



Septal Myectomy for Obstructive HCM is...*The Gold Standard*

Joseph A. Dearani, MD

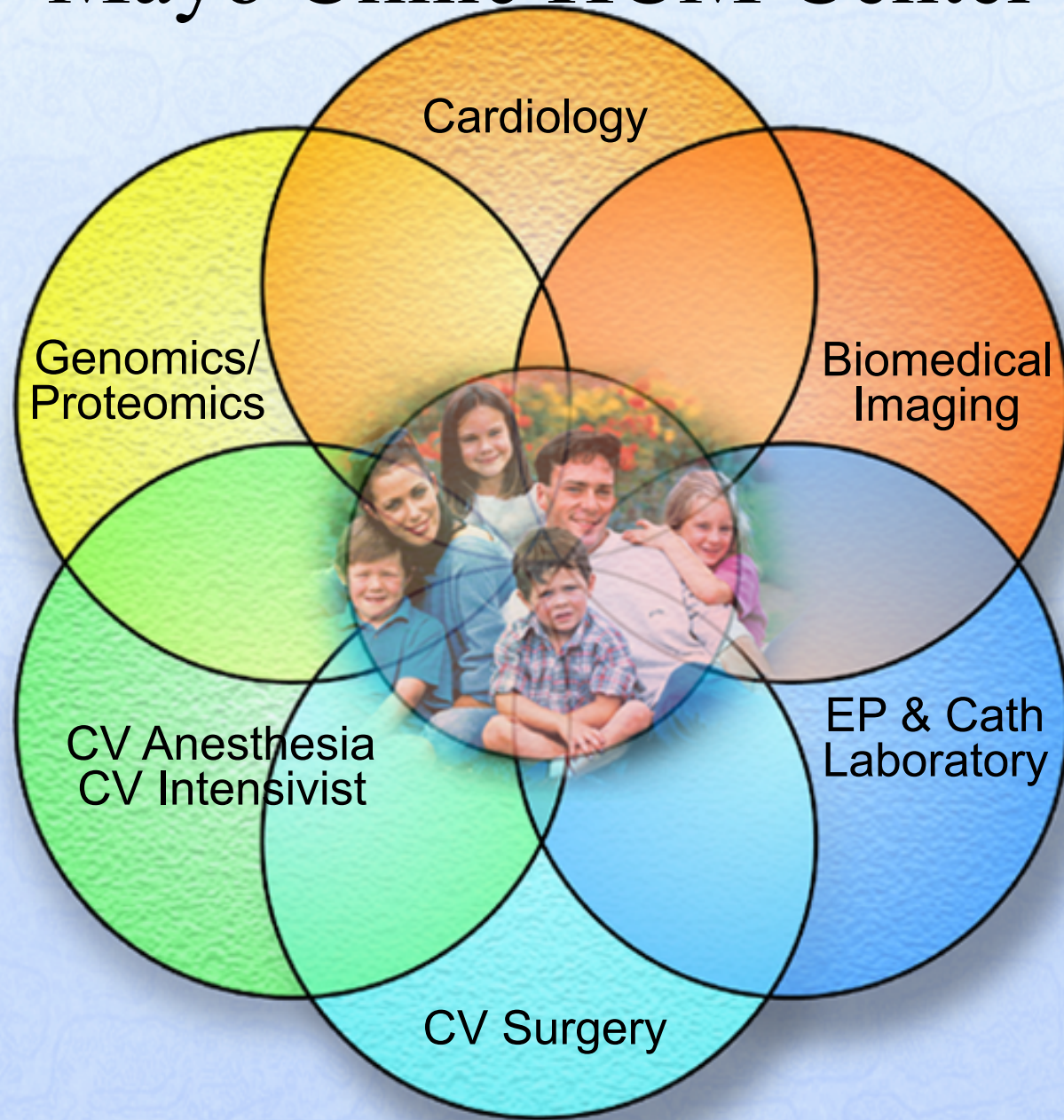
Professor and Chair, Department of Cardiovascular Surgery

Zayed Professor of Cardiovascular Diseases

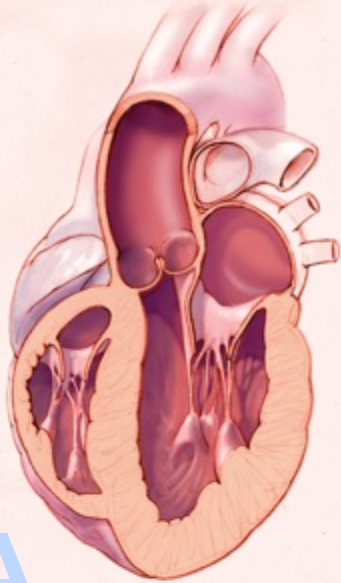
International HCM Summit VI Boston, 2017

No Disclosures

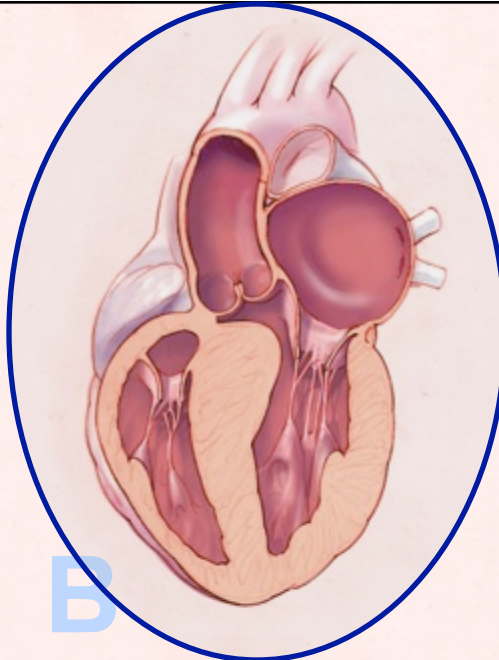
Mayo Clinic HCM Center



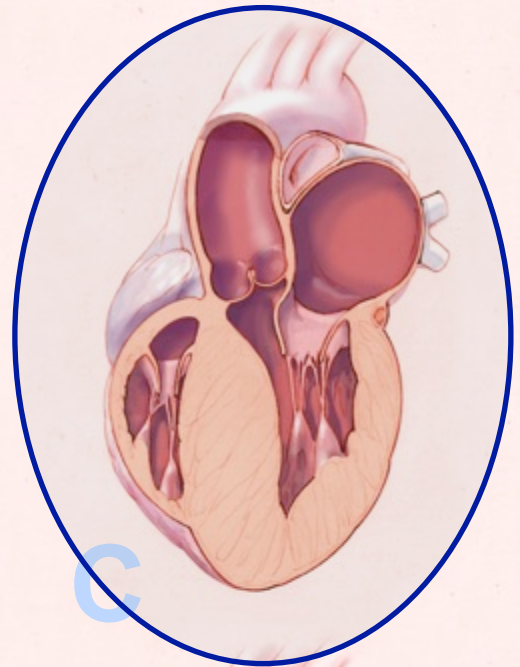
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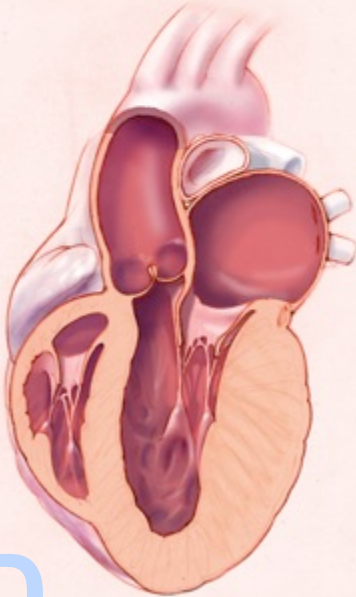
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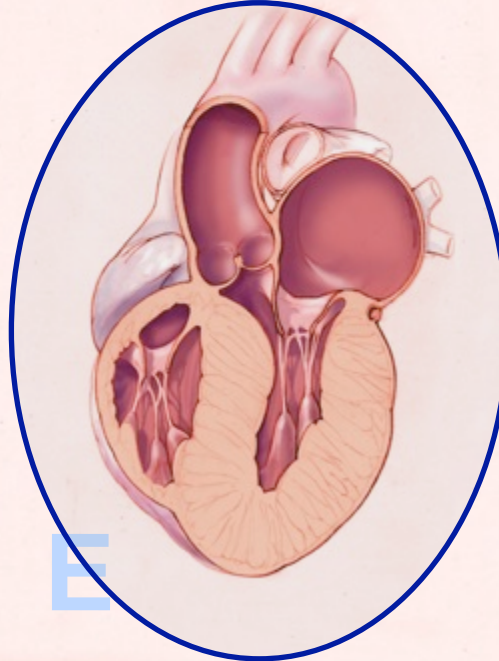
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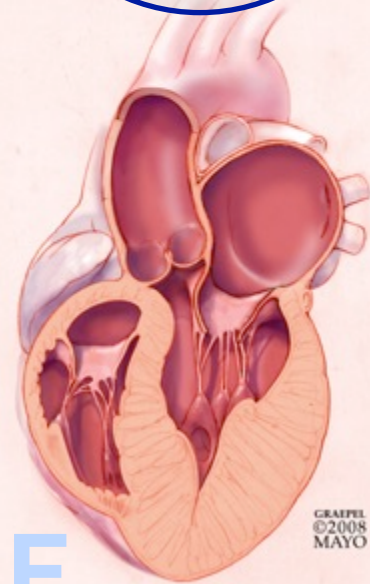
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E

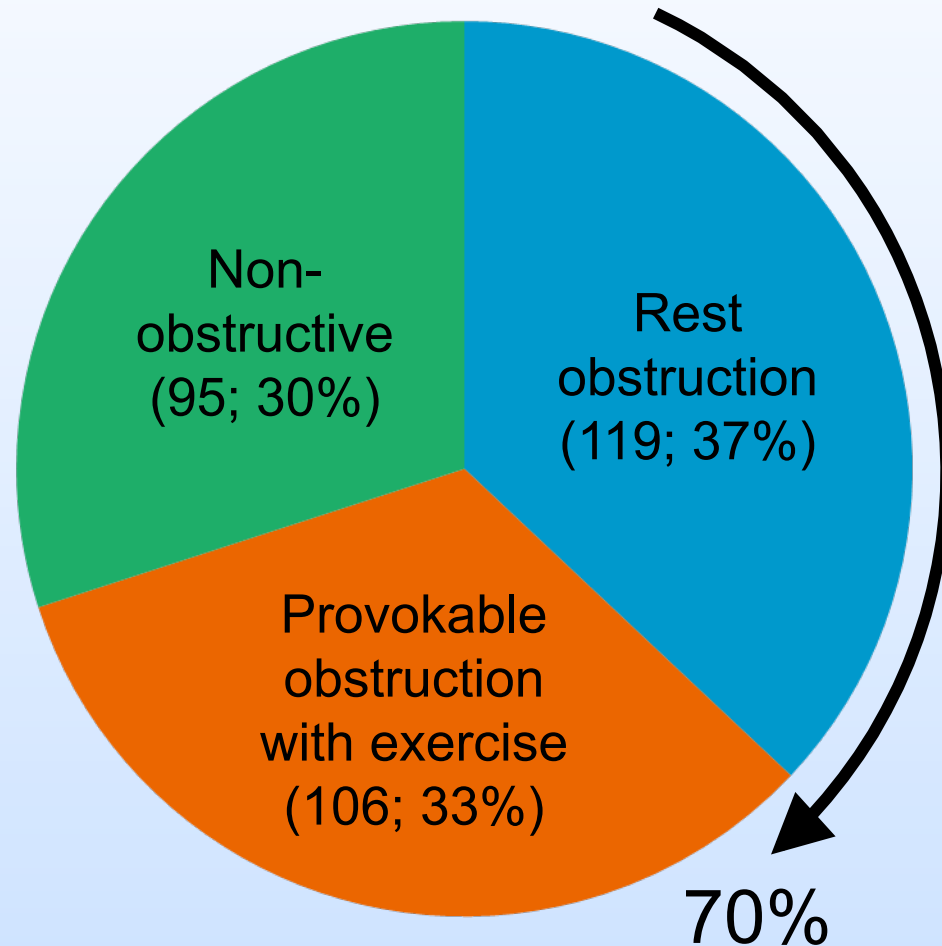


F



GRAFEL
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MAYO

Prevalence of LVOT Obstruction in the Overall Study Group of 320 HCM Patients



Maron et al: Circ, 2006

Septum 3 cm

50MM/6 3.5MHZ-M 38HZ 12CM
PROC 2/8/C
28 JUL 87 10:27:10
MAYO CLINIC/HA D/A-1
ID:
23

50MM/6 2.8-M
17 APR 92
10:16:34
PROC 3/8/C
MAYO CLINIC/A-1
'BLD'

