

Atrial Fibrillation: Catheter Ablation – Four Questions: Who? When? How? Results? Special Considerations!

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**AMERICAN
COLLEGE of
CARDIOLOGY**



Disclosure of Relationships

Francis E. Marchlinski, MD,

Consulting Fees/Honoraria: Abbot/St Jude Medical, Biotronik, Biosense Webster, Inc., Infobionics, Medtronic, Inc., Boston Scientific Corp.

Research Grants: Medtronic, Inc., Abbot/St. Jude Medical, Biosense Webster, Inc.

Atrial Fibrillation

Patient Selection/Ablation Outcome: AF Classification

✓ Classify the patient based on the most frequent AF clinical pattern

Excellent response

- **Paroxysmal**
 - Duration: < 7 days
 - Usually spontaneous termination/early cardioversion

- **Persistent** (Early Persistent < 3 mos – better response to AF ablation – before remodeling*)
 - Duration: > 7 days – 1 year
 - Cardioversion: pharmacological or electrical

- **Longstanding Persistent/Permanent**
 - More than 1 year
 - Cardioversion – fails to restore sinus rhythm for any meaningful duration

Fair response

*Calkins et al AF Ablation Consensus Document Heart Rhythm Oct 2017

Catheter Ablation for Paroxysmal AF — New Guidelines (2012, 2014, 2017))

Class I - “Is Indicated”

1. For **symptomatic paroxysmal AF refractory or intolerant to at least 1 class I or III antiarrhythmics.** (Level of Evidence:A)
2. Prior to AF catheter ablation, **assessment of the procedural risks and outcomes relevant to the individual patient is recommended.** (Level of Evidence: C)

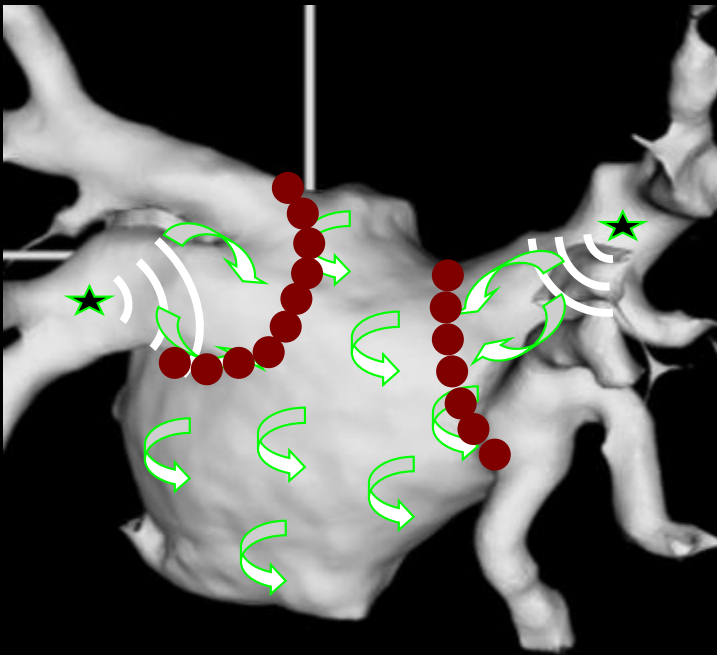
Europace(2012) 14, 1385–1413; *J Am Coll Cardiol.* 2014; 63(22):2489-2489; Calkins et al Heart Rhythm 2017



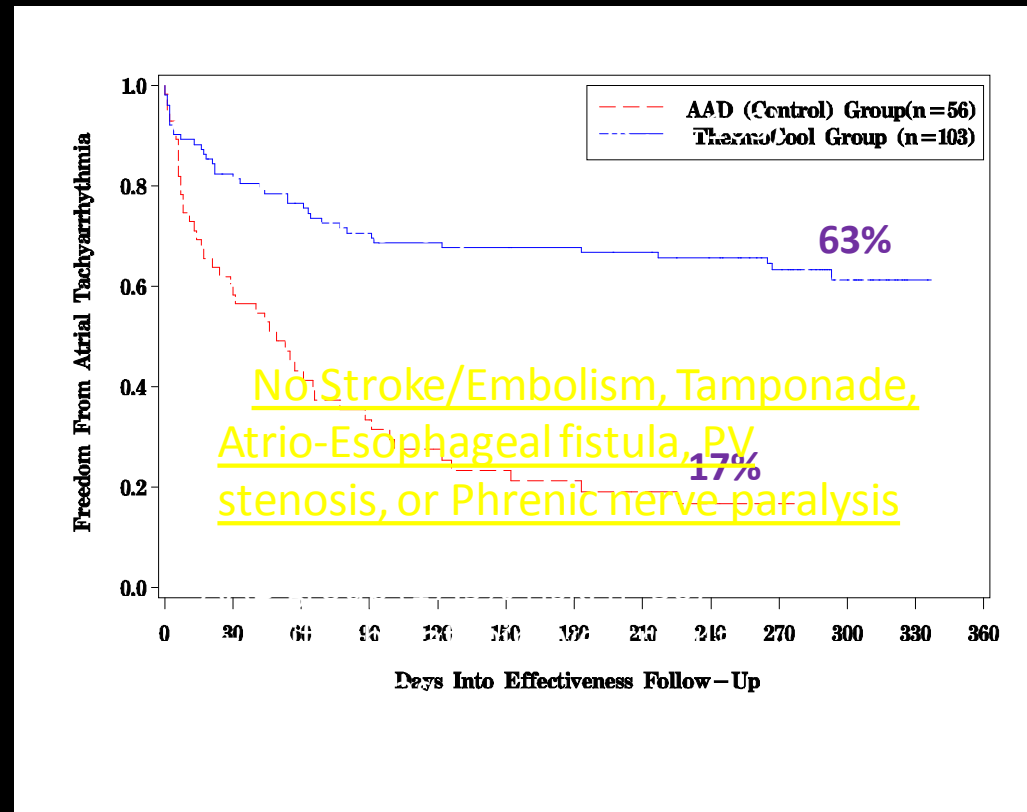
Paroxysmal AF – Catheter Ablation Outcome

Pulmonary Vein Isolation Multicenter Randomized Prospective Study Failed Initial Drug Therapy (159pts)

All Recurrent AT/AF



PVI -How?





Individual Risk Assessment Before Ablation?

