Catheter Ablation for Atrial Fibrillation: Patient Selection and Outcomes

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Disclosure of Relationships

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Atrial Fibrillation

**Patient Selection/Ablation Outcome: AF Classification**

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

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

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

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

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

All Recurrent AT/AF

No Stroke/Embolism, Tamponade, Atrio-Esophageal fistula, PV stenosis, or Phrenic nerve paralysis

Wilber D et al, JAMA, 2010
US National Inpatient Sample: 93,801 AF patients treated with catheter ablation 2000-2010; 20% 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
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)

Europace (2012) 14, 1385-1413; *J Am Coll Cardiol*. 2014; 63(22):2489-2489; Calkins et al *Heart Rhythm* 2017
FIRST LINE TREATMENT OF PAROXYSMAL AF (RAAFT 2 TRIAL – 2 YEAR FOLLOW-UP)

Time to Any AF/AFL/AT

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

Different Tools for Pulmonary Veins Isolation

FIRE AND ICE AF Clinical Trial

15 Centers
764 Patients

Paroxysmal AF Ablation

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

Class Ila - “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 Ilb - “May be Considered”
1) 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)

2. △ in 2017 – Iib to Ila “Is reasonable” before initiation of antiarrhythmic drug therapy with a class I or III antiarrhythmic medication for symptomatic persistent AF (Level of Evidence: C)

Clinical Efficacy for **Longstanding Persistent AF (>1yr)**

Antral PV Isolation + Non PV Trigger RF Ablation

N=130 pts followed for >1 year

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

Persistent AF/Recurrent Paroxysmal Catheter Ablation - Target Substrate?

PVI plus non PVI triggers

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

Which Technique?

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 benefit of lines or fractionated electrogram ablation

1:4:4 ratio

Randomized Ablation Strategies for the Treatment of Persistent Atrial Fibrillation: RASTA Study
Sanjay Dixit, Francis E. Marchlinski, David Lin, David J. Callans, Rupa Bala, Michael P. Riley, Fernin C. Garcia, Mathew D. Hutchinson, Sarah J. Ratchiffe, Joshua M. Cooper, Ralph J. Verdiino, Vickas V. Patel, Erica S. Zado, Nancy R. Cash, Tony Killian, Todd T. Tomson and Edward P. Gerstenfeld

Circ Arrhythm Electrophysiol published online December 2, 2011;
Paroxysmal or Persistent AF

Why does ablation fail?

Reconnected PV

Reisolation can prevent AF (80-90%)!

Make PV Isolation More Permanent with First Ablation

- JET Ventilation
- Sheaths for stability
- Contact Force Sensing
Jet Ventilation and Sheaths to Improve Stability and Improve PVI Outcome

Fewer Recurrences

P <0.006

Hutchinson MD et al  Heart Rhythm 2013;10:347–353
Risk Factor Modification (RFM)
The ARREST-AF Cohort Study

Impact of RFM on AF Ablation Outcome

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 R J .... Sanders P Am Coll Cardiol May 26 2015;65:2159-2169.
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 Cohort Study – 53 pts in each group) 

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

Atrial Fibrillation Ablation
Effect on LV Ejection Fraction

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

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). - Role of Ablation

Historic treatment standard - Antiarrhythmics + Pacemaker

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


Paroxysmal AF patients = 280
TBS patients = 37
1st ablation
Sinus rhythm = 19
AF recurrence = 18
Pacemaker = 1
2nd ablation =14
Sinus rhythm = 11
AF recurrence = 3
Pacemaker = 1
3rd ablation = 2
Sinus rhythm = 1
Sick sinus = 1
Pacemaker = 1

5 year follow-up

Pacemaker implantation was not performed in patients without prolonged sinus pauses

Inada, K., et al Europace, 2014. 16(2): 208-13
<table>
<thead>
<tr>
<th>Indication</th>
<th>Recommendation</th>
<th>Class</th>
<th>LOE</th>
<th>References</th>
</tr>
</thead>
<tbody>
<tr>
<td>Congestive heart failure</td>
<td>It is reasonable to use similar indications for AF ablation in selected patients with heart failure as in patients without heart failure.</td>
<td>2A</td>
<td>B-R</td>
<td>233-237, 384,386-395, 1042</td>
</tr>
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<td>Older patients (&gt;75 years of age)</td>
<td>It is reasonable to use similar indications for AF ablation in selected older patients with AF as in younger patients.</td>
<td>2A</td>
<td>B-NR</td>
<td>396-398, 401-404</td>
</tr>
<tr>
<td>Hypertrophic cardiomyopathy</td>
<td>It is reasonable to use similar indications for AF ablation in selected patients with HCM as in patients without HCM.</td>
<td>2A</td>
<td>B-NR</td>
<td>385,1043, 1044</td>
</tr>
<tr>
<td>Young patients (&lt;45 years of age)</td>
<td>It is reasonable to use similar indications for AF ablation in young patients with AF (&lt;45 years of age) as in older patients.</td>
<td>2A</td>
<td>B-NR</td>
<td>405,1045</td>
</tr>
<tr>
<td>Tachy-brady syndrome</td>
<td>It is reasonable to offer AF ablation as an alternative to pacemaker implantation in patients with tachy-brady syndrome.</td>
<td>2A</td>
<td>B-NR</td>
<td>381-383</td>
</tr>
<tr>
<td>Athletes with AF</td>
<td>It is reasonable to offer high-level athletes AF as first-line therapy due to the negative effects of medications on athletic performance.</td>
<td>2A</td>
<td>C-LD</td>
<td>370-372</td>
</tr>
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<td>Asymptomatic AF**</td>
<td>Paroxysmal: Catheter ablation may be considered in select patients.**</td>
<td>2B</td>
<td>C-EO</td>
<td>416,418</td>
</tr>
<tr>
<td></td>
<td>Persistent: Catheter ablation may be considered in select patients.</td>
<td>2B</td>
<td>C-EO</td>
<td>417</td>
</tr>
</tbody>
</table>
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 pacemake