Valvular Heart Disease

Considerations in Risk Assessment

Athena Remolina D.O., FACC, DBIM

AAIM 133rd Annual Meeting

October 18-23, 2025

CASE 1

65-year-old woman
Applying for 3Million

Medical history disclosed:

- Hypertension
- Heart murmur noted by primary physician for “many years”
- Rx: HCTZ 25 mg daily

APS ordered:

- Average 2- year blood pressure: 132/78 mmHg
- BMI: 27
- No history of CAD, CHF, diabetes or smoking
- Recent echocardiogram (ordered for murmur):
  - Normal LVEF (60-65%)
  - No LVH
  - PMVP with Mild-to-moderate mitral regurgitation (MR)

Transthoracic echocardiography is the primary imaging modality used to assess the etiology and severity of mitral regurgitation, as recommended by the American College of Cardiology

TRUE

False

Transthoracic echocardiography is the primary imaging modality used to assess the etiology and severity of mitral regurgitation, as recommended by the American College of Cardiology

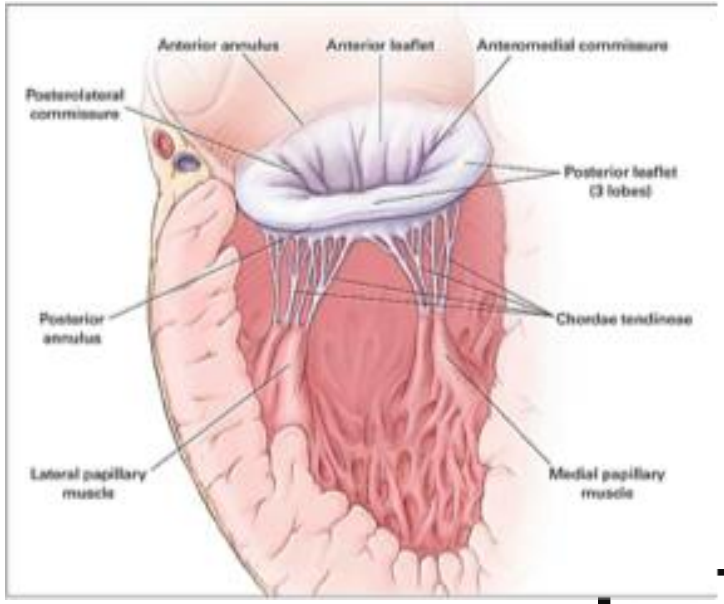
TRUE

ACC Recommendations:

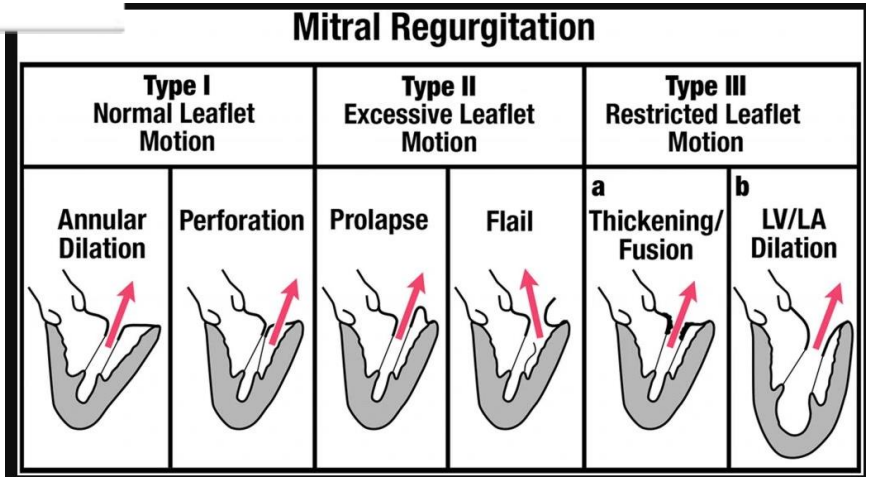
- Comprehensive evaluation of the MV complex (papillary muscles, chordae tendineae, all segments of both leaflets, MV annulus) and LV (size and function) to determine etiology

- Determine Carpentier Class

- Additional critical assessments include:
  - LA size and volume
  - RVSP
  - Confirm MR severity using multiple echocardiographic Doppler parameters



