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Catheter Ablation of Atrial Fibrillation What the generalist needs to know

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Atrial Fibrillation Mechanisms: Pulmonary veins

Haissaguerre M *N Engl J Med* 1998 15 (2), 250-262

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Left Atrial Appendage Atrial Fibrillation and Thrombus Formation

Stroke in AF patients = Appendage-related stroke

1 Blackshear JL, Ghalis JA. *Annals of Thoracic Surgery*. 1996;61:755-759

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Prognostic Implications Stroke, Mortality

Study	Stroke Risk Ratio	Mortality Risk Ratio
Framingham	~2.5	~1.5
Whitehall	~5.0	~2.0
Regional Heart Study	~7.0	~2.5
Framingham (no Heart Disease)	~2.0	~2.0
Framingham (overall)	~2.5	~2.5
Manitoba	~2.0	~2.0

Hersi and Wyse *Curr Probl Cardiol*. 2005 Apr;30(4):175-233

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Prognostic Implications Dementia

Dementia Type	No Atrial Fibrillation (%)	Atrial Fibrillation (%)
Nonspecific	~1.3	~3.3
Alzheimers	~0.8	~1.5
Senile	~0.7	~1.6
Vascular	~0.4	~0.9

Bunch TJ et al *Heart Rhythm* 2010 Apr;7(4):433-7

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Definitions

- Paroxysmal AF**
 - AF that terminates spontaneously or with intervention within 7 d of onset. Episodes may recur with variable frequency.
- Persistent AF**
 - Continuous AF that is sustained >7 d.
- Long-standing persistent AF**
 - Continuous AF >12 mo in duration.
- Permanent AF**
 - The patient and clinician make a joint decision to stop further attempts to restore and/or maintain sinus rhythm. Acceptance of AF represents a therapeutic attitude on the part of the patient and clinician rather than an inherent pathophysiological attribute of AF. Acceptance of AF may change as symptoms, efficacy of therapeutic interventions, and patient and clinician preferences evolve.
- Nonvalvular AF**
 - AF in the absence of rheumatic mitral stenosis, a mechanical or bioprosthetic heart valve, or mitral valve repair.

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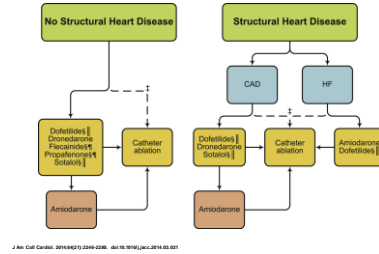
Treatment Goals



- #1: Symptom suppression
- #2: Improve outcomes:
 - Prevent strokes
 - Prevent tachycardia-induced cardiomyopathy
 - Prevent dementia?
 - Reduce mortality?
- Approaches:
 - Rhythm control
 - Rate control/anticoagulation

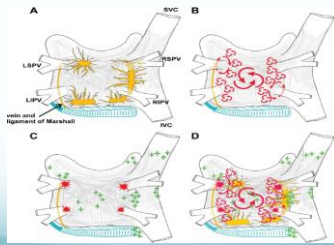
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Goal #1: Improve symptoms Rhythm Control: Drugs



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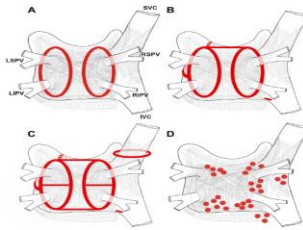
Atrial Fibrillation Mechanisms: Beyond PV ectopy



Calkins et al *Heart Rhythm* 2012

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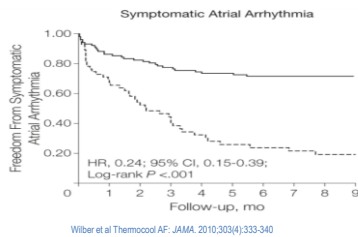
Atrial Fibrillation Ablation Strategies



Calkins et al *Heart Rhythm* 2012

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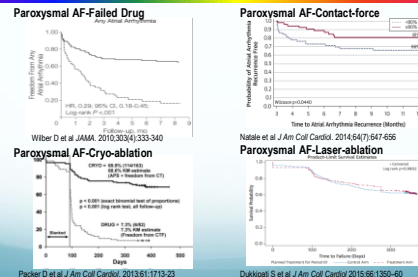
Symptom control



Wilber et al *Thrombol AF: JAMA*. 2010;303(4):333-340

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PV isolation: More effective than drugs



Packer D et al *J Am Coll Cardiol*. 2013;61:1713-23

Dakkapan S et al *J Am Coll Cardiol* 2015;66:1350-40

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Ablation as first-line?



