




1



AACVPR *ignite* 38TH ANNUAL MEETING

**Serving Challenging Diagnoses in Cardiac Rehabilitation: A Case-Based Approach**

**Aortopathies in Cardiac Rehabilitation**

Thomas P. Olson, Ph.D., M.S., FACSM, FAHA

2

## Disclosures

### Relevant Grant / Research Support

- NIH-NINR – 5R01NR018832: Improving cardiac rehabilitation outcomes through mobile case management (iCARE)
  - Principal Investigator: Thomas P. Olson, Ph.D.
  - Ongoing research support
- Laguna Health – 92783022: Recovery and behavioral health support for post-discharge care
  - Principal Investigator: Thomas P. Olson, Ph.D.
  - Ongoing research support



38TH ANNUAL MEETING

AACVPR

3

## Learning Objectives

- Discuss the guidelines for exercise participation in patients with aortopathy
- Apply exercise prescription principles to patients with aortopathy



38TH ANNUAL MEETING

AACVPR

4

## General Principles of Exercise Programming

- Guidelines for management of many cardiovascular diseases have been published
  - Most guidelines include recommendations for increased general physical activity, exercise training, and/or structured exercise prescription
  
- Numerous papers on exercise prescription in cardiac rehabilitation
  - Utilize the FITT principle (with progression)
  - Primary focus is on aerobic conditioning
  - Include resistance training
  - Include HIIT (when appropriate)



38TH ANNUAL MEETING

AACVPR

5

## Approach to Complex Patients

- Occam's Razor
  - William of Ockham
  - 14<sup>th</sup> century philosopher and theologian
  - *"The simplest explanation is usually the best explanation"*
  
- Many of our cardiac rehabilitation patients are complex.
  
- Hickam's Dictum
  - John Hickam (1914-1970)
  - American physician / Chair – Department of Medicine at University of Indiana
  - *"A patient can have as many diseases as they darn well please"*



38TH ANNUAL MEETING

AACVPR

6

## Case Study

- **Demographics:**
  - Male
  - 48 years old
  - BMI – 33.7 kg/m<sup>2</sup>
  - Blood pressure = 129/76 mmHg / Heart rate = 65 bpm
- **Medical History:**
  - Bicuspid aortic valve w/moderate stenosis and associated moderate thoracic aortic aneurism
  - Mild mitral regurgitation
  - Optimized pharmacologic therapy
- **Risk Factors:**
  - Obesity
  - Sedentary
  - Hyperlipidemia
  - Family history (valve disease)



38TH ANNUAL MEETING

AACVPR

7

## Case Study

- **Echocardiography**
  1. Normal left ventricular chamber size. Calculated ejection fraction 73%.
  2. Systolic anterior motion of the mitral leaflets with mild regurgitation.
  3. Bicuspid aortic valve with fusion of the right and left coronary cusps. Mean Doppler gradient 37 mmHg.
  4. Moderate aortic valve regurgitation, multiple eccentric jets make quantification difficult. No evidence of flow reversal in the abdominal aorta. TVI of flow reversal in the proximal descending thoracic aorta is 11-12 cm.
  5. Moderately enlarged mid ascending aorta diameter of 45 mm. Upper limit of normal for this patient: 38 mm

