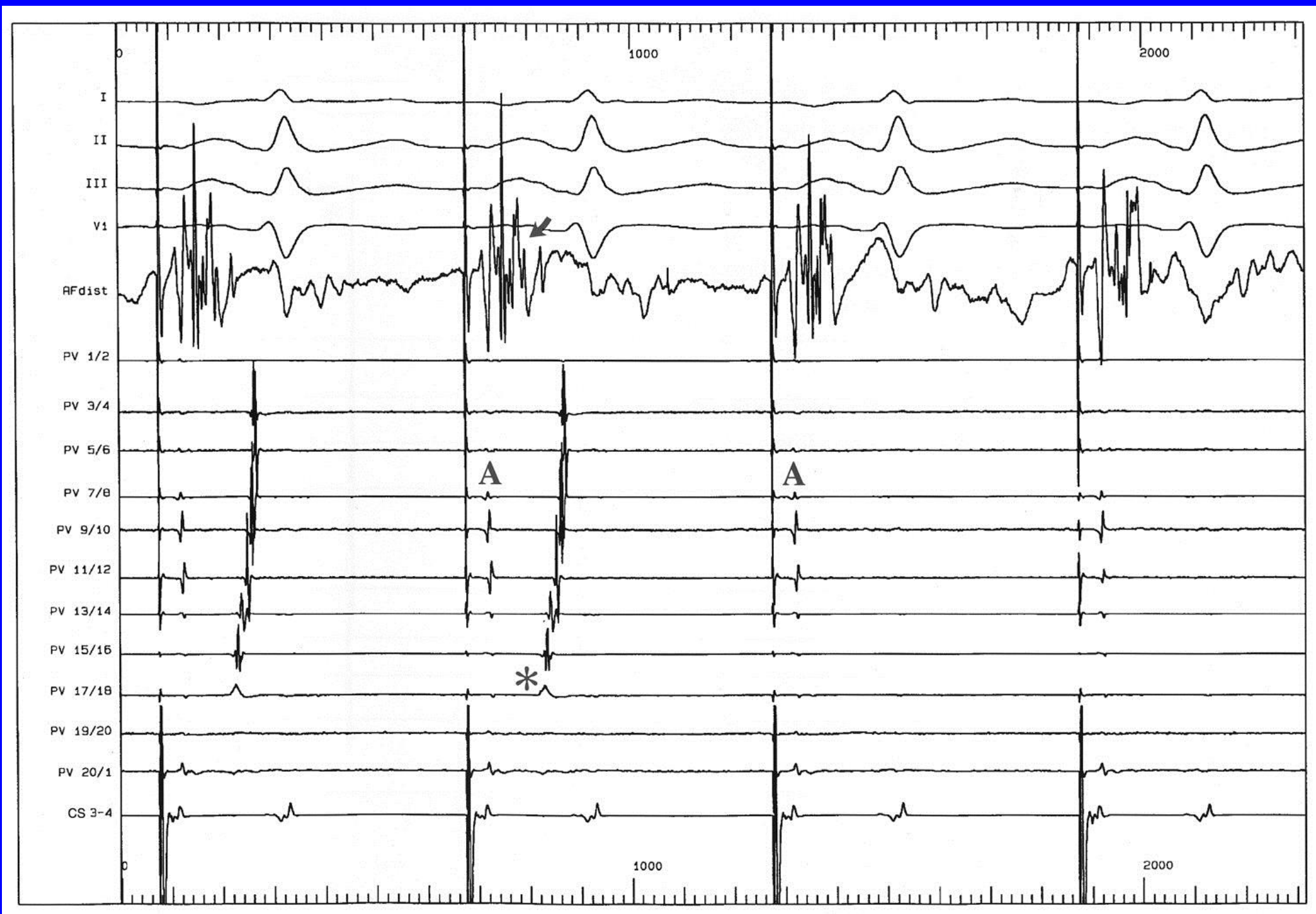


Persistent AF Ablation –

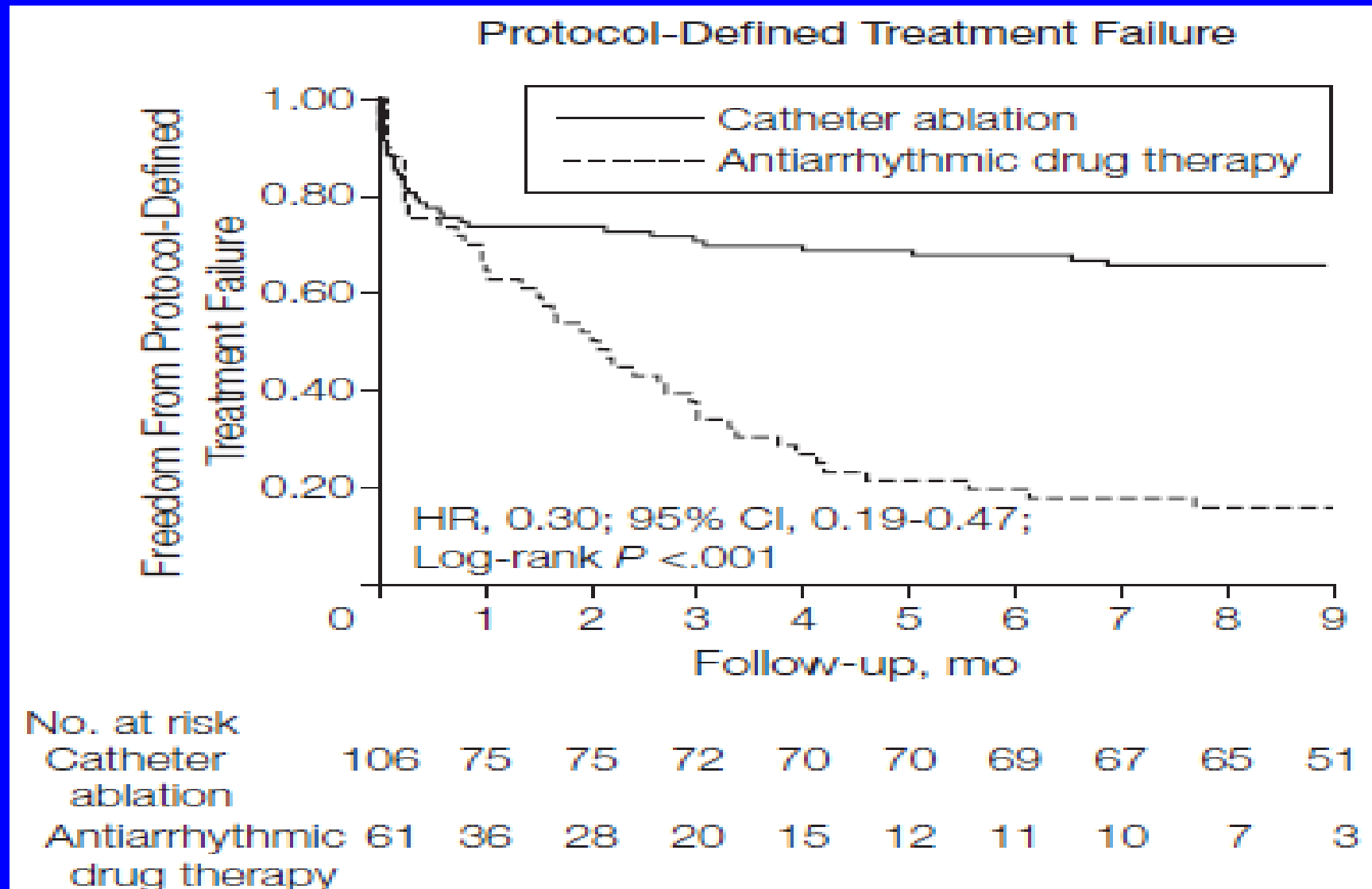
What the trials tell us & what they don't

Steve Furniss

Eastbourne UK



Ablation for paroxysmal AF



Wilber, David J., Carlo Pappone, Petr Neuzil, Angelo De Paola, Frank Marchlinski, Andrea Natale, Laurent Macle, et al. "Comparison of Antiarrhythmic Drug Therapy and Radiofrequency Catheter Ablation in Patients With Paroxysmal Atrial Fibrillation." *JAMA: The Journal of the American Medical Association* 303, no. 4 (January 27, 2010): 333–340.

