Update in Internal Medicine 2026

Saturday, May 2 • 8 a.m. – 4 p.m.

UT Southwestern Medical Center, T. Boone Pickens Medical Education & Conference Center

Hypertrophic Cardiomyopathy

Natalie Tapaskar MD

Assistant Professor; Medical Director of Hypertrophic Cardiomyopathy
Advanced Heart Failure, LVAD, and Transplant Cardiology

UT Southwestern Medical Center

Objectives

1. What is hypertrophic cardiomyopathy (HCM)?
2. What is the diagnostic algorithm for HCM and its phenocopies?
3. What is the natural history of HCM and who is at highest risk of adverse outcomes?
4. What to do if you suspect HCM at UTSW?

Not covered: Treatment algorithm of HCM

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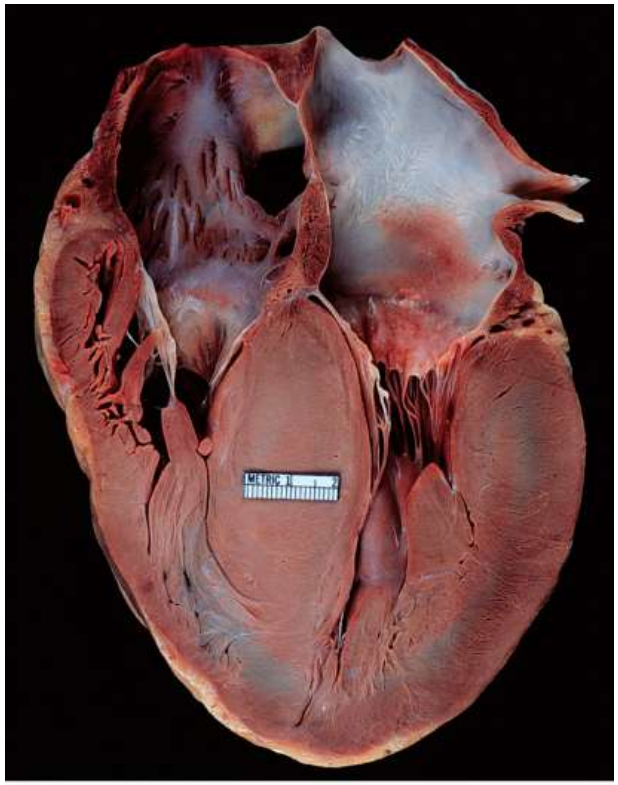
Left ventricular hypertrophy out of proportion to increased afterload

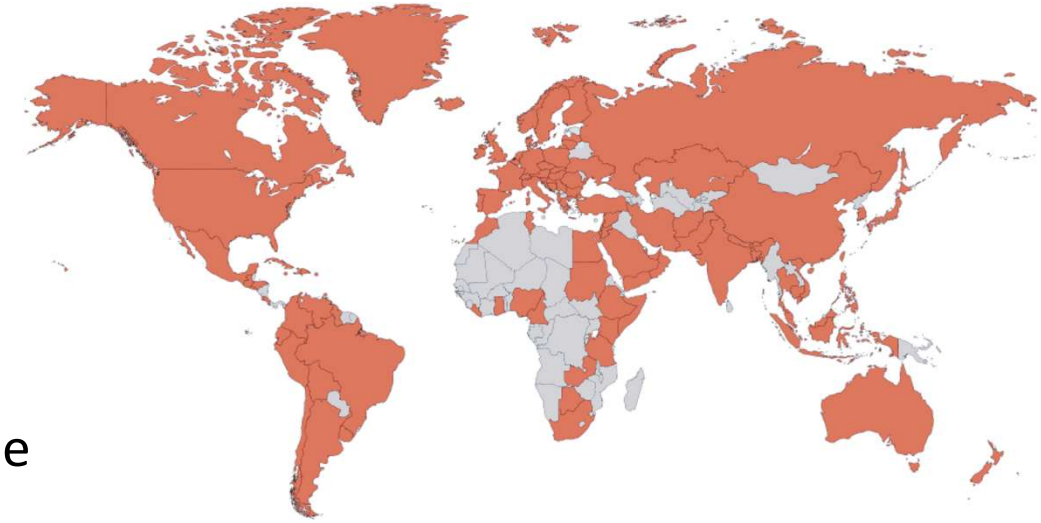
- **Imaging guided diagnosis**
- **Maximal end-diastolic wall thickness ≥ 15 mm anywhere in the left ventricle**
- **LVH =13-14 mm if:**
  - Have a family member with HCM or
  - The patient himself has a pathogenic/likely pathogenic sarcomere protein variant



Ommen et al. JACC 2024
Maron et al. JACC 2022

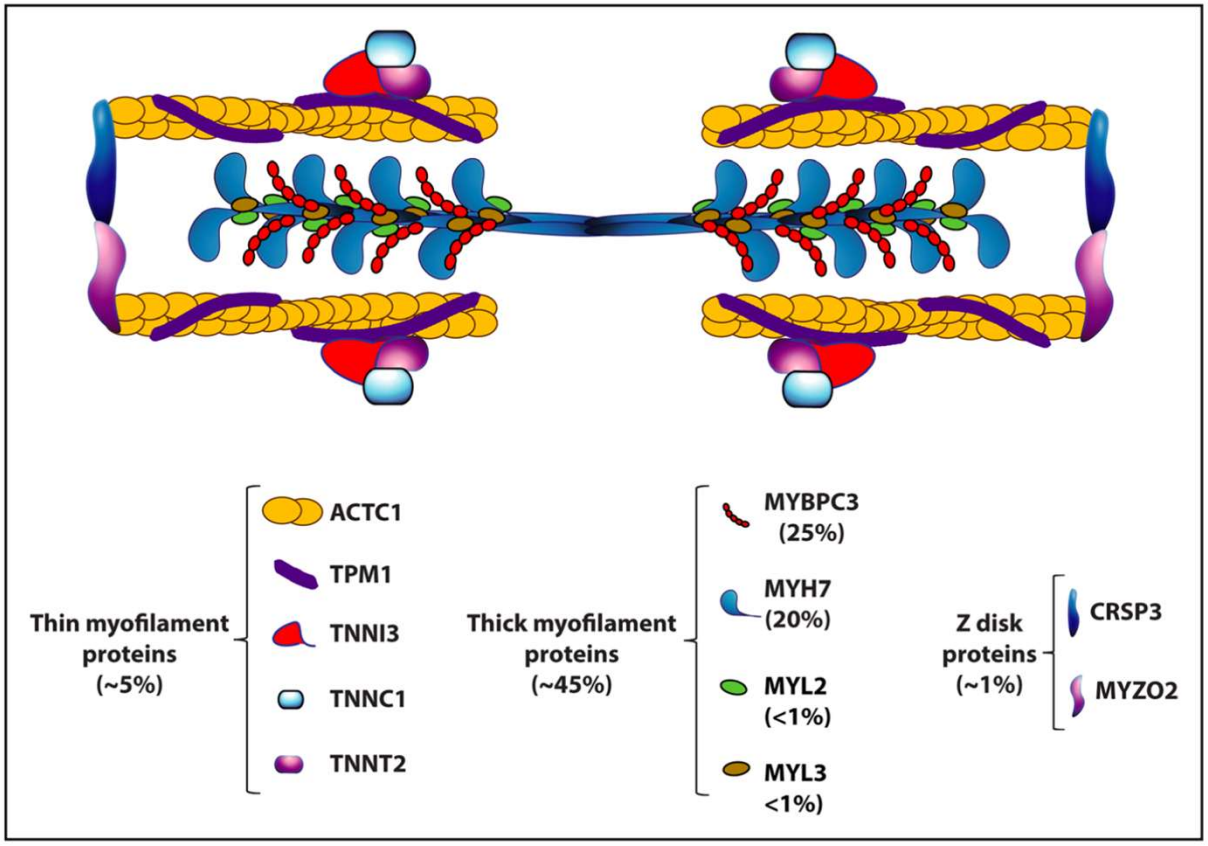
HCM is highly prevalent: 1/200-1/500 worldwide

- 30-60% have identifiable sarcomere variants
  - >2000 individual variants in ~11 genes
  - Autosomal dominant inheritance
  - Polygenic factors
- Diagnosis **does not** require a family history of HCM or positive genetic testing



