ΚΑΤΑΛΥΣΗ ΚΟΛΠΙΚΗΣ ΜΑΡΜΑΡΥΓΗΣ

Ενδείξεις και αντενδείξεις. Ποιος ασθενής δεν είναι κατάλληλος για κατάλυση?

Κωνσταντίνος Π. Λέτσας, MD, FEHRA
Εργαστήριο Επεμβατικής Ηλεκτροφυσιολογίας
ΓΝΑ «Ο ΕΥΑΓΓΕΛΙΣΜΟΣ»
Indications for catheter ablation of AF

2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of AF

Indications for Catheter Ablation of Symptomatic Atrial Fibrillation

- Symptomatic AF
  - Paroxysmal AF
    - IIa
      - AA Drugs
      - Catheter Ablation
  - Persistent AF
    - IIa
      - AA Drugs
      - Catheter Ablation
  - Long-standing Persistent AF
    - IIb
      - AA Drugs
      - Catheter Ablation
Indications for catheter ablation of AF in populations of patients not well represented in clinical trials

2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of AF

<table>
<thead>
<tr>
<th>Indication</th>
<th>Reason</th>
<th>Grade</th>
<th>Level</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>IIa</td>
<td>B-R</td>
</tr>
<tr>
<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>IIa</td>
<td>B-NR</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>IIa</td>
<td>B-NR</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>IIa</td>
<td>B-NR</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>IIa</td>
<td>B-NR</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>IIa</td>
<td>C-LD</td>
</tr>
<tr>
<td>Asymptomatic AF**</td>
<td>Paroxysmal: Catheter ablation may be considered in select patients.</td>
<td>IIb</td>
<td>C-EO</td>
</tr>
<tr>
<td></td>
<td>Persistent: Catheter ablation may be considered in select patients.</td>
<td>IIb</td>
<td>C-EO</td>
</tr>
</tbody>
</table>
Contraindications for catheter ablation of AF

2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of AF

Ablation should not be performed in patients who have a left atrial thrombus. This is the only absolute contraindication for left atrial ablation.
Pre-ablative predictors of AF recurrence following pulmonary vein isolation
Pre-ablative predictors of AF recurrence following pulmonary vein isolation

- **Univariate Cox proportional hazard regression analysis**
  - Hypertension,
  - **Body mass index,**
  - Left ventricular ejection fraction,
  - Left ventricular end-diastolic diameter,
  - Left atrial diameter,
  - WBC count, and
  - High-sensitivity C-reactive protein

- **Multivariate Cox proportional hazard regression analysis**
  - Hypertension (HR 3.127),
  - LAD (HR 1.077), and
  - WBC count (HR 1.423)
Predictors of recurrence following a single catheter ablation procedure for AF: data from 520 patients

AF type  Hypertension  LA size
Predictors of AF recurrence after catheter ablation

• Clinical predictors
  • AF type: non-paroxysmal AF predicts arrhythmia recurrence
  • Age: conflicting data
  • Gender: conflicting data, but female sex is an independent risk factor for recurrence
  • Hypertension
  • Diabetes mellitus: conflicting data
  • Obesity
  • Obstructive sleep apnea (OSA): 31% increased risk of recurrence
  • Atrial conduction disease (SSS)

• Electrophysiological predictors
  • ECG: the p-wave
  • Conduction velocity/activation time
  • Voltage mapping: fibrosis
  • Cycle length
  • Early AF relapse

• Imaging predictors
  • Echo
    • Left atrial size: >50mm predicts recurrence
    • Left atrial volume
    • Ventricular function
  • Cardiac CT: PV anatomy, LA volume >145 ml, LA pericardial fat
  • Cardiac MRI: fibrosis

Expert Review of Cardiovascular Therapy 2017;4:289-305
Is there any patient left for AF ablation ???
Significant clinical predictors
AF type: Does persistent AF have an impact on catheter ablation success rates?