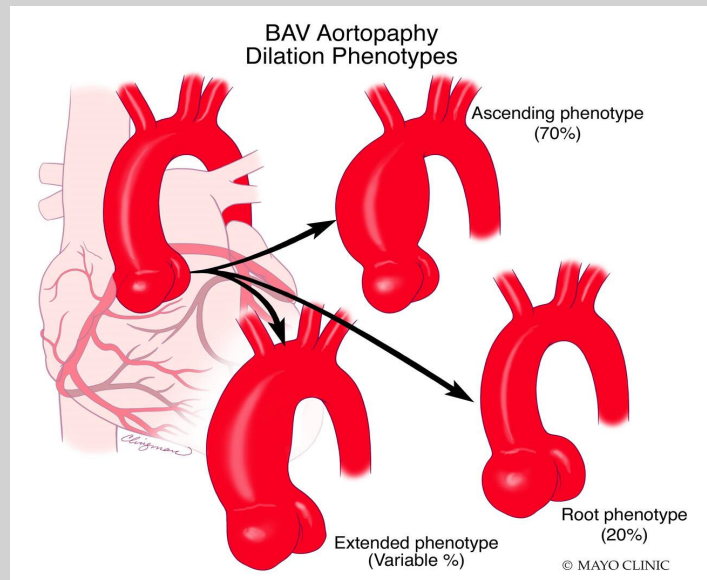


38TH ANNUAL MEETING

AACVPR

8

# Aortopathies

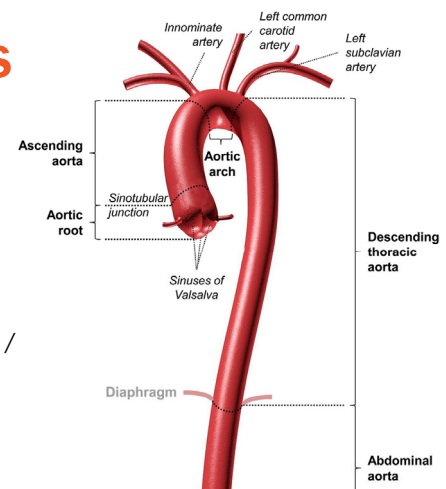


©2021 Mayo Foundation for Medical Education and Research | WFS35903-9

9

## Many Types of Aortopathies

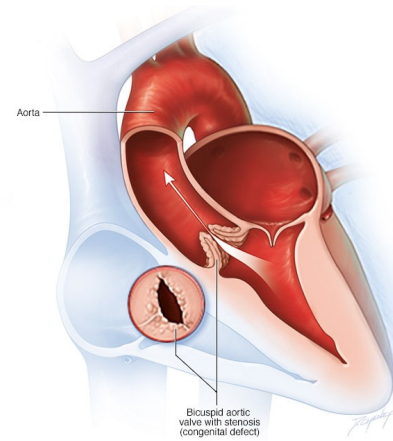
- **Abdominal Aortic Aneurysm (AAA)**
  - Most common type of aneurysm and dissection
- **Thoracic Aortic Aneurysm (TAA)**
  - **Syndromic**
    - Loeys-Dietz Syndrome / Marfan Syndrome / Turner Syndrome / Vascular Ehlers-Danlos Syndrome / Takayau's Arteritis
  - **Non-syndromic (genetic mutations)**
    - ACTA2 (most common) / FOXE3 / LOX / MYH11 / MYLK
  - **Congenital heart disease**
    - Coarctation / Tetralogy of Fallot / Truncus arteriosus / d-Transposition / Pulmonary atresia
    - **Bicuspid aortic valve-associated aortopathy = most common contributor to TAA**



10

## Bicuspid Aortic Valve

- Broad spectrum of disease
  - Valve
    - Competent, insufficient (regurgitation), stenotic
  - Aorta
    - Normal, mild, moderate, severe enlargement
- Concerns
  - Accelerated enlargement of aorta (risk for dissection)
  - LV enlargement if aortic insufficiency
  - Syncope / sudden death if aortic stenosis
- *What are our guidelines for exercise prescription?*



© MAYO FOUNDATION FOR MEDICAL EDUCATION AND RESEARCH. ALL RIGHTS RESERVED.



38TH ANNUAL MEETING

AACVPR

11

## Potential Scenarios with Bicuspid Aortic Valve

- A. Normal valve function and normal sized aorta (<2 SD from mean)**
- No restrictions on exercise Rx or competitive sports
  - One-time evaluation to exclude coarctation of the aorta
  - Yearly evaluation to detect new onset heart murmurs

### AHA/ACC SCIENTIFIC STATEMENT

#### Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 5: Valvular Heart Disease

A Scientific Statement From the American Heart Association and American College of Cardiology

Data From: Stout KK et al. Circulation 2019;139:e698–e800.  
Braverman et al. Circulation. 2015;132(22):e303–e309.  
Van Hare et al. J Am Coll Cardiol 2015;66:2385–92.



38TH ANNUAL MEETING

AACVPR

12

## Potential Scenarios with Bicuspid Aortic Valve

Severity	Jet Velocity, m/s	Mean Gradient, mm Hg	Aortic Valve Area, cm <sup>2</sup>
Mild	<3	<20	>1.5
Moderate	3-4	★ 20-40	1-1.5
Severe	>4	>40	<1.0

Reprinted from Nishimura et al (1). Copyright © 2014, American Heart Association, Inc.

### B. Aortic stenosis

- **Mild AS = No restrictions**

- Yearly exam, Doppler echo, exercise test

- **Moderate AS**

- Competitive sports with moderate-high dynamic or static demand **are not recommended**
- High intensity training and heavy resistance training are **restricted**
- Exercise test before prescribing low - moderate intensity exercise

- **Severe AS**

- Low - moderate intensity training if asymptomatic following exercise test
- No exercise training for severe, symptomatic AS (low intensity physical activity only)



38TH ANNUAL MEETING

Data From: Stout KK et al. Circulation 2019;139:e696-e800  
 RA Nishimura et al. Circulation 2017;135:e1159-e1195  
 Van Hare et al. J Am Coll Cardiol 2014;64:1192-1202



13

## Potential Scenarios with Bicuspid Aortic Valve

### C. Aortic regurgitation (insufficiency)

- **Mild AR**

- Yearly exam, Doppler echo, exercise test

- **Moderate AR**

- No restrictions if asymptomatic
- Confirm with exercise test

- **Severe AR**

- Low - moderate intensity training if asymptomatic following exercise test
- No exercise training for severe, symptomatic AR (low intensity physical activity only)



38TH ANNUAL MEETING

Data From: Stout KK et al. Circulation 2019;139:e696-e800  
 RA Nishimura et al. Circulation 2017;135:e1159-e1195  
 Van Hare et al. J Am Coll Cardiol 2014;64:1192-1202



