Interventional Treatment of Hypertrophic Obstructive Cardiomyopathy

Επεμβατική αντιμετώπιση της υπερτροφικής αποφρακτικής μυοκαρδιοπάθειας

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Disclosures

Angelos Rigopoulos has received honoraria for presentations from AstraZeneca.
Alcohol Septal Ablation in HOCM

Overview

• History and development

• Technical aspects

• Indications - Patient selection

• Results (early and long-term)

• Comparison to myectomy
Alcohol Septal Ablation in HOCM
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Hypertrophic Cardiomyopathy
Obstruction: Timeline

Hypertrophic Cardiomyopathy
PubMed Entries

HOCM Publications

Myectomy Publications

1994

1994

0
10
20
30
40
50
60
70

0
10
20
30
40
50
60

0

1994

1994
Alcohol Septal Ablation in HOCM
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Hypertrophic Cardiomyopathy
LVOT Obstruction - Alcohol Septal Ablation

Wigle ED. Heart 2001;86:709-714

Alcohol Septal Ablation in HOCM

Technique

- Temporary pacemaker lead in RV (venous access)
- (6-)7 F guide catheter in LCA
- 5F special pigtail catheter in LV

Alcohol Septal Ablation in HOCM
Initial Gradient Measurement

1. Rest
2. Valsalva manoeuvre

Valsalva


1. Rest
3. Brockenbrough manoeuvre

Brockenbrough

Alcohol Septal Ablation in HOCM Technique

Septal branch selection

OTW balloon positioning & contrast echo

Alcohol Septal Ablation in HOCM
Myocardial Contrast Echo

Alcohol Septal Ablation in HOCM

Echo Contrast Misplacement

Alcohol Septal Ablation in HOCM
Echo Contrast Misplacement

Alcohol Septal Ablation in HOCM
Echo Contrast Misplacement

No proper septal branch!

Alcohol Septal Ablation in HOCM

Technique

- Septal branch selection
- OTW balloon positioning & contrast echo
- Selective angiography & alcohol injection

Alcohol Septal Ablation in HOCM

Potential Alcohol Leakage: Problem

Alcohol Septal Ablation in HOCM
Potential Alcohol Leakage: Solution

Alcohol Septal Ablation in HOCM

Technique

- Septal branch selection
- OTW balloon positioning & contrast echo
- Selective angiography & alcohol injection
- Final angiography

Hypertrophic Cardiomyopathy

Septal Ablation

**Mechanical**
- Covered stents
- Coils
- Used wire tips

**Chemical**
- Alcohol
- Contour PVA particles

Hypertrophic Cardiomyopathy
Septal Ablation

Mechanical
- Covered stents
- Coils
- Used wire tips

Chemical
- Alcohol
- Contour PVA particles

Alcohol Septal Ablation in HOCM

Final Gradient Measurement

Alcohol Septal Ablation in HOCM
Haemodynamic Outcome: Time

Alcohol Septal Ablation in HOCM

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Alcohol Septal Ablation in HOCM

Indication

- Clinical
  - Symptoms
  - CPX
  - Syncope on exertion

- Haemodynamic
  - Rest
  - Valsalva
  - Post PVC
  - Exercise
  - $\geq 50 \text{ mmHg}$

- Morphological
  - ASH
  - $\geq 15 \text{ mm thickness}$

Alcohol Septal Ablation in HOCM

**Indication**

**Clinical**
- Symptoms
- CPX
- Syncope on exertion

**Haemodynamic**
- Rest
- Valsalva
- Post PVC
- Exercise
- ≥ 50 mmHg

**Morphological**
- ASH
- ≥ 15 mm thickness

**Concomitant disease**
- Complex coronary artery disease
- Intrinsic mitral valve disease
- Subaortic membrane

**Myectomy**

Exclude mitral disease needing surgery

MR due to SAM

Proceed with alcohol septal ablation

Wigle ED. Heart 2001;86:709-714
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Alcohol Septal Ablation in HOCM

Early Results

Alcohol Septal Ablation in HOCM

Early Adverse Results

**Euro-ASA Registry**: 1275 pts, 58±14 y, 49% women, 3.7% PM, 1.4% ICD, 5.7 y median f-up

<table>
<thead>
<tr>
<th>Event</th>
<th>Count</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Death in 30 days</td>
<td>13</td>
<td>1%</td>
</tr>
<tr>
<td>4 heart failure</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 pulmonary embolism</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 cardiac tamponade</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 sepsis</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 stroke</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 carcinoma</td>
<td></td>
<td></td>
</tr>
<tr>
<td>1 sudden cardiac death</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intra- or periprocedural VT</td>
<td>16</td>
<td>1.3%</td>
</tr>
<tr>
<td>Transient AV-Block</td>
<td>468</td>
<td>37%</td>
</tr>
<tr>
<td>Pacemaker dependence</td>
<td>151</td>
<td>12%</td>
</tr>
</tbody>
</table>
Alcohol Septal Ablation in HOCM
Long-term Outcome