ESC-EHRA AF ablation long-term registry

Contemporary management of patients undergoing atrial fibrillation ablation: in-hospital and 1-year follow-up findings from the ESC-EHRA atrial fibrillation ablation long-term registry

Elena Arbelo, Josep Brugada, Carina Blomström Lundqvist, Cécile Laroche, Josef Kautzner, Evgeny Pokushalov, Pekka Raatikainen, Michael Efremidis, Gerhard Hindricks, Alberto Barrera, Aldo Maggioni, Luigi Tavazzi, and Nikolaos Dages on behalf of the ESC-EHRA Atrial Fibrillation Ablation Long-term Registry Investigators

<table>
<thead>
<tr>
<th>Type AFib</th>
<th>No. countries</th>
<th>No. centres</th>
<th>No. patients</th>
<th>Success with AADs n (%)</th>
<th>Median (IQR) between countries</th>
<th>Success without AADs n (%)</th>
<th>Median (IQR) between countries</th>
<th>Overall success n (%)</th>
<th>Median (IQR) between countries</th>
</tr>
</thead>
<tbody>
<tr>
<td>Paroxysmal</td>
<td>27</td>
<td>96</td>
<td>2169</td>
<td>956/1125 (85.0%)</td>
<td>87.5 (76.9–94.4)</td>
<td>563/895 (62.9%)</td>
<td>64.3 (56.3–77.8)</td>
<td>1566/2085 (75.1%)</td>
<td>78.9 (69.0–84.3)</td>
</tr>
<tr>
<td>Persistent</td>
<td>27</td>
<td>85</td>
<td>859</td>
<td>333/423 (78.7%)</td>
<td>80.7 (70.8–97.6)</td>
<td>237/383 (61.9%)</td>
<td>60.4 (48.1–74.0)</td>
<td>587/828 (70.9%)</td>
<td>70.0 (66.7–76.5)</td>
</tr>
<tr>
<td>Long-lasting persistent</td>
<td>18</td>
<td>43</td>
<td>152</td>
<td>45/67 (67.2%)</td>
<td>73.0 (55.0–100.0)</td>
<td>48/71 (67.6%)</td>
<td>100.0 (68.8–100.0)</td>
<td>99/146 (67.8%)</td>
<td>75.0 (63.8–100.0)</td>
</tr>
<tr>
<td>Overall</td>
<td>27</td>
<td>96</td>
<td>3180</td>
<td>1334/1615 (82.6%)</td>
<td>85.7 (75.4–92.3)</td>
<td>848/1349 (62.9%)</td>
<td>61.4 (51.0–72.0)</td>
<td>2252/3059 (73.6%)</td>
<td>76.4 (67.4–83.6)</td>
</tr>
</tbody>
</table>
### Research Article

**Catheter ablation of atrial fibrillation in the elderly**

Louiza Lioni¹, Konstantinos P. Letsas¹, Michael Efremidis¹, Konstantinos Vlachos¹, Georgios Giannopoulos², Vasileios Karelitis¹, Spyridon Deftereos², Antonios Sideris¹

¹Second Department of Cardiology, Laboratory of Cardiac Electrophysiology, Evangelismos General Hospital of Athens, Athens 10676, Greece
²Department of Cardiology, "G. Gennimatas" General Hospital of Athens, Greece

<table>
<thead>
<tr>
<th>Studies</th>
<th>Number of patients</th>
<th>Techniques</th>
<th>AF Type</th>
<th>Compared age groups</th>
<th>Success rate</th>
<th>Major complications in the elderly</th>
</tr>
</thead>
<tbody>
<tr>
<td>Zado, et al.¹⁵</td>
<td>32</td>
<td>PVI plus ablation of focal sources</td>
<td>PAF</td>
<td>&lt; 65 yrs</td>
<td>89%</td>
<td>2.9%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PersAF</td>
<td>65–74 yrs</td>
<td>84%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PAF</td>
<td>&gt; 75 yrs</td>
<td>86%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PersAF</td>
<td>&gt; 60 yrs</td>
<td>82%</td>
<td></td>
</tr>
<tr>
<td>Bhargara, et al.¹⁶</td>
<td>103</td>
<td>PVI</td>
<td>PersAF</td>
<td>51–60 yrs</td>
<td>83%</td>
<td>3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PermAF</td>
<td>&lt; 50 yrs</td>
<td>85%</td>
<td></td>
</tr>
<tr>
<td>Kusumoto, et al.¹⁷</td>
<td>61</td>
<td>PVI</td>
<td>PAF</td>
<td>&gt; 75 yrs</td>
<td>61%</td>
<td>0%</td>
</tr>
<tr>
<td>Tan, et al.¹⁸</td>
<td>49</td>
<td>PVAI</td>
<td>PersAF</td>
<td>65–75 yrs</td>
<td>84%</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&gt; 80 yrs</td>
<td>70%</td>
<td></td>
</tr>
<tr>
<td>Bunch, et al.¹⁹</td>
<td>35</td>
<td>PVAI plus linear lesions</td>
<td>PAF</td>
<td>&gt; 80 yrs</td>
<td>75%</td>
<td>0.057%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PersAF</td>
<td>&lt; 80 yrs</td>
<td>78%</td>
<td></td>
</tr>
<tr>
<td>Liu, et al.²⁰</td>
<td>2970</td>
<td>PVAI</td>
<td>PersAF</td>
<td>&gt; 60 yrs</td>
<td>77%</td>
<td>4.53%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>PermAF</td>
<td>&gt; 60 yrs</td>
<td>79%</td>
<td></td>
</tr>
<tr>
<td>Present study</td>
<td>95</td>
<td>PVAI</td>
<td>PAF</td>
<td>≥ 65 yrs</td>
<td>58%</td>
<td>3.2%</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>&lt; 65 yrs</td>
<td>67%</td>
<td></td>
</tr>
</tbody>
</table>
Female Sex the Strongest Predictor of Outcomes Following Ablation of AF

