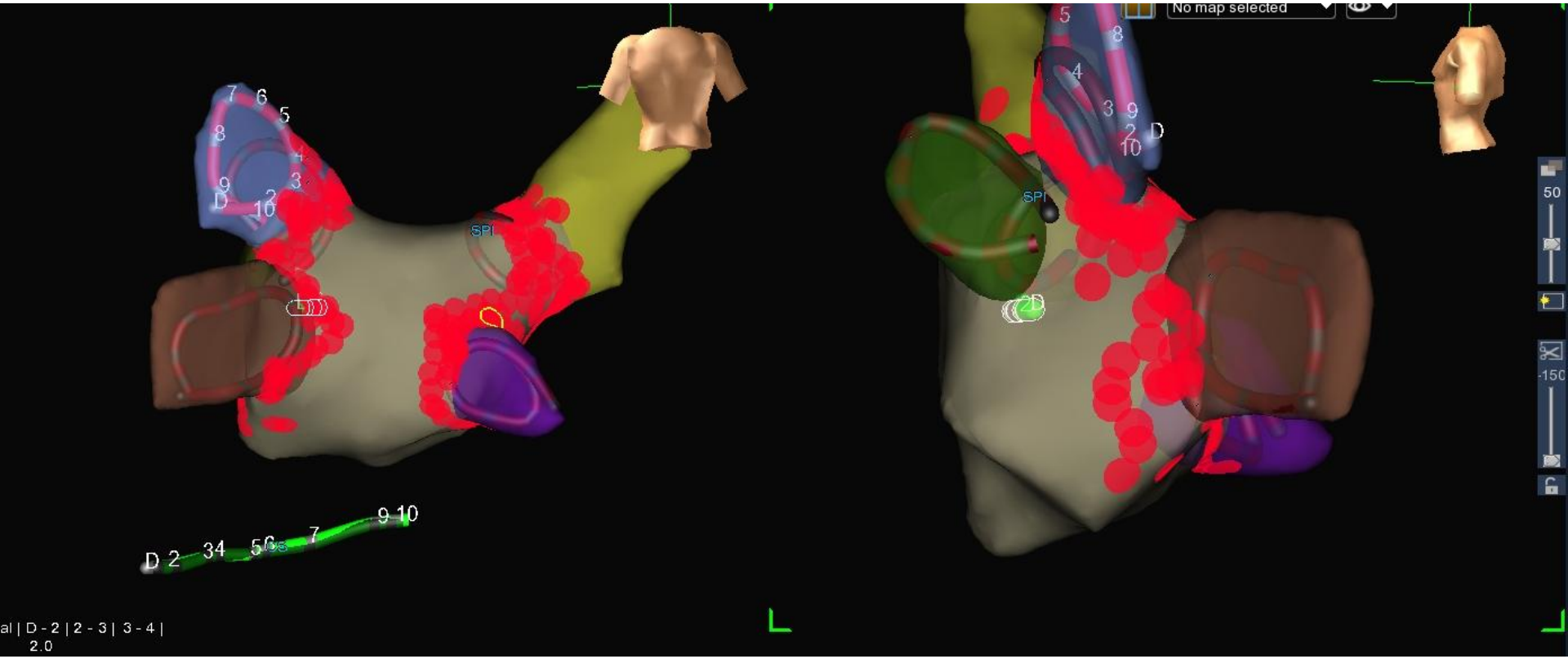
PVI: Technique in APAF, Thermocool AF







PVI: ESI-NAVX (paroxysmal lesion set)



Key to define: Pulmonary vein isolation

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Endpoint is to achieve electric isolation of all PVs.

- Entrance Block: confirmed with absence of electrograms at the os of veins (along plane of ablation). Adenosine infusion- hyperpolarize membrane which results in conduction when line of block is incomplete. May confirm with distal pacing (ie from appendage, coronary sinus or right atrium)