PVI – Meta analysis of Cryoablation

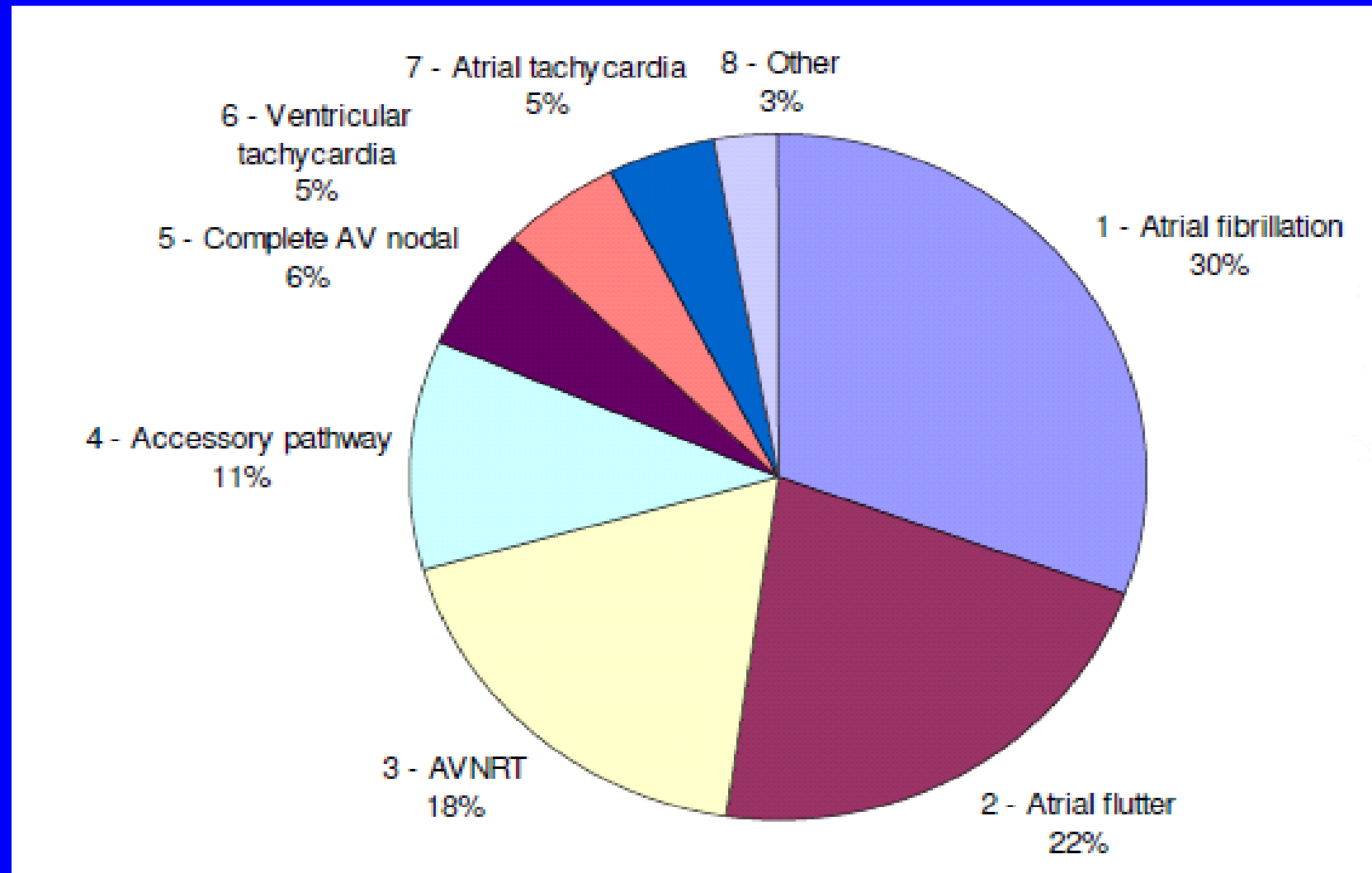
? Currently the best option

CB2

- quicker
- equivalent efficacy

Complications	Study	Mean (%)	RR	95% CI	P	I ²
CB vs RFCA	16	8.2 vs 5.4	1.39	1.06 to 1.83	0.13	29
CBA vs RFCA	5	9.8 vs 6.8	1.43	0.90 to 2.28	0.18	37
CB/CBA vs RFCA	2	6.6 vs 8.7	0.74	0.41 to 1.34	0.41	0
CB vs MTCA	7	12.6 vs 3.8	2.4	1.17 to 4.93	0.59	0
Total	30	8.8 vs 5.7	1.38	1.12 to 1.71	0.09	26
Acute PVI	Study (n)	Mean (%)	RR	95% CI	P	I ²
CB vs RFCA	8	97.5 vs 97.8	1.00	0.99 to 1.01	0.007	62
CBA vs RFCA	4	99.3 vs 98.9	1.00	0.99 to 1.01	<0.00001	90
CB/CBA vs RFCA	1	99.3 vs 97.4	1.02	1.00 to 1.04		
CB vs MTCA	5	95.3 vs 97	0.99	0.96 to 1.02	0.08	52
Total	18	98.2 vs 97.9	1.00	1.00 to 1.01	0.005	51
Fluoroscope time	Study (n)	Mean (minutes)	SMD	95% CI	P	I ²
CB vs RFCA	15	36.1 vs 37.7	-0.07	-0.38 to 0.24	<0.00001	96
CBA vs RFCA	6	26.7 vs 39.3	-0.76	-1.36 to -0.16	<0.00001	97
CB/CBA vs RFCA	3	29.6 vs 41.5	-0.49	-1.05 to 0.08	<0.00001	94
CB vs MTCA	6	34 vs 29.3	0.43	0.18 to 0.68	0.33	13
Total	30	31.6 vs 37	-0.15	-0.42 to 0.13	<0.00001	97
Ablation time	Study (n)	Mean (minutes)	SMD	95% CI	P	I ²
CB vs RFCA	6	61.5 vs 41.8	0.56	0.31 to 0.82	0.001	75
CBA vs RFCA	2	40.5 vs 66.5	-1.31	-1.49 to -1.13	0.25	25
CB vs MTCA	3	81.7 vs 94	-0.29	-0.81 to 0.24	0.05	67
Total	11	61.2 vs 67.4	0.05	-0.58 to 0.68	<0.00001	99
Energy delivery time	Study (n)	Mean (minutes)	SMD	95% CI	P	I ²
CB vs RFCA	4	38.1 vs 34	0.41	-0.69 to 1.50	<0.00001	96
CBA vs RFCA	5	33.4 vs 51.5	-0.65	-1.65 to 0.35	<0.00001	98
CB/CBA vs RFCA	1	32 vs 37.9	-0.47	-0.67 to -0.26		
CB vs MTCA	8	41.7 vs 30.2	0.81	-0.31 to 1.92	<0.00001	96
Total	18	36.3 vs 38.4	0.16	-0.32 to 0.65	<0.00001	97

UK Ablations 2011



What have the trials taught us about AF ablation?

- Paroxysmal AF ablation works
- Pulmonary vein isolation is the cornerstone
- AF ablation is the commonest form of ablation done

Some Fundamentals

BUT

Persistent AF is different beast...