Multivariable analysis determined independent predictors of outcomes in the FIRE AND ICE Trial

<table>
<thead>
<tr>
<th>Primary Efficacy Endpoint Failure</th>
<th>Cardiovascular Rehospitalization</th>
<th>Repeat Ablation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Increased risk of endpoint failure</td>
<td>Increased risk of rehospitalization</td>
<td>Increased risk of Re-ablation</td>
</tr>
<tr>
<td>Female Sex (37% ↑ risk)</td>
<td>Female Sex (36% ↑ risk)</td>
<td>Longer History of AF (3% ↑ risk/year)</td>
</tr>
<tr>
<td>Prior Direct Current Cardioversion (40% ↑ risk)</td>
<td>Hypertension (48% ↑ risk)</td>
<td></td>
</tr>
</tbody>
</table>
Body mass index and catheter ablation of AF

The impact of body mass index on the efficacy and safety of catheter ablation of atrial fibrillation

Konstantinos P. Letsas a,b,*, Claudia Herrera Siklódy b, Panagiotis Korantzopoulos c, Reinhold Weber b, Gerd Bürkle b, Constantinos C. Mihas a, Dietrich Kalusche b, Thomas Arentz b

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ABSTRACT

Background: Obesity is a well established risk factor for atrial fibrillation (AF) development. Our purpose was to determine the impact of body mass index (BMI) on the safety and efficacy of radiofrequency catheter ablation of AF.

Methods: Two hundred and twenty-six consecutive patients with symptomatic, drug-refractory paroxysmal (59.3%) and persistent (40.7%) AF underwent wide circumferential electrical pulmonary vein isolation. Patients were classified according to BMI as normal (<25 kg/m²); overweight (25 to 29.9 kg/m²); and obese (≥30 kg/m²).

Results: Patients with high BMI were younger and displayed a higher rate of hypertension, increased left atrial diameter, increased left ventricular end-diastolic and end-systolic diameters, and increased levels of several conventional markers of inflammation and oxidative stress including white blood cell count, fibrinogen, uric acid, alanine aminotransferase, and gamma-glutamyltransferase (p < 0.05). After a mean follow-up period of 432.32 ± 306.09 days from the index procedure, AF recurrence rate was 34.9% for normal weight, 46.2% for overweight, and 46.2% for obese patients (p: 0.258). Subjects classified above the 50th percentile for BMI displayed a trend toward a higher AF recurrence rate (p: 0.08). In univariate Cox regression survival analysis, BMI was not predictive of AF recurrence. Radiation exposure was significantly higher in overweight and obese patients in relation to normal weight patients (p: 0.003). No significant differences regarding major complications were observed among BMI groups.

Conclusions: In this study population, BMI was not an independent predictor of AF recurrence following left atrial catheter ablation.
Patients with a baseline BMI ≥ 30 kg/m² have a higher recurrence rate of AF following catheter ablation and therefore lifestyle modification to target obesity preprocedure should be considered in these patients.
Significant left atrial structural remodeling predicts AF recurrence

- Echocardiography
- Cardiac MRI
- Electroanatomical mapping
Left atrial size / function assessed by echocardiography

• A meta-analysis identified LA size >50 mm as a powerful predictor of prognosis in 4357 patients.