ID:
184
BP 130/80

50MM/6
XMIT: A
60BPM
16CM
34HZ

Septum 1.5 cm

07 Jun 11

10:59:39 am

TE-V5M 74Hz

3.5MHz 120mm

MAYO TEE

General

Lens Temp <37.0°C

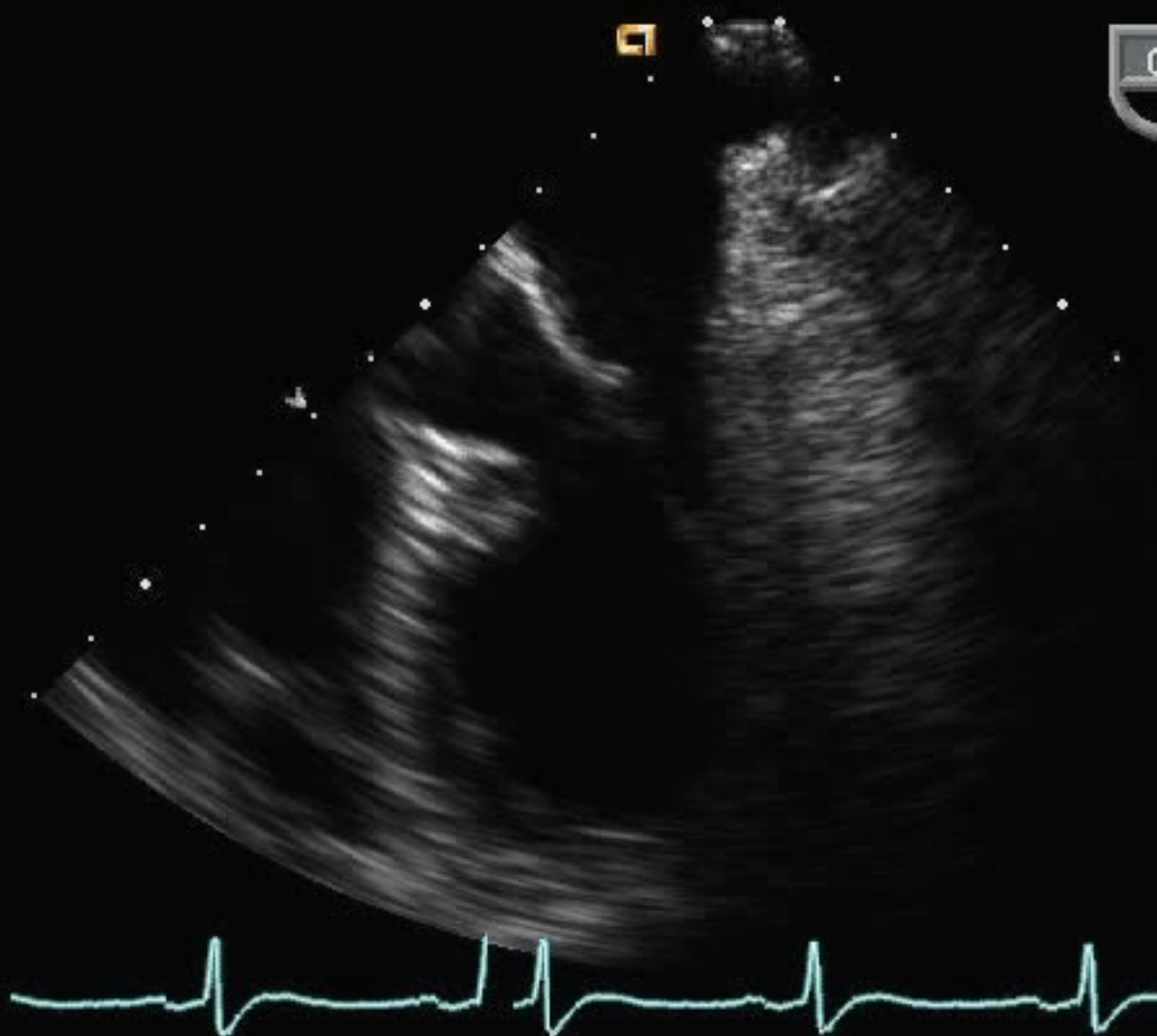
65dB S1/ 0/1/4

Gain=-17dB Δ=1

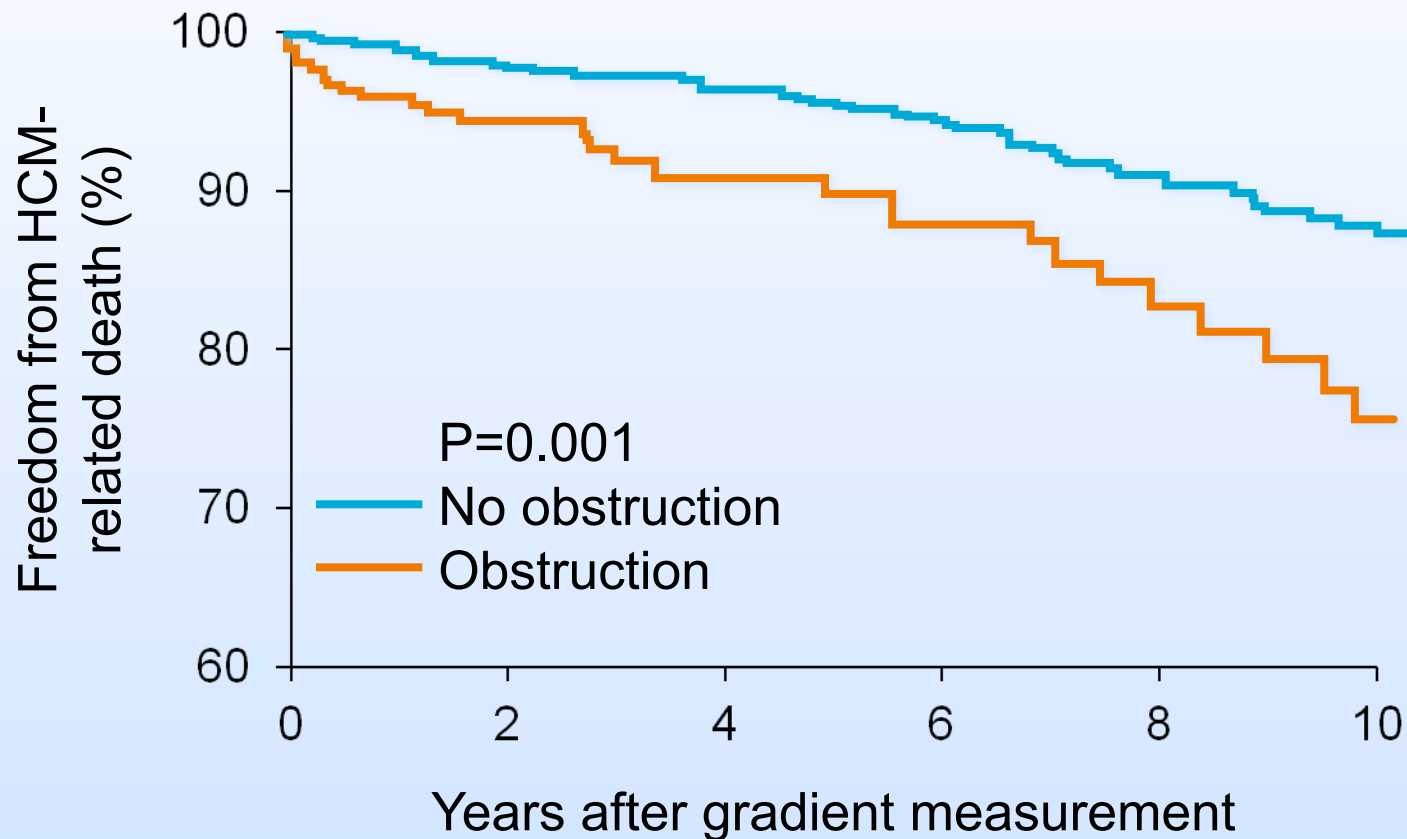
Store in progress

0:25:22

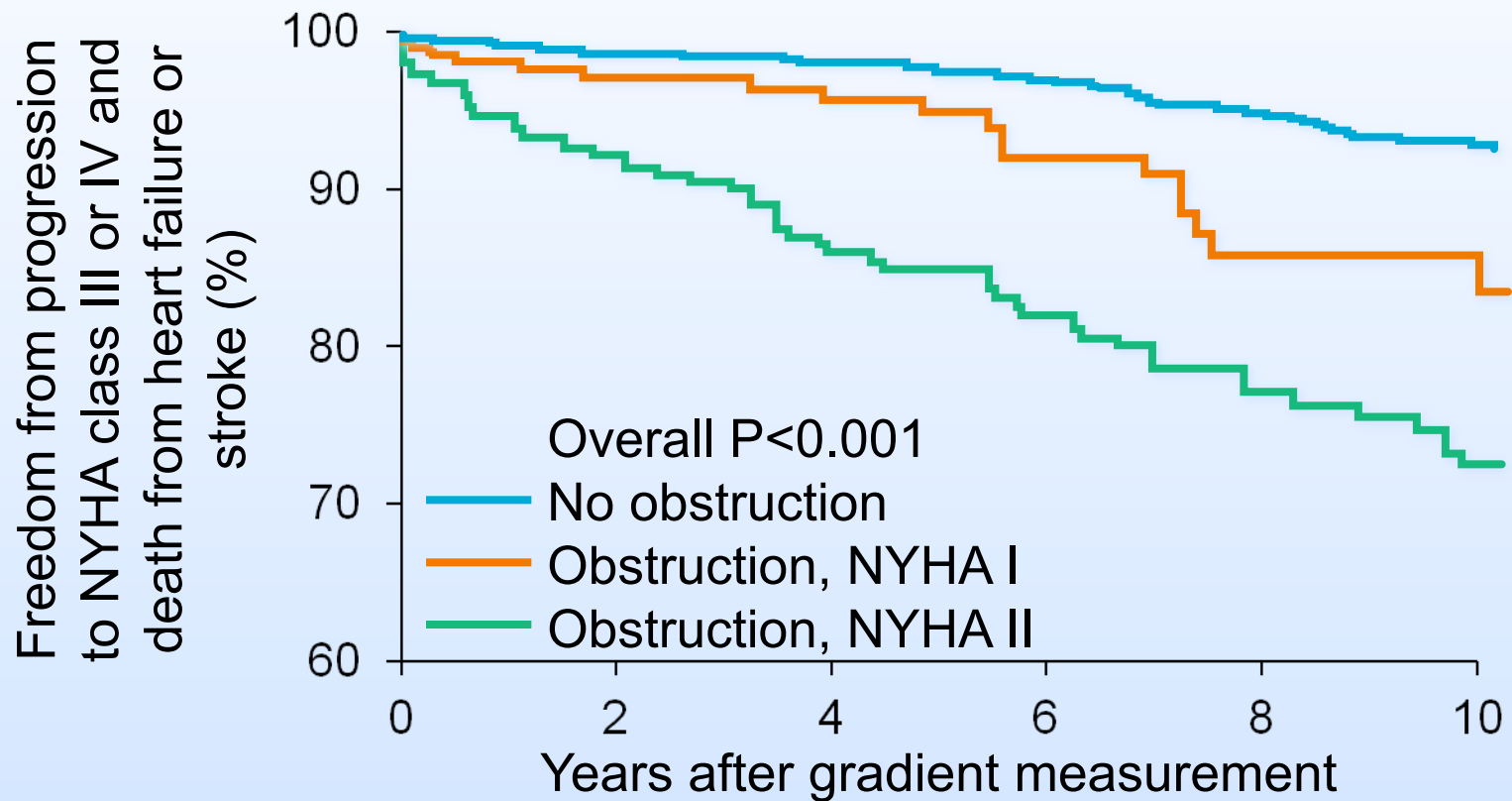
HR= 68bpm



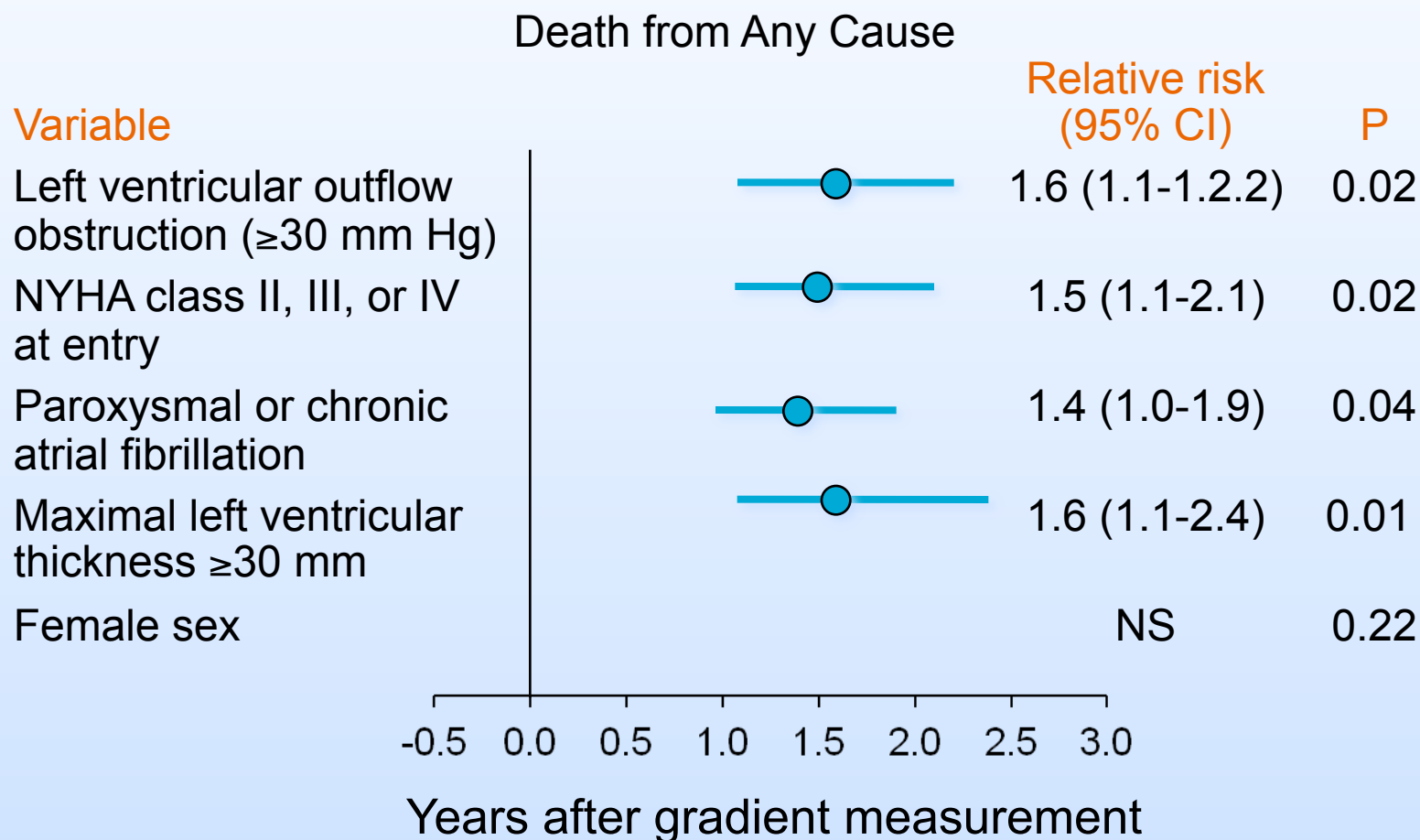
HCM-Related Death Among 273 Patients with Basal LVOT Gradient >30 mm Hg and 828 Patients Without Obstruction



Probability of Progression to Severe Heart Failure (NYHA Class III or IV) or Death from Heart Failure or Stroke

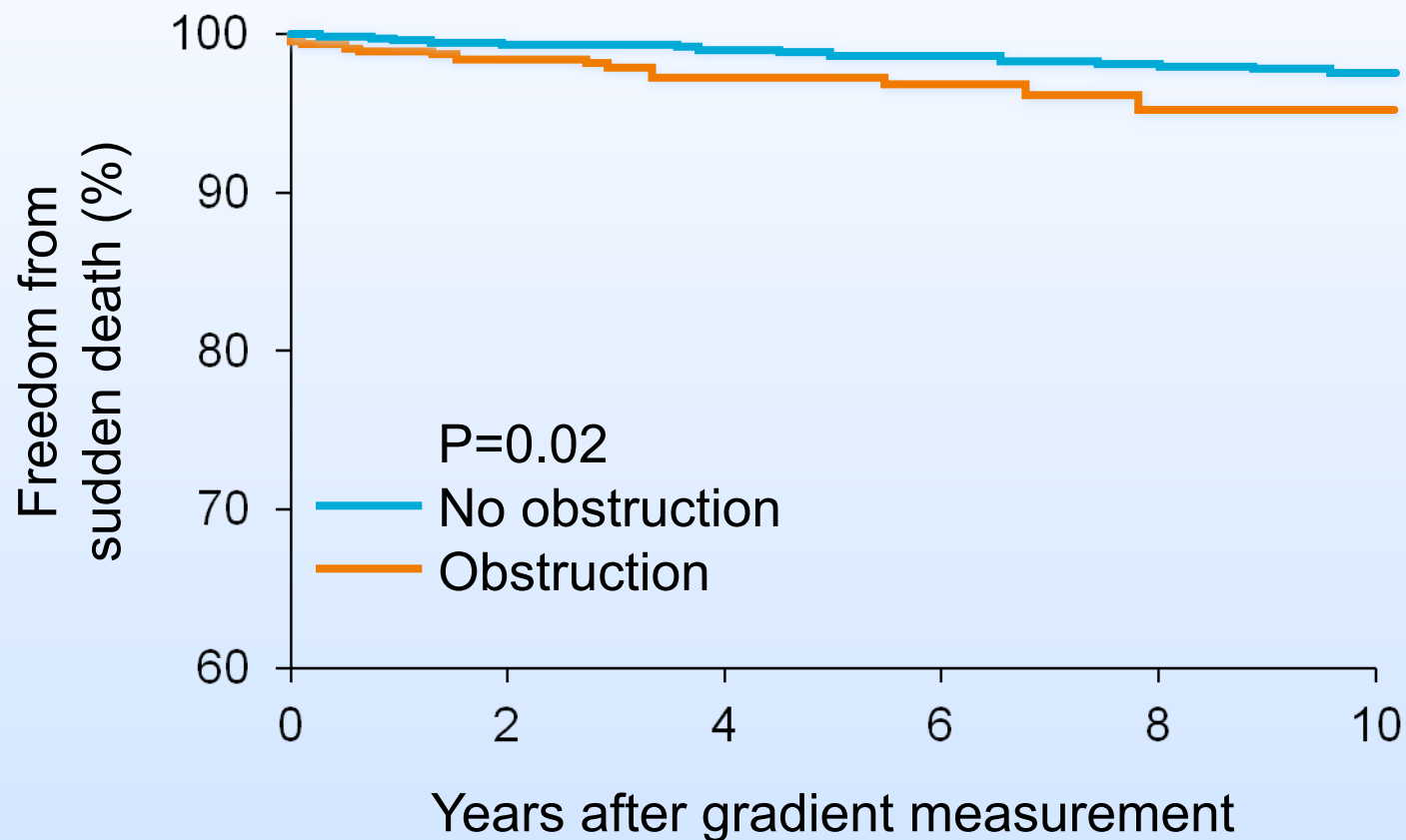


Age-Adjusted Multivariate Cox Proportional-Hazards Analysis of the Relation Between Baseline Clinical Variables and Outcome



Maron et al: NEJM 348:295, 2003

Probability of Sudden Death





European Heart Journal (2006) 27, 1933–1941
doi:10.1093/eurheartj/ehi130

Left ventricular outflow tract obstruction and sudden death risk in patients with hypertrophic cardiomyopathy

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Received 29 August 2005; revised 13 April 2006; accepted 4 May 2006; online publish-ahead-of-print 5 June 2006

See page 1895 for the editorial comment on this article (doi:10.1093/eurheartj/ehi130)

KEYWORDS

Outflow tract obstruction;
Prognosis;
Hypertrophic cardiomyopathy

Aims Left ventricular outflow tract obstruction (LVOTO) is associated with reduced survival in patients with hypertrophic cardiomyopathy (HCM). The influence of LVOTO on survival from SD in relation to other recognized clinical risk markers is unknown.

Methods and results A total of 917 patients with HCM (554 males, 43 ± 15 years) were studied; 288 (31.4%) had LVOTO at rest (≥ 30 mmHg). During follow-up [median 61 (30–99) months], 54 (5.9%) patients died suddenly (SD), survived ventricular fibrillation, or had an appropriate ICD discharge; 29 (2.7%) died from heart failure or were transplanted; 17 (1.8%) died from other cardiovascular causes. Five-year survival from all-cause death or cardiac transplantation was lower in patients with LVOTO [86.5% (95% CI: 81.7–91.2) vs. 90.1% (95% CI: 87.3–92.8), $P = 0.006$], with a trend towards higher all-cause death and transplantation with increasing LVOTO [(RR per 20 mmHg = 1.24 (95% CI: 1.08–1.42), $P = 0.003$)]. In patients with obstruction, there was a significant relation between 5-year survival from all-cause death and functional limitation (NYHA class I: 91.0%; NYHA class II: 83.3%; NYHA class III/IV: 82.6%, $P = 0.002$). LVOTO was associated with reduced survival from SD and ICD discharge (SD/ICD) [91.4% (95% CI: 87.4–95.3) vs. 95.7% (95% CI: 93.8–97.6), $P = 0.0004$]. Magnitude of LVOTO was related to a higher occurrence of SD/ICD [RR per 20 mmHg = 1.36 (95% CI: 1.12–1.65), $P = 0.001$]. There was no relation between survival from SD/ICD, LVOTO, and NYHA class. The annual rate of SD/ICD in patients with LVOTO and no risk factors was 0.37% (95% CI: 0.05–1.35). There was a trend towards lower survival from SD/ICD, with increasing numbers of risk factors in patients with and without LVOTO ($P = 0.002$ and $P = 0.002$, respectively). Multivariable analysis demonstrated that LVOTO was an independent predictor of SD/ICD, with a 3.4-fold ($P = 0.003$) increase in the risk of SD/ICD.

Conclusion LVOTO is associated with an increased risk of SD/ICD that is related to the severity of obstruction and the presence of other recognized risk factors for SD. The low sudden death mortality in asymptomatic patients with LVOTO and no other SD risk markers suggests that aggressive interventions to reduce LVOTO are unwarranted in this group. Further studies are required to determine the most appropriate treatment strategies (ICD or gradient reduction) in patients with additional risk factors.

Conclusion LVOTO is associated with increased risk of SD/ICD that is related to the severity of obstruction and the presence of other recognized risk factors for SD.

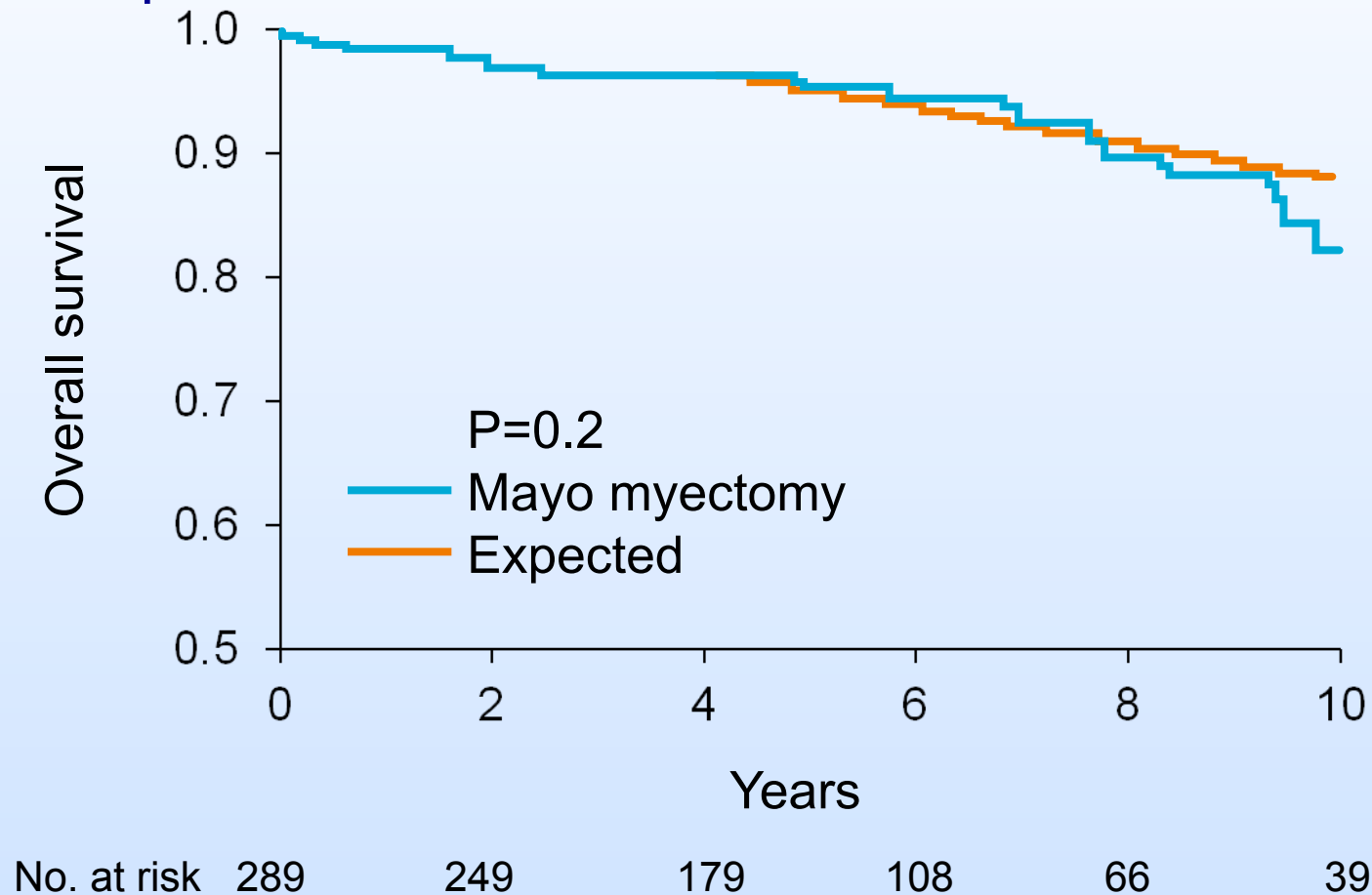
European Heart Journal (2006) 27, 1933–1941

