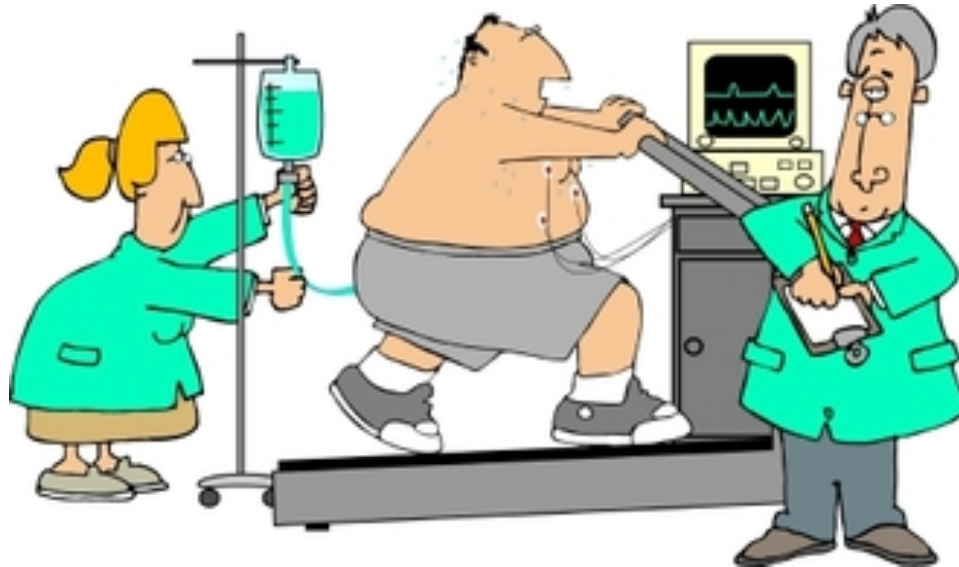


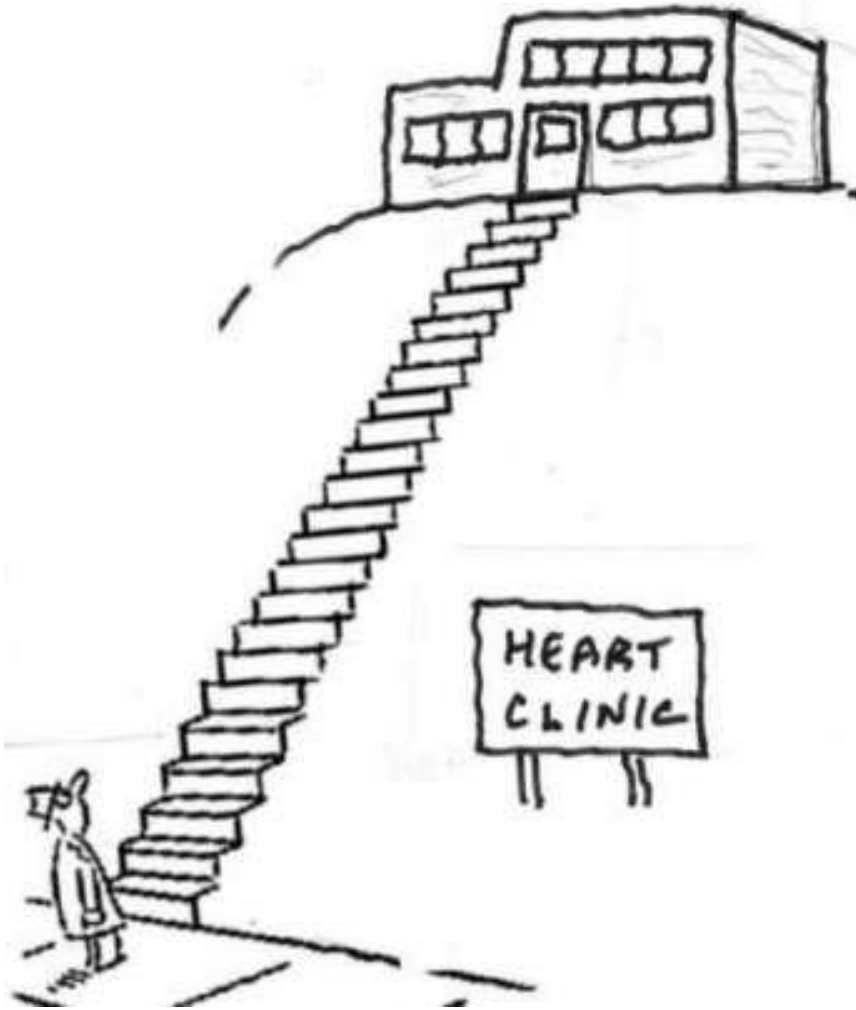
# The role of stress testing in hypertrophic cardiomyopathy



