Alcohol Septal Ablation for Hypertrophic Obstructive Cardiomyopathy

Alcohol Septal Ablation (ASA)

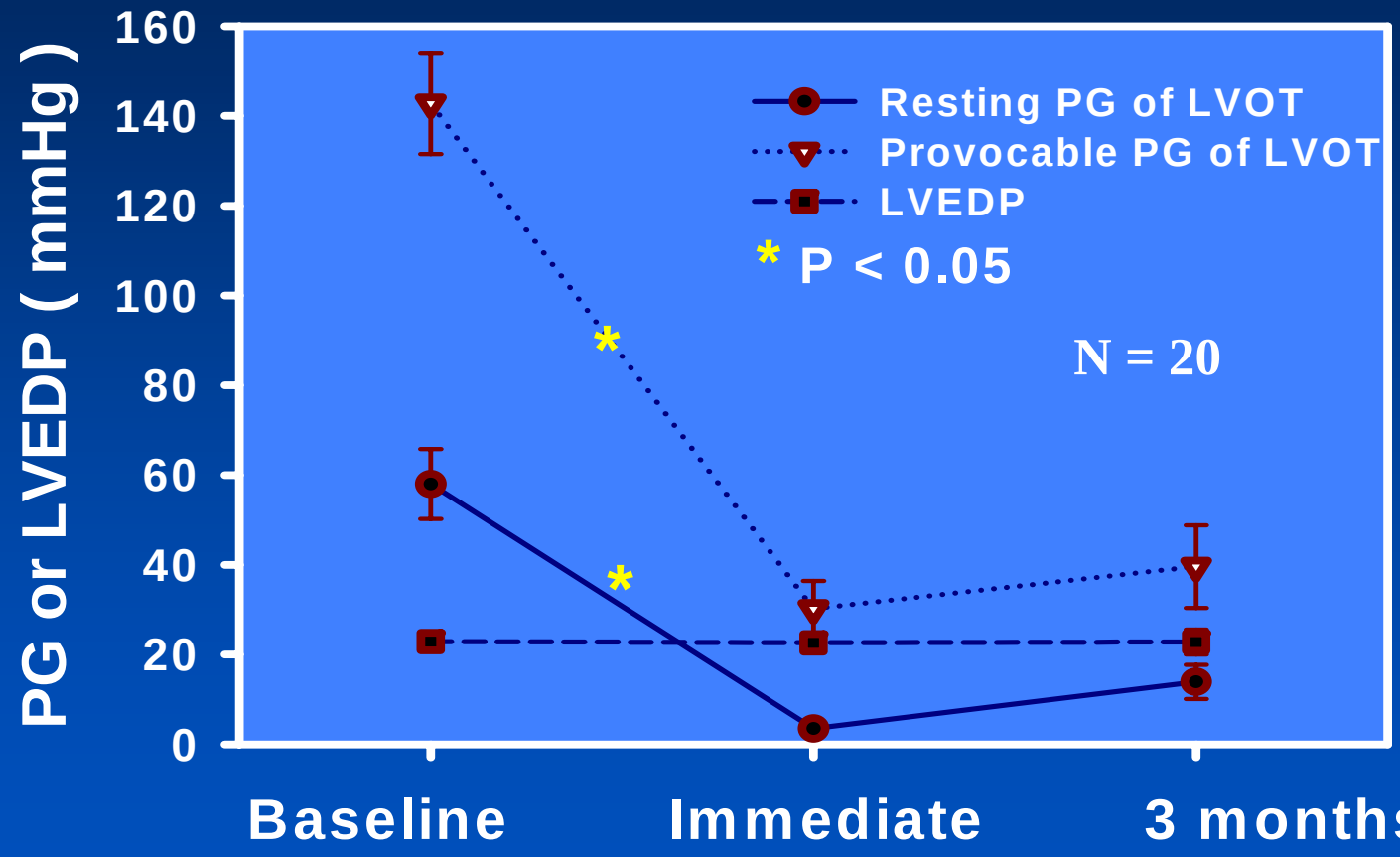
- Nonsurgical technique for septal myocardial reduction
- Dramatic hemodynamic improvement
- Technically easy to interventional cardiologists

ASA therapy has been increasingly used for patients with HOCM unresponsive to medical treatment (until now, ~3,500 cases worldwide).

Limitations of AST

- Potential serious complications:
  - a large infarct
  - complete AV block
  - ventricular tachyarrhythmia
- Hemodynamic recurrence

Hemodynamic Recurrence



SJ Park et al. Am J Cardiol 1999:83:1220-3

Purpose

- To investigate the incidence and determinants of hemodynamic recurrence after successful ASA therapy
- To investigate the impact of ethanol dose on hemodynamic recurrence and clinical outcomes

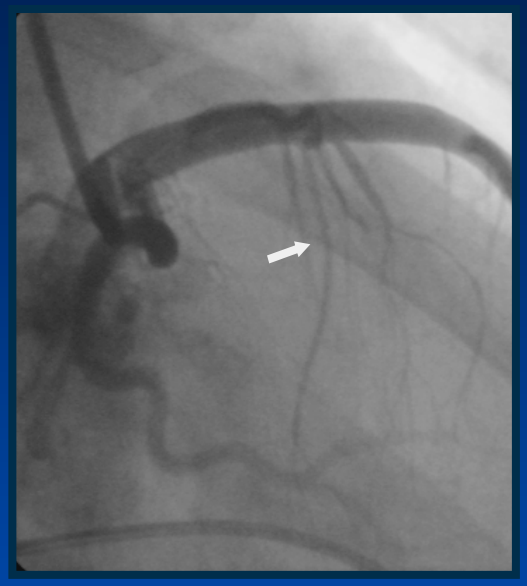
Indications

- Symptomatic patients (≥NYHA FC II) with HOCM unresponsive to medical therapy
- Significant LVOT obstruction: resting > 30mmHg or provocable > 50mmHg
- Basal septal thickness > 15mm

Study Patients

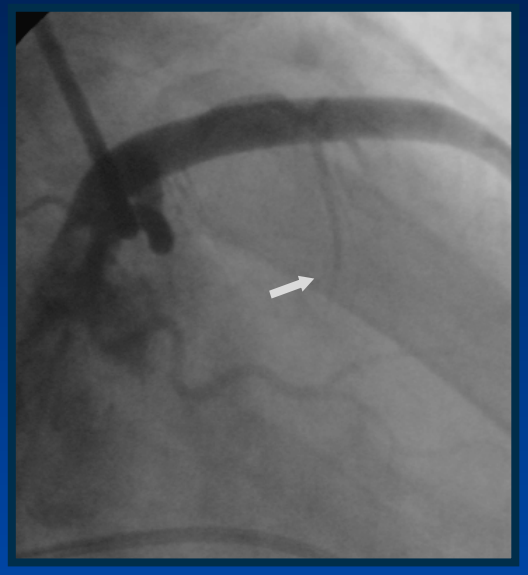
Between December 1996 & March 2004, 37 patients (20 females, 17 males) with symptomatic HOCM