Ommen et al. JACC 2024
Maron et al. JACC 2022

Disease of cardiac sarcomere



Imbalance in myosin head conformational states

↓

More myosin in disordered relaxed state

↓

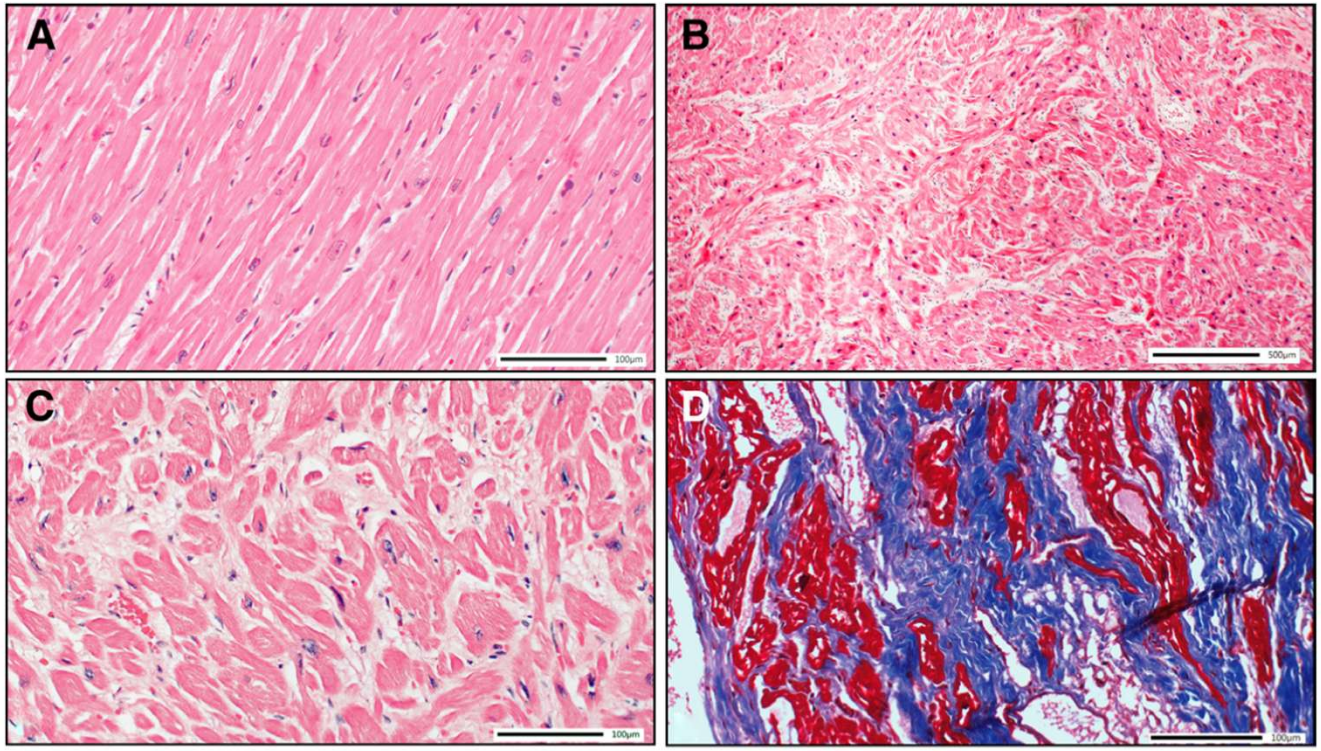
More myosin-actin cross bridges

↓

1. HYPERCONTRACTILITY
2. IMPAIRED RELAXATION
3. INCREASED ENERGY CONSUMPTION

Marian and Braunwald. Circulation Research. 2017

Deranged myocytes at the cellular level



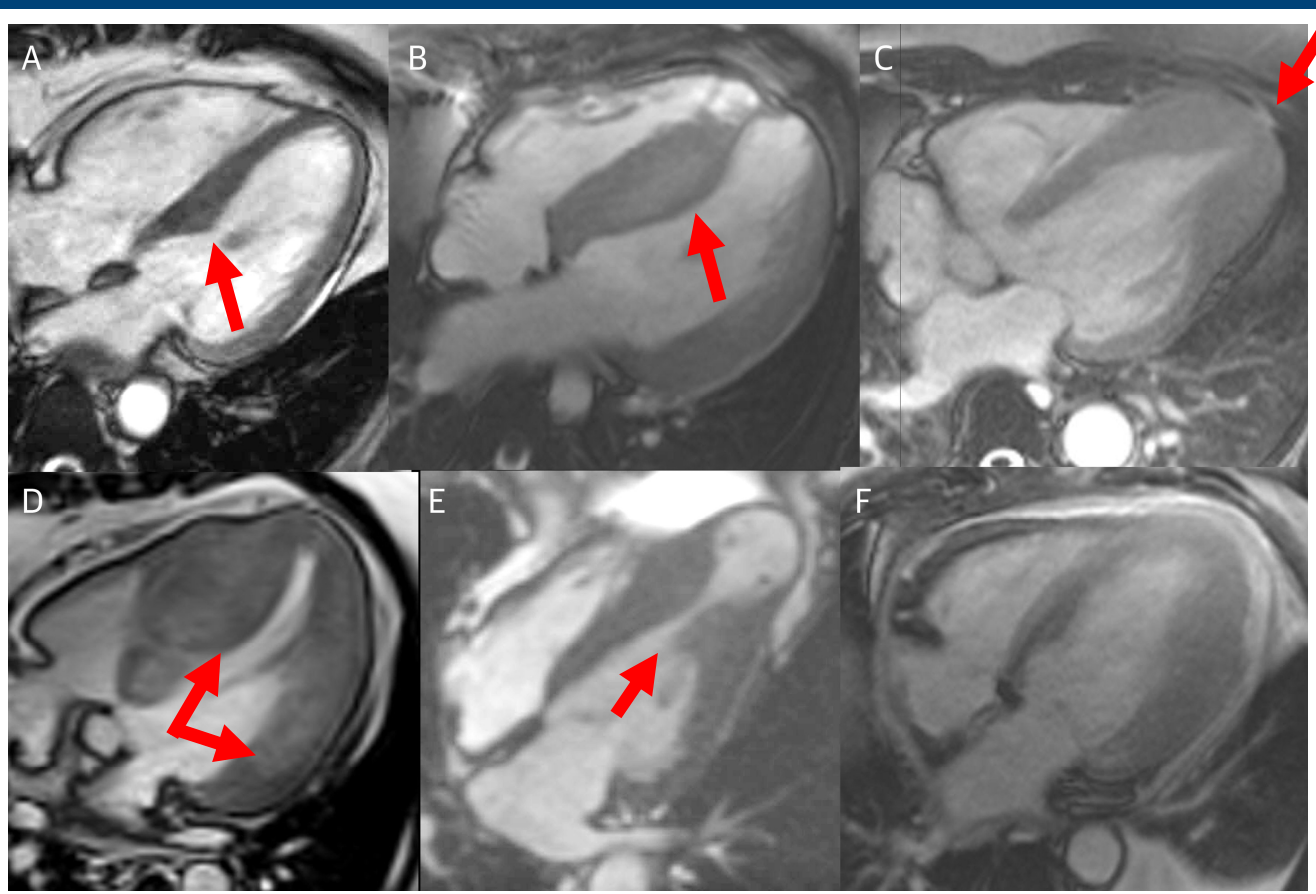
- **Cardiac myocytes are hypertrophied, disorganized, and separated by interstitial fibrosis**

- (A) Normal myocardium
- (B) Disorganized myocardial architecture in HCM
- (C) Myocyte disarray in HCM
- (D) Interstitial fibrosis (blue) in HCM

Marian and Braunwald. Circulation Research. 2017

Numerous patterns of LVH are possible

(A) localized basal septal hypertrophy
(B) reverse curvature septal hypertrophy
(C) apical HCM
(D) concentric HCM
(E) mid-cavity obstruction with apical aneurysm
(F) other



Neubauer et al. JACC 2019

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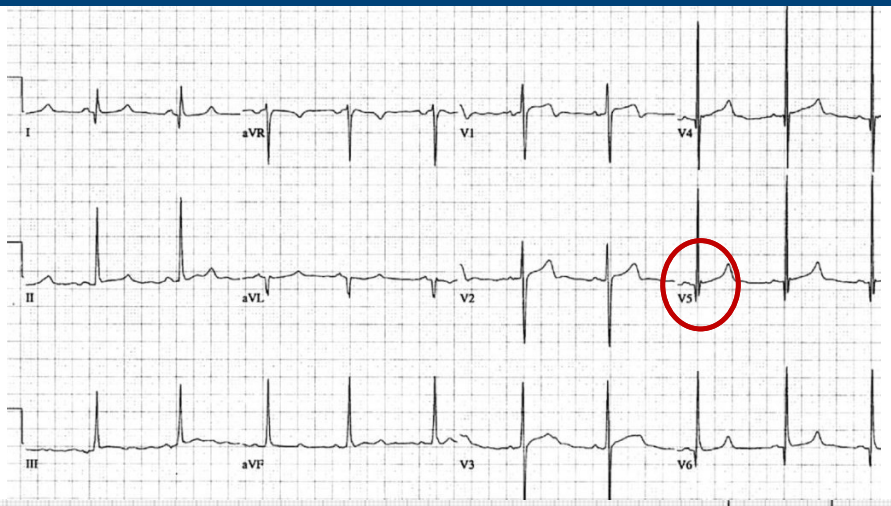
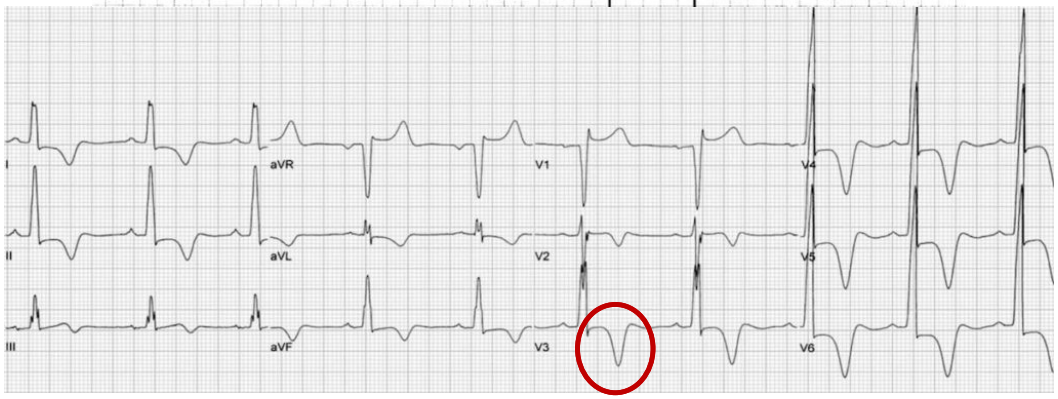
ECG abnormalities present in 95% of patients with HCM

- LVH criteria
- Deep, narrow, dagger-like Q waves in lateral leads

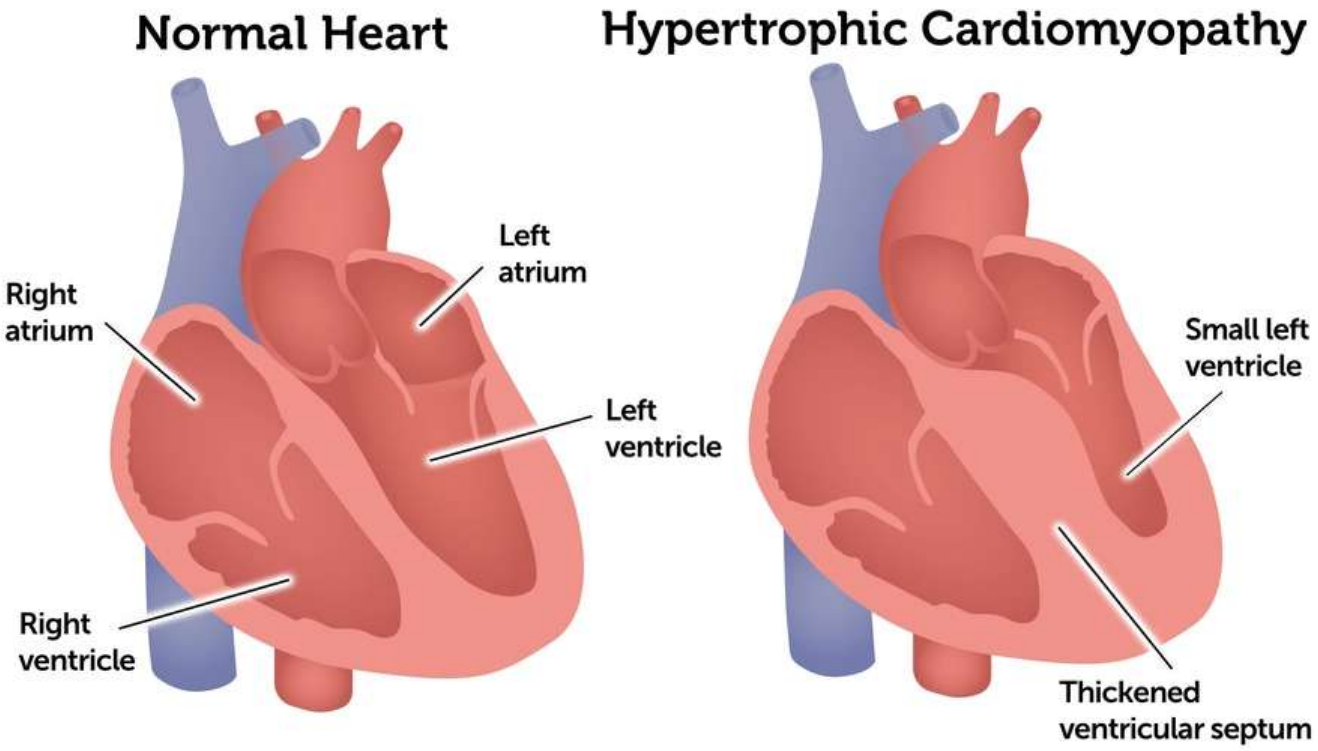
Associated features:

- Left atrial enlargement
- WPW (short PR, delta wave)
- Arrhythmias
- Giant precordial T wave inversions (apical HCM)





Why does left ventricular hypertrophy matter clinically?



1. Small
2. Stiff
3. Hypercontractile

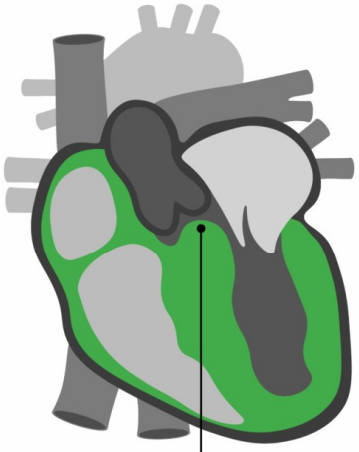
Obstructive HCM accounts for ~70% of HCM cases

DYNAMIC interplay between:

1. **Hypertrophied** basal interventricular septum
2. **Abnormalities of the mitral valve apparatus,** and
3. **Systolic anterior motion (SAM) of** the mitral valve leaflet

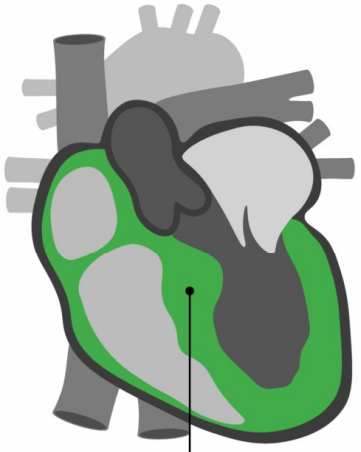
Which together narrow and obstruct the outflow tract during systole