Athletes, Sudden Death and HCM  
Stanford University  
June 26, 2009

Sharlene M. Day, MD  
Director, HCM Program  
University of Michigan

# Should stress testing be a routine component of the evaluation of HCM patients?



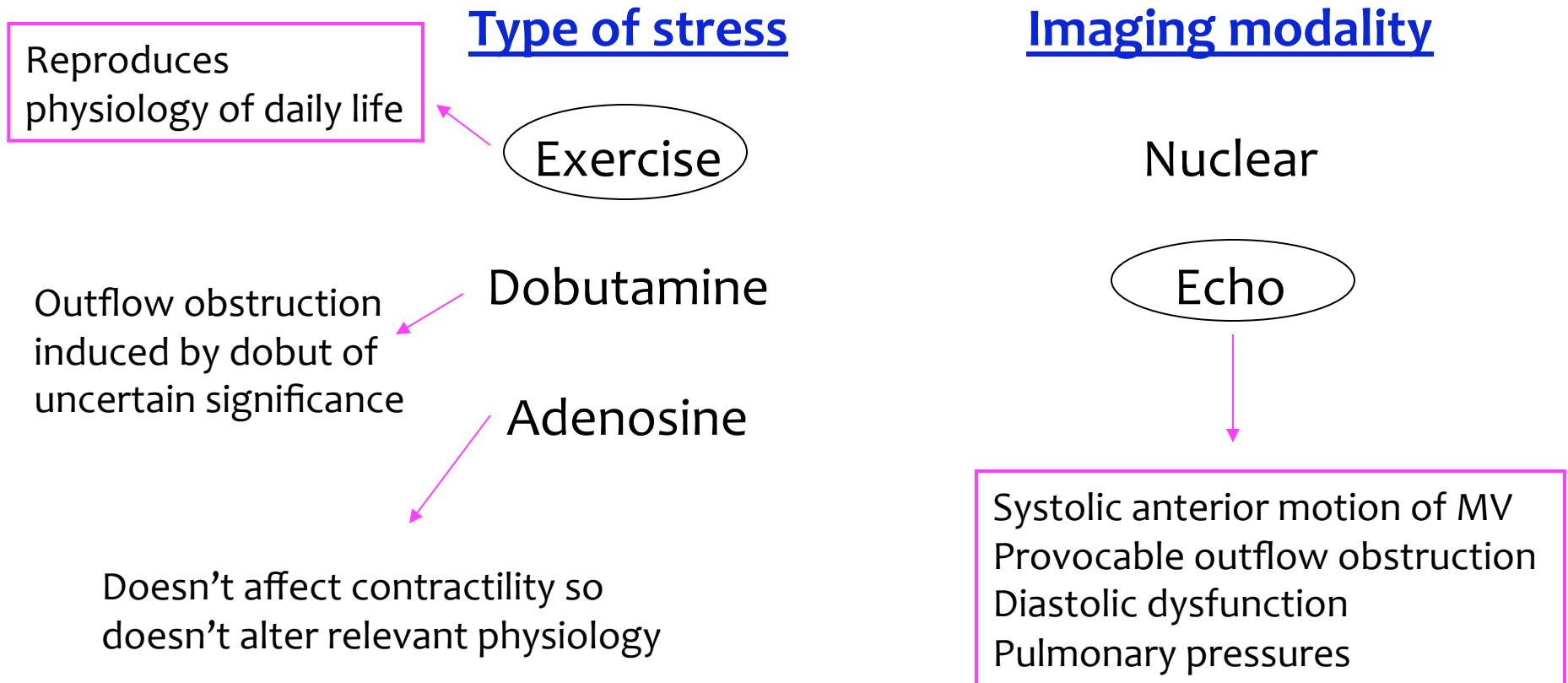