Heart valve surgery.com



ASE 2017 Native Regurgitation Guidelines

Definition: Mitral regurgitation (MR) is the backflow of blood from the LV to LA during systole due to valve insufficiency

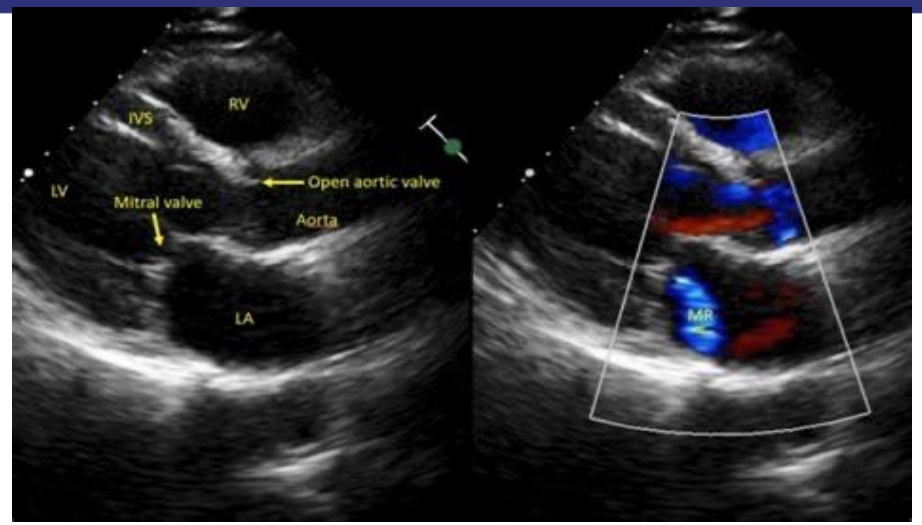
Etiology:

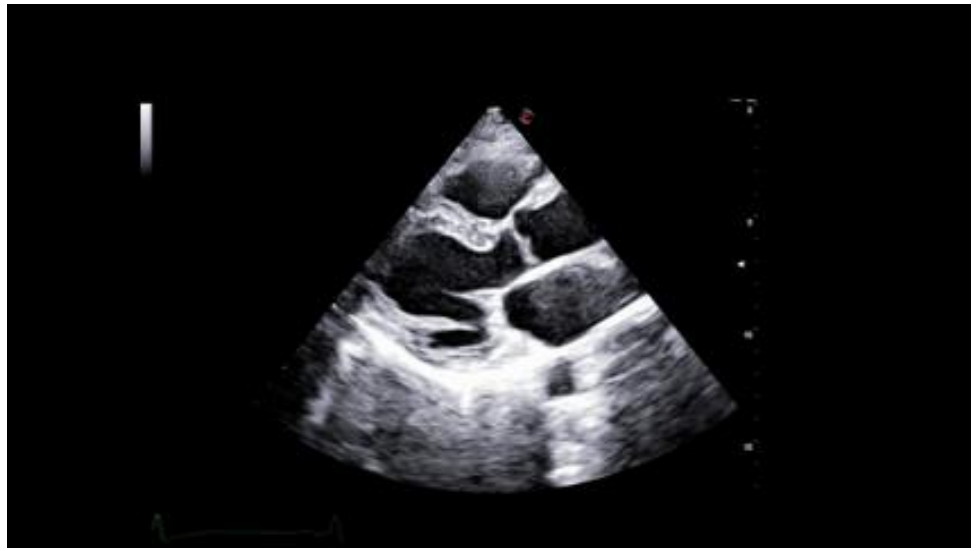
- *Primary (organic)*: Valve leaflet abnormality (e.g., myxomatous disease, rheumatic)
- *Secondary (functional)*: LV or annular dilation (e.g., ischemic, dilated cardiomyopathy)

MR is the most common form of valvular abnormality worldwide and prevalence increases with age

- Widespread use of color flow Doppler has increased the recognition of MR
- A trivial amount of MR is noted in up to 70% of individuals, often termed physiologic MR
- Framingham Heart study, at least mild MR was detected in 19% of participants
- Moderate to severe MR is present in 2-3% of adults age > 65

Chronic MR can lead to volume overload of LA and LV, causing chamber dilation, eccentric hypertrophy, elevated pulmonary pressure, arrhythmias and eventually heart failure if untreated