Obstructive HCM



Thickened heart muscle restricting blood flow from the left ventricle

Non-obstructive HCM

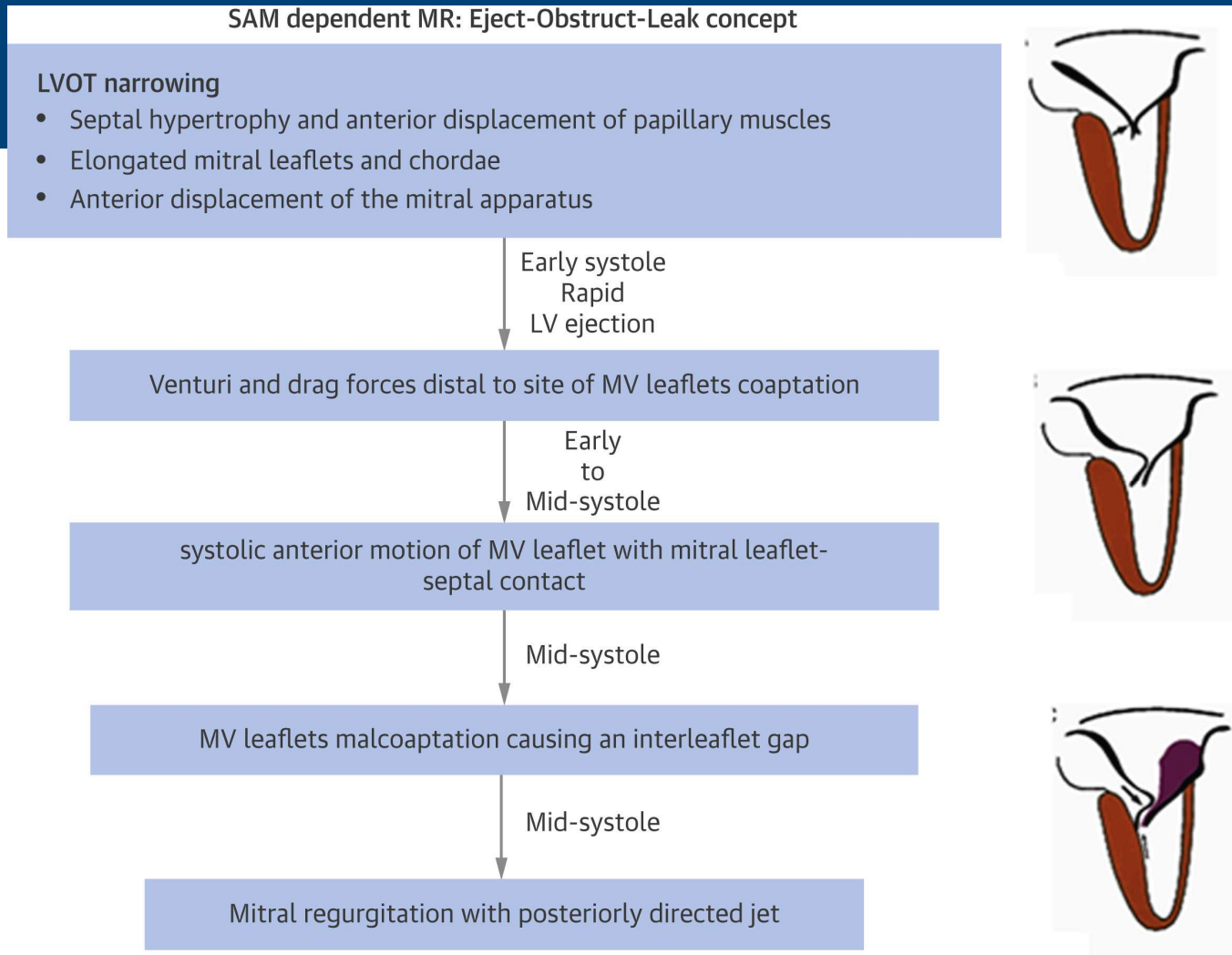


Thickened heart muscle but blood flow not restricted

Eject–Obstruct–Leak

Drag forces on the anterior mitral leaflet are the dominant mechanism pushing it toward the LVOT

Venturi forces may contribute as a secondary amplifying effect once the LVOT is already significantly narrowed and flow velocities are high



Wissler-Snir. JACC 2016

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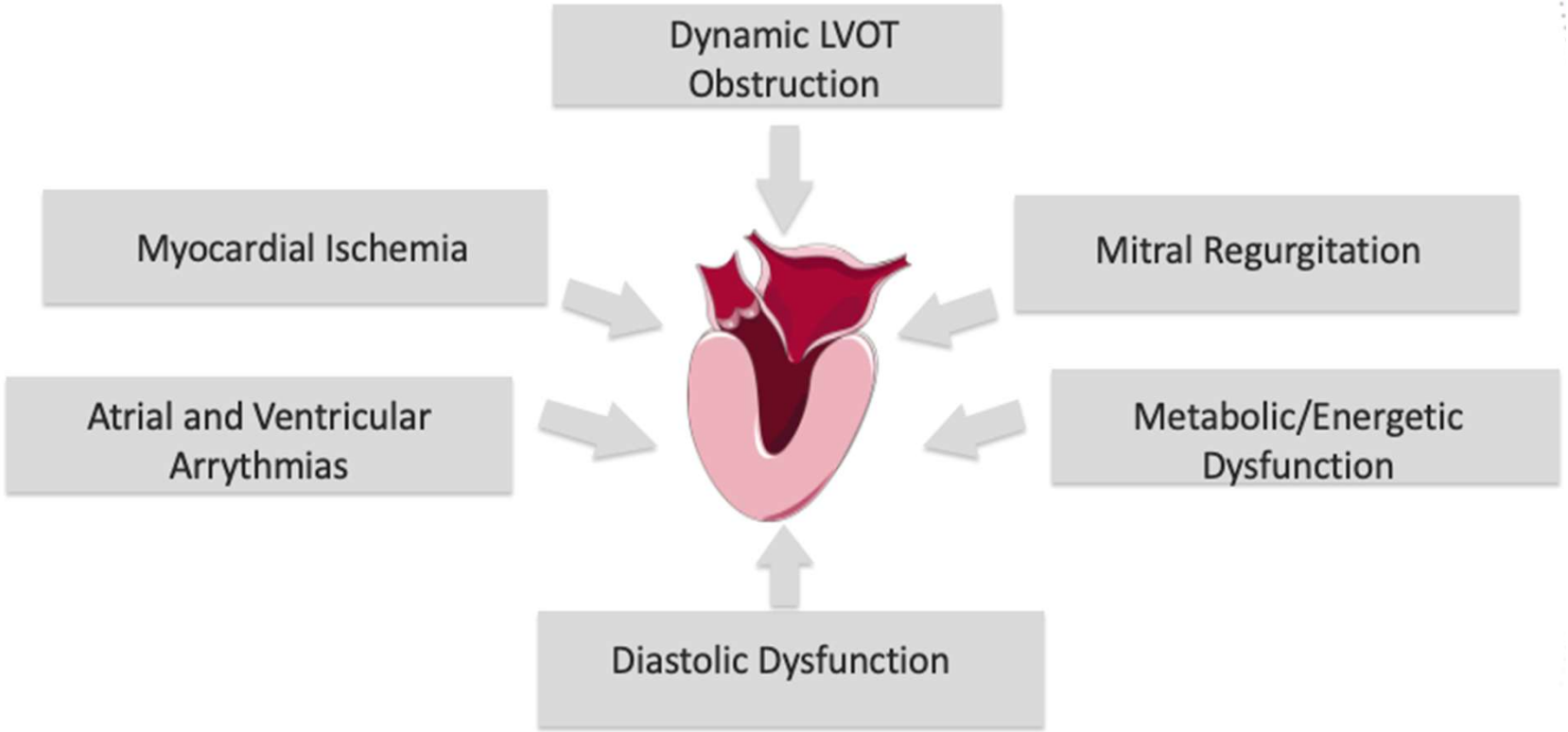
Numerous mechanisms drive symptom burden



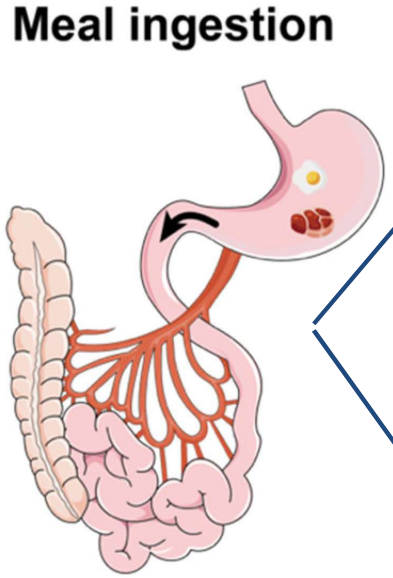
Ommen et al. JACC 2024

HCM can present with a constellation of nonspecific symptoms

Exertional symptoms	Arrhythmic symptoms	Heart failure symptoms
• Chest pain • Fatigue • Dizziness	• Palpitations • Presyncope • Syncope	• Dyspnea • Orthopnea • Peripheral edema

Maron et al. JACC HF. 2018

Post prandial symptoms present in ~35% of HCM patients



Decreased systemic vascular resistance

- Reduced afterload
- Reduced ventricular preload

→ **LVOT obstruction in HCM**

- Increased heart rate
- Increased intracardiac filling pressures (RAP, mPAP, PCWP)
- No significant change in stroke volume

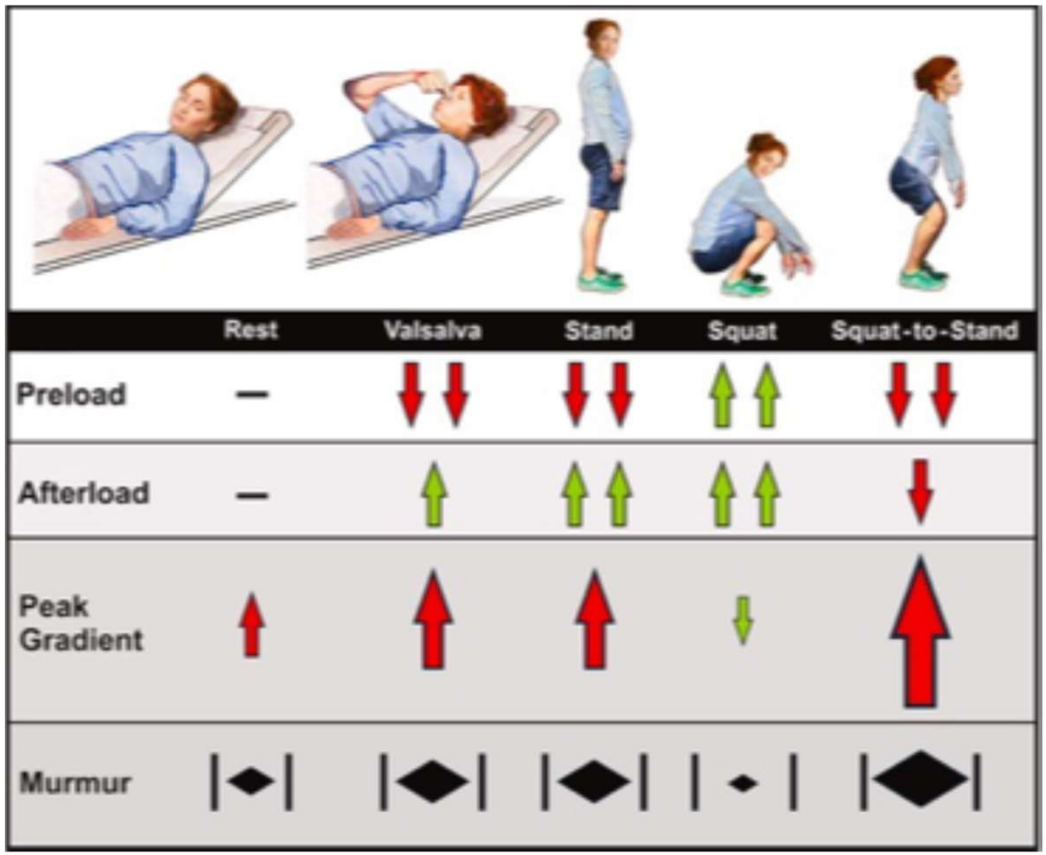
→ **Hemodynamic collapse with post-prandial exercise in HCM patients**

Gilligan et al. JACC 1991

Suspect HCM when there is a family history of early SCD

Family history
• Unexplained or sudden death in a first degree relative <50 years old

Systolic ejection murmur that increases with decreased preload suggests dynamic LVOT obstruction



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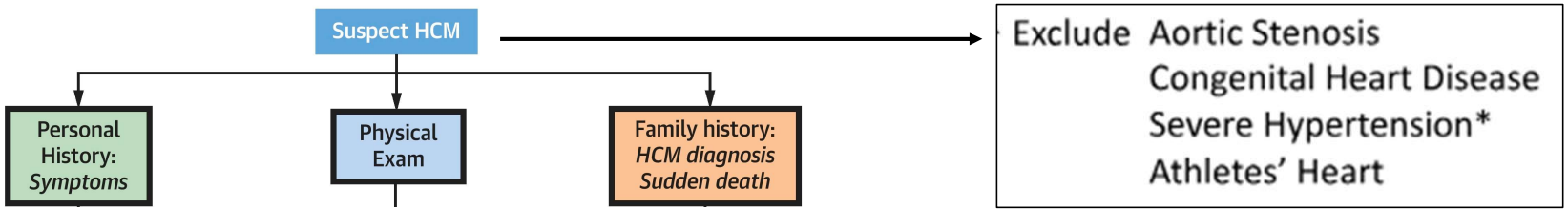
Diagnostic algorithm