Left ventricular outflow tract obstruction and sudden death risk in patients with hypertrophic cardiomyopathy

Perry M. Elliott, Juan R. Gimeno, Maria T. Tomé, Jaymin Shah, Deirdre Ward, Rajesh Thaman, Jens Mogensen, and William J. McKenna

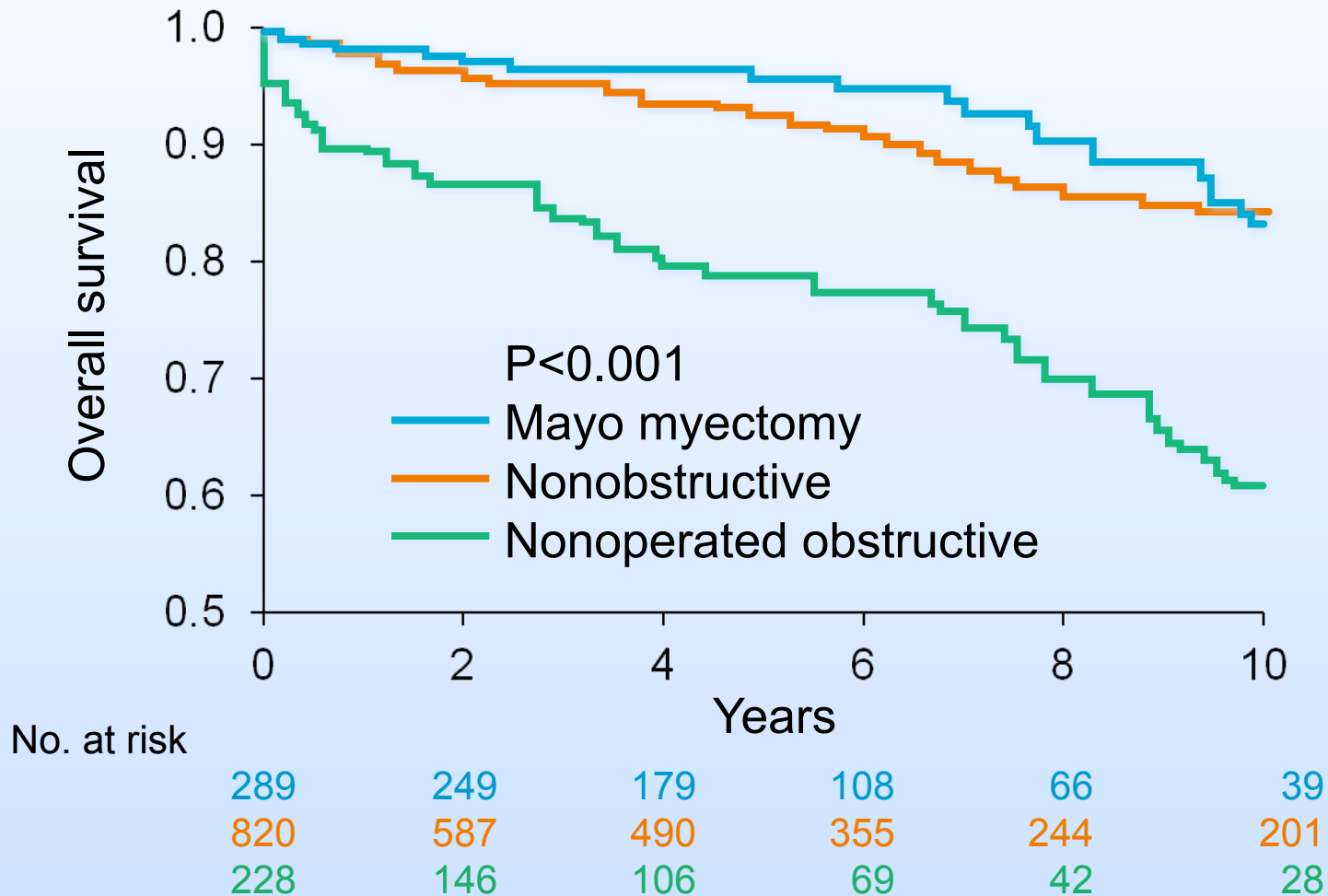
Methods and results A total of 917 patients with HCM (554 males, 43 ± 15 years) were studied; 288 (31.4%) had LVOTO at rest (≥ 30 mmHg)

Survival Free from All-Cause Mortality After Surgical Myectomy for Obstructive Hypertrophic Cardiomyopathy (n=289) Compared with the Age- and Gender-Matched General U.S. White Population



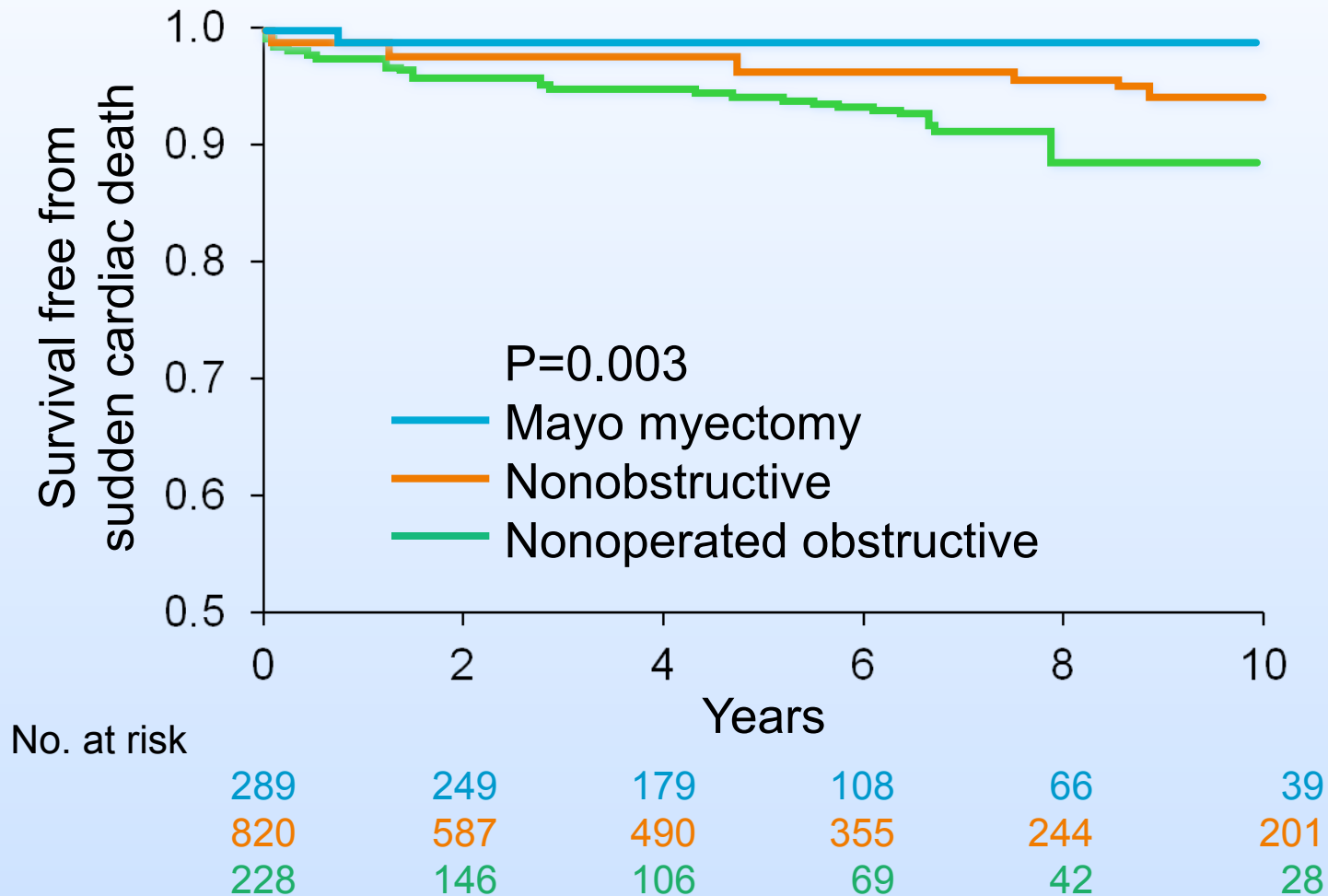
Ommen et al: JACC 46:470, 2005

Survival Free from All-Cause Mortality



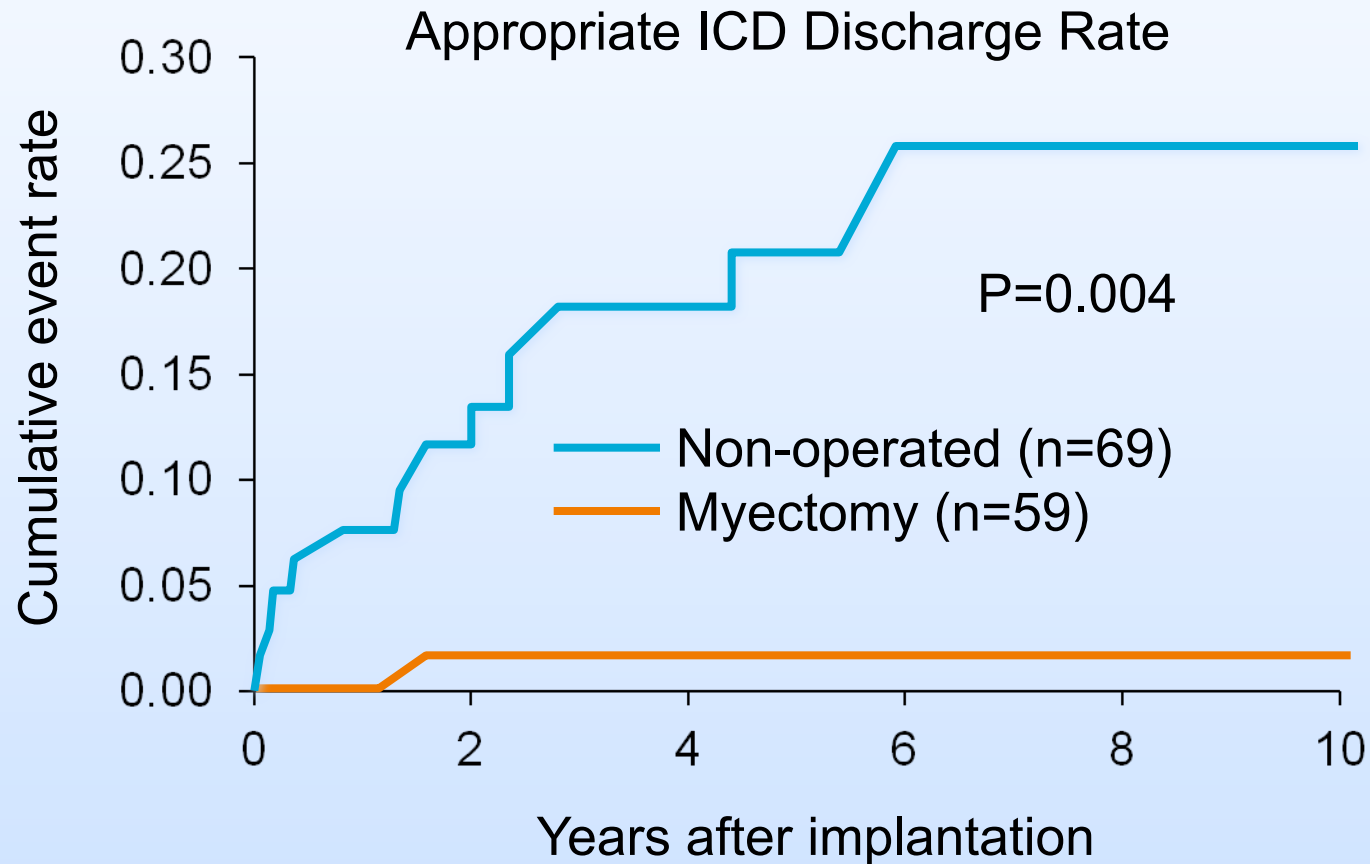
Ommen et al: JACC 46:470, 2005

Survival Free from Sudden Cardiac Death



Ommen et al: JACC 46:470, 2005

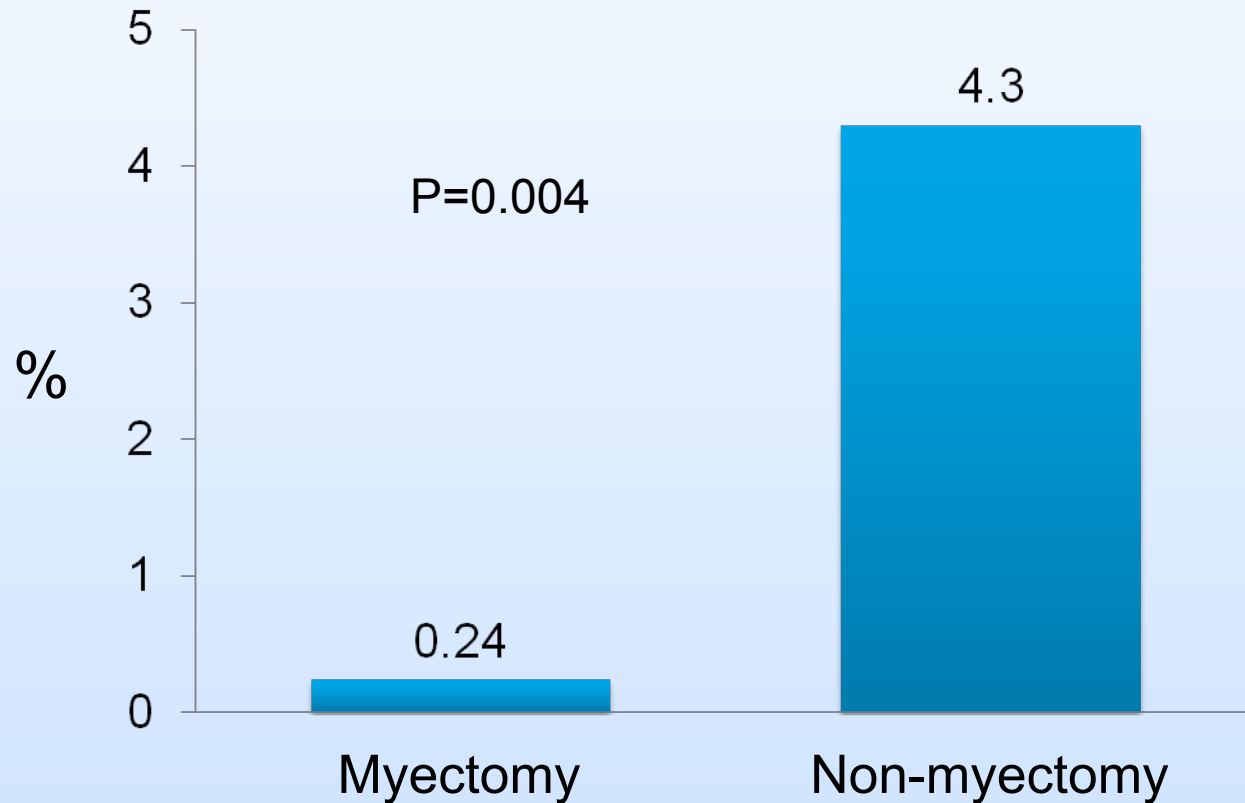
Implantable Cardioverter Defibrillator Discharge Rates



