

Catheter Ablation of persistent AF

CFAE's ablation

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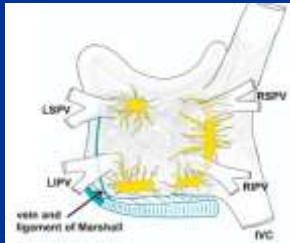
Mechanism of AF

Multiple factors ?

Mechanisms of Atrial Fibrillation

(HRS/EHRS/ECAS consensus document, 2007)

A. *Ganglionic plexi*



B. *Multiple reentrant wavelets*



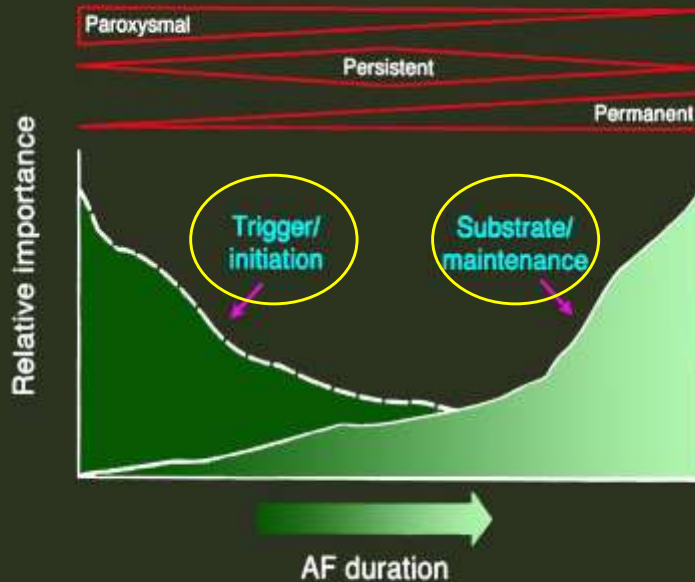
C. *PV and non-PV triggers*



D. *Multiple mechanisms*



Pathophysiological adaptation of atrial substrate as the duration of AF progress → **Remodeling**



Lesion Sets for Catheter Ablation of AF

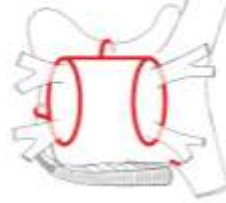
A. PV Isolation

Make sure to complete isolation



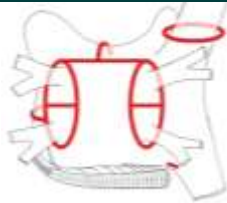
B. PVI, Roof line, CTI

Complete line block



C. PVI, Roof, CTI, Carina, SVCI

Find the residual PVP or non-PV ectopy



D. DF and CFAE

AF substrate mapping



Current Catheter Ablation Techniques for Chronic AF

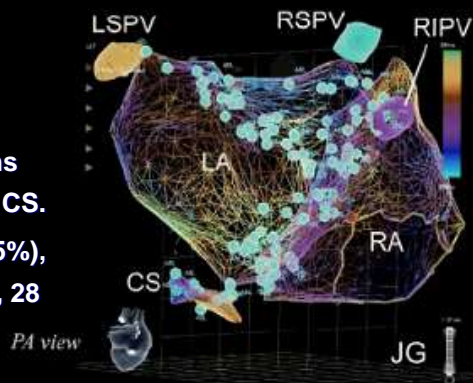
- ◆ Pure pulmonary vein isolation (PVI)
- ◆ PVI with adjunctive substrate modification
 - ◆ Anatomic approach: linear ablation
 - ◆ Electrogram-guided approach: based on fractionation mapping and/or frequency mapping.

CFAE Ablation

Adjunctive procedure ?

Substrate Modification: Target the Fractionated Electrograms

- ◆ 121 patients (age 63 yrs, 57 paroxysmal, 64 chronic) under CARTO mapping during AF.
- ◆ Target the complex electrograms at LA (mostly septum), RA, and CS.
- ◆ Acute termination in 115/121 (95%), one year F/U 63 % without drug, 28 % with ibutilide, overall 91 % successful rate.



