Optimal therapy for atrial fibrillation: Surgical vs. catheter based MAZE

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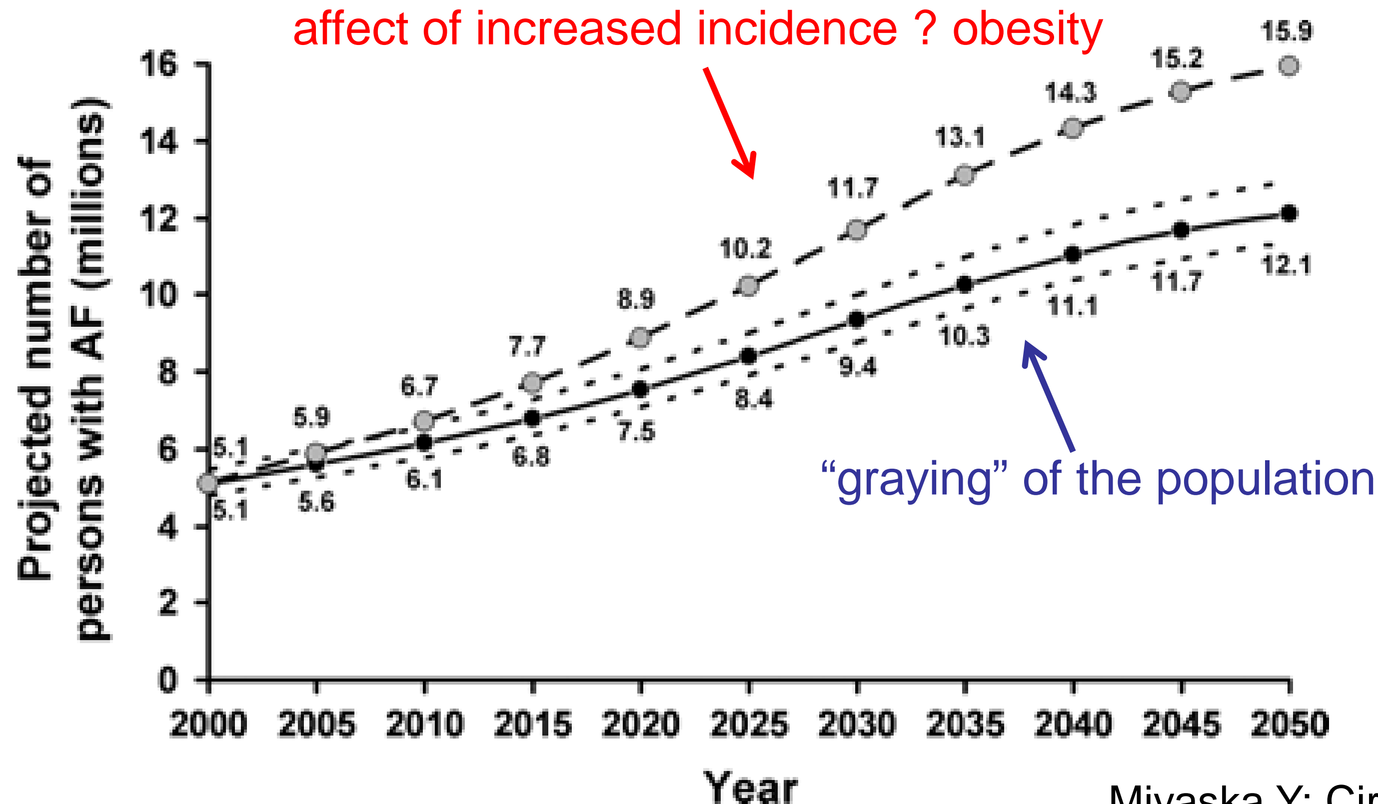
Growing population burden of AF



Miyaska Y: Circulation 2006

- Not all AF patients require rhythm control therapy
- Medical therapy: poor efficacy and prominent side effects