• Basal LA strain rate and maximum left atrial volume are independent predictors of recurrence.

Left atrial fibrosis detected in cardiac MRI and AF recurrence

Stage 1 (<10%)
Stage 2 (10%–<20%)
Stage 3 (20%–<30%)
Stage 4 (30%)

Left atrial fibrosis detected in cardiac MRI and AF recurrence

Electroanatomical mapping
DE-MRI of atrial scar and co-registration with electroanatomical voltage mapping

EAM

DE- MRI

How accurate are electroanatomical maps for scar detection? The importance of high density voltage mapping with contact details

- Patchy scar
- Dense scar
How accurate are modern electroanatomical maps for scar detection? The importance of high density voltage mapping with contact details.
A “diseased” left atrium predicts AF recurrence in patients with paroxysmal AF
A “diseased” left atrium predicts AF recurrence in patients with paroxysmal AF
Electroanatomical mapping-guided catheter ablation of AF: is it feasible?
Extensive fibrosis in this long-standing persistent AF case: is PVAI the right ablation strategy for this case?
The importance of atrial cardiomyopathy: clinical implications in stroke prevention and AF management

- Lack of universal definition
  - EHRA Histologic definition
  - The UTAH score (DE-MRI)
  - Kottkamp’s EAM definition
    - FACM I, II, III, IV (similar to UTAH score)
Fibrosis-guided catheter ablation of AF
Tips for an easy and relatively accurate selection of patients for AF ablation
A p-wave duration >150 ms reflects extensive low voltage areas and is a significant predictor of recurrence.
Check the CHADS$_2$ and CHADS$_2$-VAS$_{C}$ scores and select your patients for AF ablation.
Check the CHADS$_2$ and CHADS$_2$-VAS$_C$ scores and select your patients for AF ablation.
Why CHADS$_2$ and CHADS$_2$-VAS$_C$ scores are predictive for AF recurrence following catheter ablation?
A larger amount of LA fibrosis is seen in patients with a higher CHADS2 score.

J Am Coll Cardiol 2011;57:831–8
The importance of life-style modification before catheter ablation procedures
Aggressive risk factor management improves the long-term success of AF ablation.
Prepare your patients for catheter ablation of persistent AF! Cardiovert AF and maintain SR with antiarrhythmics.
Take home messages

• Don’t let your patients to develop persistent AF and left atrial enlargement...

• Check the p-waves and the CHADS$_2$ and CHADS$_2$-VAS$_C$ scores to predict AF ablation outcomes for your patient.

• Life-style modifications: Obesity, hypertension, sleep apnea, and diabetes.

• “Prepare” your patient before catheter ablation: better for your patient, better for the electrophysiologists.
See your patient, modify potential risk factors for recurrence and send him/her for AF ablation.

“Don’t believe everything you read (in the EP literature) or at least (don’t believe) the interpretation of the results and conclusions drawn. It is not etched in stone (like the Ten Commandments).”
—Mark Josephson, 1978

Thank you very much for your attention.
Left atrial remodeling after ablation

• The effect of ablation on improvements in echocardiographically assessed LA function parameters was recently reported. Only patients who were free of AF after ablation demonstrated a significant improvement in LA diameter, LA emptying fraction, LA strain, and strain rate.

• Kottkamp et al. reported no clear correlation between the extent of the LA fibrosis and the amount of the cardiac risk factors, duration of AF, or LA size.7

• Perhaps the fibrotic atrial substrate is a result of a specific disease that Kottkamp et al. have described as “fibrotic atrial cardiomyopathy” (FACM).43,44 Genetics and the progressive inflammatory substrate of left atrium play a crucial role in FACM. There is now increasing evidence that even in patients with so-called lone or idiopathic AF, the AF is an arrhythmic manifestation of a structural atrial disease. Different expressions can be found from mild (FACM I), moderate (FACM II) to excessive fibrosis (FACM III), and wide clinical variations from asymptomatic to multiple arrhythmic manifestations (including AF, left and/or right atrial reentrant tachycardia, sinus, and/or atrioventricular node disease).44
<table>
<thead>
<tr>
<th>Chronic acceptable success rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of AF.</td>
</tr>
</tbody>
</table>

**One-year success**

One-year success is defined as freedom from AF/AFL/AT after removal from antiarrhythmic drug therapy as assessed from the end of the 3-month blanking period to 12 months following the ablation procedure. Because cavotricuspid isthmus-dependent atrial flutter is easily treated with cavotricuspid isthmus ablation and is not an iatrogenic arrhythmia following a left atrial ablation procedure for AF, it is reasonable for clinical trials to choose to prespecify that occurrence of isthmus-dependent atrial flutter, if confirmed by entrainment maneuvers during electrophysiology testing, should not be considered an ablation failure or primary effectiveness endpoint.

