Radiofrequency catheter ablation in patients with recurrent organized atrial tachycardia who underwent prior ablation for atrial fibrillation

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Background
Organized atrial tachycardia (OAT) after atria fibrillation (AF) ablation

- Focal atrial tachycardia & reentrant atrial tachycardia
OAT after AF ablation – Clinical importance

- Common problem after AF ablation
  - Reported incidence: 4.7-31%
- Often very symptomatic, and 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
Study purpose

- To evaluate long term success rates of redo RFCA in patients presenting with recurrent OAT after prior AF ablation in comparison to patients presenting with recurrent AF
- To analyze effective ablation strategies for those patients
Methods
Patient selection

- Retrospective, single center study.
- All patients undergoing redo RFCA after prior AF ablation in Seoul St. Mary’s hospital between March 2009 ~ December 2015
- Included subjects were divided according to the recurred rhythm presented before redo RFCA
  - OAT group: patients presenting with only recurrent OAT
  - AF group: patients whose any recurred rhythm includes AF
- Mean follow up duration: $34.5 \pm 20.1$ months
Common procedure characteristics

- Circular mapping catheter and ablation catheter were advanced via double trans-septal accesses.
- If any pulmonary vein reconnection was documented, re-isolation of pulmonary vein was performed at first.
- When OAT was sustained or induced after pulmonary vein isolation, entrain mapping ± activation mapping was performed.
The OAT was considered macroreentrant tachycardia if following feature was present, otherwise, it was considered to be focal AT

- Constant atrial fusion during overdrive pacing
- Activation mapping showed continuous electrical activity accounting for most of the tachycardia cycle length

According to the mapping result, linear ablation or focal earliest site ablation was performed.

The procedure endpoint was a termination of AT
Representative case

- **F/64 22885921**
- **Palpitation 1 year after RFCA for AF**
• Sustained OAT after PVI
Entrainment mapping

- Post pacing interval – tachycardia cycle length
  - Distal CS: 140 ms
  - Proximal CS: 50 ms
  - Distal HRA: 170 ms
  - LA roof: 5 ms
  - Anterior wall: 10 ms
Outcome Analysis

- Primary endpoint: Atrial tachyarrhythmia recurrence (AF or OAT)
- Acute success: achieving sinus rhythm during RFCA without electrical cardioversion
Result
## Baseline characteristics

<table>
<thead>
<tr>
<th></th>
<th>Total N=133</th>
<th>OAT group N=48 (36.1%)</th>
<th>AF group N=85 (63.9%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years</td>
<td>60.0 ± 9.4</td>
<td>57.8 ± 10.2</td>
<td>0.225</td>
<td></td>
</tr>
<tr>
<td>Male, n(%)</td>
<td>38 (79.2%)</td>
<td>68 (80.0%)</td>
<td>0.931</td>
<td></td>
</tr>
<tr>
<td>Paroxysmal, n(%)</td>
<td>16 (33.3%)</td>
<td>58 (68.2%)</td>
<td>&lt;0.001</td>
<td></td>
</tr>
<tr>
<td>CHA₂DS₂-Vasc score</td>
<td>1.8 ± 1.7</td>
<td>1.5 ± 1.4</td>
<td>0.373</td>
<td></td>
</tr>
<tr>
<td>Left atrial diameter, mm</td>
<td>43.4 ± 16.2</td>
<td>41.1 ± 7.4</td>
<td>0.278</td>
<td></td>
</tr>
<tr>
<td>Hypertension, n(%)</td>
<td>29 (60.4%)</td>
<td>47 (55.3%)</td>
<td>0.967</td>
<td></td>
</tr>
<tr>
<td>Diabetes, n(%)</td>
<td>9 (18.7%)</td>
<td>15 (17.6%)</td>
<td>0.919</td>
<td></td>
</tr>
<tr>
<td>Coronary artery disease, n(%)</td>
<td>2 (4.2%)</td>
<td>7 (8.2%)</td>
<td>0.304</td>
<td></td>
</tr>
<tr>
<td>Heart failure, n(%)</td>
<td>2 (4.2%)</td>
<td>3 (3.5%)</td>
<td>0.958</td>
<td></td>
</tr>
<tr>
<td>Stroke, n(%)</td>
<td>7 (14.5%)</td>
<td>7 (8.2%)</td>
<td>0.340</td>
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</tbody>
</table>
## Procedure characteristics

<table>
<thead>
<tr>
<th></th>
<th>OAT group N=48 (36.1%)</th>
<th>AF group N=85 (63.9%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>PV reconnection</td>
<td>42 (87.5%)</td>
<td>80 (94.1%)</td>
<td>0.225</td>
</tr>
<tr>
<td>Ablation strategy</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Only PV reisolation</td>
<td>13 (27.1%)</td>
<td>20 (23.5%)</td>
<td>0.649</td>
</tr>
<tr>
<td>Linear ablation</td>
<td>33 (68.8%)</td>
<td>51 (60.0%)</td>
<td>0.315</td>
</tr>
<tr>
<td>Either PV isolation ± linear ablation, or both</td>
<td>35 (72.9%)</td>
<td>49 (57.6%)</td>
<td>0.080</td>
</tr>
<tr>
<td>Focal trigger ablation</td>
<td>13 (27.1%)</td>
<td>35 (41.2%)</td>
<td>0.104</td>
</tr>
<tr>
<td>Procedure time, min</td>
<td>166 ± 52</td>
<td>182 ± 64</td>
<td>0.236</td>
</tr>
<tr>
<td>Acute success</td>
<td>36 (75.0%)</td>
<td>55 (64.7%)</td>
<td>0.434</td>
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</tbody>
</table>
Frequency of ablation in OAT group

Freedom from atrial tachyarrhythmia

Log rank p=0.028

Recurrence free survival, %

Time, days

0 365 730 1095

OAT
AF

81.3%
61.2%
Summary of the results

- During redo RFCA, only reconnected PV isolation ± linear ablation were performed in more than 70% of patients with recurrent OAT.

- The redo RFCA in patients with recurrent OAT showed high acute success rate (75.0%) and excellent 3-year AF-free rate (81.3%), which was significantly higher than those in patients with recurrent AF.
Discussion

- Types of OAT after AF ablation
  - Macroneentrant AT: perimitral, roof-dependant, peripulmonary veins, CTI-dependent, interatrial septum, dual-loop circuits
  - Small-loop AT: associated to conduction gaps or very slow conducting areas
  - Pulmonary vein AT: reconnected pulmonary vein
  - Genuine focal AT: triggered activity or abnormal automaticity
Discussion

- Identification of the mechanism
  - Macoreentrant 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
    - Demonstration of constant fusion during entrainment
      - 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
Ablation strategies

Characterization, mapping, and catheter ablation of recurrent atrial tachycardias after stepwise ablation of long-lasting persistent atrial fibrillation. Circ Arrhythm Electrophysiol. 2010
Conclusion

- RFCA for patients with recurrent OAT after AF ablation shows excellent long-term success rates.
- Reconnected PV isolation and appropriate mapping with linear ablation are the most important strategies and may confer favorable procedure outcomes in those patients.
Thank you