Fibrillation Atriale Paroxystique : ablation, résultats, complications

DIU Rythmologie – Paris, le 29/01/14

s.boveda@clinique-pasteur.com
A disease with bad consequences

Population de FA X 2 entre 1995 et 2030

RR de patients en FA comparé avec des patients sans FA

ACC/AHA/ESC 2006 Guidelines for the Management of Patients With Atrial Fibrillation

Go et al, JAMA 2001
Afib ablation: is it THE Solution?

- "Pulmonary vein ablation improves mortality, morbidity, and QoL as compared with medical therapy"
- "Our findings pave the way for randomized trials to prospect a wider application of ablation for AF"

Mortality, Morbidity, and Quality of Life after Circumferential Pulmonary Vein Ablation for Atrial Fibrillation
Outcomes from a Controlled Nonrandomized Long-term Study
Pappone C et al. J Am Coll Cardiol 2003

<table>
<thead>
<tr>
<th>Characteristic</th>
<th>Ablation Group (n = 589)</th>
<th>Medical Group (n = 582)</th>
<th>p Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (yrs)</td>
<td>65 ± 9</td>
<td>65 ± 10</td>
<td>0.99</td>
</tr>
<tr>
<td>Male gender (%)</td>
<td>58</td>
<td>59</td>
<td>0.95</td>
</tr>
<tr>
<td>Follow-up duration, median (range), (days)</td>
<td>861 (161-1491)</td>
<td>911 (179-1508)</td>
<td>0.22</td>
</tr>
</tbody>
</table>

All patients should be ablated...
Afib ablation: theoretical aspects

Haissaguerre M et al. NEJM 1998
Afib ablation: theoretical aspects

Foyer

FA
Afib ablation: theoretical aspects

25 mm/s
1000 ms
Initiation
= Paroxysmal
= Persistent

Primary focuses
(95% PV)

Focal ablation

Sustained
= LA substrate

Altered Tissue

Linear lesions

Strategy of Afib ablation
Afib ablation: theoretical aspects

- Kuck, Pappone
- Lasso + Irrigated
- 3-D + Irrigated
- Single shot tools
- Bordeaux 2000
- Bordeaux 1999
- Bordeaux 2001
Afib ablation: technical aspects
Afib ablation: technical aspects

A. Typical

AF: N = 16
Control: N = 18

B. Short Common Left Trunk

N = 7 (including 3 of D)
N = 5 (including 2 of D)

C. Long Common Left Trunk

N = 2

D. Right Middle PV

AF: N = 4
Control: N = 3

E. Two Right Middle PVs

N = 1
N = 0

F. Right Middle PV and Right “upper” PV

N = 1

END-POINTS

1. All 4 veins disconnection assessed by the absence of PV potential at the ostium of each vein

2. Control of the 4 veins just before removing the catheters (frequent recurrences +++)

3. ATP?...
dissociation potentiel og et vpsd puis deconnection vpsd durant rf
Follow-up

- Holter just after the procedure, after 3, 6 and 12 months

- OAC at least during 3 months in case of AF recurrences

- Then, depending on the CHA²DS²-Vasc score
Why still so much recurrences?
Navigation systems

Nowadays:
PV Isolation: the larger the better?

- Ostial segmental PVI = small isolation
- Circumferential Isolation = large isolation

Arentz et al. Circulation 2007
PV Isolation: the larger the better?

Arentz et al. Small or large isolation areas around the PVs. Circulation 2007
# Afib ablation: technical aspects

Single shot tools for paroxysmal AFib

<table>
<thead>
<tr>
<th>Catheter description</th>
<th>Energy source</th>
<th>System description</th>
<th>Catheter positioning</th>
<th>Mapping</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bard High Density Mesh</td>
<td>Pulsed RF</td>
<td>Distributes power sequentially to electrodes of the HDMA, using microwave information from catheter to RF power delivery. Electrodes can be activated in each of 4 quadrants</td>
<td>Over-the-wire system</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic - Ablation Frontiers Pulmonary Vein Ablation Catheter</td>
<td>Phased RF</td>
<td>Generator can selectively deliver energy in bipolar, unipolar, or combination modes to any or all of the 8 catheter electrodes – based on patient requirements</td>
<td>Over-the-wire system</td>
<td>Yes</td>
</tr>
<tr>
<td>Medtronic - CryoCath Arctic Front</td>
<td>Cryothermal energy</td>
<td>Console controls the delivery of the liquid refrigerant to the catheter, recovers the warmed refrigerant vapor under constant vacuum, and disposes of the refrigerant through the hospital scavenging system</td>
<td>Over-the-wire system</td>
<td>No</td>
</tr>
</tbody>
</table>