Perfect procedure for AF ablation

- High efficacy (no recurrent AF or AT)
- Limited morbidity
- Preserves LA function
- Provides protection against LA thrombus
- Can be performed without exceptional skill / resource
- Adaptable for individual patients’ circumstances (15% incidence of non PV triggers for AF)

Reciprocal relationships

- Most reasonable people would accept reciprocal relationship between morbidity and efficacy, if it were to exist
- What has been demonstrated is an uncanny reciprocal relationship between incision size and follow up data
- RCT of surgery vs. catheter ablation unlikely
  -- both strategies have multiple, evolving techniques
  -- patients included for study are different

What I told patients about efficacy of surgical ablation, until recently

Comprehensive list of all high quality (≥ 1 year F/U, monitoring, discussion of AAD strategy, multicenter) studies of surgical ablation

In lieu of data, surgeons do show great intraoperative movies during their presentations!

Recent example of surgical science

- Thoughtful discussion of AF pathophysiology, patient selection between catheter/surgical ablation
- Minimally invasive cryo Maze in 41 lone AF patients
- 4 cm R inframammary incision, + CP bypass
- no perioperative mortality, stroke
- 3 months: NSR 92.7%; 1 year f/u in only 23/41
- no monitoring, no mention of AAD use
- 3 patients with “new” right AFl not counted in results

Moten (Chitwood): Heart, Lung and Circulation 2007;16:S88–S93

A better example…

- Bilateral thoracotomy, off pump bipolar RF PV isolation (confirmed) and autonomic denervation
- 74 patients (pAF in 46), 13 with prior catheter ablation (> 1 in 7)
- Follow up ≥ 6 months, autotrigger TTM at 6 months
- 4 major complications, 1 death
- …it should be noted that very often the decision to discontinue AAD was not made until after the 6 month office visit.

Edgerton JR: Ann Thorac Surg 2008;86:35–9

A better example…

- Efficacy varied by type of AF, use of AAD and intensity of monitoring
- 6 month efficacy ± AAD: 83.7% paroxysmal AF
  56.5% persistent AF

Table 1. Outcomes

	Paroxysmal Atrial Fibrillation Patients n = 46		Persistent/Long-standing Persistent Atrial Fibrillation Patients n = 28	
	ECG n = 43	Holter/PM Interrogation/ Event Monitor n = 43	ECG n = 27	Holter/PM Interrogation/ Event Monitor n = 23
Follow-Up	NSR	NSR	NSR	NSR
Six months	43 (100.0%)	36 (83.7%)	22 (81.5%)	13 (56.5%)
Six months off antiarrhythmic drugs	33 (76.7%)	30 (69.8%)	13 (48.1%)	8 (34.8%)

ECG = electrocardiogram; NSR = normal sinus rhythm; PM = pacemaker.

Edgerton JR: Ann Thorac Surg 2008;86:35–9

Still better…

- 52 patients, mean age 60 yrs, with paroxysmal AF Minimally invasive bipolar RF PVI, denervation and ligation of ligament of Marshall; LAA closure in 88%
- All reporting in concordance with 2007 HRS/ESC Expert Consensus Statement – 12 month follow up, off AAD, all arrhythmias considered, + monitoring
- No death or major events. PM in 3, AFl ablation in 2
- NSR at 12 months 80.8%
- 33/37 (sic) not on AAD at 12 months
- Warfarin discontinued in patients free of AF and “without LAA” 88%

Edgerton JR: JTCS 2010;140:1-6

LAA excision / exclusion

- Conceptually beneficial, typically performed with surgical ablation; not possible with catheter ablation (yet)
- Dawson literature review: 310 papers → 5 trials (1 RCT) 1400 patients – no clear benefit for stroke reduction
  ? if lack of benefit due to lack of effective closure (55-66%) and risk of continued communication
- CCF study: TEE in 137/2546 post LAA excision /exclusion
  -- Only 40% of closures were successful (excision 73%)
  -- LAA thrombus in 41% with unsuccessful exclusion
  -- Stroke/TIA in 11% of successful and 12% of unsuccessful LAA closure