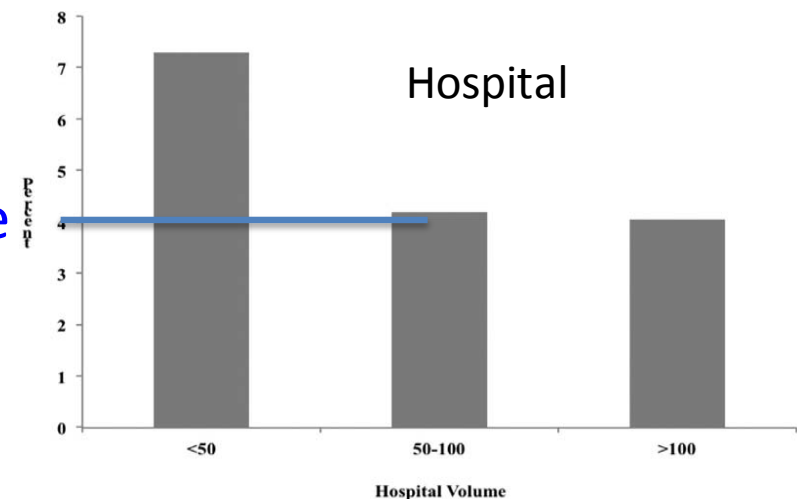
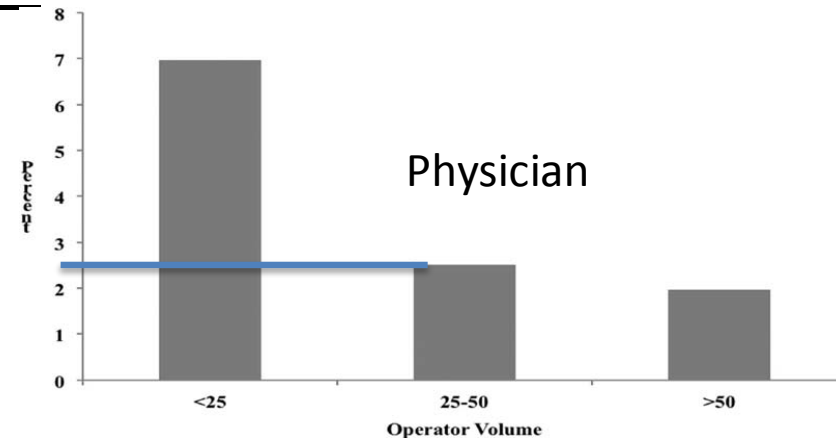
Extreme Obesity, Age >80 –More Groin Complications

Role of Experience on Ablation Complications

U.S. National Inpatient Sample: 93,801 AF
patients treated with catheter ablation
2000-2010; 20% U.S. hospitals sampled

- In hospital complications assessed by ICD 9 codes
1. 81% of AF ablations done by low volume operators - perform < 25/yr
 2. Acute complications, inversely related to operator/program volume

% Complication Based on Volume



Catheter Ablation for Paroxysmal AF — New Guidelines (2012, 2014)

Class I -“Is Indicated”

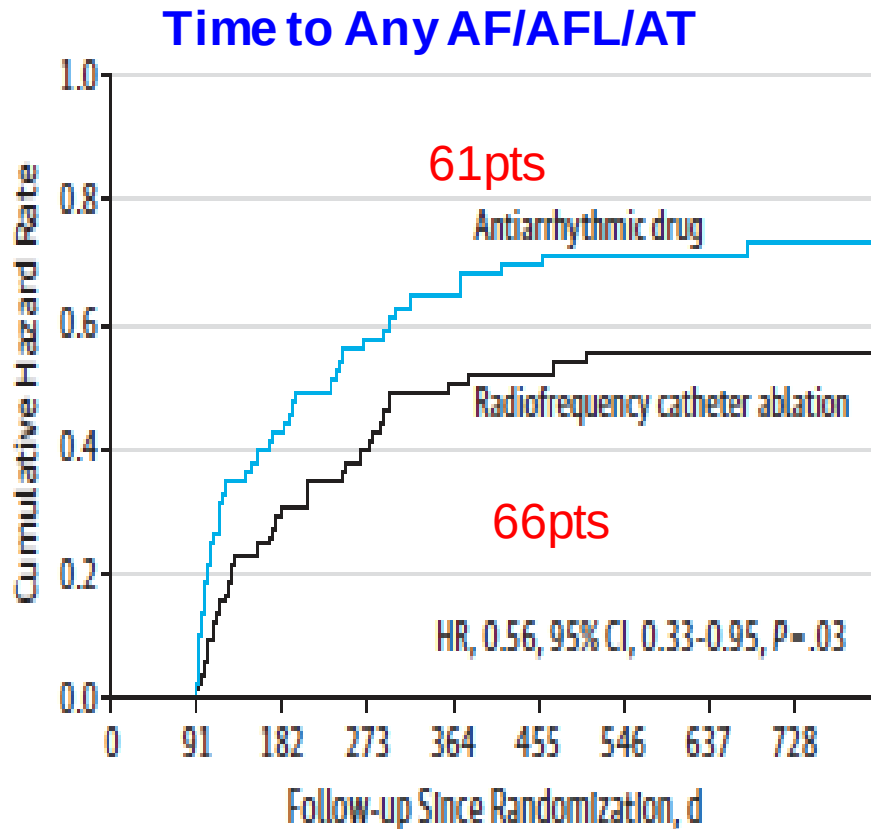
1. For **symptomatic** paroxysmal AF refractory or intolerant to at least 1 class I or III antiarrhythmics. (Level of Evidence:A)
2. Prior to AF catheter ablation, assessment of the procedural risks and outcomes relevant to the individual patient is recommended. (Level of Evidence: C)

Class II A - “Is reasonable” first line therapy

In patients with recurrent **symptomatic** paroxysmal AF, prior to therapeutic trials of antiarrhythmic drug therapy, after weighing risks and outcomes of drug and ablation therapy relevant to the individual patient. (Level of Evidence: B)



FIRST LINE TREATMENT OF PAROXYSMAL AF (RAAFT 2 TRIAL – 2 YEAR FOLLOW-UP)



Rigorous Monitoring
Transmit with
symptomatic episodes
of possible AF and
transmit biweekly for
asymptomatic AF

- No deaths, No strokes
- 43% of patients with meds had recurrent AF with crossover to AF ablation at 1 yr versus only 9% of patient with ablation had AAA drugs added

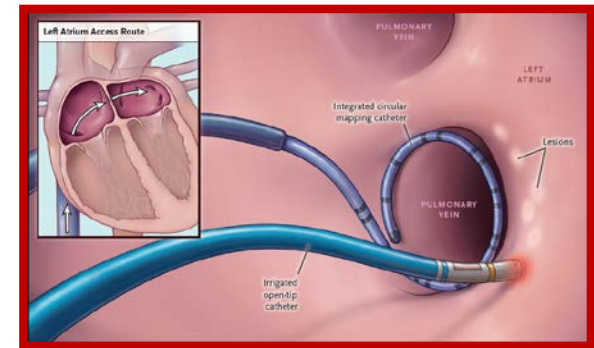
How? - Different Tools for Pulmonary Veins Isolation