Alcohol Septal Ablation in HOCM
Long-term Survival

n = 178 pts with 1st ASA, follow-up 4.8 y (IQR 2.1-7.5), all-cause mortality 2.1%/y

Alcohol Septal Ablation in HOCM

Longterm Survival

$n = 470$

$8.4 \pm 4$ years

## Alcohol Septal Ablation in HOCM

### Risk Factor Modification

<table>
<thead>
<tr>
<th>Risk Factors</th>
<th>Before (%)</th>
<th>After (%)</th>
<th>p</th>
</tr>
</thead>
<tbody>
<tr>
<td>Abnormal BP Response (%)</td>
<td>23</td>
<td>9</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>NSVT (%)</td>
<td>23</td>
<td>17</td>
<td>0.047</td>
</tr>
<tr>
<td>Syncope (%)</td>
<td>26</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>MWT ≥30 mm (%)</td>
<td>7</td>
<td>2</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>FH SCD (%)</td>
<td>19</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>≥2 RFs (%)</td>
<td>25</td>
<td>8</td>
<td>&lt;0.001</td>
</tr>
</tbody>
</table>

Alcohol Septal Ablation in HOCM
Mortality and Early Remaining Obstruction

n = 270 pts with 1st ASA, 1582 pt-yrs, all-cause mortality 2.78%/y

<table>
<thead>
<tr>
<th>Cardiovascular mortality events during follow-up</th>
<th>LVOTO &lt;30 mmHg N=208</th>
<th>LVOTO ≥30 mmHg N=62</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cardiovascular death</td>
<td>12 (5.8%)</td>
<td>6 (9.7%)</td>
<td>0.353</td>
</tr>
<tr>
<td>First appropriate ICD discharge</td>
<td>2 (1.0%)</td>
<td>4 (6.5%)</td>
<td>0.007</td>
</tr>
<tr>
<td>Resuscitation</td>
<td>1 (0.5%)</td>
<td>3 (4.8%)</td>
<td>0.011</td>
</tr>
</tbody>
</table>

Alcohol Septal Ablation in HOCM
VTs and ICD-Intervention

n = 32 pts with ICD before 1st ASA, follow-up 5.0 y (IQR 4.3-5.7)

Periprocedural outcomes (<30 days)

<table>
<thead>
<tr>
<th>Periprocedural outcomes</th>
<th>≤50 years (n=369)</th>
<th>51-64 years (n=423)</th>
<th>≥65 years (n=405)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol (ml)</td>
<td>2.0 (2.0-3.0)</td>
<td>2.0 (1.5-2.5)</td>
<td>2.0 (1.5-2.5)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>CK-MB (IU/l)</td>
<td>77 (52-127)</td>
<td>73 (54-140)</td>
<td>82 (55-164)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>Complete heart block</td>
<td>119 (32)</td>
<td>161 (39)</td>
<td>169 (42)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Cardiac tamponade</td>
<td>1 (0.3)</td>
<td>2 (0.5)</td>
<td>12 (3.0)</td>
<td>&lt;0.01</td>
</tr>
<tr>
<td>Adv. arrh. events</td>
<td>7 (1.9)</td>
<td>6 (1.4)</td>
<td>11 (2.7)</td>
<td>NS</td>
</tr>
<tr>
<td>Mortality</td>
<td>1 (0.3)</td>
<td>2 (0.5)</td>
<td>8 (2.0)</td>
<td>&lt;0.05</td>
</tr>
</tbody>
</table>

Alcohol Septal Ablation in HOCM

Young versus Old

n = 1197 pts (3 age groups), follow-up 5.4 ± 4.2 y
# Alcohol Septal Ablation in HOCM