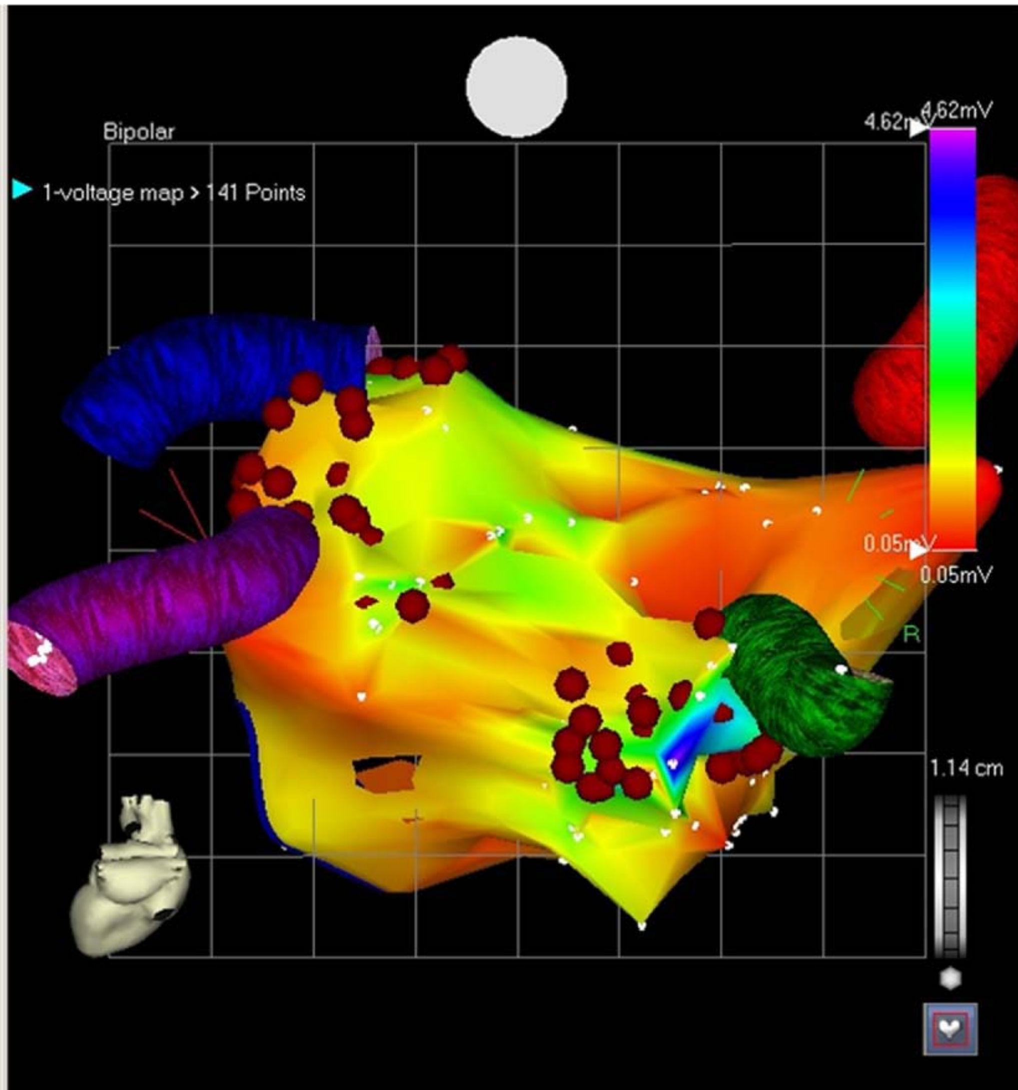
Dawson AG: Interact CardioVasc Thorac Surg 2010;10:306-311
Kanderian AS: J Am Coll Cardiol 2008;52:924–9

EP study after surgical ablation

- VCU collaboration: Drs. Kasirajan and Ellenbogan
- 50 patients (74% paroxysmal) treated with bipolar PV antral ablation (EP documented block), GP ablation, LoM ligation, LAA stapling
- Follow up TTM off AAD at 6, 12 months + symptoms
- 12 months: 20 pts recurrent arrhythmias (most AF)
- EP study in 13: AF, right AFl, AVNRT (!)

