Alcohol Septal Ablation for HOCM: Case selection

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Background

- Hypertrophic (obstructive) cardiomyopathy (HOCM/HCM) is characterized by:
  - hypertrophy of IVS (>12 mm)
  - narrowed LV outflow tract
  - systolic anterior motion of MV resulting in dynamic LV outflow obstruction (≈1/3rd)

- Is the most common genetic CV disease transmitted as autosomal dominant trait
- Occurs in 1 in 500 (≈0.2%) of general population
- In the USA there are currently 300,000 people with HOCM
- Most patients are identified in their 30’s and 40’s
- <1% of patients are referred for echocardiography
- Probably #1 cause of sudden cardiac death in young athlete
- More common in men; women likely to be severely disabled
Background

HOCM/HCM

Asymmetric septal hypertrophic (ASH) without obstruction (≈ 70%)

Asymmetric septal hypertrophic (ASH) with obstruction (≈ 30%)
Morphologic Features for Sudden Death

Disproportionate thickening of the ventricular septum (VS) with respect to left ventricular (LV) free wall; gross heart specimen from a 13-yr old.

Marked disarray of cardiac muscle cells in the disproportionately thickened VS forming typical disorganized architecture of HOCM.

LV myocardium showing several abnormal intramural coronary arteries with markedly thickened walls and narrowed lumen, dispersed.

Maron et al. JAMA 2002;287:1308
Clinical Manifestations

HOCM

Majority of patients are asymptomatic or only mildly symptomatic;

- Shortness of breath occurs in 90% of symptomatic patients due to increased LVEDP
- Fatigue, presyncope, syncope
- Chest pain on exertion in 75% of patients, due to demand-supply imbalance, epicardial coronaries are usually normal
- Rarely sudden death.
Implications of LV Outflow Tract Obstruction in HOCM

1,101 consecutive patients with HCM (outflow gradient ≥30 mmHg)

Maron et al., N Engl J Med 2003;348:298
Effect of LV Outflow Tract Obstruction and Age on Clinical Outcome in HOCM

<table>
<thead>
<tr>
<th>Freedom from CHF III-IV &amp; death (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Years after gradient measurement</td>
</tr>
<tr>
<td>0    2    4    6    8    10</td>
</tr>
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</table>

No. at Risk

<table>
<thead>
<tr>
<th>No obstruction, &lt;40 yr of age</th>
<th>349 251 206 146 103 80</th>
</tr>
</thead>
<tbody>
<tr>
<td>No obstruction, ≥40 yr of age</td>
<td>421 306 258 188 128 108</td>
</tr>
<tr>
<td>Obstruction, &lt;40 yr of age</td>
<td>106 70 52 37 21 15</td>
</tr>
<tr>
<td>Obstruction, ≥40 yr of age</td>
<td>118 74 51 29 18 10</td>
</tr>
</tbody>
</table>

Maron et al., NEJM 2003;348:295
Evaluation of LVOT Obstruction

Brockenbrough-Braunwald phenomenon – reliable sign of dynamic obstruction

Mechanism: increased ventricular filling overwhelming by increase in contractility; arterial pulse pressure fails to increase as expected (or decreases)

Dynamic obstruction during the strain phase of a Valsalva maneuver
LVOT Obstruction and Symptoms

Genetic disorder

HCM

ASH

SAM

HOCM

Mitral Regurgitation

Atrial Fibrillation

Pulmonary Hypertension

Low Cardiac Output

Intermittent Hypotension (Syncope)

Sudden Cardiac Death
Algorithm for Evaluating Patients with HCM with Significant Obstruction Based on the Severity of Symptoms