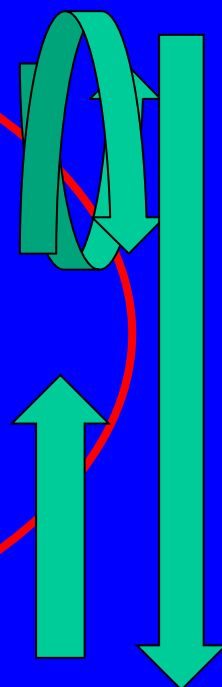
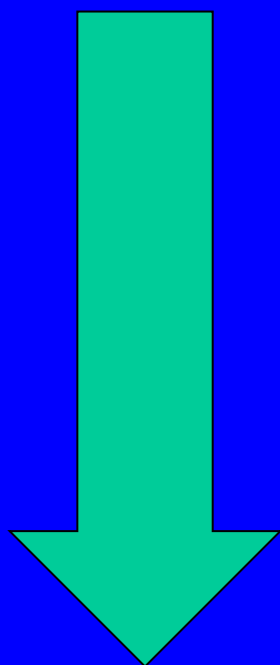
Definitions:

- persistent
- long-standing persistent
- permanent

Guidelines
Natural history

AF pattern	Definition
First diagnosed AF	AF that has not been diagnosed before, irrespective of the duration of the arrhythmia or the presence and severity of AF-related symptoms.
Paroxysmal AF	Self-terminating, in most cases within 48 hours. Some AF paroxysms may continue for up to 7 days. ^a AF episodes that are cardioverted within 7 days should be considered paroxysmal. ^a
Persistent AF	AF that lasts longer than 7 days, including episodes that are terminated by cardioversion, either with drugs or by direct current cardioversion, after 7 days or more.
Long-standing persistent AF	Continuous AF lasting for ≥ 1 year when it is decided to adopt a rhythm control strategy.
Permanent AF	AF that is accepted by the patient (and physician). Hence, rhythm control interventions are, by definition, not pursued in patients with permanent AF. Should a rhythm control strategy be adopted, the arrhythmia would be re-classified as 'long-standing persistent AF'.