Kron J: Heart Rhythm 2010;7:445–451

EP study after surgical ablation



"Recovered PV conduction is the most common cause for recurrent atrial arrhythmias after PVI with catheter and surgical ablation."

Extensive scarring noted in the antrum and posterior LA

Kron J: Heart Rhythm 2010;7:445–451

Catheter ablation for AF

What we have accomplished scientifically

- Demonstration in several RCT that ablation is superior to medical therapy and “ablate and pace”
- Single procedure, off AAD, efficacy ≈ 70% in pAF, less (45-50%) in persistent AF
- Unlike surgery, catheter ablation can be repeated, and efficacy incremental (70% increment)
- Ablation limited to PV area results in no reduction in LA function; extensive ablation diminishes LA fx

Calkins H: Heart Rhythm 2007;4:816-861
Jais P: Circulation 2008;118:2498-2505
Wilber DJ: JAMA 2010;303:333-340
Verma A: JCE 2006;17:741-746

Catheter ablation for AF

What remains to be done

- Does catheter ablation result in survival benefit? [CABANA]
- Should catheter ablation be 1st line therapy? [RAAFT]
- Does successful catheter ablation allow for cessation of anticoagulation therapy?
- Is catheter ablation the preferred therapy in patients with recent onset heart failure? [CASTLE-AF]
- Are there patients that should not be treated with catheter ablation? [DECAAF]

Catheter ablation for AF

2nd Worldwide Survey (with apologies)

- 16,309 patients with AF between 2003 and 2006 with procedures at 85 centers
- Freedom from symptomatic AF in ≈ 70% off AAD additional 10% with AAD) after 1.3 procedures

Table 3. Success Rates in Relationship With the Type of AF

			Success Without AADs		Success With AADs		Overall Success	
Type of AF	No. of Centers	No. of Patients	No. of Patients	Rate, Median (Interquartile Range)*	No. of Patients	Rate Median (Interquartile Range)*	No. of Patients	Rate Median (Interquartile Range)*
Paroxysmal	85	9590	6580	74.9 (64.9–82.6)	1290	9.1 (0.2–14.7)	7870	84.0 (79.7–88.6)
Persistent	73	4712	2800	64.8 (52.4–72.0)	595	10.0 (0.8–15.2)	3395	74.8 (66.1–80.0)
Long-lasting	40	1853	1108	63.1 (53.3–71.4)	162	7.9 (0.9–15.9)	1270	71.0 (67.4–76.3)