1. Hypertrophic Cardiomyopathy with Obstruction
   - Risk stratify for ICD (primary or secondary)
     - *All patients*

2. Symptoms of Heart Failure?
   - Severe
     - Medical therapy for all patients. Consider Surgical Myectomy or Alcohol Septal Ablation for symptoms that are refractory to medical therapy
   - Mild
     - Significantly reduced quality of life
       - Consider Further Testing:
         - *Cardiopulmonary exercise testing*
         - *6-minute walk test*
         - *KCCQ*
         - *NT-pro-BNP*
     - Reassuring
       - Medical therapy, longitudinal follow-up and testing
     - Non-reassuring
       - Objective testing may be useful if not clear if patient truly asymptomatic or not

3. Medical therapy, longitudinal follow-up and testing
   - None

Note: The diagram provides a flowchart for evaluating patients with hypertrophic cardiomyopathy with significant obstruction, based on the severity of symptoms. The algorithm includes risk stratification for ICD, assessment of heart failure symptoms, and consideration of further testing and medical interventions.
Clinical, Hemodynamic, and Morphologic Changes After ASA in HOCM

- Decrease in Septal Thickness
- Increase in Left Ventricular Outflow Tract
- Reduction in Systolic Anterior Movement
  - Decrease in LVOT Obstruction
  - Decrease in Mitral Regurgitation
  - Decrease in Left Atrial Diameter
    - Decrease in Left Ventricular End-diastolic Pressure
    - Decrease in Pulmonary Artery Pressure
    - Symptom Improvement
    - Prognosis Not Worsened
Alcohol Septal Ablation in HOCM

Results at Follow-up 3.0±1.3 Years

- Resting LVOT (mm Hg)
- Stress-induced LVOT (mm Hg)
- LVEF %
- Peak Oxygen Consumption (ml/kg/min)

Alcohol Septal Ablation in HOCM

Reduction in Septal Thickness (N=63)

Baseline  3 mo       1 year   2 years   3 years   4 years     5 years

Spencer, Clin Cardiol 2005;28:124
Alcohol Septal Ablation in HOCM

**Method**

- One or more septal perforators
- 1-5cc absolute (desiccated) alcohol
- Temporary pacemaker via RIJ
- Co-axial guide catheter to avoid trauma to LMCA
- Small short balloons (Maverick 1.5-2.5/9mm)
- Runthrough or BMW or any hydrophilic floppy wires
- Contrast echocardiography
- Liberal use of Versed and Morphine
- 1cc/min slow continuous alcohol infusion, guided by echo
- Measure gradient – catheter and echo
- In CCU for 2 days with TPM and then d/c once CKMB <60U
STEPS for Alcohol Septal Ablation (ASA) for HOCM

**Indications:**
1. Severe drug (β blockers/Ca ++ blockers/disopyramide) resistant symptoms of CHF (NYHA Class III-IV) or intolerance to drugs.
2. Drug-resistant angina (III-IV).
3. Syncope
4. Resting LVOT gradient >30 mmHg.
5. Provoked LVOT gradient >50 mmHg if resting gradient <30 mmHg.

**Procedure:**
1. If no PPM, a temporary pacemaker via right internal jugular vein.
2. Two arterial sheaths, 6 Fr and 5 Fr.
3. Two transducers to measure simultaneous LV and peripheral pressures.
4. 95% absolute alcohol (3-5 cc) available as 1 cc/ampoule.
5. Echo team for pre-procedure and intra-procedure myocardial contrast echo.
6. Finder/Whitney 190 cm wire.
7. 1.5/2.0/2.5-9 mm Maverick OTW balloon.

**Steps for Operator:**
1. Fr MP catheter in the LV and 6 Fr appropriate guide catheter for septal ablation. Measure the resting and post PVC gradients.
2. Baseline bloods including CPK/MB, troponin, chemistry and CBC.
3. IV Heparin bolus of 5000 unit and keep ACT = 275-300 sec.
4. Coronary angiography to define septal artery in RAO caudal and AP cranial views.
5. Wire the major septal and inflate the balloon and inject the echo contrast (Allixity) material to delineate the hypertrophied septum. Change the balloon position in the same septal or different septal artery until the correct septal artery is identified.
6. Document the balloon position in the septal artery without LAD comprise during balloon inflation by short cine of the left coronary artery.
7. Inject absolute alcohol through the lumen of inflated balloon no more than 1 cc/min.
8. Total balloon inflation time of at least 5 minutes.
9. Repeat echo and measure the LVOT gradient while the balloon is inflated and remove any residual alcohol from the lumen by additional saline flush.
10. If resting gradient <20 mmHg and post PVC gradient of <40 mmHg, deflate the balloon and finish the procedure after confirming LAD patency.