- Exit Block: Less critical to define, but involves pacing from lasso catheter and monitoring for capture outside of vein
- Drug testing and programmed stimulation:
  - Adenosine: 6-18 mg IV push with lasso at os of each vein (hence administer four times)
  - Isuprel: 10-20 mcg/min with lasso in place to look re-induction of AF and non-pulmonary vein triggers
  - Search for dual AV node physiology, AP, or inducible arrhythmia
- In total 30 minute monitoring period following final ablation

Pre-Isolation

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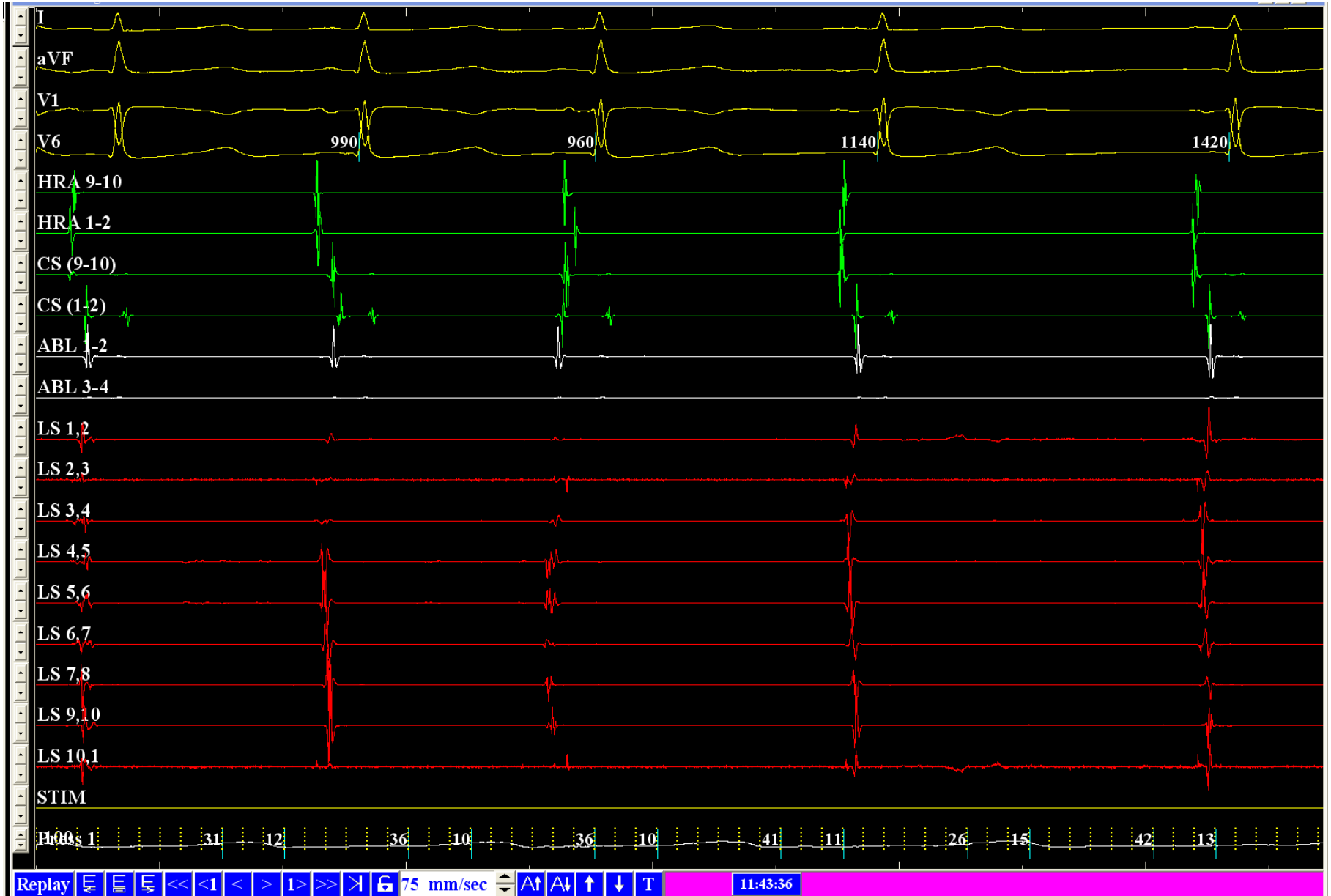
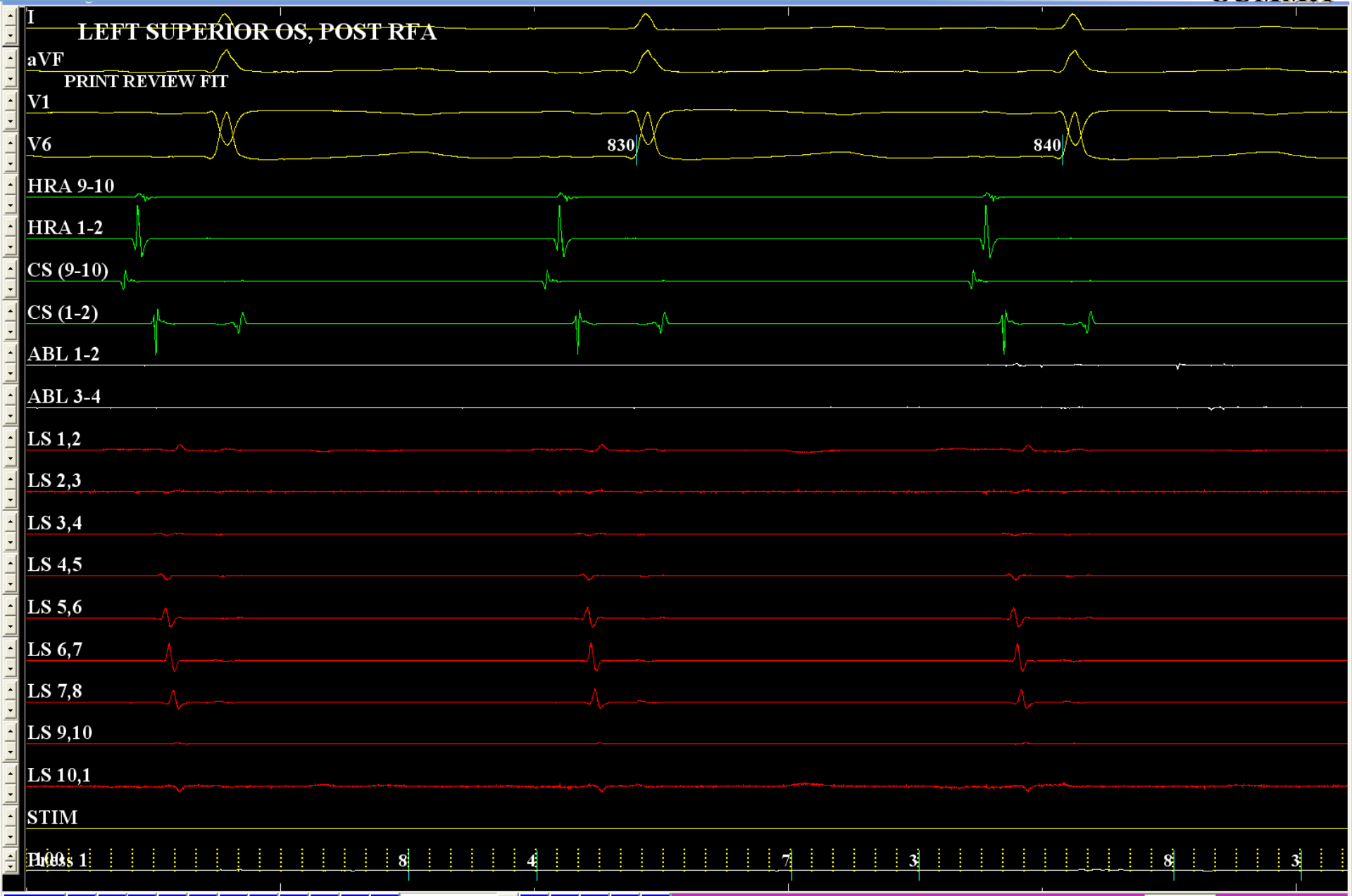
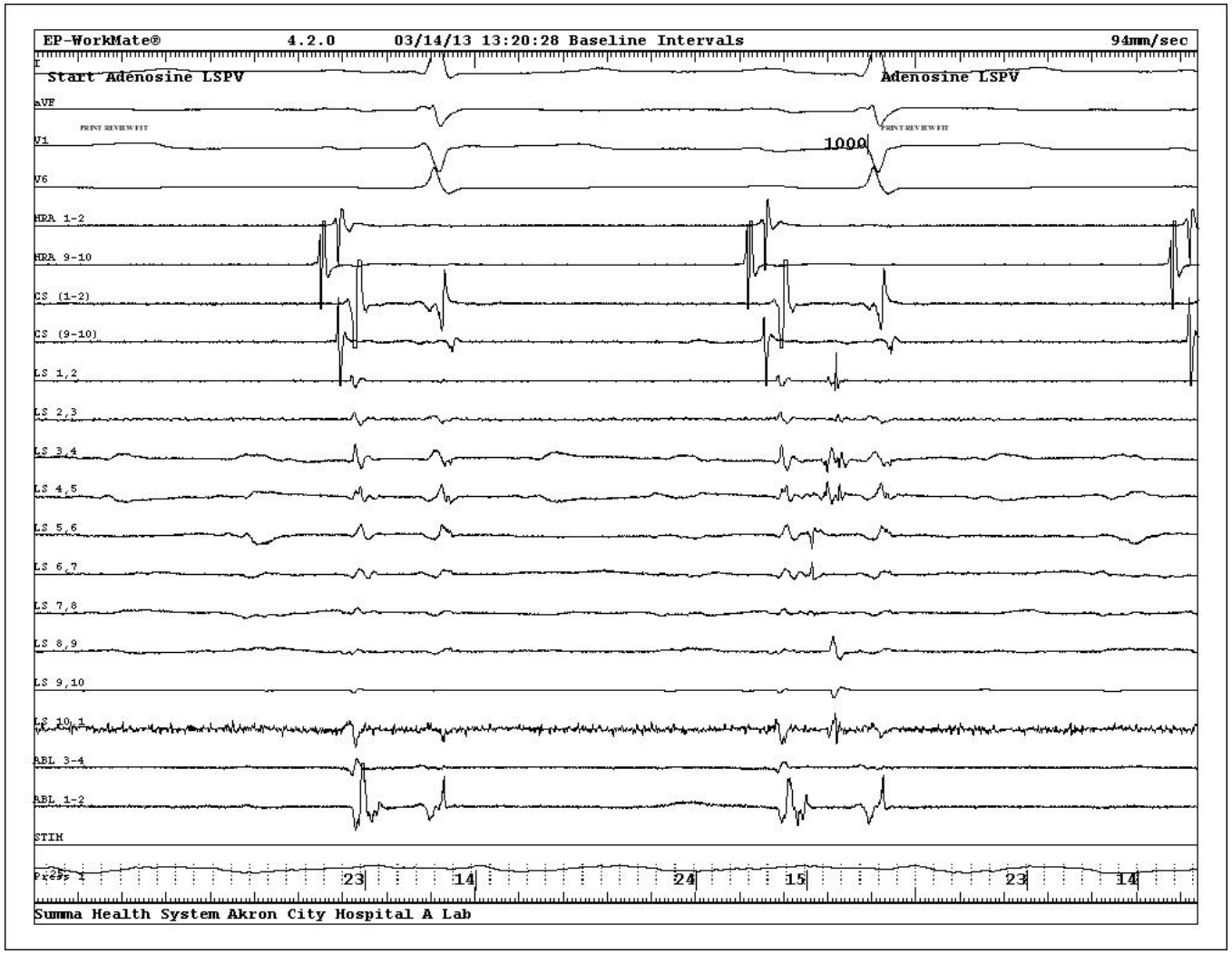