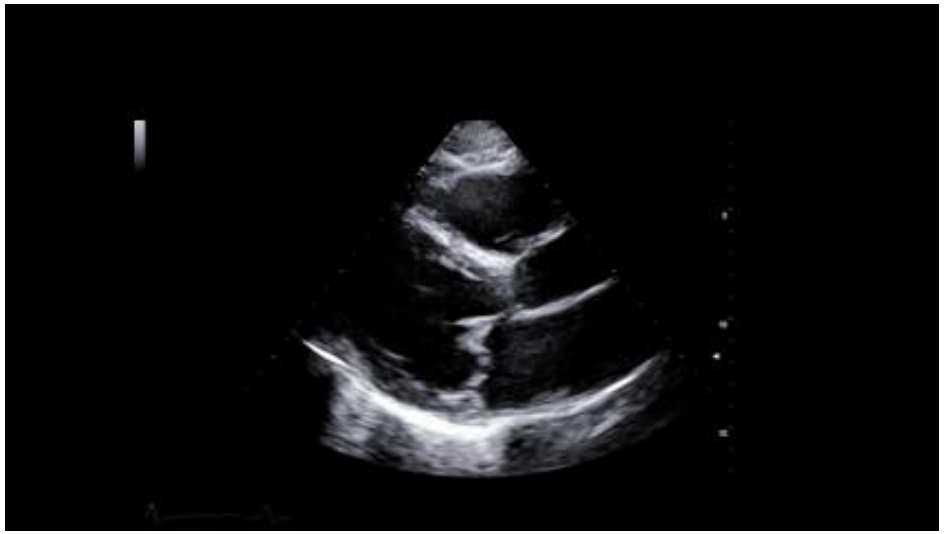
- **Symptoms:**
  - Often no symptoms, even with severe chronic mitral regurgitation (MR)
  - When present: shortness of breath with exertion, fatigue, reduced exercise tolerance and palpitations

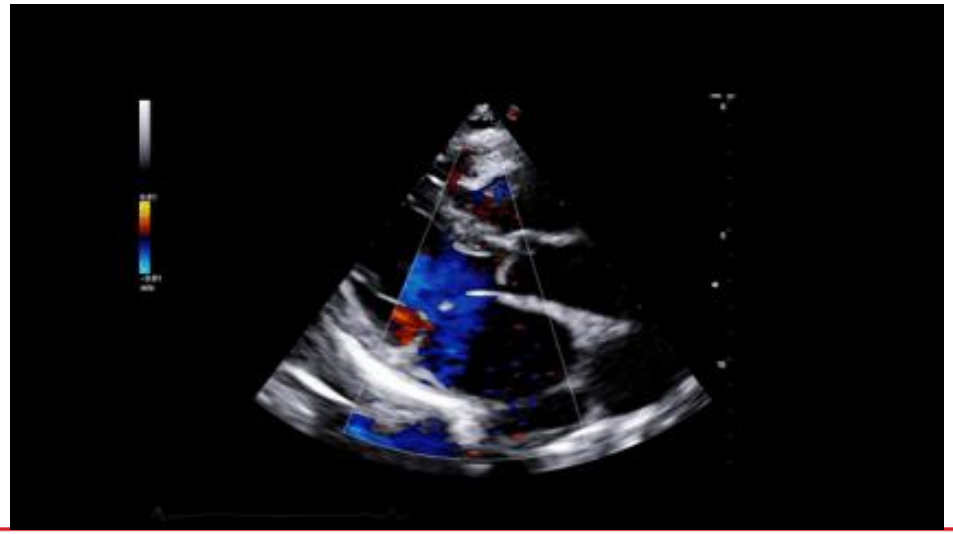
- **Murmur:**
  - Holosystolic murmur heard best at the apex, radiating to the axilla

- **Diagnosis**:
  - Primary tool for evaluating etiology and severity is transthoracic echocardiography
  - Important findings include leaflet shape, annular dilation, sizes of the LV and LA, and characteristics of the regurgitant jet

- **Severity Assessment:** Severity is determined by integrating all available echocardiographic data and clinical context- no single finding is definitive

- **Treatment:**
  - Depends on etiology (primary vs. secondary)
  - Timing based on symptoms and LV function
  - Gold Standard for primary MR is surgical MV repair-better outcomes than mitral valve replacement





Mitral valve prolapse without associated MR is associated with increased mortality compared to the general population