14

## Case Study

- Patient underwent aortic valve replacement
  - Enlarged mid ascending aorta remains
- Referred to cardiac rehabilitation
- No current (or previous) exercise program
  - Goals = improve exercise capacity / reduce BMI / CVD risk factor control
- Limited symptoms since surgery
  - Still reports general fatigue with exertion (general deconditioning)



38TH ANNUAL MEETING

AACVPR

15

## Case Study: Baseline

Variables	Intake Assessment
Body mass (kg)	111.6 kg
BMI	33.7 kg/m <sup>2</sup>
Resting heart rate	69
Blood pressure	130/82
Six-Minute Walk Test (M)	465 (73% pred)



38TH ANNUAL MEETING

AACVPR

16



## Potential Scenarios with Aortic Aneurysm

### AHA/ACC SCIENTIFIC STATEMENT

#### Eligibility and Disqualification Recommendations for Competitive Athletes With Cardiovascular Abnormalities: Task Force 7: Aortic Diseases, Including Marfan Syndrome

A Scientific Statement From the American Heart Association and American College of Cardiology

### Aortopathy

- **Aortic diameter <40mm or Z-score <2**
  - No restrictions
- **Aortic diameter 40-44 mm (men)/36-39 mm (women) or Z-score 2 - 3.5**
  - Restrict to mild – moderate exercise
  - Activities with low risk of bodily contact and limited static component
- **Aortic diameter 45-50mm or Z-score >3.5**
  - Low intensity endurance exercise with no static component
- **Aortic diameter >50mm**
  - No exercise training (low intensity physical activity only)



38TH ANNUAL MEETING

Data From: Stout KK et al. Circulation 2019;139:e698–e800.  
Braverman et al. J Am Coll Cardiol 2015;66:2385–92.

AACVPR

17

## Scope of Exercise Prescription

	Mild Disease and Asymptomatic <i>Unrestricted</i>	Moderate Disease Asymptomatic <i>Modified</i>	Severe Disease Symptomatic <i>Restricted</i>
Frequency	4-7 days/week	3-5 days/week	1-3 times/day
Intensity (RPE - 6-20 scale)	12-16* (Mod-Vigorous)	11-13 (Mod)	9-12 (Low)
Time (Duration)	30+ minutes	20 - 40 minutes	10 - 30 minutes
Type			
Interval Training	Yes	MIIT	No (with caveats)
Aerobic	No limit	No limits (with caveats)	
Resistance Training	Yes	Low resistance <b>No Valsalva</b>	Low resistance <b>No Valsalva</b>
Competitive Sports	Yes	Low intensity only (no contact)	No
Goals (Results)	Weight management Risk factor control Improved fitness ↑↑	Weight management Risk factor control Improved fitness ↑	Weight management Risk factor control Maintain fitness



38TH ANNUAL MEETING

AACVPR

18

## Case Study Exercise Prescription

### Initial Exercise Prescription

**Type:**

Walk indoors/outdoors/ treadmill, Cycle stationary

**Frequency:**

5 sessions/week

**Intensity:**

Work at a level that is comfortable but also challenging  
Rating of Perceived Exertion (RPE) Range: 10-12 (Borg: 6-20 scale)

**Time:**

Warm Up Minutes: 3-5  
Aerobic Exercise Minutes: 15-20 min \* Shorter sessions 2x/day as necessary  
Cool Down Minutes: 3-5  
Goal Duration: 30 daily accumulated minutes  
Goal Duration per week: 150

**Progression:**

Use RPE to guide when to increase work level intensity and duration  
Increase 1-2 minutes each session, as tolerated

**Strength Training (Review with cardiac rehabilitation staff prior to starting):**

Elastic bands (Low Intensity - No Valsalva)  
Major muscle groups  
Sessions per Week: 2-3 on non-consecutive days  
Reps: 10-15  
Sets: 1-2

**Flexibility:**

Stretch major muscle groups daily

**Other activity:**

Avoid prolonged sitting, Take the stairs



38TH ANNUAL MEETING

AACVPR

19

## Case Study: Follow-up

Variables	Intake Assessment	Follow-up Assessment	
Body mass (kg)	111.6 kg	107.2 kg	↓
BMI	33.7 kg/m <sup>2</sup>	32.1 kg/m <sup>2</sup>	↓
Resting heart rate	69	70	
Blood pressure	130/82 mmHg	124/78 mmHg	↓
Six-Minute Walk Test (M)	465 (73% pred)	590 (92% pred)	↑

Initial Goals = improve exercise capacity / reduce BMI / CVD risk factor control



38TH ANNUAL MEETING

AACVPR

20

## Summary

- Patients in our CR programs may have complex conditions requiring additional time and attention to ensure safe and effective therapy
- Patients with aortopathy need additional education on exercise intensity and minimizing the Valsalva maneuver
- With initial oversight and appropriate education, patients with aortopathy can engage in a structured exercise programs to improve risk factor control and maximize benefits



38TH ANNUAL MEETING

AACVPR

21

The background of the slide features a dark, abstract design with diagonal streaks of light in shades of orange, red, and blue, creating a sense of motion and energy.

**Thank You!**

22