FIRE AND ICE AF Clinical Trial

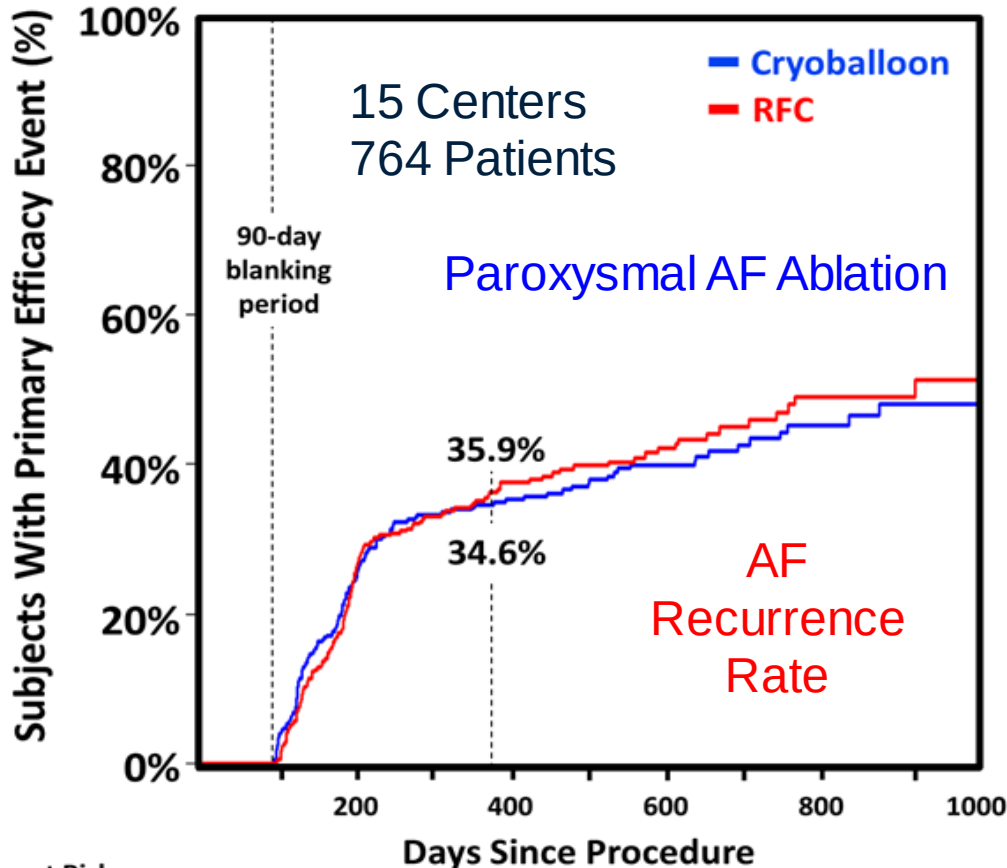
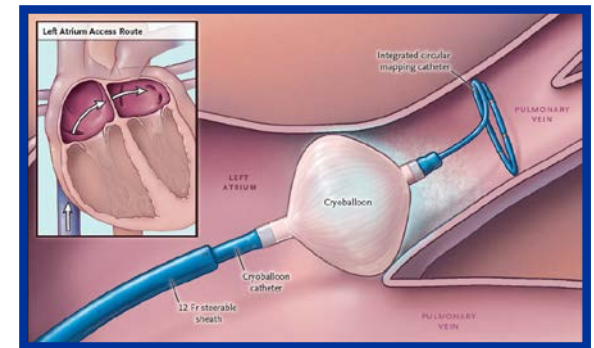
Modified ITT analysis

- HR [95% CI] = 0.96 [0.76-1.22]; p = 0.0004
- Non-inferiority hypothesis met

FIRE - RF



ICE - Cryo



Number at Risk

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

Kuck K-H, et al. Cryoballoon or Radiofrequency Ablation of Paroxysmal Atrial Fibrillation. N Engl J Med 2016;374:2235–2245.



Catheter Ablation **Persistent AF**— New AF Guidelines (2012,2014)

Class IIa - “Is reasonable”

1) For patients with **symptomatic persistent AF** refractory or intolerant to at least 1 class I or III antiarrhythmic medication (157,161–163). (Level of Evidence: A)

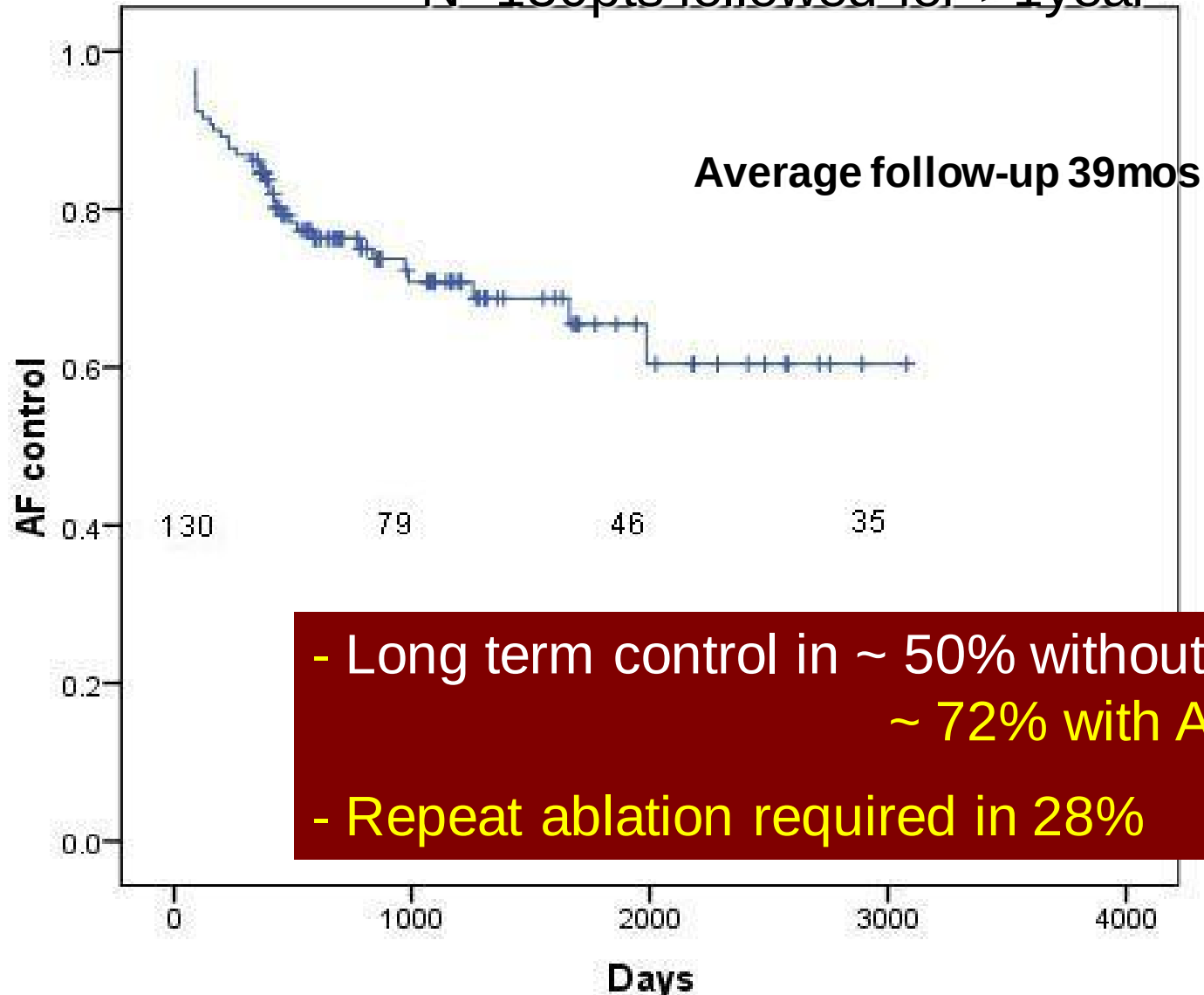
Class IIa “Is reasonable” 1st line therapy—for **symptomatic persistent AF before** class I or 3 antiarrhythmic drug therapy- (change from IIB to IIA in 2017 update -Level of Evidence: C)

Class IIb - “May be Considered” For **symptomatic long-standing (>12 months) persistent AF** refractory or intolerant to at least 1 class I or III antiarrhythmic medication when a rhythm-control strategy is desired (154,167). (Level of Evidence: B)

Europace (2012) 14, 1385–1413; *J Am Coll Cardiol*. 2014; 63(22):2489-2489; Calkins et al Heart Rhythm 2017

Clinical Efficacy for Longstanding Persistent AF(>1yr) Antral PV Isolation + Non PV Trigger RF Ablation