## Young vs. Old: Long-Term Outcome

$n = 1197$ pts (3 age groups), follow-up $5.4 \pm 4.2$ y

<table>
<thead>
<tr>
<th></th>
<th>≤50 years (n=369)</th>
<th>51-64 years (n=423)</th>
<th>≥65 years (n=405)</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Follow-up (yrs)</td>
<td>$6.2 \pm 4.6$</td>
<td>$5.3 \pm 4.1$</td>
<td>$4.6 \pm 3.6$</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Pacemaker implantation</td>
<td>29 (8)</td>
<td>53 (13)</td>
<td>65 (16)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>ICD implantation</td>
<td>21 (6)</td>
<td>18 (4)</td>
<td>11 (3)</td>
<td>&lt;0.05</td>
</tr>
<tr>
<td>NYHA ≥III</td>
<td>19 (5)</td>
<td>36 (9)</td>
<td>73 (19)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Improvement ≥NYHA class</td>
<td>322 (89)</td>
<td>359 (87)</td>
<td>315 (80)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Reintervention</td>
<td>39 (11)</td>
<td>44 (10)</td>
<td>30 (7)</td>
<td>NS</td>
</tr>
</tbody>
</table>

**Source:** Liebregts M, et al. JACC Cardiovasc Interven 2017;10:1134-43
Alcohol Septal Ablation in HOCM

Influence of Septal Thickness

n = 531 pts (Euro-ASA), 56±14 y, 55% male, follow-up 7.9±4.0 y

LVOTO Reduction

NYHA Class

Survival

LVOTO Reduction

NYHA Class

Survival

IVS>25 mm: 5-fold risk
Alcohol Septal Ablation in HOCM
Effect of Impaired Cardiac Conduction


n = 1416 pts with 1st ASA, f-up: 5.0±4.0 yrs, 44% new BBB (31% RBBB), 13% new PM – 5% new ICD
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# Septal Reduction in HOCM
## ASA vs. Myectomy: Metaanalysis


<table>
<thead>
<tr>
<th>10 studies</th>
<th>Alcohol Septal Ablation</th>
<th>Septal Myectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number</td>
<td>805</td>
<td>1019</td>
</tr>
<tr>
<td>Men</td>
<td>349 (677)</td>
<td>367 (721)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>49.1 ± 14</td>
<td>43.6 ± 11.6</td>
</tr>
<tr>
<td>LVOT gradient-baseline (mm Hg)</td>
<td>78.5 ± 14.5</td>
<td>80.8 ± 16.6</td>
</tr>
<tr>
<td>LVOT gradient-final (mm Hg)</td>
<td>19.7 ± 6.4</td>
<td>12.2 ± 3.8</td>
</tr>
<tr>
<td>Follow up</td>
<td>2.9 ± 2</td>
<td>4.5 ± 4.4</td>
</tr>
<tr>
<td>30-day mortality</td>
<td>8</td>
<td>17</td>
</tr>
<tr>
<td>Long-term mortality</td>
<td>64 (545)</td>
<td>67 (453)</td>
</tr>
<tr>
<td>Long-term cardiac mortality</td>
<td>27 (512)</td>
<td>33 (458)</td>
</tr>
<tr>
<td>Sudden cardiac death</td>
<td>11 (569)</td>
<td>9 (473)</td>
</tr>
<tr>
<td>PPM/AICD implants</td>
<td>44 (250)</td>
<td>35 (350)</td>
</tr>
<tr>
<td>Repeat procedure</td>
<td>54 (545)</td>
<td>7 (453)</td>
</tr>
</tbody>
</table>

P = 0.0001

< 30 mmHg

P < 0.00001

P < 0.0001
Septal Reduction in HOCM
Mortality: Meta-analysis ASA vs. Myectomy

Septal Reduction in HOCM
Timing of Septal Reduction

n=126 patients (55 post-ASA and 71 post-SM), 53±15 years, f-up 5±4 years after SRT

Septal Ablation in HOCM
Institutional Experience & Outcome

n = 1310 pts with ASA, First-50: 482 pts, 5.5±4.1 years, 7186 pt-y

Cardiovascular Death

Adverse events @30 days

Septal Reduction in HOCM
Hospital Volume Outcomes: Myectomy & ASA

n = 11248 pts (6386 SM, 4862 ASA): 59.9% ≤ 10 SM/y, 66.9% ≤ 10 ASA/y

Kim LK, et al. JAMA Cardiol 2016; 1(3):324-332
Septal Reduction in HOCM

Hospital Volume Outcomes: Myectomy & ASA

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Kim LK, et al. JAMA Cardiol 2016; 1(3):324-332
Septal Ablation in HOCM

Conclusions

• Alcohol septal ablation in HOCM has broadened the availability of septal reduction treatment including patients that would not be eligible or reject surgery

• Alcohol septal ablation in HOCM has been proven feasible, effective and safe when performed by experienced teams with clinical, imaging and interventional expertise

• Alcohol septal ablation and especially myectomy should be offered exclusively in high-volume centres, in order to maximise expertise and reduce complications and mortality

• Delay of treatment when the indication is given may be deleterious and should be avoided
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