

IMAGING VIGNETTE

INTERMEDIATE

CLINICAL VIGNETTE

## 2 Cases of Elusive Left Ventricular Outflow Tract Gradient



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### ABSTRACT

Patients with hypertrophic cardiomyopathy (HCM) typically have septal hypertrophy and left ventricular outflow tract gradient, usually present at rest with increase under certain hemodynamic conditions. We report 2 cases of HCM in which there was subtle septal hypertrophy; the gradient was detected only postprandially, highlighting the importance of considering postprandial imaging in patients with suspected HCM. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2022;4:1404-1408) Published by Elsevier on behalf of the The Authors. This is an open access article under the CC BY-NC-ND license (<http://creativecommons.org/licenses/by-nc-nd/4.0/>).

Patients with hypertrophic cardiomyopathy (HCM) typically have septal hypertrophy and left ventricular outflow tract gradient, usually present at rest with increase under certain hemodynamic conditions. We report 2 such cases.

### CASE 1

A 71-year-old woman with hypertension, hyperlipidemia, and coronary artery disease with prior stent presented with worsening dyspnea on exertion. Further query revealed worsening of her symptoms after meals. The results of pulmonary function testing and ambulatory cardiac monitoring were normal. Multiple transthoracic echocardiograms at rest, with Valsalva maneuver, and with exercise did not show evidence of structural heart disease including HCM (Video 1). Computer tomographic coronary scanning, myocardial perfusion imaging, and coronary angiography ruled out in-stent restenosis of her prior treated coronary lesion. Owing to the persistence of symptoms, she was given anxiolytic therapy. She was seen by multiple providers over a 4-year period without a diagnosis, and ultimately a postprandial echocardiogram revealed the cause of her symptoms. She had a dynamic left ventricular outflow tract (LVOT) gradient, which increased from 2.3 m/s (rest) to 3.9 m/s (exercise) postprandially, with maximum peak gradient 61 mm Hg (Figure 1, Video 2). The patient was treated with  $\beta$ -blocker pharmacotherapy for a goal heart rate below 60 beats/min and with lifestyle interventions, but because of her persistent severe symptoms, a septal myectomy was performed. After this procedure, she experienced complete resolution of her symptoms.

### CASE 2

A 73-year-old woman with a history of hypothyroidism and hyperlipidemia presented to the clinic with 2 episodes of syncope after meals. She underwent extensive testing, including ambulatory cardiac monitoring, multiple transthoracic echocardiograms at rest, exercise and Valsalva maneuver, tilt table testing, and