Procedure of ASA



Target Artery

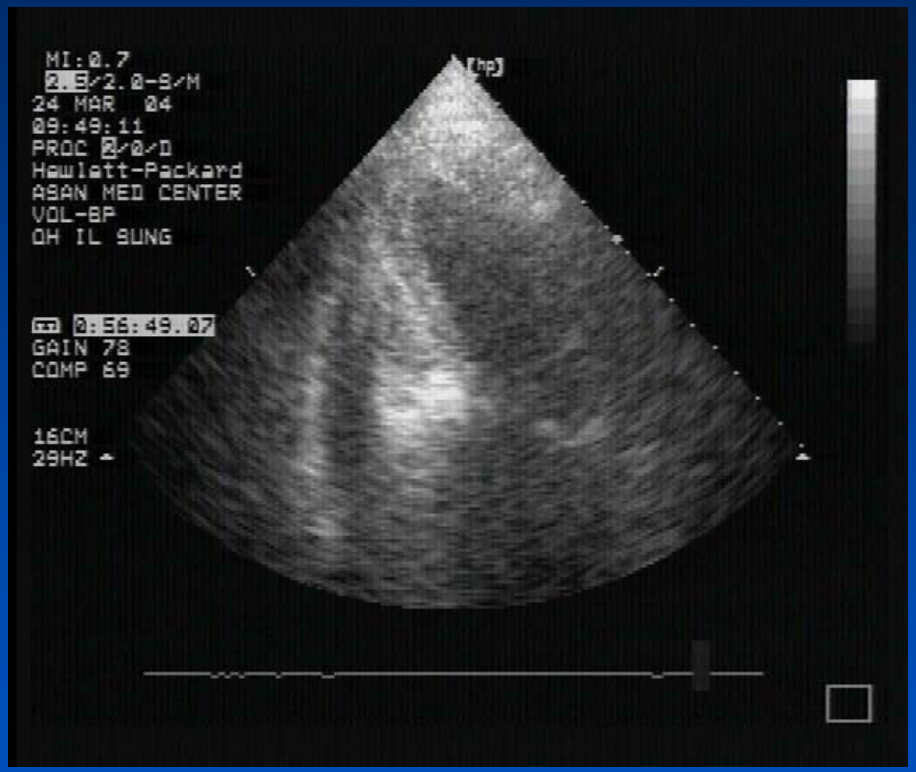
Balloon

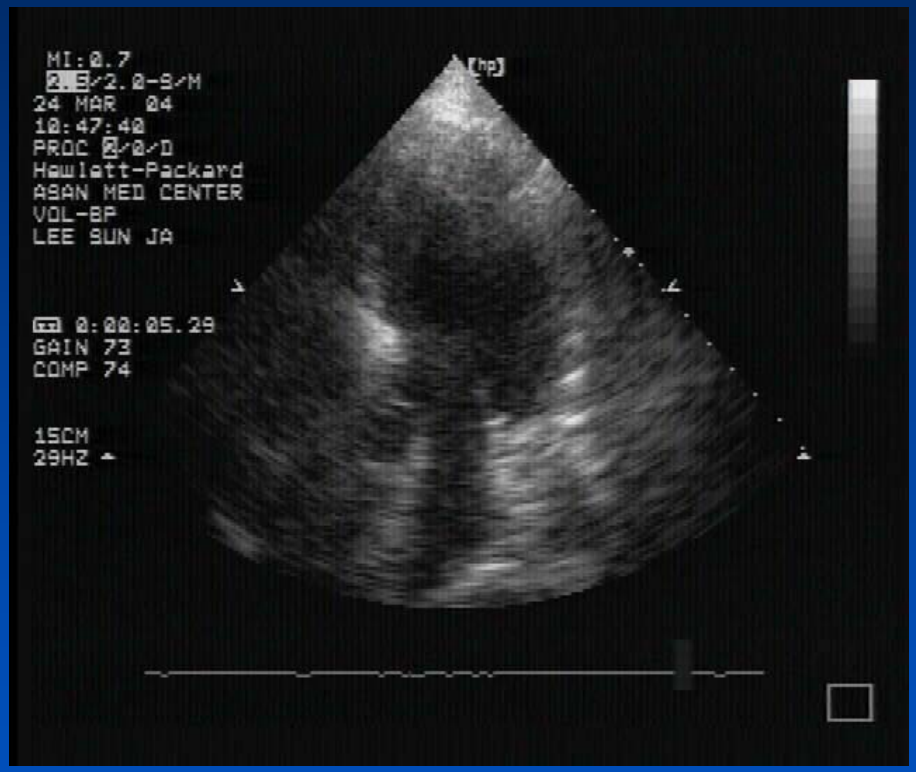


No Reflow

Absolute alcohol (usually 2-3ml) was slowly injected through the lumen of the inflated balloon into the septal artery & left for 5 minutes before the balloon is deflated.

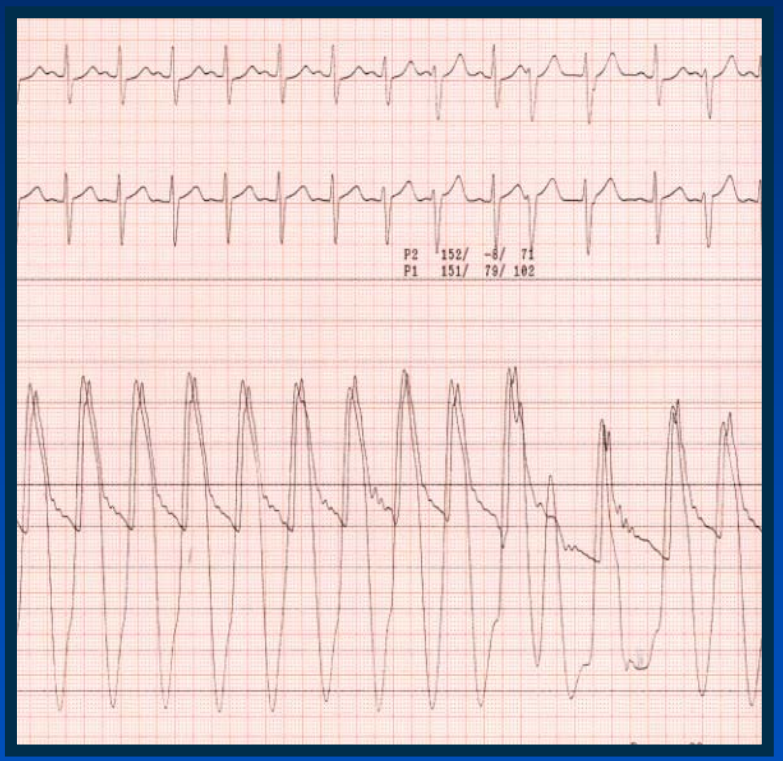
Myocardial Contrast Echocardiography (MCE)





MCE was used to select the target artery,
which supply the septal myocardium to be ablated.

Pressure Recording



Before Ablation

After Ablation

Post-ablation Management

- Patients were observed in the intensive care unit for 1-3 days.
- ECG and cardiac enzymes were carefully monitored.
- Discharge : usually 7 days after the ASA

Procedure Summary

- Target artery:

  1st septal branch; 31 (80%)

  2nd septal branch; 6 (15%)

  >1 septal branches; 3 (8%)

- Alcohol amount: 3.7 ± 2.1ml (1~10)
- Use of MCE: last 16 cases (43%)

Follow Up

- **Clinical follow-up every 3 months**
- **Echocardiographic follow-up**
  before discharge, 3-6 months and 1 year after the procedure, and thereafter when clinically indicated

Therapeutic Effects

- Procedural success (relief of symptoms and reduction of LVOT pressure gradient >50% of baseline at Cath. Lab): 35 patients of 37 patients who received AST (95%)

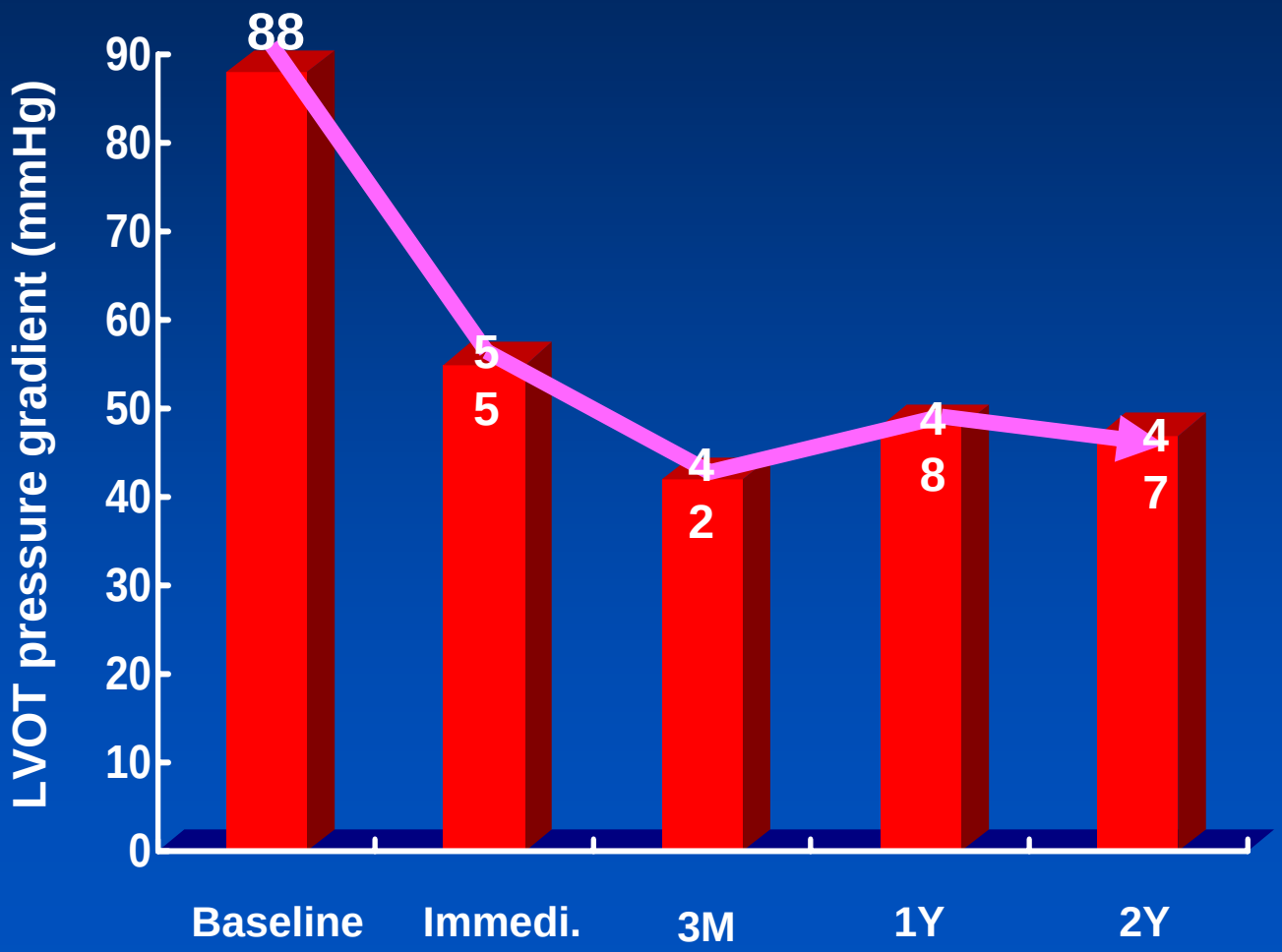
- Symptomatic improvements(NYHA FC≥ grade 1): 31 patients of 35 patients with procedural success (88%)

