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IMAGING VIGNETTE

CLINICAL VIGNETTE

Dysplastic Mitral Valve in Costello Syndrome

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ABSTRACT

Costello syndrome is an autosomal dominant condition caused by variants in the *HRAS* gene. Cardiac presentation includes valvular disease (usually valvar pulmonary stenosis), arrhythmias, and hypertrophic cardiomyopathy. To our knowledge, this is the first such report of dysplastic mitral valve associated with Costello syndrome. (J Am Coll Cardiol Case Rep 2024;29:102408) Crown Copyright © 2024 Published by Elsevier on behalf of the American College of Cardiology Foundation. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/).

A 17-year-old male patient was referred to an adult inherited cardiovascular conditions clinic with a suspected diagnosis of hypertrophic cardiomyopathy (HCM) after a syncopal episode in the aftermath of a 45-minute session of playing football. During exertion, he reported feeling lightheaded and had to be substituted. Within a few minutes of leaving the pitch, he lost consciousness. No significant musculoskeletal injuries were sustained. The patient regained full consciousness within a few minutes and was promptly transported to a local accident and emergency department for further assessment.

During the diagnostic investigation, a 12-lead electrocardiogram demonstrated sinus rhythm with left QRS-axis deviation and a right bundle brunch block, a normal PR interval, and no evidence of pre-excitation. Subsequently, a loop recorder was implanted to facilitate continuous monitoring for arrhythmias. Transthoracic echocardiography demonstrated a hypertrophic left ventricle with a hypertrophied papillary muscle and secondary chords to the posterior mitral valve leaflet (PMVL), apical displacement of the posterior annulus, and systolic anterior motion (SAM) of the mitral valve with midcavity obstruction. The anterior mitral valve leaflet (AMVL) and PMVL were elongated and plastered onto the left ventricular wall. This led to variable leaflet coaptation points associated with mild mitral regurgitation (Video 5), including AMVL tip coaptation with the base of the PMVL (**Figure 1A** arrow, Video 1) and coaptation at the posterior mitral valve annulus (**Figure 1B** arrow, Video 1). Exercise stress echocardiography indicated a dynamic left ventricular outflow and midventricular obstruction, with a resting gradient of 32 mm Hg (**Figures 1C and 1E**, Video 3) and a peak gradient of 61 mm Hg (**Figure 1D**, Video 4).

Cardiac magnetic resonance imaging confirmed a dysplastic mitral valve by showing PMVL adherence to the ventricular wall without apical displacement of the mitral valve orifice. On cardiac magnetic resonance, 4-chamber steady-state free precession (SSFP) cine imaging excluded congenitally corrected transposition of the great arteries, evidenced by morphologic features of the left and right ventricle and the tricuspid valve

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ABBREVIATIONS AND ACRONYMS

AMVL = anterior mitral valve leaflet

HCM = hypertrophic cardiomyopathy

PMVL = posterior mitral valve leaflet

SAM = systolic anterior motion

SSFP = steady-state free precession

hinge line positioned more apically than that of the mitral valve (**Figure 1F**, Video 2). Notably, the short-axis cine SSFP imaging demonstrated SAM of the AMVL tip (**Figure 1G**). There was no late gadolinium enhancement. Genetic testing unveiled a pathogenic *HRAS* gene variant, thus confirming the diagnosis of Costello syndrome. The patient was started on bisoprolol, 2.5mg once daily and has heeded advice to refrain from high-intensity exercise. He has remained symptom-free, without any evidence of rhythm disturbance on an implantable loop recorder.

Costello syndrome is a rare RASopathy first discovered in 1977 by Dr Jack Costello, a New Zealand pediatrician.[1] It is distinguished by a constellation of clinical features, including the following: dysmorphic craniofacial characteristics; developmental delay; musculoskeletal and neurologic features such as hyperextensible joints, tight Achilles tendons, hydrocephalus, Arnold-Chiari malformation, and tethering of the spinal cord. Cardiovascular manifestations include HCM, valvular anomalies, and susceptibility to arrhythmias.[2] Valvular abnormalities in Costello syndrome mainly consist of congenital pulmonary stenosis and rarely mitral valve abnormalities related to HCM.[3] To our knowledge, this is the first report of dysplastic mitral valve associated with Costello syndrome with SAM of a mitral valve leaflet secondary to HCM.