Maron et al. JACC 2022
Bakalakos et al. Canadian Journal of Cardiology 2024

Left ventricular hypertrophy out of proportion to increased afterload

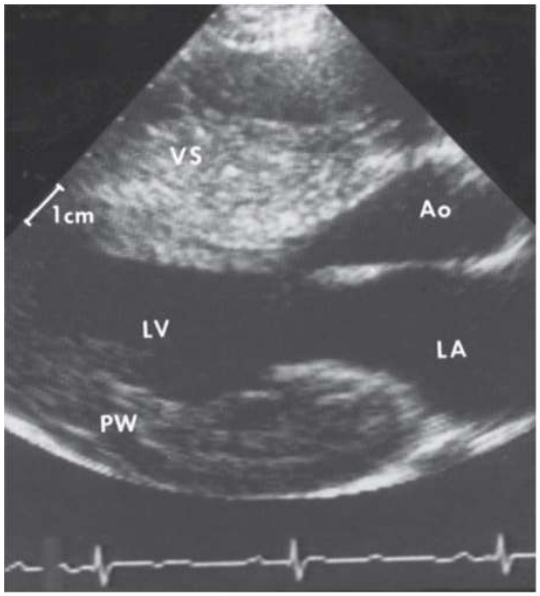
LVH must be **in the absence of another cardiac, systemic, or metabolic disease capable of producing the magnitude of LVH in a given patient

Hypertension

Athletic Heart

Aortic Stenosis

Cardiac Amyloidosis/Other Phenocopies



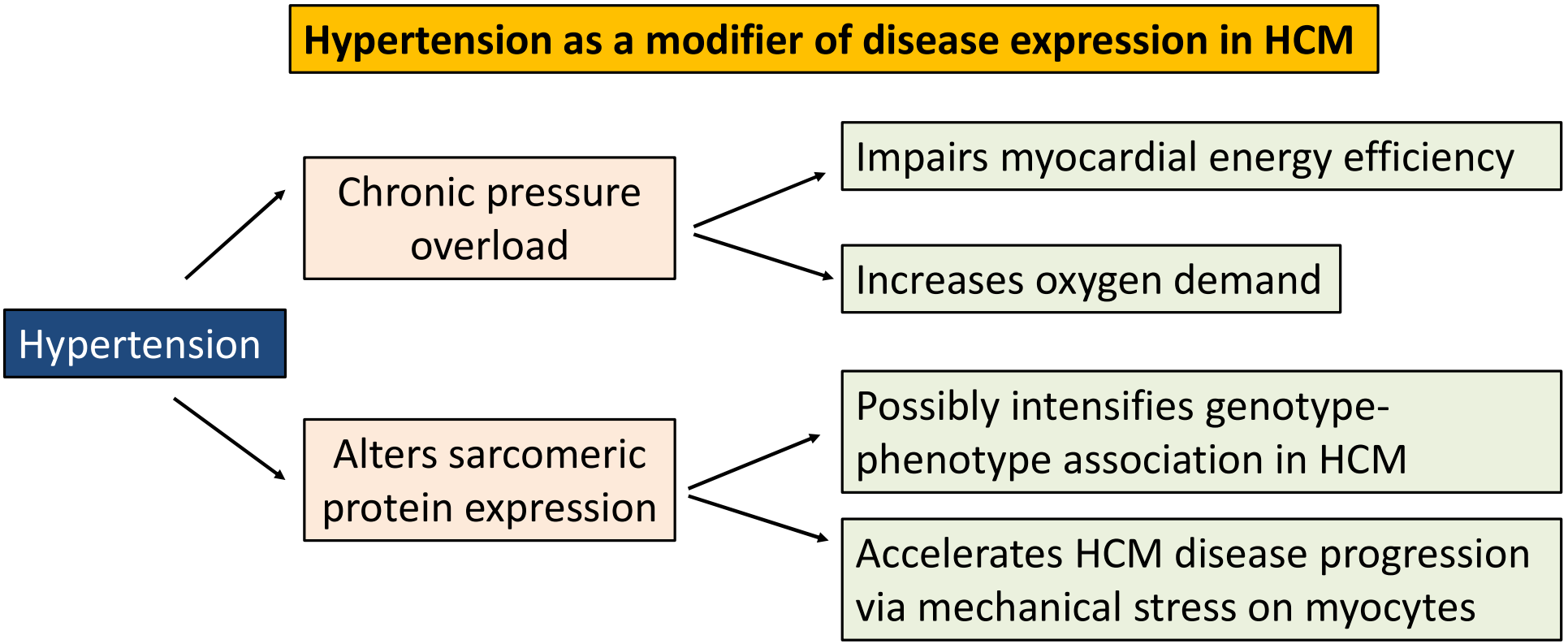
(A)

Ommen et al. JACC 2024
Maron et al. JACC 2022

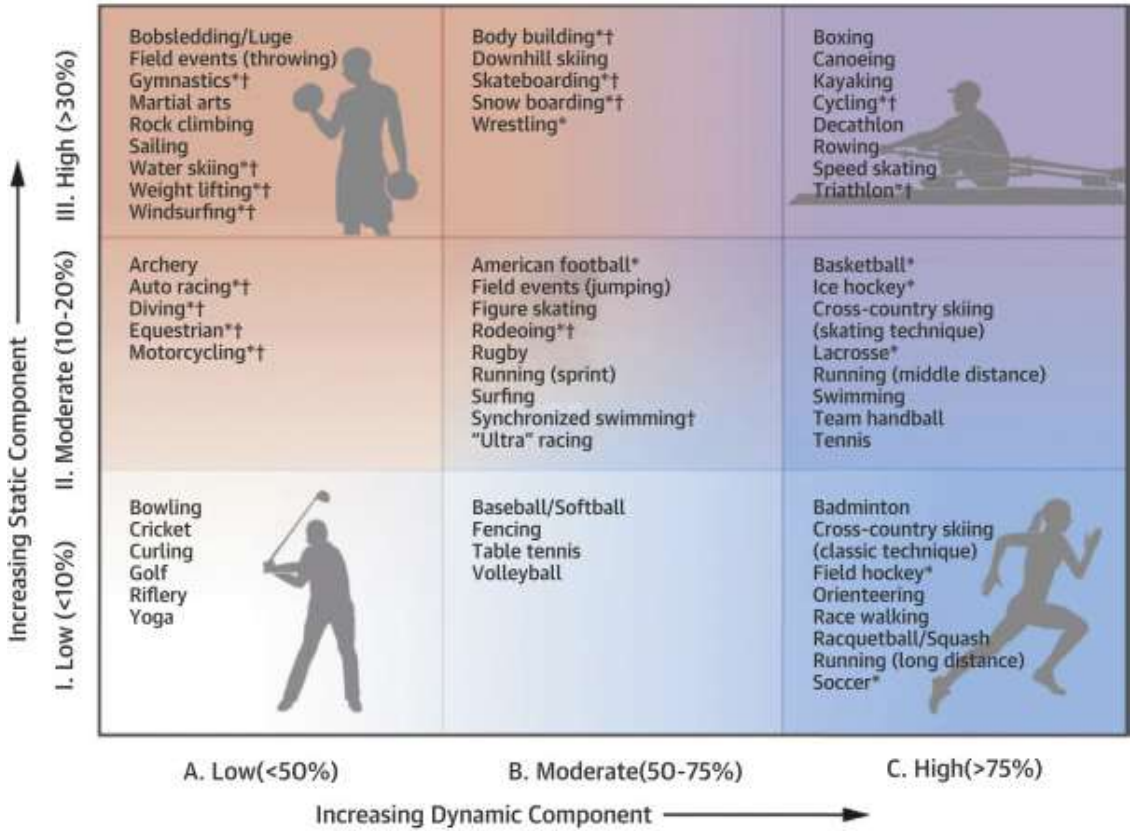
Hypertension coexists in 40-60% of adults with HCM

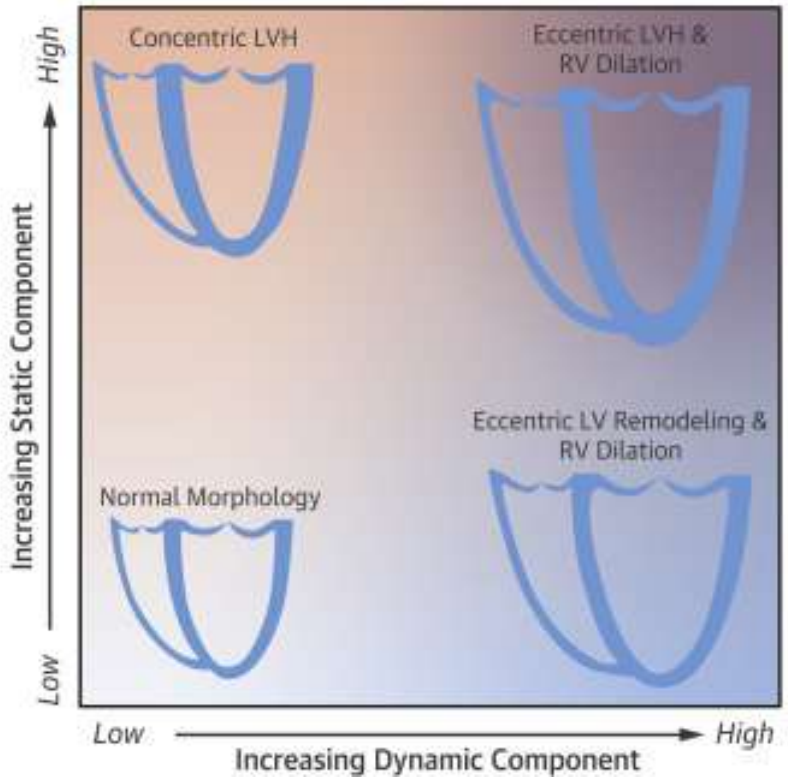
Aspect	HCM Alone	HCM with Hypertension
Imaging Features	More likely asymmetric LVH	Mixed patterns, concentric LVH also common

Hypertension coexists in 40-60% of adults with HCM



Athletic remodeling depends on dynamic and static load

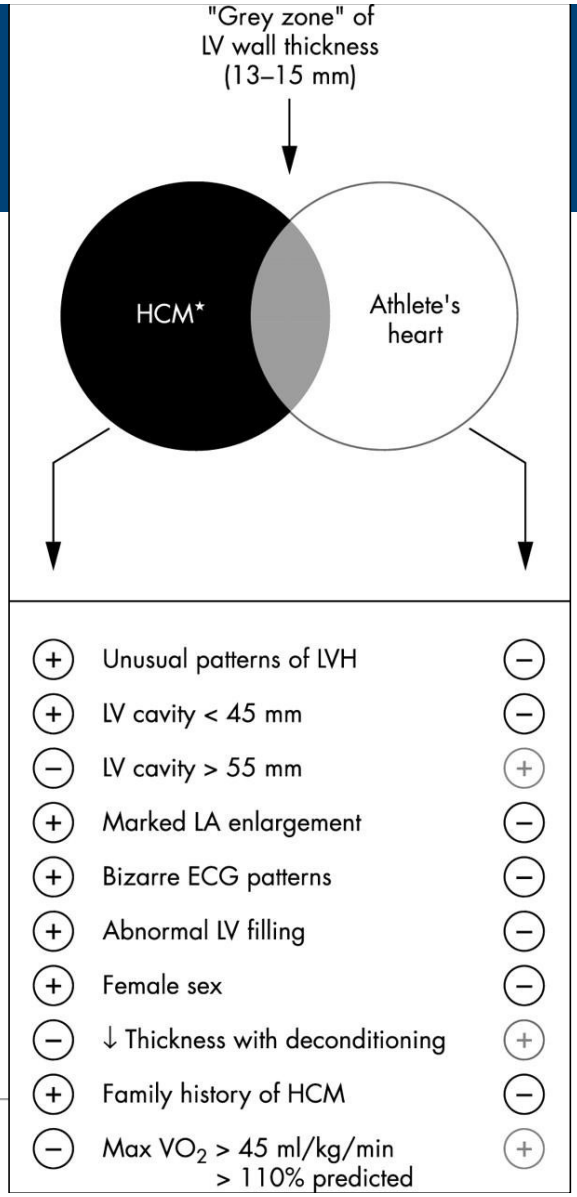




HCM hearts have smaller LV cavity sizes than athletic hearts

When to suspect HCM instead of athletic remodeling

- ✓ Patchy or asymmetric pattern of LVH
- ✓ LV cavity deficiency (<45 mm)
- ✓ Marked left atrium enlargement
- ✓ Abnormal diastolic function
- ✓ Wall thickness does NOT regress with de-training