McLeod et al: Eur Heart J 28:2583, 2007

Appropriate ICD Discharges

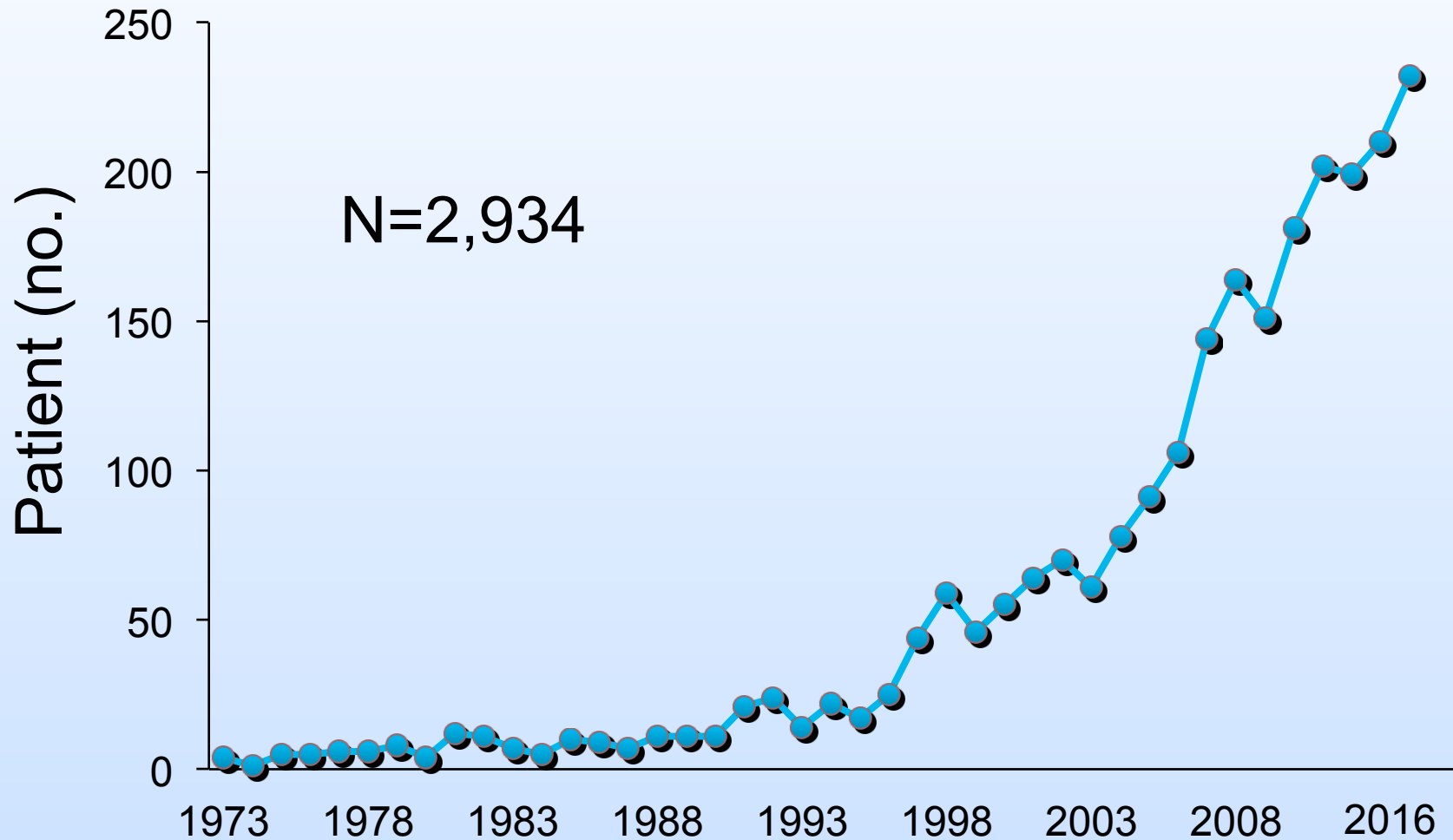
Average Annualized First Event Rate



McLeod et al: Eur Heart J 28:2583, 2007

Myectomy for HCM

Mayo Clinic 1973-2016



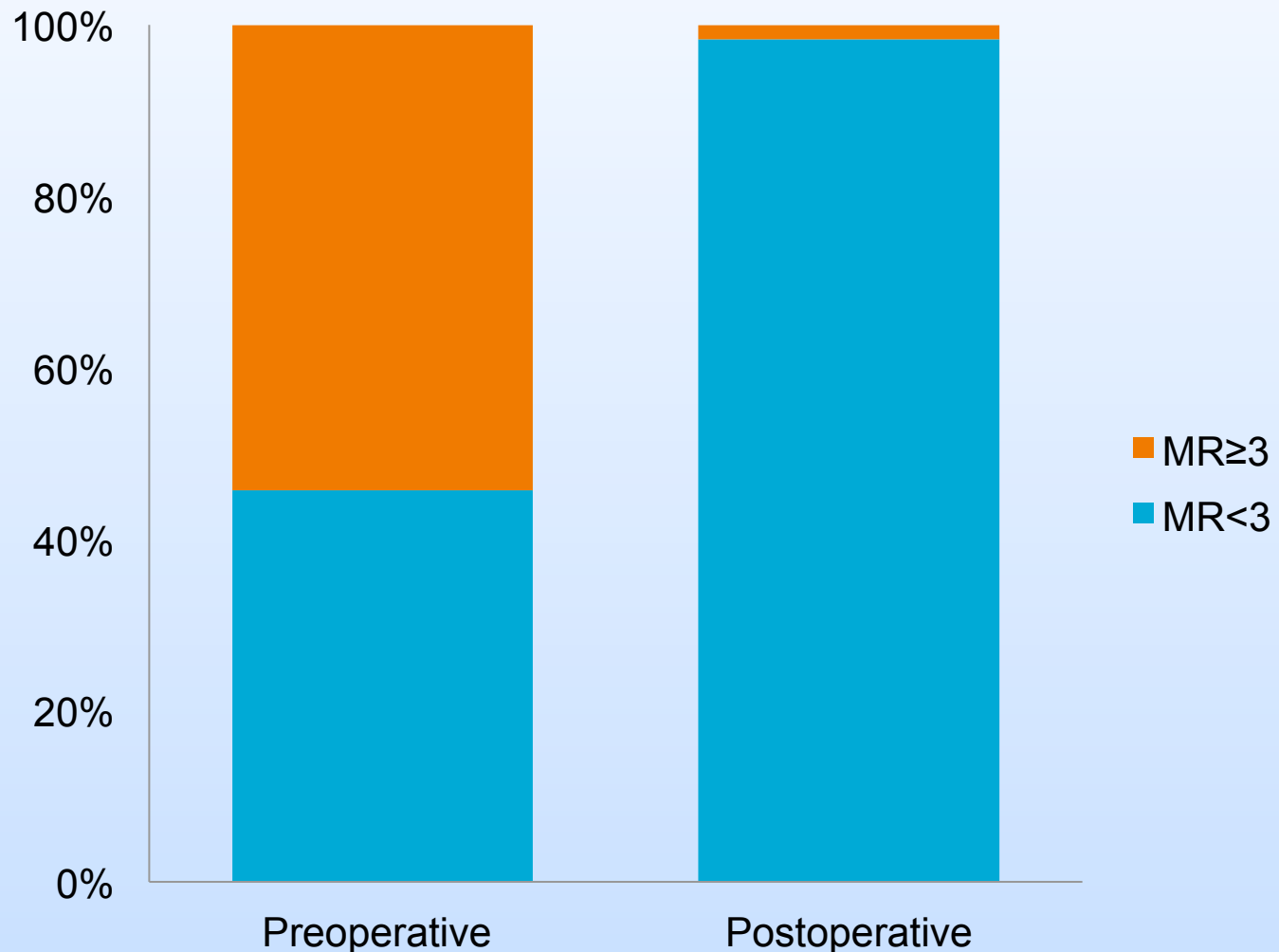
Results

Myectomy for Severely Symptomatic HOCM – Mayo Clinic 800 Patients

- Operative mortality 0.8%
- Gradient reduction 67 → 3 mm Hg
- Postop NYHA 1-2 94%

Mitral Regurgitation in HOCM

Change in MR Following Myectomy



Transaortic Extended Septal Myectomy

Surgical Principles

- Sternotomy, measure intracardiac pressures
- Normothermic CPB, cold cardioplegia, no vent
- Low oblique aortotomy, avoid injury to
 - ✓ Aortic valve cusps
 - ✓ Mitral valve leaflets
- Expose obstructing septum

Mayo Expectations with Myectomy

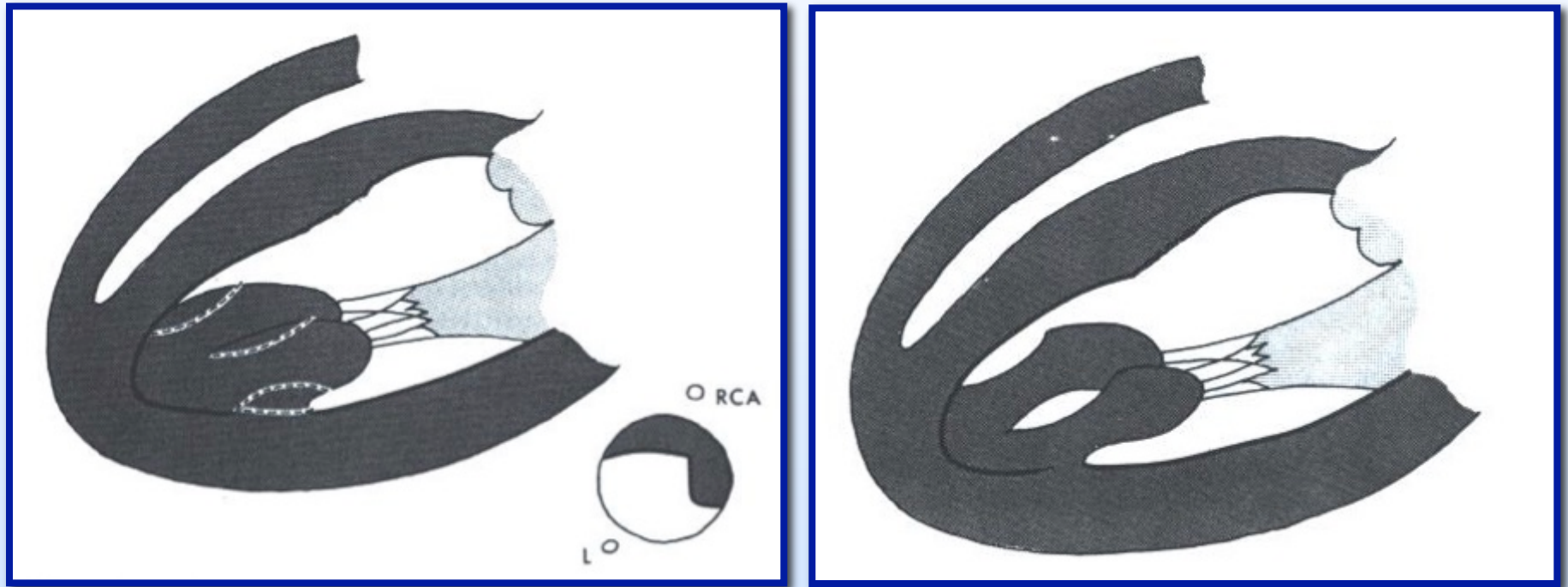
- Early mortality ~ 0%
- Residual provoked gradient <10 mmHg
- Documented tracings in OR
- < mild MR
- Pacemaker < 2%
- MV replacement almost never

Mayo Surgeons



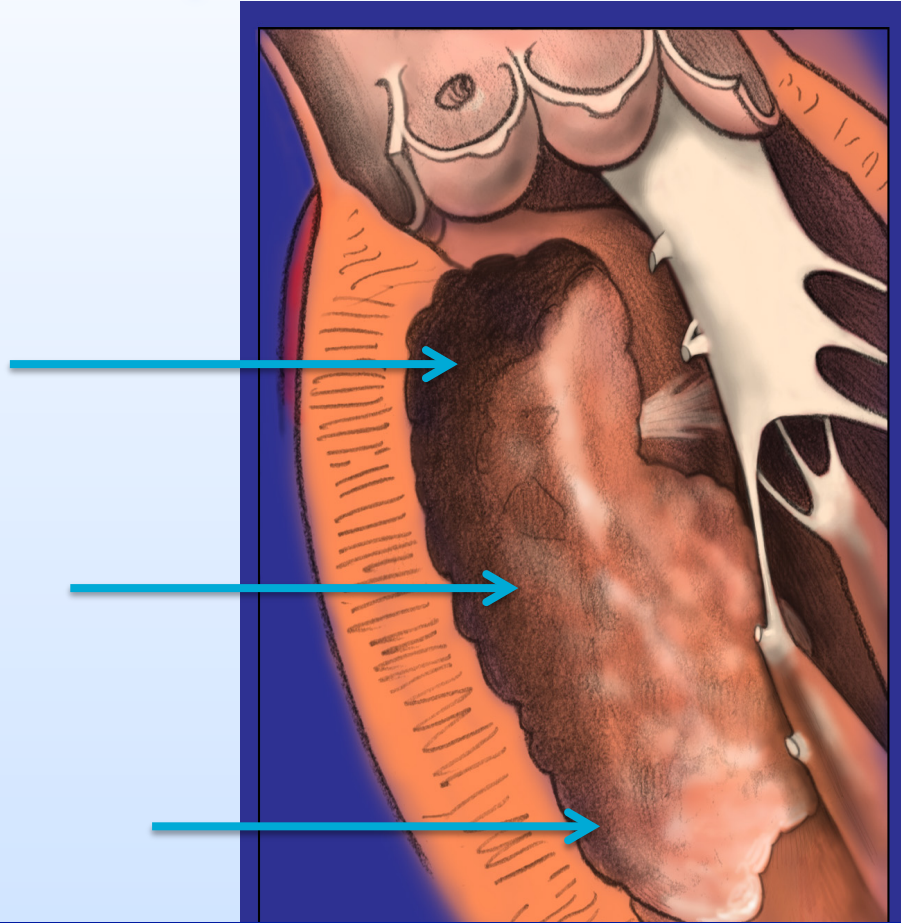
- First 25-50 myectomies with senior mentor
- Focused – Schaff, Dearani, *Said*, (Danielson)
- Total 200 - 250 myectomies per year
- ~ Even distribution amongst surgeons