Cappato R: Circ Arrhythm Electrophysiol 2010;3:32-38

Catheter ablation for AF

2nd Worldwide Survey

Table 7. Major Complications in the Overall Population

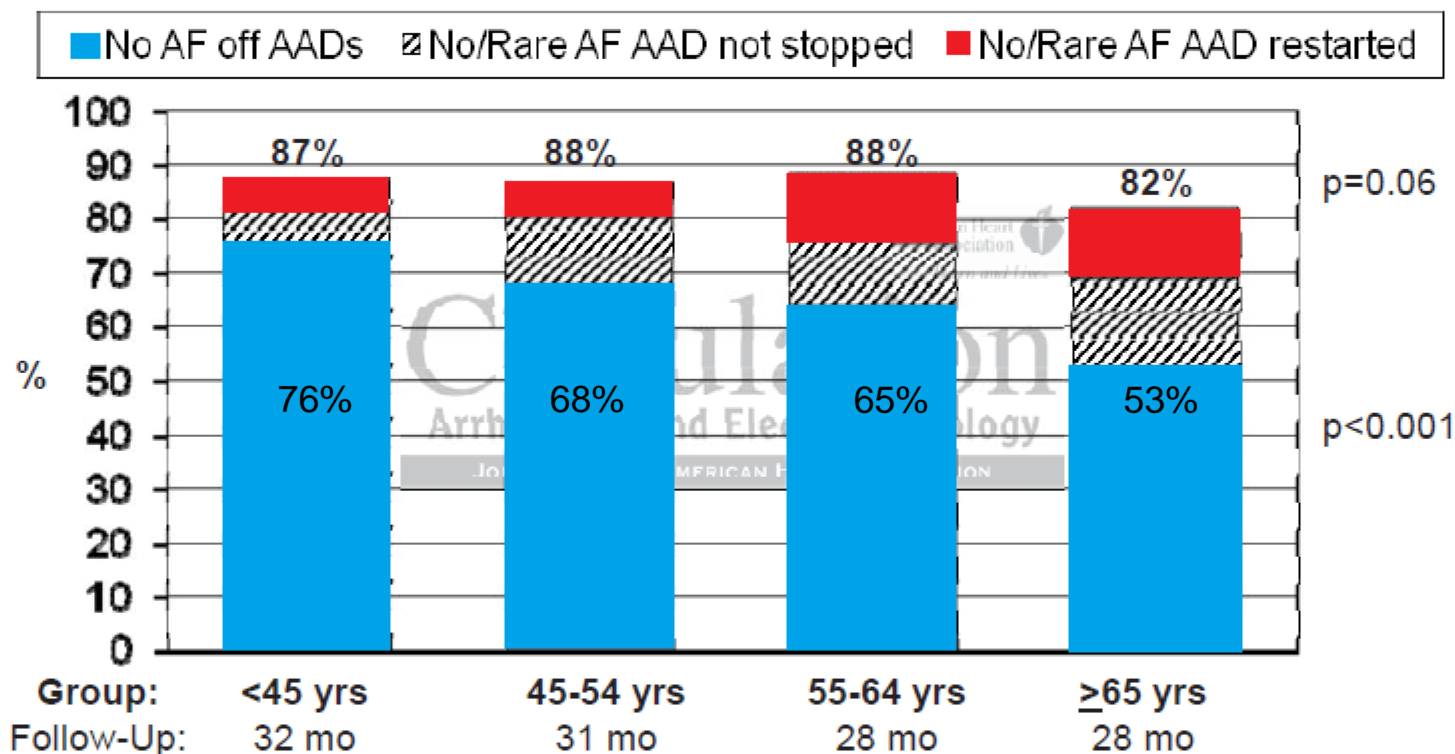
Type of Complication	No. of Patients	Rate, %
Death	25	0.15
Tamponade	213	1.31
Pneumothorax	15	0.09
Hemothorax	4	0.02
Sepsis, abscesses, or endocarditis	2	0.01
Permanent diaphragmatic paralysis	28	0.17
Total femoral pseudoaneurysm	152	0.93
Total artero-venous fistulae	88	0.54
Valve damage/requiring surgery	11/7	0.07
Atrium-esophageal fistulae	6	0.04
Stroke	37	0.23
Transient ischemic attack	115	0.71
PV stenoses requiring intervention	48	0.29
Total	741	4.54

- Major complications in 4.5%
- Death 1 in 1000, stroke / TIA 1%

Cappato R: Circ Arrhythm Electrophysiol 2010;3:32-38

AF catheter ablation at Penn (11/2000-9/2008)

- Antral PVI and ablation of non PV triggers: 1548 patients (65% pAF), 2038 procedures



Leong-Sit P: Circ Arrhythm Electrophysiol online September 2010

Catheter ablation for AF at Penn

Why this might be better going forward

- Improved tools (irrigated RF, steerable sheaths)
- Affect of routine general anesthesia, jet ventilation
- Practice!