**Safety**

**Diagnosis**

**Management**

**Prognosis**

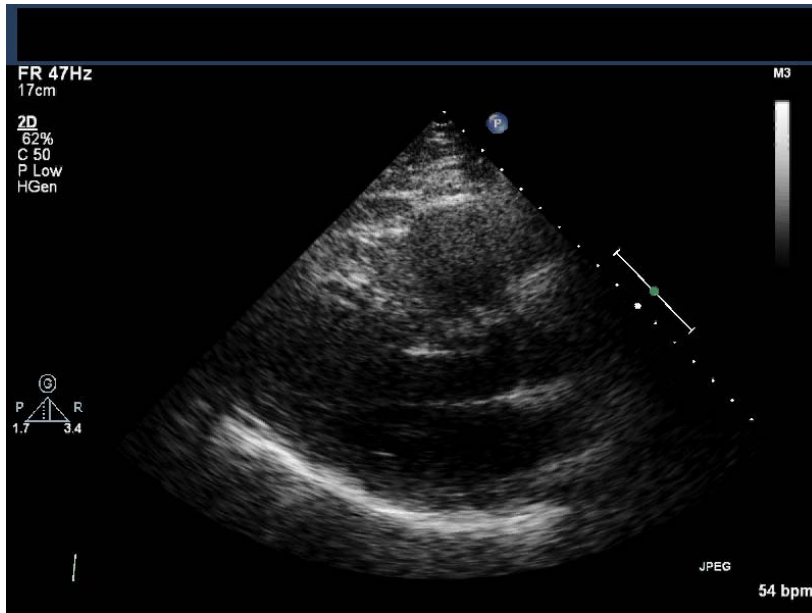
# First – what type of stress?



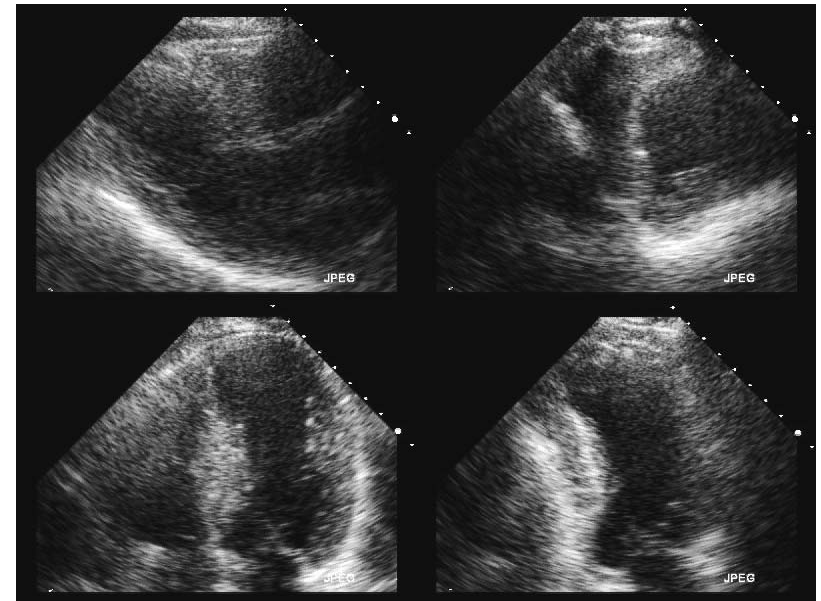
# Exercise testing in HCM patients is safe