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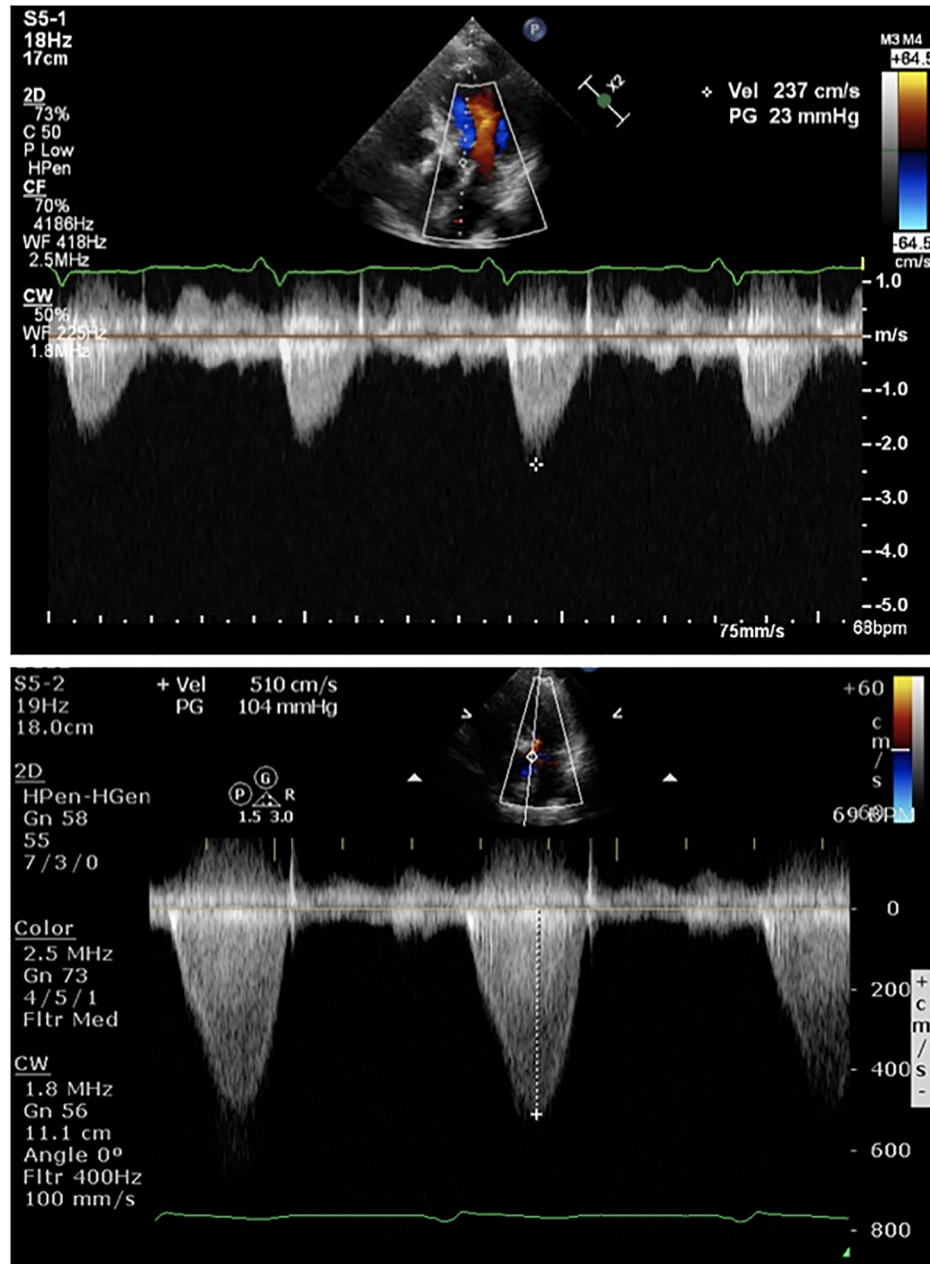
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coronary angiography, the results of all of which were normal or unremarkable (Figure 2, Video 3). Although she had septal thickening, there was no LVOT gradient; thus, it was believed to be age related. She was thought to have a vasovagal cause of her symptoms. After 13 years of persistent symptoms, she finally underwent a postprandial echocardiogram, which revealed a dynamic LVOT gradient that increased from 4 m/s (rest) to 5.8 m/s (Valsalva), with peak gradient 104 mm Hg

**ABBREVIATIONS  
AND ACRONYMS**

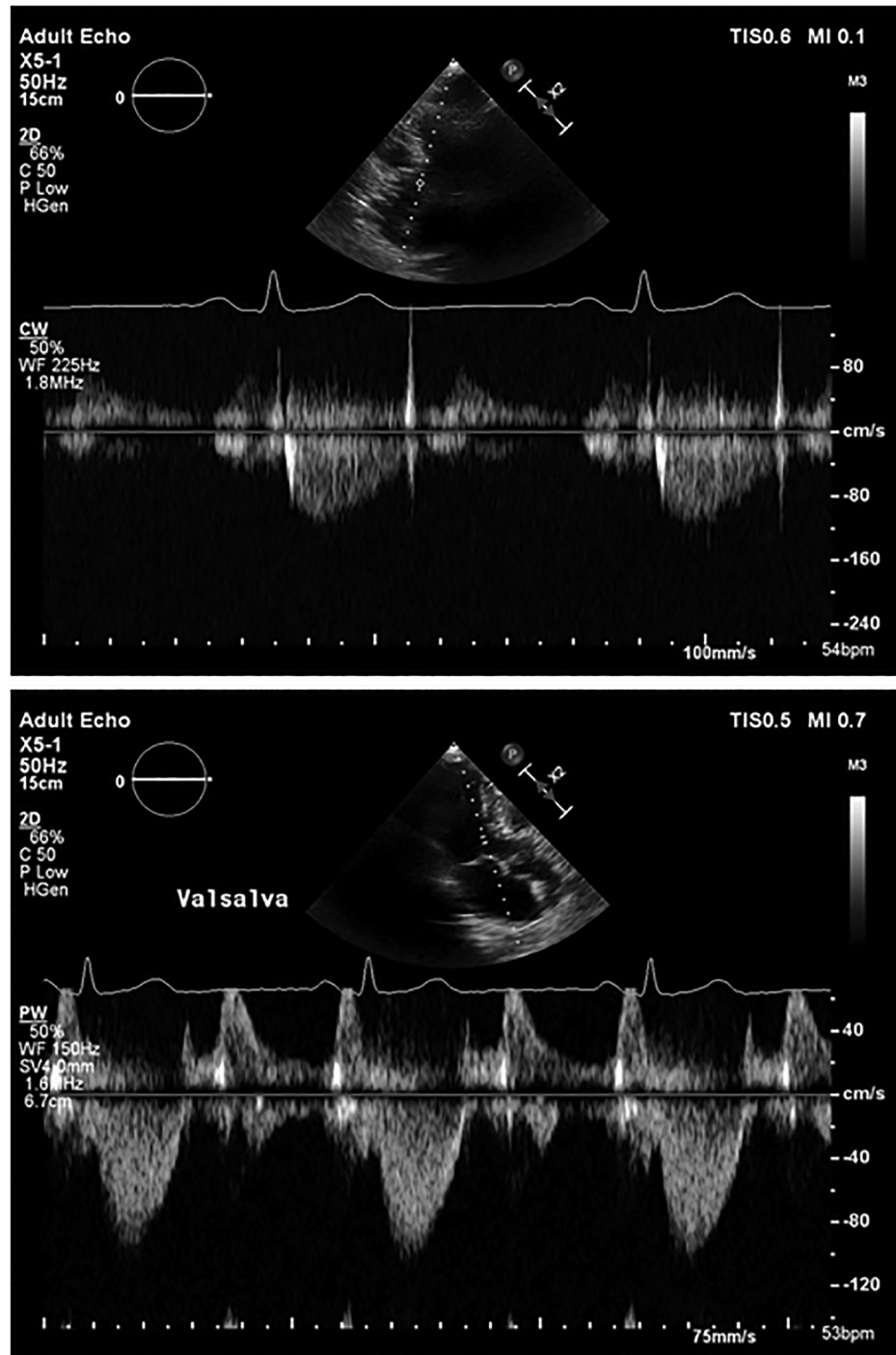
**HCM** = hypertrophic cardiomyopathy  
**LVOT** = left ventricular outflow tract