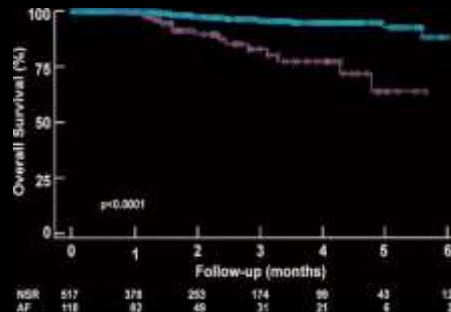
**Does CFAE represent the atrial substrate ??
What are the mechanisms of CFAE ??**

Nademanee et al, JACC, 2004

CFAE approach

Clinical Outcome of High Risk Group of AF Underwent CFE Ablation

- ◆ 674 patients (67 ± 12 yrs, 40%=PAF, 60%=non-paroxysmal).
- ◆ Mean LA= 45 ± 6 mm, LVEF $<40\%$ in 22%.
- ◆ Complication rate 0.8%; 81% remained in SR after mean follow-up period of 2.3 years, only 13% with AAD.
- ◆ SR after AF ablation is a marker of relatively low mortality and stroke risk.

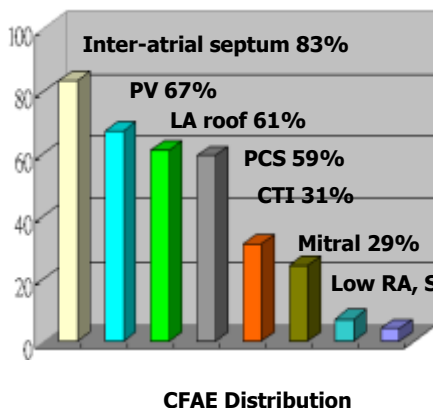


Nademanee et al. JACC 2008

How to Detect CFAÉ ?
Visual inspection
Automatic algorithm

Operator-Determined CFEs

Low amplitude, multicomponent potentials (0.05-0.25 mV) that are either continuous or separated by short isoelectric interval (< 120 msec) over a 10 seconds period.



Type I: CFAE



Type II: CFAE



Nademanee et al. JACC 2004
Nademanee et al. JACC 2004

Complex Fractionated Atrial Electrograms (CFAE)

- CFAE: potential AF substrate sites and target sites for AF ablation.
- CFAE are electrograms with highly fractionated potentials or with a very short cycle length (120 ms).
- CFAEs usually are low-voltage multiple potential signals between 0.06 and 0.25 mV.

Non-CFAEs: Discrete Eg with isoelectric segment and CL >120 ms.



Type IIa : Fractionated Eg with continuous activity.

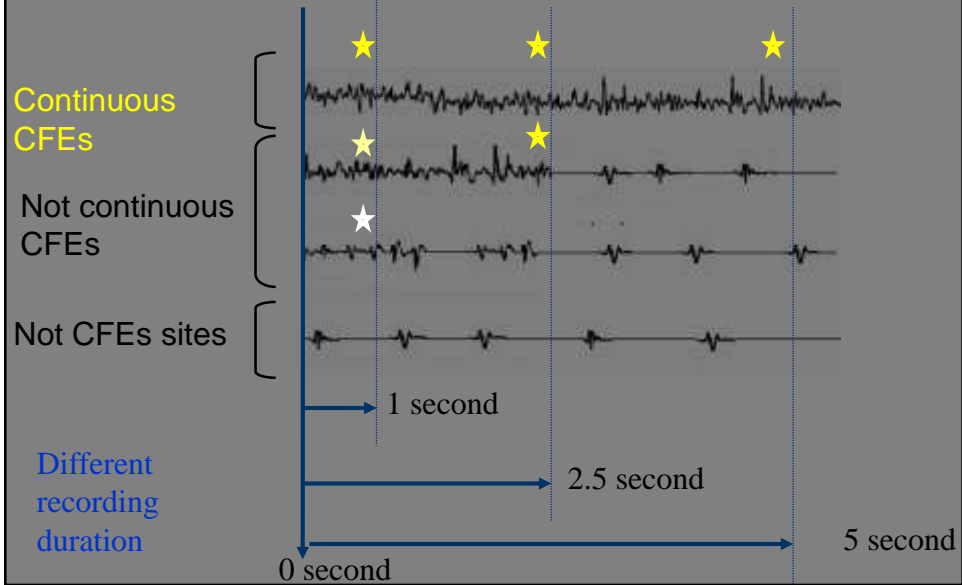


Type IIb : Fractionated Eg with isoelectric segment and the CL < 120 ms.

