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## CASE REPORT

## INTERMEDIATE

## CLINICAL CASE: SPORTS CARDIOLOGY

# Collegiate Wrestler With a Bicuspid Aortic Valve and Aortic Dilation



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## ABSTRACT

Bicuspid aortic valve and aortopathy are generally considered contraindications to isometric exercise. For athletes with mild disease at low risk of adverse events, a shared decision-making approach for continued sports participation is reasonable. We present a case of a collegiate wrestler with bicuspid aortic valve and aortopathy to illustrate shared decision making. (**Level of Difficulty: Intermediate.**) (J Am Coll Cardiol Case Rep 2022;4:1548–1552) © 2022 The Authors. 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/>).

## HISTORY OF PRESENTATION

A 19-year-old competitive collegiate male wrestler presented to our sports medicine clinic with an incidentally diagnosed bicuspid aortic valve (BAV) and aortic dilatation. These diagnoses were made by transthoracic echocardiogram when he volunteered as a practice patient for sonographer training. His regular exercise routine consisted of moderate-

to high-intensity isometric exercise, including weightlifting at least 4 times a week. He had no specific cardiovascular symptoms at rest or with exertion, including dizziness, syncope, shortness of breath, palpitations, or chest pain. Upon diagnosis of his condition, the patient was referred to a sports cardiology specialist for further evaluation and management.

He reported occasional alcohol intake. He denied use of tobacco products, recreational drugs, or performance-enhancing drugs. He had no family history of congenital heart disease or aortopathy. At the time of evaluation, his parents were alive and without any cardiac conditions.

On physical examination, his blood pressure was 102/72 mm Hg, and his heart rate was 60 beats/min. His height was 5 feet 6 inches, and his weight was 146 lbs. His body mass index was 23.69 kg/m<sup>2</sup>. His body surface area was 1.9 m<sup>2</sup>. Pertinent examination

## LEARNING OBJECTIVES

- To understand the implications of exercise in the setting of aortic dilation.
- To understand the approach to risk stratification for sports participation in patients with bicuspid aortic valves and aortopathies.
- To review the importance of shared decision making when caring for athletes.

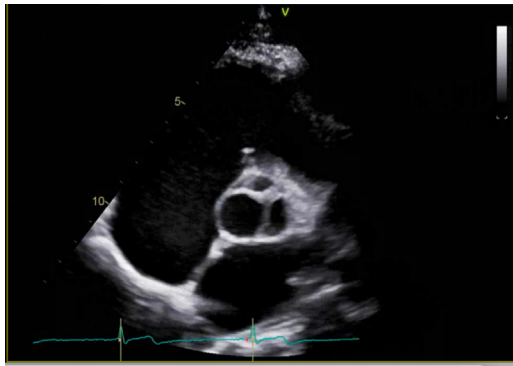
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Eugene Chung, MD, served as Guest Associate Editor for this paper.

The authors attest they are in compliance with human studies committees and animal welfare regulations of the authors' institutions and Food and Drug Administration guidelines, including patient consent where appropriate. For more information, visit the [Author Center](#).

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**FIGURE 1** Transthoracic Echocardiogram Demonstrating Bicuspid Aortic Valve



Parasternal short-axis view at the level of the aortic valve demonstrating fusion of the right and left coronary cusps.

findings included normal limb length, normal uvula appearance, normal skin translucency, and normal joint mobility.

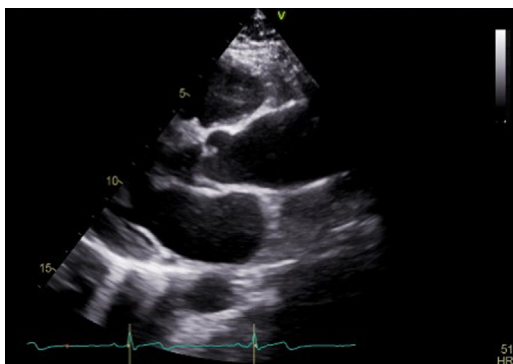
### PAST MEDICAL HISTORY

The patient had a history of acute appendicitis and appendectomy as a child.