- **Available in 20mm and 25mm diameters**
- **36-wire catheter with 916-gauge side-hole electrode array**
- **4 equidistantly spaced thermocouples**
- **Fluoroscopy visible catheter poles 1 and 9**

- **Helical, decapolar catheter with a 25mm-diameter array at the distal tip**
- **8 platinum electrodes**
- **Each electrode with a thermocouple under the anterior surface**

- **23mm & 28mm diameter balloons**
- **N₂O delivered to inner balloon**
- **Double balloon safety system**
- **Central lumen for contrast injection**
PAF Typical baseline ECG
Afib coming from RSPV
LSPV before RF ablation
LSPV after first RF application: 1st degree PV block
LSPV after RF ablation

vpsg post rf
Pacing inside LSPV showing LA dissociation
Pacing inside LIPV: still connected...
RSPV pre RF ablation
RSPV dissociation after RF ablation
Cryoablation is it superior to radiofrequency ablation?

- Less endocardial disruption
- Preservation of underlying tissue architecture
- Reduce platelet and clotting activation
- Thrombus formation

Cryolesion 1 week (dog, LV)
Freezor 4 mm, -75°C, 240 s

Achieve in the LSPV, isolation at 35 s freeze during CS pacing
Paroxysmal AF, Achieve® in the LSPV, without pacing
- Where is the A potential?
- Where is the venous potential?
- Where is the ventricular potential?
During cryo ablation at 15 sec
### Afib ablation: results

#### Parox AF ablation: success rate

Meta-analysis of catheter ablation studies

<table>
<thead>
<tr>
<th>Ablation method</th>
<th>Patients</th>
<th>Paroxysmal AF</th>
<th>SHD</th>
<th>6-mo cure</th>
<th>6-mo OK</th>
</tr>
</thead>
<tbody>
<tr>
<td>Linear</td>
<td>443</td>
<td>75 %</td>
<td>26 %</td>
<td>33 %</td>
<td>55 %</td>
</tr>
<tr>
<td>Focal</td>
<td>508</td>
<td>81 %</td>
<td>35 %</td>
<td>54 %</td>
<td>71 %</td>
</tr>
<tr>
<td>Isolation</td>
<td>2,187</td>
<td>83 %</td>
<td>36 %</td>
<td>62 %</td>
<td>75 %</td>
</tr>
<tr>
<td>Circumferential (all)</td>
<td>15,455</td>
<td>68 %</td>
<td>37 %</td>
<td>64 %</td>
<td>74 %</td>
</tr>
<tr>
<td>Circumferential (LACA, WACA)</td>
<td>2,449</td>
<td>65 %</td>
<td>37 %</td>
<td>59 %</td>
<td>72 %</td>
</tr>
<tr>
<td>Circumferential (PVAI)</td>
<td>11,132</td>
<td>68 %</td>
<td>42 %</td>
<td>67 %</td>
<td>76 %</td>
</tr>
<tr>
<td>Substrate ablation (CFAE)</td>
<td>559</td>
<td>51 %</td>
<td>49 %</td>
<td>75 %</td>
<td>87 %</td>
</tr>
<tr>
<td>Total</td>
<td>23,626</td>
<td>61 %</td>
<td>55 %</td>
<td>63 %</td>
<td>75 %</td>
</tr>
</tbody>
</table>

The VeniceChart international consensus document
# PAF Ablation: Randomized Studies

