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Hypertrophic Cardiomyopathy (HCM): An AHP Guide

Authors: Ashwin Venkateshvaran and Aideen Fallon

Hypertrophic Cardiomyopathy (HCM) is a genetic cardiac disorder marked by abnormal thickening of the myocardium, most commonly involving the interventricular septum. This hypertrophy can lead to diastolic dysfunction, impaired ventricular filling, and in some cases, left ventricular outflow tract (LVOT) obstruction. Understanding the pathophysiological changes associated with HCM is crucial for the CMR Technologist or Allied Health Professional (AHP), particularly when utilizing advanced imaging modalities.

Cardiac MRI plays a vital role in the detailed assessment of myocardial thickness, fibrosis (via late gadolinium enhancement), and ventricular function, offering high-resolution images that aid in diagnosis, risk stratification, and treatment planning. A strong grasp of these aspects allows AHP's to optimize imaging protocols and contribute effectively to patient management.

1. Patient Preparation & Setup

• Field strength: 1.5 T preferred; 3 T optional with optimized shimming.

• ECG gating: Ensure reliable R-wave detection. Use real-time cine or pulse gating in arrhythmia.

• Coils: ≥8-element coil for high SNR and parallel imaging.

• Contrast: Confirm no contraindications; collect hematocrit for ECV mapping.

• Breath-holds: Use SENSE or acceleration techniques to limit to ≤10–12 s.

2. Imaging Workflow

Step	Sequence / Technique	Purpose / Notes
1	Anatomy (Localizers)	Scout images in standard cardiac planes for orientation
2	LV Function – Cine SSFP	Full SA stack + long-axis (2CH, 3CH, 4CH) to assess volumes, EF, and wall motion

3	LVOT Cines (2 planes)	Orthogonal views across LVOT to assess for narrowing and SAM
4	Phase-Contrast (VENC) Imaging	In-plane and through-plane across LVOT
5	T1 Mapping (Optional)	Native T1 to evaluate diffuse fibrosis or early-stage disease
6	LV Tagging (Optional)	3 short-axis slices + 4CH to assess myocardial deformation (strain, contraction)
7	LGE Imaging	Post-contrast SA stack and long-axis views to assess fibrosis patterns

3. Reporting Essentials

LV Morphology and Function
- LV end-diastolic and end-systolic volumes (EDV, ESV) (indexed to BSA)
- Stroke volume (SV), ejection fraction (EF), and LV mass (indexed to BSA)
- Maximal wall thickness in diastole and location

Segmental Wall Thickening
- Assess for regional hypertrophy and contraction abnormalities

LVOT Assessment
- Presence of dynamic obstruction at rest
- Identify SAM of the mitral valve and resulting LVOT narrowing

Fibrosis
- Presence, location, and extent of LGE
- Note characteristic patterns (e.g. mid-wall or patchy fibrosis in hypertrophied segments)

4. Key Diagnostic Criteria for HCM

<u>Wall Thickness</u>
- ≥15 mm in general population
- ≥13 mm in first-degree relatives (familial HCM)
- ≥20 mm in Afro-Caribbean/Black patients (consider ethnicity-related reference ranges)

Wall Thickness Ratios
- Septal-to-lateral wall thickness ratio >1.3 suggests asymmetrical septal hypertrophy
- Apical-to-basal wall thickness ratio ≥1.3–1.5 indicates apical variant

Functional Indicators
- Resting or provoked LVOT obstruction
- Reduced contractility in hypertrophied segments

5. Tips & Tricks for Technologists

LGE at RV Insertion Points: Common and non-specific; seen in normal individuals—do not overinterpret.

Features Suggestive of HCM:
- Localized myocardial thickening
- Hypokinesia or reduced strain in thickened segments (tagging useful)
- Presence of fibrosis on LGE

Myocardial Crypts:
- Best visualized in long-axis views (especially 2CH and 4CH)
- Associated with genotype-positive/phenotype-negative individuals
- May be subtle or missed on SA stack due to partial volume effects

Reference

Herzog, B. A., Greenwood, J. P., Plein, S., Garg, P., Haaf, P., & Onciul, S. (2017). Cardiovascular magnetic resonance pocket guide. *Eur Soc Cardiol*.