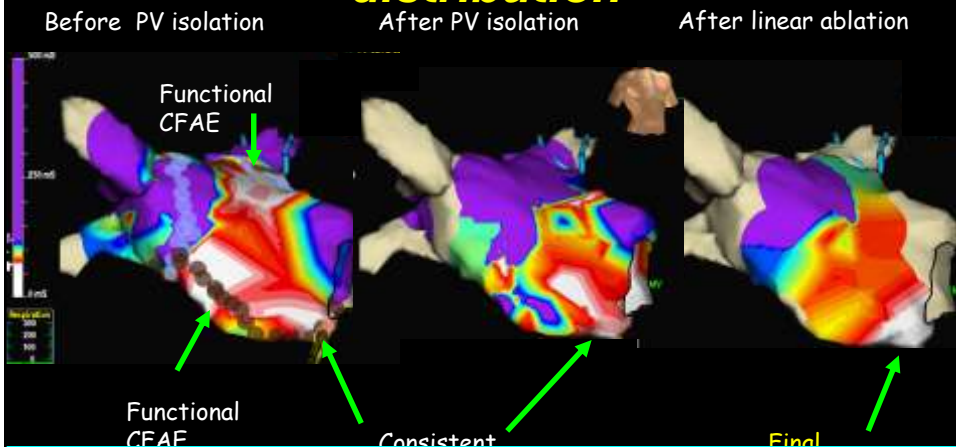


Taipei VGH 2008

The requirement of long-term recording in CFE mapping in 3D mapping



The Effect of PVI and lines on CFE distribution



The timing of CFEs mapping may affect the CFEs;
Persistent presence of CFEs are important

How to identify the important CFEs

Complex fractionation electrogram
50-70% area of total atria

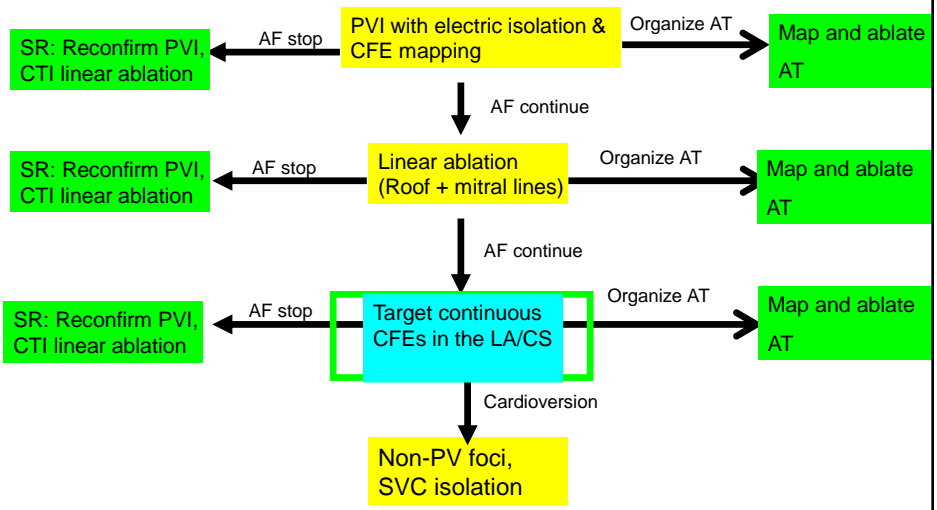
Culprit CFEs

- Relate to procedural termination
- Higher dominant frequency
- Continuous over time