- ACC/AHA guidelines 2002 - HCM a relative contraindication to exercise testing; can be “superseded if benefits outweigh risks”
- Total of 516 HCM patients in 3 studies - 1 major adverse event (hemodynamically stable sustained VT requiring CV)
  - Sadoul et al., Circ 1997
  - Drinko et al., Am J Cardiol 2004
  - Bunch et al., Am J Cardiol 2007
- Total of 455 patients without obstruction at rest – no adverse events
  - Maron et al., Circ 2006
  - Shah et al., Heart 2008

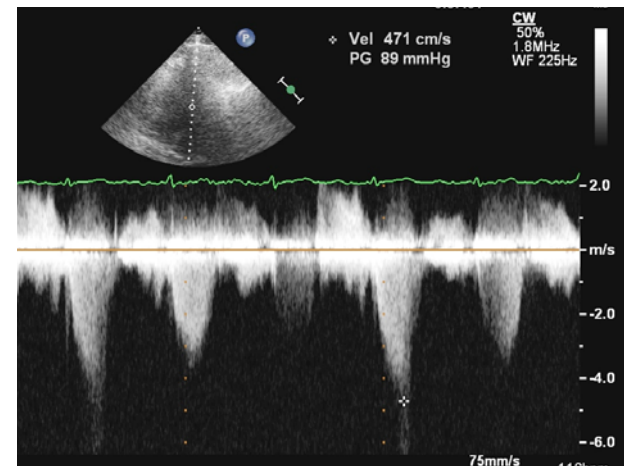
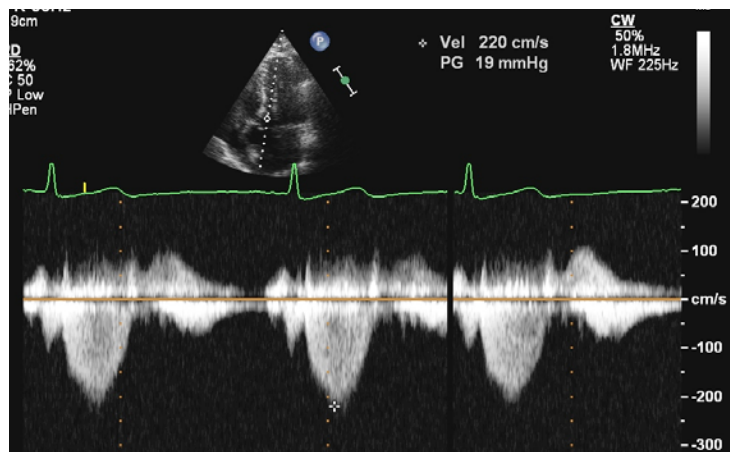
# Diagnosis: Latent obstruction