Extended Septal Myectomy

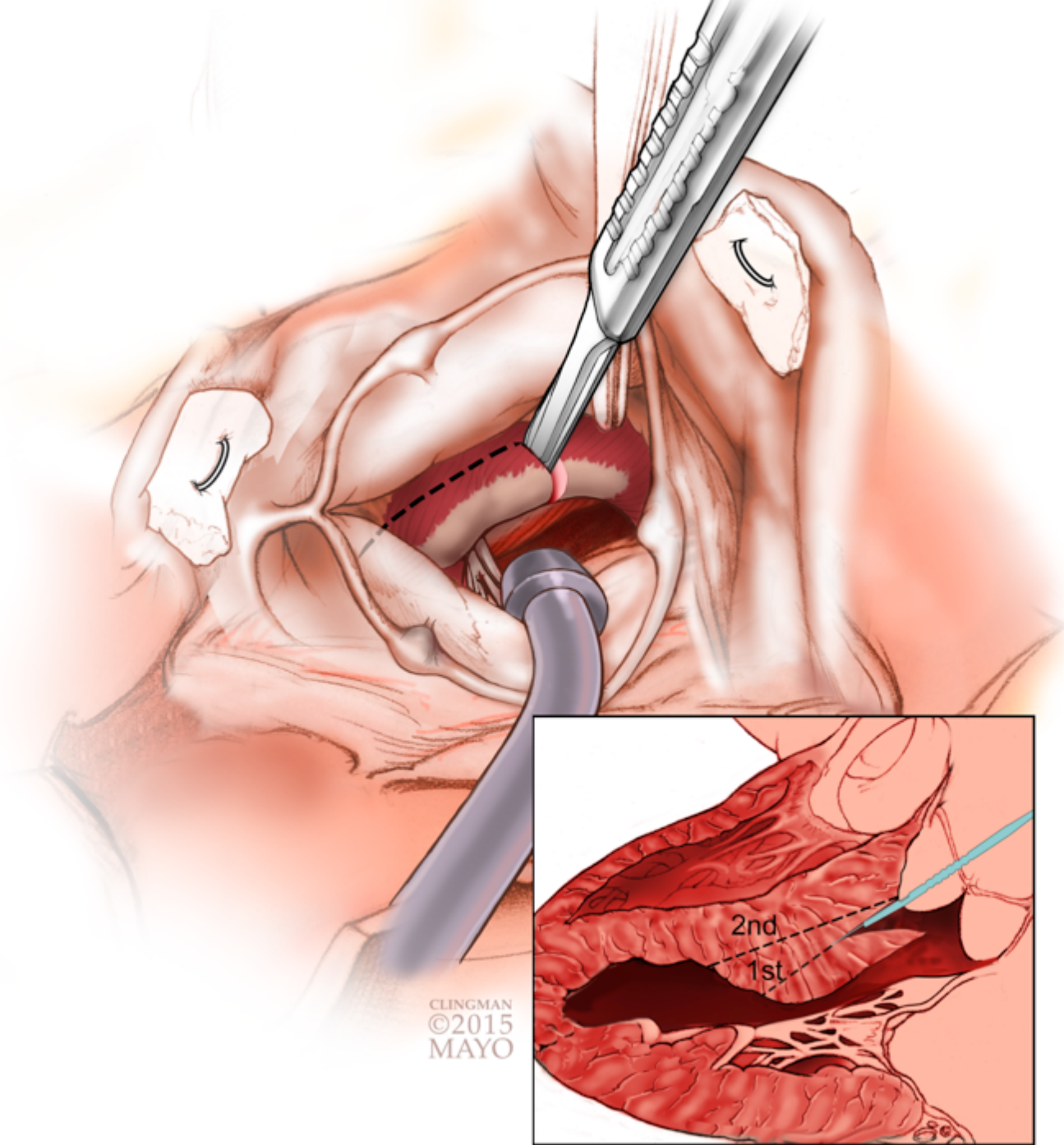


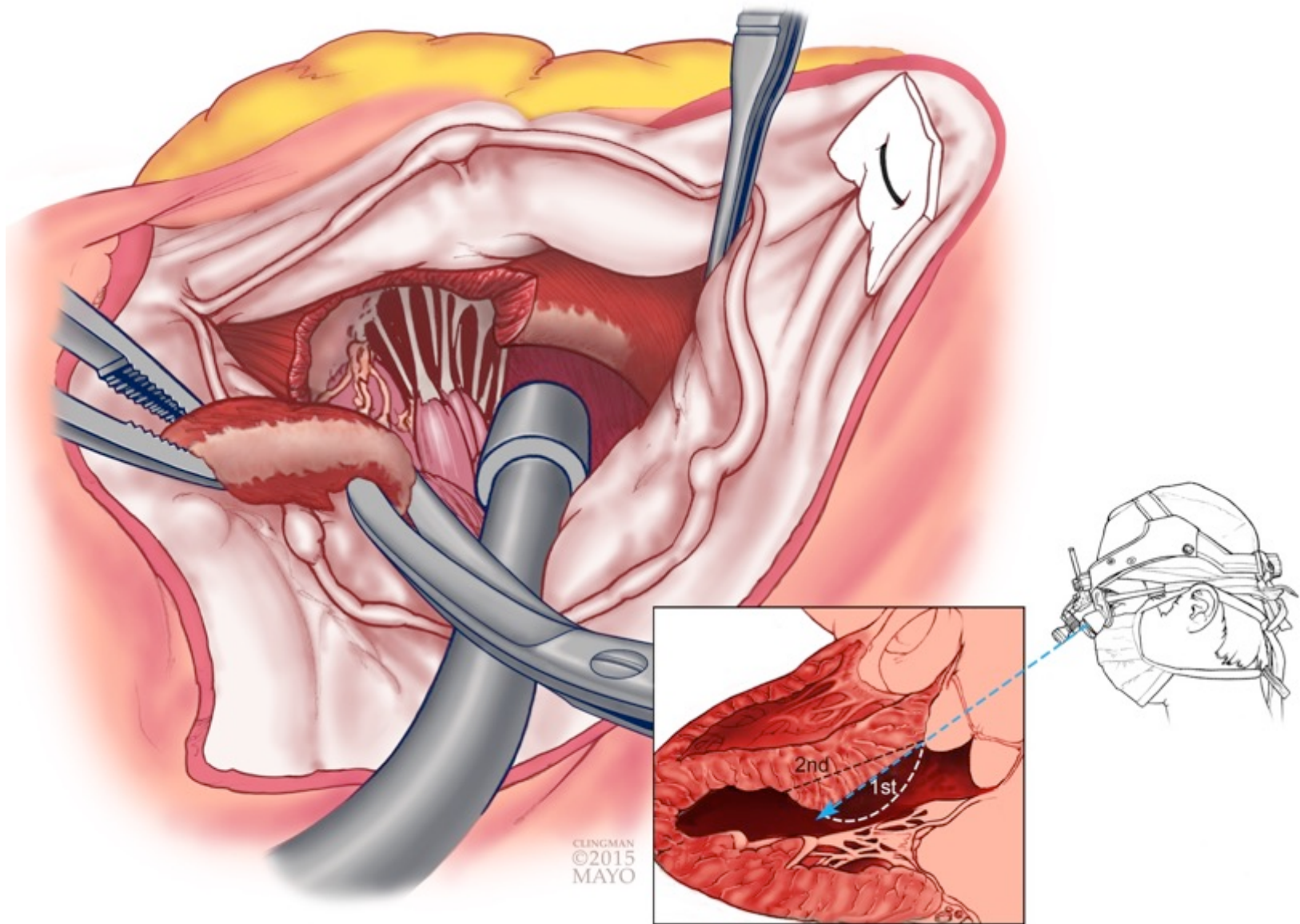
Messmer, Ann Thorac Surg 1994

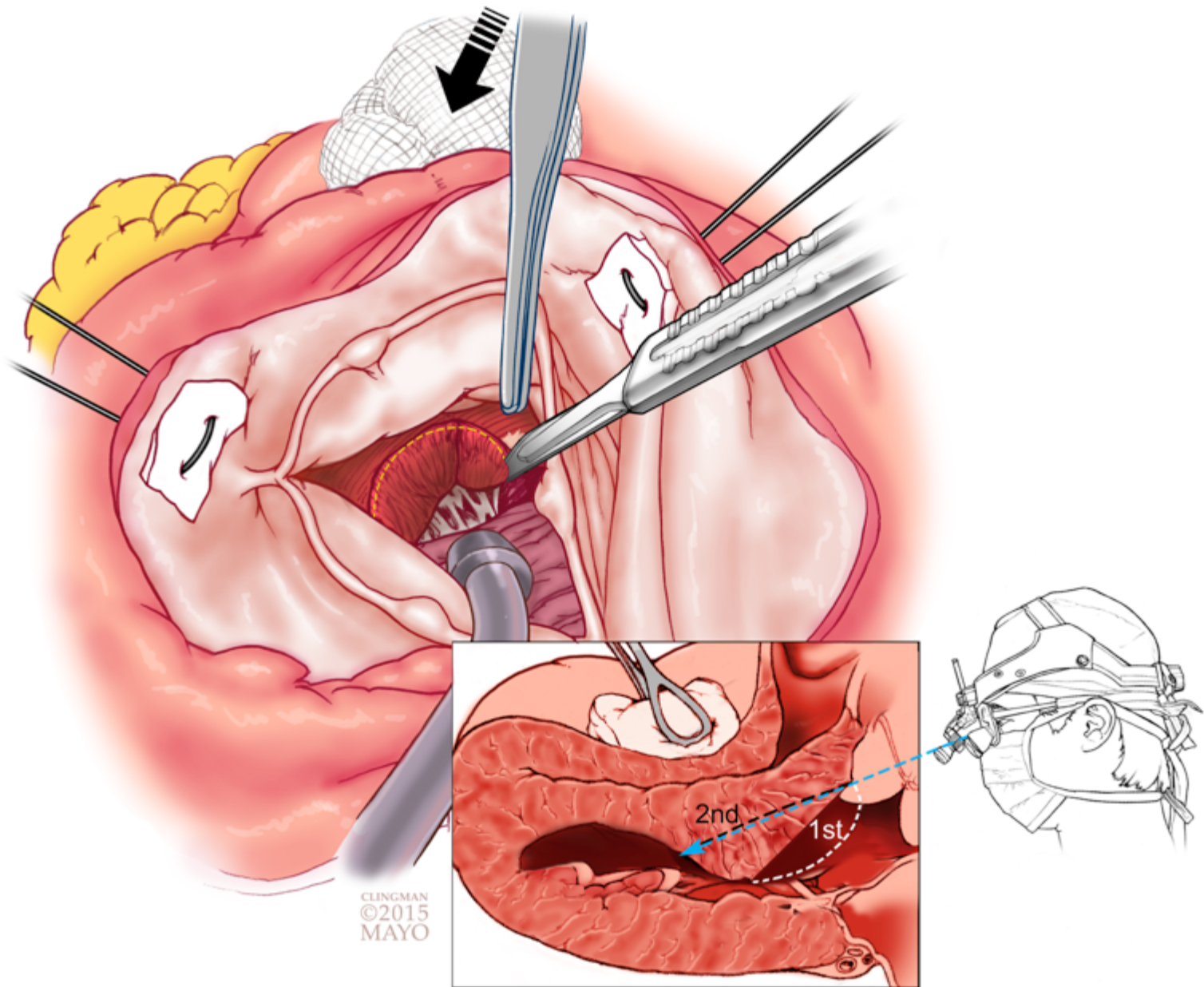
Apical extent of myectomy is more important than depth

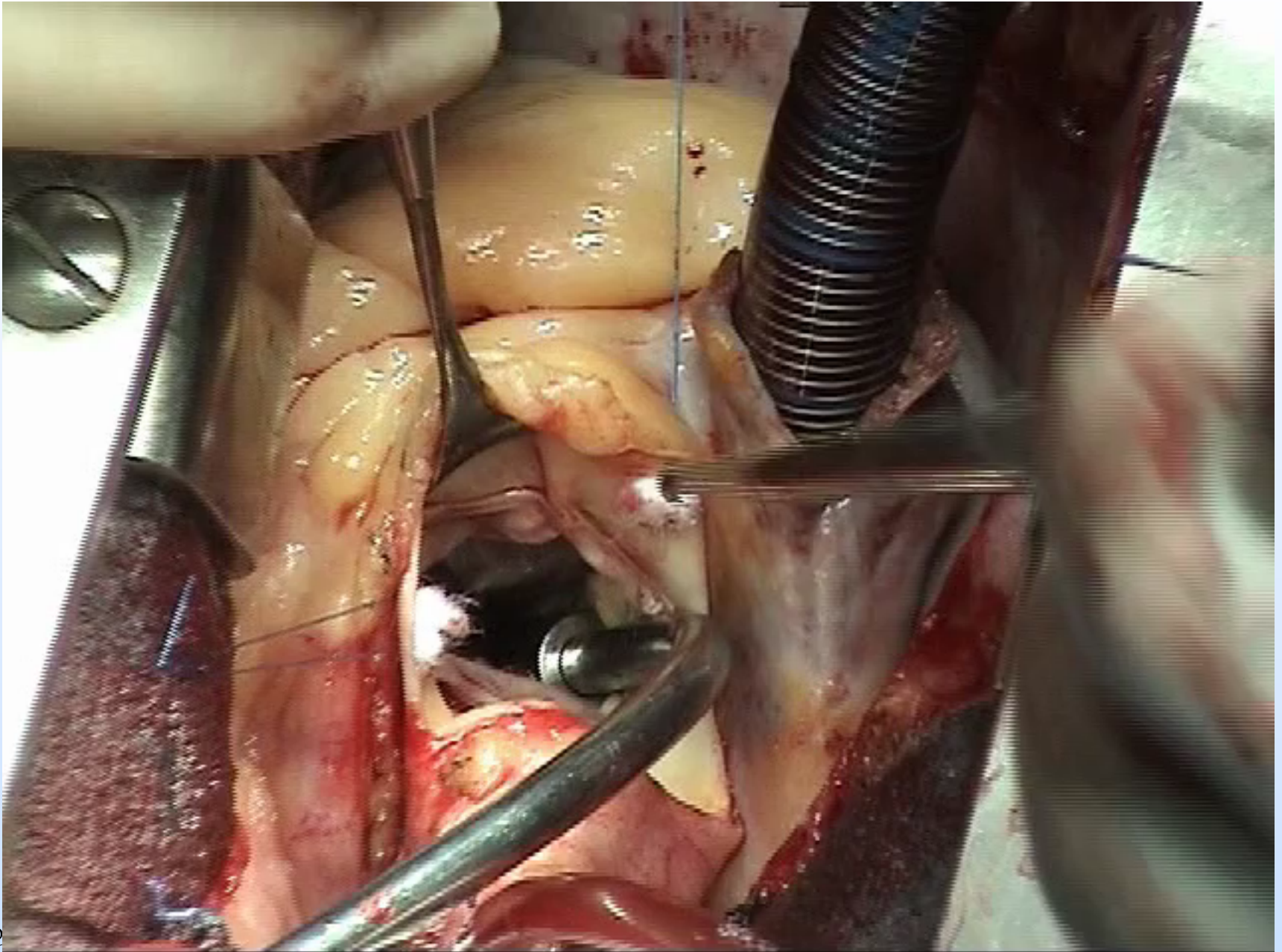


Trough opposite leaflet and subvalvar apparatus

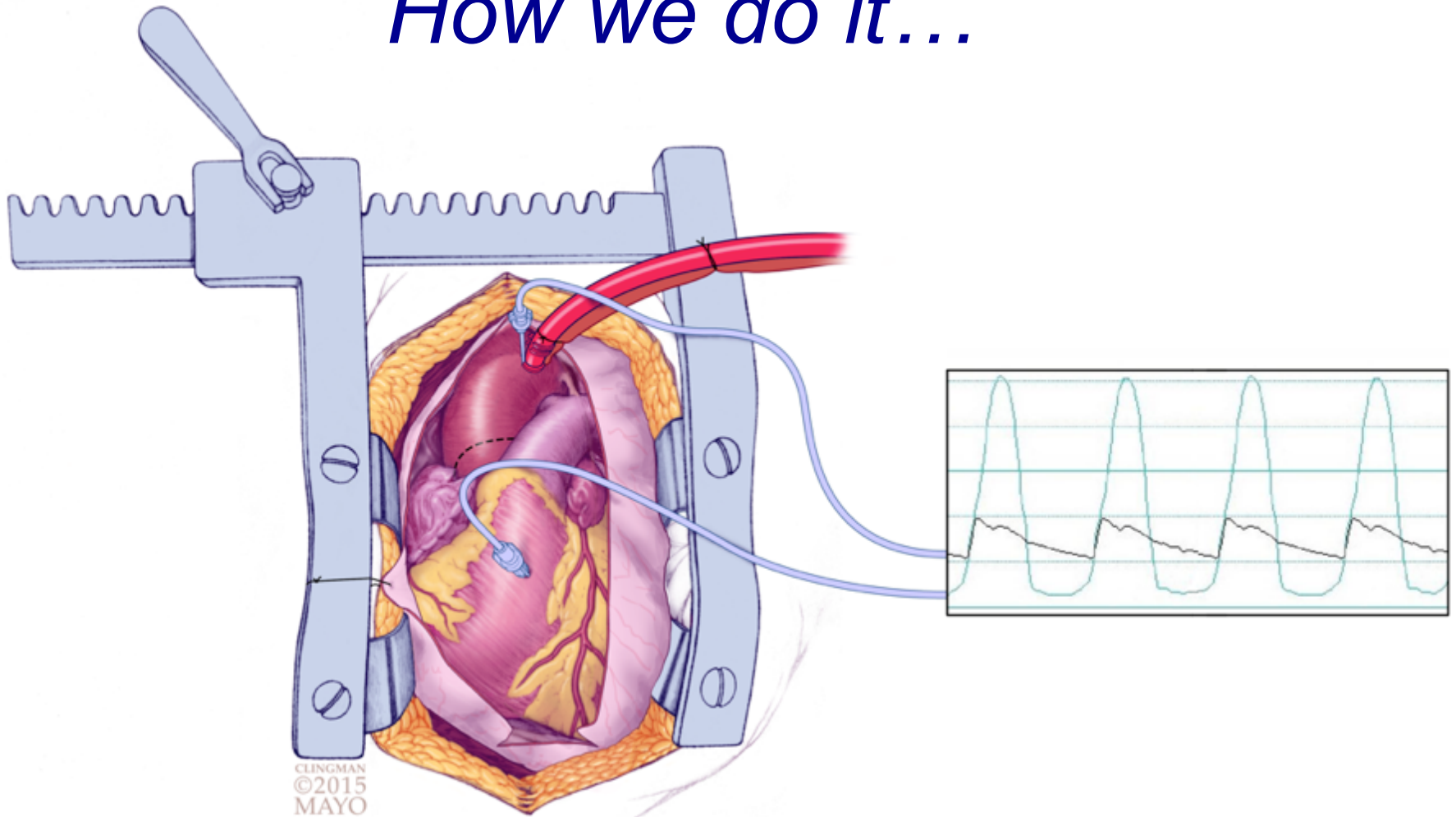


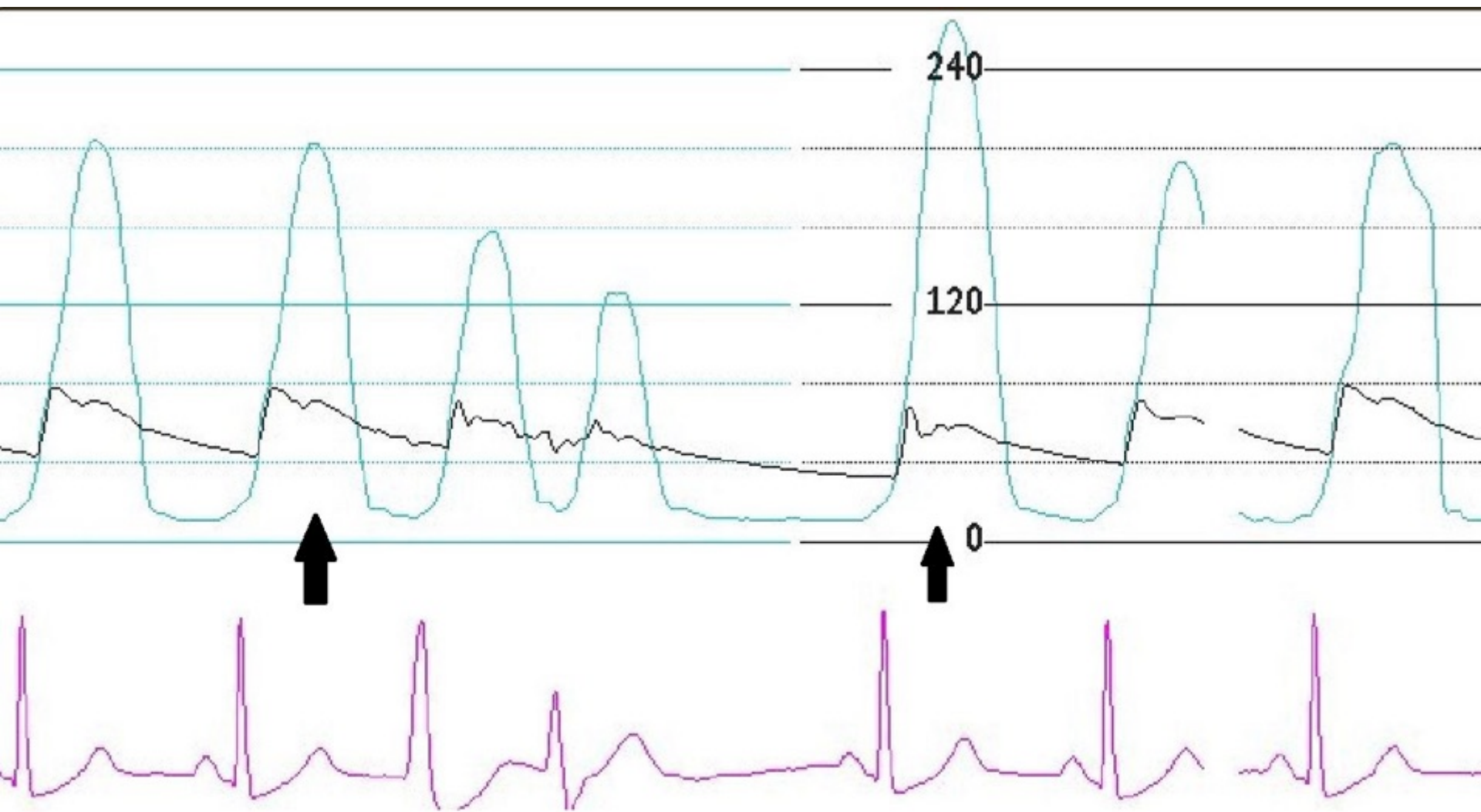






How we do it...