### DIFFERENTIAL DIAGNOSIS

In patients with an aortopathy, the differential diagnosis includes genetically mediated vasculopathy (Marfan syndrome, Loeys-Dietz syndrome, Ehlers-

**FIGURE 2** Transthoracic Echocardiogram Demonstrating Aortic Dilation



Parasternal long-axis view at the proximal ascending aorta demonstrating effacement of the sinotubular junction and dilation of the ascending aorta.

Danlos syndrome, Turner syndrome), congenital heart disease (BAV-associated aortopathy), aortitis (inflammatory and infectious), and degenerative aortopathy.

### INVESTIGATIONS

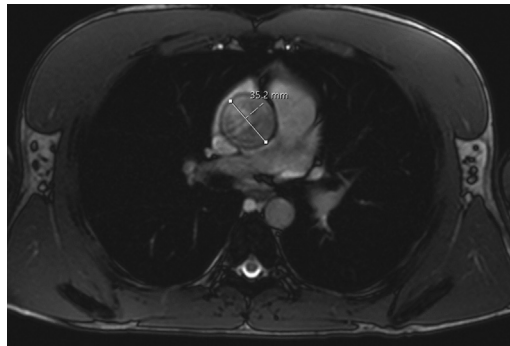
Transthoracic echocardiogram demonstrated a left ventricular ejection fraction of 66%, BAV with fusion of the right and left coronary cusps, mild aortic regurgitation, and mild aortic stenosis (mean gradient: 11 mm Hg; calculated aortic valve area: 2.0 cm<sup>2</sup>) (Figure 1). There was effacement of the sinotubular junction and mild dilation of the ascending aorta, measuring 35 mm (2.1 cm<sup>2</sup>/m<sup>2</sup> indexed) from leading edge to leading edge (Figure 2). Measurements were made using the American Society of Echocardiography leading edge adult convention.<sup>1</sup> Exercise treadmill stress test showed excellent exercise capacity (17 METS; peak blood pressure: 116/76 mm Hg), no anginal symptoms, and no electrocardiographic evidence of ischemia. Magnetic resonance angiography of the chest confirmed mild enlargement of the ascending aorta of 35 mm, and the descending thoracic aorta measured 20 mm (Figures 3 and 4).

### MANAGEMENT

This patient's imaging confirmed a diagnosis of BAV with mild aortic stenosis and mild aortic dilation. At the time of diagnosis, he did not meet criteria for surgical intervention for the aortic valve or aortopathy. Expert consensus recommendations for athletes with more than a mildly dilated aorta caution against participation in contact sports with a likelihood of significant bodily contact or high-intensity resistance training given the unquantified, but increased, risk of aortic dissection and unknown impact on the progression of aortic dilation.<sup>2</sup> A patient-centric discussion using a shared decision-making (SDM) approach was conducted. The goals of this conversation were to discuss the risks and benefits of restricting sports participation given the unknown impact on the clinical progression of disease. Considerations included the possible resultant undesirable side effects of loss of athlete identity and decline in mental health from restriction of sports participation versus continued participation with the risks of disease progression or significant cardiac event such as aortic dissection. After this conversation, the patient elected to continue wrestling competitively with plans for frequent interval monitoring of symptoms and serial imaging for disease progression. He underwent echocardiogram and magnetic resonance angiography

### ABBREVIATIONS AND ACRONYMS

- ACC = American College of Cardiology
- AHA = American Heart Association
- BAV = bicuspid aortic valve
- SDM = shared decision making

**FIGURE 3** Magnetic Resonance Angiography of the Aorta (Axial View)

Axial view of the aorta demonstrates a dilated ascending aorta measuring 35.2 mm.

6 months later, which demonstrated stable aortic size. Screening of his first-degree family members for BAV was also recommended. Consistent with the 2010 American College of Cardiology (ACC)/American Heart Association (AHA) guidelines for the diagnosis

**FIGURE 4** Magnetic Resonance Angiography of the Aorta (Sagittal View)

Sagittal view of the aorta demonstrates a dilated ascending aorta with effacement of the sinotubular junction and no other thoracic aortic abnormalities.

and management of patients with thoracic aortic disease, genetic counseling was not pursued because the patient had no syndromic features or a family history of vasculopathies.<sup>3</sup> Finally, intracranial aneurysms have been reported in up to 10% of patients with BAV, particularly among those with aortic coarctation. Screening for intracranial aneurysms among patients with aortic coarctation may be reasonable,<sup>4</sup> but because this patient did not have BAV-associated coarctation, this was not pursued. However, it may be appropriate to reconsider this in the future, particularly with ongoing participation in a contact sport.