?True
Natural history



Evolution of Persistent AF Ablation

Point by point PVI

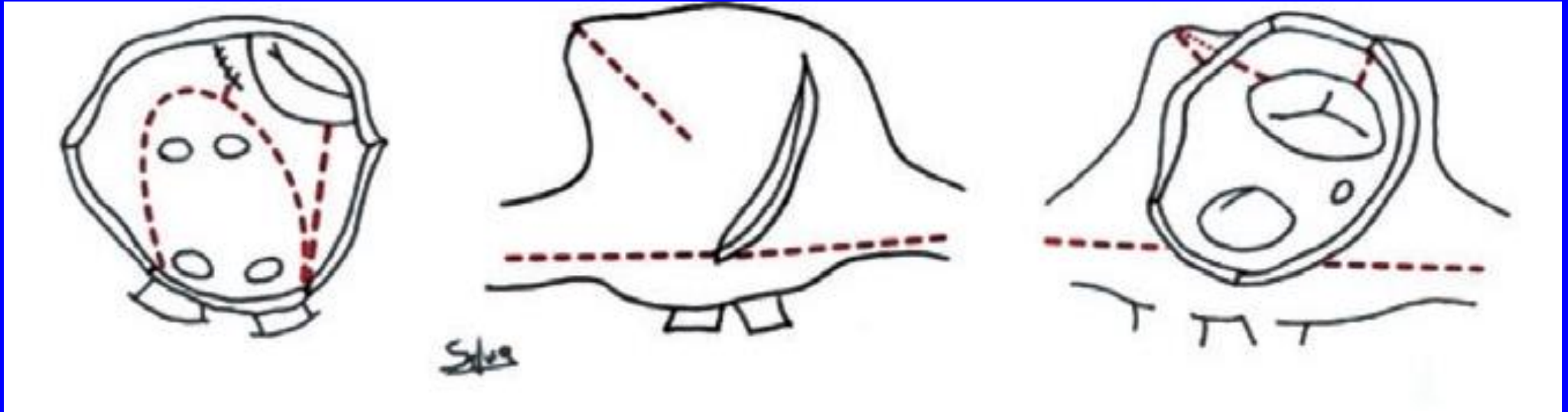
1° success 30%

long-term success 10%

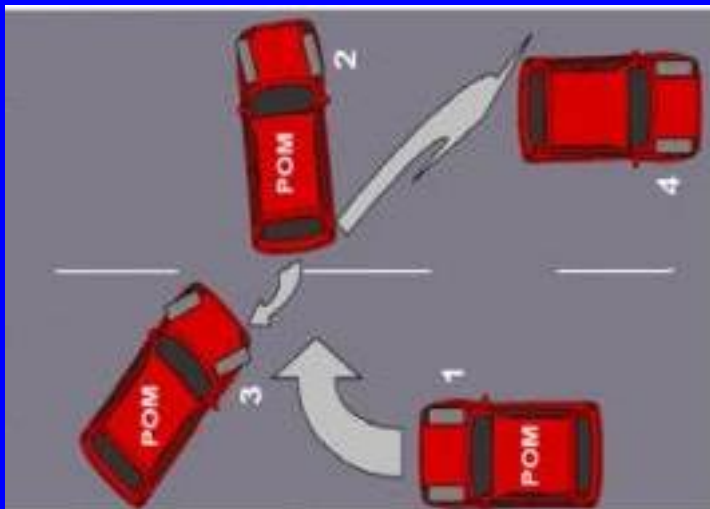
Linear ablation

derived from Cox Maze surgery

Cox Maze III



PVI but a lot more – reentry is prevented



3-point turn is possible in a wide road but impossible in a very narrow one

Surgery for Persistent AF

Is effective

Cox Maze III gold standard
technically challenging
limited availability

Modified lesion sets developed
LA ablation
Dallas set

Hybrid ablation

Evolution of Persistent AF Ablation

Guidelines

PVI + substrate ablation

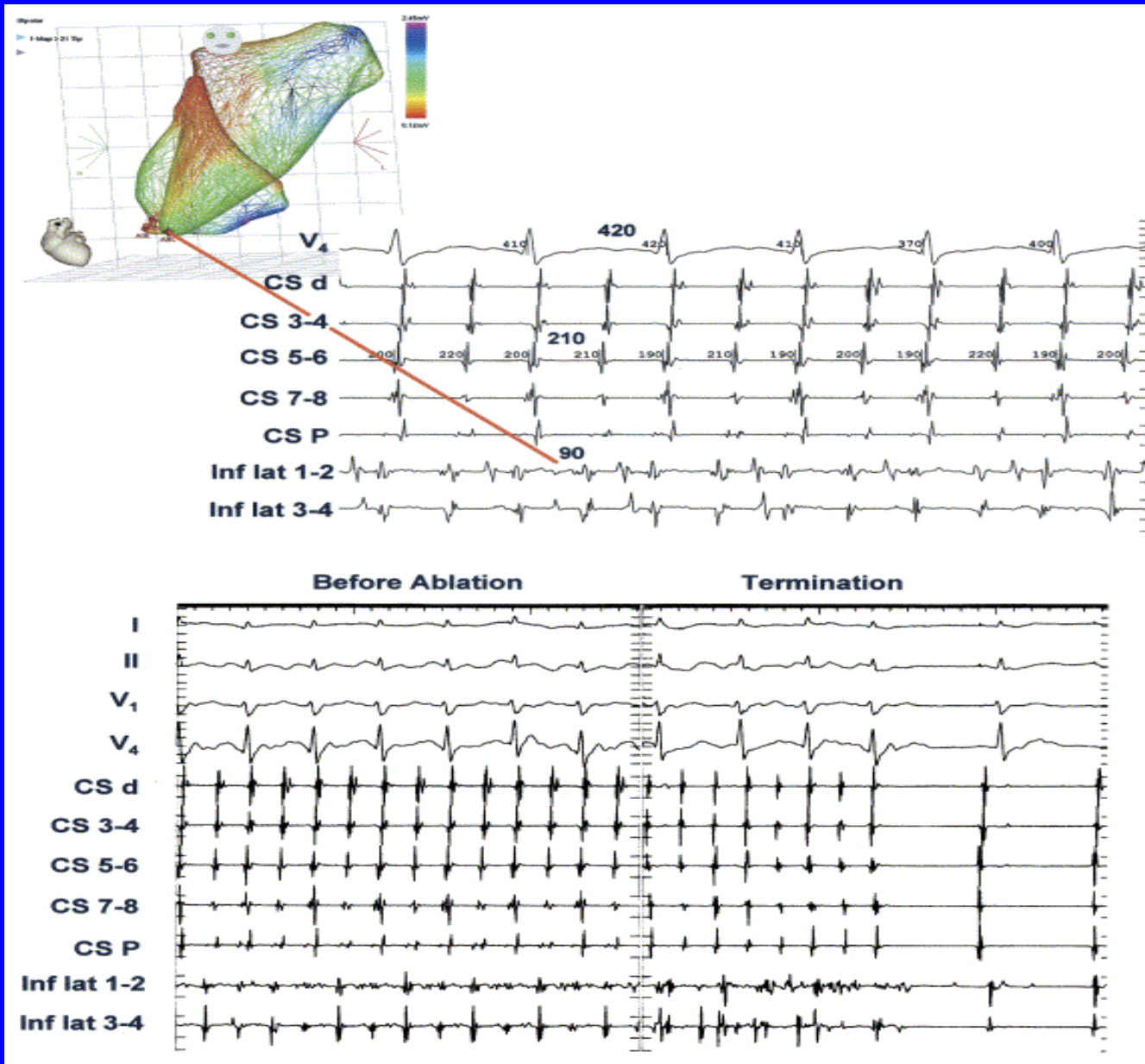
linear ablation

- roof line
- mitral isthmus line
- CTI line

CFAE ablation

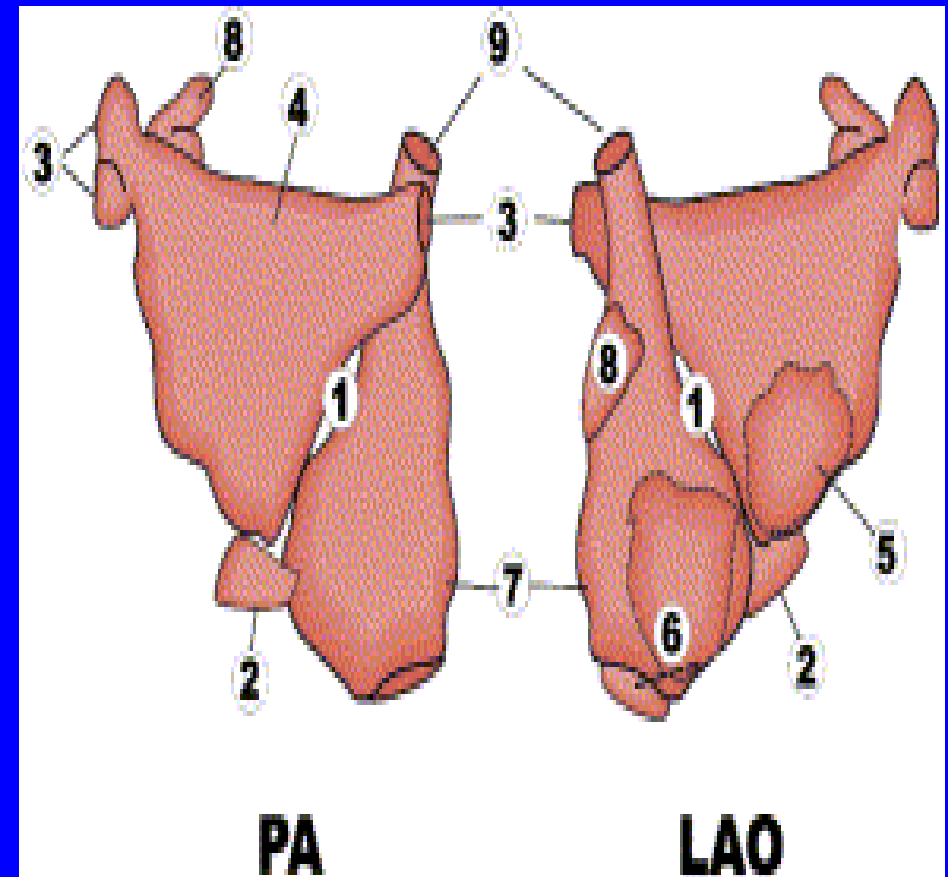
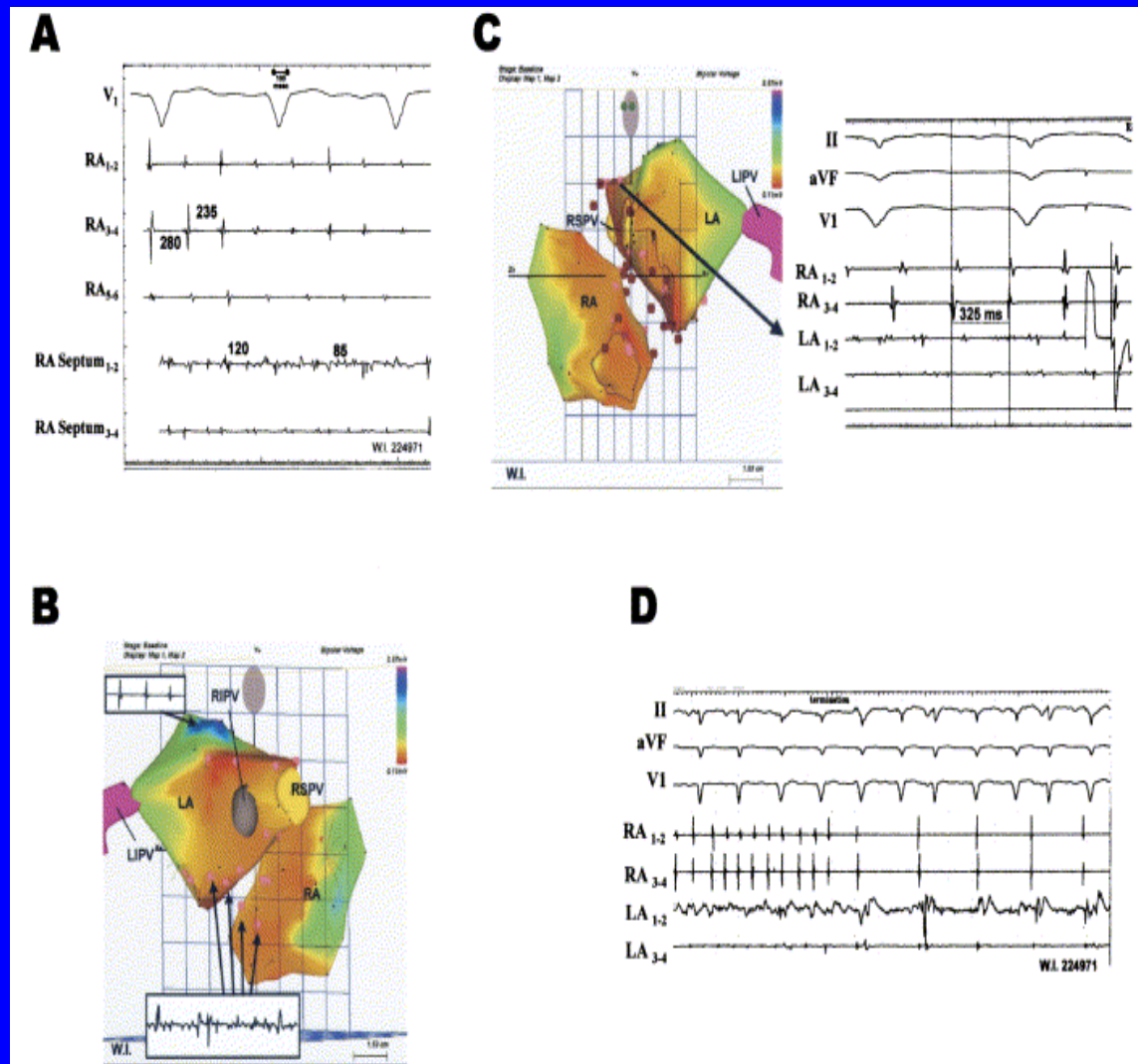
non-PV triggers