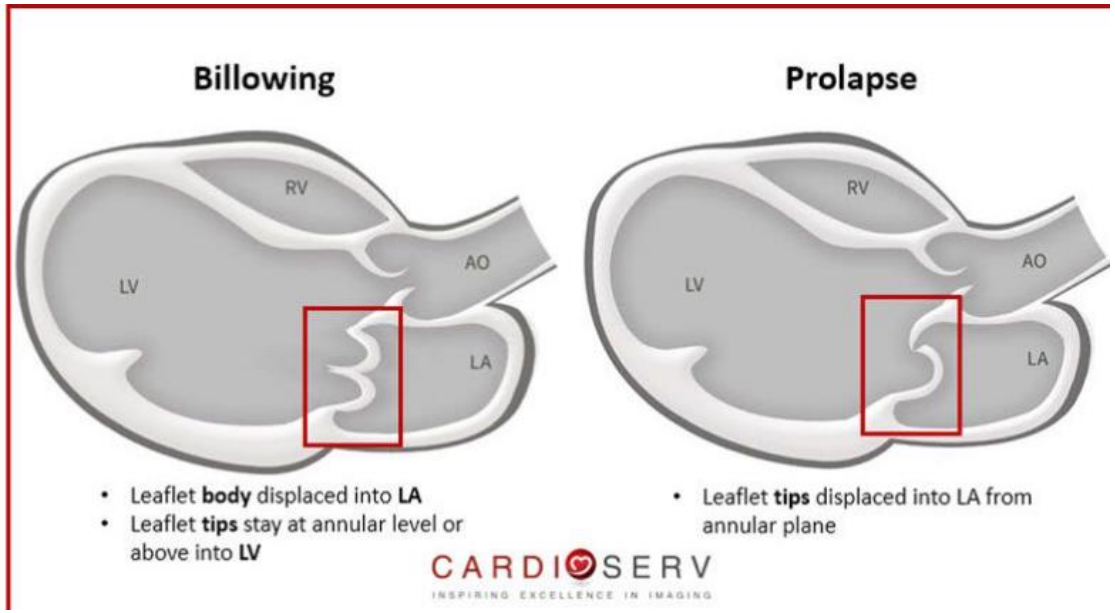
TRUE

False

Mitral valve prolapse without associated MR is associated with increased mortality compared to the general population