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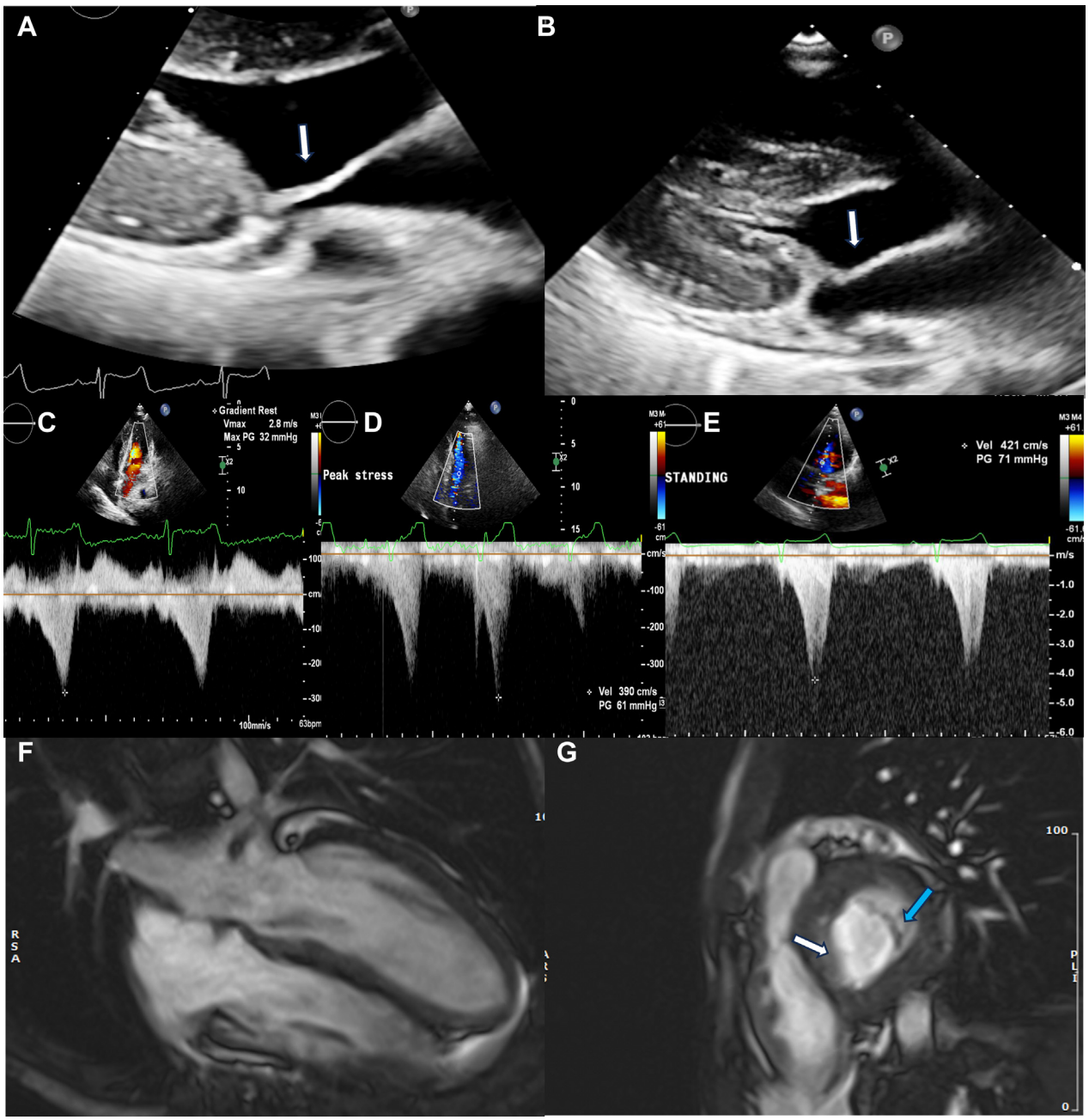
KEY WORDS Costello syndrome, mitral valve malformation

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

FIGURE 1 **Dysplastic Mitral Valve**



(A) Transthoracic echocardiography demonstrating anterior mitral valve leaflet coaptation with the base of the posterior mitral valve leaflet (arrow). (B) Coaptation at the posterior mitral valve annulus (arrow). (C) Exercise stress echocardiography demonstrating a resting left ventricular outflow tract gradient. (D) Peak left ventricular outflow tract gradient. (E) Transthoracic echocardiography continuous wave Doppler imaging demonstrating intraventricular obstruction. (F) Cardiac magnetic resonance 4-chamber cine imaging, normal left and right ventricular morphology, tricuspid and mitral valve hinge points, exclusion of congenitally corrected transposition of great arteries. (G) Short-axis cine imaging demonstrating systolic anterior motion (white arrow, anterior mitral valve leaflet; blue arrow, posterior mitral valve leaflet). PG = pressure gradient; Vel = velocity; Vmax = maximum velocity.