AF substrate ablation

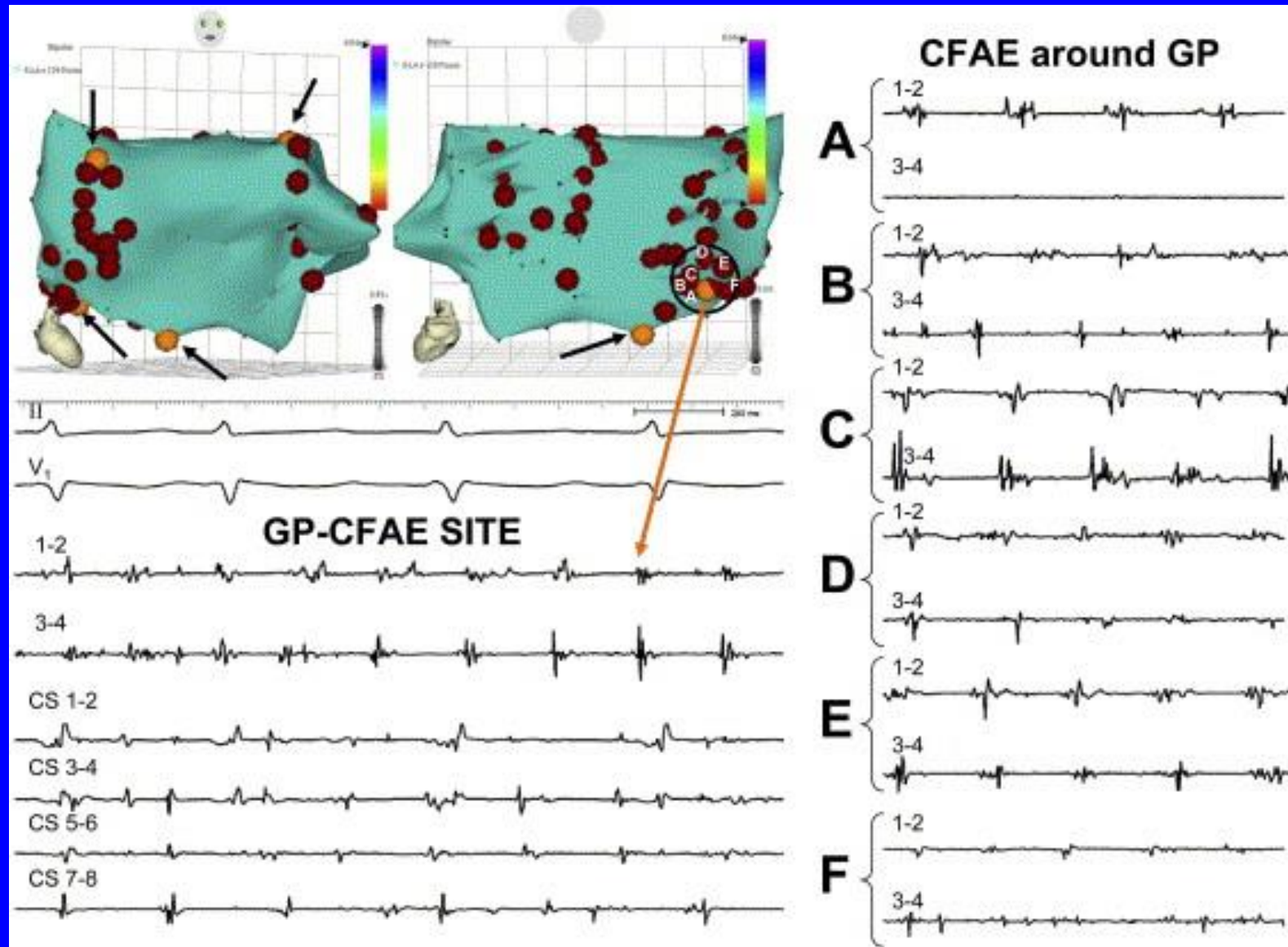


Nademanee JACC
2004;43:2004

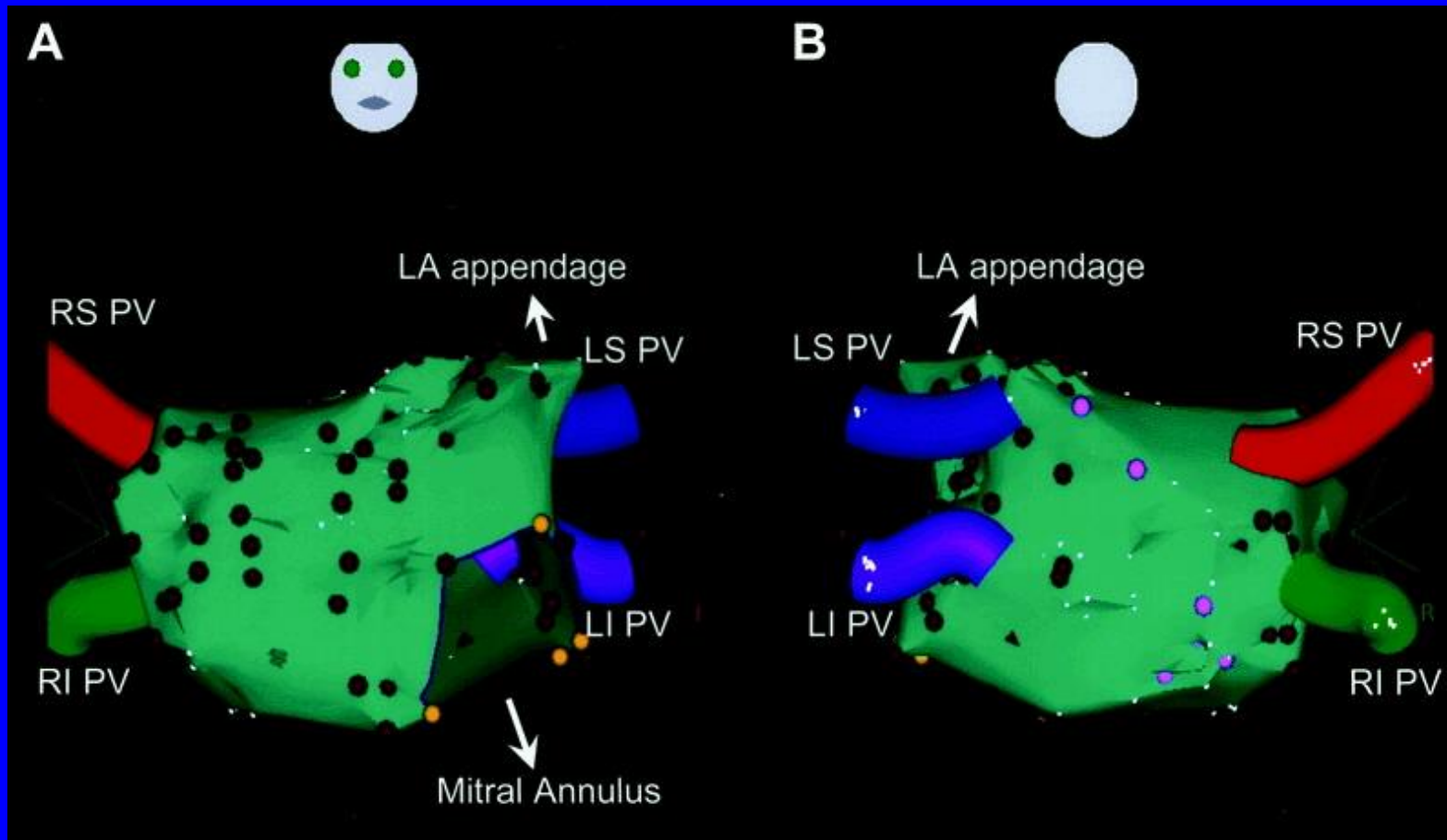
AF substrate ablation



Relationship of CFAE & Ganglionated Plexi



CFAE - Guided ablation



Not v effective – better combined with PVI

Oral Circulation 2007;115:2606-2612

CFAE Ablation

Ablation of them increases success

but at a cost of time, risk? & new arrhythmias

? Related to scar burden
MRI Utah grade
electrogram voltage

Meta-analysis of CFAE ablation – no benefit

Evolution of Persistent AF Ablation

PVI + substrate ablation

PVI = **Permanent** Vein Isolation

Is a disappointing result due to

- incomplete vein isolation ?
- uncertain/ inadequate substrate ablation ?
- new arrhythmias from prior ablation ?