Echocardiographic Data

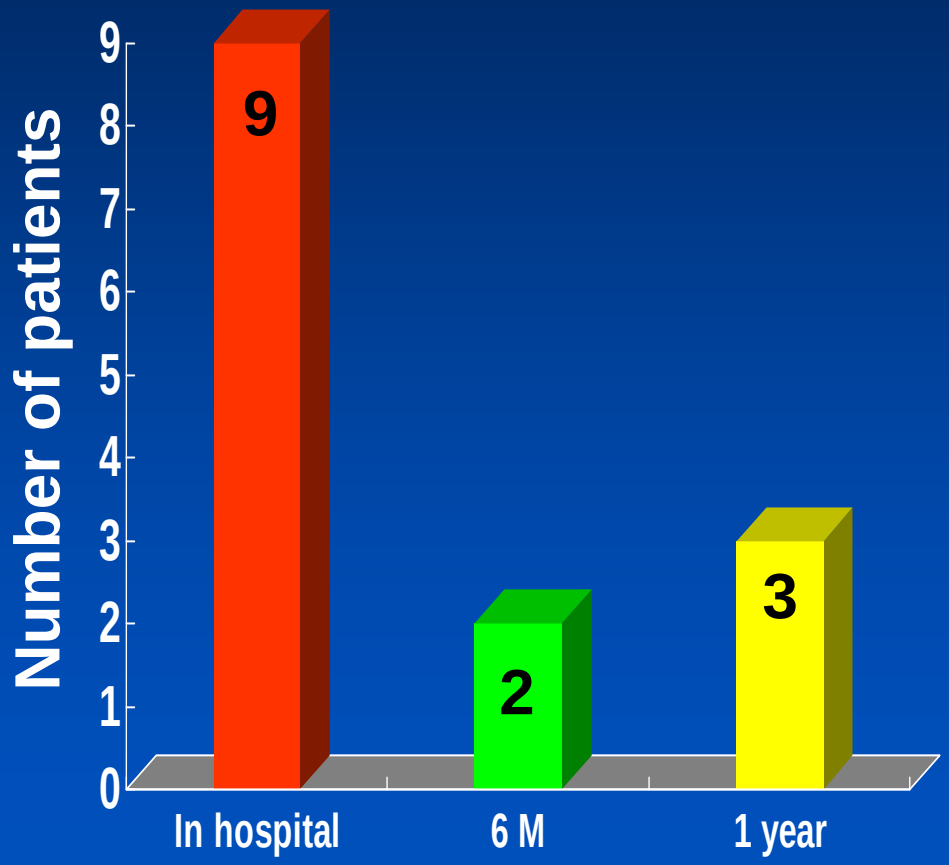
	Baseline	Imme. post-procedure	3 months after procedure	1 year after procedure
LVESD (mm)	23.3 ± 5.6	23.4 ± 4.7	25.9 ± 5.3*	26.5 ± 5.6*
LVEDD (mm)	41.7 ± 7.5	41.9 ± 6.4	45.1 ± 6.8*	45.3 ± 6.5*
IVS (mm)	22.0 ± 5.0	21.7 ± 4.8	18.6 ± 4.4*	18.4 ± 4.9*
LVPW (mm)	12.7 ± 2.3	12.4 ± 1.9	11.9 ± 2.5	11.9 ± 2.4
LA (mm)	47.0 ± 7.4	44.9 ± 6.1	46.6 ± 8.2	47.2 ± 7.5
LVOT PG (mmHg)	88.1 ± 45.8	55.3± 40.9*	42.1 ± 49.0*	48.2 ± 40.3*

*p<0.05

Evolution of LVOT PG Doppler echocardiogram



Hemodynamic Recurrence



Definition:

defined as re-elevation of LVOT pressure gradient ≥50% of baseline after successful procedure

Of 35 patients with successful procedure, 14 patients (40%) had recurrence of LVOT obstruction.

Determinants of Hemodynamic Recurrence

	Recurrence (n=14)	No Recurrence (n=21)	p-Value
F/U duration (month)	56.5±30.3	62.5±30.2	NS
Age (year)	52.8±11.2	46.6±9.1	NS
NYHA Class, initial	2.6±0.8	2.1±0.9	NS
NYHA Class, F/U	1.2±0.6	0.7±0.8	NS
MCE, n(%)	8(57.1%)	7(33.3%)	NS

Determinants of Hemodynamic Recurrence

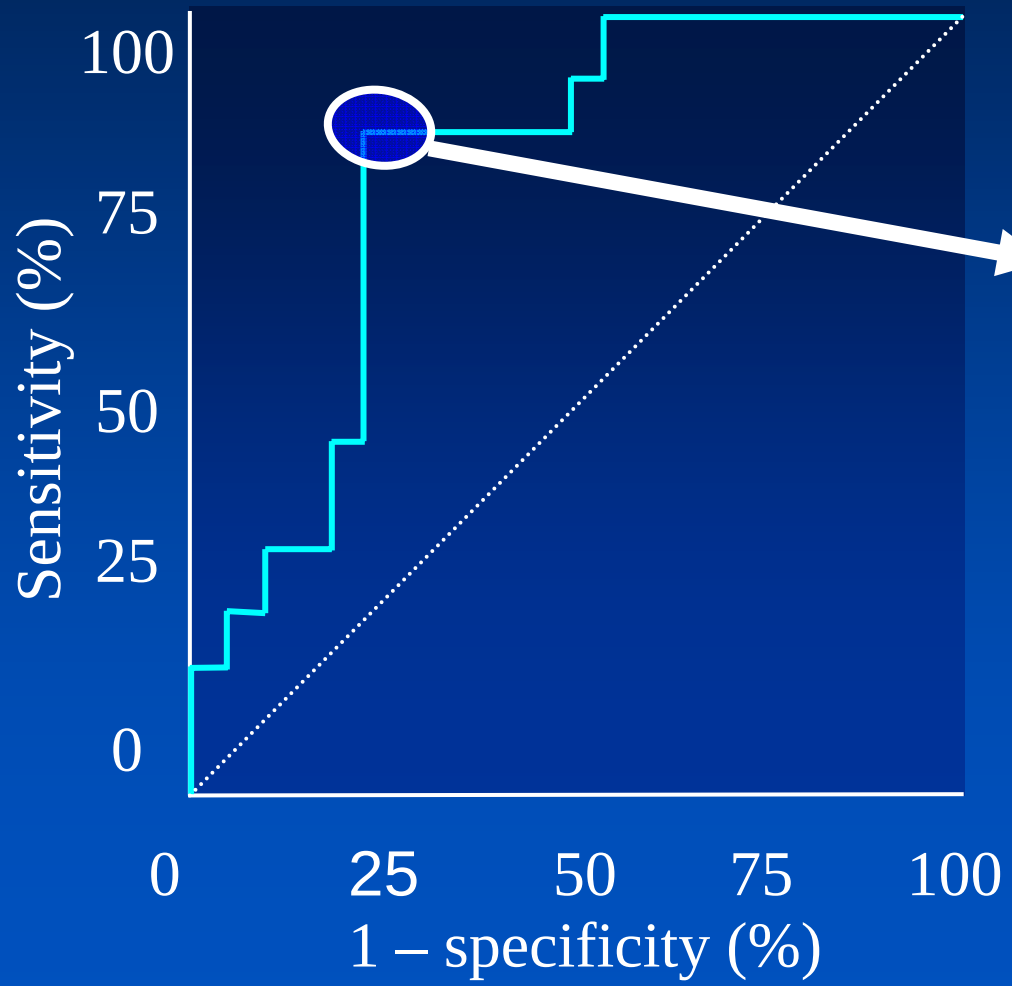
	Recurrence (n=14)	No Recurrence (n=21)	p-Value
Alcohol (ml)	3.1±2.0	4.2±2.2	NS
Peak CK (U/L)	949±429	2125±1510	<0.05
IVS (mm)	18.9±4.2	23.0±6.8	<0.05
Resting LVOT PG (mmHg)	79.9±32.0	49.6±32.1	<0.05

Recurrence of LVOT Obstruction

Independent determinant of hemodynamic Recurrence of LVOT obstruction :