<table>
<thead>
<tr>
<th>Study</th>
<th>Reference</th>
<th>Patients (n)</th>
<th>Age, years</th>
<th>Type of AF</th>
<th>Previous use of AAD</th>
<th>Ablation technique</th>
<th>Repeat ablation in the ablation group</th>
<th>Crossed to ablation in the AAD group</th>
<th>AF free at 1 year</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Ablation</td>
</tr>
<tr>
<td>Jais et al. 2008 (A4 study)</td>
<td>133</td>
<td>112</td>
<td>51 ± 11</td>
<td>Paroxysmal</td>
<td>≥1</td>
<td>PVI ± LA lines ± CTI ablation</td>
<td>Mean 1.8 ± 0.8, median 2 per patient</td>
<td>63%</td>
<td>89%</td>
</tr>
<tr>
<td>Forleo et al. 2008f</td>
<td>Online</td>
<td>70</td>
<td>63 ± 9 (ablation) 65 ± 6 (AAD)</td>
<td>Paroxysmal, persistent</td>
<td>≥1</td>
<td>PVI ± LA lines ± CTI ablation</td>
<td>Not stated</td>
<td>Not stated</td>
<td>80%</td>
</tr>
<tr>
<td>Wilber et al. 2010 (Thermocool)g</td>
<td>96</td>
<td>167</td>
<td>55.5 (ablation) 56.1 (AAD)</td>
<td>Paroxysmal</td>
<td>≥1 (mean 1.3)h</td>
<td>PVI ± LA lines ± CFAEs ± CTI ablation ± RA lines</td>
<td>12.6% within 80 days after 1st procedurel</td>
<td>59%c</td>
<td>66%</td>
</tr>
<tr>
<td>Packer et al. 2010 (STOP-AF)l</td>
<td>Online</td>
<td>245</td>
<td>56.7 (ablation) 56.4 (AAD)</td>
<td>Paroxysmal</td>
<td>≥1b</td>
<td>Cryo-PVI ± LA lines</td>
<td>19% within 90 days after 1st procedure</td>
<td>79%</td>
<td>69.9%</td>
</tr>
</tbody>
</table>

AF - ESC Guidelines, EHJ 2010
**Study Design of the STOP-AF Trial**

**Inclusions:**
Patients >2 AF episodes in 2 months w ECG doc. of 1 Rx Failure of > 1 AA Rx

- AA Rx failure n=304
- Randomized 2:1 to ablation vs. Drug Rx

- Screening Exclusion n=46
- Consent withdrawal n=7
  - Screening failure n=6

- Cryoballoon ablation n=163
- Drug Rx n=82
- Drug optimization 90 days
- Blanking period (90 day) Redo ablation n=31

- Cross-over n=65

Follow-up 1,3,6,9, &12 mo
Holters Weekly TTM
Primary Effectiveness Analysis

Treatment Success

KM estimate 68.6% (SE 3.9%) vs 7.3% (SE 2.9%)

CRYO 69.9% 114/163

P<0.001

Blanked

DRUG Rx 7.3% 6/82
Afib ablation : elderly patients

Efficacy of radiofrequency catheter ablation in athletes with atrial fibrillation

In patients with documented focal induction of non-permanent AF and absence of structural heart disease, PVI is as effective in athletes as in other patients.
Afib ablation : complications

Accès Percutané

Complications « locales » : Fistule artério/veineuse, Hématome fémoral

Manipulation cathéters / Ponction Transeptale

Perforation cardiaque / Tamponnade ; Perforation du sinus coronaire ; lésion aortique…

Energie Délivrée

Perforation cardiaque / Tamponnade ; Lésion valvulaire ; AVC ; Fistule oesophagienne…
**Afib ablation: complications**

**TABLE 2. Complication Rates Compiled From 1033 Patients in the Studies in Table 1**

<table>
<thead>
<tr>
<th>Complication</th>
<th>Events, n</th>
<th>Rate, %</th>
<th>Range in Studies, %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Transient ischemic attack</td>
<td>4</td>
<td>0.4</td>
<td>0–3</td>
</tr>
<tr>
<td>Permanent stroke</td>
<td>1</td>
<td>0.1</td>
<td>0–1</td>
</tr>
<tr>
<td>Severe PV stenosis (&gt;70%, symptomatic)</td>
<td>3</td>
<td>0.3</td>
<td>0–3</td>
</tr>
<tr>
<td>Moderate PV stenosis (40–70%, asymptomatic)</td>
<td>13</td>
<td>1.3</td>
<td>0–5</td>
</tr>
<tr>
<td>Tamponade/perforation</td>
<td>5</td>
<td>0.5</td>
<td>0–3</td>
</tr>
<tr>
<td>Severe vascular access complication</td>
<td>3</td>
<td>0.3</td>
<td>0–4</td>
</tr>
</tbody>
</table>

Verma A et al. (Circulation 2005;112: 1214-1231)

*Global risk between 2 and 3% (higher for persistent Afib?...)*
**Afib ablation : complications**

AVC : incidence = 0 à 4%...

- ACT 300-350 (per-op + post-op)
- Surveillance clinique per-op + post-op
- Stroke center / Fibrinolyse…

*Troughton R, Heart 2003*

*Dixit S, Heart Rhythm 2007*
5 Afib ablation : complications

Tamponnade : incidence = 1.2 à 6%...