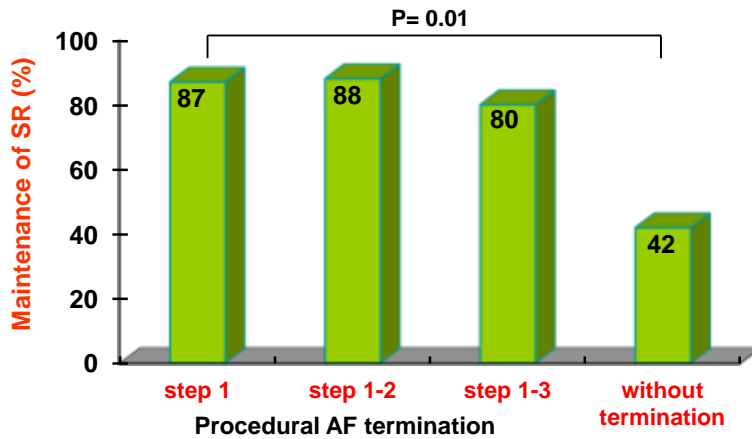
Bystander CFEs

- Not relate to procedural termination
- Peripheral to the high DF
- Not continuous over time

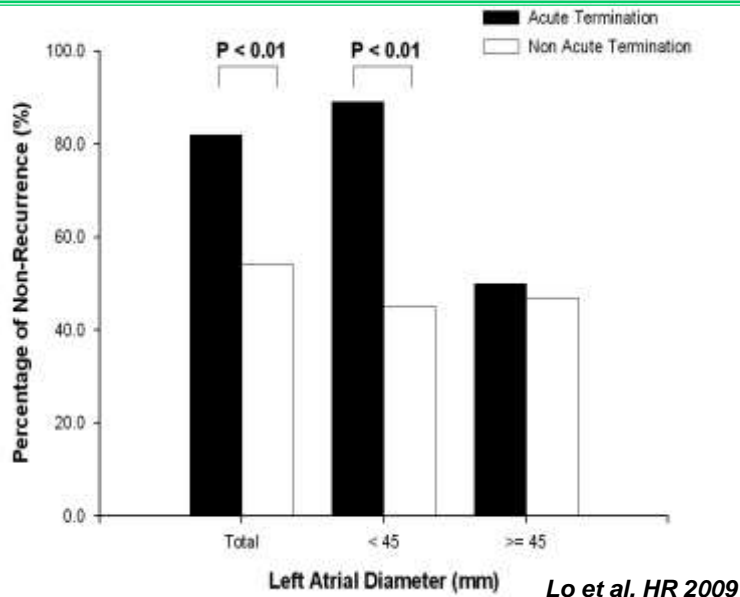
Ablation Technique of Chronic AF



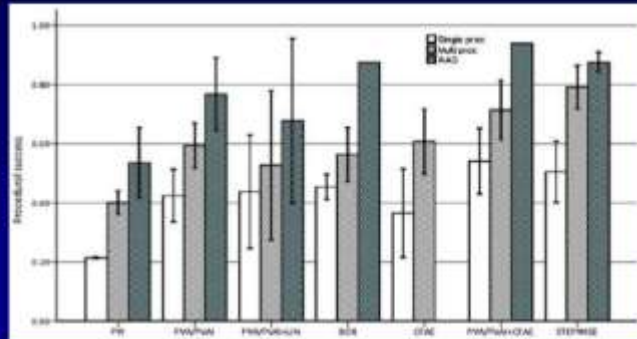
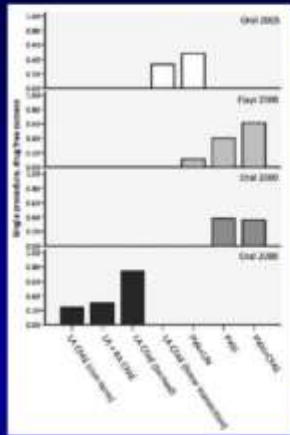
Efficacy of stepwise ablation procedure



Procedural AF Termination and Long-term Outcome (N=85, follow-up 13 months)



Review of Ablation for Long-standing Persistent AF (>1y): Techniques and Outcomes are Variable