Why this might be worse going forward

- Increased percentage of persistent AF
- Older patients with more structural heart disease

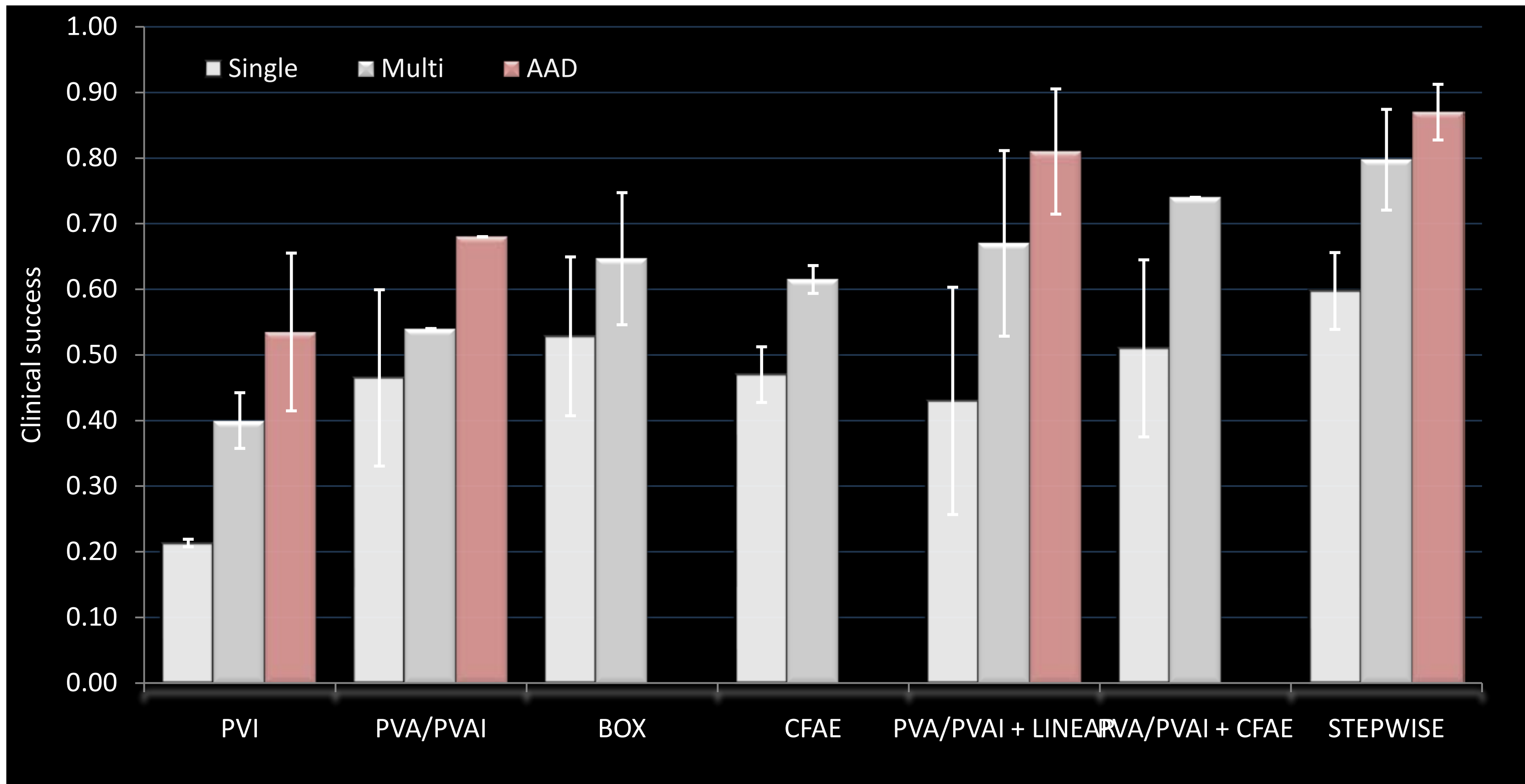
Towards a middle ground…

- There may be populations of patients that are better served by surgical ablation