**Watch for following complications during procedure:**
1. Chest pain during alcohol injection (Rx with liberal use of IV morphine and Versed).
2. Brady arrhythmia-complete heart block (prophylactic temporary pacemaker).
3. Ventricular tachycardia/VF (keep the defib paddles charged).

**Post Procedure:**
1. Needs post intervention orders and admission to CCU; continue reduced dosage of pre-ASA negative inotropic meds and start aspirin 81 mg PO daily for one year.
2. Temporary pacemaker needs to be left in place for minimum of 48 hours and then can be removed if no paced rhythm. If still paced after 48 hours, then PPM should be implanted. PPM for unresolved CHF is required in 8-10% of cases.
3. Monitor CPK/MB Q 8 hrly x 24 hours and later if still rising, discharge when CKMB falls below <10x normal (<60 unit).
4. Transthoracic echo next day to evaluate resting gradient, LV function, and MR.

**To be expected:**
1. No. of arteries to be injected ~ 1.7
2. Mean volume of alcohol injection ~ 3 cc
3. Peak CPK release around 800 unit. Mean time to peak CPK rise 12 hours
4. Peak CPK rise correlated with the volume of ethanol injected
5. 10-20% of patients develop new conduction abnormalities (RIBBI, LAFB, LEBB)
6. 30% may develop transient CHB especially if patients have baseline (RBBB or LBBB)
7. 8-10% of patients may require PPM after ASA for persistent complete heart block
8. Resting gradient should decrease to < 10-20 mmHg
9. There will be additional 30% reduction in septal thickness over next 4-6 weeks on follow-up echo.
ASA: Safety and Complications

• In-hospital Mortality
  – 0.7% in North American Registry (n=874)
  – 0.7% in European Multi-center Registry (n=421)
  – 0.3% in Scandinavian Registry (n=313)

Data are similar to Surgical Myectomy mortality as shown in Mayo Clinic, Cleveland Clinic and Toronto General Hospital (i.e. <1%)
Complete Heart Block after ASA

- 261 consecutive pts
- 37 had PPM/AICD before ASA
- 14% (31/224) developed CHB and required PPM post-ASA
- 30 pts developed CHB in-hospital, 1 pt came back with CHB in 1 week

| Clinical and Echocardiographic Outcome of Pts Who Require vs Who did Not Require PPM |
|---------------------------------|-----------------|-----------------|-----------------|
| NYHA class improvement          | 1.76 ± 0.63     | 1.47 ± 0.74     | 0.09            |
| IVS reduction                   | 0.82 ± 0.67     | 0.56 ± 0.54     | 0.063           |
| % IVS reduction                 | 37 ± 20         | 27 ± 26         | 0.003           |
| Rest LVOTG reduction            | 56 ± 42         | 40 ± 37         | 0.07            |
| Increase in exercise duration(s) | 68 ± 149        | 102 ± 138       | 0.35            |

Chang et al., J Am Coll Cardiol 2003;42:296
Alcohol Septal Ablation Vs. Myectomy in HOCM

Average Pressure Gradients at Follow-up

Before          Immediately after   Follow-up at 3 months

Resting PG (mmHg)

P=NS

P<0.001

P<0.01

Qin et al., JACC 2001;38:1994
Alcohol Septal Ablation vs Myectomy

- No difference in short or long term survival
- No difference in functional status improvement
- No difference in NYHA heart failure class improvement
- No difference in arrhythmias
- No difference in rates of repeat procedures
- No difference in improvement of mitral regurgitation