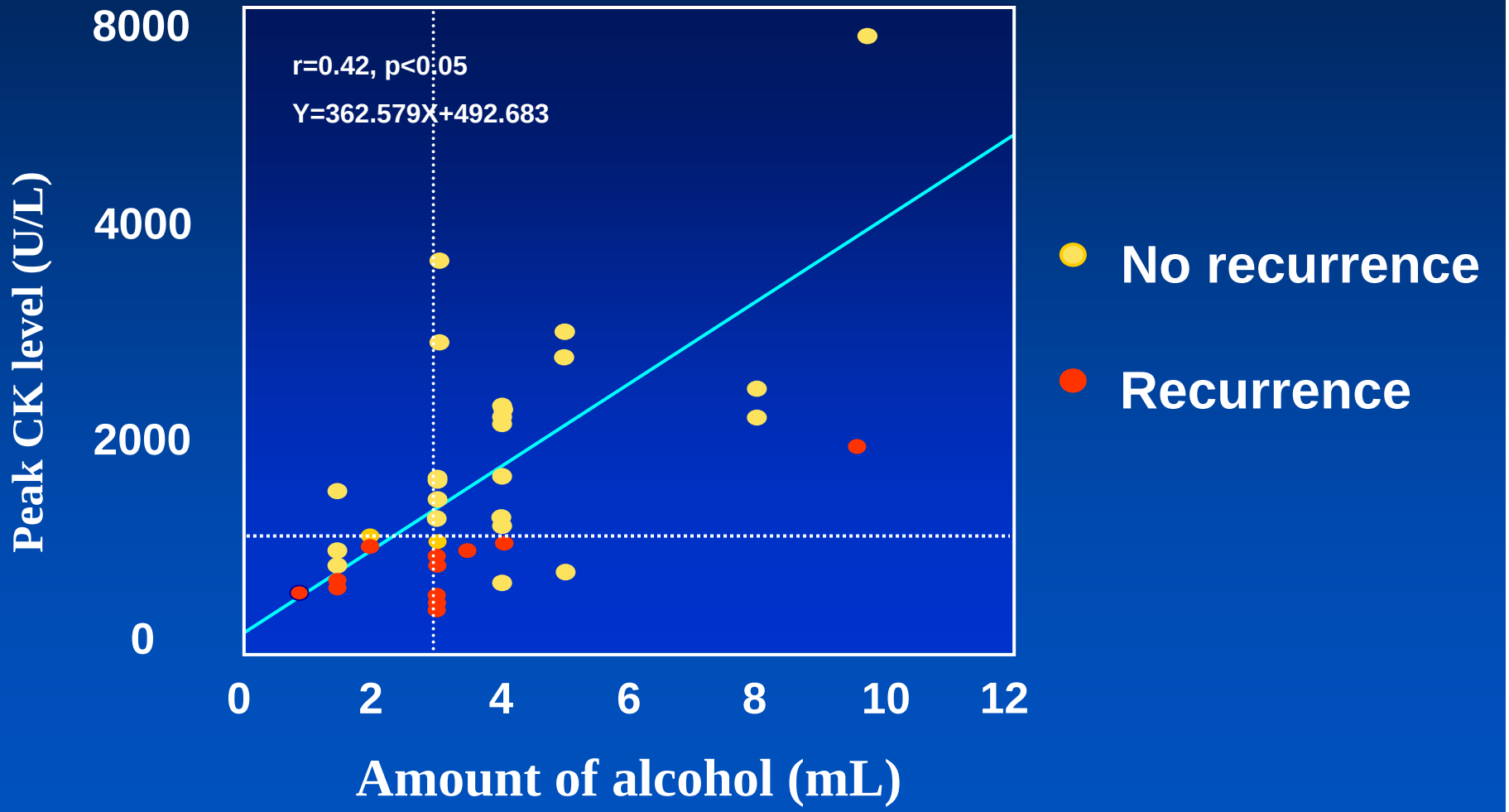
Lower CK level (<1,100 U/L) (OR 27.7, p<0.05, 95%CI 1.9-403.1)

Recurrence of LVOT Obstruction



For the prediction of hemodynamic recurrence

Recurrence of LVOT Obstruction



Early Complications

- Death due to intractable VT: 1 (3%)
- LAD infarct: 2 (5%)
- CAVB: permanent 5 (14%), transient 18 (49%)

Predictors of Major Complications

- **Major complications**

(cardiac death, LAD infarction,CAVB):

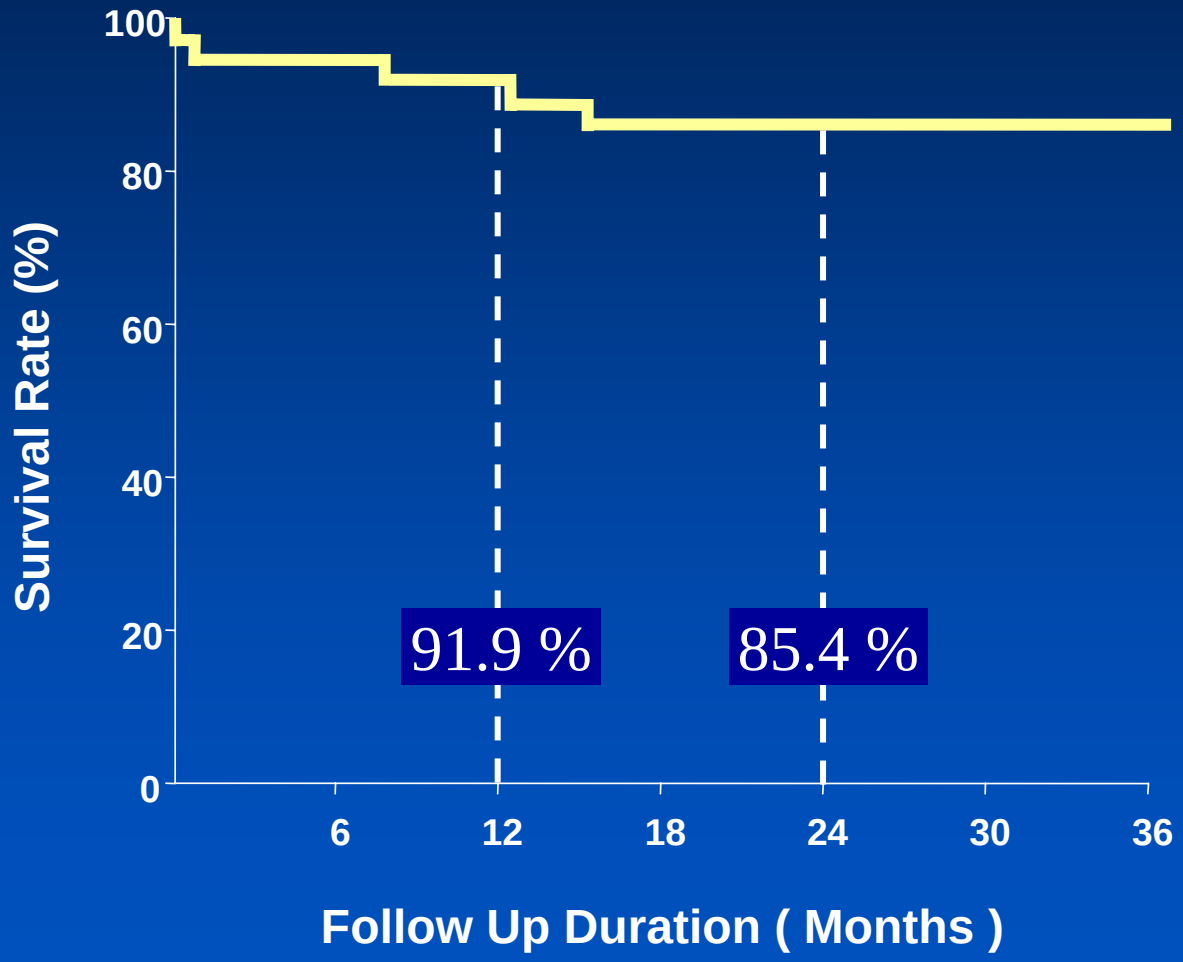
- peak CK level > 2,000 U/L (50.0% vs. 22.2%, p<0.05)
- amount of alcohol≥4ml (70.0% vs. 25.9%, p<0.05)

- **Amount of alcohol injection≥4ml** was an independent determinant of major complications. (OR 15.33, 95% CI : 1.53-163.55, p<0.05)

Long-term Follow up

- Follow up duration : 20.6 ± 8.9 months
- All cause death : 5 patients
  - Cardiac death 3 patients
    (peri-procedural death : 1 patients)
  - Non cardiac death 2 patients
- Symptomatic improvement : 26/37 patients (70%)
- Symptomatic ventricular tachycardia : 0 patients
- Myocardial infarction : 3 patients