Optimal Method and Outcomes of Catheter Ablation of Persistent AF: The STAR AF 2 Trial

NEJM 2015

THE NEW ENGLAND JOURNAL OF MEDICINE

ORIGINAL ARTICLE

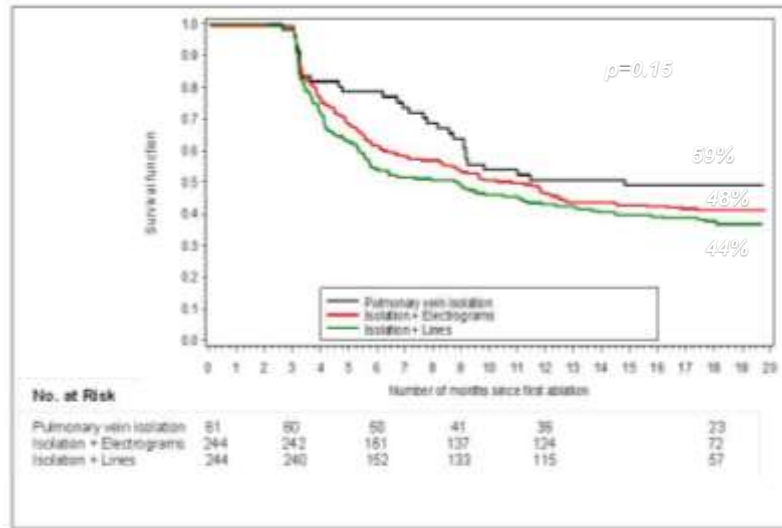
Approaches to Catheter Ablation for Persistent Atrial Fibrillation

Atul Verma, M.D., Chen-yang Jiang, M.D., Timothy R. Betts, M.D., M.B., Ch.B.,
Jian Chen, M.D., Isabel Deisenhofer, M.D., Roberto Mantovan, M.D., Ph.D.,
Laurent Macle, M.D., Carlos A. Morillo, M.D., Wilhelm Haverkamp, M.D., Ph.D.,
Rukshen Weerasooriya, M.D., Jean-Paul Albenque, M.D., Stefano Nardi, M.D.,
Endrj Menardi, M.D., Paul Novak, M.D., and Prashanthan Sanders, M.B., B.S., Ph.D.,
for the STAR AF II Investigators*

UNIFESP – julho 2016

Results - Primary Outcome

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



Results - Secondary Outcomes

	PVI	PVI+CFE	PVI+LINES	p value
Freedom from AF/AFL/AT after 1 procedure	49 %	41 %	37 %	0.15
Freedom from AF after 2 procedures	72 %	60 %	58 %	0.18
Freedom from AF/AFL/AT after 2 procedures	60 %	50 %	48 %	0.24
Percentage of patients still on AAD at 18 mo	11 %	12 %	12 %	0.35

*AAD = antiarrhythmic drug

Table S2. Procedural Details

	Isolation alone	Isolation+electrograms	Isolation+lines	p value
Procedure time (min)*	167 ± 55	229 ± 88	223 ± 89	<0.001
Mapping time (min)*	14 ± 7	19 ± 14	14 ± 8	<0.001
Fluoroscopy time (min)*	29 ± 16	42 ± 21	41 ± 25	<0.001
Acute AF termination during procedure (%)*	8%	40%	22%	<0.001
Patients receiving successful linear ablation with conduction block (%)*	-	-	Roof line 231 (93%) Mitral line 187 (75%) Both lines 184 (74%)	-
Crossover during first procedure*	1 Total 1 Isolation+lines	6 Total 2 Isolation alone 2 Isolation+lines 2 Isolation+electrograms+lines	1 Total 1 Isolation+electrograms+lines	0.16
Patients receiving a second ablation procedure (%)	14 (22%)	67 (26%)	83 (33%)	0.10
Crossover during second procedure	4 total 4 Isolation+electrograms	15 total 2 Isolation alone 5 Isolation+lines 8 Isolation+electrograms+lines	3 total 3 Isolation+electrograms+lines	<0.001