- Higher need for pacemaker
- Higher residual gradients after ablation

“The choice of treatment strategy should be made after a thorough discussion of the procedures with the individual patient”
Survival After Alcohol Septal Ablation for Obstructive Hypertrophic Cardiomyopathy

Paul Sorajja, MD; Steve R. Ommen, MD; David R. Holmes, Jr, MD; Joseph A. Dearani, MD; Charanjit S. Rihal, MD; Bernard J. Gersh, MB, ChBDPhil; Ryan J. Lennon, MS; Rick A. Nishimura, MD

**Background**—The clinical efficacy of alcohol septal ablation for obstructive hypertrophic cardiomyopathy (HCM) has been demonstrated, but the long-term effects of the procedure remain uncertain. This study examined the survival of patients after septal ablation performed in a tertiary HCM referral center.

**Methods and Results**—We examined 177 patients (mean age, 64 years; 68% women) who underwent septal ablation at our institution. Over a follow-up of 5.7 years, survival free of all mortality was no different than the expected survival for a comparable general population, and similar to that of age- and sex-matched patients who underwent isolated surgical myectomy (8-year survival estimate, 79% versus 79%; \( P=0.64 \)). For the end point of documented sudden cardiac death or unknown cause of death, the incidence per 100 person-year follow-up was 1.31 (95% confidence interval, 0.60–2.38). Residual left ventricular outflow tract gradient after ablation was an independent predictor of long-term survival free of any death.

**Conclusions**—In this nonrandomized study of carefully selected patients undergoing septal ablation by experienced operators in a tertiary referral HCM center, long-term survival was favorable and similar to that of an age- and sex-matched general population, and to patients undergoing surgical myectomy, as well, without an increased risk of sudden cardiac death. *(Circulation. 2012;126:2374-2380.)*
Survival After Alcohol Septal Ablation

Sorajja et al., Circulation 2012;126:2374
<table>
<thead>
<tr>
<th>First Author, Year</th>
<th>Country</th>
<th>Period</th>
<th>n</th>
<th>Mean Follow-Up, yrs</th>
<th>Mean Age, yrs</th>
<th>Peri Mortality, %</th>
<th>Peri (A)SCD, %</th>
<th>Pacemaker, %</th>
<th>Mean LVOTG, mm Hg</th>
<th>REDO, %</th>
<th>All-Cause Mortality (Annual), %</th>
<th>(A)SCD (Annual), %</th>
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<td>Agarwal, 2010</td>
<td>6 countries</td>
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<td>—</td>
<td>55/49</td>
<td>NS</td>
<td>NS</td>
<td>DR: 2.6 (favors SM)</td>
<td>SMD 0.45 (favors SM)</td>
<td>NS</td>
<td>—</td>
<td>—</td>
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<tr>
<td>ten Cate, 2010</td>
<td>the Netherlands</td>
<td>1999-2007</td>
<td>91/40</td>
<td>5.4/6.6</td>
<td>54/49</td>
<td>2.2/0</td>
<td>5.5/0</td>
<td>4/3</td>
<td>8/-</td>
<td>11/5</td>
<td>1.8/0.8</td>
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<td>Soraja, 2012</td>
<td>United States, Rochester</td>
<td>1983-2010</td>
<td>177/177</td>
<td>5.7/5.7</td>
<td>63/62</td>
<td>1.1/0.6</td>
<td>1.7/0.6</td>
<td>22/4</td>
<td>13/-</td>
<td>9/1</td>
<td>2.5/2.4</td>
<td>1.3/1.1</td>
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<tr>
<td>Steggerda, 2014</td>
<td>the Netherlands</td>
<td>1981-2010</td>
<td>161/102</td>
<td>5.1/9.1</td>
<td>59/56</td>
<td>1.2/2.0</td>
<td>2.5/0</td>
<td>7/9</td>
<td>19/10</td>
<td>6/1</td>
<td>1.5/2.2</td>
<td>—</td>
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<tr>
<td>Vriesendorp, 2014</td>
<td>Belgium and the Netherlands</td>
<td>1990-2012</td>
<td>316/250</td>
<td>6.3/7.9</td>
<td>58/52</td>
<td>1.6/1.2</td>
<td>3.1/0.4</td>
<td>—</td>
<td>10/9</td>
<td>10/2</td>
<td>1.9/2.0</td>
<td>1.0/0.8</td>
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<td>Samardhi, 2014</td>
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<td>47/23</td>
<td>3.6/3.8</td>
<td>57/47</td>
<td>0/8.7</td>
<td>4.3/0</td>
<td>15/13</td>
<td>27/13</td>
<td>17/0</td>
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<td>Sedehi, 2015</td>
<td>United States, Stanford</td>
<td>1972-2006</td>
<td>52/171</td>
<td>3.2/13.7</td>
<td>57/48</td>
<td>0/2.9</td>
<td>—</td>
<td>8/6</td>
<td>36/34</td>
<td>—</td>
<td>1.2/1.0</td>
<td>—</td>
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<td>Liebregts, 2015</td>
<td>16 countries</td>
<td>1963-2013</td>
<td>2,013/2,791</td>
<td>6.2/7.4</td>
<td>56/47</td>
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<td>—</td>
<td>8/2</td>
<td>1.5/1.4</td>
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<td>Yang, 2015</td>
<td>China</td>
<td>2001-2014</td>
<td>22/37</td>
<td>3.0/3.0</td>
<td>46/45</td>
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<td>0/0</td>
<td>—</td>
<td>5/0</td>
<td>1.5/0.9</td>
<td>0/0.9</td>
</tr>
</tbody>
</table>