Evolution of Persistent AF Ablation

STAR AF II

589 pts with persistent AF randomised to
PVI alone
PVI + CFAE
PVI +linear ablation

No difference in outcomes

ESC Guidelines 2016

PVI alone is as effective as complex ablation

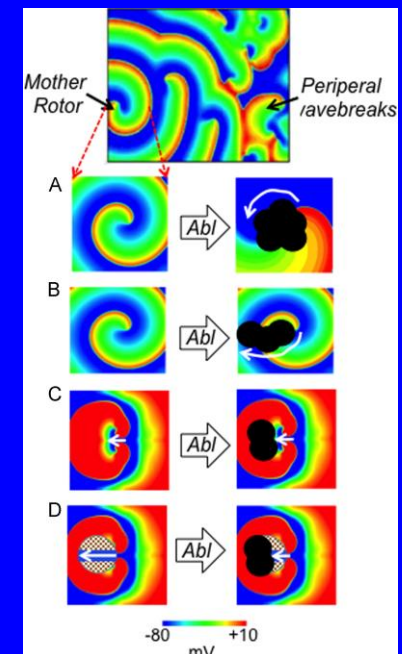
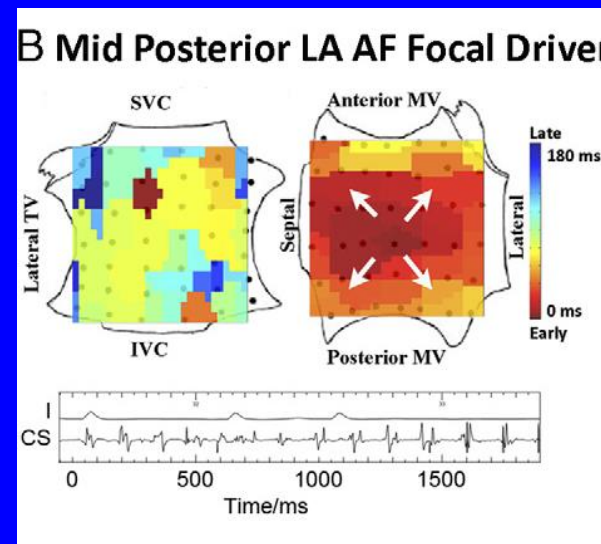
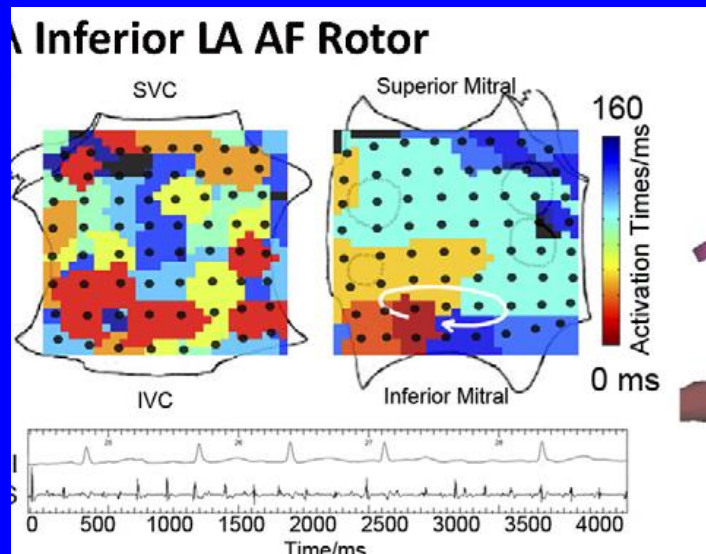
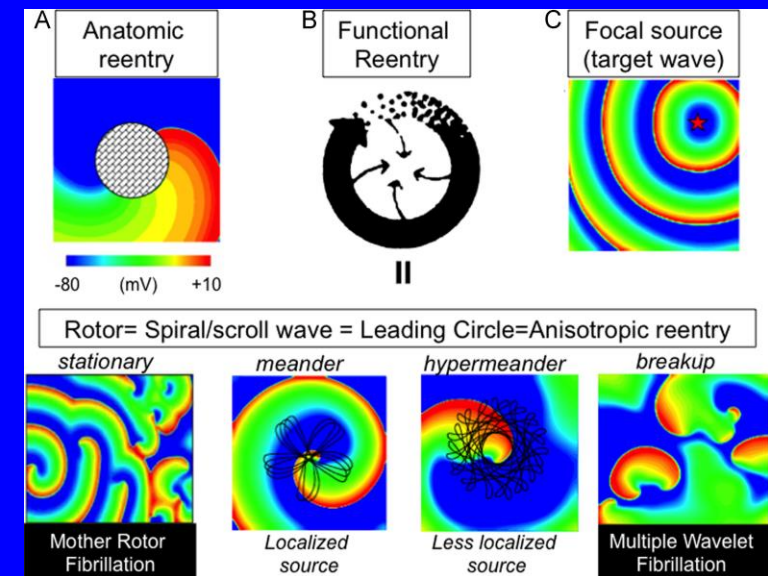
Complex ablation is not justified in the 1st procedure

