Isolation Of The Left Atrial Appendage: Techniques And Safety

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DISCLOSURES

I am a consultant for

✓ Biosense Webster
✓ Hansen Medical
INTRODUCTION

• Several studies have shown that together with pulmonary veins (PVs) many extra PVs areas may be the source of initiation and maintenance of atrial fibrillation/atrial tachyarrhythmias (AF/AT).

• The most common sites are: the superior vena cava, the ligament of Marshall, the coronary sinus, the crista terminalis, and the left atrial posterior wall.
We report on the prevalence of firing from the Left Atrial Appendage (LAA) and the optimal strategy to eliminate these triggers.
METHODS

• 987 consecutive patients (29% paroxysmal and 71% non-paroxysmal) undergoing repeat catheter ablation for symptomatic and drug resistant atrial fibrillation were included in this study.

• Patients were enrolled at Texas Cardiac Arrhythmia Institute, Austin, Texas, USA; California Pacific Medical Center, San Francisco, California, USA; Catholic University, Rome, Italy; Metro-Health Hospital, Case Western University, Cleveland, Ohio, USA; Akron General Hospital, Akron, Ohio USA, Stanford University, Palo Alto, California, USA and Ospedale dell’Angelo, Mestre, Venice, Italy.

• Patients were enrolled if:
  ❖ They had a previous ablation for AF at the participating centers or at other Institutions;
  ❖ They showed LAA firing at baseline or after administration of isoproterenol
METHODS

• In all patients, pulmonary vein antrum isolation (PVAI) guided by circular mapping catheter and by intracardiac echocardiography (ICE) of the reconnected veins was performed;

• In patients with paroxysmal AF, the portion of the posterior wall contained within the PV area were targeted if reconnected.

• In patients with persistent and long standing persistent AF, the electrical isolation of the reconnected pulmonary veins was extended to the entire posterior wall down to the coronary sinus and to the left side of the septum;

• Ablation of complex fractionated atrial electrograms (CFAEs) in the right and left atrium and in the coronary sinus were also performed if defragmented potential were found.

• In patients with AF/AT, ablation was performed to terminate the tachycardia.

• If termination was unsuccessful, cardioversion was performed to restore sinus rhythm.

• In all patients isoproterenol up to 30 mcg/min was given to disclose for any triggers of tachycardya or consistent PACs.
METHODS

• LAA firing was defined as consistent premature atrial contractions (PACs) with the earliest activation in the LAA (at least 10 in one minute) or as atrial fibrillation/tachyarrhythmia originating from the LAA.

• At each participating center, the physician performed one of these following 3 strategies:

  • 1) ignore the LAA firing and perform a standard procedure (group 1);
  • 2) focal ablation of the LAA (group 2);
  • 3) LAA electrical isolation (group 3)
Paroxysmal Atrial Fibrillation
Pulmonary Veins and Antra in Paroxysmal AF
Pulmonary Veins and Antra in Paroxysmal AF
Persistent and Long-Standing Persistent Atrial Fibrillation
Long-Standing Persistent Atrial Fibrillation
LAA isolation was performed by placement of the circular catheter at the ostium of the LAA guided by ICE. Lesions were delivered targeting the earliest electrical activation on the circular mapping catheter.
RESULTS
RESULTS

✓ Among the 987 consecutive patients undergoing redo ablation during the study period, the prevalence of LAA PACs or fibrillation/tachycardia with standard LA sites reconnection was 27% (266 patients).

✓ In 86/987 (8.7%) patients (5 paroxysmal, 81 non-paroxysmal) LAA was found to be the only source of arrhythmia with no PV or extra PV site reconnection.
Study Population

Total Population (N= 3,966)
PAF 36%, Persistent 20%, LS Persistent 44%

Referred for Redo (N= 987)
PAF 29%, Persistent 20%, LS Persistent 51%

- No LAA Firing
  - 721 (73%)

- LAA Firing Observed
  - 266 (27%)
  - PAF 18%, PER 23%, LSP 58%

  - Group 1 - LAA Not Ablated (n=43)
  - Group 2 - Focal Ablation Performed (n=56)
  - Group 3 - LAA Isolation Performed (n=167)

  - LAA Isolation; 2nd Redo (n=88)
Baseline characteristics of patients where LAA firing was recorded