Liebregts et al., J Am Coll Cardiol 2017;70:481
Decision Tree for Patients with Obstructive HCM and Complicating Patient Factors

Adult patient with medical therapy resistant obstructive HCM

Surgical necessity?
- Mitral valve pathology
- Three-vessel disease
- Mid-cavity obstruction by papillary muscles

NO

Presence of suitable perforator for ASA?

YES

Pro myectomy
- Less suitable septal anatomy for ASA
- Pre-existent LBBB

NO

Pro ASA
- Moderate AVI
- Pre-existent RBBB
- (Pre-existent CHB)

YES

Surgical myectomy
± Valve surgery ± CABG

Patient preference

Alcohol septal ablation

FIT

FOR

SURGERY

NO

• MitraClip (± ASA)
• PCI + ASA
• Conservative treatment

NO

NO

YES

YES

NON
Survival After Alcohol Septal Ablation in Patients With Hypertrophic Obstructive Cardiomyopathy

Angelika Batzner, MD, Barbara Pfeiffer, MD, Anna Neugebauer, MD, Daa Aicha, MD, Christoph Blank, MD, Hubert Seggewiss, MD
Overall Survival with 95% CI After PTSMA in 952 Patients

Analysis after PTSMA estimated:
- 5-yr survival of 95.8%
- 10-yr survival of 88.3%
- 15-yr survival of 79.7%

Estimated Survival Free of Cardiac Events with 95% CI After PTSMA in 952 Patients

Analysis after PTSMA estimated:
- 5-yr survival free of cardiac events - 98.9%
- 10-yr survival free of cardiac events - 88.3%
- 15-yr survival free of cardiac events - 79.7%

Batzner et al., J Am Coll Cardiol 2018;72:3087
Survival After Alcohol Septal Ablation in Patients With Hypertrophic Obstructive Cardiomyopathy

CONCLUSIONS In this study, PTSMA could be proofed as a safe procedure with ongoing symptomatic improvement and excellent long-term survival. Therefore, PTSMA is a reasonable alternative to surgical myectomy in HOCM. (J Am Coll Cardiol 2018;72:3087-94) © 2018 by the American College of Cardiology Foundation.
Outcomes of Alcohol Septal Ablation in Younger Patients With Obstructive Hypertrophic Cardiomyopathy