Rotors & Drivers

Optical studies in animals showed the presence of rotors could maintain AF

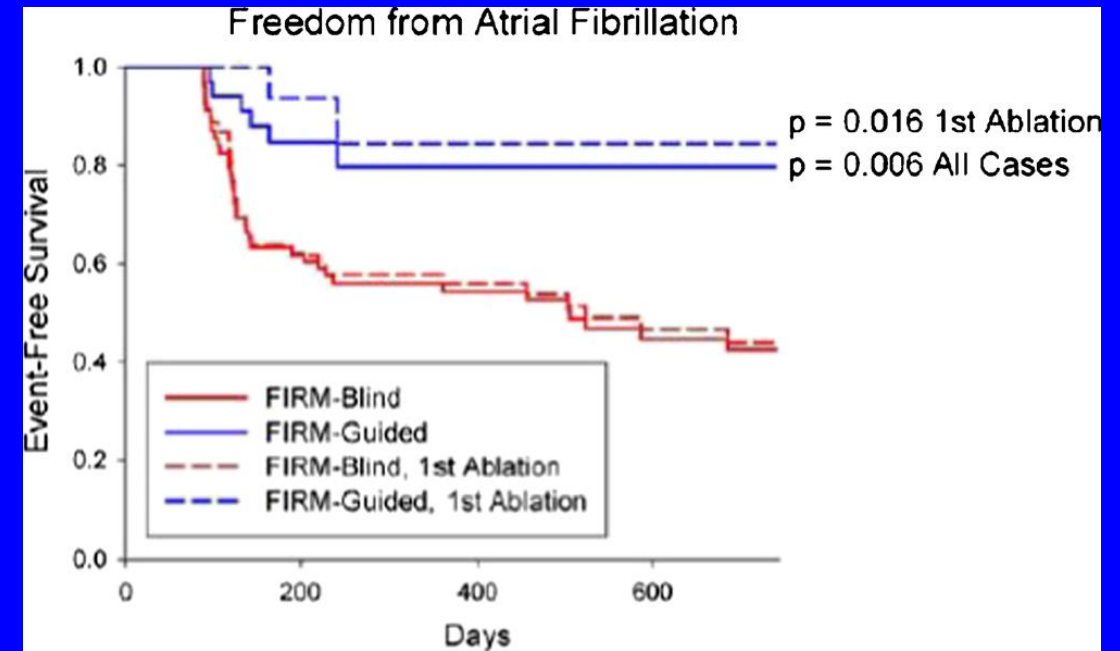
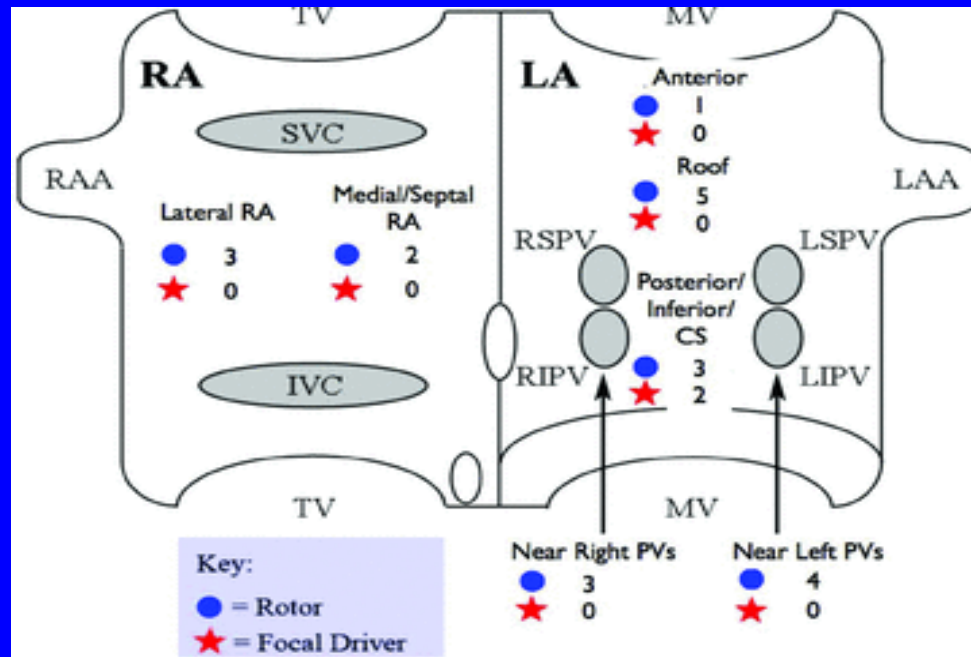
FIRM mapping

CONFIRM study (Topera system)

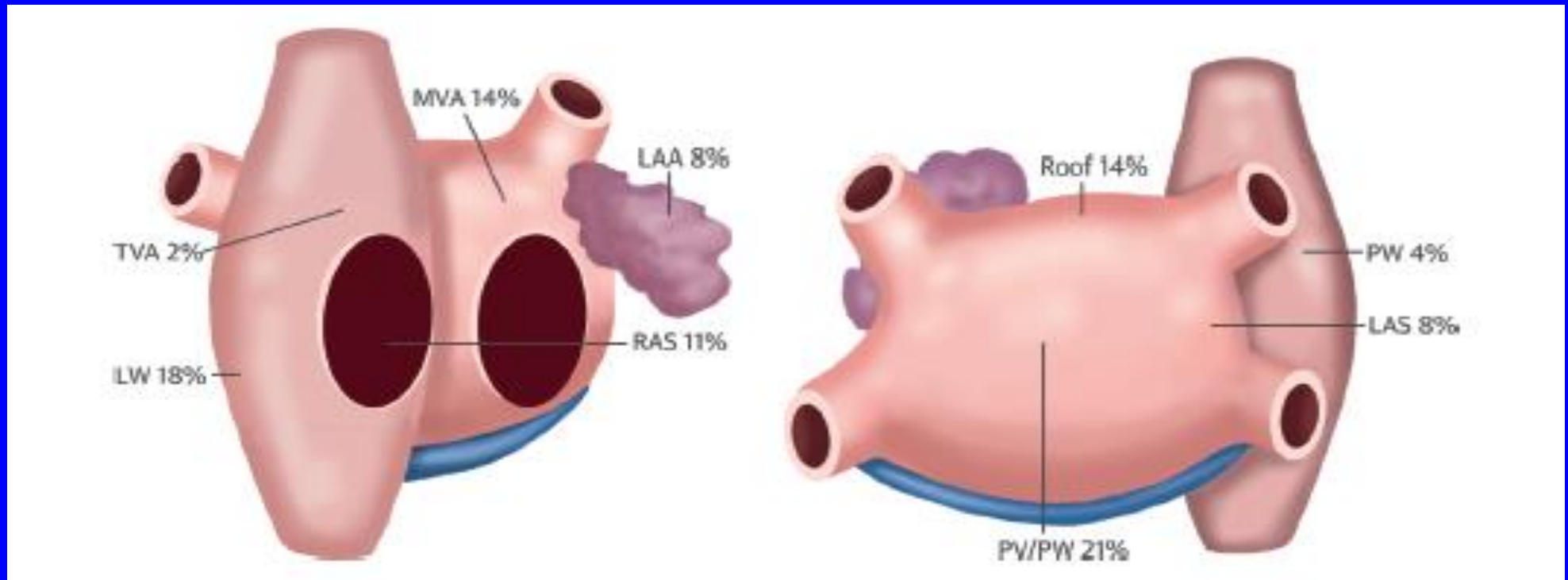


Weiss JN, Qu ZQ Shivkumar K Heart Rhythm 2016;13:1868-1877;
NarayanJCE;2014;23:1277-1285. Narayan JACC 2013;62:140-7