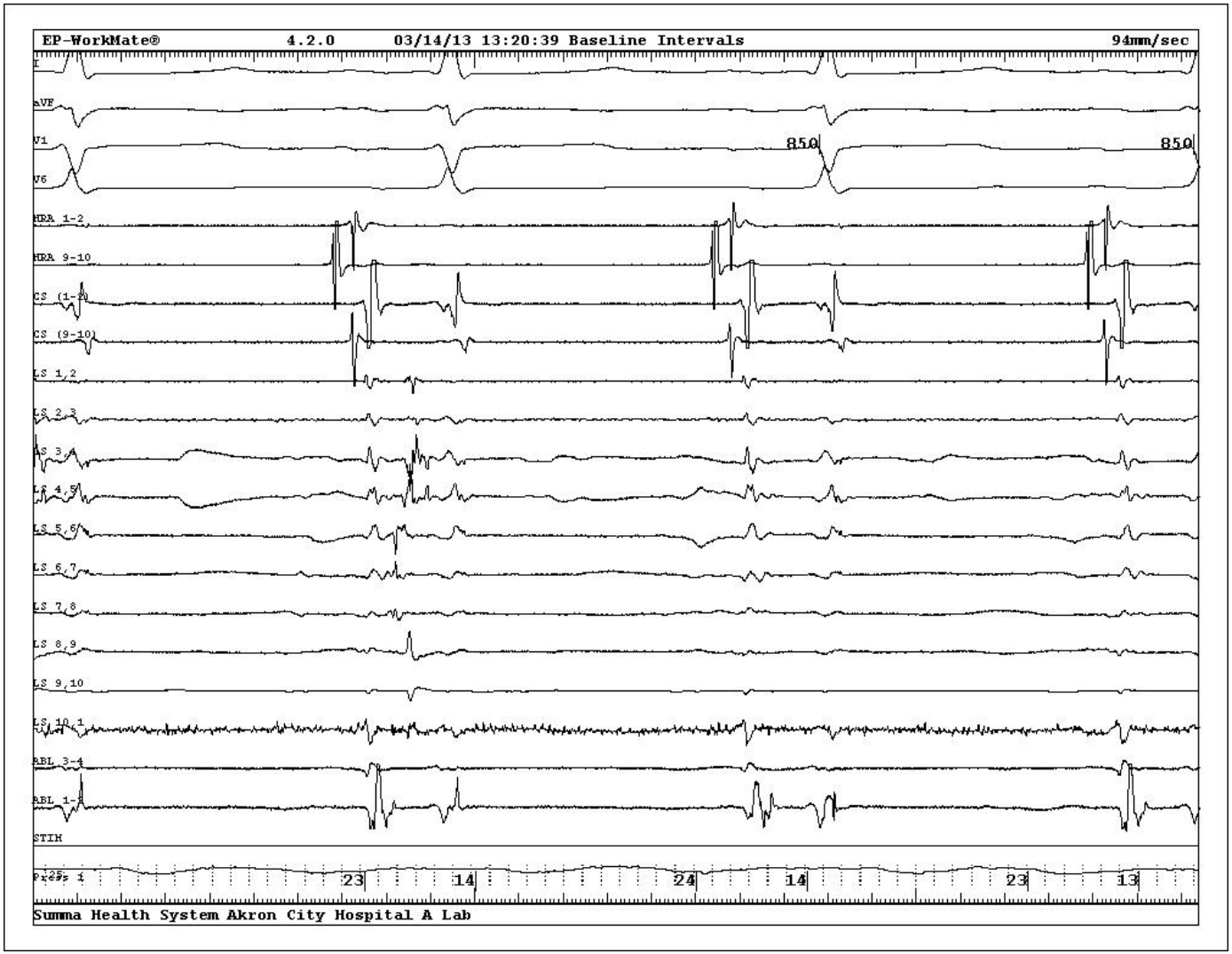
Post-Ablation



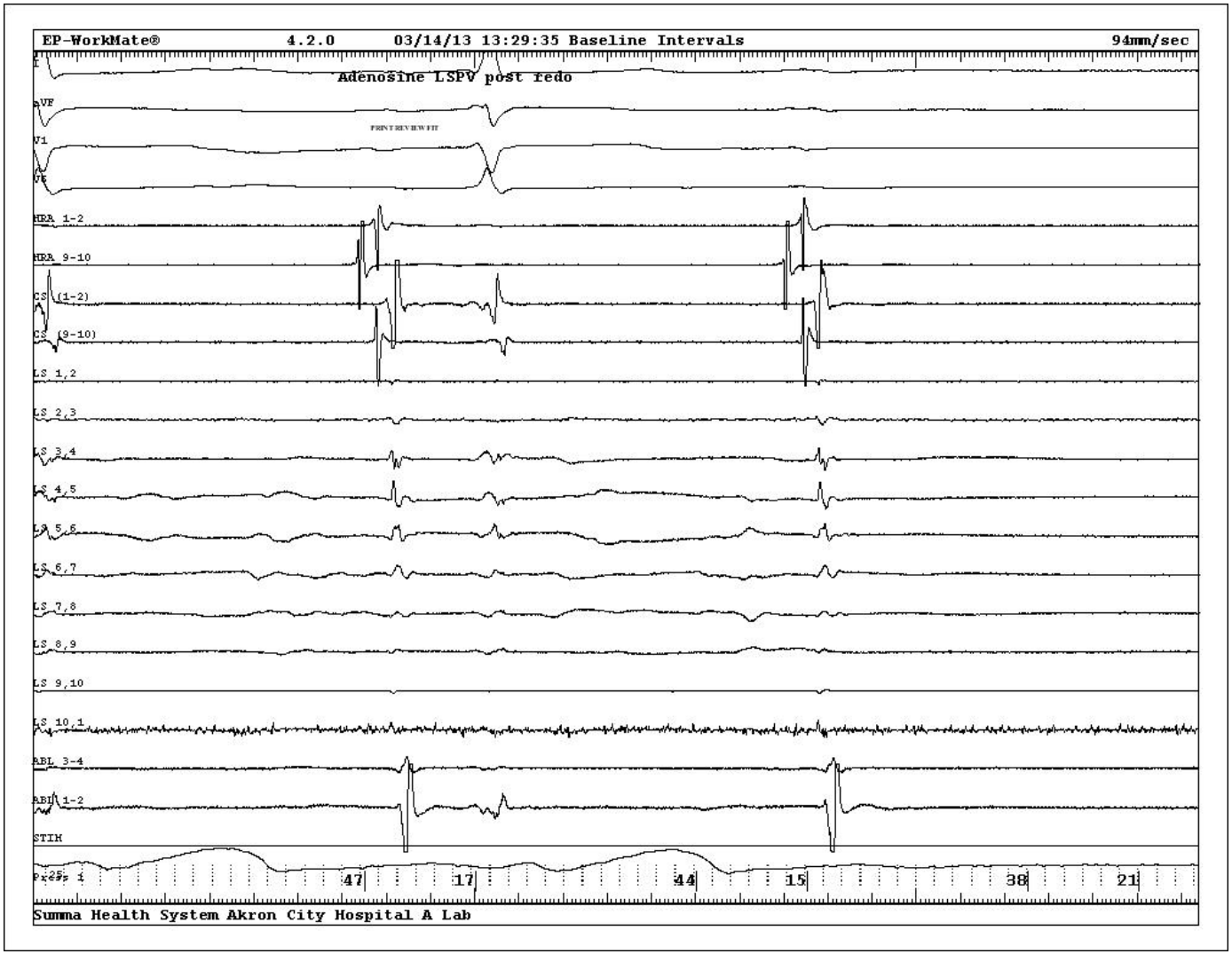
PV reconnection with Adenosine



Adenosine wears off – but need to treat



Post RF ablation – no reconnection



PVI vs antiarrhythmic medical therapy?

When to consider a patient with AF for PVI ablation?

Paroxysmal AF after failed AADs

- APAF Trial
- Thermocool-AF Study
- STOP-AF Trial

Paroxysmal AF as initial therapy

- Mantra-PAF
- RAAFT-2
- CABANA should be definitive trial

➢ Ablation is best suited when relatively low risk of stroke (CHADS2 score) and recurrent, self-limited symptomatic episodes of atrial fibrillation in particular when occur on medical therapy i.e. Paroxysmal AF refractory to an antiarrhythmic drug (AAD)

PVI vs antiarrhythmic medical therapy?

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When to refer a patient with AF for ablation?

Solid evidence for Paroxysmal AF

- APAF Trial
- Thermocool-AF Study
- STOP-AF Trial
- MANTRA-PAF
- RAAFT-2

- Ablation is best suited for patient with relatively low risk of stroke (CHADS2 score) and recurrent, self-limited symptomatic episodes of atrial fibrillation
- The time to consider AF ablation is soon after symptomatic recurrences. Risk of waiting is progression to more persistent nature of AF with more LA scarring and decrease opportunity for long-term rhythm control

2012 Guidelines for AF ablation

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INDICATIONS FOR CATHETER ABLATION of AF

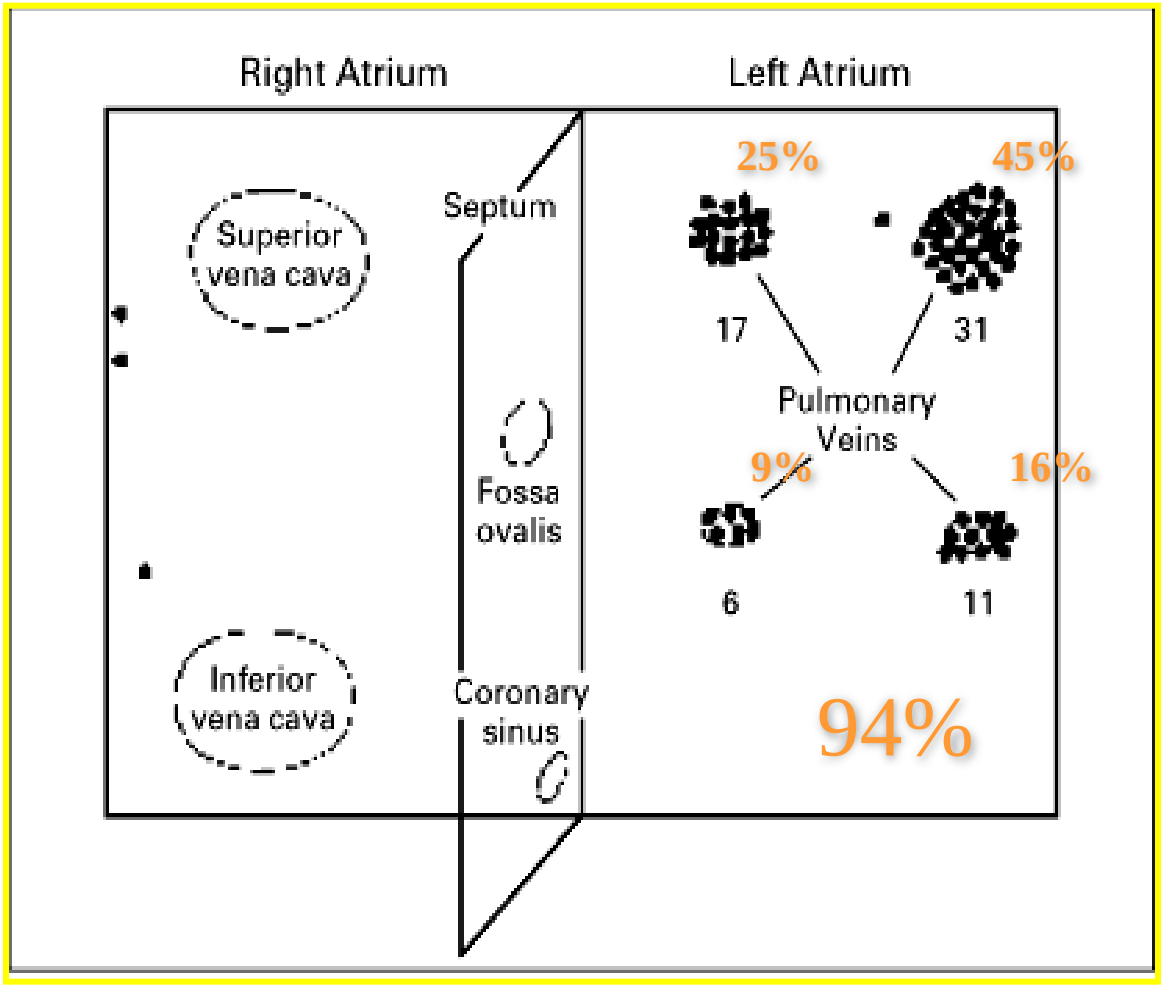
	CLASS	LEVEL
Symptomatic AF refractory or intolerant to at least one Class 1 or 3 antiarrhythmic medication		
Paroxysmal: Catheter ablation is recommended *	I	A
Persistent: Catheter ablation is reasonable	IIa	B
Longstanding Persistent: Catheter ablation may be considered	IIb	B
Symptomatic AF prior to initiation of antiarrhythmic drug therapy with a Class 1 or 3 antiarrhythmic agent		
Paroxysmal: Catheter ablation is reasonable	IIa	B
Persistent: Catheter ablation may be considered	IIb	C
Longstanding Persistent: Catheter ablation may be considered	IIb	C

**Catheter ablation of symptomatic paroxysmal AF is considered a Class 1 indication only when performed by an electrophysiologist who has received appropriate training and is performing the procedure in an experienced center*