Wazni et al JAMA 2005;293:2634
Radiofrequency Ablation vs Antiarrhythmic Drugs as First-Line Treatment of Symptomatic Atrial Fibrillation: A Randomized Trial

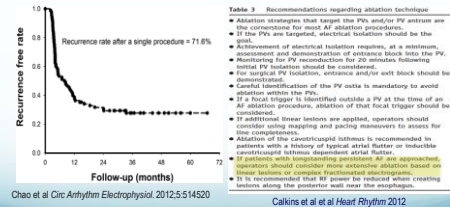
Nielsen et al NEJM 2012;367:1587
The NEW ENGLAND JOURNAL of MEDICINE
Radiofrequency Ablation as Initial Therapy in Persistent Atrial Fibrillation

Morillo et al JAMA 2014;311:1692
Radiofrequency Ablation vs Antiarrhythmic Drugs as First-Line Treatment of Paroxysmal Atrial Fibrillation (RAAF1-2): A Randomized Trial

Primary endpoint: Symptomatic AF
 Primary endpoint: AF burden
 Primary endpoint: Time to documented atrial tachyarrhythmia

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PV isolation: Unsatisfactory for Persistent AF



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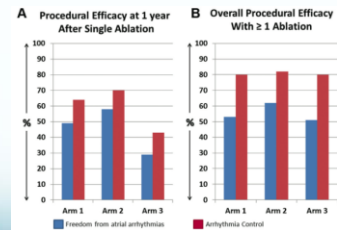
Strategies and targets



- Pulmonary vein isolation
- Wide area circumferential ablation
- Antral isolation
- Complex and fractionated potential ablation
- Ganglionic vagal ablation
- Left atrial posterior linear ablation
- Mitral isthmus linear ablation
- Ectopic foci from the pulmonary veins
- Vagal innervation
- Triggers from the vein of Marshall
- Rotors in the posterior left atrium
- Elimination of iatrogenic flutter
- Rotor-anchoring and wavebreak sites

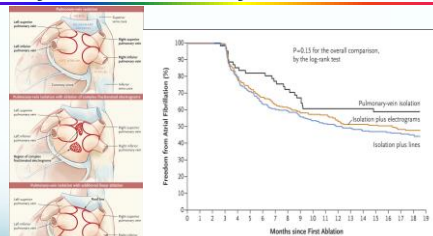
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Persistent AF: Beyond the Pulmonary Veins?



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Persistent AF: Beyond the Pulmonary Veins?



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Symptom control at what price? Complications



- Pericardial bleeding and Tamponade (1%)
- TIA/Stroke (0.5 – 1%)
- Atrio-esophageal fistula (0.01%)
- Phrenic nerve paralysis (0.1%)
- Pulmonary vein stenosis (0.5%)
- Laryngeal nerve paralysis
- Vascular access complications (0.5-1%)
- Gastroparesis
- Death (0.05-0.1%)

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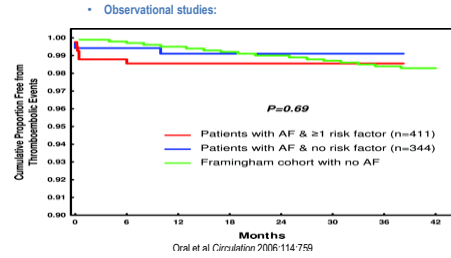
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 - Reduce mortality?

