Hypertrophic Cardiomyopathy (HCM) Summary Table

Category	Details
Genetics & Inheritance	• Autosomal *dominant* inheritance • Mutations in sarcomere proteins (e.g., **myosin-binding protein C**, **β-myosin heavy chain**) • Variable penetrance (not all affected pts have symptomatic 1st-degree relatives)
Pathophysiology	• Asymmetric **left ventricular hypertrophy (LVH)**, predominantly in the **interventricular septum** • **Dynamic left ventricular outflow tract (LVOT) obstruction** due to septal hypertrophy & systolic anterior motion (SAM) of the mitral valve • **Diastolic dysfunction** due to impaired LV relaxation • **Myocardial disarray** & **coronary microvascular dysfunction** ↑ arrhythmogenic risk
Clinical Features	• Often **asymptomatic**, diagnosed via murmur or ECG findings • **Symptomatic pts** may present with: - **Exertional dyspnea** - **Chest pain (angina-like Sxs)** - **Palpitations** - **Presyncope/syncope (lightheadedness or fainting)** - **Sudden cardiac arrest (SCD risk due to arrhythmias)**
Heart Murmur Characteristics	• **Harsh crescendo-decrescendo systolic murmur** • Best heard at the **apex** & **left sternal border** • **Murmur intensity ↑** with ↓ LV blood volume (Valsalva, standing, dehydration) • **Murmur intensity ↓** with ↑ LV blood volume (squatting, passive leg raise, handgrip)
Echocardiographic Findings	• **↑ LV mass** • **↓ LV cavity size** • **Preserved or ↑ LV ejection fraction** • **Asymmetric LV wall hypertrophy**, esp. affecting the **septum** • **LA enlargement** due to ↑ LV end-diastolic pressure
Effect of Maneuvers on Murmur	
Maneuver	**Physiologic Effect**
Valsalva (strain phase)	↓ Preload
Abrupt standing	↓ Preload
Nitroglycerin administration	↓ Preload

Category	Details
Sustained handgrip	↑ Afterload
Squatting	↑ Afterload & Preload
Passive leg raise	↑ Preload
Medications That Worsen LVOT Obstruction (Avoided)	• **Preload reducers:** - Venous dilators (**nitrates**) - Diuretics (**furosemide**) • **Afterload reducers:** - Arterial dilators (**hydralazine**) • **Balanced vasodilators:** - **Dihydropyridine calcium channel blockers**, ACE inhibitors • **Why?** These drugs ↓ LV blood volume, worsening LVOT obstruction
Medications That Improve LVOT Obstruction	• **Negative chronotropic agents (reduce heart rate, increase diastolic filling time):** - **Beta blockers (metoprolol, propranolol)** - **Nondihydropyridine calcium channel blockers (verapamil, diltiazem)** • **Negative inotropic agents (reduce contractility, decreasing LVOT obstruction):** - **Disopyramide (Class I antiarrhythmic, Na-channel blocker)**
Comparison with Other Conditions	
Condition	**Key Differences from HCM**
Cardiac Amyloidosis (Restrictive Cardiomyopathy)	• Older pts (**>60 years**) • **Diastolic dysfunction** with normal LV cavity size • **Amyloid deposits** in interstitial space
Athlete's Heart	• **Physiologic adaptation to endurance training** • **Enlarged LV cavity size**, uniform wall thickening (no septal hypertrophy) • **Normal systolic function**
Aortic Stenosis	• **Concentric LV hypertrophy** (not asymmetric) • **Delayed carotid pulse (pulsus parvus et tardus)** • **Single or soft S2**

Category	Details
Arrhythmogenic Right Ventricular Cardiomyopathy (ARVC)	• **Desmosomal gene mutation**, affecting the **right ventricle** • **RV failure** & **ventricular arrhythmias** • **Eccentric LV dilation**, unlike HCM
Viral Myocarditis	• **Subendocardial fibrosis**, leading to **dilated cardiomyopathy** • **↑ LV cavity size** • **↓ ejection fraction**
Sudden Cardiac Death (SCD) Risk in HCM	• **Major cause of SCD in young adults** (due to ventricular arrhythmias) • **Triggers:** exertion, stress, dehydration • **Histologic findings:** - **Cardiomyocyte hypertrophy** - **Myocyte disarray** (haphazard cellular arrangement) - **Interstitial fibrosis** (electrical instability)
Differentiation from Other Causes of SCD	
Condition	**Why It Does Not Cause SCD in Young Adults**
Atherosclerotic CAD	• **Most common cause of SCD in older adults (>35 years)** • Not a primary arrhythmic disorder
Long QT Syndrome	• **Ion channelopathy**, causes arrhythmias but **no structural abnormalities**
Restrictive Cardiomyopathy	• **Slowly progressing disease**, typically due to infiltrative conditions (amyloidosis, hemochromatosis)
Pulmonary Embolism	• Can cause sudden death but typically presents with **respiratory symptoms**

Educational Objectives

1. **HCM is an autosomal dominant inherited disorder** caused by **sarcomere protein mutations**.
2. **LVOT obstruction worsens with reduced LV blood volume** (Valsalva, standing, dehydration).

3. **HCM murmur ↑ in intensity with maneuvers that ↓ LV preload** & **decreases with maneuvers that ↑ LV preload**.
4. **Beta blockers and nondihydropyridine calcium channel blockers** (e.g., verapamil) are 1st-line therapy to **↑ LV preload & reduce LVOT obstruction**.
5. **HCM is a major cause of sudden cardiac death (SCD) in young adults**, primarily due to **ventricular arrhythmias**.
6. **Histologic hallmark of HCM:** cardiomyocyte hypertrophy, myocyte disarray, & interstitial fibrosis.
7. **Avoid meds that ↓ preload (e.g., nitrates, diuretics)**, as they worsen LVOT obstruction.