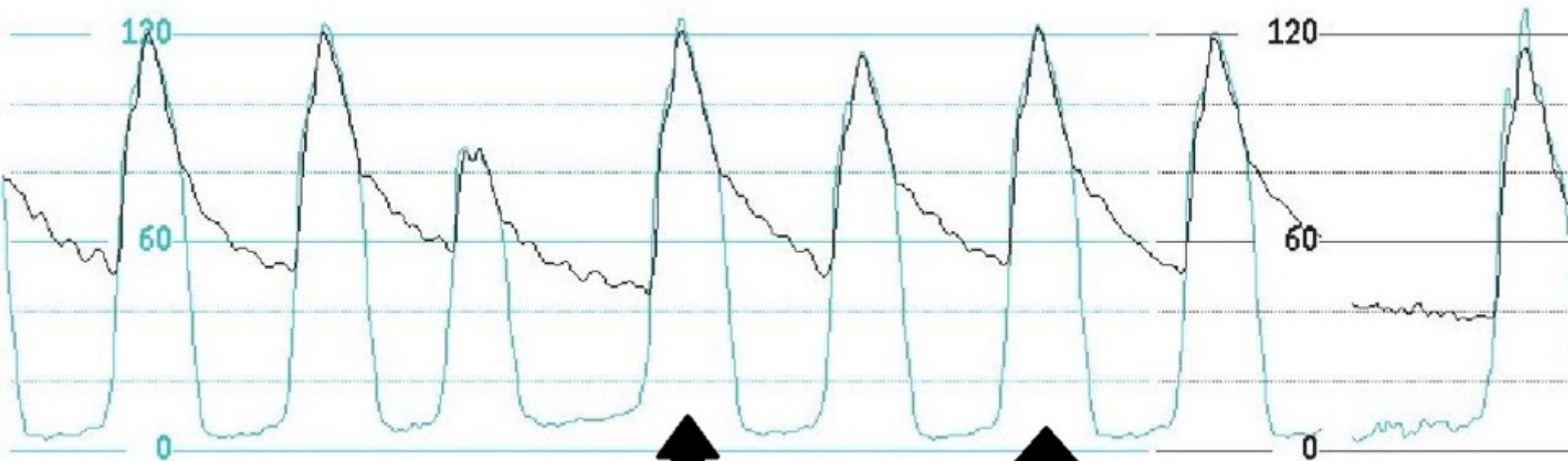




PRE PVC
AO=78/47
LV=202/12
GRAD=124

PRE BYPASS
POST PVC
AO=68/39
LV=264/10
GRAD=196

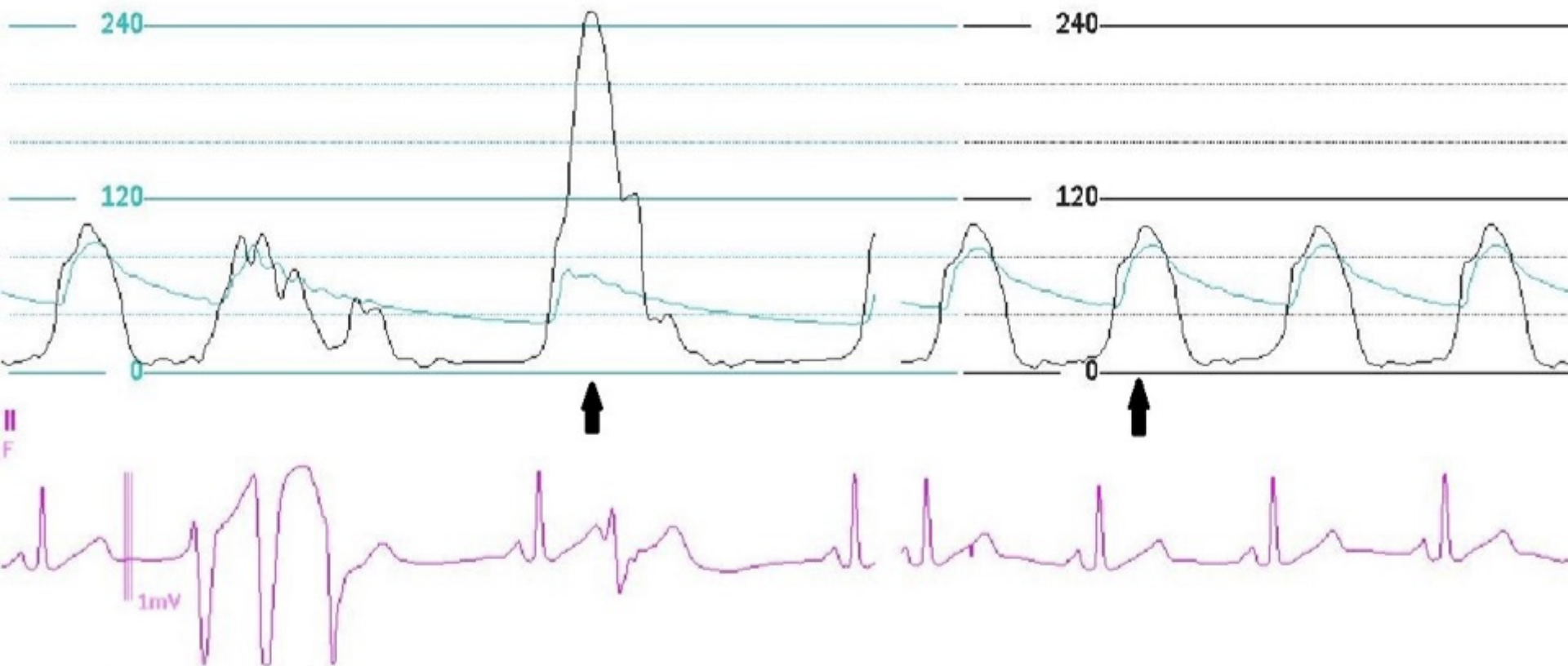
HVS
TECH SLU
HR=62 CO=4.63



PRE PVC
AO= 122/52
LV= 123/4
GRAD= 1

POST BYPASS
POST PVC
AO= 121/50
LV= 125/5
GRAD= 4

HVS
TECH KWM
HR= 71 CO=NA



PRE PVC
 AO=87/47
 LV=102/6
 GRAD=15

PRE BYPASS

POST PVC

AO=71/34

LV=250/5

GRAD=179

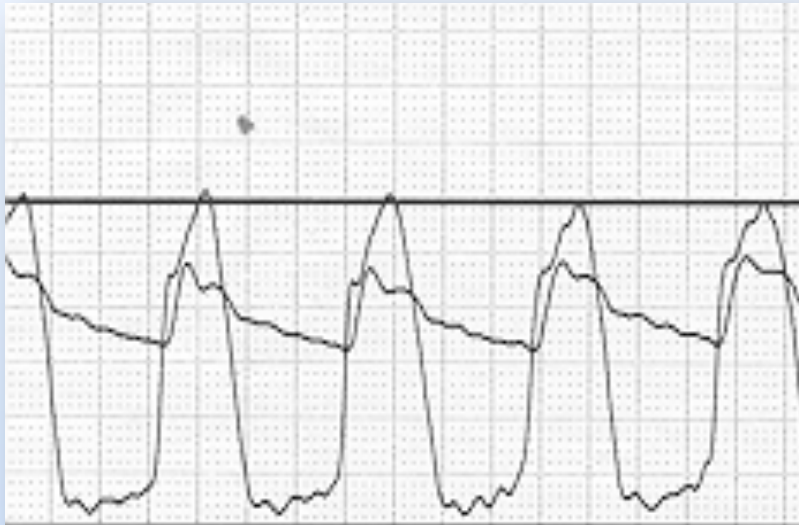
HVS

TECH SEJ

HR=58 CO=3.98

Provocable Gradient

Premyectomy



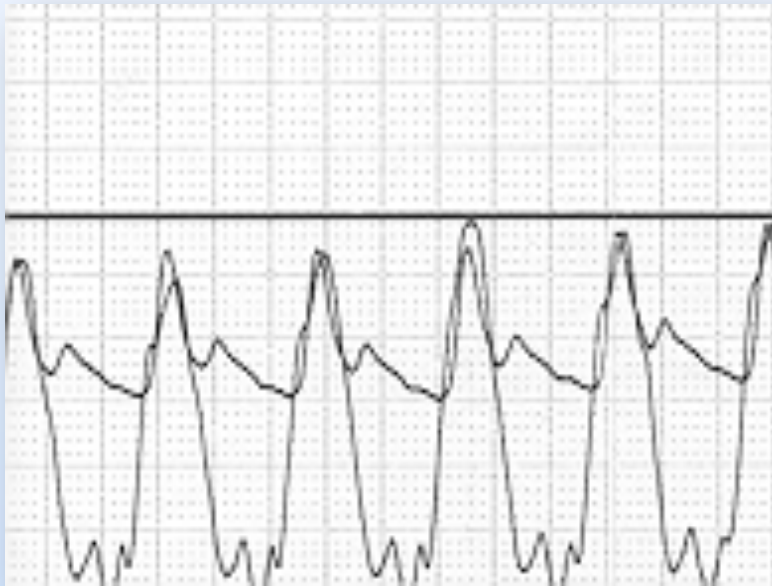
Rest



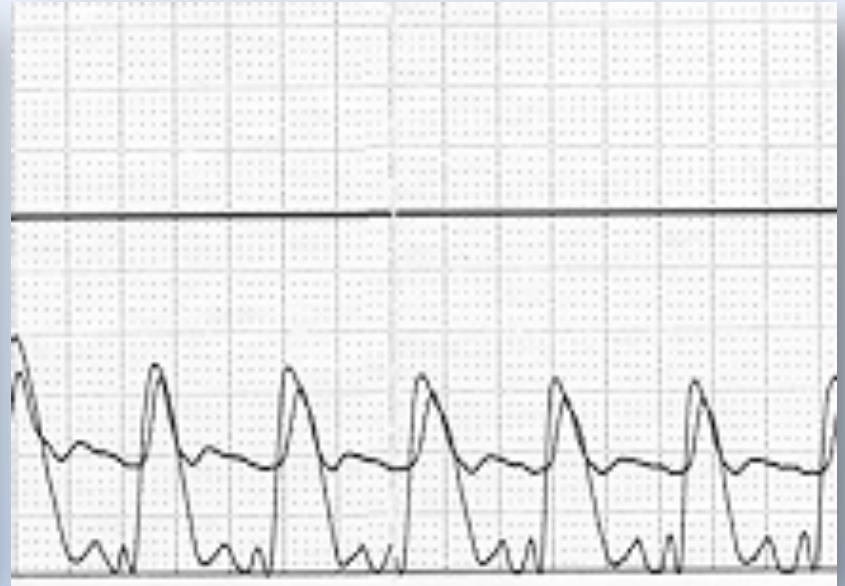