2015: Ablation Candidates

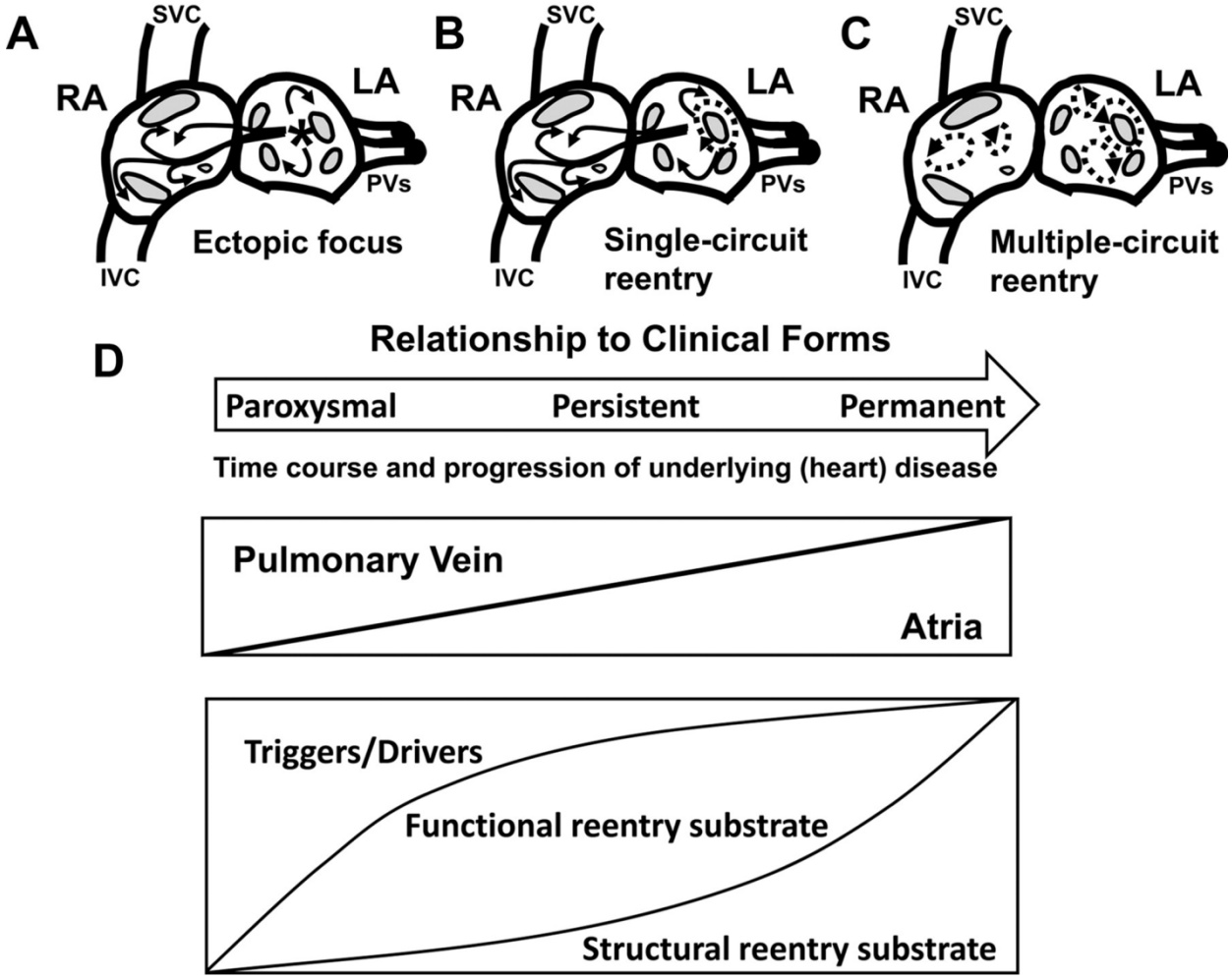
- Symptomatic Paroxysmal AF refractory to ≥ 1 AAD:
  - Freedom from AF for 1 year is ~75%-85% (APAF, ThermoCool)
- Symptomatic Paroxysmal AF as first line treatment (MANTRA-PAF, RAAFT1/2):
  - Freedom from any recurrence over 2 years is ~55%
- Symptomatic Persistent AF refractory to ≥ 1 AAD
  - Freedom from AF for 1 years is ~50% (Oral et al, NEJM 2006)
  - ? Efficacy of ablation in Long standing atrial fibrillation, in particular when left atrium is severely dilated and/or scarred

Classic Paper defining AF Triggers



Haissaguerre New Engl J Med 1998

Possible mechanism of Atrial Fibrillation



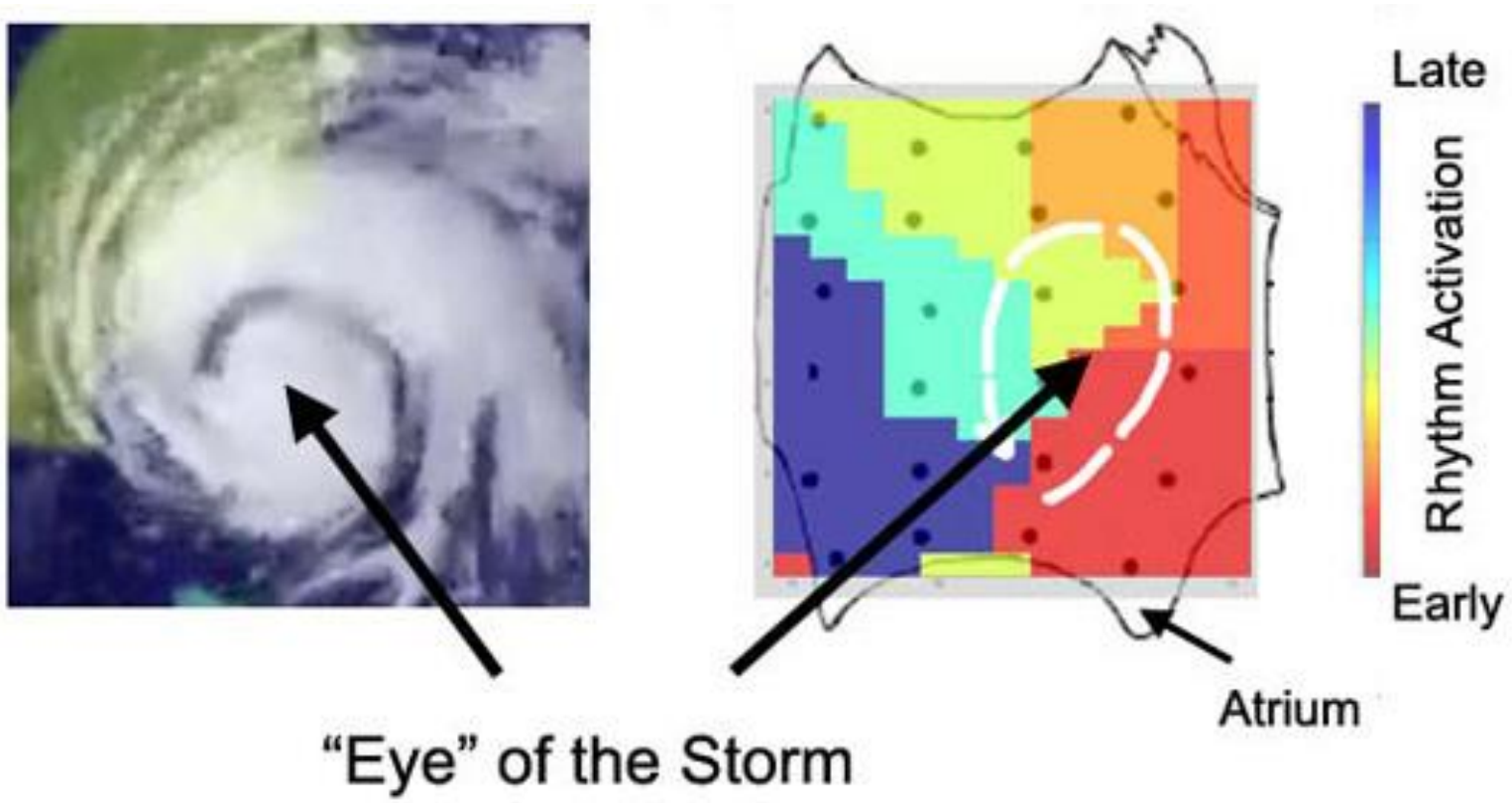
Mechanism of AF

- Haissaguerre et al. demonstrated that ectopic beats from PV may trigger AF, however underlying mechanisms which supports and sustains AF are not well understood
- 2 prevailing hypotheses:
  1. Multiwavelet hypothesis: continuously meandering, random electrical wavelets create an unorganized atrial rhythm (AF)
  2. Localized source hypothesis: organized reentrant circuits are stable and self-sustained to cause high frequency activation which results in complex patterns of activation that characterize AF – so called rotors

Rotors

Hurricane

Atrial Fibrillation



Sustained arrhythmia requires substrate

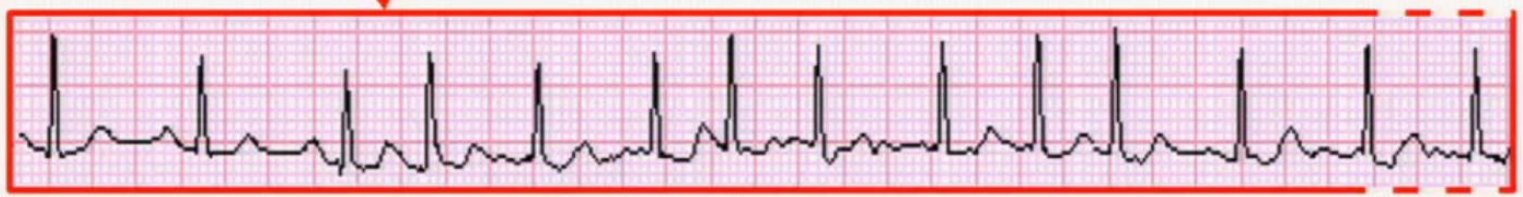
Tens of Minutes/Hours

Trigger + **Accessory Pathway, Cavotricuspid Isthmus, Slow Pathway, Ectopy** → **SVT**

Ablation → >85 % success[1]
(one procedure)

Paroxysmal AF: Hours/Days

Trigger + **Sustaining Mechanisms (Stable Rotors/Focal sources)** → **AF**



CONFIRM Trial

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Journal of the American College of Cardiology
© 2012 by the American College of Cardiology Foundation
Published by Elsevier Inc.