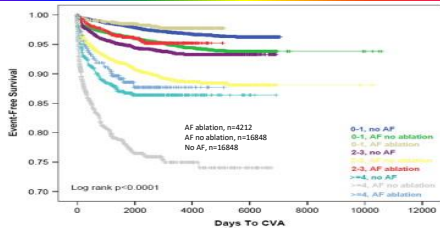
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Ablation and Stroke prevention



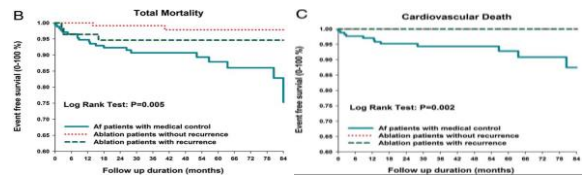
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Stroke prevention AF ablation ~ no AF



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Ablation and Mortality

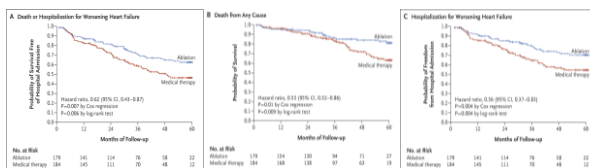


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Does AF ablation improve survival?

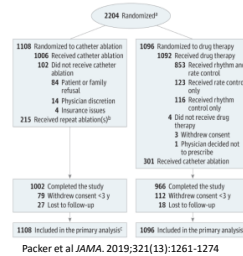


- AATAC: EF <40%. Lower death from all causes in ablation group (8% vs 18% in amiodarone), 53% reduction. Di Biase et al *Circulation*. 2016;133:1637-1644.
- CASTLE AF: Heart failure population, EF <35%



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CABANA Trial

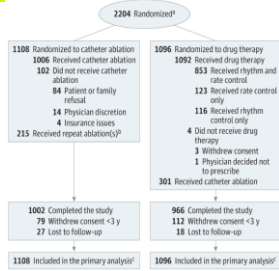


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CABANA analyses

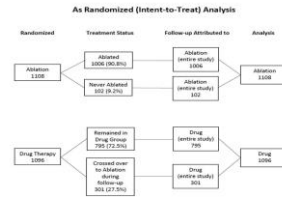


- Primary analysis as "intention to treat".
- "Per-protocol" comparisons were performed in which :
 - Drug group consisted of all patients randomized to drug therapy, with the follow-up of patients who received catheter ablation and crossed over to catheter ablation censored at the time of ablation (n=301).
 - Catheter ablation group included patients randomized to catheter ablation who received an ablation within the 6-month time window following randomization, (censored 102 patients)
- "Treatment received": all catheter-ablation treated patients vs drug-treated patients



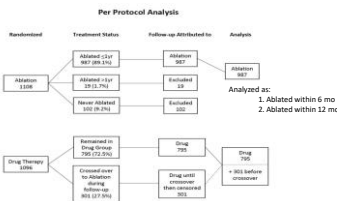
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CABANA "Intention-to-Treat" Analysis



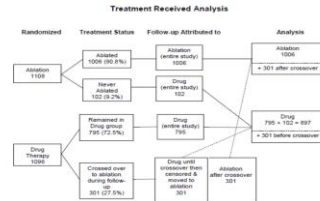
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CABANA "Per-protocol" Analysis



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CABANA "Treatment Received" Analysis



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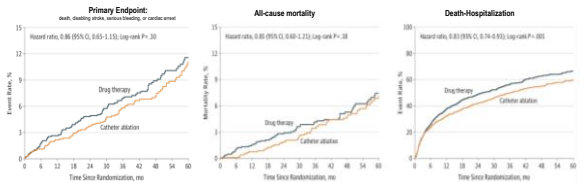
Outcomes by Intention-to-treat



Events, No. (%)	Drug Therapy		Catheter Ablation		Hazard Ratio (95% CI)	P Value
	Catheter Ablation Group (n = 1108)	Drug Therapy Group (n = 1096)	Catheter Ablation Group (n = 1006)	Drug Therapy Group (n = 1096)		
Primary end point: Death, disabling stroke, serious bleeding, or cardiac arrest	89 (8.0)	101 (9.2)	7.2	8.9	1.17	0.04-1.10*
Components of primary end point						
Death	58 (5.2)	67 (6.1)	4.7	5.3	0.85	0.60-1.21
Disabling stroke	3 (0.3)	7 (0.6)	0.1	0.7	0.42	0.11-1.62
Serious bleeding	36 (3.2)	36 (3.3)	3.0	3.7	0.78	0.62-0.99
Cardiac arrest	7 (0.6)	11 (1.0)	0.7	1.1	0.42	0.24-0.74
Secondary end point: Death or cardiovascular hospitalization	171 (15.3)	167 (15.2)	14.9	14.7	0.83	0.74-0.93