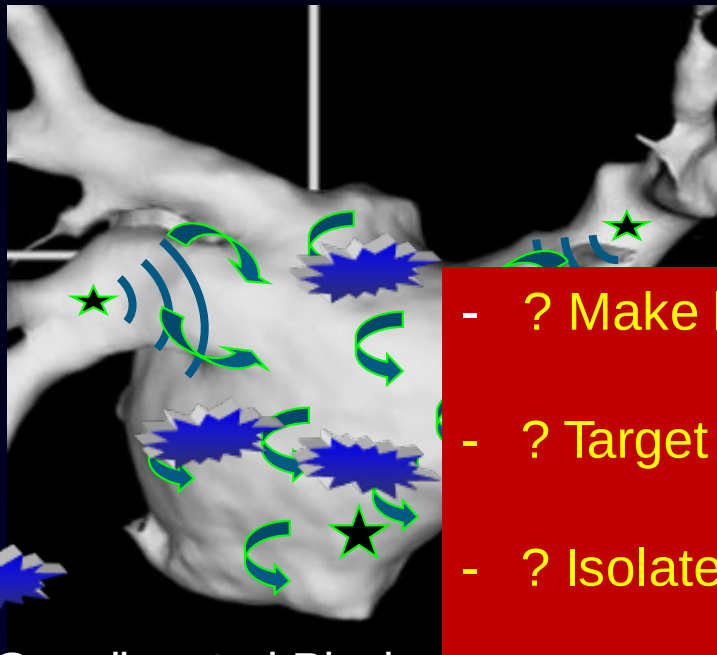
N=130pts followed for >1year



- Long term control in ~ 50% without AADs
~ 72% with AADs
- Repeat ablation required in 28%

Persistent AF Catheter Ablation - Target Substrate to Further Improve Outcome?

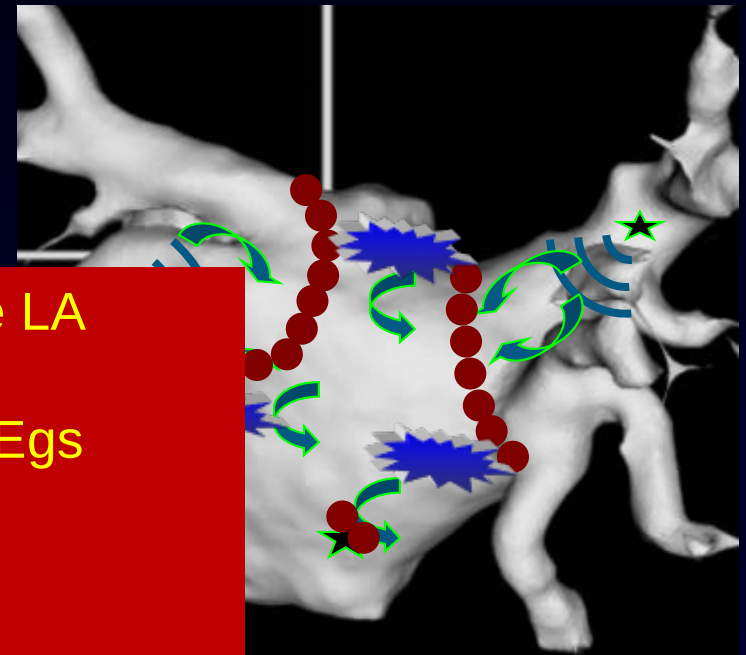
PVI plus non PVI triggers



Ganglionated Plexi

Which
Technique?

- ? Make lines to divide LA
- ? Target fractionated Egs
- ? Isolate Post LA
- ? Isolate the SVC, CS, LAA
- ? Ganglionated plexi ablation
- ? Target rotors

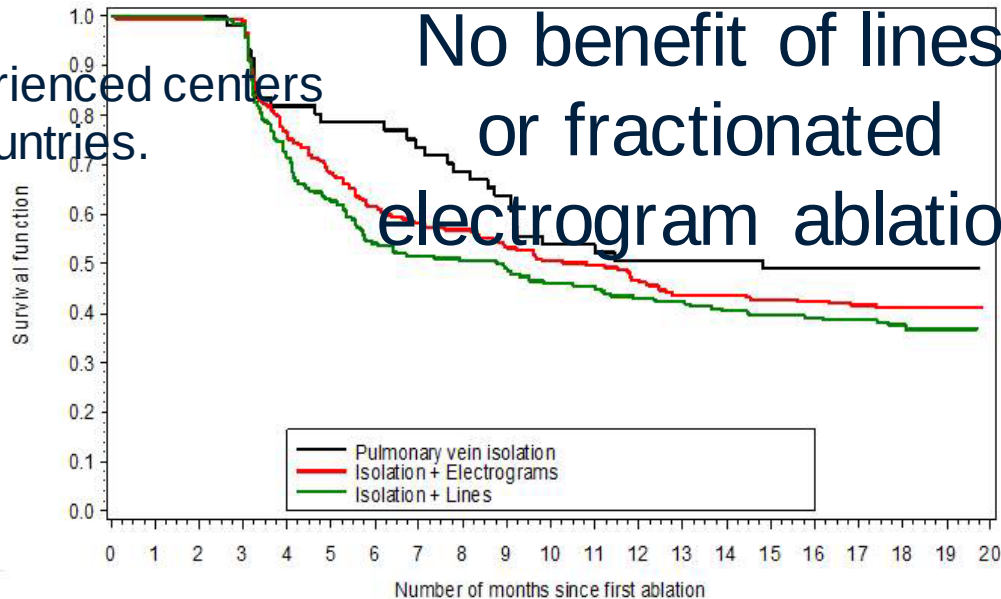


Which
Patients?

STAR AF II Results - Primary Outcome in Persistent AF (Verma et al)

Documented AF > 30 seconds after one procedure with or without AAD

48 experienced centers
in 12 countries.



No. at Risk

Pulmonary vein isolation	61	60	50	41	36	23
Isolation + Electrograms	244	242	161	137	124	72
Isolation + Lines	244	240	152	133	115	57