Max Liebregts, MD, Lothar Faber, MD, Morten K. Jensen, MD, Pieter A. Vriesendorp, MD, PhD, Jaroslav Januska, MD, Jan Krejci, MD, PhD, Peter R. Hansen, MD, DMSc, PhD, Hubert Seggewiss, MD, Dieter Horstkotte, MD, Radka Adlova, MD, Henning Bundgaard, MD, DMSc, Jurriën M. ten Berg, MD, PhD, Josef Veselka, MD, PhD
Survival Free of Adverse Arrhythmic Events Following ASA (n=1,197)

Long-term (>30 days) AAE Rates following ASA:
- Young (≤50 yrs) = 0.8%
- Middle-Age (51-64 yrs) = 0.8%
- Older (≥65 yrs) = 1.0%

Approximately 2/3 of AAEs were fatal in both young and older patients

No independent predictors of AAEs in young and middle-age patients

Older patients, ≥2 conventional risk factors for SCD predicted AAEs during long-term f/u

ICD implantation following ASA was more common in young compared to older patients (6% vs 3%, p=0.04)

*Liebregts et al., J Am Coll Cardiol Intv 2017;10:1134*
How to Choose Between Alcohol Septal Ablation and Surgical Myectomy?

<table>
<thead>
<tr>
<th>Alcohol Septal Ablation</th>
<th>Surgical Myectomy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Adults and elderly</td>
<td>Children and adolescents</td>
</tr>
<tr>
<td>Septal bulge</td>
<td>Mitral valve intervention</td>
</tr>
<tr>
<td>Right bundle branch clock</td>
<td>Left bundle branch block</td>
</tr>
<tr>
<td>Previous cardiac surgery</td>
<td>Low operative risk</td>
</tr>
<tr>
<td>Expert interventional team</td>
<td>Expert surgical team</td>
</tr>
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</table>
## Alcohol Septal Ablation Vs. Myectomy in HOCM

### Procedural Data and Choice at MSH

<table>
<thead>
<tr>
<th></th>
<th>Alcohol Septal Ablation (ASA)</th>
<th>Surgical Myectomy (SM)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length of stay (days)</td>
<td>4 ± 2</td>
<td>8 ± 3</td>
</tr>
<tr>
<td>PPM</td>
<td>Higher (12%)</td>
<td>Lower (4%)</td>
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<tr>
<td>Procedure mortality</td>
<td>&lt;1%</td>
<td>&lt;1%</td>
</tr>
<tr>
<td>Available F/U (yrs)</td>
<td>&gt;8</td>
<td>&gt;30</td>
</tr>
<tr>
<td>Septal thickness (mm)</td>
<td>14-28</td>
<td>&gt;25</td>
</tr>
<tr>
<td>Treatment of choice</td>
<td>Elderly with co-morbidities and no significant MR</td>
<td>Young with no comorbidities and other valve disease/CAD</td>
</tr>
</tbody>
</table>
Newer Techniques of Septal Ablation in HOCM

1. Coil embolization

2. Radiofrequency ablation

3. Cryoablation

4. Covered stent in LAD over septal

5. MitraClip in patients with only modest septal hypertrophy
Management of ASH to Facilitate TAVR

A – ASH present on TEE
B – LVOT gradient
C – Upper septal contrast enhancement following contrast injection in septal artery
D – TEE image of reduced upper septum post-ASA (4 weeks post ablation)
E – Fluoroscopic image of coronary wire in a large septal branch with over-the-wire balloon during ASA
F – Successful occlusion of the septal artery
G – Reduced LVOT gradient post-ASA
H – Fluoroscopic view of CoreValve post-implantation
I – Experience and Outcomes with this Management Strategy