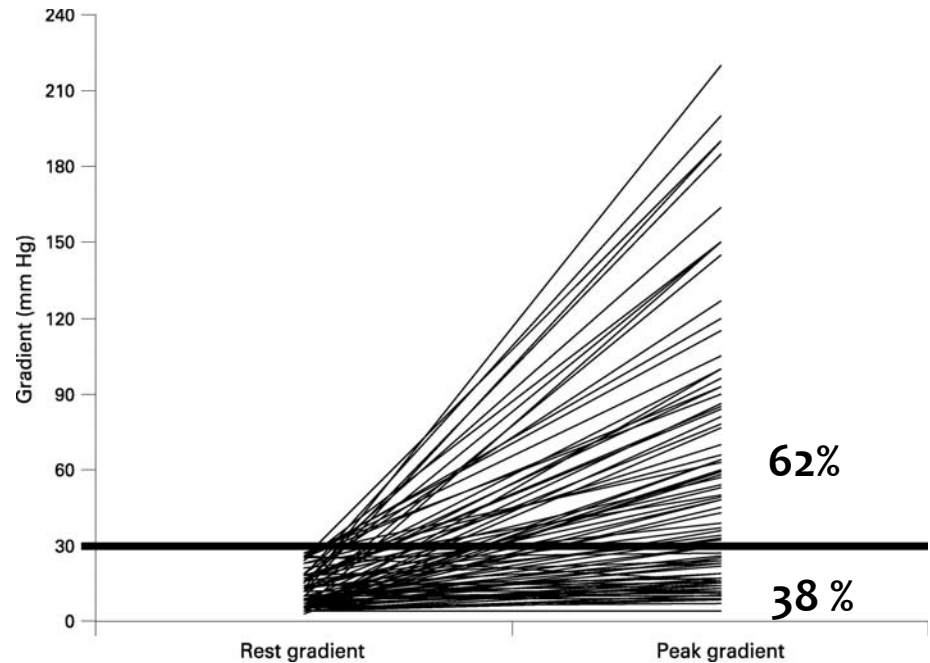
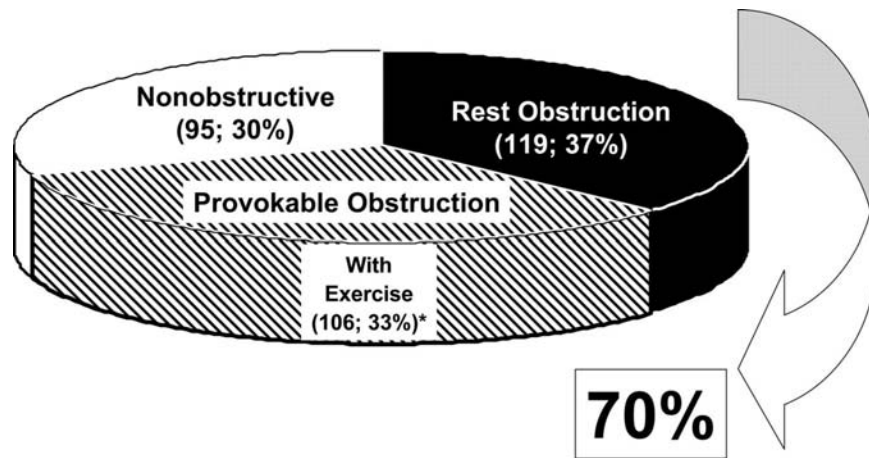
Resting outflow gradient = 19 mmHg