**FIGURE 1** Echocardiograms of Case 1



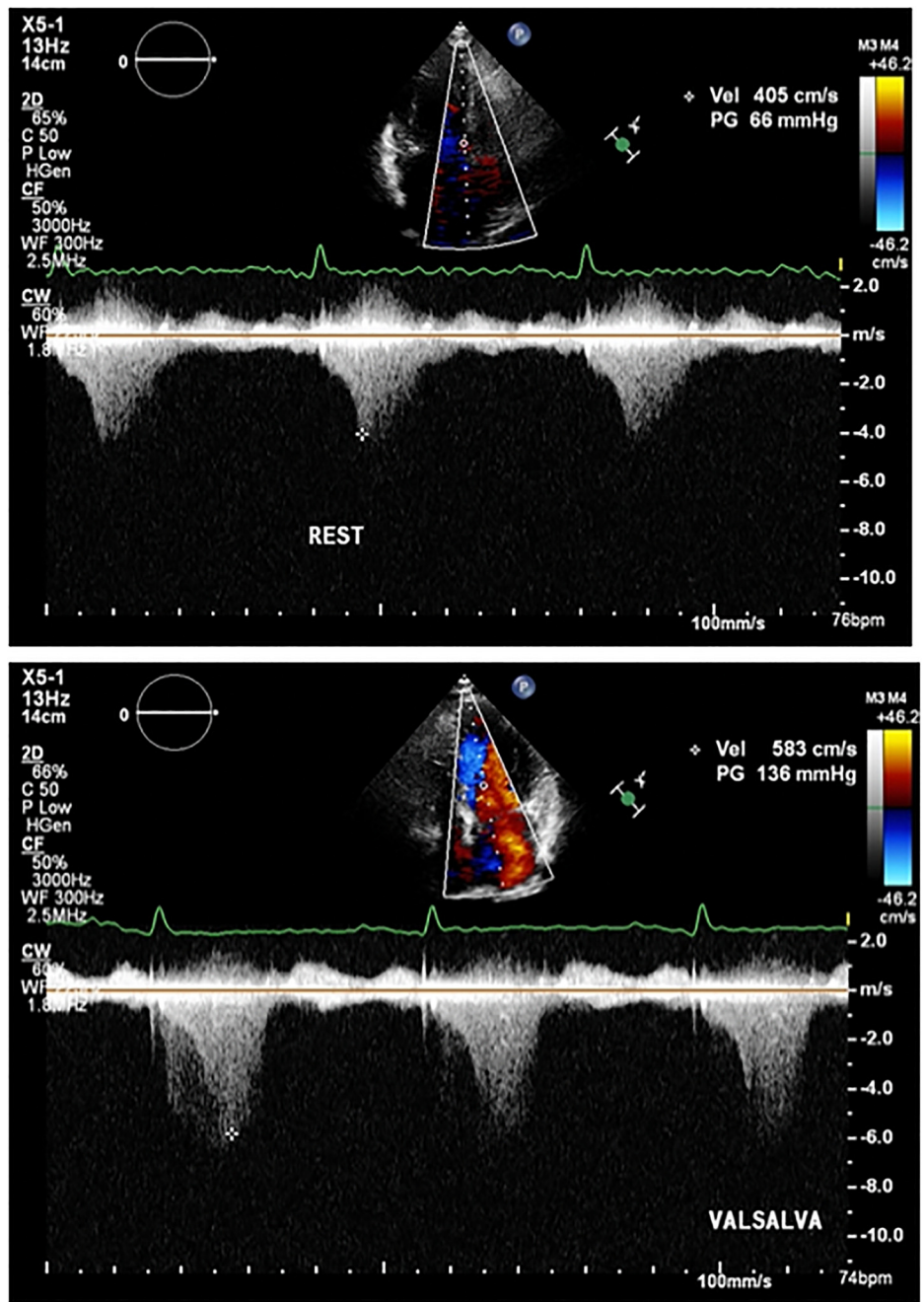
**(Top)** Echocardiogram with patient in postprandial state with left ventricular outflow tract velocity at rest of 2.3 m/s. **(Bottom)** Echocardiogram with patient in postprandial state with left ventricular outflow tract velocity of 5.1 m/s and peak gradient 104 mm Hg with Valsalva maneuver.