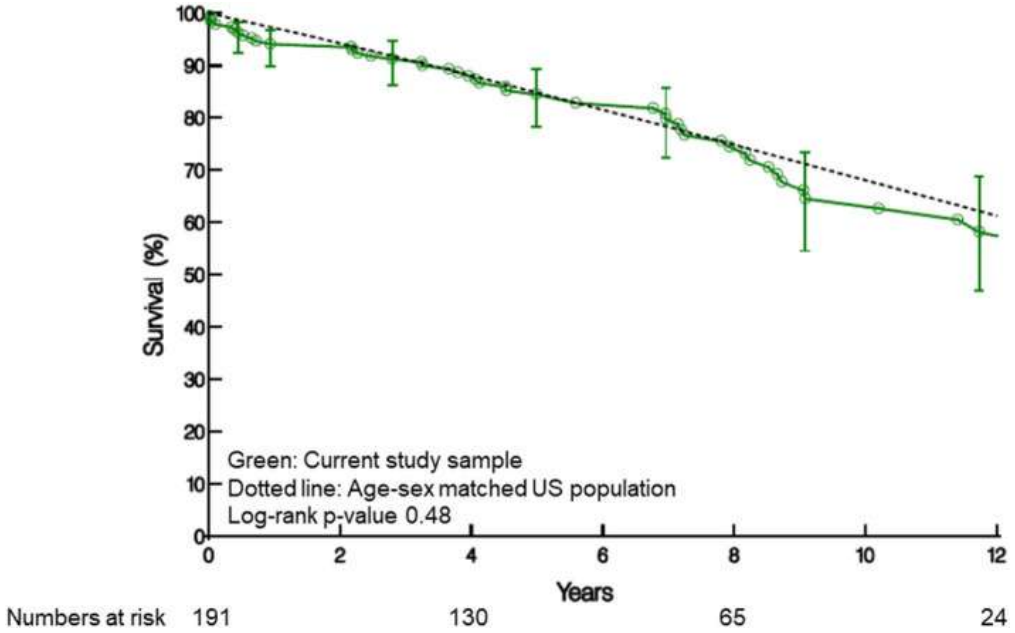


Maron BJ. Heart 2005

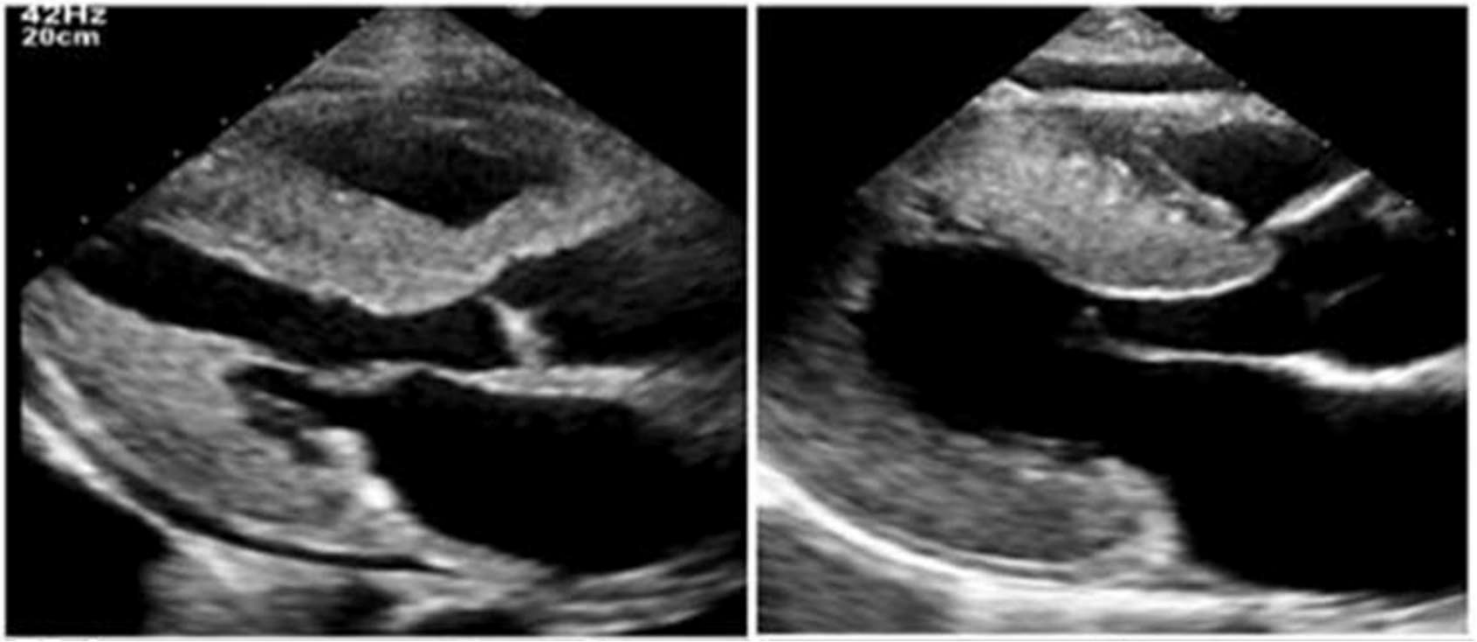
Valvular aortic stenosis can co-occur with HCM

- Unknown disease prevalence
- Diagnostic challenge that requires identifying the level of obstruction

- **191 patients undergoing myectomy + surgical AVR**
  - Older than isolated HCM
  - No difference in mortality compared to age-matched general population



Cardiac amyloidosis is a must not miss diagnosis



Zhang et al. The International Journal of Cardiovascular Imaging 2023

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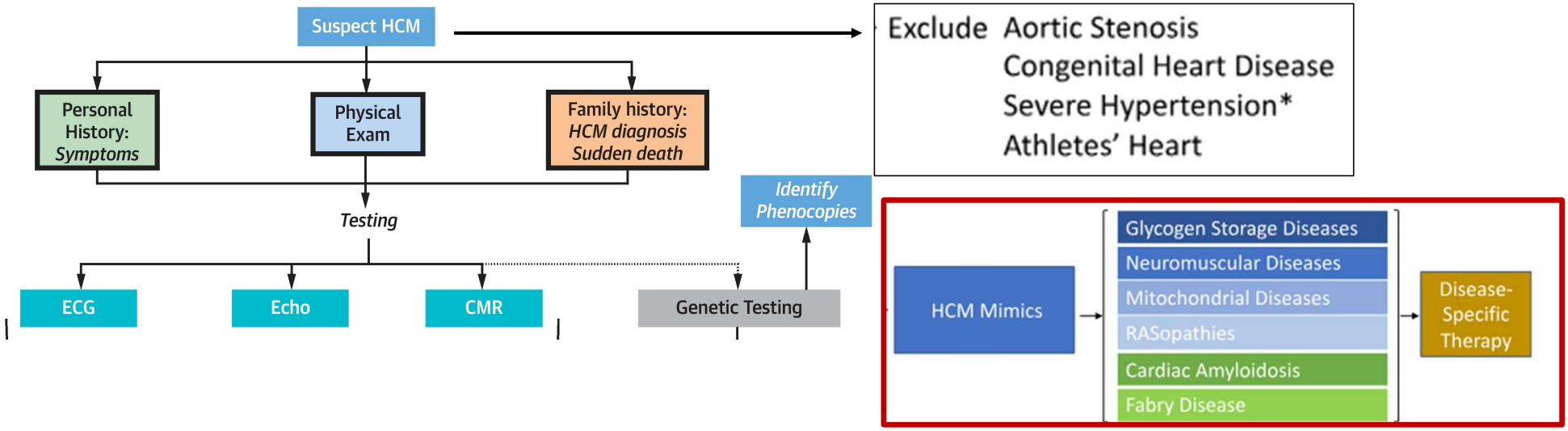
Suspect cardiac amyloidosis in the setting of extra-cardiac manifestations

When to suspect cardiac amyloid instead of HCM

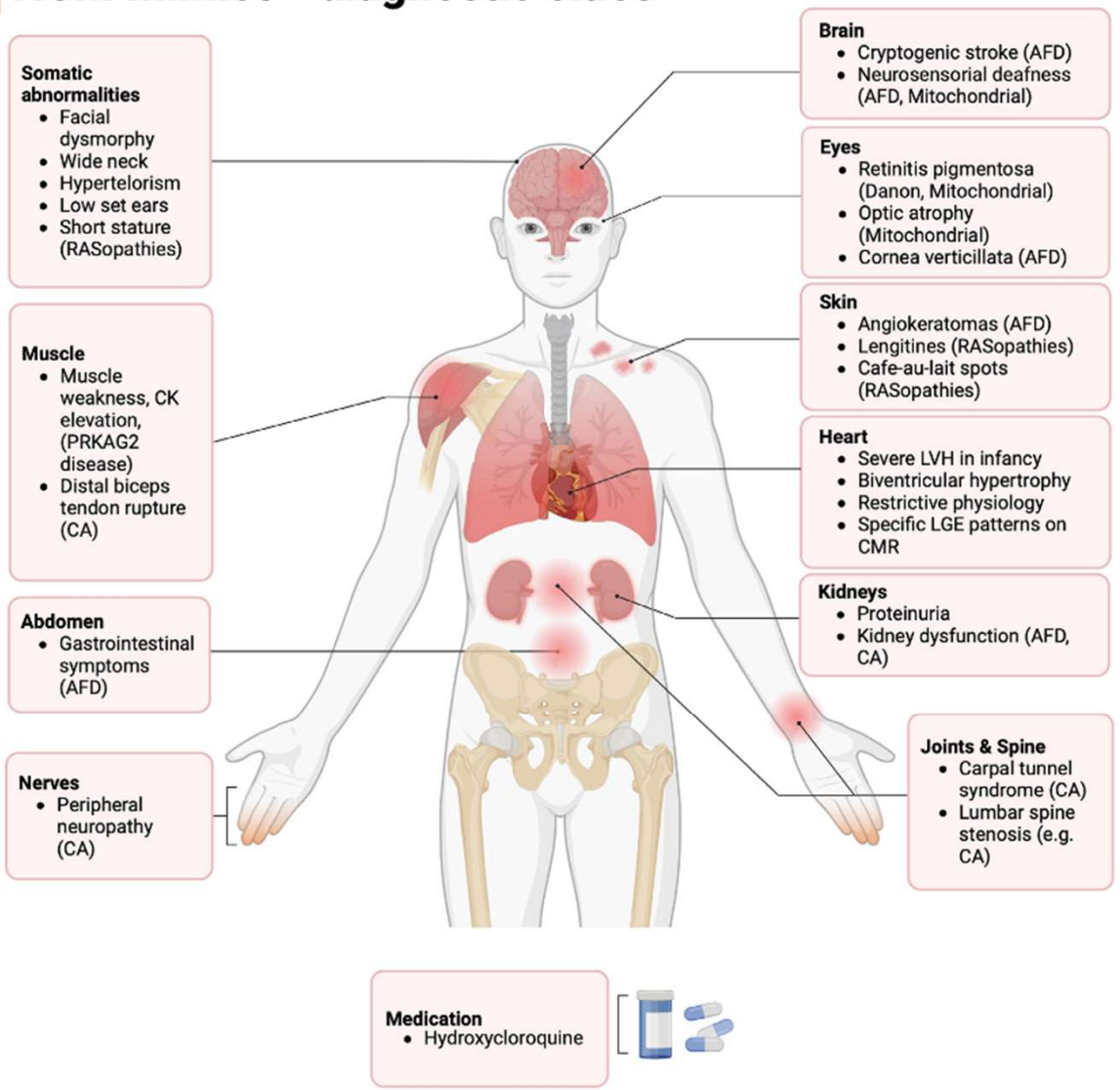
- ✓ History of bilateral carpal tunnel syndrome (5-10 years prior to cardiac diagnosis)
- ✓ Lumbar or cervical spinal stenosis
- ✓ Spontaneous biceps tendon rupture
- ✓ Hip/knee replacements (~80% of ATTR patients have orthopedic interventions)
- ✓ Peripheral neuropathy
- ✓ Autonomic dysfunction (orthostatic hypotension, gastroparesis, urinary incontinence)
- ✓ Intolerance to vasodilating antihypertensives
- ✓ **Low voltage QRS on EKG despite LVH (25-40% of cases only)**

