Minimally Invasive Cox-Maze IV Procedure

Ralph J. Damiano, Jr., MD
Evarts A. Graham Professor of Surgery
Chief, Division of Cardiothoracic Surgery
Barnes-Jewish Hospital
Washington University School of Medicine
St. Louis, MO USA

AATS STARS Meeting
November 18, 2017
DISCLOSURE

- Speaker for AtriCure, Edwards Lifesciences, LivaNova
- Consultant for Medtronic
- Research and educational grants over the last 2 years:
  - AtriCure
  - Edwards
Surgical Approaches for AF Ablation: Keys to a successful surgical ablation procedure

- Use an effective ablation technology to perform a complete lesion set.
- It is not possible to separate the approach from the ablation technology.
Bipolar Radiofrequency Ablation
Bipolar RF Ablation

- Ablate without unclamping until ablation time is less than 10 seconds
- 2-3 ablations for each lesion

Tissue Conductance

![Graph showing tissue conductance over time](image-url)
Technical Tips with Bipolar RF Ablation

- Fully mobilize the pulmonary veins
- Do not bunch tissue in the clamp –
  - perform individual PV isolation if needed
- Ablation duration and energy delivery is controlled by an algorithm based on conductance between the electrodes – avoid artificially decreasing conductance (i.e. air, fat, char)
Cryoaablation Devices

2-3 cm long, reusable probes

Lee, et al
Innovations 2010;5:281-286

10 cm long disposable probes
Technical Tips with Cryoablation

- All ablations are performed at 3 minutes at 60°C.
- You need to have complete contact of the probe with the tissue, any even small gaps will result in a non-transmural ablation and an incomplete line. Remember ice is a great insulator.
Technical Tips with Cryoablation

- Do not rush the rewarming – tissue death occurs during this time.
- Safe around valvular tissue and the coronary sinus.
- Avoid coronary arteries – causes late intimal hyperplasia.
Minimally Invasive Cox-Maze IV Procedure: Patient positioning
Soft Tissue Retractor:
No rib spreading
Minimally Invasive Cox-Maze Procedure: The importance of endoscopic visualization
Right Mini-Thoracotomy Cox-Maze Procedure

Ralph Damiano MD
Jeremy Leidenfrost MD
A minimally invasive Cox maze IV procedure is as effective as sternotomy while decreasing major morbidity and hospital stay

Christopher P. Lawrance, MD, Matthew C. Henn, MD, Jacob R. Miller, MD, Laurie A. Sinn, RN, BSN, Richard B. Schuessler, PhD, Hersh S. Maniarc, MD, and Ralph J. Damiano, Jr, MD

Objectives: The Cox maze IV procedure has the best results for the surgical treatment of atrial fibrillation. It has been traditionally performed through sternotomy with excellent outcomes, but this has been considered to be too invasive. An alternative approach is to perform a less invasive right anterolateral minithoracotomy. This series compared these approaches at a single center in consecutive patients.

Methods: Patients undergoing a Cox maze IV procedure (n = 356) were retrospectively reviewed from January 2002 to February 2014. Patients were stratified into 2 groups: right minithoracotomy (RMT; n = 104) and sternotomy (ST; n = 252). Preoperative and perioperative variables were compared as well as long-term outcomes. Patients were followed up for 2 years and rhythm was confirmed with an electrocardiogram or prolonged monitoring.

Results: Freedom from atrial tachyarrhythmias off antiarrhythmic drugs was 81% and 74% at 1 and 2 years, respectively, using an RMT approach and was not significantly different from the ST group at these same time points. The overall complication rate was lower in the RMT group (6% vs 13%, \( P = .044 \)) as was 30-day mortality (0% vs 4%, \( P = .039 \)). Median length of stay in the intensive care unit was lower in the RMT group than in the ST group (2 days [range, 0-21 days] vs 3 days [range, 1-61 days]; \( P = .004 \)) as was median hospital length of stay (7 days [range, 4-35 days] vs 9 days [range, 1-111 days]; \( P < .001 \)).

Conclusions: The Cox maze IV procedure performed through a right minithoracotomy is as effective as sternotomy in the treatment of atrial fibrillation. This approach was associated with fewer complications, decreased mortality and decreased length of stay in the intensive care unit and hospital length of stay. (J Thorac Cardiovasc Surg 2014;148:955-62)
<table>
<thead>
<tr>
<th>Variable</th>
<th>Mini (n=104)</th>
<th>Sternotomy (n=255)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cross clamp time (min)</td>
<td>82 ± 33</td>
<td>69 ± 33</td>
<td>0.001</td>
</tr>
<tr>
<td>Perfusion time (min)</td>
<td>184 ± 41</td>
<td>156 ± 45</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Overall major complications</td>
<td>6 (6%)</td>
<td>33 (13%)</td>
<td>0.044</td>
</tr>
<tr>
<td>Median ICU LOS in days (range)</td>
<td>2 (0-21)</td>
<td>3 (1-61)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>Median hospital LOS in days (range)</td>
<td>7 (4-35)</td>
<td>9 (1-111)</td>
<td>&lt;0.0001</td>
</tr>
<tr>
<td>30 day mortality (%)</td>
<td>0</td>
<td>10 (4%)</td>
<td>0.039</td>
</tr>
</tbody>
</table>
Freedom from ATAs

<table>
<thead>
<tr>
<th>Time</th>
<th>Sternotomy</th>
<th>Right Mini-thoracotomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 mos</td>
<td>91%</td>
<td>92%</td>
</tr>
<tr>
<td>6 mos</td>
<td>89%</td>
<td>92%</td>
</tr>
<tr>
<td>12 mos</td>
<td>86%</td>
<td>91%</td>
</tr>
<tr>
<td>24 mos</td>
<td>86%</td>
<td>83%</td>
</tr>
</tbody>
</table>

Percent: p = 0.83, p = 0.41, p = 0.41, p = 0.62

- Sternotomy
- Right Mini-thoracotomy
Thank you for your attention.