The RFCA Outcomes of Redo Cases of AF ablation: Differences between AF and AT/AFL

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Disclosure

Conflict of interest: Nothing to report.
Type of recurrence after AF ablation

- AF recurrence (Paroxysmal/Persistent)
- Atrial tachycardia recurrence (Focal / macroreentrant atrial flutter)
Clinical importance of Organized atrial tachycardia (OAT) in patients with prior AF ablation

- Common problem after AF ablation
  - Reported incidence: 4.7-31%
- Often very symptomatic, and is usually associated to faster ventricular response
- Respond poorly to antiarrhythmic drug
- Concurrence of several types of AT in same patients
- The OAT mechanisms may be linked to that responsible for AF maintenance
Type of recurrent OAT after AF ablation

1. Macroe rentrant AT: perimitral, roof-dependent, peripulmonary veins, CTI-dependent, interatrial septum, dual-loop circuits

2. Small-loop AT: associated to conduction gaps or very slow conducting areas

3. Pulmonary vein AT: reconnected pulmonary vein

4. Genuine focal AT
Type of recurrent OAT after AF ablation

Redo ablation outcomes of recurrent OATs

- Although high acute success rate (95%) was demonstrated, substantial long-term recurrence was observed, especially in patients with multiple ATs during redo ablation.

Our clinical data

- We enrolled all patients with a history of prior AF ablation and have undergone redo RFCA in Seoul St. Mary’s hospital between 2009 ~ 2015

- Subjects were divided into two groups according to the recurred rhythm before the redo procedure
  
  - OAT group: patients presenting with only recurrent OAT
  - AF group: patients whose any recurred rhythm includes AF

- Mean follow up duration: 34.5 ± 20.1 months
Ablation strategies

- Assess pulmonary vein (PV) reconnection at first.

1. In patients with AF, reconnected PVI isolation and then extra PV ablation was conducted with the goal of AF termination.

2. In patients with ongoing OAT, entrainment mapping with or without activation mapping was performed and then reconnected PV isolation was done. According to the mapping result, linear ablation or focal earliest site ablation was performed with the goal of OAT termination.

3. In patients with sinus rhythm (SR), reconnected PV isolation was performed and then arrhythmia induction maneuver was conducted → ablate as 1 or 2.
<table>
<thead>
<tr>
<th>Baseline characteristics</th>
<th>Total N=133</th>
<th>OAT group N=50</th>
<th>AF group N=83</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>60.6 ± 9.8</td>
<td>57.4 ± 9.9</td>
<td></td>
<td>0.073</td>
</tr>
<tr>
<td>Male, n(%)</td>
<td>38 (76.0%)</td>
<td>68 (81.9%)</td>
<td></td>
<td>0.410</td>
</tr>
<tr>
<td>Paroxysmal, n(%)</td>
<td>15 (30.0%)</td>
<td>53 (63.9%)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>CHA₂DS₂-Vasc score</td>
<td>1.9 ± 1.8</td>
<td>1.5 ± 1.3</td>
<td></td>
<td>0.102</td>
</tr>
<tr>
<td>Left atrial diameter, mm</td>
<td>43.3 ± 15.9</td>
<td>41.1 ± 7.4</td>
<td></td>
<td>0.288</td>
</tr>
<tr>
<td>Hypertension, n(%)</td>
<td>31 (62.0%)</td>
<td>45 (54.2%)</td>
<td></td>
<td>0.743</td>
</tr>
<tr>
<td>Diabetes, n(%)</td>
<td>10 (20.0%)</td>
<td>14 (16.8%)</td>
<td></td>
<td>0.788</td>
</tr>
<tr>
<td>Coronary artery disease, n(%)</td>
<td>2 (4.0%)</td>
<td>7 (8.4%)</td>
<td></td>
<td>0.304</td>
</tr>
<tr>
<td>Heart failure, n(%)</td>
<td>3 (6.0%)</td>
<td>2 (2.4%)</td>
<td></td>
<td>0.345</td>
</tr>
<tr>
<td>Stroke, n(%)</td>
<td>8 (16.0%)</td>
<td>6 (7.2%)</td>
<td></td>
<td>0.144</td>
</tr>
</tbody>
</table>
## Procedure characteristics