Kittleson et al. JACC. 2023

Diagnostic algorithm

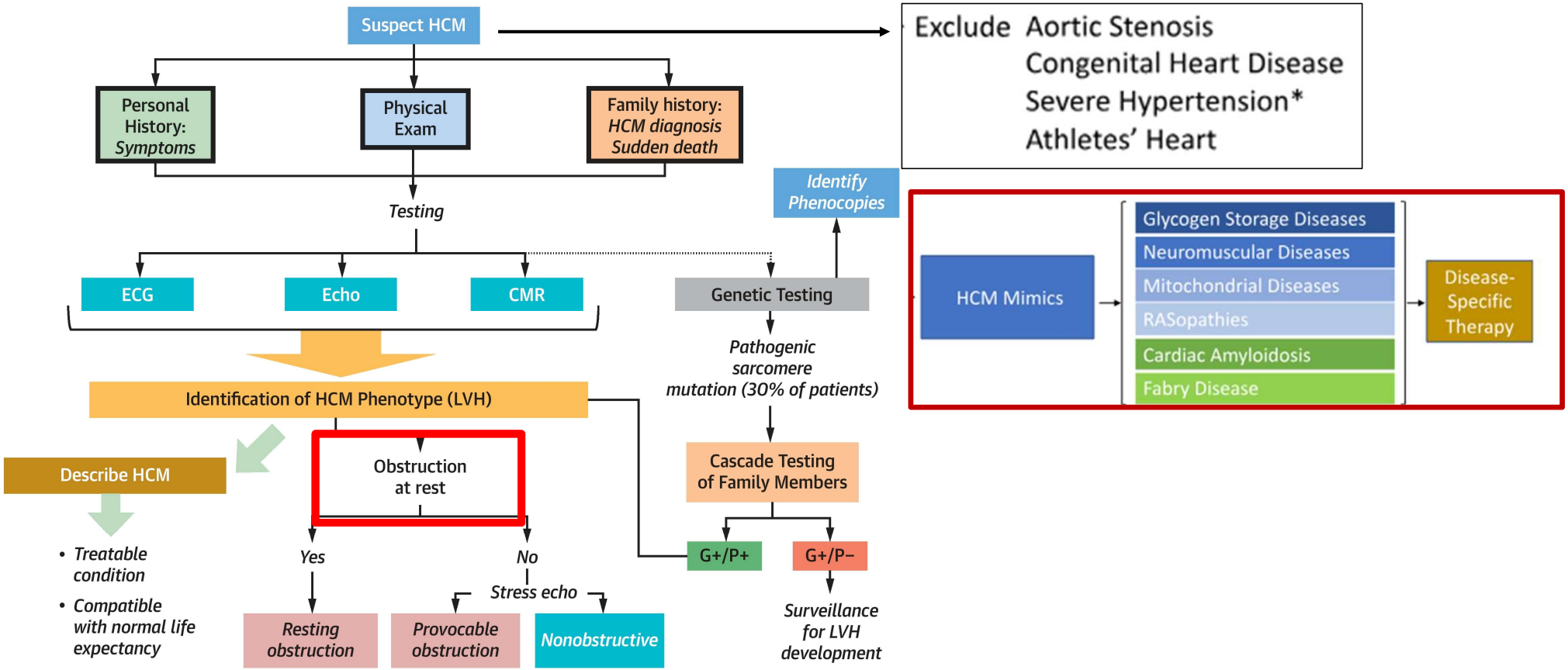


HCM mimics - diagnostic clues



Bakalakos et al, Candian Journal of Cardiology 2024

Diagnostic algorithm



Maron et al. JACC 2022
Bakalakos et al. Canadian Journal of Cardiology 2024

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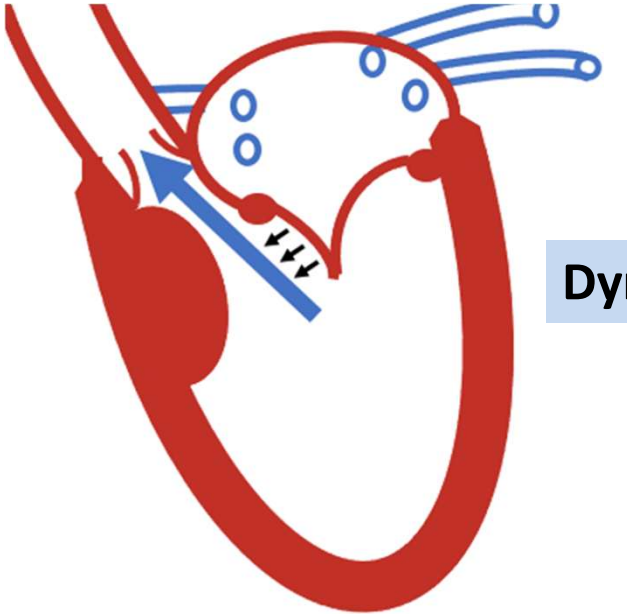
Not all LVOT /mid-cavitary obstruction is HCM



Dynamic

- Cirrhosis (~25% on stress testing)
- Takotsubo/stress cardiomyopathy (~15-25% of patients)
- Cardiac amyloidosis (~4% of patients)
- Extreme hypovolemic shock (even in absence of underlying structural heart disease)
- Post-cardiac surgery (after MVR/MVr)
- Acute myocardial infarction

Trzebicka et al. Anaesth Crit Care Pain Med. 2026

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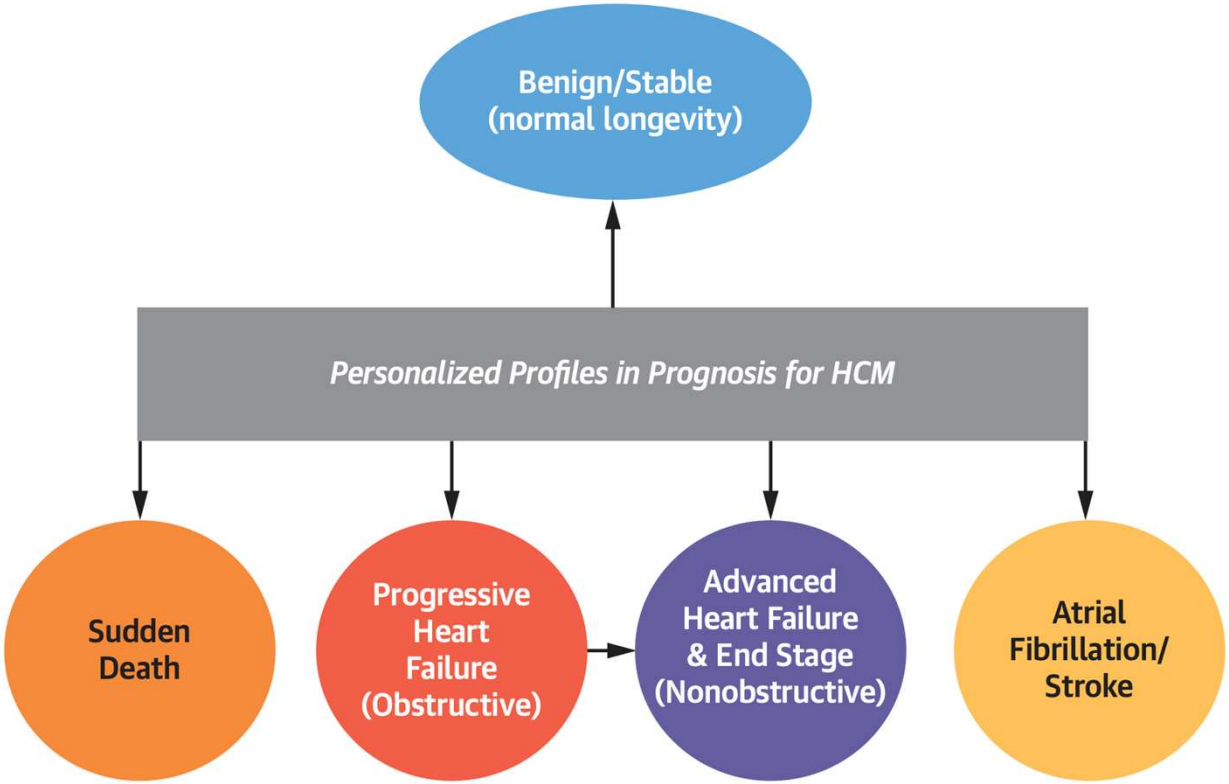
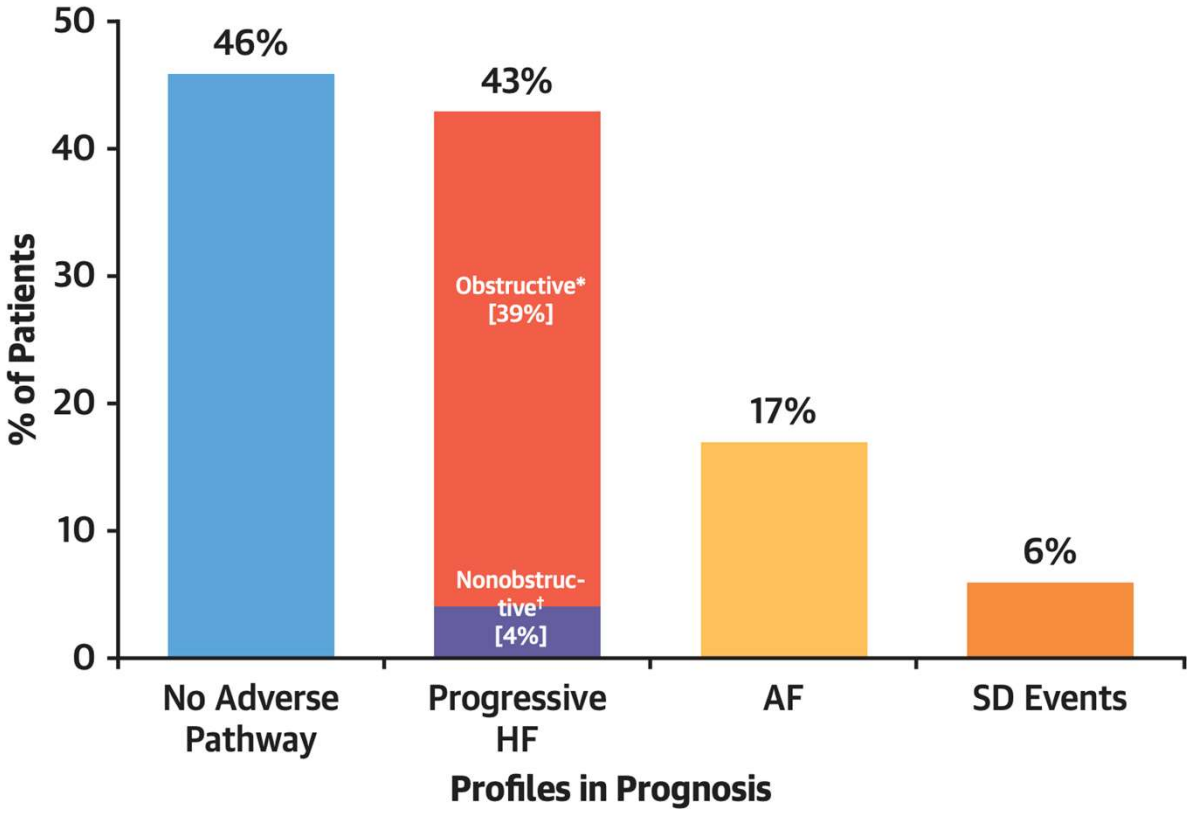
Natural history is highly variable



Maron et al. JACC 2022

Phenotypes are not mutually exclusive



Maron et al. JACC 2022

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Dual phenotyping: (1) Symptom phenotype and (2) Sudden cardiac death risk

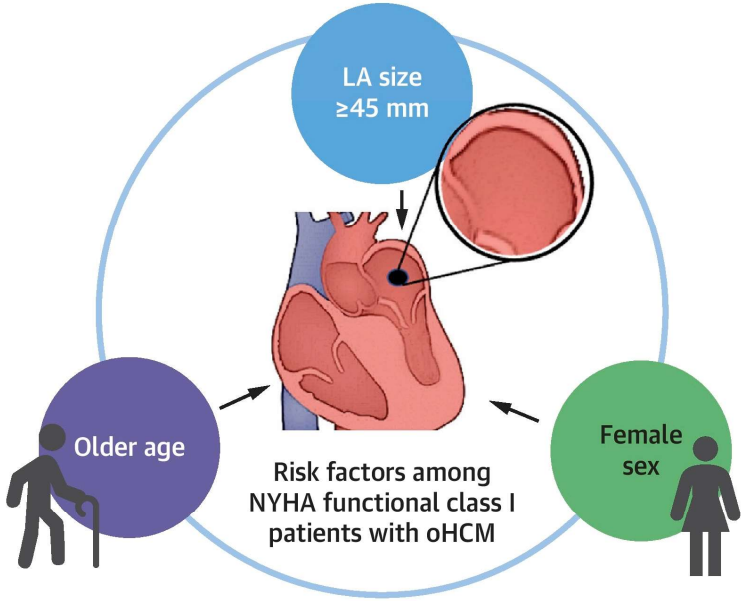
- Wide phenotypic expression and symptom burden
- Higher lifelong risk of adverse events (mortality, HF, stroke, ventricular arrhythmias, AF) in:
  - (1) patients with pathogenic/likely pathogenic sarcomere variants
  - (2) patients diagnosed earlier in life