    -- concomitant heart surgery
    -- multiple failed catheter based procedures
    -- obese patients
    -- patients with HCM
    -- long lasting persistent AF (> 1 year)
    -- ≥ moderate MR (without indication for surgery)

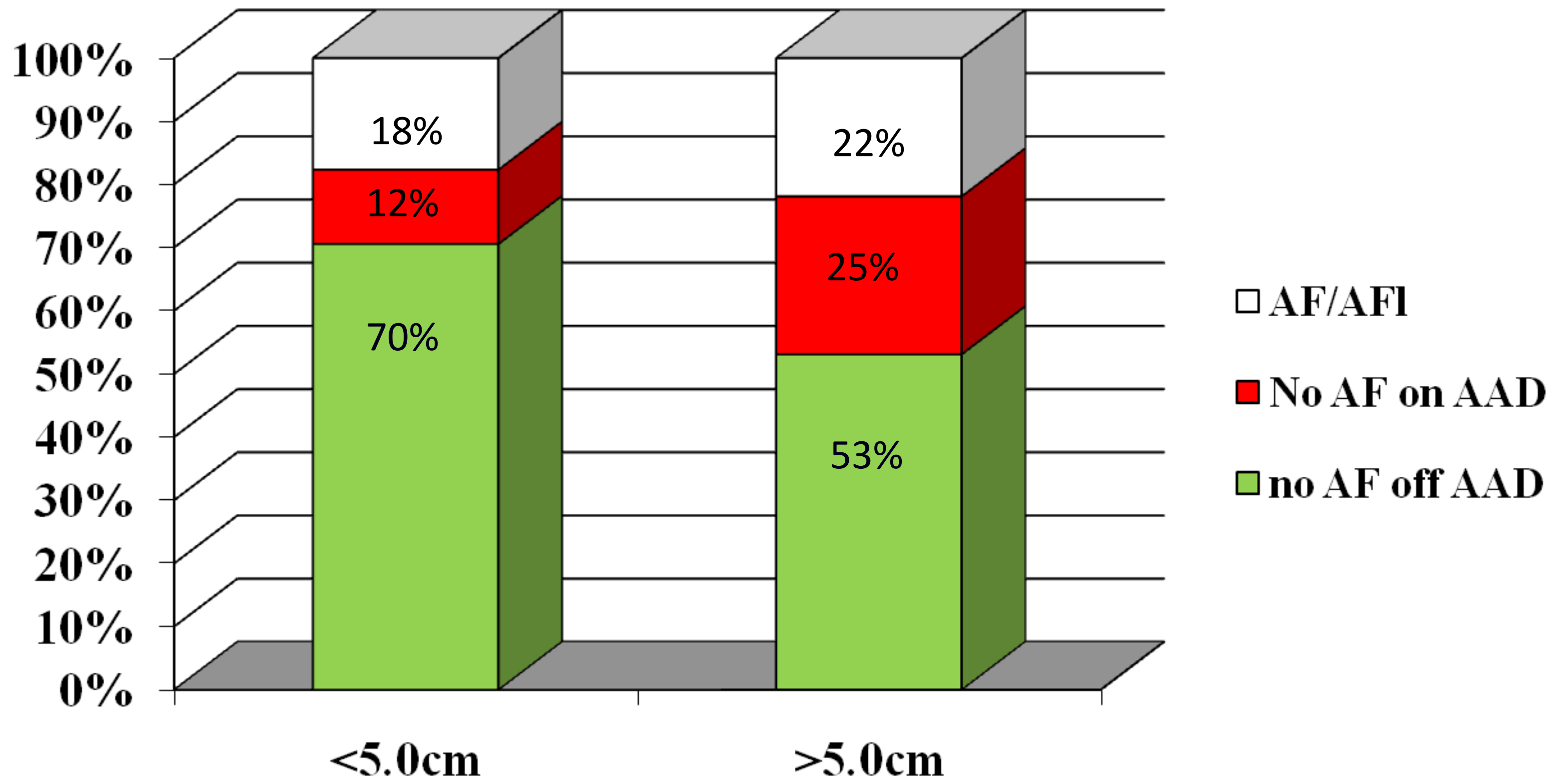
Catheter ablation in long lasting persistent AF