**Clinical/partial success**

It is reasonable for clinical trials to define and incorporate one or more secondary definitions of success that can be referred to as “clinical success” or “partial success.” If these alternative definitions of success are included, they should be defined prospectively. In prior Consensus Documents the Task Force has proposed that clinical/partial success be defined as a “75% or greater reduction in the number of AF episodes, the duration of AF episodes, or the % time a patient is in AF as assessed with a device capable of measuring AF burden in the presence or absence of previously ineffective antiarrhythmic drug therapy.” Because there is no firm scientific basis for selecting the cutoff of 75% rather than a different cutoff, this prior recommendation is provided only as an example of what future clinical trials may choose to use as a definition of clinical/partial success.

**Minimum effectiveness endpoint for patients with symptomatic and asymptomatic AF**

The minimum effectiveness endpoint is freedom from symptomatic and asymptomatic episodes of AF/AFL/AT recurrences at 12 months following ablation, free from antiarrhythmic drug therapy, and including a prespecified blanking period.

| Minimum chronic acceptable success rate: paroxysmal AF at 12-month follow-up |
| Minimum chronic acceptable success rate: persistent AF at 12-month follow-up |
| Minimum chronic acceptable success rate: long-standing persistent AF at 12-month follow-up |

If a minimum chronic success rate is selected as an objective effectiveness endpoint for a clinical trial, we recommend that the minimum chronic acceptable success rate for paroxysmal AF at 12-month follow-up is 50%.

If a minimum chronic success rate is selected as an objective effectiveness endpoint for a clinical trial, we recommend that the minimum chronic acceptable success rate for persistent AF at 12-month follow-up is 40%.

If a minimum chronic success rate is selected as an objective effectiveness endpoint for a clinical trial, we recommend that the minimum chronic acceptable success rate for long-standing persistent AF at 12-month follow-up is 30%.
Early arrhythmia recurrence is a significant predictor of arrhythmia recurrence after the blanking period.
Serum HbA1c levels is associated with an increased risk of AF
Obstructive sleep apnea and AF
AF type: paroxysmal vs. persistent and long-standing persistent AF
Association of Atrial Tissue Fibrosis Identified by Delayed Enhancement MRI and Atrial Fibrillation Catheter Ablation: The DECAAF Study

LGE in the LA is heterogeneously distributed. LGE was highly distributed in the inferior left PV antrum near the posterior wall side.
Check the p-wave and select your patients for AF ablation

• Patients with prolonged P-wave duration had higher rates of AF recurrences compared with those without prolonged P-wave duration (49 vs. 14%)

• AF recurrence was significantly associated with prolonged P-wave duration (129 W 13 vs. 119 W 11 ms; P < 0.001) and P-wave dispersion (54 W 12 vs. 42 W 10 ms; P < 0.001) compared with those who remained in sinus rhythm.

P-Wave Indices and Risk of Ischemic Stroke

A Systematic Review and Meta-Analysis

Jinli He, BS; Gary Tse, MBBS, PhD, FESC, FACC;
Panagiotis Korantzopoulos, MD, PhD; Konstantinos P. Letsas, MD, FEHRA;
Sadeq Ali-Hasan-Al-Saegh, MD; Hooman Kamel, MD; Guangping Li, MD, PhD;
Gregory Y.H. Lip, MD, FESC, FEHRA, FACC; Tong Liu, MD, PhD

Background and Purpose—Atrial cardiomyopathy is associated with an increased risk of ischemic stroke. P-wave terminal force in lead V₁, P-wave duration, and maximum P-wave area are electrocardiographic parameters that have been used to assess left atrial abnormalities related to developing atrial fibrillation. The aim of this systematic review and meta-analysis was to examine their values for predicting ischemic stroke risk.