Vol. 60, No. 7, 2012
ISSN 0735-1097/$36.00
http://dx.doi.org/10.1016/j.jacc.2012.05.022

EXPEDITED PUBLICATIONS

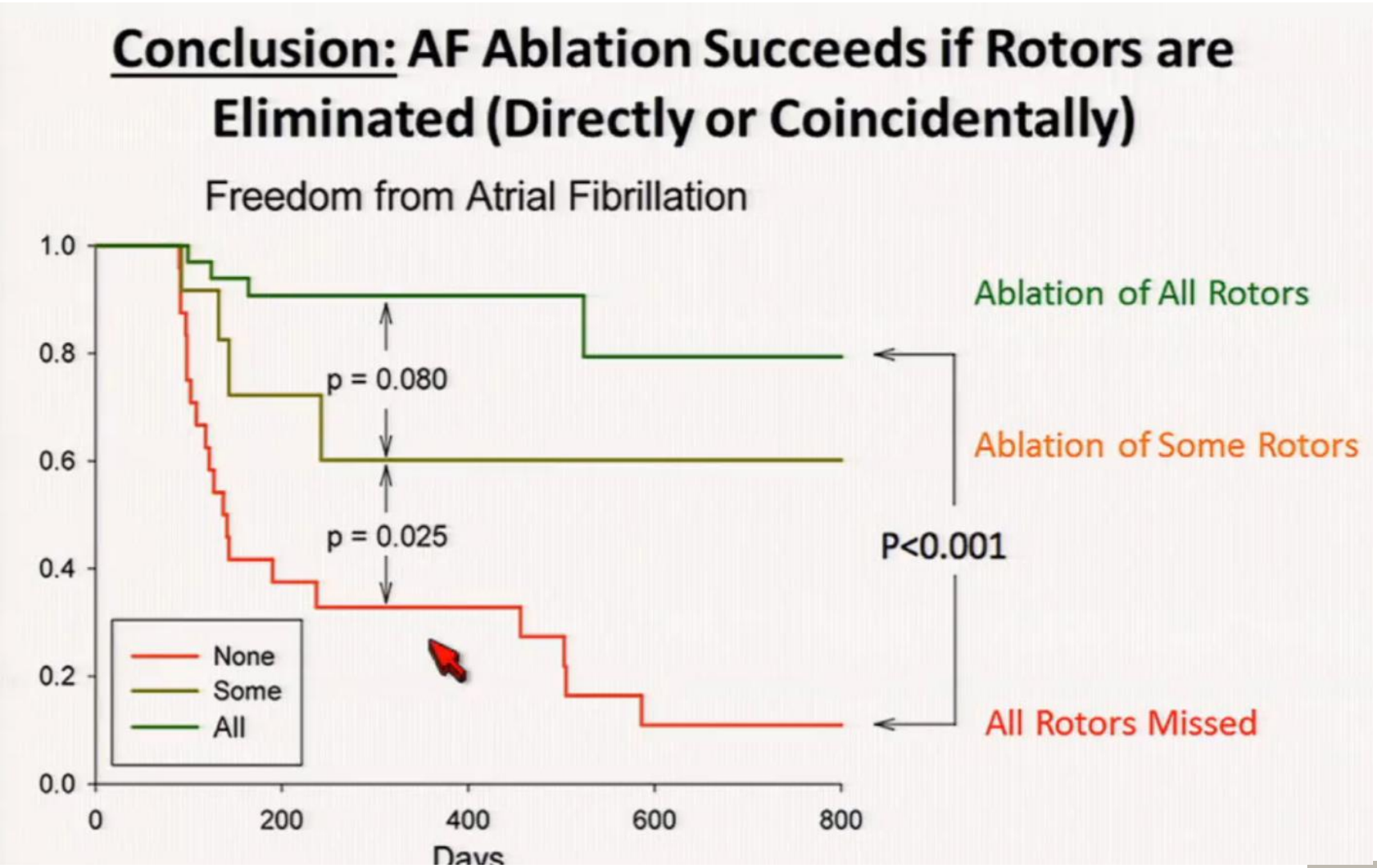
Treatment of Atrial Fibrillation by the Ablation of Localized Sources

CONFIRM (Conventional Ablation for Atrial Fibrillation With or Without Focal Impulse and Rotor Modulation) Trial

Sanjiv M. Narayan, MD, PHD,*† David E. Krummen, MD,*† Kalyanam Shivkumar, MD, PHD,‡ Paul Clopton, MS,† Wouter-Jan Rappel, PHD,§ John M. Miller, MD‖

San Diego and Los Angeles, California; and Indianapolis, Indiana

Does PVI knock off AF Rotors?



Follow-up from CONFIRM, Narayan et al. JACC. 2013 epub.

Characteristics of AF

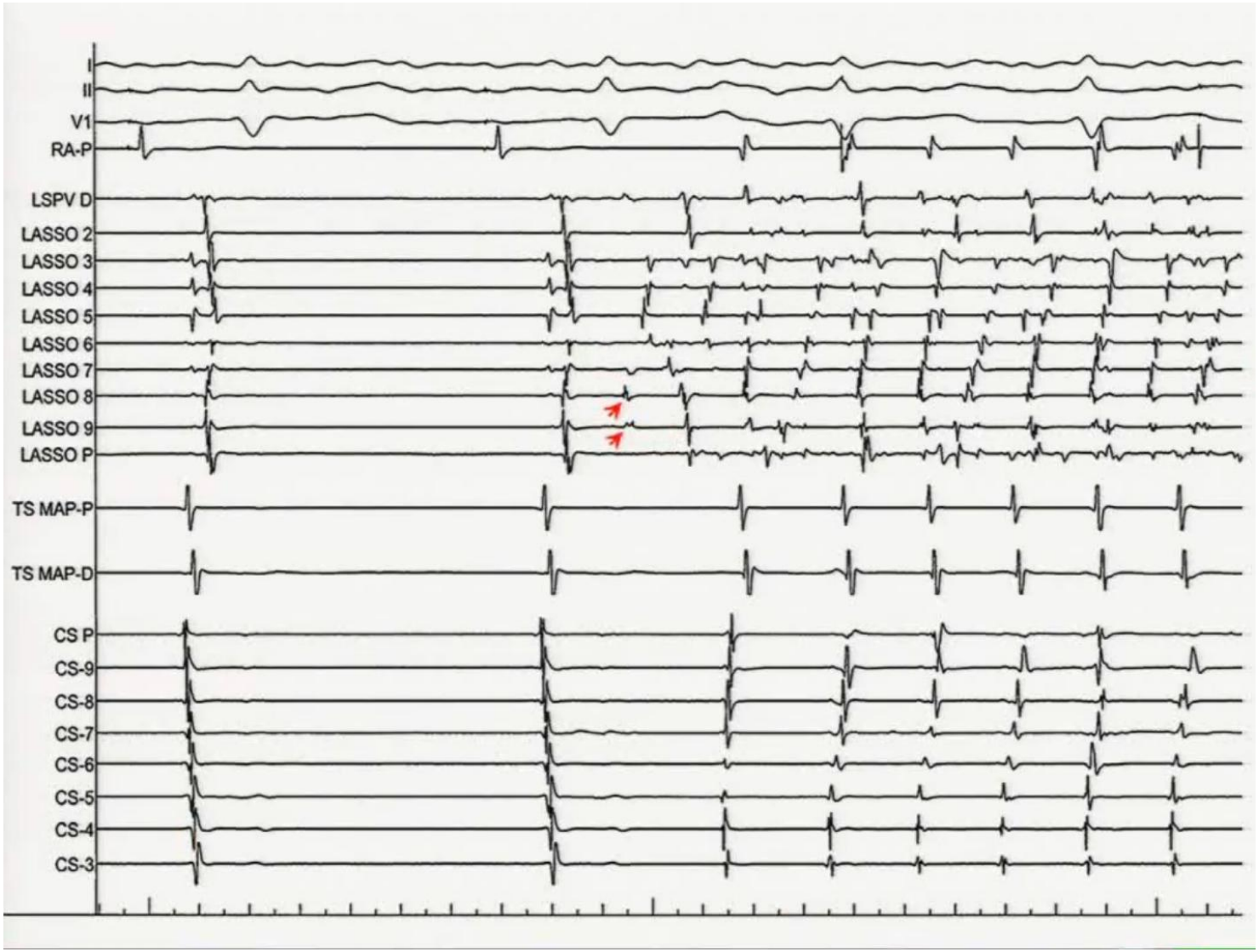
1. Triggers and substrate appear to originate from the same type of tissue
2. AF requires a combination of focal firing and reentry
3. "AF begets AF"