Literature review: 1675 patients, various techniques



Brooks AG: Heart Rhythm 2010;7:835–846

Outcome in pts with longstanding persistent AF – Antral PVI + NPV triggers

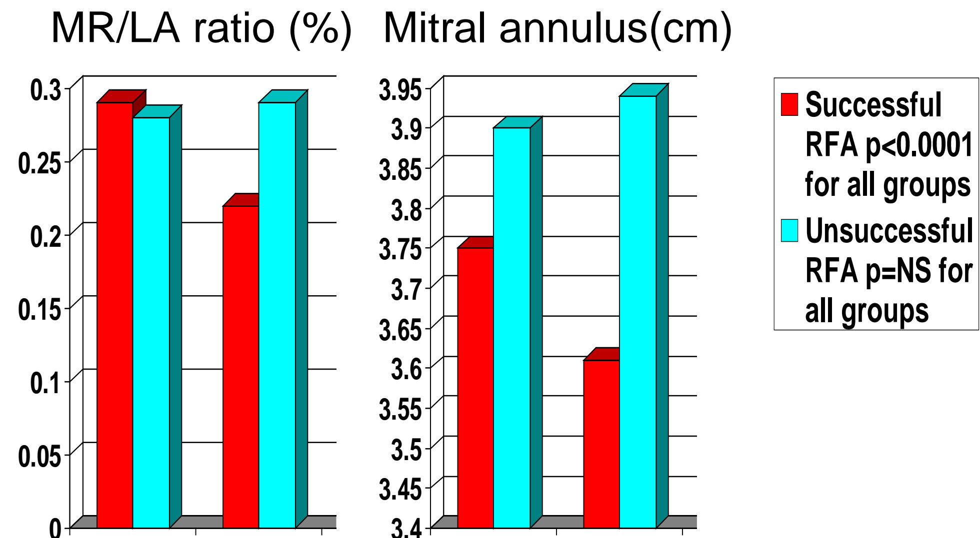


LA Size (cm) N=68 N =32

18(26%) with redo procedure 7(22%) with redo procedure

Influence of MR on AF recurrence

- Successful AF ablation reduces LA size and degree of MR



- However, ≥ moderate MR associated with decreased ablation efficacy. 95 pts with ≥ moderate MR vs. matched controls. MR pts had larger LA, more persistent AF (71%) and more recurrent AF (61%)

Saghy L: Heart Rhythm 2010 abstract
Gertz Z: manuscript in review

Surgical vs. catheter ablation for AF

- Neither literature is blameless, but –

  Catheter ablation: careful studies of thousands of patients, including RCT and multicenter studies

  Surgical ablation: less careful studies of hundreds of patients, single center, observational

- Efficacy / safety is evolving, but –

  Appears to be similar in equivalent patients studied with similar methodology

  Failure of both surgical and catheter ablation is recurrent PV – atrial conduction

Surgical vs. catheter ablation for AF

- A mini-thoracotomy is still a thoracotomy!
  - Morbidity (and likely mortality) is greater with surgical ablation
- Catheter ablation is the optimal choice for the vast majority of patients with indications for non-pharmacologic treatment of AF
- Future evolution of both strategies and earlier access to definitive care will be important for treatment of the epidemic of AF