<table>
<thead>
<tr>
<th>Patient</th>
<th>IVS Thickness (cm)</th>
<th>Peak LV Gradient (mmHg)</th>
<th>ASA Procedural Success</th>
<th>Needfor Pacemaker</th>
<th>IVS Thickness post ASA (cm)</th>
<th>Valve Type</th>
<th>TAVR Procedural Success</th>
<th>Paravalvular Leak</th>
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<tbody>
<tr>
<td>1</td>
<td>1.6</td>
<td>None</td>
<td>Unsuccessful</td>
<td>Yes, post TAVR</td>
<td>1.6</td>
<td>Balloon expandable</td>
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<td>Trivial</td>
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<tr>
<td>2</td>
<td>2.4</td>
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<td>Successful</td>
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<td>1.3</td>
<td>Balloon expandable</td>
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<tr>
<td>3</td>
<td>2.3</td>
<td>60</td>
<td>Successful</td>
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<td>1.5</td>
<td>Self-expanding valve-in valve</td>
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<tr>
<td>4</td>
<td>1.6</td>
<td>33</td>
<td>Successful</td>
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<td>1.4</td>
<td>Self-expanding</td>
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<td>5</td>
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<td>None</td>
<td>Successful</td>
<td>No</td>
<td>1.4</td>
<td>Self-expanding</td>
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<tr>
<td>6</td>
<td>1.7</td>
<td>41</td>
<td>Successful</td>
<td>No</td>
<td>1.2</td>
<td>Self-expanding</td>
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<td>None</td>
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<tr>
<td>7</td>
<td>1.6</td>
<td>69</td>
<td>Successful</td>
<td>No</td>
<td>1.0</td>
<td>Balloon expandable</td>
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<td>None</td>
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<tr>
<td>8</td>
<td>1.7</td>
<td>20</td>
<td>Successful</td>
<td>Yes, post TAVR</td>
<td>1.2</td>
<td>Self-expanding</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>9</td>
<td>2.0</td>
<td>None</td>
<td>Successful</td>
<td>No</td>
<td>1.2</td>
<td>Self-expanding</td>
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<td>10</td>
<td>1.6</td>
<td>30</td>
<td>Successful</td>
<td>Yes</td>
<td>1.2</td>
<td>Self-expanding</td>
<td>Yes</td>
<td>None</td>
</tr>
<tr>
<td>Parameter</td>
<td>Value</td>
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<tr>
<td>Mean age (years) / Female gender (%)</td>
<td>55 ± 12 / 72</td>
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<tr>
<td>Baseline resting gradient mean (mm Hg)</td>
<td>42 ± 15</td>
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<tr>
<td>Baseline post-PVC gradient (mm Hg)</td>
<td>90 ± 22</td>
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<tr>
<td>Post ASA resting gradient (mm Hg)</td>
<td>10 ± 6</td>
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<tr>
<td>Post ASA post-PVC gradient (mm Hg)</td>
<td>28 ± 16</td>
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<tr>
<td>Alcohol dose (cc)</td>
<td>2.5 (1-5)</td>
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<tr>
<td>Peak CPK/ peak MB (U/L)</td>
<td>1600 ± 520 / 162 ± 42</td>
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<tr>
<td>Need for permanent pacemaker</td>
<td>10</td>
<td></td>
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<tr>
<td>In-hospital death</td>
<td>1 pt (ref VT)</td>
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<tr>
<td>Average LOS (days)</td>
<td>3 ± 1</td>
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<tr>
<td>5Yr need for re-ASA (%)</td>
<td>4.5% (1 SM)</td>
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Alcohol Septal Ablation for Obstructive Hypertrophic Cardiomyopathy: Key Messages

- Patients undergoing ASA have similarly low long-term mortality and (aborted) sudden cardiac death rates compared with patients undergoing myectomy.
- 1/10 patients require a permanent pacemaker following ASA compared with 1/25 following myectomy.
- ASA and myectomy have comparable 30-day mortality rates.
- Alcohol volumes for ASA between 1.5 mL and 2.5 mL were found to be well balanced in terms of efficacy and safety for most patients.
- 1/13 ASA patients require reintervention, 5x the risk following myectomy.

Liebregts et al., J Am Coll Cardiol 2017;70:481