Methods—PubMed and EMBASE databases were searched until December 2016 for studies that evaluated the association between P-wave indices and stroke risk. Both fixed- and random-effects models were used to calculate the overall effect estimates.

Results—Ten studies examining P-wave terminal force in lead V₁, P-wave duration, and maximum P-wave area were included. P-wave terminal force in lead V₁ was found to be an independent predictor of stroke as both a continuous variable (odds ratio [OR] per 1 SD change, 1.18; 95% confidence interval [CI], 1.12–1.25; P<0.0001) and categorical variable (OR, 1.59; 95% CI, 1.10–2.28; P=0.01). P-wave duration was a significant predictor of incident ischemic stroke when analyzed as a categorical variable (OR, 1.86; 95% CI, 1.37–2.52; P<0.0001) but not when analyzed as a continuous variable (OR, 1.05; 95% CI, 0.98–1.13; P=0.15). Maximum P-wave area also predicted the risk of incident ischemic stroke (OR per 1 SD change, 1.10; 95% CI, 1.04–1.17).

Conclusions—P-wave terminal force in lead V₁, P-wave duration, and maximum P-wave area are useful electrocardiographic markers that can be used to stratify the risk of incident ischemic stroke. (Stroke. 2017;48:2066-2072. DOI: 10.1161/STROKEAHA.117.017293.)
Potential Practical Applications of the Atrial Cardiomyopathy Concept

1. Stroke prevention
   a. Identification of at-risk individuals, independent of AF
   b. More efficient identification of patients with AF who do not require anticoagulation
   c. Indicating when OAC can be stopped after ablation
   d. Therapeutic specification of anticoagulation (e.g., patients inadequately protected by OAC)

2. Rhythm therapy
   a. Identification of individuals for whom ablation therapy will fail
   b. Therapeutic specification of ablation approach
   c. Guiding and evaluating upstream therapy
   d. Guiding antiarrhythmic drug therapy
   e. Guiding ancillary therapy for rhythm maintenance

3. Rate control
   a. Defining patient-specific rate control targets
   b. Identifying individuals for whom rate control is likely to fail
AF begets AF: restore SR as soon as possible!

Stable atrial lesions following successful ablation of AF

Progressive atrial lesions following AF ablation recurrence

European Heart Journal 2017;38:14–19
Inflammation and atrial fibrillation

Risk factors:
- Hypertension
- Congestive heart failure
- Coronary artery disease
- Diabetes
- COPD
- Sleep apnea
- Obesity
- Air pollution
- Gastroesophageal reflux

Aggressive risk factors management:
- Mediterranean diet
- Weight reduction
- Exercise
- Smoking cessation

Inflammation:
- Corticosteroids
- Colchicine
- Statins
- Thiazolidinedione
- Aldosterone antagonists

Atrial fibrillation:
- Calcium overload
- Oxidative stress
- Energy depletion
- Apoptosis
- Membrane dysfunction

Calcification of atrial fibrillation:
- Ablation
- Antiarrhythmic drugs

Triggering of atrial ectopic activity:
- Atrial APD shortening
- Atrial conduction slowing

Gap junction modulation / connexin dysregulation:
- Apoptosis / myolysis
- Atrial fibrosis
- Calcium handling abnormalities
Persistent AF case with heart failure
Non-ablation strategies to improve outcomes
2017 HRS/EHRA/ECAS/APHRS/SOLAECE expert consensus statement on catheter and surgical ablation of AF

**Weight loss can be useful** for patients with AF, including those who are being evaluated to undergo an AF ablation procedure, as part of a comprehensive risk factor management strategy.

It is reasonable to **consider a patient’s BMI** when discussing the risks, benefits, and outcomes of AF ablation with a patient being evaluated for an AF ablation procedure.

It is reasonable to screen for **signs and symptoms of sleep apnea** when evaluating a patient for an AF ablation procedure and to recommend a sleep evaluation if sleep apnea is suspected.

**Treatment of sleep apnea** can be useful for patients with AF, including those who are being evaluated to undergo an AF ablation procedure.
Scoring systems have been developed to predict response to AF ablation.

**DR-FLASH Score**
- Diabetes mellitus, renal dysfunction, persistent form of AF, LA diameter >45mm, age >65 years, female sex, hypertension.

**CAAP-AF Score**
- Coronary artery disease, atrial diameter, age, persistent or long standing AF, antiarrhythmics failed, female sex.

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