<table>
<thead>
<tr>
<th>Procedure characteristic</th>
<th>OAT group N=50</th>
<th>AF group N=83</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV reconnection</td>
<td>44 (88.0%)</td>
<td>78 (94.0%)</td>
<td>0.226</td>
</tr>
<tr>
<td>Ablation strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only PV reisolation</td>
<td>14 (28.0%)</td>
<td>19 (22.9%)</td>
<td>0.509</td>
</tr>
<tr>
<td>Linear ablation</td>
<td>33 (66.0%)</td>
<td>51 (61.4%)</td>
<td>0.598</td>
</tr>
<tr>
<td>Only PV isolation ± linear ablation</td>
<td>37 (74.0%)</td>
<td>47 (56.6%)</td>
<td>0.044</td>
</tr>
<tr>
<td>Focal trigger ablation</td>
<td>13 (26.0%)</td>
<td>35 (42.2%)</td>
<td>0.060</td>
</tr>
<tr>
<td>Procedure time, min</td>
<td>165 ± 51</td>
<td>185 ± 64</td>
<td>0.137</td>
</tr>
<tr>
<td>Acute success</td>
<td>46 (92.0%)</td>
<td>63 (75.9%)</td>
<td>0.019</td>
</tr>
</tbody>
</table>
**Type of OAT (initial or initially induced)**

<table>
<thead>
<tr>
<th>Types</th>
<th>Number (Total N=50)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macroreentrant tachycardia</td>
<td>28</td>
</tr>
<tr>
<td>Perimitral isthmus dependent flutter</td>
<td>18</td>
</tr>
<tr>
<td>Roof dependent flutter</td>
<td>3</td>
</tr>
<tr>
<td>VOM-related reentry</td>
<td>3</td>
</tr>
<tr>
<td>PV-related reentry</td>
<td>3</td>
</tr>
<tr>
<td>CTI dependent flutter</td>
<td>1</td>
</tr>
<tr>
<td>Focal tachycardia</td>
<td>12</td>
</tr>
<tr>
<td>PV origin</td>
<td>8</td>
</tr>
<tr>
<td>CS origin</td>
<td>2</td>
</tr>
<tr>
<td>RA origin</td>
<td>1</td>
</tr>
<tr>
<td>Septum origin</td>
<td>1</td>
</tr>
</tbody>
</table>

**Diagram:**

- 60
d- 50
- 40
- 30
- 20
- 10
- 0

- **Types**
  - Unknown
  - Focal tachycardia
  - Macroreentrant tachycardia

- **Graph:**
  - Total N=50
  - Unknown: 10
  - Focal tachycardia: 12
  - Macroreentrant tachycardia: 28
Frequency of linear ablation in OAT group

Freedom from atrial tachyarrhythmia

Log rank p=0.030

Recurrence free survival, %

Time, days

0 365 730 1095

OAT
AF

71.8%
57.4%
In our data..

- The redo RFCA in patients with recurrent OAT showed high acute success rate (92.0%) and 3-year arrhythmia freedom (71.8%).

- Although the proportion of patients with persistent arrhythmia and LA diameter were higher in the OAT group, the acute and long-term procedure success rate were significantly higher than recurrent AF group.

- Mappable OATs were frequently macroreentrant (70%), and PV, LA roof, perimitral isthmus, and the vein of Marshall were responsible for most of the OATs (87.5%).
Ablation strategy of OAT

1. Identification of the mechanism

- Macrocirentrant AT: most frequent (57-91%)
  - Activation mapping yields continuous electrical activity accounting for > 80-90% of the TCL (or early meets late)
    - Limitation – misinterpretation as focal origin by false- centrifugal activation
  - Entrainment mapping demonstrates constant fusion
    - Limitations – not possible to entrain, termination of AT
Focal AT:
- Centrifugal spread of the activation front in all directions from the site of earliest atrial activation.
- Range of activation duration <80-90% of the TCL
- TCL variation >10%
- Inconsistent return cycles after overdrive pacing
2. Ablation strategies

- Isolation of reconnected pulmonary veins
- Linear ablation or focal target ablation according to the identified OAT mechanism
- If another OAT is developed, repeat mapping and ablation
- After sinus rhythm restoration, confirm bidirectional linear block
Conclusions

1. RFCA for patients with recurrent OAT after AF ablation shows excellent acute and long-term success rates compared to the patients with recurrent AF.

2. Initial entrainment/activation mapping is important to determine the ablation target in patients with OATs.

3. Reconnected PV isolation with ablation of appropriate linear or focal target substrate is an effective ablation strategy for recurrent OATs.
Thank you for your attention
2. Ablation strategies

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- Linear ablation or focal target ablation according to the identified OAT mechanism
- If another OAT is developed, repeat mapping and ablation
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- Focal AT:
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