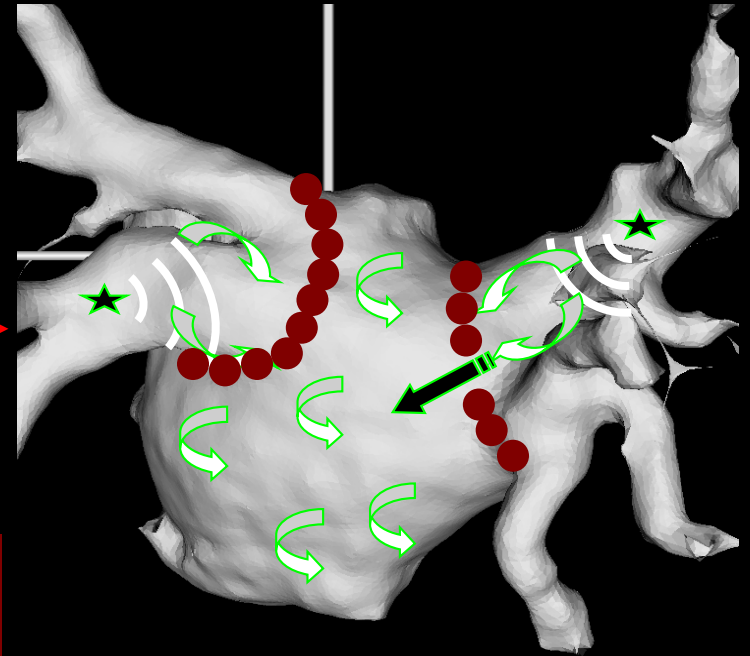
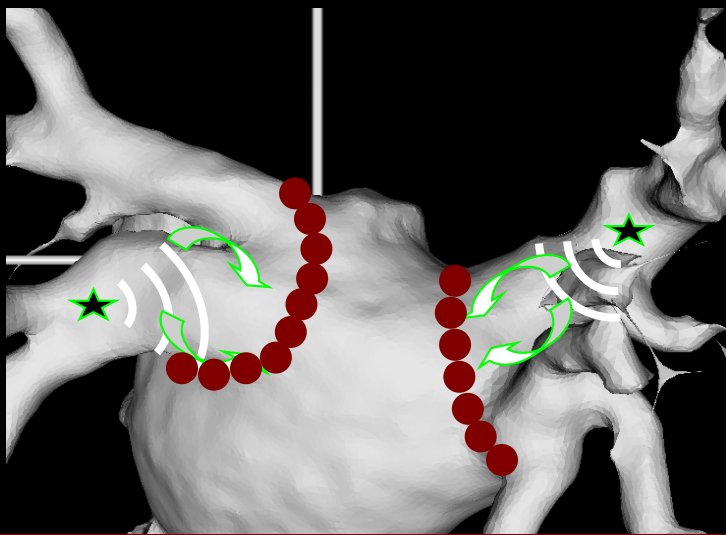
1:4:4 ratio

N ENGL J MED 372;19 NEJM.ORG MAY 7, 2015



Paroxysmal or Persistent AF

Why does ablation fail?



Make PV Isolation More Permanent
with First Ablation (Improve stability)

- JET Ventilation
- Sheaths for stability
- Contact Force Sensing

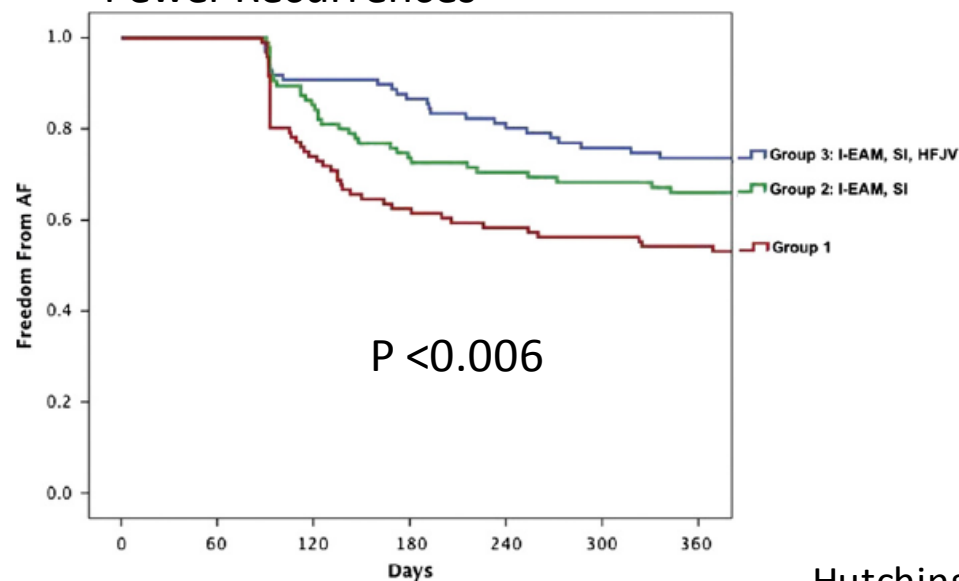
Reconnected PV
Reisolation can prevent
AF (80-90%)!



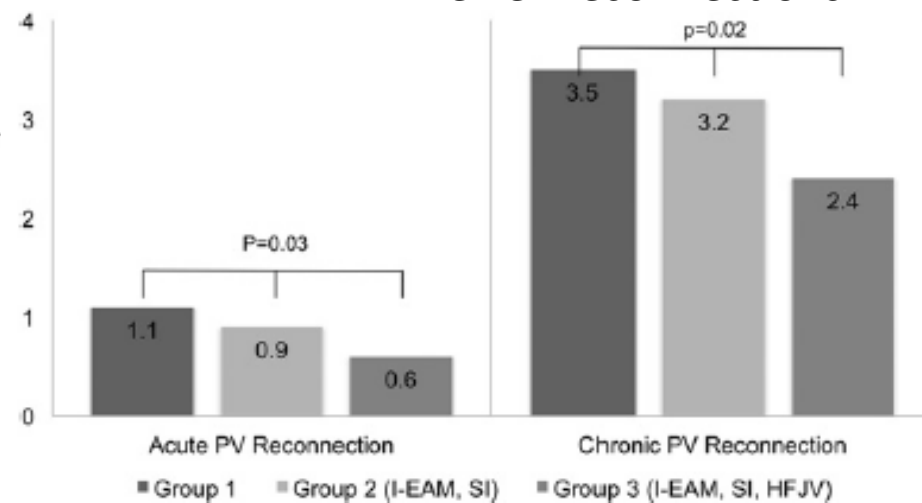
Jet Ventilation and Sheaths to Improve Stability and Improve PVI Outcome



Fewer Recurrences



Fewer Reconnections



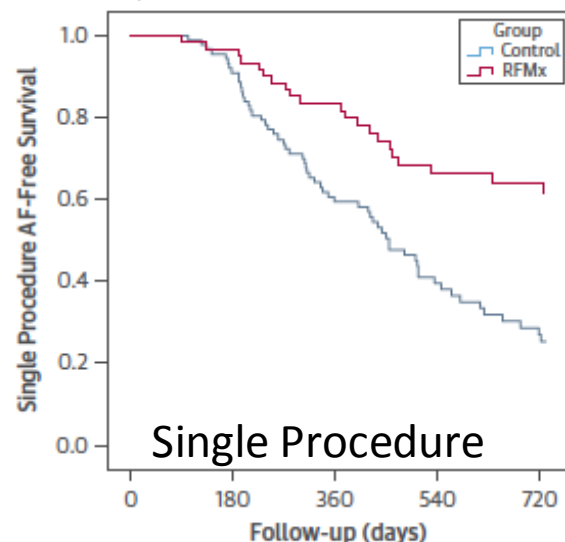


Risk Factor Modification (RFM)

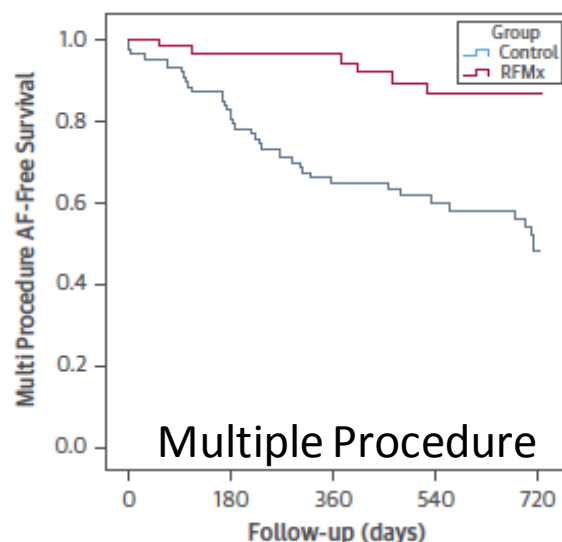
The ARREST-AF Cohort Study

Pathak R ..Sanders P et al J Am Coll Cardiol Dec 2 2014;64:2222-2231.