• Drainage sous-xyphoïden

• **Chirurgie +++**

*Wu R, J Cardiovasc Electrophysiol 2002*
Fistule atrio œsophagienne : incidence < 0.25% / Mortalité = 50%...

5 Afib ablation : complications

Sra J, J Interv Card Electrophysiol 2008

Dixit S, Heart Rhythm 2007
PV stenosis: up to 15% / Severe >70%: 1-3%
Looking at the Guidelines

2012 focused update of the ESC Guidelines for the management of atrial fibrillation

An update of the 2010 ESC Guidelines for the management of atrial fibrillation
Developed with the special contribution of the European Heart Rhythm Association

Authors/Task Force Members: A. John Camm (Chairperson) (UK)*, Gregory Y.H. Lip (UK), Raffaele De Caterina (Italy), Irene Savelieva (UK), Dan Atar (Norway), Stefan H. Hohnloser (Germany), Gerhard Hindricks (Germany), Paulus Kirchhof (UK)

www.escardio.org/guidelines European Heart Journal 2012
## Looking at the Guidelines

### Detecting patients with AF

#### Opportunistic Screening

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class&lt;sup&gt;a&lt;/sup&gt;</th>
<th>Level&lt;sup&gt;b&lt;/sup&gt;</th>
</tr>
</thead>
<tbody>
<tr>
<td>Opportunistic screening for AF in patients ≥65 years of age using pulse-taking followed by an ECG is recommended to allow timely detection of AF.</td>
<td>I</td>
<td>B</td>
</tr>
</tbody>
</table>

<sup>a</sup>Class of recommendation.  
<sup>b</sup>Level of evidence.  
AF = atrial fibrillation; LoE = level of evidence.
### Left Atrial Ablation

**Recommendations for left atrial ablation**

<table>
<thead>
<tr>
<th>Recommendations</th>
<th>Class</th>
<th>Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Catheter ablation of symptomatic paroxysmal AF is recommended in patients who have symptomatic recurrences of AF on antiarrhythmic drug therapy (amiodarone, dronedarone, flecainide, propafenone, sotalol) and who prefer further rhythm control therapy, when performed by an electrophysiologist who has received appropriate training and is performing the procedure in an experienced centre.</td>
<td>I</td>
<td>A</td>
</tr>
<tr>
<td>Catheter ablation of AF should be considered as first-line therapy in selected patients with symptomatic, paroxysmal AF as an alternative to antiarrhythmic drug therapy, considering patient choice, benefit, and risk.</td>
<td>IIa</td>
<td>B</td>
</tr>
</tbody>
</table>

AF - ESC Guidelines, *EHJ 2012*
EHRA score is recommended to quantify AF-related symptoms. I B

**Classification of AF-related symptoms (EHRA score)**

<table>
<thead>
<tr>
<th>EHRA class</th>
<th>Explanation</th>
</tr>
</thead>
<tbody>
<tr>
<td>EHRA I</td>
<td>‘No symptoms’</td>
</tr>
<tr>
<td>EHRA II</td>
<td>‘Mild symptoms’; normal daily activity not affected</td>
</tr>
<tr>
<td>EHRA III</td>
<td>‘Severe symptoms’; normal daily activity affected</td>
</tr>
<tr>
<td>EHRA IV</td>
<td>‘Disabling symptoms’; normal daily activity discontinued</td>
</tr>
</tbody>
</table>

AF = atrial fibrillation; EHRA = European Heart Rhythm Association.

AF - ESC Guidelines, *EHJ 2010*
Continuation of OAC therapy post-   
ablation is recommended in patients   
with 1 'major' ('definitive') or ≥2   
'clinically relevant non-major' risk   
factors (i.e. **CHA\_2DS\_2-VASc score >=2**).
Looking at the Guidelines

Choice of Anti-coagulant

- Includes rheumatic valvular AF, hypertrophic cardiomyopathy, etc.