<table>
<thead>
<tr>
<th></th>
<th>GROUP 1 (n = 43, 16%)</th>
<th>GROUP 2 (n = 56, 21%)</th>
<th>GROUP 3 (n = 167, 63%)</th>
<th>P-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>AGE</td>
<td>61±11</td>
<td>61±11</td>
<td>64±11</td>
<td>0.019</td>
</tr>
<tr>
<td>MALE</td>
<td>32(74%)</td>
<td>43(76%)</td>
<td>122(73%)</td>
<td>0.964</td>
</tr>
<tr>
<td>AF TYPE</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PAF</td>
<td>12(29%)</td>
<td>15(26%)</td>
<td>22(13%)</td>
<td>0.015</td>
</tr>
<tr>
<td>PER</td>
<td>10(24%)</td>
<td>14(25%)</td>
<td>38(23%)</td>
<td>0.978</td>
</tr>
<tr>
<td>LSP</td>
<td>21(49%)</td>
<td>27(49%)</td>
<td>107(64%)</td>
<td>0.044</td>
</tr>
<tr>
<td>AF DURATION</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>(months)</td>
<td>83±59</td>
<td>82±60</td>
<td>90±62</td>
<td>0.424</td>
</tr>
<tr>
<td>BMI</td>
<td>29±6</td>
<td>29±6</td>
<td>29±5</td>
<td>0.403</td>
</tr>
<tr>
<td>HTN</td>
<td>17(40%)</td>
<td>22(39%)</td>
<td>78(47%)</td>
<td>0.479</td>
</tr>
<tr>
<td>DM</td>
<td>3(7%)</td>
<td>4(7%)</td>
<td>13(8%)</td>
<td>1.000</td>
</tr>
<tr>
<td>PRIOR_CVA</td>
<td>2(5%)</td>
<td>2(4%)</td>
<td>10(6%)</td>
<td>0.922</td>
</tr>
<tr>
<td>CHADS2</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>12(28%)</td>
<td>17(30%)</td>
<td>28(17%)</td>
<td>0.068</td>
</tr>
<tr>
<td>1</td>
<td>18(42%)</td>
<td>22(40%)</td>
<td>84(50%)</td>
<td>0.306</td>
</tr>
<tr>
<td>≥2</td>
<td>13(30%)</td>
<td>17(30%)</td>
<td>55(33%)</td>
<td>0.918</td>
</tr>
<tr>
<td>LA SIZE, mm</td>
<td>40.8±8</td>
<td>40.6±7</td>
<td>43.2±9</td>
<td>0.063</td>
</tr>
<tr>
<td>LVEF %</td>
<td>58±8</td>
<td>58±8</td>
<td>59±7</td>
<td>0.577</td>
</tr>
<tr>
<td>FOLLOW-UP</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>MONTHS</td>
<td>11±3</td>
<td>11±3</td>
<td>12±3</td>
<td>0.910</td>
</tr>
</tbody>
</table>
RESULTS

In group 3 LAA isolation was achieved with segmental lesions in 117 patients (70%) and with circumferential ablation in 50 patients (30%).

The mean RF time for LAA isolation was $31 \pm 6$ minutes and $15 \pm 5$ minutes for focal ablation ($p < 0.001$).
Example of tachycardia firing from the LAA (Group II)
Example of tachycardia termination with Focal Lesions at the LAA ostium (Group II)
On Isoproterenol 30 mcg/min: LASSO in the LA appendage
On Isoproterenol 30 mcg/min: LASSO in the LA appendage
Termination Of LAA Tachycardia (group II)
Example of LAA isolation (Group III)
Example of LAA isolation (Group III)
Dissociated Firing
Dissociated Firing
Another example of LAA isolation while the lasso at the ostium of the LAA
## Recurrence by AF type

<table>
<thead>
<tr>
<th>AF type</th>
<th>Group 1 (n=43)</th>
<th>Group 2 (n=56)</th>
<th>Group 3 (n=167)</th>
<th>P value (Groups 1 vs. 2 vs. 3)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Recurrence by AF type</td>
<td>Total Recurrences in Group 1</td>
<td>Recurrence by AF type</td>
<td>Total Recurrences in Group 2</td>
</tr>
<tr>
<td>Paroxysmal</td>
<td>3(9%)</td>
<td>32(74%)</td>
<td>3(8%)</td>
<td>38(68%)</td>
</tr>
<tr>
<td>Persistent</td>
<td>9(28%)</td>
<td>12(32%)</td>
<td>7(28%)</td>
<td>17(68%)</td>
</tr>
<tr>
<td>Long-standing Persistent</td>
<td>20(36%)</td>
<td>23(61%)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Turkey-Kramer multiple comparison showed statistical significance difference between group 1 and 3 and group 2 and 3.
Kaplan Meier curve showing probability of AF-free survival across different population subgroups
Complications

During LAA isolation 4/266 (1.8%) pericardial effusion requiring pericardiocentesis occurred.

None of the patients required surgery.

None of the patients had phrenic nerve injury.

All patients were discharged after a median hospitalization of one day.
Conclusion

- The LAA appears to be responsible for arrhythmias in 27% of patients presenting for repeat procedures.

- Isolation of the LAA is the best strategy to achieve cure of AF.

- When LAA is ignored or focal ablation is performed, the procedural success rate is dismal.

- Similar to the pulmonary veins, in many cases the LAA can be isolated with segmental lesions.

- The clinical relevance of LAA isolation and its consequences with respect to potential complications requires further investigation.
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Back up slides
TTE and TEE results at 6 months follow-up of patients that did not experienced recurrences

<table>
<thead>
<tr>
<th>Recurrence free at six month</th>
<th>TEE and TTE after first LAA isolation</th>
<th>TEE and TTE after second LAA isolation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N, % (95% CI)</td>
<td>N, % (95% CI)</td>
</tr>
<tr>
<td>TEE and TTE Done</td>
<td>204, 100%</td>
<td>60, 100%</td>
</tr>
<tr>
<td>E/A Ratio ≥1.6</td>
<td>110, 54% (44%-65%)</td>
<td>34, 57% (39%-79%)</td>
</tr>
<tr>
<td>Flow Velocity &gt;0.3 M/sec</td>
<td>108, 53% (43%-64%)</td>
<td>35, 55% (38%-77%)</td>
</tr>
<tr>
<td>Excellent LAA Contractility</td>
<td>108, 53% (43%-64%)</td>
<td>33, 55% (38%-77%)</td>
</tr>
<tr>
<td>Poor LAA Contractility</td>
<td>96, 47% (38%-57%)</td>
<td>27, 45% (30%-65%)</td>
</tr>
</tbody>
</table>
TTE and TEE results at 6 months follow-up of patients that did not experienced recurrences.
Left Atrial Appendage Tachycardia
Tachycardia Initiation after Isoproterenol (Lasso in the LAA)
Tachycardia Termination with Focal Lesion at the LAA ostium