Survival Curve



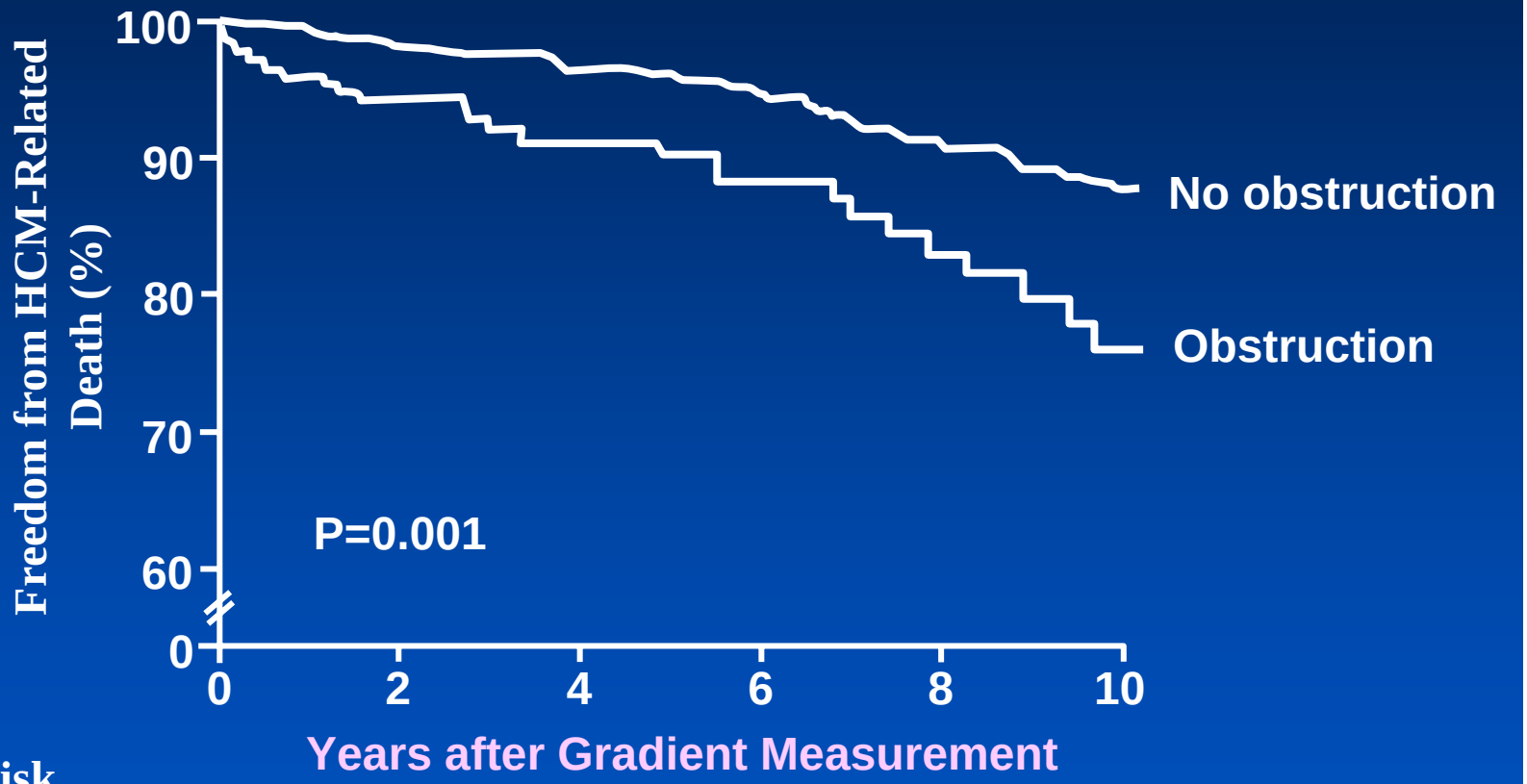
Conclusions

- AST is a promising nonsurgical technique for septal myocardial reduction in HOCM.
- Major complications was related to a large amount of alcohol injection (>4 ml), and hemodynamic recurrence was related to insufficient infarction.
- Taken together, target artery and ethanol dose (2-3ml) should be carefully selected to get the therapeutic benefits without major complications.

Hypertrophic Obstructive Cardiomyopathy

- Left ventricular(LV) outflow obstruction is an important determinant of symptoms
- Therapies that reduce the LV outflow pressure gradient may improve LV filling pressure and symptoms

Effect of LVOT on Clinical Outcome in HCMP



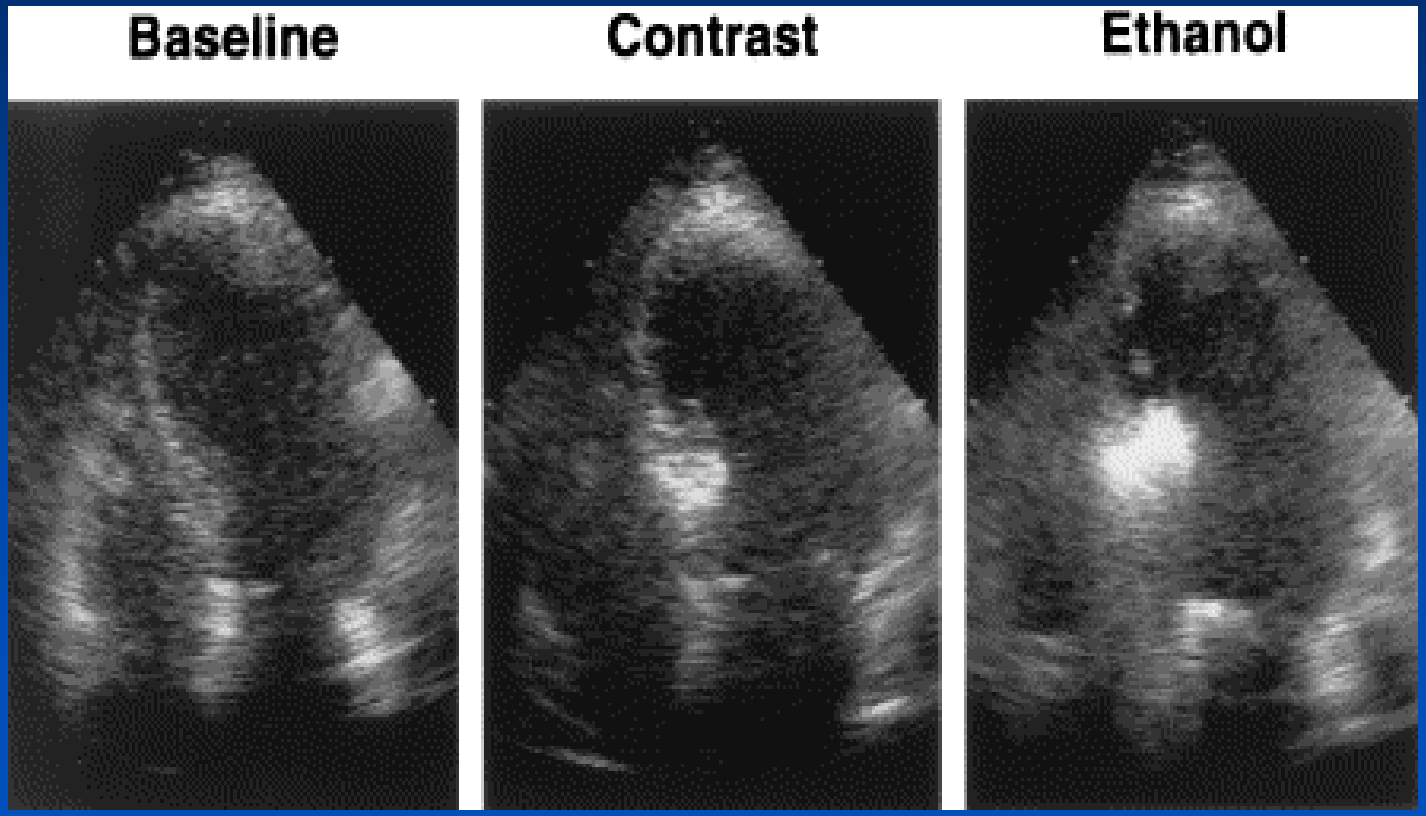
No. at Risk						
No obstruction	828	594	495	360	247	201
obstruction	273	178	130	84	54	35