**FIGURE 2** Echocardiograms of Case 2



Nonpostprandial echocardiograms without left ventricular outflow tract gradient at rest (**top**) and with Valsalva maneuver (**bottom**).

**FIGURE 3** Echocardiograms of Case 2



Postprandial echocardiograms with left ventricular outflow tract velocity at rest of 4.0 m/s (**top**) and with left ventricular outflow tract velocity of 5.8 m/s with Valsalva maneuver (**bottom**).

([Figure 3](#), [Video 4](#)). Pharmacotherapy was initiated with disopyramide 100 mg every 12 hours, and she was advised to eat small frequent meals (recommendation for half of current meal intake per meal with hydration above 1 oz/kg).<sup>1</sup> Since the beginning of this treatment, she has had near resolution of symptoms and no further episodes of syncope.

## DISCUSSION

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The majority of symptoms in patients with HCM are caused by LVOT obstruction. Because the gradient that causes obstruction can be transient, provocative maneuvers are often necessary to make the diagnosis with echocardiography and are recommended by the American College of Cardiology and the American Heart Association.<sup>2</sup> Common maneuvers used to provoke the gradient include exercise and the Valsalva maneuver; however, in some patients, the hemodynamic changes may manifest in the postprandial state. One study demonstrated that a postprandial echocardiogram elicits a transient LVOT gradient more effectively than post-exercise or post-Valsalva studies.<sup>3</sup> In both of these cases, careful history taking and obtaining the correct image with the patient in the correct hemodynamic state were the essential steps in securing the diagnosis of HCM. In conclusion, obstructive HCM should also be included in the differential diagnosis of patients with dyspnea or syncope after meals, and a postprandial echocardiogram should be considered part of the workup in these cases.

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## REFERENCES

1. Kansal MM, Mookadam F, Tajik AJ. Drink more, and eat less: Advice in obstructive hypertrophic cardiomyopathy. *Am J Cardiol.* 2010;106(9):1313-1316.
2. Ommen SR, Mital S, Burke MA, et al. 2020 AHA/ACC guideline for the diagnosis and treatment of patients with hypertrophic cardiomyopathy: Executive Summary: a report of the American College of Cardiology/American Heart Association joint committee on clinical practice guidelines. *J Am Coll Cardiol.* 2020;76(25):3022-3055.
3. La Canna G, Scarfò I, Arendar I, Alati E, Caso I, Alfieri O. Phenotyping left ventricular obstruction with postprandial re-test echocardiography in hypertrophic cardiomyopathy. *Am J Cardiol.* 2020;125(11):1688-1693.

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**KEY WORDS** cardiomyopathy, echocardiography, hemodynamics, imaging

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**APPENDIX** For supplemental videos, please see the online version of this paper.