Post-exercise outflow gradient = 89 mmHg



# Many HCM patients develop obstruction with exercise



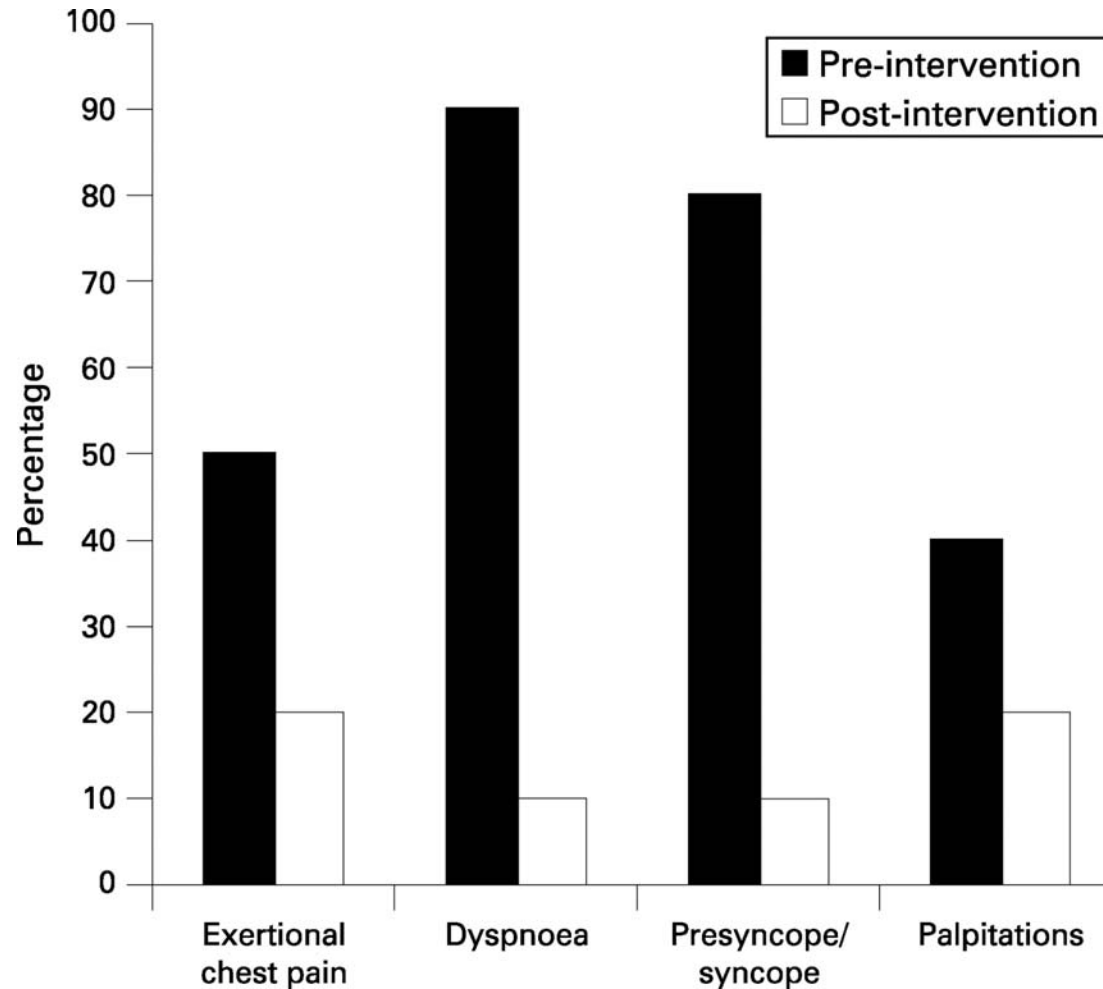
Maron, M. S. et al. *Circulation* 2006;114:2232-2239

Shah, J S et al. *Heart* 2008;94:1288-1294

## Implications for management of symptomatic patients:

- negative inotropes
- aggressive hydration
- avoidance of afterload reduction and high dose diuretics

# Symptom reduction after septal reduction for provokable obstruction



# Does exercise testing have any additional value in management of HCM patients?

## Exercise capacity

- Quantifies degree of functional limitation
- Guides medical therapy for diastolic dysfunction, heart failure, ischemia
- Cardiopulmonary parameters correlate w/ invasive hemodynamics

## Diagnosis of ischemic heart disease

- epicardial CAD vs. microvascular

## Determines need for referral for advanced heart failure therapies/ transplant

- Restrictive physiology
- Pulmonary hypertension
- End-stage, “burned out”

# What exercise parameters are useful prognostically?

**Abnormal blood pressure response w/ upright exercise**

Hypotensive = drop  $\geq 20$  mmHg from peak  
Flat = change  $\leq 20$  mmHg during test