Impact of RFM on AF Ablation Outcome



Time (days)	0	180	360	540	730
RFM	61	59	48	33	27
Control	88	79	51	28	16



Time (days)	0	180	360	540	730
RFM	61	55	46	32	25
Control	88	72	51	36	23

Modifiable Risk Factors

- Hypertension
- Diabetes (glycemic control)
- Sleep apnea
- Obesity
- Excess alcohol use

**Aggressive Risk Factor Modification in AF
Should be Standard of Care**

Adapted from Pathak RJ Sanders P Am Coll Cardiol May 26 2015;65:2159-2169.

Afib Catheter Ablation – Who? /Results? Special Considerations

Reversible Disease States due to AF???

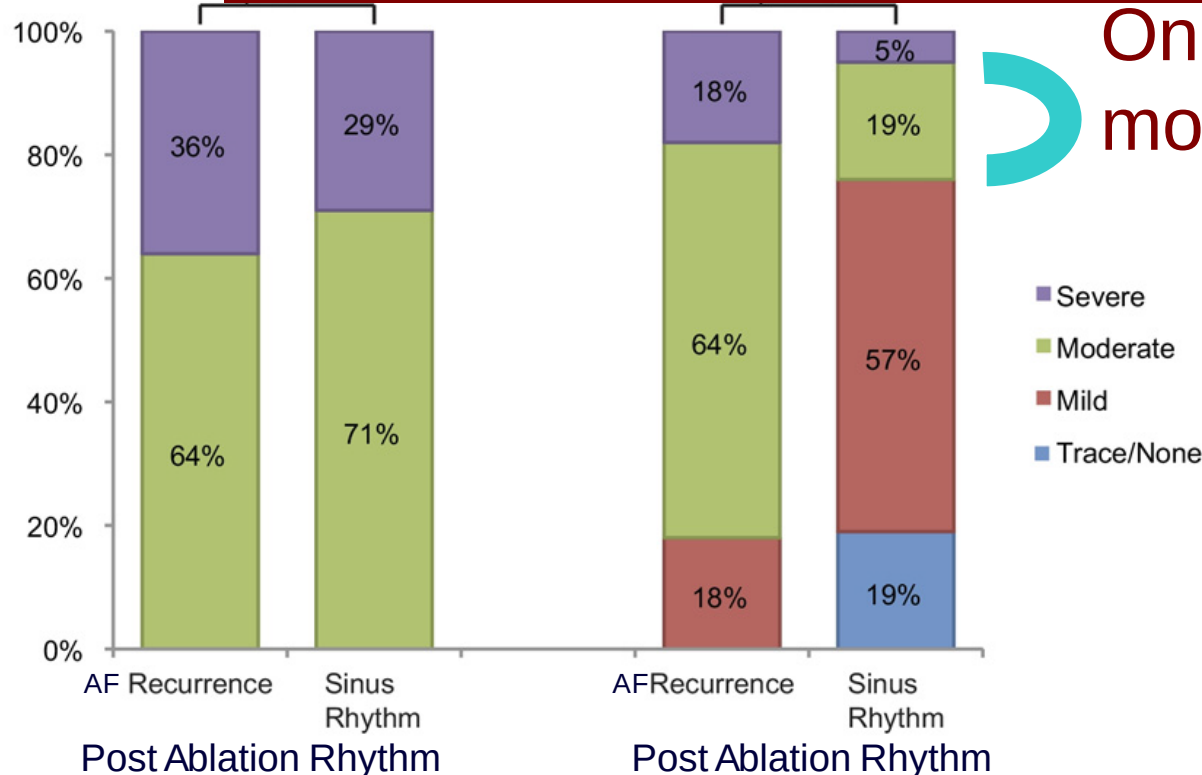
54 y/o with increase in LA and severity of MR associated with long lived but self terminating AF over the last two years??

Is the worsening MR due to the AF?

Functional Mitral Regurgitation Due to AF: Reversal with AF Ablation

(Retrospective group)
54 y/o with increase in LA and severity of MR associated with long lived but self

Pre-
B
terminating AF over the last two years??
– Effort to control AF may reverse the MR



Only 24% remained mod/severe

Post successful ablation
No/minimal MR with

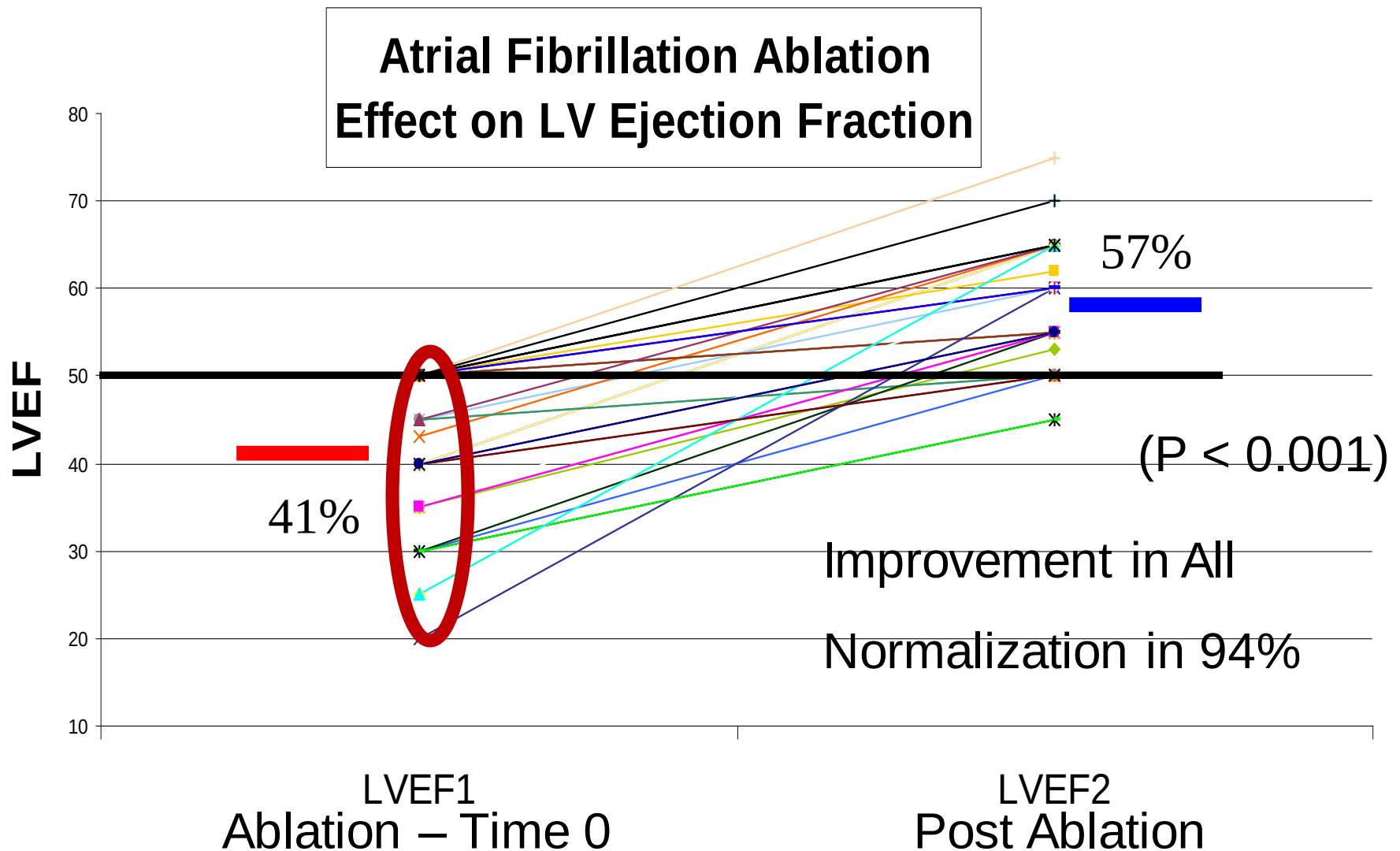
- Greater ↓↓ LA size
- Greater ↓↓ Annular dimension