NEJM 2003;348:295-3

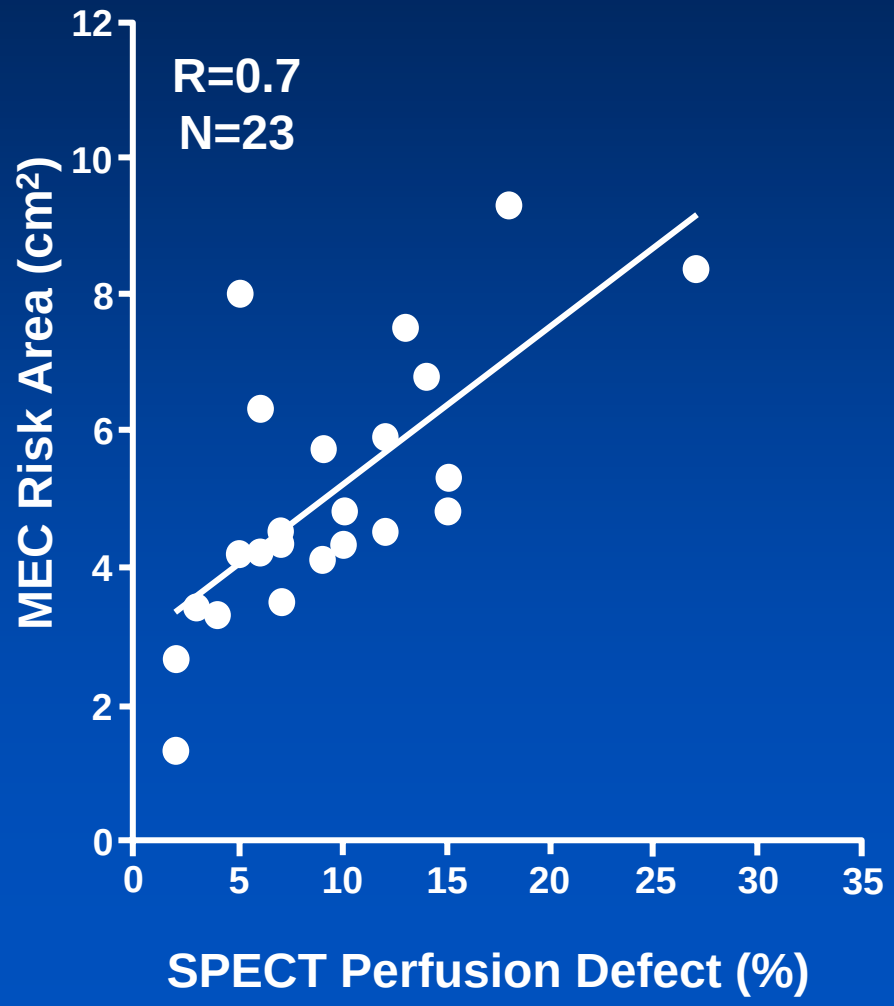
Indication for ASA

- **Medically refractory symptoms**
- **LV outflow pressure gradient:**
  basal condition > 30 mmHg
  provocative maneuver > 50 mmHg

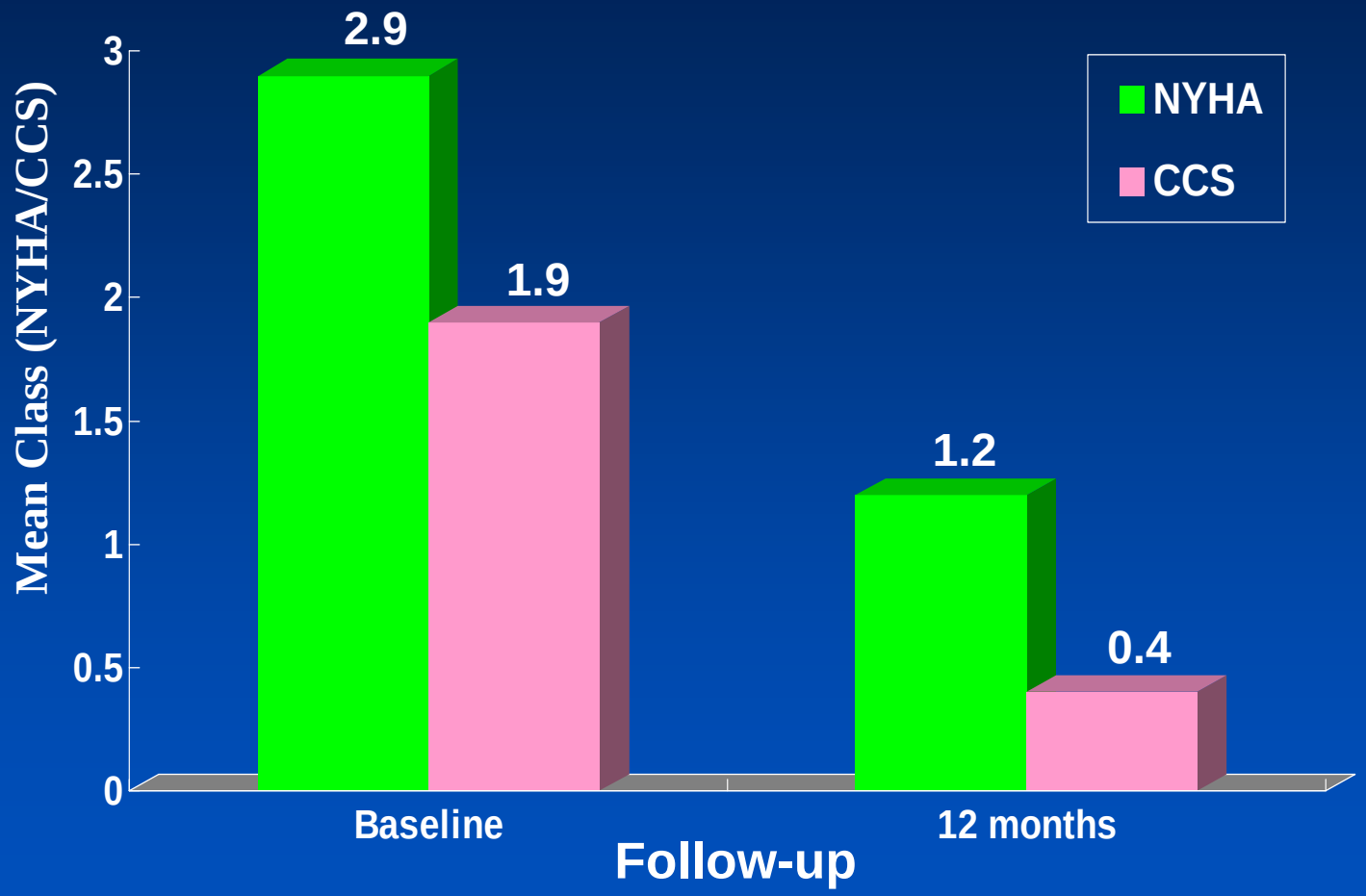
Myocardial Contrast Echocardiography



Myocardial Contrast Echocardiography



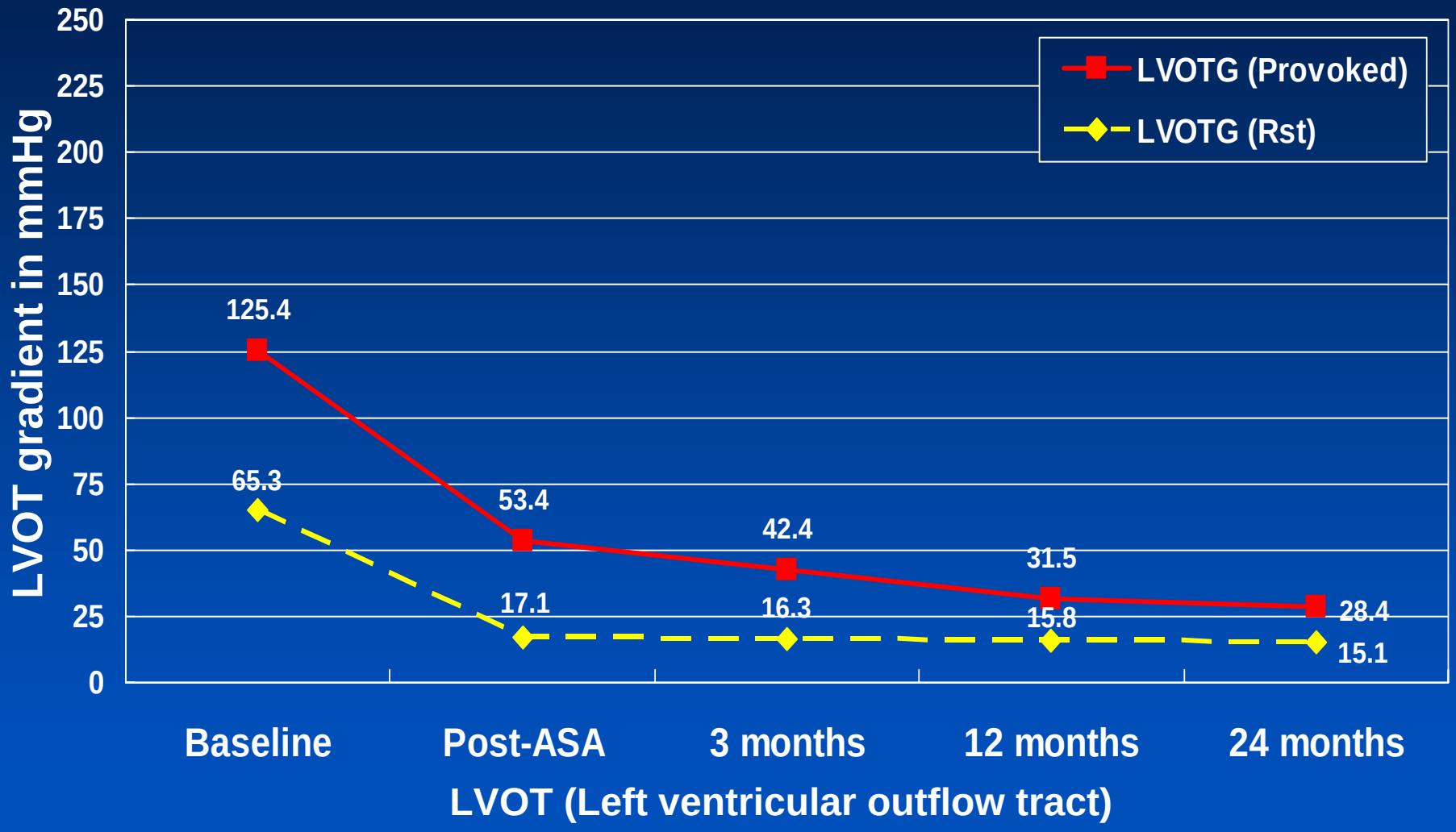
Mean NYHA & CCS Class before and after Alcohol Septal Ablation