## DISCUSSION

Aortic dilation is highly prevalent in patients with BAV, and the risk of aortic dissection is directly related to the degree of aortic dilation.<sup>5</sup> Certain physical activities, including heavy lifting and high-intensity activity, are associated with elevations in blood pressure that are hypothesized to increase shear wall stress. There is also an increased risk of dissection from deceleration injuries during contact sports. These risks are amplified in cases of genetic or familial aortopathy (e.g., Marfan syndrome).<sup>6</sup> When assessing the risk of a collision injury, the type of aortopathy as well as the sport and intensity of competition should be taken into consideration (Table 1). The AHA/ACC guidelines for eligibility and disqualification recommendations for athletes with cardiovascular abnormalities provide guidance on management and surveillance strategies for athletes with aortopathies.<sup>2</sup> It is important to note that there are limited data in this field with considerable debate about the risk of adverse events and suitability for continued participation in competitive athletics in athletes with aortic dilation.

Although there is sparse evidence for activity weight restrictions, it is known that heavy isometric weightlifting markedly increases systolic arterial pressures.<sup>3</sup> This can pose a theoretical risk for aortic dissection and accelerated dilation.<sup>6</sup> The guidelines do not specify a numerical value for weight restrictions because there are many factors to take into account (such as the athlete's conditioning, muscle groups involved, and type of movement). However, it is advised that strength training requiring a Valsalva maneuver should generally be avoided, and patients should instead be encouraged to do increased repetitions with lower weights.<sup>3,7</sup> Because of the ambiguity of weight restrictions, an SDM approach for athletes with aortopathies should be tailored to each patient. It is also important to

**TABLE 1 Likelihood of Impact From Certain Sports**

High likelihood of impact	
Basketball	Karate
Boxing	Lacrosse
Downhill skiing	Snowboarding
Football	Soccer
Hockey	Wrestling
Low likelihood of impact	
Baseball	Running
Cricket	Sailing
Cycling	Softball
Equestrian	Squash
Figure skating	Tennis
Golf	Track and field
Gymnastics	Volleyball
Riflery	Weightlifting

note that commonly prescribed cardiovascular medications for the management of hypertension in patients with aortic dilation (for example, beta blockers) are prohibited in and out of competition for certain sports that require trunk and extremity stability (archery, racing, golf, shooting). As such, cardiologists caring for athletes should familiarize themselves with the World Anti-Doping Agency prohibited medications list.<sup>8</sup>

Importantly, the presence of a BAV alone does not warrant exclusion from participating in sports. Athletes with a BAV should be evaluated for aortic regurgitation and aortic stenosis at least annually, and the decision to participate in sports should involve risk stratification based on the severity of valvular disease and associated aortopathy according to the 2015 AHA/ACC guidelines for athletes with cardiovascular abnormalities.<sup>2,9</sup>

Recent cardiology guidelines have reinforced the importance of SDM for all patients, and this is particularly important for patients who are athletes. SDM provides physicians the ability to provide counsel on the known and theoretical risks of sports participation while acknowledging the potentially severe repercussions of medical decisions, including disqualification from sports participation, which may adversely affect a patient's quality of life and

livelihood. It is imperative to carefully incorporate the patient's values and preferences in conjunction with a careful cardiovascular assessment of risk for continued participation. Involving the patient and other stakeholders in the decision-making process can aid in the understanding of risk and probability of adverse events, thus enabling athletes to make informed decisions.<sup>10</sup>

### FOLLOW-UP

After an SDM discussion with the patient, his parents, coach, team physician, and athletic trainers, a decision was made for the athlete to continue competitive wrestling with reassessment of risk at regular intervals and modification of his training regimen. He continues to wrestle competitively at a collegiate level with serial monitoring and imaging, with minimal interval disease progression. In this case, a careful consideration of the patient's values and preferences was balanced with the risk of cardiovascular morbidity and mortality.

### CONCLUSIONS

BAV is commonly associated with an aortopathy, which raises the theoretical risk for cardiac events during sports with bodily contact and high-intensity resistance training. Given the paucity of data and uncertainty in risk, a decision to continue participation in competitive athletics may be reasonable with SDM.

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