Low EF and AF

- 66 y/o man with persistent AF (X 6mos) reasonable rate control (80-90 at rest) on digoxin, metoprolol(75bid), diltiazem(120qd).
- Some exercise intolerance - shortness of breath, palpitations (Heart rate 110-140)
- Echo – LVEF 38% //LA 4.7
- Failed two CV off /on sotalol

Is the low EF due to AF/Role of ablation?

Observational Study – AF and Low LV EF (48 pts)

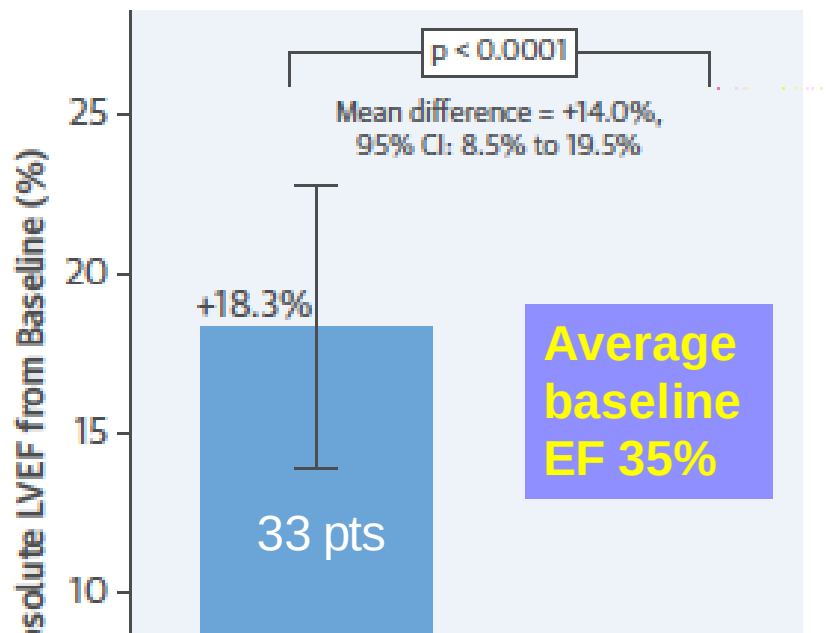


Frequent paroxysmal AF (34pts) or “apparent” rate control with persistent (14pts) AF

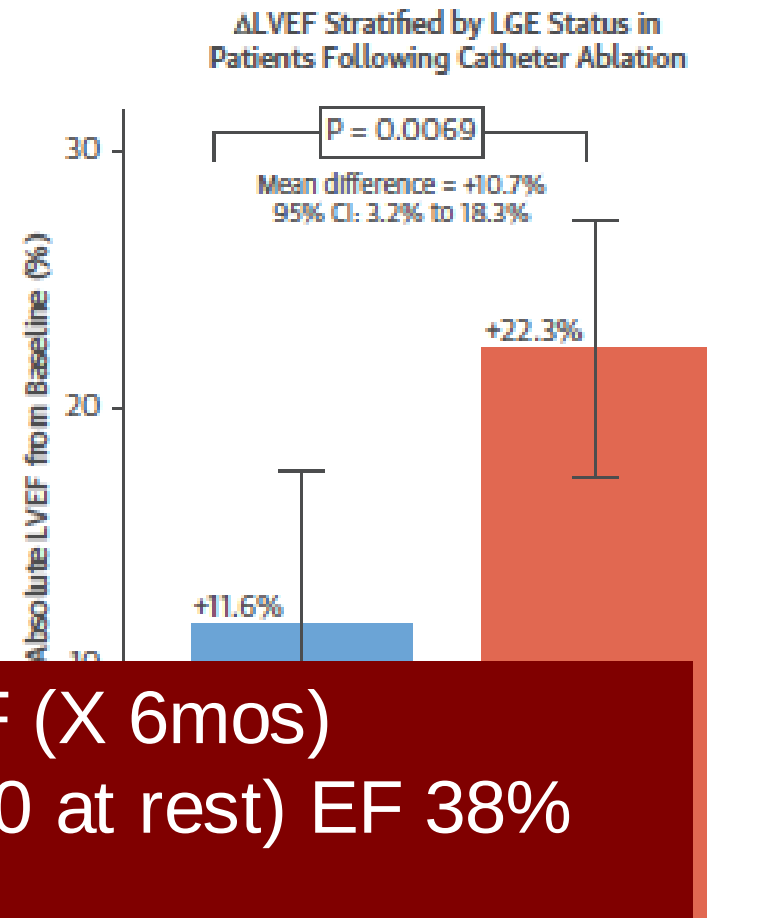


CAMERA-MRI Study – Persistent AF and LV Dysfunction

Primary Endpoint: Change in LVEF at Baseline and 6 Months by Treatment Arm



Randomized prospective study



66 y/o man with persistent AF (X 6mos)
reasonable rate control (80-90 at rest) EF 38%
with mild exertional dyspnea

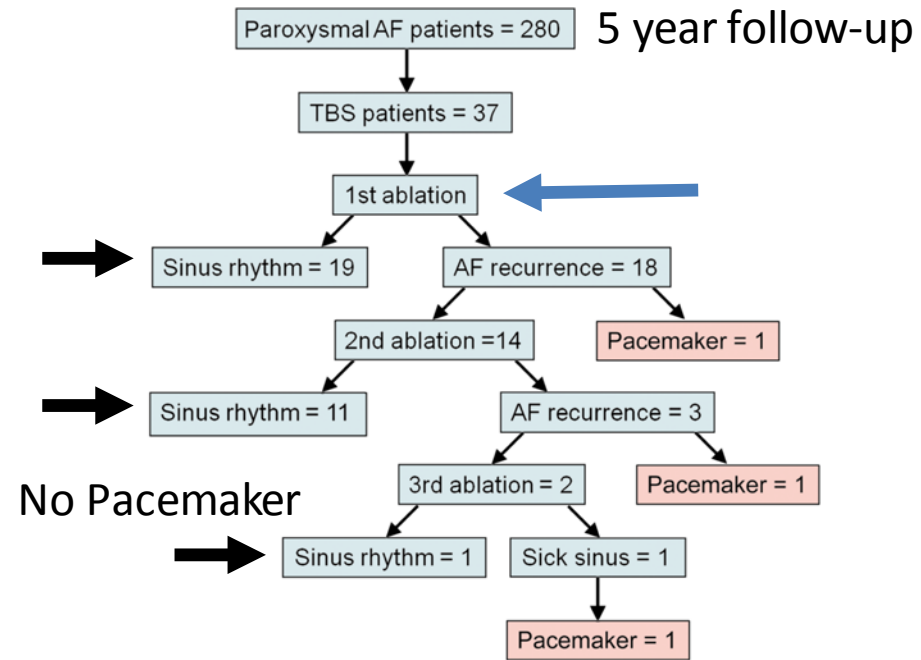
**Strong consideration for catheter ablation for
improvement in symptoms + LV function!!**



Atrial Fibrillation with Conversion Pauses (Tachy-Brady Syndrome -TBS). - Role of Ablation?