AF ► Inflammation ► AF ► Fibrosis ► AF

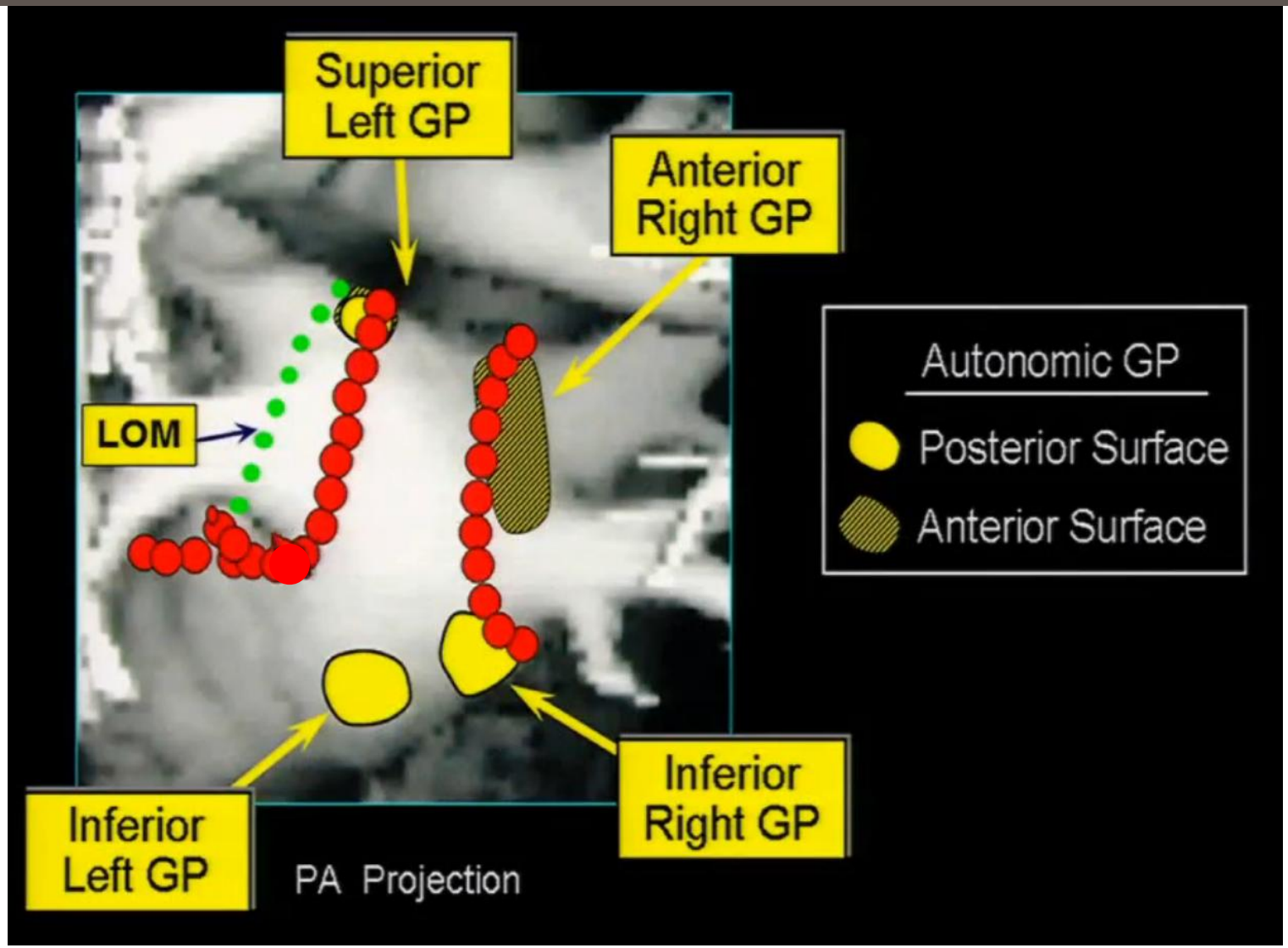
Perhaps

AF ► ↑ Autonomic Tone ► AF

What causes this PV PAC?



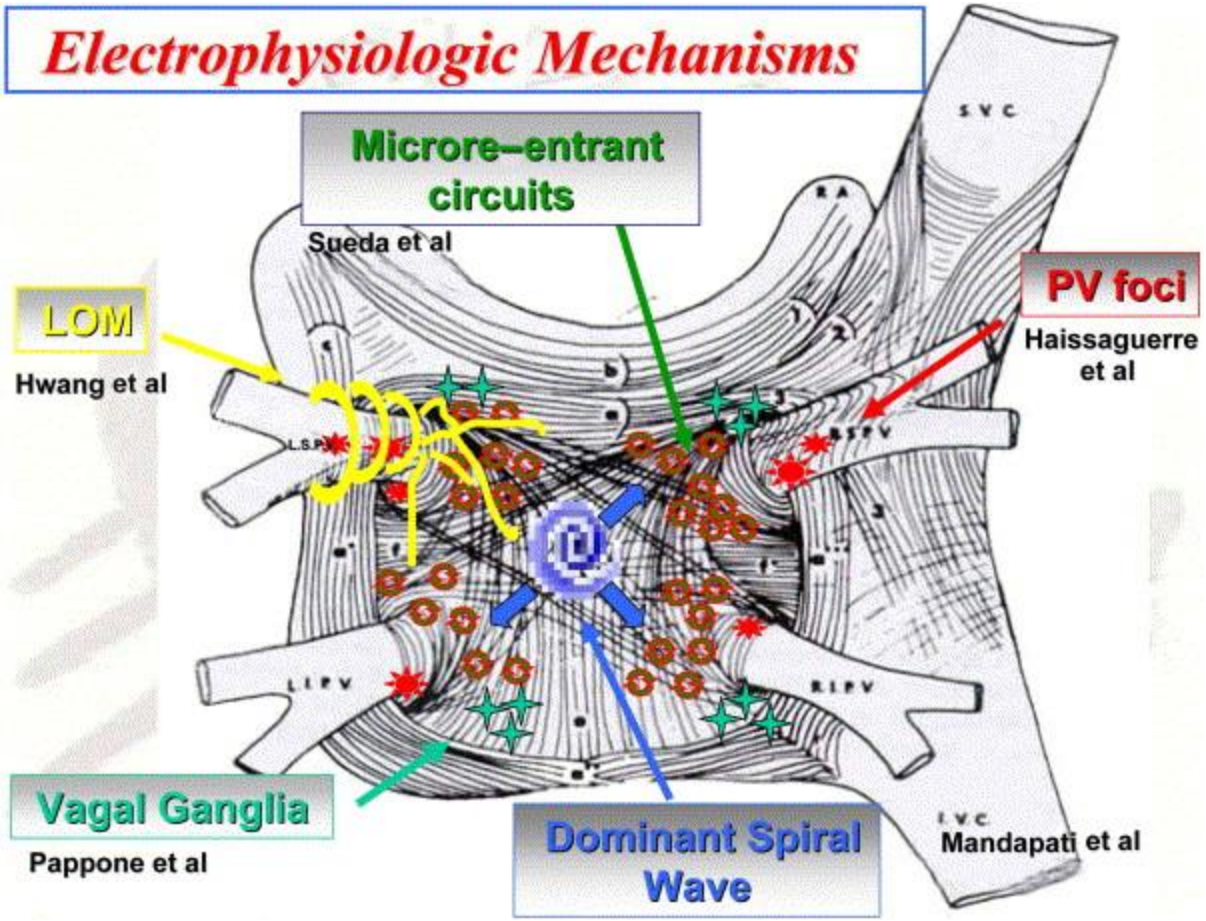
Ganglionic Plexi relative to PVI ablation



Role for therapy directed toward modulation of ANS?

- Evidence that modulation of autonomic nervous system during PVI improves outcomes
- Technology development geared toward easier localization of GPs
- Renal denervation as adjunctive therapy for patients with refractory hypertension and AF
  - JACC paper (Pokushalov et al. April, 2012) demonstrating improved freedom from AF vs PVI alone

Current Understanding of MOA



Overview

- Pulmonary vein isolation is effective in treatment of paroxysmal Afib, although plenty of room for improvement
- The pathophysiology underlying AF is complex, involving not only pulmonary vein triggers
  - Rotors, spiral waves, and atrial substrate changes
  - Autonomic innervation
  - Fibrosis and stretch
  - Even with respect to paroxysmal AF, as much as 20% of electical impulses arising from the PVs might propagate through pathways other than venoatrial continuity at the PV ostium (primarily via epicardial connections)

ESI – Ablation of Persistent AF

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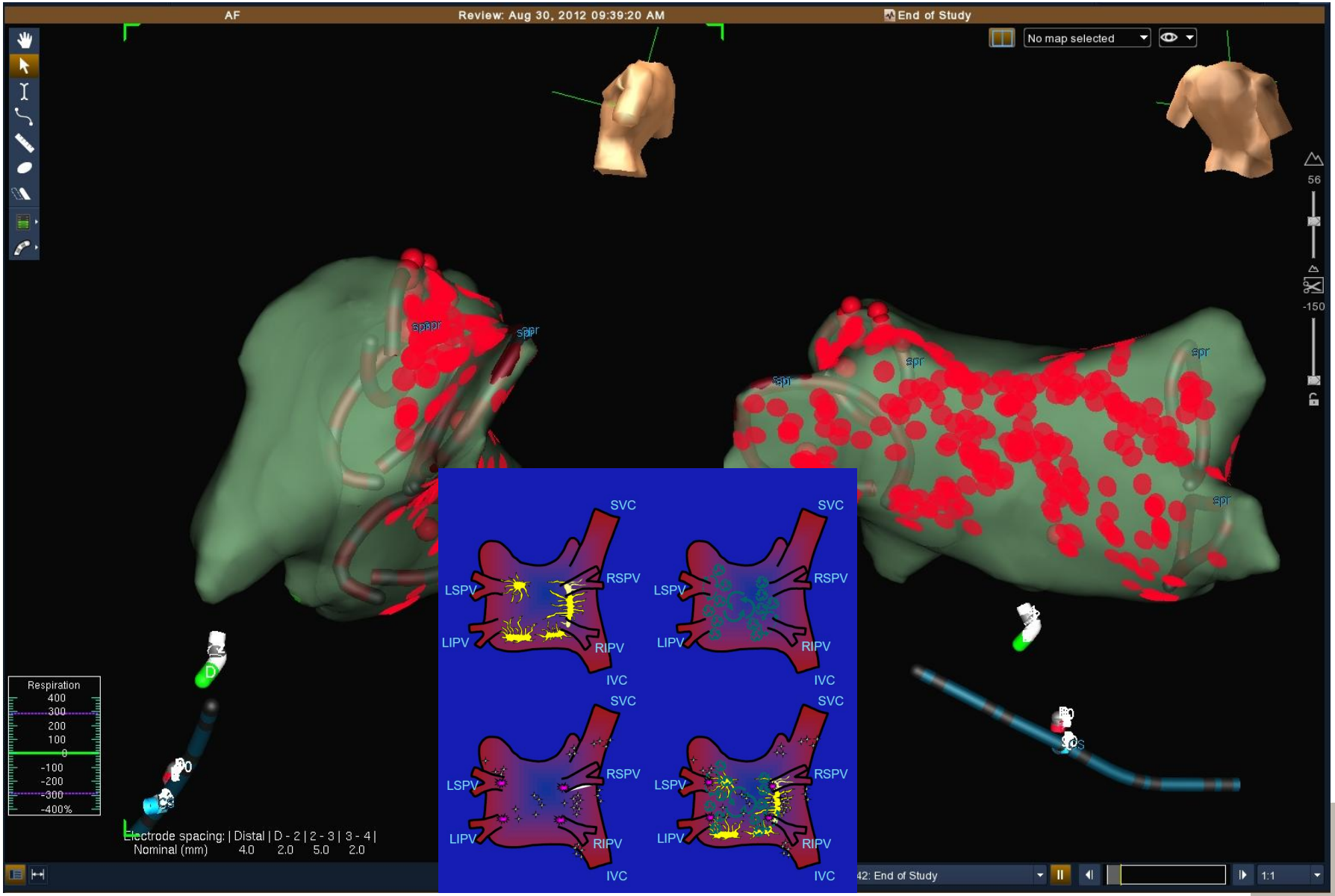


Surgical Approach

Dr. Espinal

MAZE

Atticure

Combined valve and Atticure etc

Summa AF ablation experience

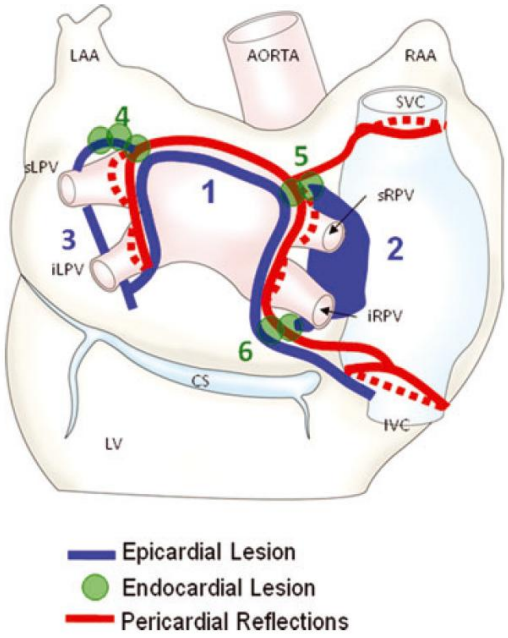
- Posterior wall and/or extra linear lesion sets in patients with persistent AF
- Very few “Long-standing Persistent” cases to date

- How might we expand treatment options to patients with more difficult to control persistent AF or patients with recurrence despite medications and PVI?