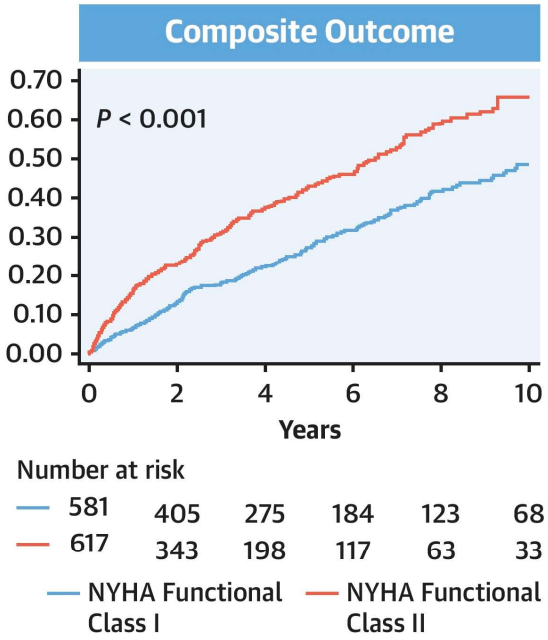
Even asymptomatic patients can be high risk for sudden cardiac death

Symptom burden ≠ sudden death risk

Ommen et al. JACC 2024

NYHA class I patients have 49% risk of adverse 10-year outcomes





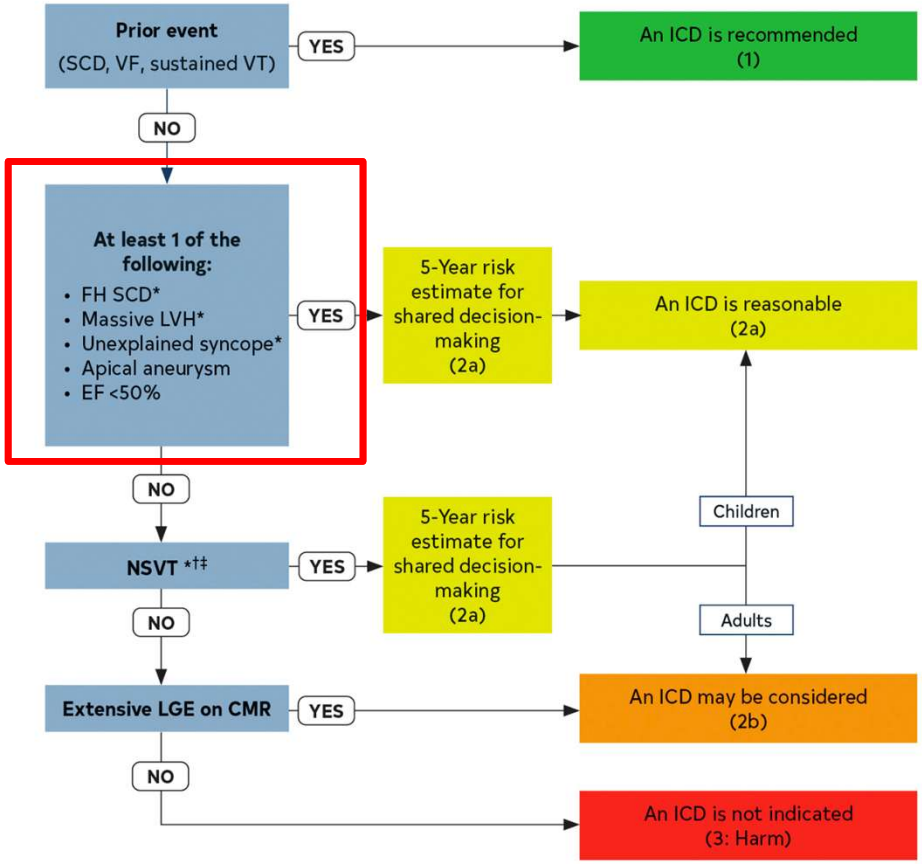
	n	1-Year Risk	5-Year Risk	10-Year Risk
NYHA functional class I	598	7%	28%	49%
NYHA functional class II	641	16%	44%	66%

Composite outcome

- NYHA III/IV
- LVEF<50%
- Afib
- CVA
- Ventricular arrhythmias SRT
- Heart transplant
- LVAD
- Death

Must risk stratify every patient for arrhythmogenic sudden death

Family history
Unexplained syncope
***Massive LVH ≥ 30 mm**
Apical aneurysm
EF <50%



Ommen et al. JACC 2024

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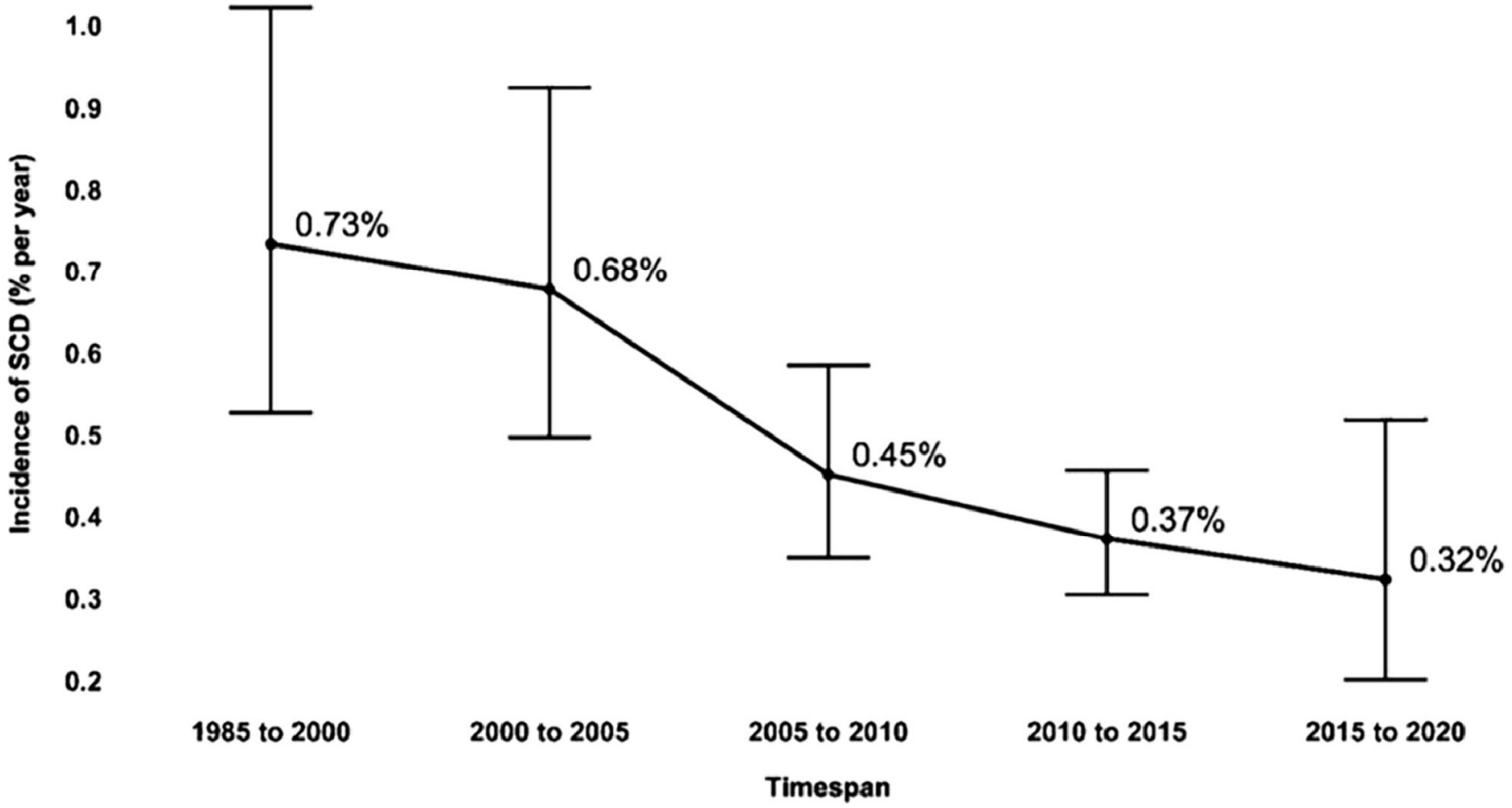
Decreasing rates of sudden death globally in post-ICD era



Maron et al. J Am Card. 2023

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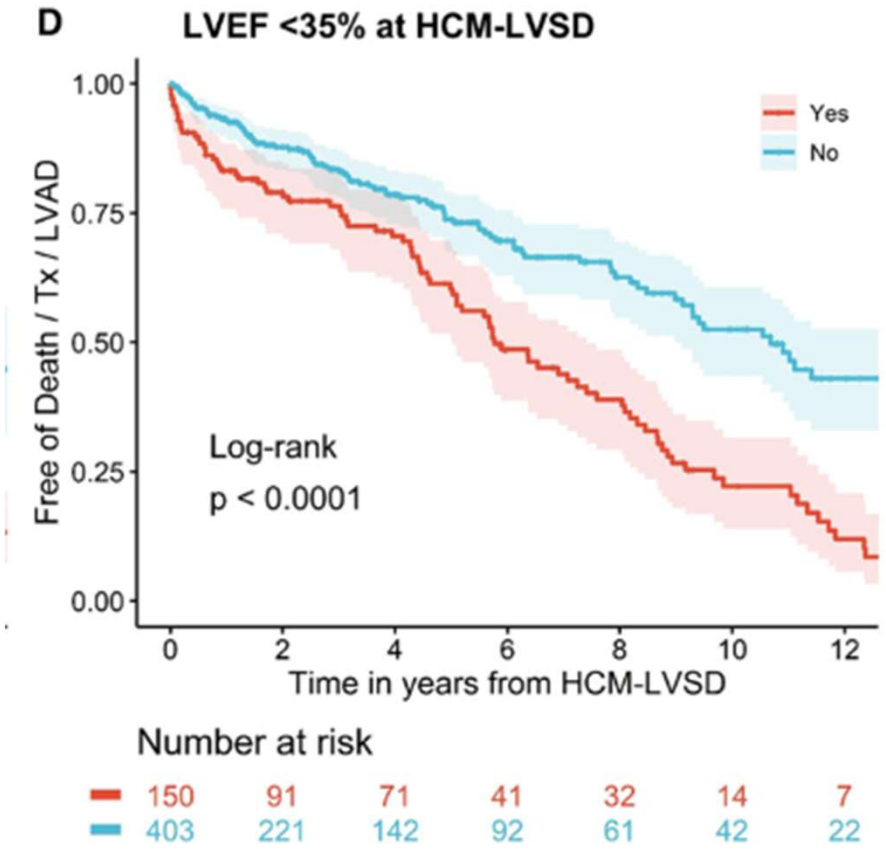
HCM with LVEF<35% represents a particularly high-risk population



Marstrand et al. Circulation 2020

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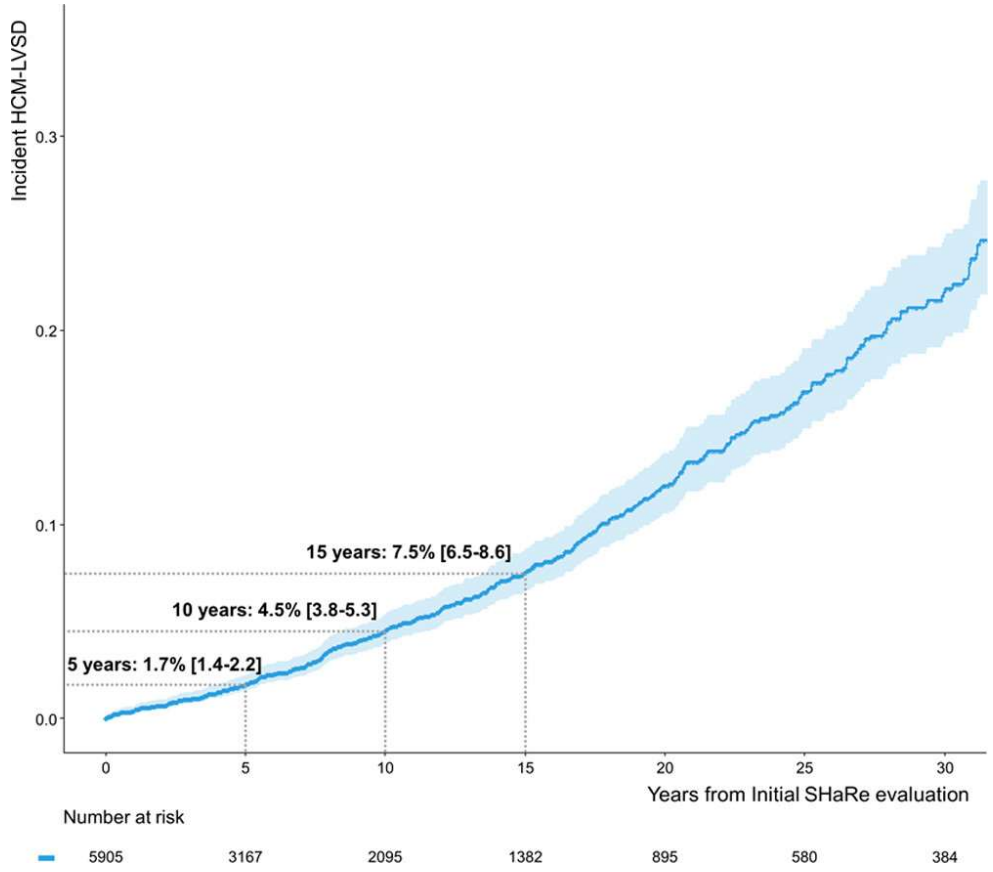
Time from initial evaluation to development of HCM with LVEF <50%: 7.5% incidence rate after 15 years



