The Significance of “Contractile Reserve” in the Echocardiographic Assessment of Athletic Heart Syndrome

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Abstract

The clinical distinction between athlete’s heart and structural heart disease in the echocardiography laboratory is often challenging. We present a case where athletic heart syndrome was promptly differentiated from pathology with a simple maneuver during echocardiography.

Keywords: Athlete’s heart, echocardiography, ejection fraction

INTRODUCTION

We present a case of a young athletic male with left ventricular enlargement and low ejection fraction. We demonstrated contractile reserve as a means of differentiating athletic heart syndrome from dilated cardiomyopathy.

CASE REPORT

A 56-year-old male was referred for transthoracic echocardiogram to evaluate a systolic cardiac murmur. The patient was a noncompetitive runner who had no prior known cardiac history and no cardiovascular complaints. His vital signs were remarkable for bradycardia (41 beats/min), blood pressure was 124/70 mmHg, and his body mass index was 20.8 kg/m². Echocardiography revealed normal wall thickness (parasternal long-axis septal thickness 10 mm and posterior wall thickness 10 mm), mild left ventricular (LV) enlargement (parasternal long-axis diastolic LV dimension of 51 mm, systolic LV dimension of 40 mm, and apical biplane volume index of 120 mL/m²), and mild right ventricular (RV) enlargement (apical four-chamber base-apex diastolic RV diameter of 99 mm), and mild left atrial enlargement. Biplane LV ejection fraction was calculated as 47% (linear ejection fraction by M mode at 44%), and wall motion analysis was consistent with mild generalized hypokinesis without regional wall motion abnormalities [Figure 1 and Video 1]. LV stroke volume index was calculated as 94 mL (inde × 56 mL/m² square), and cardiac output was calculated as 4.15 L/min (cardiac inde × 2.19 L/min/m²). The average longitudinal LV strain was normal at −20%. Diastolic function was normal (medial mitral annulus tissue Doppler velocity 0.09 m/s with a normal transmural flow). The patient’s heart rate increased to 80 beats/min after repetitive squatting, and repeat imaging showed a significant improvement of biplane ejection fraction to 64% (two-dimensional ejection fraction by M mode 57%) and decrease of end-systolic biplane volume from 121 to 59 mL [Figure 1 and Video 2]. These findings were consistent with the athlete’s heart and no further evaluation was performed.

DISCUSSION

Identification of the athletic heart and differentiation from structural heart disease is often challenging, particularly when resting echocardiography demonstrates LV dilation with or without decreased resting LV systolic function. The degree of LV dilation in athletes is variable, and a study of 1309 elite Italian athletes showed that LV end-diastolic dimension was larger than 54 mm in 45% and larger than 60 mm in 15% of cases.[1] In addition, low-normal or mildly depressed ejection fraction is a common finding among highly athletic

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Cardiac magnetic resonance imaging (CMR), with or without exercise, can be a superior modality to echocardiography in uncertain cases. CMR can accurately quantify chamber size and ejection fraction and may demonstrate pathologic late gadolinium enhancement. Contractile reserve is a distinguishing feature of athletic heart syndrome that could be easily demonstrated with both exercise echocardiography and exercise CMR. Although a multimodality imaging approach is essential in establishing the accurate diagnosis, it could be associated with less efficiency and increased cost. On the contrary, simple maneuvers (such as squatting during standard echocardiography) may be used to establish the correct diagnosis and defer further unnecessary cardiac workup.

**Declaration of patient consent**

The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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**Conflicts of interest**

There are no conflicts of interest.

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**Figure 1:** (a) Parasternal long-axis two-dimensional view and (b) apical four-chamber view at rest (40 beats/min) demonstrating mild left ventricular enlargement. M-mode assessment at rest (c) and after squatting (80 beats/min) (d) demonstrating significant decrease in end-systolic dimension and increase in calculated ejection fraction with squatting.