** Antiplatelet therapy with aspirin plus clopidogrel, or – less effectively – aspirin only, may be considered in patients who refuse any OAC

Atrial fibrillation

Valvular AF*

Yes

No (i.e. non-valvular AF)

< 65 years and lone AF (including females)

Assess risk of stroke (CHA₂DS₂-VASc score)

0

1**

≥2

Oral anticoagulant therapy

Assess bleeding risk (HAS-BLED score)
Consider patient values and preferences

No antithrombotic therapy

NOAC

VKA
Safety and efficacy of dabigatran versus warfarin in patients undergoing catheter ablation of atrial fibrillation: a systematic review and meta-analysis

Rui Providência, Jean-Paul Albenque, Stephane Combes, Abdesslam Bouzeman, Benjamin Casteiglt, Nicolas Combes, Kumar Narayanan, Eloi Marijon, Serge Boveda

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Dabigatran</th>
<th>Warfarin</th>
<th>Stroke and Thromboembolism</th>
<th>Risk Ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total (95% CI)</td>
<td>1823</td>
<td>2959</td>
<td>1.78 [0.66, 4.80]</td>
<td></td>
</tr>
<tr>
<td>Total events</td>
<td>10</td>
<td>5</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Heterogeneity: Tau² = 0.00; Chi² = 3.78, df = 7 (P = 0.80); I² = 0%</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Test for overall effect: Z = 1.14 (P = 0.26)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Heart 2013
14 studies were identified enrolling a total of 4782 patients (1823 treated with dabigatran and 2959 with warfarin).

In the setting of AF catheter ablation, this first pooled analysis suggests that patients treated with dabigatran have a similar incidence of thromboembolic events and major bleeding compared to warfarin, with low event rates overall.

### Table: Major Bleeding

<table>
<thead>
<tr>
<th>Study or Subgroup</th>
<th>Dabigatran</th>
<th>Warfarin</th>
<th>Risk Ratio M-H, Random, 95% CI</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bassiouny 2013</td>
<td>4/376</td>
<td>8/623</td>
<td>0.83 [0.25, 2.73]</td>
</tr>
<tr>
<td>Bernard 2013</td>
<td>2/155</td>
<td>2/44</td>
<td>0.28 [0.04, 1.96]</td>
</tr>
<tr>
<td>Haines 2012</td>
<td>3/222</td>
<td>3/222</td>
<td>1.00 [0.20, 4.90]</td>
</tr>
<tr>
<td>Ichiki 2012</td>
<td>4/30</td>
<td>4/180</td>
<td>6.00 [1.59, 22.71]</td>
</tr>
<tr>
<td>Kaseno 2012</td>
<td>0/110</td>
<td>2/101</td>
<td>0.18 [0.01, 3.78]</td>
</tr>
<tr>
<td>Kim 2012</td>
<td>4/191</td>
<td>12/572</td>
<td>1.00 [0.33, 3.06]</td>
</tr>
<tr>
<td>Lakireddy 2012</td>
<td>9/145</td>
<td>1/145</td>
<td>9.00 [1.16, 70.13]</td>
</tr>
<tr>
<td>Maddox 2013</td>
<td>1/212</td>
<td>3/251</td>
<td>0.39 [0.04, 3.77]</td>
</tr>
<tr>
<td>Mendoza 2012</td>
<td>0/60</td>
<td>0/58</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Nin 2012</td>
<td>0/45</td>
<td>0/45</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Pavaci 2012</td>
<td>0/27</td>
<td>0/27</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Rowley 2012</td>
<td>0/113</td>
<td>1/169</td>
<td>0.50 [0.02, 12.09]</td>
</tr>
<tr>
<td>Snipelsky 2012</td>
<td>0/31</td>
<td>0/125</td>
<td>Not estimable</td>
</tr>
<tr>
<td>Yamaji 2012</td>
<td>0/106</td>
<td>4/397</td>
<td>0.41 [0.02, 7.62]</td>
</tr>
<tr>
<td><strong>Total (95% CI)</strong></td>
<td>1823</td>
<td>2959</td>
<td>1.07 [0.51, 2.26]</td>
</tr>
</tbody>
</table>

Heterogeneity: Tau² = 0.54; Chi² = 15.19, df = 9 (P = 0.09); I² = 41%

Test for overall effect: Z = 0.18 (P = 0.86)
Should we ablate before?

Catheter ablation of atrial fibrillation as first-line therapy—a single-centre experience

Hildegard Tanner*, Karol Makowski, Laurent Roten, Jens Seiler, Nicola Schwick, Christian Müller, Jürg Fuhrer, and Etienne Delacrétaz

This suggests that the selection of patients for the invasive strategy should be considered at an earlier stage of the disease, even before AAD.

Europace 2011
Take Home Message

1. Symptomatic parox Afib ablation after AAD failure is a I / IIa indication with a 75% success and 2-3% complication rates

2. Afib ablation is cost-effective in these patients

3. Afib type, absence of SHD, LA enlargement, LA fibrosis/SRM seem to be important factors for a better outcome after ablation

4. …try to ablate before Afib becomes persistent

5. …at earlier stages of the disease