Alternative Approach

Convergent Procedure

1. Epicardial ablation performed through transdiaghragmatic access
2. Endovascular ablation performed via transseptal access with pulmonary vein isolation and confirmatory testing



Dr. Espinal

Initial Data from Single Center Trials

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Author & Institution	Society Meeting	N	% Persistent or Longstanding Persistent	Mean AF Duration	Mean Sinus Rhythm at Follow-Up	Monitoring
Dr. Nick Child Guy's & St. Thomas', UK	Heart Rhythm Congress UK	19	100%	7.8 yrs	90% at 1 year	Holter
Dr. Dmitri Pajitnev Kerckhoff Klinik, Germany	European Society of Cardiology Barcelona, Spain	28	100%	4.6 yrs	80% at 1 year	Reveal 24/7
Dr. Michael Zembala Sileasian Center for Heart Diseases, Poland	American Association for Thoracic Surgery, Toronto, Canada	54	100%	4.4 yrs	85% at 1 year	Holter 7-day
Dr. Borut Gersak University Medical Center Ljubljana, Slovenia	International AF Symposium Orlando, Florida	60	100%	6.2 yrs	83% at 1 year	Reveal 24/7

Reference (# Subjects)	% NPAF	Type of Monitoring	Freedom from AF/AFL/AT (Follow-up)	Repeat Ablations	Adverse Event Rate
Civello[16] (n=104)	73 %	72 hours to 14 days Holter	92.0 % (8.0 months)	4 %	5.8 %
Gilligan[17] (n=39)	79 %	72 hours Holter	94.0 % (12.6 months)	6 %	2.6 %
Golden[18] (n=61)	88 %	72 hours Holter	79.0 % (11.0 months)	8 %	3.3 %
Gersak[10] (n=50)	94 %	Reveal® XT	91.0 % (12.0 months)	2 %	10.0 %
Gehi[8] (n=101)	83 %	24 hour Holter	70.5 %* (12.0 months)	6 %	6.0 %

*AF = atrial fibrillation; AFL = atrial flutter; AT = atrial tachycardia; NPAF = Non-paroxysmal atrial fibrillation. *Arrhythmia free survival.*

Low Rate of Atrial Fibrillation Recurrence Verified by Implantable Loop Recorder Monitoring Following a Convergent Epicardial and Endocardial Ablation of Atrial Fibrillation

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From the *Department of Cardiovascular Surgery, and †Department of Cardiology, University Medical Center Ljubljana, Zaloska, Ljubljana, Slovenia

Implantable Loop Recorder Monitoring Outcomes for the Convergent AF Procedure.

Objective: **Evaluate long-term outcomes in patients undergoing the Convergent procedure (CP) for the treatment of atrial fibrillation (AF).**

Background: **The CP provides a multidisciplinary approach, combining endoscopic creation of epicardial linear lesions followed by endocardial mapping and ablation and targets persistent and longstanding persistent AF patients who are at increased risk of heart failure, stroke, and mortality.**

Methods: **Outcomes from a prospective nonrandomized study were recorded for consecutive patients by interrogation of implanted Reveal® monitors. Rhythm status and AF burden were quantified 6–24 months postprocedure, and compared relative to AF type, gender, age, body mass index, left atrial size, left ventricular ejection fraction, and congestive heart failure, hypertension, age >75 years, age between 65 and 74 years, stroke/TIA/TE, vascular disease (previous MI, peripheral arterial disease or aortic plaque), diabetes mellitus, female (CHA_2DS_2VASc).**

Results: **A total of 50 patients were enrolled with 94% having persistent or longstanding persistent AF. There were 2 atrioesophageal fistulas reported. In one patient, the fistula resulted in death at 33 days postprocedure; in the second, the fistula was surgically repaired but patient died 8 months postprocedure from a CVI. After CP, 95% of patients were in sinus rhythm at 6-month follow-up; 88% at 12 months; and 87% at 24 months. The median AF burden recorded with Reveal XT monitors was 0.0%, 0.1%, and 0.1% at 6, 12, and 24 months with 81%, 81%, and 87% of patients reporting a burden less than 3%, respectively.**

Conclusion: **Using 24 × 7 continuous loop recording, the CP demonstrated success in treating persistent and longstanding persistent AF patients. Endocardial mapping and catheter ablation with diagnostic confirmation of procedural success complemented the endoscopic creation of epicardial linear lesions in restoring sinus rhythm.** *(J Cardiovasc Electrophysiol, Vol. 23, pp. 1059-1066, October 2012)*

Gersak et al: Baseline Characteristics

TABLE 1
Demographic Characteristics

	All Subjects
Characteristic	N = 50
Male, n (%)	42 (84%)
Age (years), mean (SD)	56.4 (10.8)
Range	31, 79
BMI (kg/m^2), mean (SD)	28.8 (3.9)
Range	20, 42
Preoperative LA (cm), mean (SD)	4.8 (0.5)
Range	3.2, 5.7
Preoperative LVEF (%), mean (SD)	58.6 (10.5)
Range	40, 80
Atrial fibrillation type, N	
Paroxysmal	3 (6%)
Persistent	8 (16%)
Longstanding persistent	39 (78%)
AF duration (years), mean (SD)	5.0 (4.7)
Range	1, 25
Type of procedure, N	
Staged epicardial and endocardial hybrid	16 (32%)
Single setting convergent procedure	34 (68%)
Preexisting conditions, N (%)	
Congestive heart failure	8 (16%)
Hypertension	37 (74%)
Diabetes	2 (4%)
Stroke/TIA/thromboembolic event	3 (6%)
Vascular disease (CAD, PAD)	2 (4%)

Methods:
Prospective, nonrandomized

Enrollment:
1/2009-7/2011

50 patients underwent procedure at the University of Ljubljana Medical Center in Solvenia

Gersak et al: Major Adverse Events

TABLE 2

Major Adverse Cardiac Event Rates in the Perioperative Period

MACE	Total # (%)
Procedural mortality (1 and 8 month postprocedure resulting from esophageal fistulas)	2/50 (4.0%)
Stroke/CVA	1/50 (2.0%)
Transient ischemic attack (TIA)	0 (0%)
Tamponade	0 (0%)
Pericardial effusion	1/50 (2.0%)
Phrenic nerve palsy	0 (0%)
Myocardial infarction	0 (0%)
Newly developed 3rd degree AV block	0 (0%)
Acute limb ischemia	0 (0%)
Excessive bleeding requiring >2 units of blood transfusion	1/50 (2.0%)
Major complications were observed in 5 patients	**5/50 (10.0%)**

- Initially esophageal temperature was not measured

Gersak et al: Results

TABLE 3

Outcomes at Each Follow-Up Visit (Excluding Staged Patients Not Receiving Catheter Ablation)

Clinical Measure	Percent Responders
Sinus rhythm	
6 months	95% (41/43)
12 months	88% (28/32)
24 months	87% (13/15)
SR and No AADs†	
6 months	67% (29/43)
12 months	75% (24/32)
24 months	67% (10/15)

†Includes patients off amiodarone.

- Amiodarone was initiated for all patients post-procedure then AAD therapy was directed by referring physician
- Rhythm followed by Implantable Loop Recorders

Gersak et al: Results Continued

TABLE 4

Reveal Monitoring AF Burden at 6, 12, and 24 months

AF Burden Threshold	6 month	12 month	24 month
≤0.2%	72% (31/43)	56% (18/32)	53% (8/15)
≤0.5%†	74% (32/43)	66% (21/32)	60% (9/15)
≤1.0%‡	77% (33/43)	75% (24/32)	73% (11/15)
≤2.1%§	79% (34/43)	73% (24/32)	80% (12/15)
≤3.0%¶	81% (35/43)	81% (26/32)	87% (13/15)
≤4.2%††	81% (35/43)	84% (27/32)	87% (13/15)

†7 min/day. Threshold based on published Reveal XT outcomes in drug refractory paroxysmal AF prospective randomized study.[22]

‡14 min/day. Threshold based on published catheter ablation outcomes comparing continuous monitoring at 10 min/day to 24-hour, 48-hour, and 7-day Holters.[23]

§30 min/day. Threshold based on cutting HRS recommendations of cumulative AF time in half; the duration of each individual episode was not available.[12]

¶43 min/day.