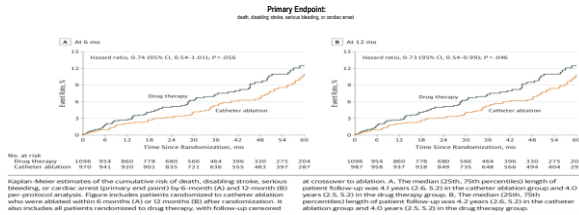
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Outcomes by Intention-to-treat



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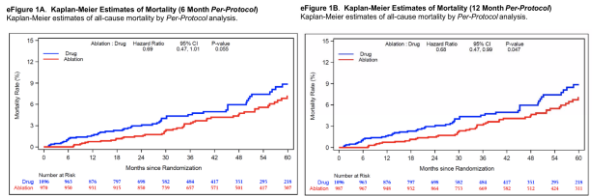
Outcomes by Per-protocol analysis



Packer et al JAMA. 2019;321(13):1261-1274

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Mortality by Per-protocol analysis



Packer et al JAMA. 2019;321(13):1261-1274

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Current Procedural limitations in AF ablation



- Technical limitations of the PV isolation procedure:**
 - Inability to achieve durable PV isolation
 - Procedure time and complexity
 - Procedure risks
 - Repeat procedures
- Mechanistic limitations of the PV isolation procedure:**
 - Are all sources of AF ablated with PV isolation?
 - How much PV antrum/posterior wall should be included in a PVI
- What other targets besides PV isolation should be ablated?**
 - AF substrates:
 - Rotors?
 - Focal triggers?
 - Innervation?
 - Scar?
- What ablation strategy should be used in each individual patient?**
 - Paroxysmal vs persistent
 - Lone vs "accompanied" AF
 - LA scar vs healthy
 - Young vs old.

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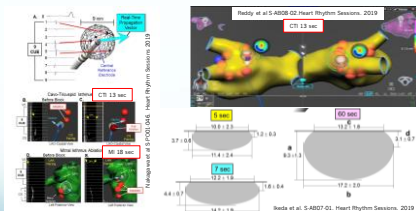
Current Clinical limitations in AF ablation



- Patient selection**
 - Paroxysmal vs persistent vs longstanding persistent
 - Impact of structural heart disease
 - Atrial scar
 - Ventricular dysfunction
- Timing of the procedure**
 - Guided by symptoms?
- Prognostic implications:**
 - Do we prevent stroke, dementia, reduce mortality?
 - Can we stop oral anticoagulants in high-risk patients?

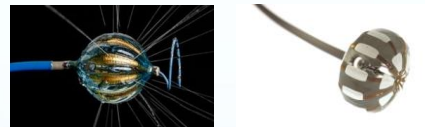
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Affera® Lattice electrode ablation catheter Ultra-rapid ablation



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Radiofrequency balloons for PVI



- HelioStar® RF balloon.
- In IDE clinical trial in the US.
- Apama® RF balloon
- In IDE clinical trial in the US.

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When is AF ablation appropriate? INDIVIDUALIZE!



AF HETEROGENEITY

- Symptoms
- AF burden
- Structural disease
- Prognostic impact:
 - Stroke (CHADS-VASc)
 - Dementia

ADD CHOICE AND SUCCESS

- Paroxysmal vs Persistent
- Structural disease
- Compliance long-term

ABLATION SUCCESS

- Paroxysmal vs Persistent
- Structural disease
- Risks

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Who is an appropriate candidate for ablation?



- **BENEFIT:** will the patient's health improve?
 - Symptoms control
 - Outcome improvement
 - Freedom from anticoagulation
- **SAFETY:** are complication risks acceptable?
- **TECHNICAL FEASIBILITY**
 - LA thrombus
 - Massive LA enlargements

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Conclusions



- AF ablation is a valuable tool in the management of AF:
 - Greatest impact on symptoms and quality of life
 - Can reduce death-hospitalization
- Valuable as first-line treatment but drug therapy may be more acceptable
- Does not worsen outcomes
- Most effective in paroxysmal AF -persistent outcomes similar after repeat procedures

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