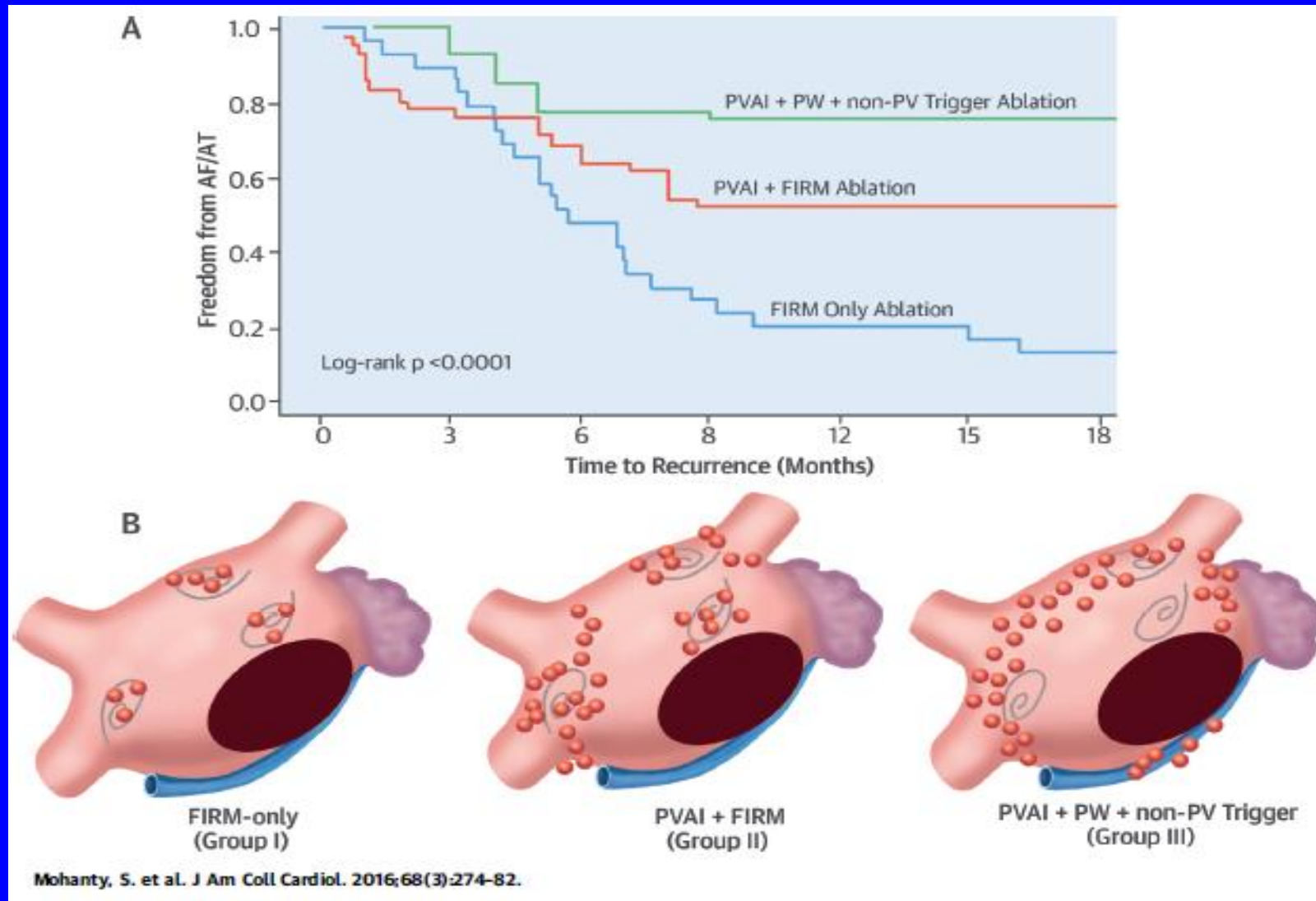
ROTORS – FIRM Ablation



OASIS Trial - Location of rotors



FIRM ablation not effective in subsequent studies



Mohanty JACC 2016;68:274-82;
Gianni Heart Rhythm 2016;13:830-835

Persistent AF Ablation - questions

- Which persistent AF patients need **ONLY** Permanent Vein Isolation?
(which paroxysmal AF patients need additional substrate ablation?)
- What predicts the outcome of persistent AF ablation?
- Which patients need substrate ablation?

LA size/volume

>12-18 months continuous AF

?CL of AF

McCready J et al Europace 2011;13:355-361; Kohari et al PACE;201437:422-429

Jarman J et al JICE 2012;33:313-14

Takahashi Y Circ EP 2010;3:465-471

Yuen Europace 2015;17:1391-1401

Matsuo JACC 2009;54:788-795

Persistent AF Ablation - questions

- Which persistent AF patients need **ONLY** PVI?
- Which HF patients with AF have a tachymyopathy?
- After PVI what should be mapped?
 - non PV triggers?
 - rotors/drivers?
 - anatomy?

Persistent AF Ablation - questions

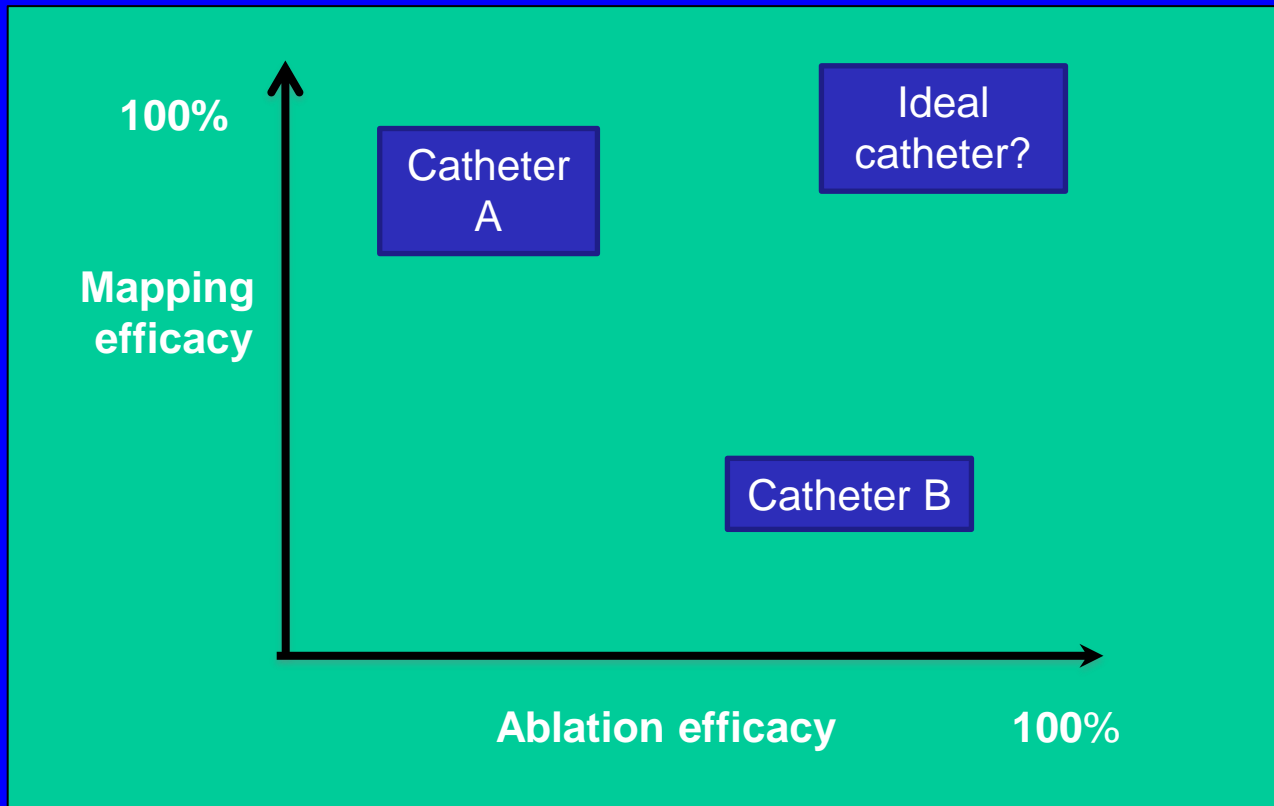
- Which persistent AF patients need **ONLY** PVI?
- Which HF patients with AF have a tachymyopathy?
- After PVI what should be mapped?
- What is the best ablative approach for substrate ablation?

Bayer et al Frontiers in physiology 2016;7:108-116

Persistent AF Ablation - questions

- Which persistent AF patients need **ONLY** PVI?
- Which HF patients with AF have a tachymyopathy?
- After PVI what should be mapped?
- What is the best ablative approach for substrate ablation?
- Which patients should be considered for surgical/hybrid ablation?

AF Ablation - cost-effectiveness matters



3 factors

- **Efficacy**
- **Time**
- **Cost**

How much better does a procedure have to be if it costs 3 times as much or takes twice as long?

Catheter Ablation of AF: *Is it affordable?*

2 scenarios

- 1) 1-2 cases per day
Pre-op imaging (CT/MRI)
TOE
4 catheters
Complex mapping system
Multiple staff
ICE
5 hour procedure
3 days in hospital
1.7 procedures per patient
Postop CT MRI
Multiple 7 day Holters

Cost – enormous

is this going to be cost effective ?

Catheter Ablation of AF: *Is it affordable?*

2 scenarios

2)

Cath list: 14/8/09 EDGH start 9.00

persistent AF ablation

persistent AF ablation

paroxysmal AF ablation + flutter ablation

paroxysmal AF ablation

cor angio

cor angio + R coronary stent

finish 4.40pm

No preop / postop imaging / TOE

No complex mapping system

Done on warfarin

60% as day case

4 staff

Persistent AF Ablation - questions

- Which persistent AF patients need ONLY PVI?
- Which HF patients with AF have a tachymyopathy?
- After PVI what should be mapped?
- What is the best ablative approach for substrate ablation?
- Which patients should be considered for surgical/hybrid ablation?
- How do we make it all affordable and relevant for the NHS?

Thank you