NYHA (New York Heart Association class),
CCS (Canadian Cardiovascular Society class)

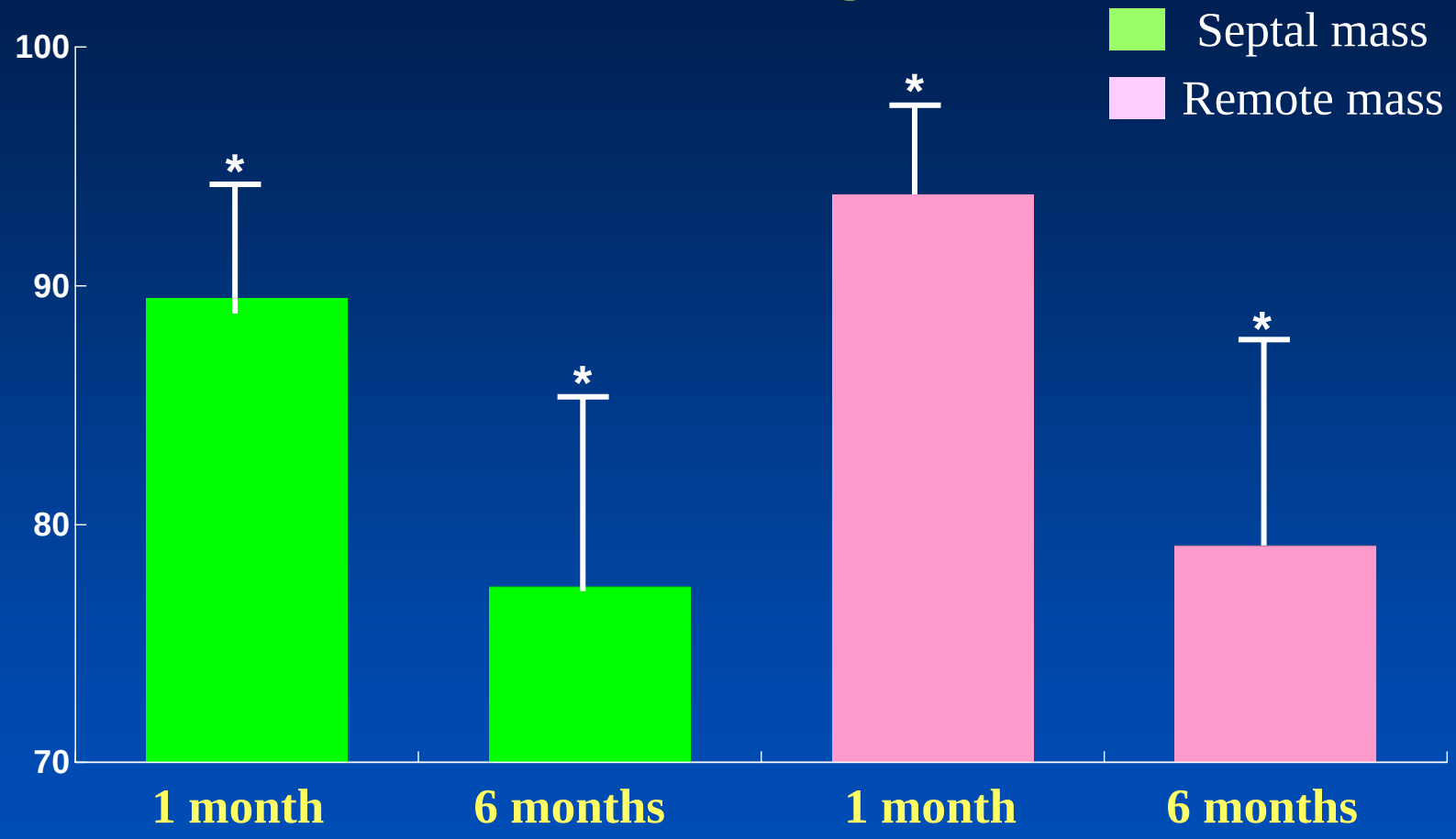
J Interv Cardiol 2006;19:319–327

Mean LVOT PG before and after ASA



J Interv Cardiol 2006;19:319–327

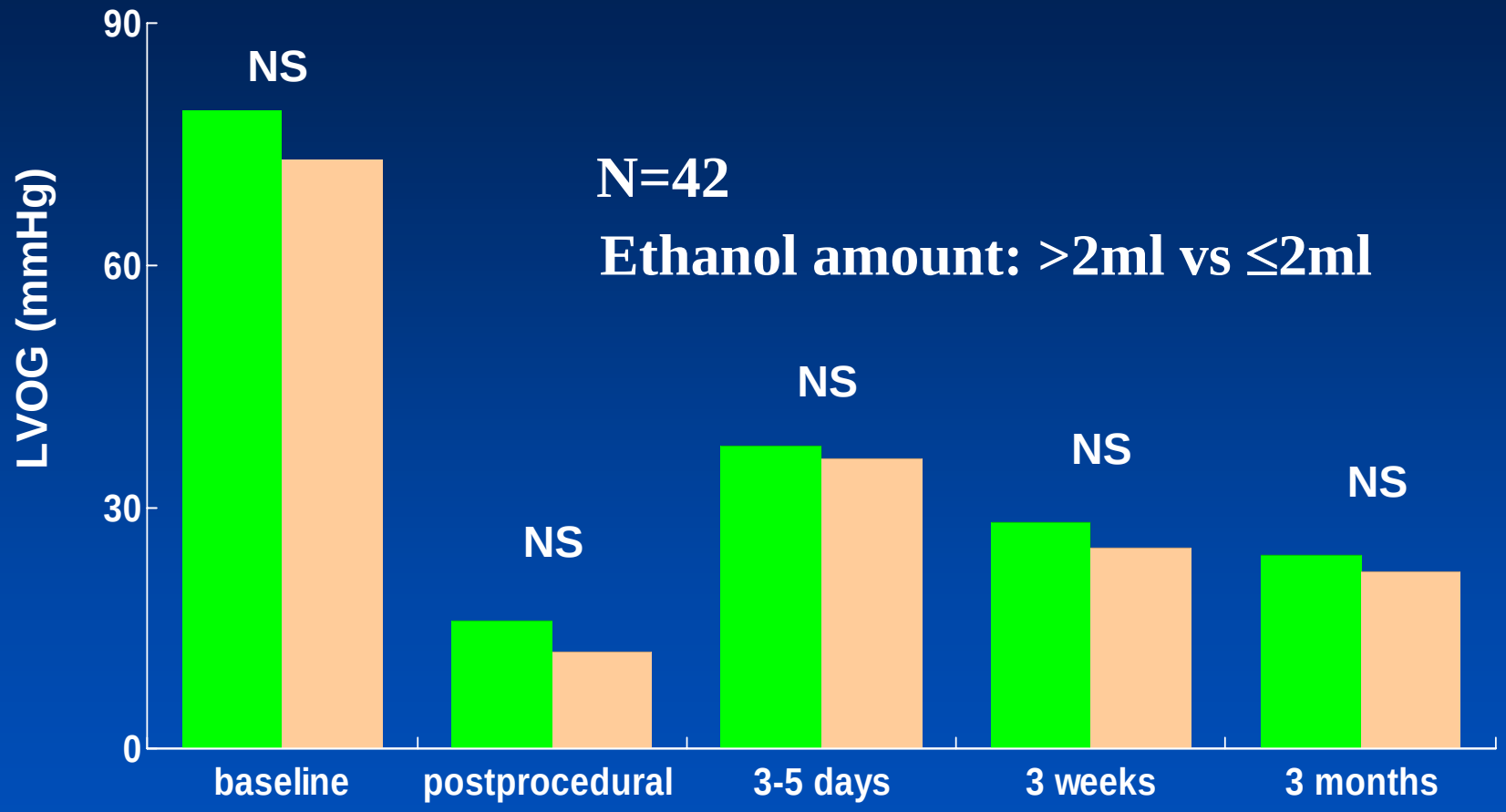
LV Remodeling After ASA



LV remodeling after ASA occurs early and progresses on midterm follow-up. Remote mass reduction is associated with infarct location & correlates with reduction of the LVOT PG.