## Potential mechanisms for BP drop during exercise

Exaggerated peripheral vasodilation

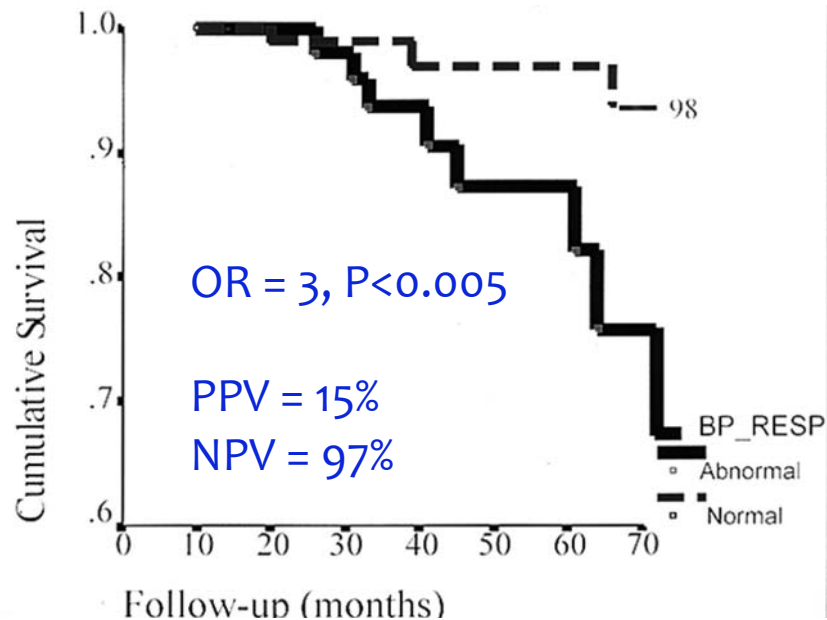
Decreased stroke volume

Ischemia

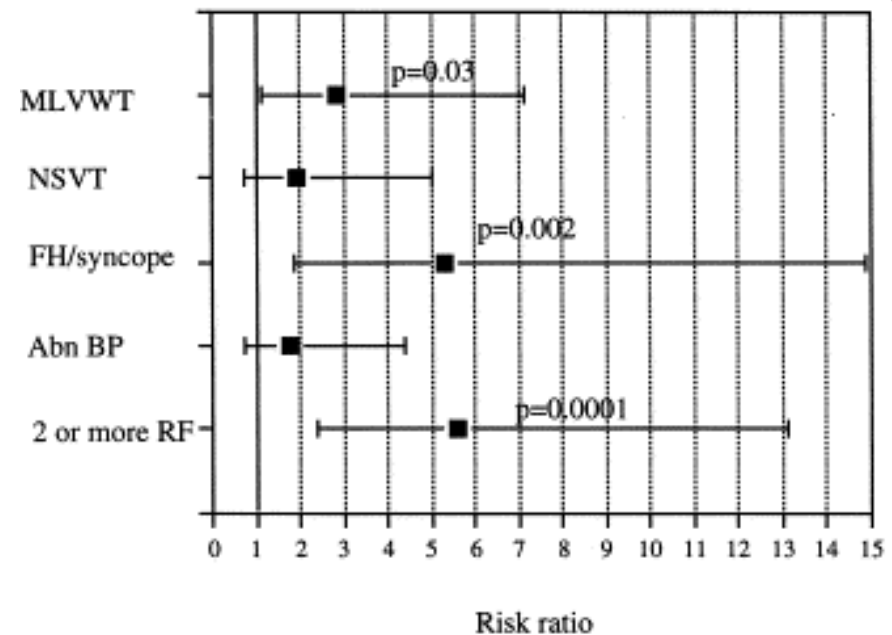
Obstruction

# Is abnormal BP response to exercise a risk factor for sudden cardiac death?

Age  $\leq$  40 y/o



Sadoul, N. et al. *Circulation* 1997;96:2987-2991



Elliott et al., *JACC* 2000;36:2212-2218

## To consider before committing:

- Accuracy of readings....consider repeating the test
- Effects of medications....consider repeating off beta and calcium channel blockers
- Degree of provokable obstruction

## Are there other prognostic exercise parameters?

- Exercise duration = lower risk
- Wall motion score index = higher risk
- Oxygen consumption and ventilatory efficiency?
- Exercise-induced systolic dysfunction?



"Looks like we're finally ready to start your stress test!"

## Exercise stress testing in HCM:

Safe

Identifies provocable outflow obstruction

Guides medical/surgical therapies

Provides prognostic information

**Should be a routine component of the evaluation of the HCM patient**