††1 hour/day. Threshold based on HRS recommendations of cumulative AF time since the duration of each individual episode was not available to compare against the 30 seconds limit.[12]

RESEARCH ARTICLE

Combined Endocardial and Epicardial Ablation for Symptomatic Atrial Fibrillation: Single Center Experience in 100+ Consecutive Patients

KENNETH C. CIVELLO, MD, MPH, FACC, CHARLES ANDREW SMITH, MD, FACC and WILLIAM BOEDEFELD, MD

Our Lady of the Lake Hospital, Baton Rouge, LA

ABSTRACT. *Our aim was to document and evaluate the outcomes of the first 100+ patients who underwent the convergent procedure at Our Lady of the Lake Hospital. Between May 2010 and December 2011, 104 symptomatic atrial fibrillation (AF) patients underwent the convergent procedure combining surgical epicardial radiofrequency ablation and endocardial ablation. Antiarrhythmic drugs were discontinued at 8 weeks. Arrhythmia episodes were detected by electrocardiogram at 1 month, 3 months, 6 months, and 1 year. A ≥72-h patient monitoring or interrogation of Permanent Pacemaker/Implantable cardioverter-defibrillator was performed at 6 and 12 months. Of the 104 patients (age 60.9 years, 77% males, body mass index 32.7, ejection fraction 56.1%, left atrial diameter 4.1 cm) paroxysmal AF was present in 27% and persistent/longstanding persistent AF in 73%. AF duration was 5.2 years. At 12 month follow up 87.5% (63/72) of patients were in sinus rhythm (SR) ± antiarrhythmic drugs (AADs). At last follow-up 89.0% (92/104) of patients were in SR ± AADs. Three patients underwent a repeat catheter ablation for atypical atrial flutter. No complications <7 days, no atrio-esophageal fistulas, myocardial infarction, or death were reported. The convergent procedure, bringing together the strengths of the endoscopic epicardial ablation and endocardial catheter ablation, provides a viable and promising treatment option for patients with symptomatic AF.*

KEYWORDS. *atrial fibrillation, convergent, endocardial ablation, epicardial ablation, radiofrequency.*

ISSN 2156-3977 (print)
ISSN 2156-3993 (online)

Civello et al: Baseline Characteristics

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Table 1: Demographic characteristics

Characteristic	All subjects (n=104)
Male, n (%)	80 (77)
Age (years), mean (SD)	60.9 (8.6)
Range	37–79
Body mass index (kg/m^2), mean (SD)	32.7 (5.8)
Range	22.5–46.7
Preoperative left atrium (cm), mean (SD)	4.1 (0.6)
Range	3.1–6.1
Preoperative left ventricular ejection fraction (%), mean (SD)	56.1 (9.1)
Atrial fibrillation type, N (%)	
Paroxysmal	28 (27)
Persistent	31 (30)
Longstanding persistent	45 (43)
AF duration (years), mean (SD)	5.2 (4.9)

Methods: Between May 2010 and December 2011, the first 104 AF patients Underwent hybrid epicardial and endocardial ablation. Patients were excluded If they had prior open heart surgery or major abdominal procedure.

Civello et al : Major Adverse Events

Table 2: Major adverse cardiac event rates (<7 days post procedure) and at last follow-up (>7 days post procedure)

Major Adverse Cardiac Events	<7 days post procedure	>7 days post procedure
Procedural mortality	0/104 (0.0%)	0/104 (0.0%)
Stroke/Cerebrovascular Accident	0/104 (0.0%)	1/104 (1.0%)
Transient ischemic attack	0/104 (0%)	1/104 (1.0%)
Tamponade	0/104 (0%)	0/104 (0%)
Pericardial effusion	0/104 (0%)	1/104(1.0%)
Phrenic nerve palsy	0/104 (0%)	0/104 (0%)
Pulmonary vein stenosis	0/104 (0%)	1/104(1.0%)
Pleural effusion	0/104 (0%)	2/104(2.0%)
Esophageal fistula	0/104 (0%)	0/104 (0%)
Excessive bleeding requiring >2 units of blood transfusion	0/104 (0%)	0/104 (0%)

- One CVA in patient with longstanding persistent AF and EF = 30%
- One pericardial effusion >30 days after procedure
- Two pleural effusions, one PV stenosis

Civello et al: Results

Table 3: Outcomes of atrial fibrillation success for all atrial fibrillation types

Clinical measure	Percent responders
Sinus rhythm (±AADs)	
12 months	87.5% (63/72)
Last follow-up (292 days±90)	89% (93/104)
Sinus rhythm and no AADs	
12 months	72% (52/72)
Last follow-up (292 days±90)	73% (76/104)

AAD: antiarrhythmic drug

Antiarrhythmic drug (AAD):

Dofetilide 65%
Flecanide or propafenone 13%
Amiodarone 8%
Dronedarone 3%
Sotalol 1%
No AAD 6%

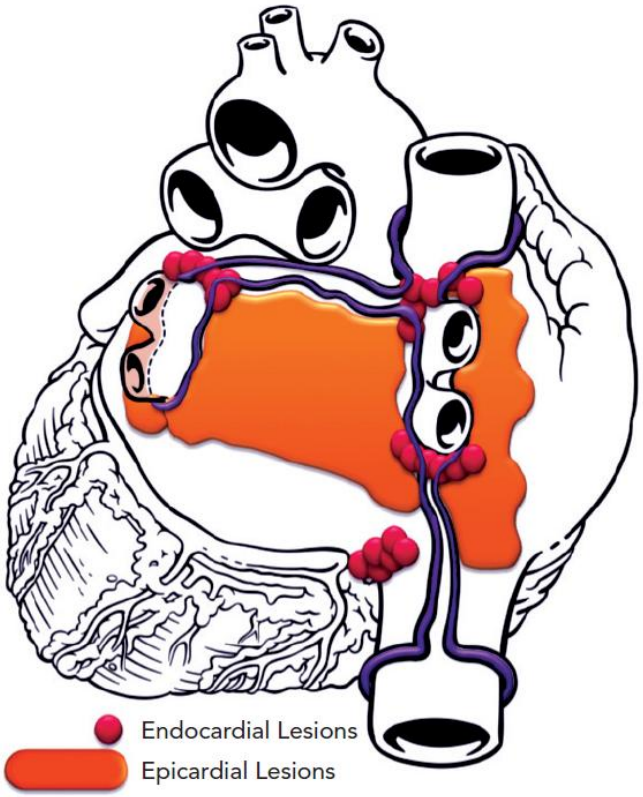
- AAD for minimum of 8 weeks

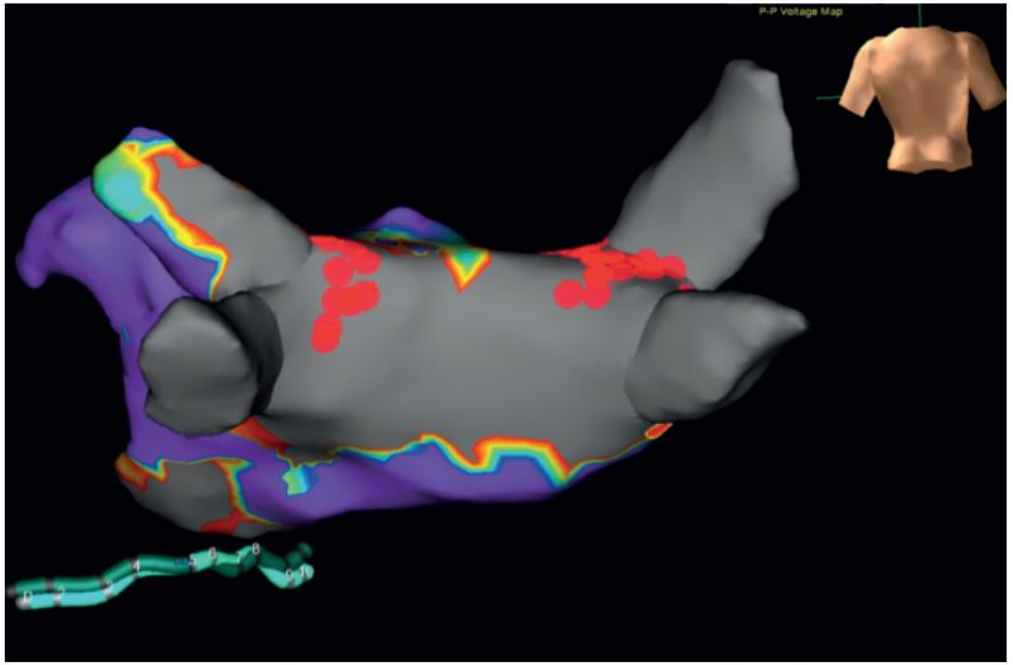
Table 4: Outcomes of atrial fibrillation success based on type of atrial fibrillation

	SR and no AADs at 12 months	SR±AADs at 12 months	SR no AADs at last follow-up (292 days±90)	SR±AAD at last follow-up (292 days±90)
Paroxysmal	72%	89%	71%	93%
Persistent	84%	88%	84%	87%
Longstanding persistent	62%	86%	67%	89%

AAD: antiarrhythmic drug; SR: sinus rhythm.

Convergent Lesion Sets





Converge Clinical Trial

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ClinicalTrials.gov
A service of the U.S. National Institutes of Health

Example: "Heart attack" AND "Los Angeles"
Search for studies: Search
Advanced Search | Help | Studies by Topic | Glossary

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Home > Find Studies > Search Results > Study Record Detail

Text Size

Trial record **1 of 1** for: The Converge Study | "Atrial Fibrillation"
Previous Study | Return to List | Next Study

CONVERGE - Epi/Endo Ablation For Treatment of Persistent Atrial Fibrillation(AF)

This study is currently recruiting participants. (see Contacts and Locations)
Verified September 2014 by nContact Surgical Inc.

Sponsor:
nContact Surgical Inc.

Information provided by (Responsible Party):
nContact Surgical Inc.

ClinicalTrials.gov Identifier:
NCT01984346

First received: November 7, 2013
Last updated: September 23, 2014
Last verified: September 2014
History of Changes

Full Text View | Tabular View | No Study Results Posted | Disclaimer | How to Read a Study Record

Tracking Information	
First Received Date ICMJE	November 7, 2013
Last Updated Date	September 23, 2014
Start Date ICMJE	December 2013
Estimated Primary Completion Date	June 2016 (final data collection date for primary outcome measure)
Current Primary Outcome Measures ICMJE (submitted: November 13, 2013)	AF/AT/Atrial Flutter(AFL) free absent class I and III AADs except for a previously failed or intolerant class I or III AAD with no increase in dosage. [Time Frame: 12 Months] [Designated as safety issue: No] The primary efficacy endpoint is success or failure to be AF/AT/AFL free absent class I and III AADs except for a previously failed or intolerant class I or III AAD with no increase in dosage following the 3 month blanking period through the 12 months post procedure follow-up visit.
Original Primary Outcome Measures ICMJE	*Same as current*

Inclusion/Exclusion for Converge

Study protocol