Isuprel

Provocable Gradient

Postmyectomy



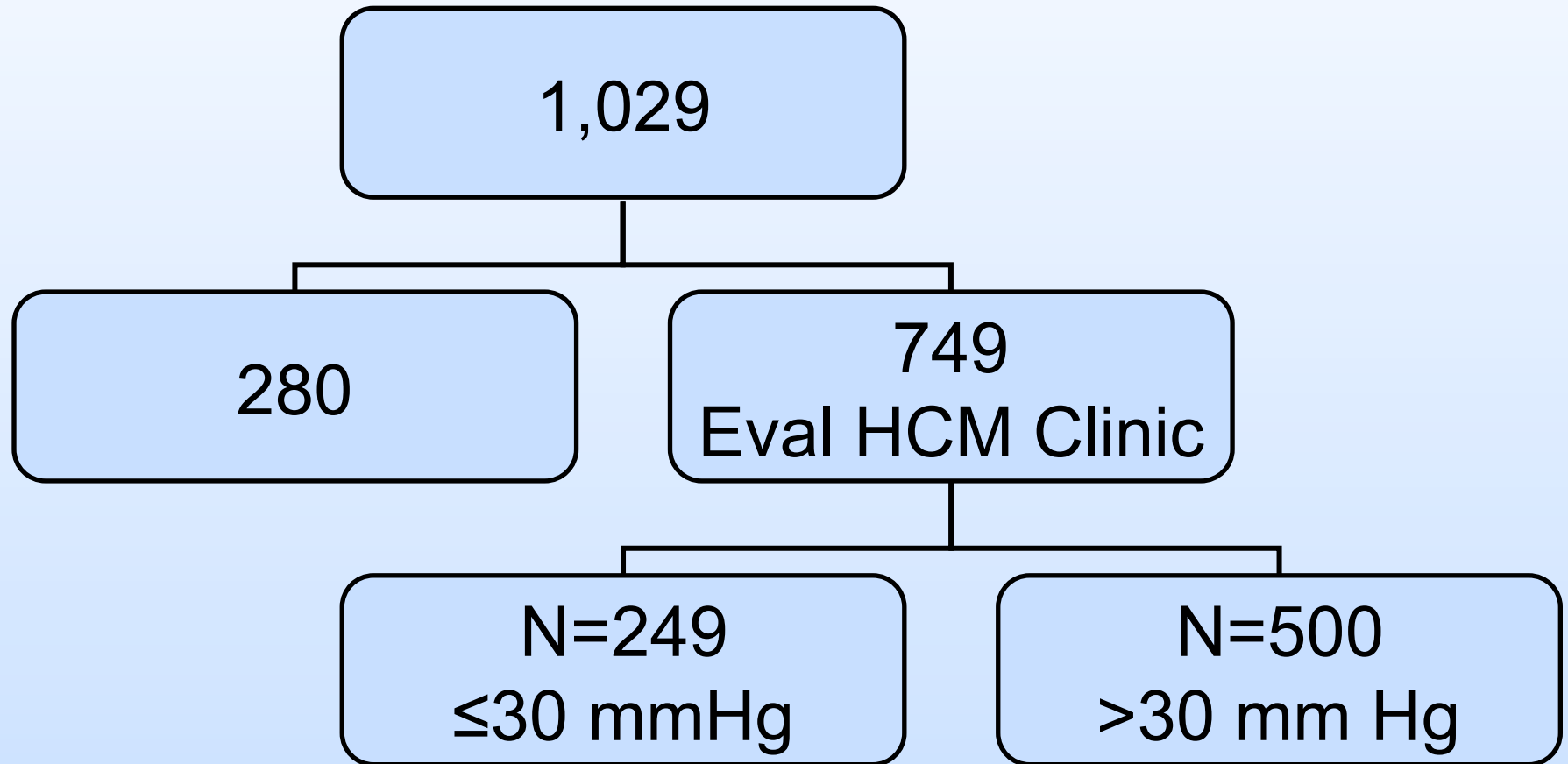
Rest



Isuprel

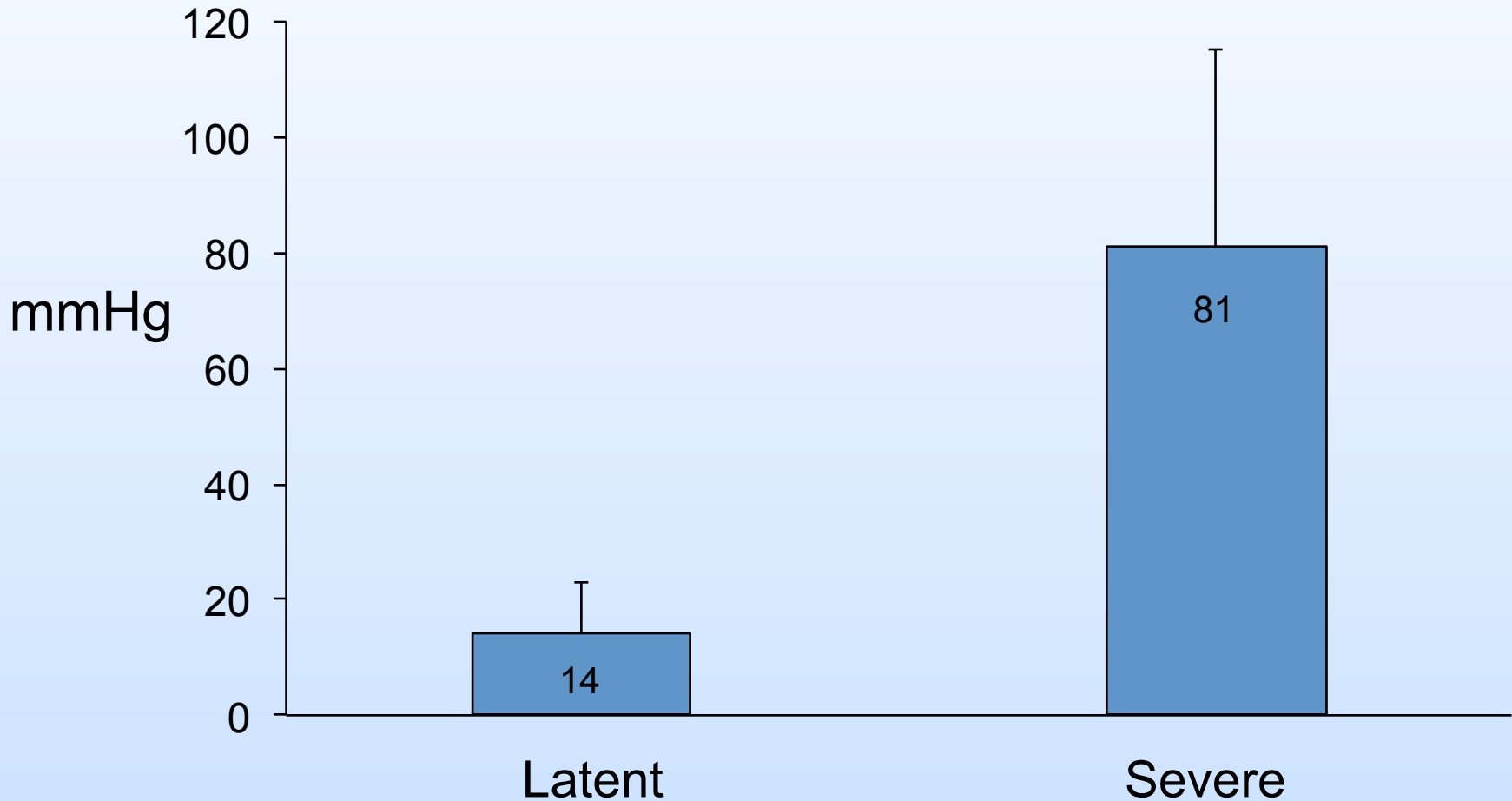
Septal Myectomy for Obstructive HCM

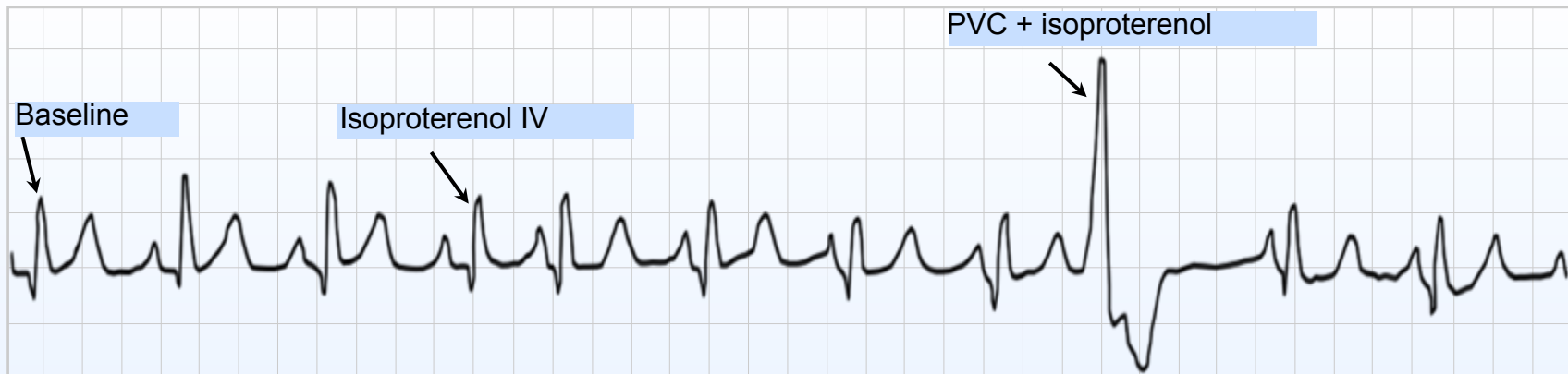
1993-2007 *Low Gradient*



Myectomy for HCM

Preoperative LVOT Gradients

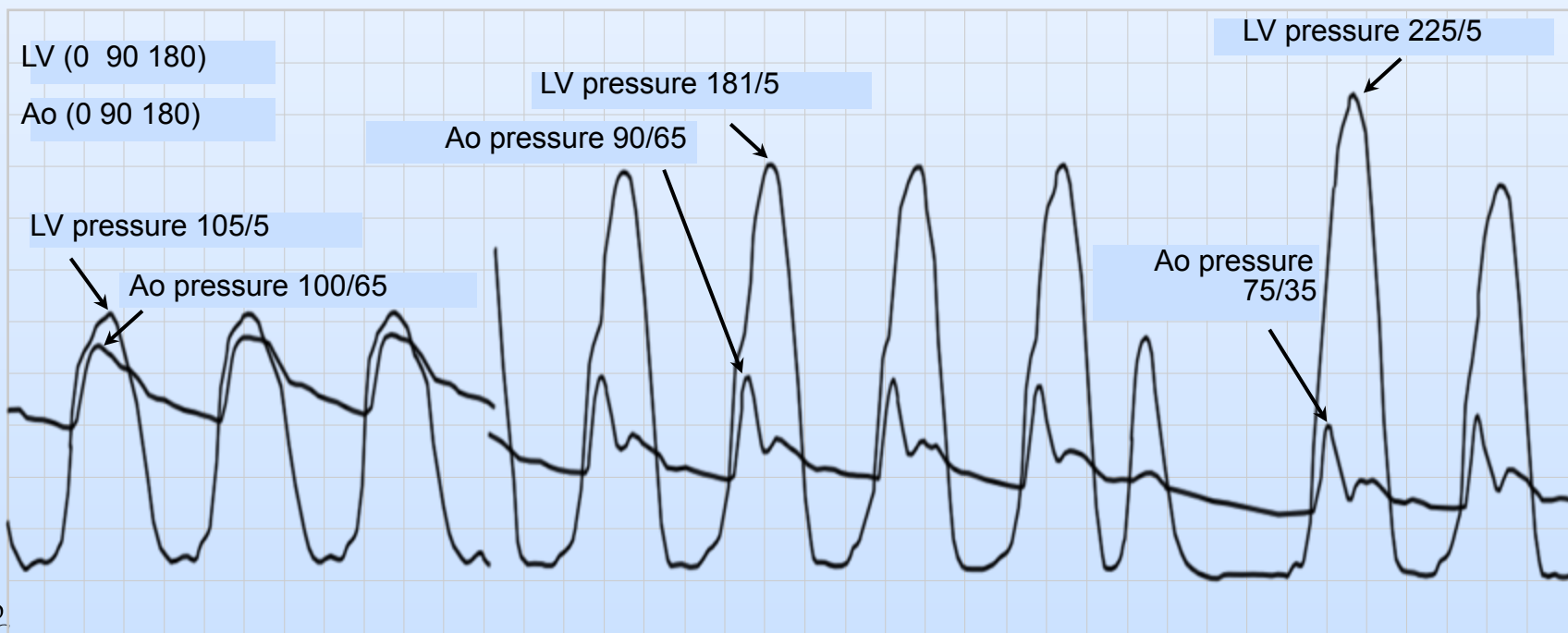


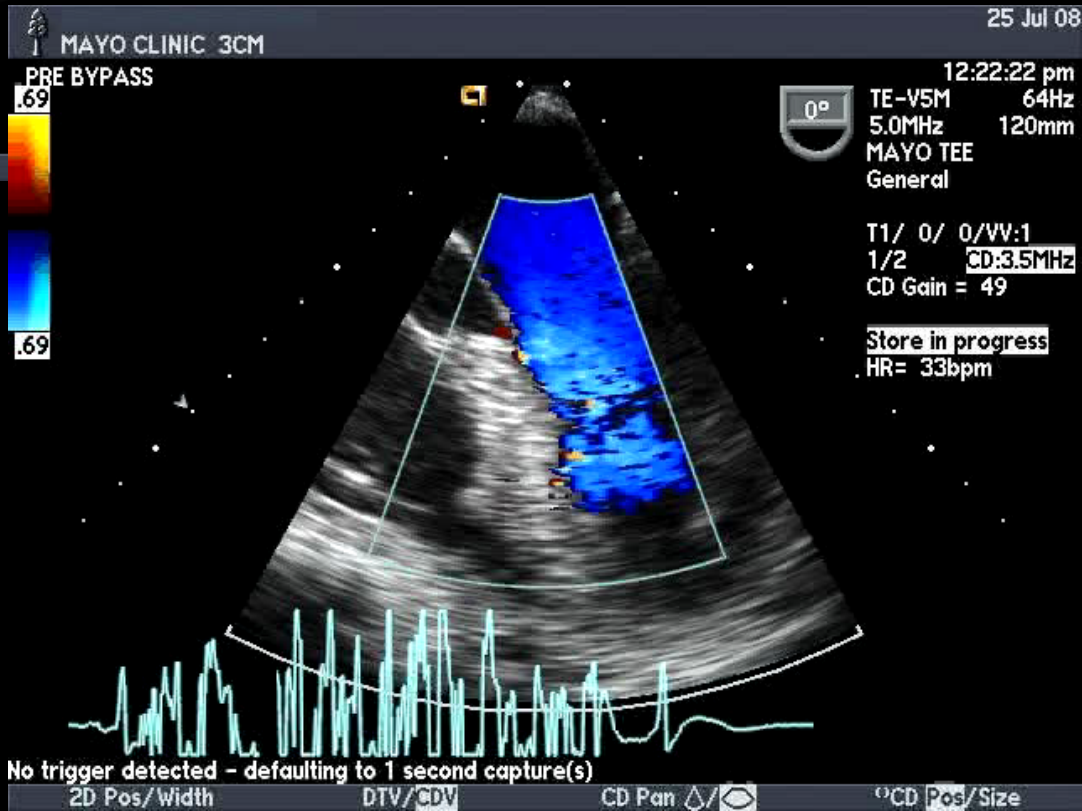


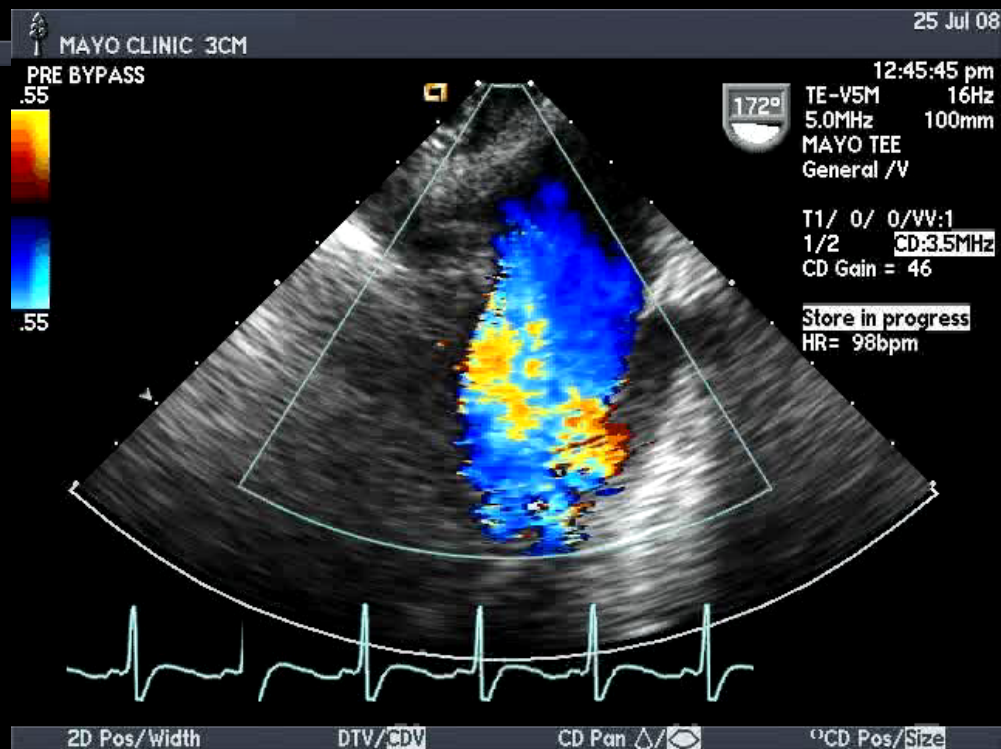
Gradient at baseline = $115 - 100 = 15$ mm Hg

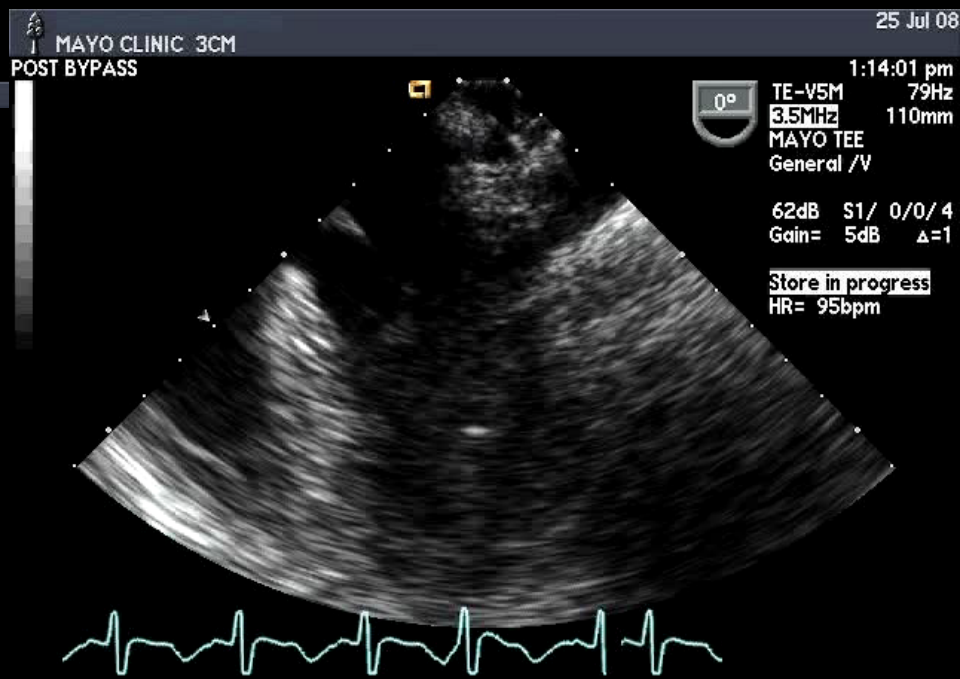
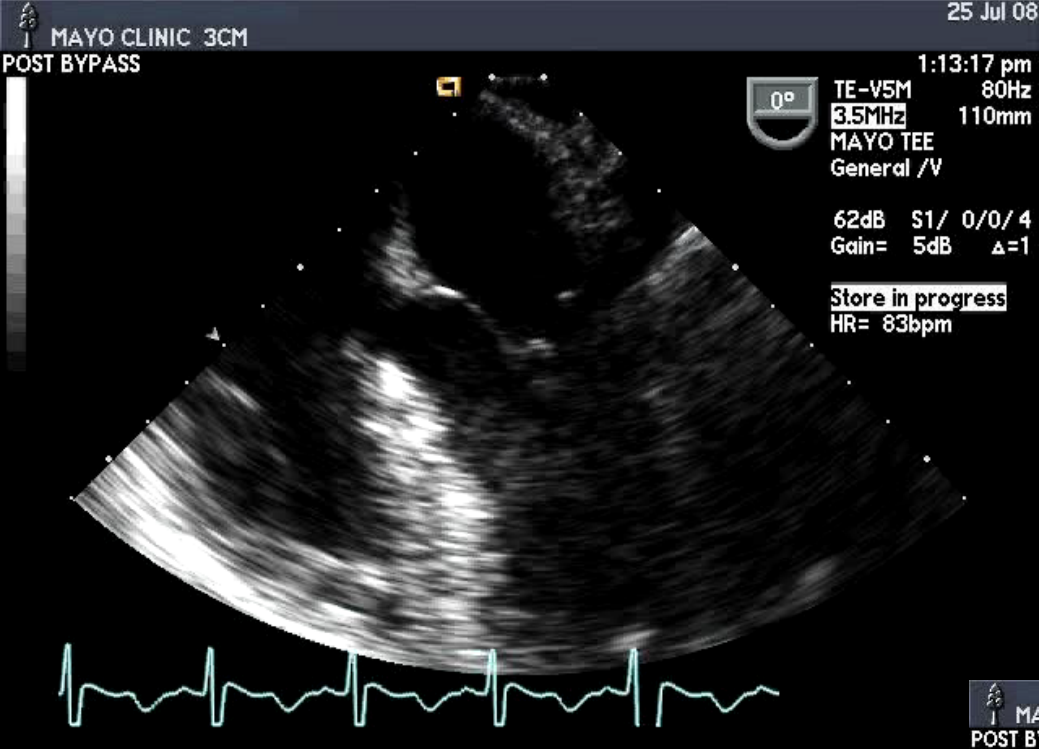
Gradient after isoproterenol IV = $181 - 90 = 91$ mm Hg