Original Article

Five-Year Follow-Up After Catheter Ablation of Persistent Atrial Fibrillation Using the Stepwise Approach and Prognostic Factors for Success

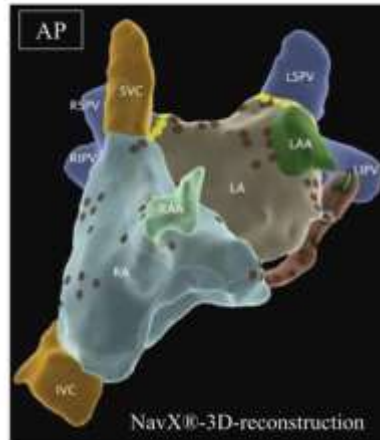
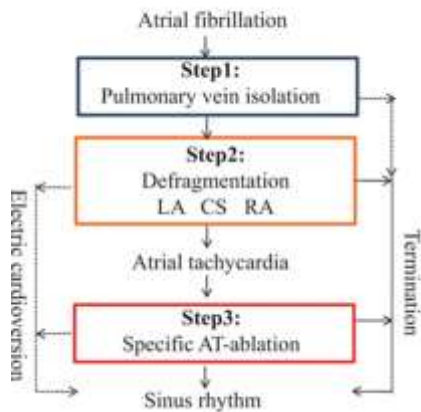
Doreen Schreiber, MD*; Thomas Rostock, MD*; Max Fröhlich; Arian Sultan, MD; Helge Servatius, MD; Boris A. Hoffmann, MD; Jakob Lüker, MD; Inke Berner, MD; Benjamin Schäffer, MD; Karl Wegscheider, PhD; Susanne Lezius, MSc; Stephan Willems, MD; Daniel Steven, MD

Background—In the meantime, catheter ablation is widely used for the treatment of persistent atrial fibrillation (AF). There is a paucity of data about long-term outcomes. This study evaluates (1) 5-year single and multiple procedure success and (2) prognostic factors for arrhythmia recurrences after catheter ablation of persistent AF using the stepwise approach aiming at AF termination.

Methods and Results—A total of 549 patients with persistent AF underwent de novo catheter ablation using the stepwise approach (2007–2009). A total of 493 patients were included (Holter ECGs ≥every 6 months). Mean follow-up was 59±16 months with 2.1±1.1 procedures per patient. Single and multiple procedure success rates were 20.1% and 55.9%, respectively (80% off antiarrhythmic drug). Antiarrhythmic drug-free multiple procedure success was 46%. Long-term recurrences (n=171) were paroxysmal AF in 48 patients (28%) and persistent AF/atrial tachycardia in 123 patients (72%). Multivariable recurrent event analysis revealed the following factors favoring arrhythmia recurrence: failure to terminate AF during index procedure (hazard ratio [HR], 1.279; 95% confidence interval [CI], 1.093–1.497; P=0.002), number of procedures (HR, 1.154; 95% CI 1.051–1.267; P=0.003), female sex (HR, 1.263; 95% CI, 1.027–1.553; P=0.027), and the presence of structural heart disease (HR, 1.236; 95% CI, 1.003–1.524; P=0.047). AF termination was correlated with a higher rate of consecutive procedures because of atrial tachycardia recurrences (P=0.003; HR, 1.71; 95% CI, 1.20–2.43).

Conclusions—Catheter ablation of persistent AF using the stepwise approach provides limited long-term freedom of arrhythmias often requiring multiple procedures. AF termination, the number of procedures, sex, and the presence of structural heart disease correlate with outcome success. AF termination is associated with consecutive atrial tachycardia procedures. (*Circ Arrhythm Electrophysiol*. 2015;8:308–317. DOI: 10.1161/CIRCEP.114.001672.)

Stepwise approach



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Conclusion

- ◆ Combination of PVI and adjunctive substrate modification improve success in treatment of chronic AF.
- ◆ Both frequency and fractionation mapping may provide the information to plan our ablation strategy.
- ◆ Effects should be directed to identify the AF sources with minimal ablation in individual patient.