Circulation 2005; 111: 2503

Optimal Ethanol Amount



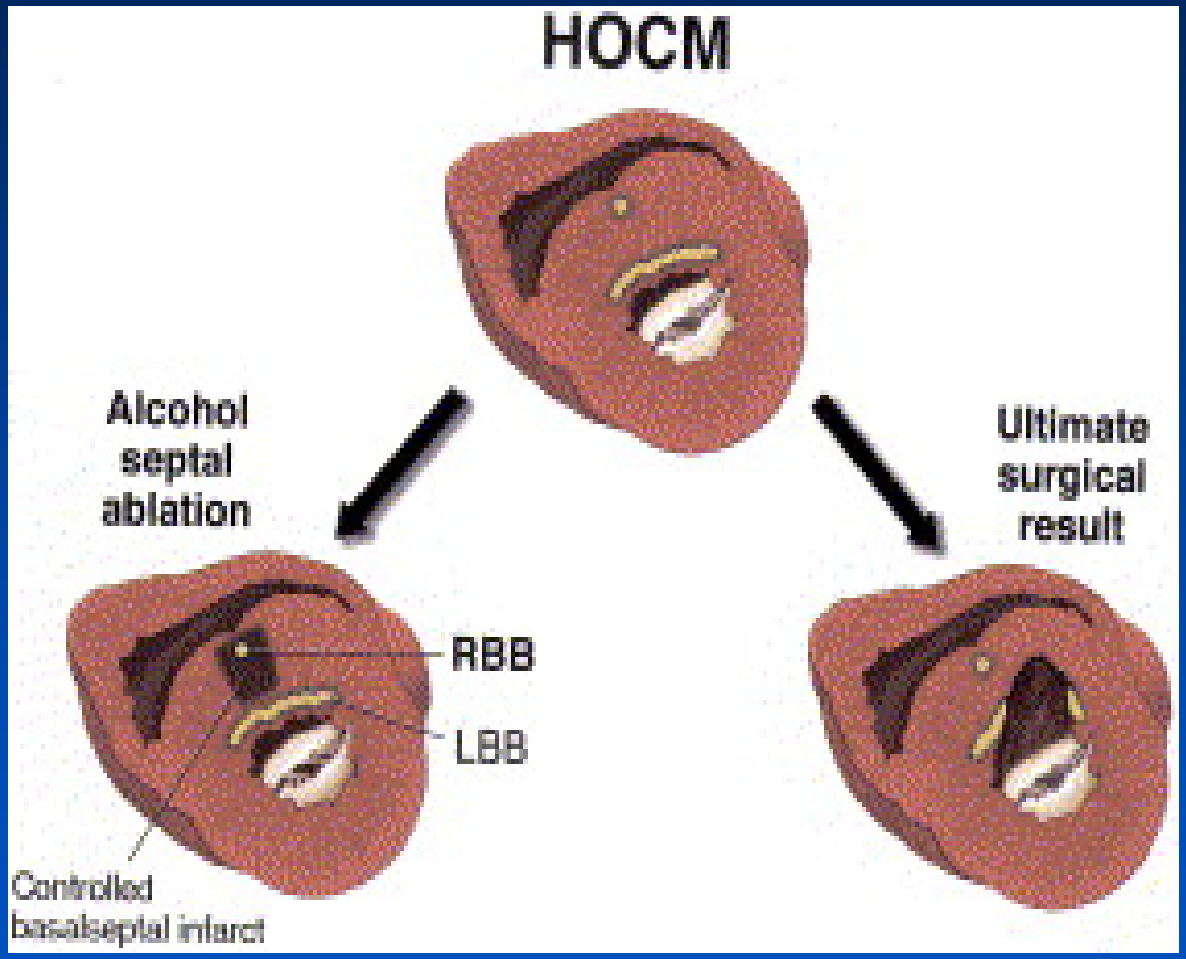
N=42

Ethanol amount: >2ml vs ≤2ml

The early course of hemodynamic changes is not related to the use of a small or standard (>2 ml) dose of ethanol.

Am J Cardiol 2005;95:675-8

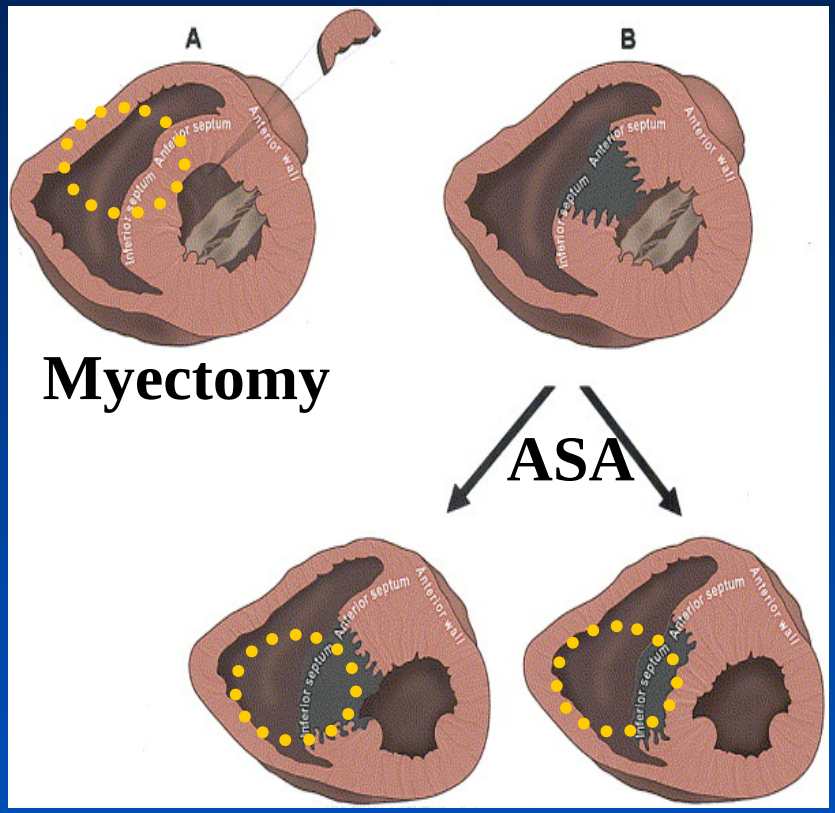
Alcohol Septal Ablation vs Surgical Septal Myectomy

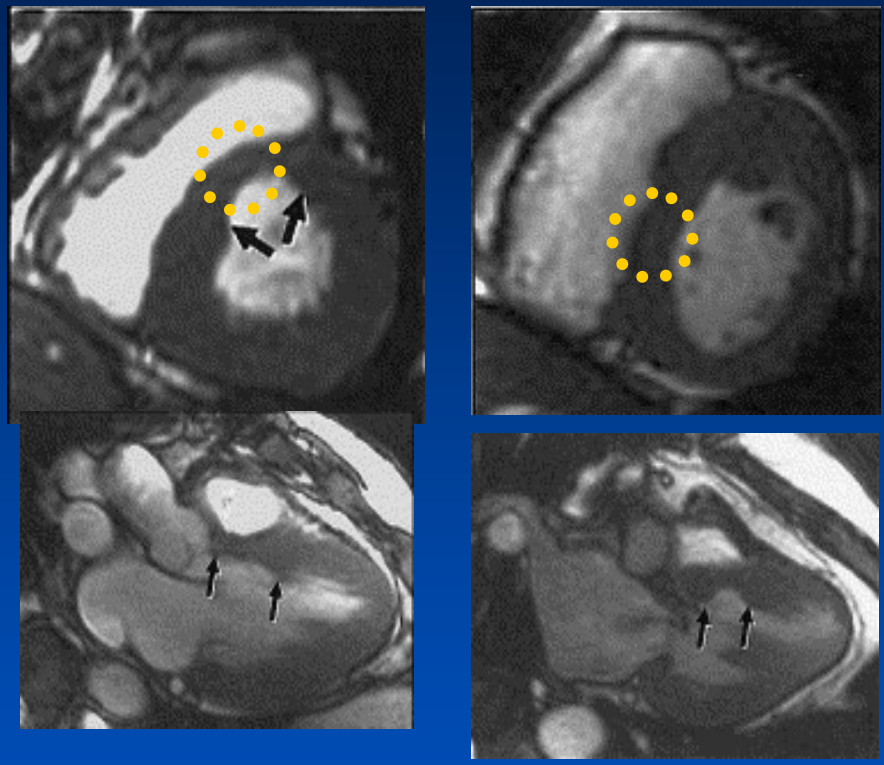


ASA selectively produces transmural infarction of the basal mid-septum and adjacent right bundle tissue, whereas surgical myectomy affects the endocardial portion of the basal anterior septum and adjacent left bundle tissue.

JACC2004;44:2329

Comparison of Surgical Myectomy vs ASA With Cardiac MRI in Patients with HOCM





Myectomy ASA

Septal myectomy provides consistent resection of the obstructing portion of the anterior basal septum, whereas the effect of ethanol septal ablation is more variable (more inferior location in basal & mid-ventricular septum; proximal basal septum spared in 25%).

Complications (Systematic Review)

	N	Mean±SEM	Range
In-hospital mortality (%)	2,959	1.5±0.03	0.0-5.0
Late mortality (%)	2,840	0.5±0.03	0.0-9.3
Complete AV block (%)	1,869	10.5±0.2	0.0-40.0
Ventricular fibrillation (%)	464	2.2±0.1	0.0-4.0
Persistence of symptoms (%)	724	10.8±0.2	5.0-25.0

J Interv Cardiol 2006;19:319–327

Need For Rigorous Studies

- Potential complications:
  complete AV block, ventricular arrhythmia
- At present, long-term follow-up is lacking.
- Without a randomized study, it is difficult to assign efficacy differences between the ASA and surgical myectomy.

Summary

- ASA is a promising nonsurgical technique for septal myocardial reduction in HOCM
- A randomized trial comparing myectomy with ASA may be needed to assess the effectiveness of these therapies.