Gradient after isoproterenol IV and PVC = $225 - 75 = 150$ mm Hg

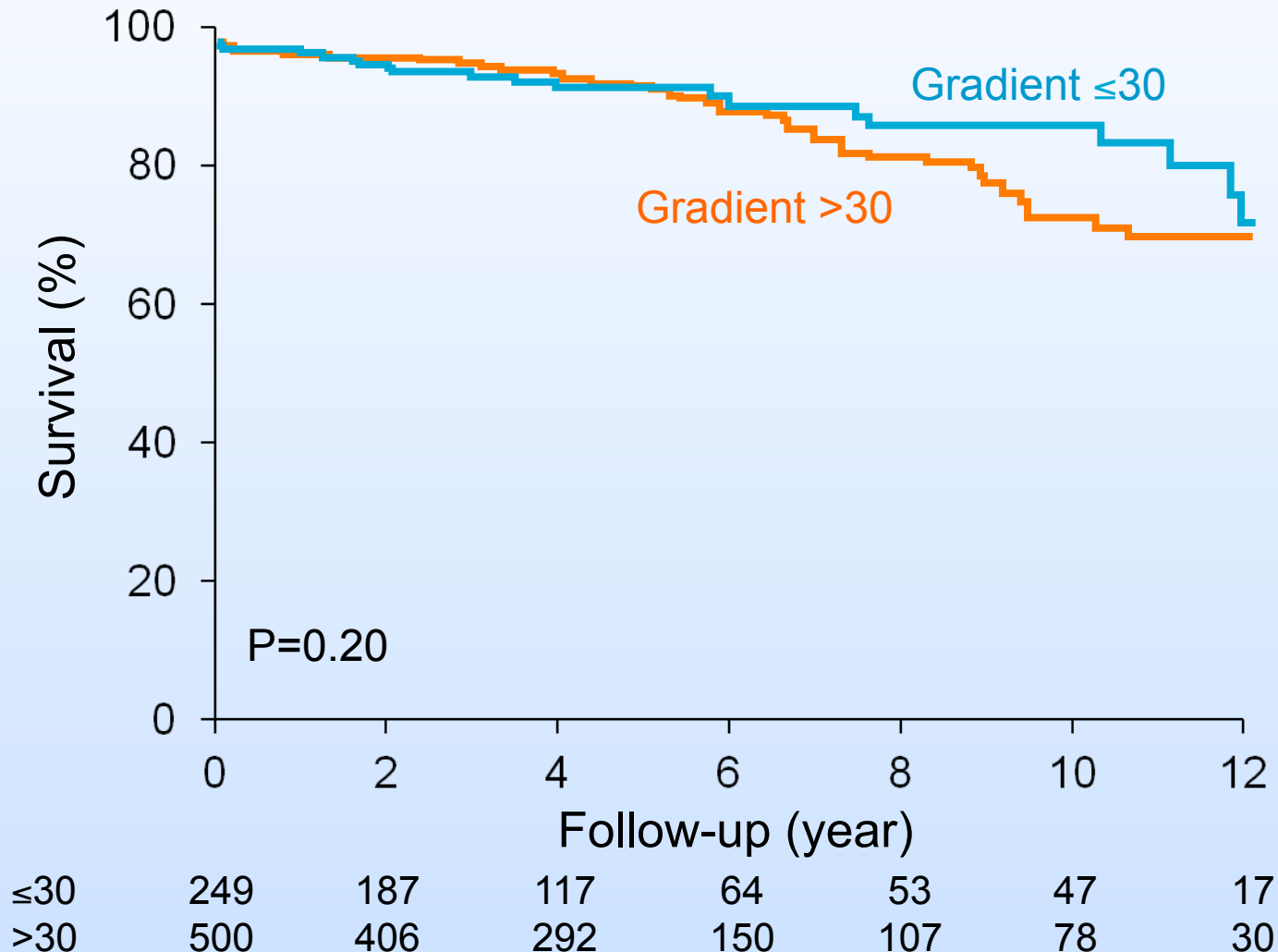






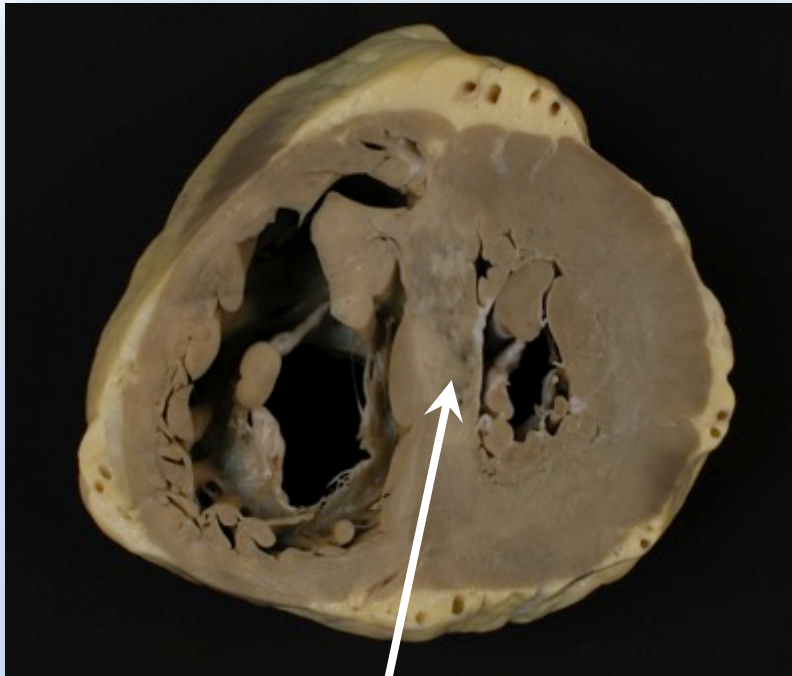


Survival of Pt with Preoperative Resting Peak Gradient ≤ 30 and >30 mmHg



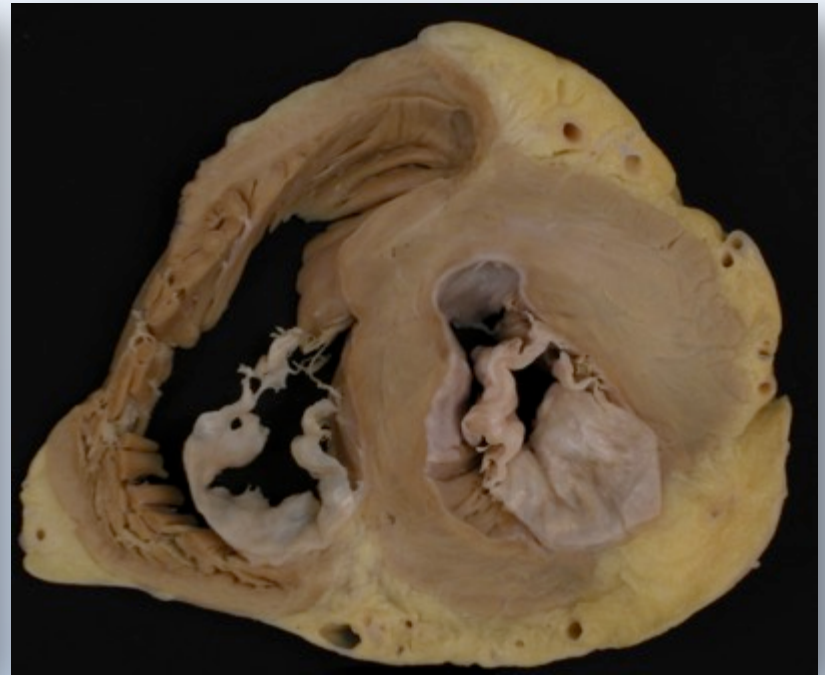
Absent Septal Scarring with Myectomy

Post-Ablation



Septal scar

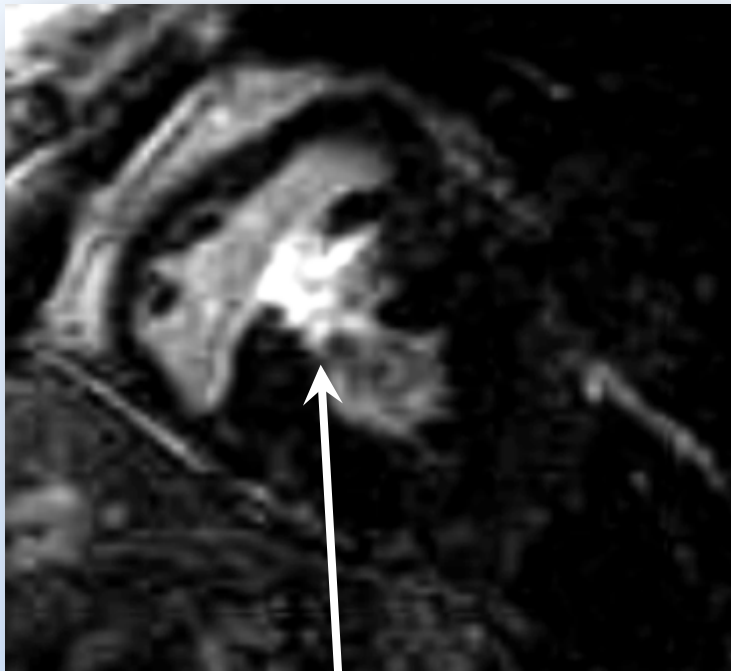
Post-Myectomy



No scar

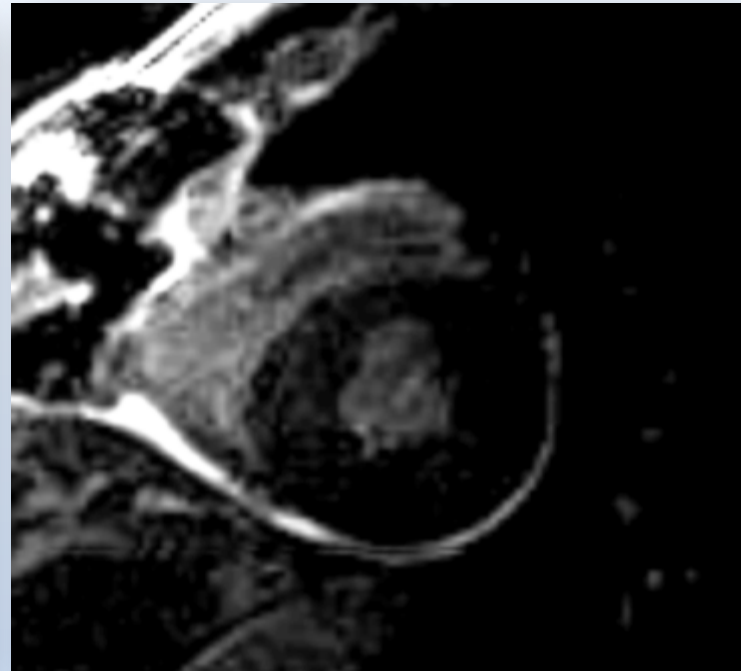
The Ablation Scar

Post-Ablation



Septal scar

Post-Myectomy



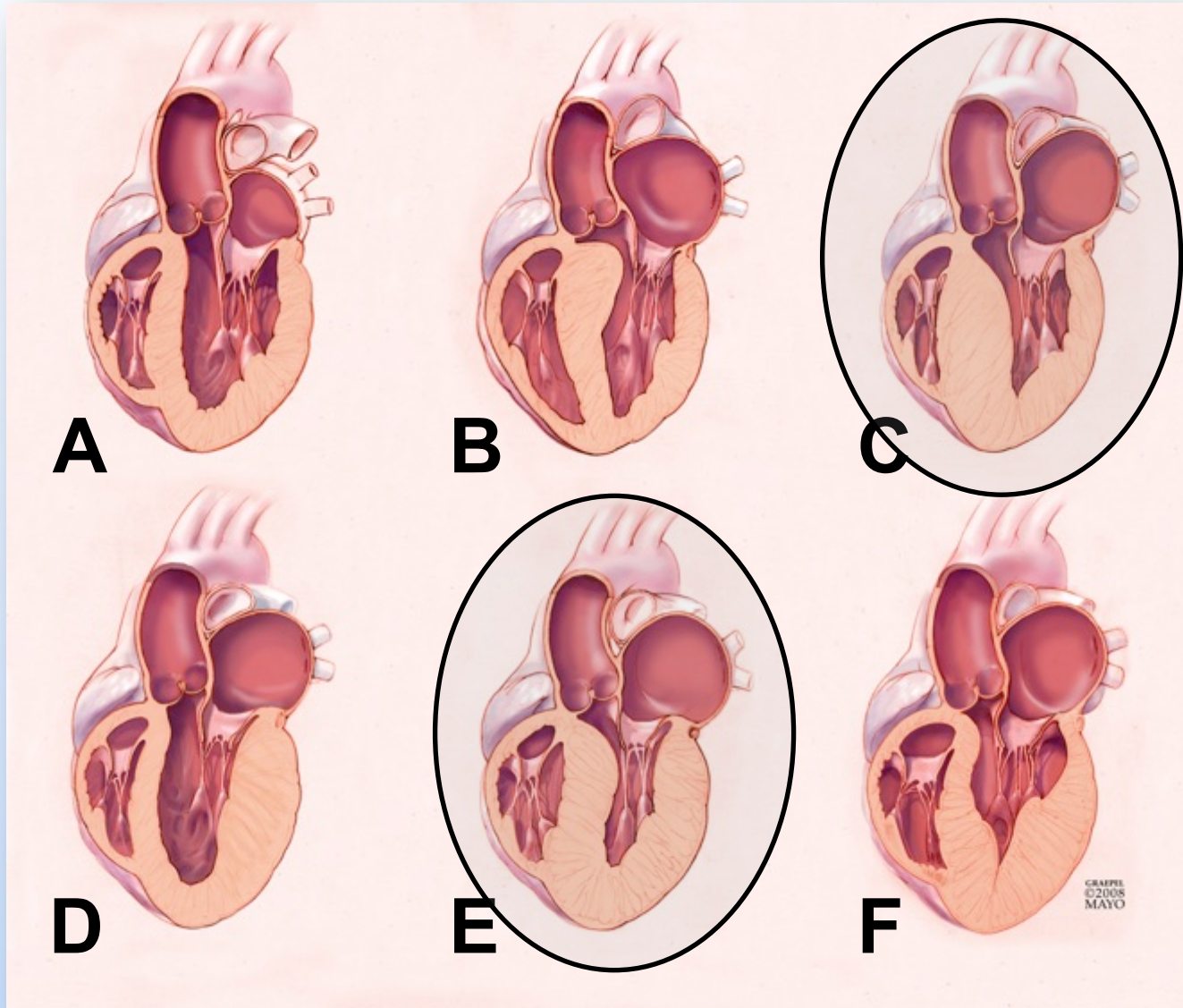
No scar

Septal Myectomy for HCM

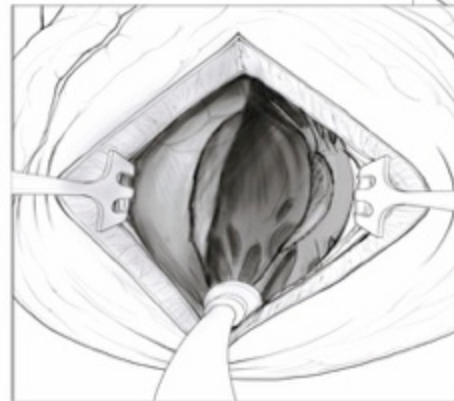
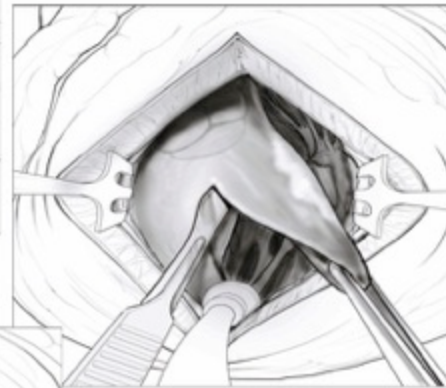
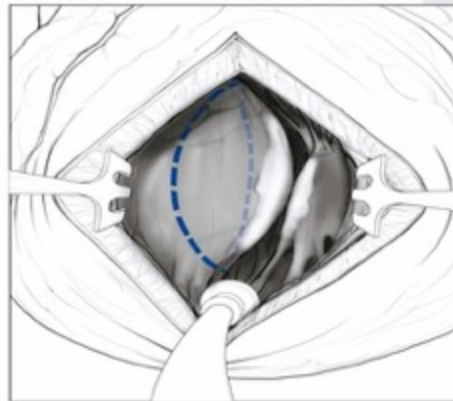
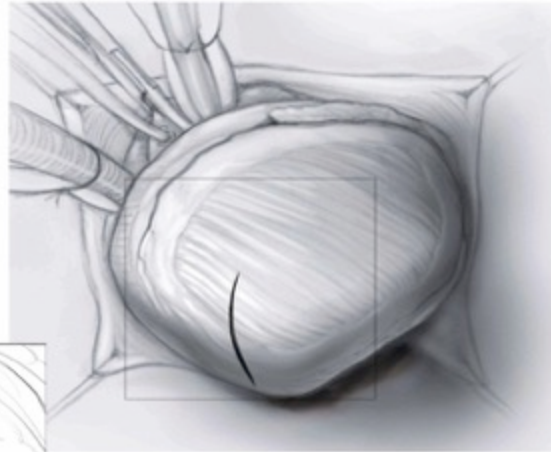
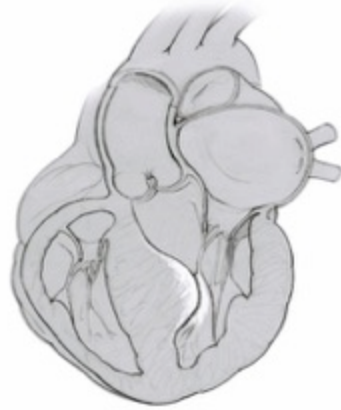
Key Points

- Obstruction is common ($>70\%$)
- Myectomy relieves gradients and symptoms (95%)
- Risk $<1\%$
- No scar
- Thick or thin septums
- May improve late survival

Midventricular Obstruction



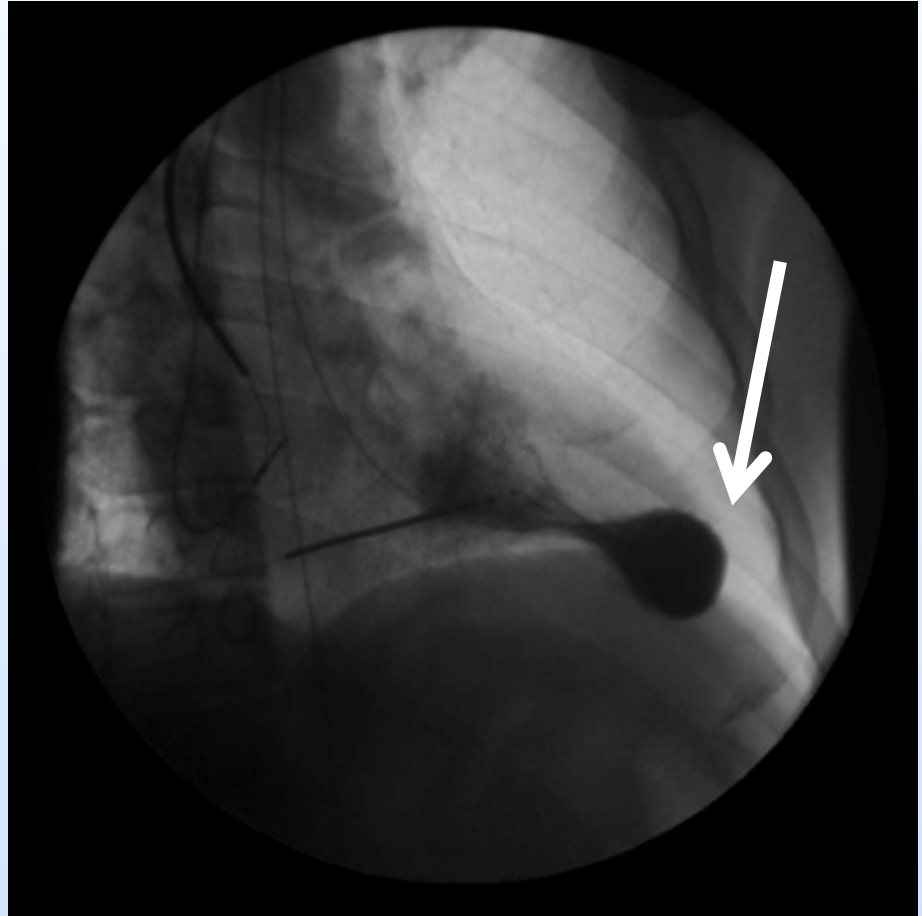
Apical approach



Myectomy for Midventricular Obstruction

Operative Techniques

- Surgical approach
 - Trans-aortic 5 pt
 - Trans-apical 31 pt
 - Both 19 pt
- Apical pouch/aneurysm 13 pt





Mayo Clinic 7EZ

12/11/2012 1:12:32 P USR

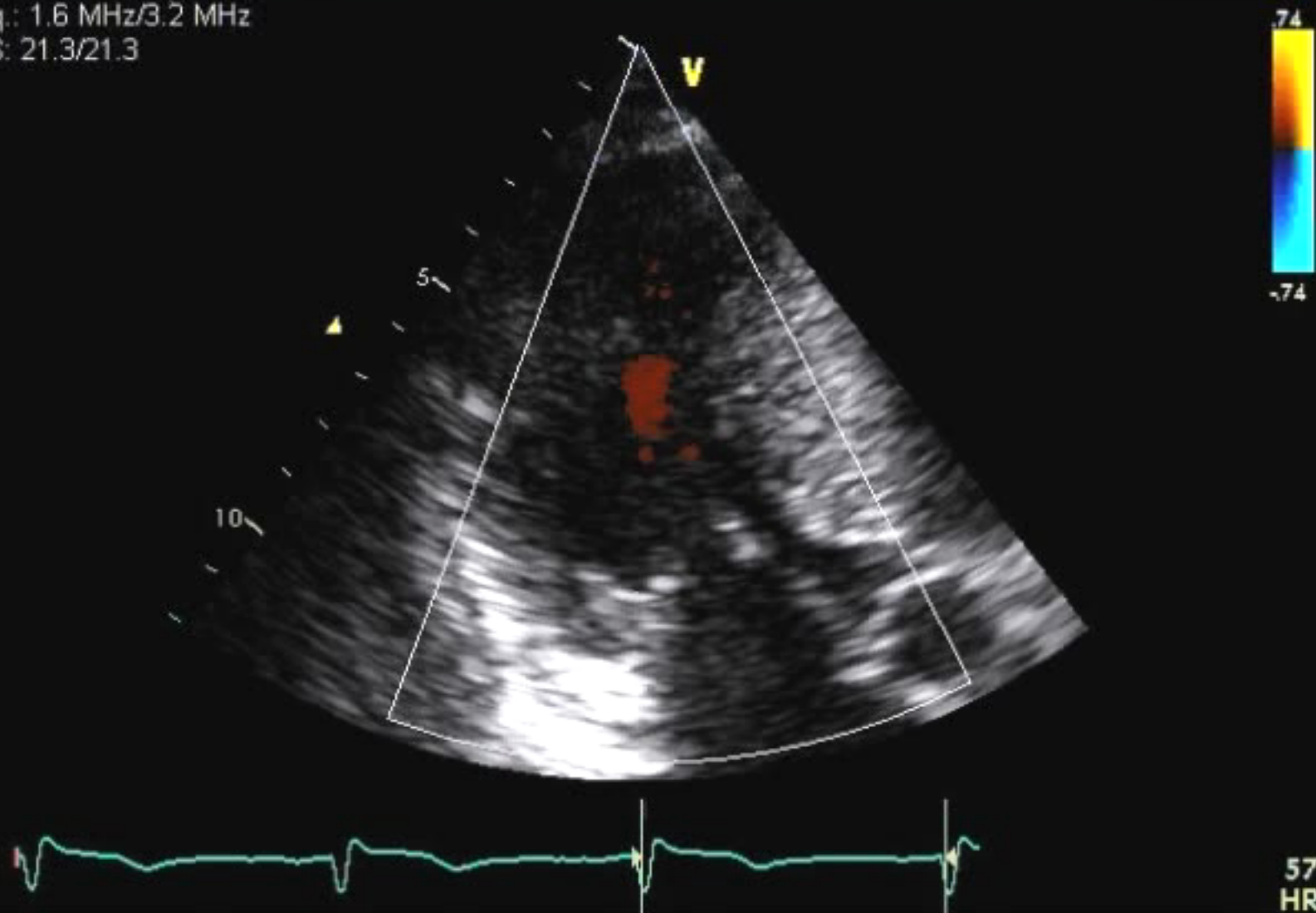
M5S

Cardiac

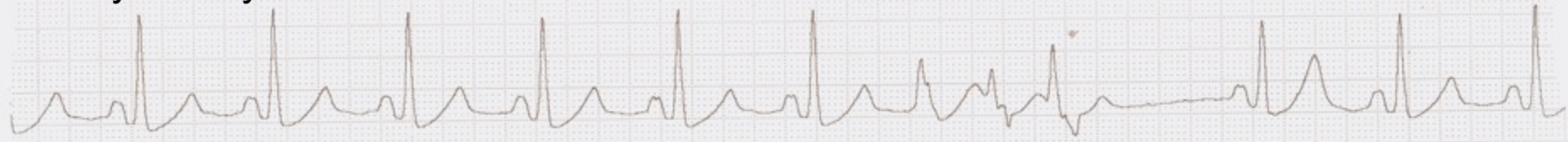
MI 1.3

TIS:1.2

Freq.: 1.6 MHz/3.2 MHz
FPS: 21.3/21.3



Pre-myectomy



300 —

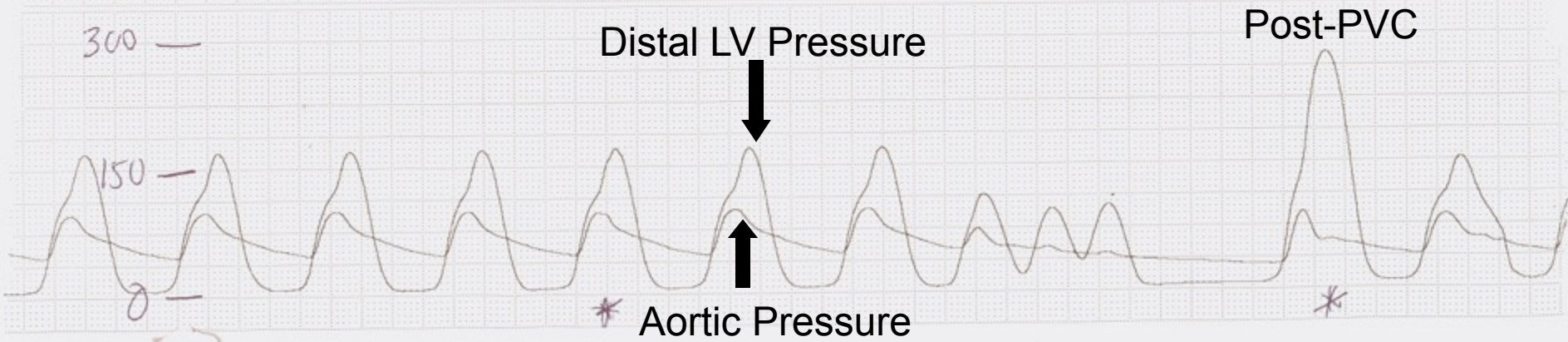
Distal LV Pressure

Post-PVC

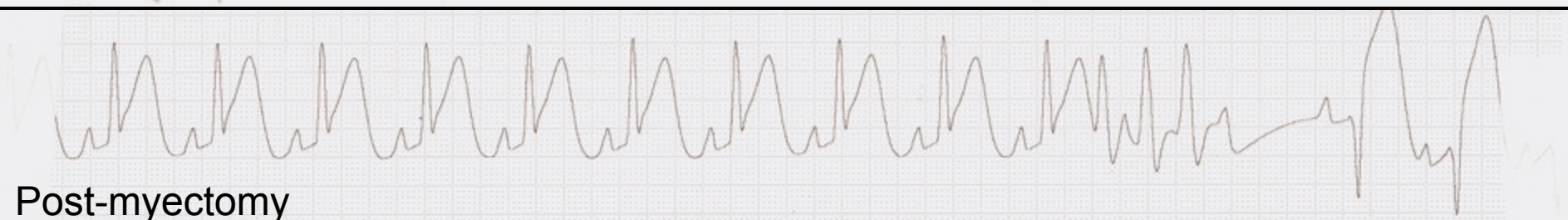
150 —

0 —

Aortic Pressure



Post-myectomy



Post-PVC

-180

-90

0