**Historic treatment standard -
Antiarrhythmics + Pacemaker**



Pacemaker implantation was not performed in patients without prolonged sinus pauses

Inada, K., et al Europace, 2014. 16(2): 208-13

**New recommendation - Catheter
ablation + No Pacemaker (2A)**
Calkins et al Heart Rhythm Oct 2017

Afib Catheter Ablation – Who? /Results?

Special Considerations

- *Functional MR* 
- *LV dysfunction*  Reversible Disease States?
- *Conversion Pauses after Afib – treat by eliminating Afib*
- ***Late recurrences***
 - 56 y/o male with symptomatic Persistent AF – 1 -2 AF per month for 2 years – undergoes AF ablation. He experiences one AF episode 18mos later requiring CV – **wants to know prognosis?**

430 consecutive patients with AF recurrence after ablation + 3mo blanking period

(First ablation 2004 - 2008)

At least 18 mos (mean 41 ± 19 mos) of additional follow-up

Time of 1st
Recurrence

3 – 6 mos

6 – 12 mos

>12 mos

245 pts

118 pts

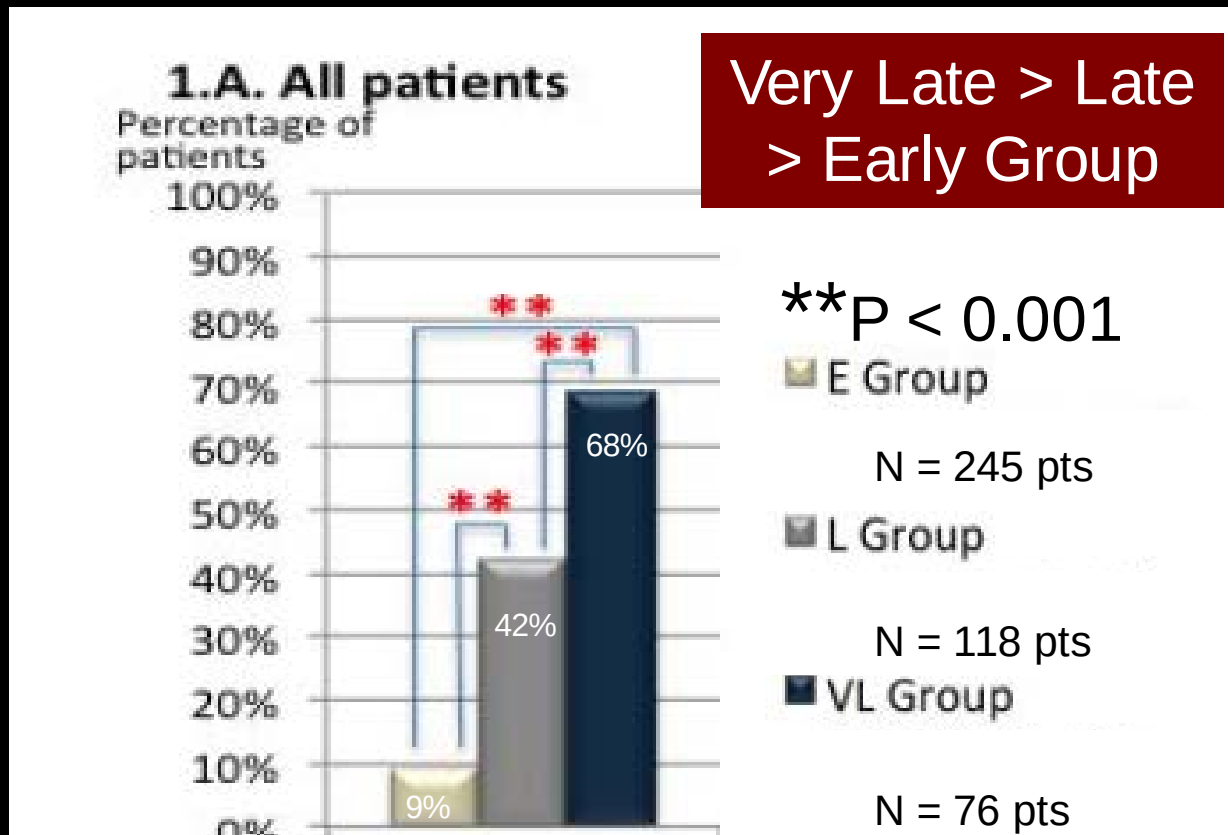
76 pts

Early

Late

Very Late

No or Rare* AF during Long Term Follow-up Mean 41 ± 19 months



56 y/o male with symptomatic Persistent AF – 1 -2 episodes per month for 2 years undergoes AF ablation. he then experiences one AF episode at 18mos/CV – **wants to know prognosis? – Likely rare episodes!**

Table 2B Indications for atrial fibrillation ablation in populations of patients not well represented in clinical trials

	Recommendation	Class	LOE	References
Congestive heart failure	It is reasonable to use similar indications for AF ablation in selected patients with heart failure as in patients without heart failure.	2A	B-R	233-237, 384,386-395, 1042
Older patients (>75 years of age)	It is reasonable to use similar indications for AF ablation in selected older patients with AF as in younger patients.	2A	B-NR	396-398, 401-404
Hypertrophic cardiomyopathy	It is reasonable to use similar indications for AF ablation in selected patients with HCM as in patients without HCM.	2A	B-NR	385,1043, 1044
Young patients (<45 years of age)	It is reasonable to use similar indications for AF ablation in young patients with AF (<45 years of age) as in older patients.	2A	B-NR	405,1045
Tachy-brady syndrome	It is reasonable to offer AF ablation as an alternative to pacemaker implantation in patients with tachy-brady syndrome.	2A	B-NR	381-383
Athletes with AF	It is reasonable to offer high-level athletes AF as first-line therapy due to the negative effects of medications on athletic performance.	2A	C-LD	370-372
Asymptomatic AF**	Paroxysmal: Catheter ablation may be considered in select patients.**	2B	C-EO	416,418
	Persistent: Catheter ablation may be considered in select patients.	2B	C-EO	417

“Atrial Fibrillation: Catheter Ablation – Who? How? Results?”

- AF ablation - integral part of AF management in patients with paroxysmal and persistent AF – good outcome in most .
- Pulmonary vein isolation and elimination of non PV triggers remain the cornerstone of the ablation procedure
 - What else to do to modify substrate in persistent Afib is still debated?
 - Reconnection of PVs remains major reason for recurrence.
 - Efforts to stabilize catheter and permanently isolate veins (JET, sheaths, force sensing) produce better outcomes
- AF Risk Factor Modification – Important even in ablation pts
- *Moderate/severe MR with LA dilatation or LV dysfunction* in AF may be functional/ reversed with successful AF ablation (Earlier consideration for ablation even with mild symptoms)
- AF ablation should be considered as primary therapy for patients with post conversion pauses - not pacemaker
- Late recurrence (>1yr) after ablation - more benign prognosis