Marstrand et al. Circulation 2020

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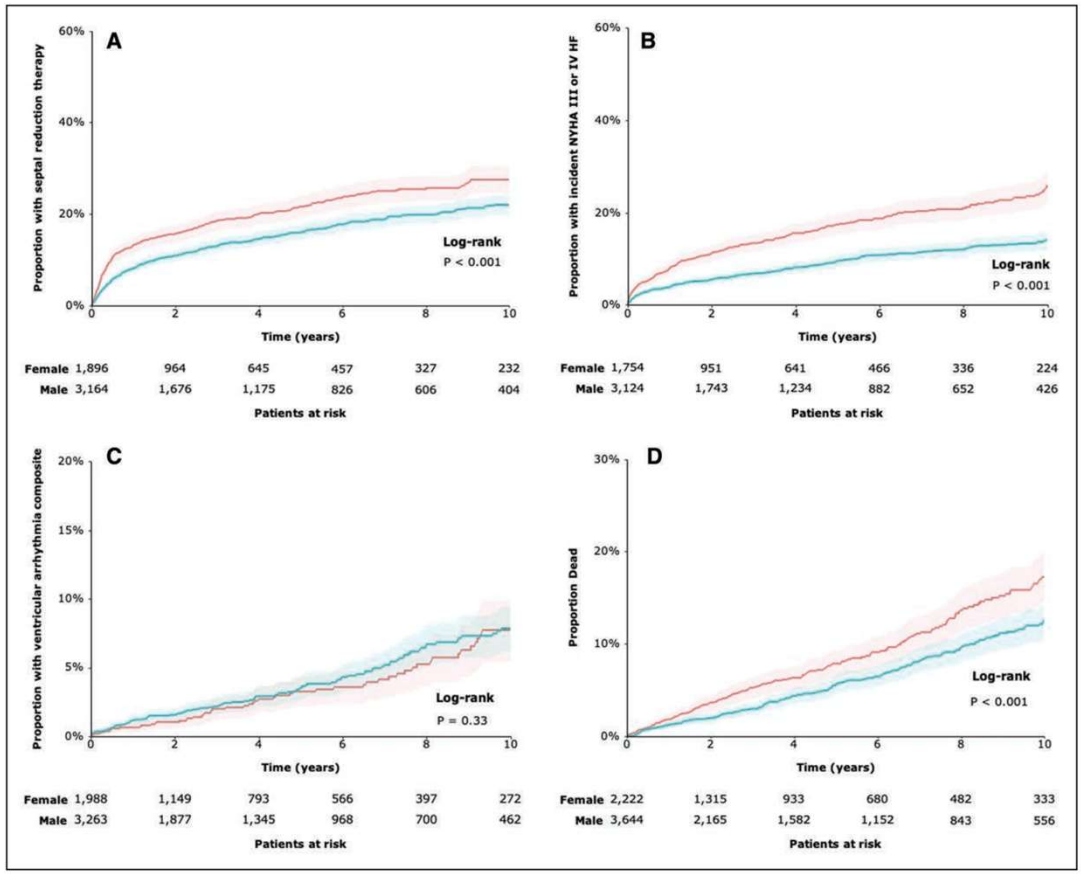
Females have higher all-cause mortality when controlling for age, sarcomere variant, LVEF, and LAVi

SRT
F>M



NYHA III-IV
F>M

Ventricular arrhythmias
F=M

Mortality
F>M

Lakdawala et al. Circulation: Genomic and Precision Medicine 2020

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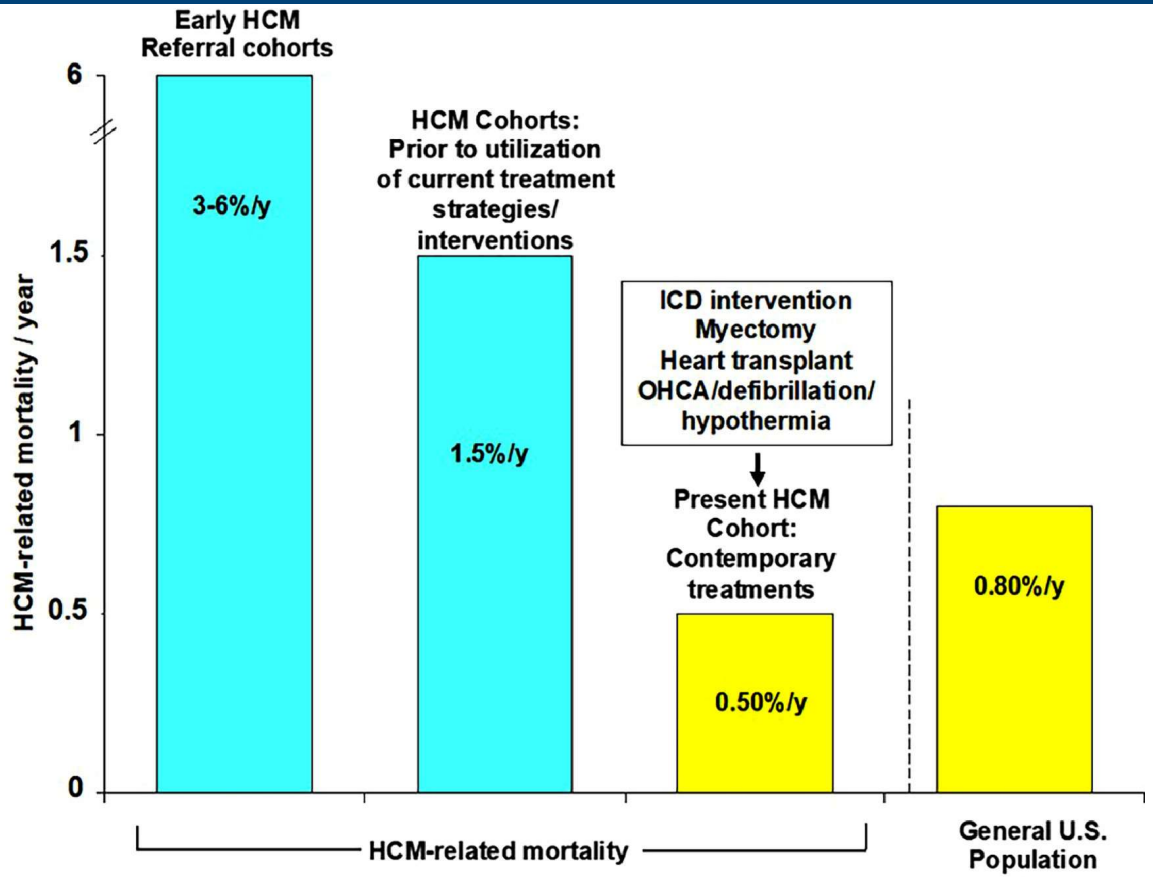
Decreasing HCM-related mortality in contemporary era



Maron et al. J Am Card. 2023

Take home points

- HCM is highly prevalent: 1/200-1/500 worldwide
- Diagnosis via imaging of LVH ≥ 15 mm
- Must rule out mimics (cardiac amyloid)
- Risk stratify for SCD via high-risk criteria
  - Family history of SCD
  - Massive LVH >30 mm
  - Apical aneurysm
  - LVEF <50%
  - Personal history of unexplained syncope
- Overall mortality has improved in contemporary era

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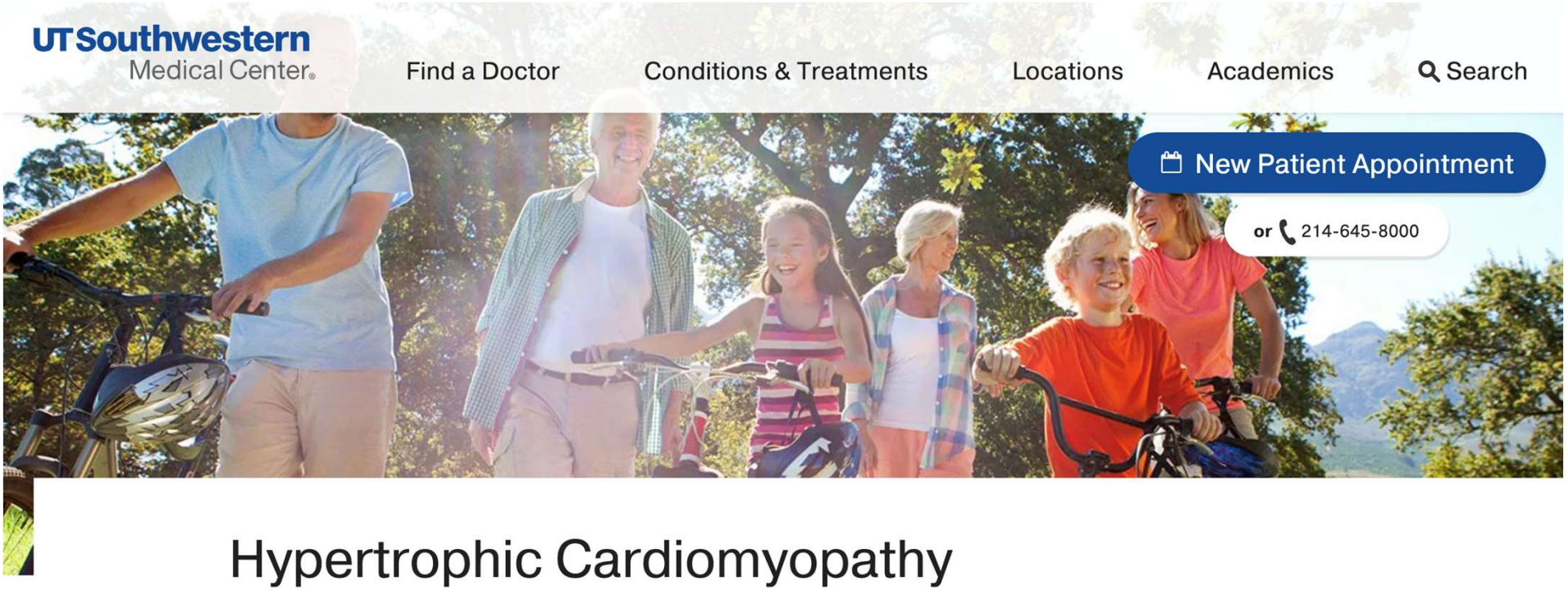
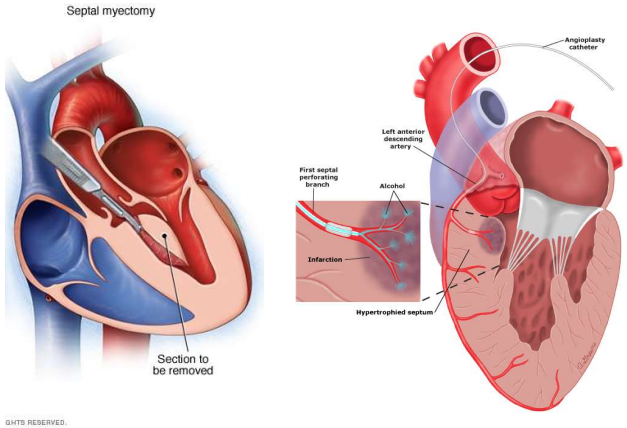
UTSW is an HCM Center of Excellence

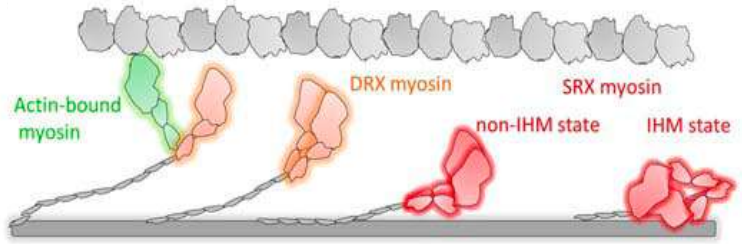


UTSW is an HCM Center of Excellence

Myectomy
Alcohol Septal ablation



Cardiac myosin inhibitors



Heart Transplant

Electrophysiology

Genetic counseling

Advanced exercise testing

Comprehensive cardiac imaging

Invasive hemodynamics

Clinical Trials

UTSouthwestern Medical Center

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Medical Center

Thank you

Natalie.tapaskar@utsouthwestern.edu