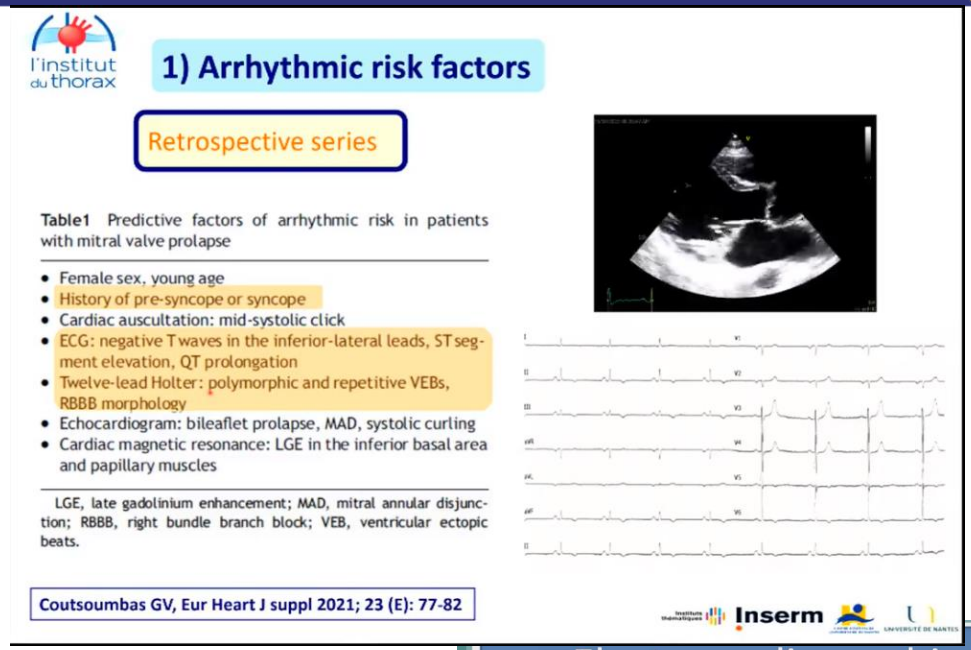
False

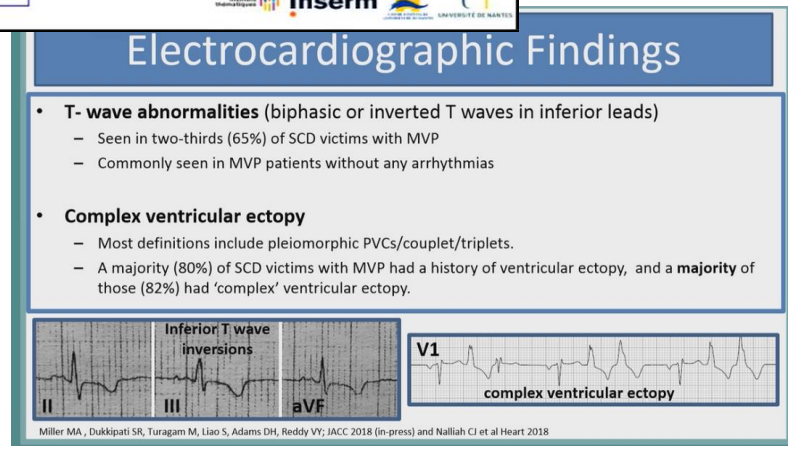
- MVP (floppy MV syndrome, systolic-click murmur syndrome, Barlow's syndrome) is a developmental anomaly caused when one or both mitral leaflets are displaced into the LA below the mitral annulus during systole
- MVP is observed in 2-3% of the general population
- Leading cause of MR in the US
- Most individuals with MVP who do not have significant mitral regurgitation, experience a benign clinical course, with no increase in mortality compared to the general population



However….

- There is a small subset of individuals who are at risk for complex ventricular arrhythmias and rarely, SCD
- Evidence from the Framingham sub-study noted a 2.4% prevalence of MVP in individuals with SCD
- High Risk features for arrhythmic MVP:
  - Phenotypic features: bileaflet prolapse, marked leaflet redundancy/thickness, MAD, Female sex, especially young ♀
  - ECG finding: T wave inversions or repolarization abnormalities in the inferior leads
  - CMR: Myocardial fibrosis, particularly in the papillary muscles and inferobasal LV wall
  - Complex or frequent ventricular ectopy
  - History of unexplained syncope





VUMEDI: Arrhythmic MVP: From EP to Imaging By Heart Valve Society 2025 Dr. Le Tourneau

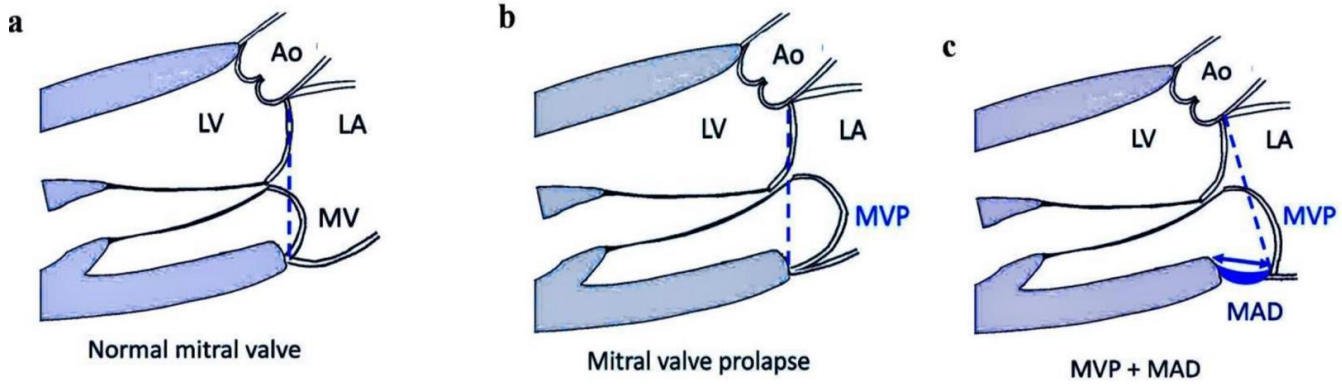
Mitral Annular disjunction

- Structural abnormality:
  - Abnormal separation between MV annulus and LV myocardium
  - Mostly commonly seen in individuals with MVP but can occur independently

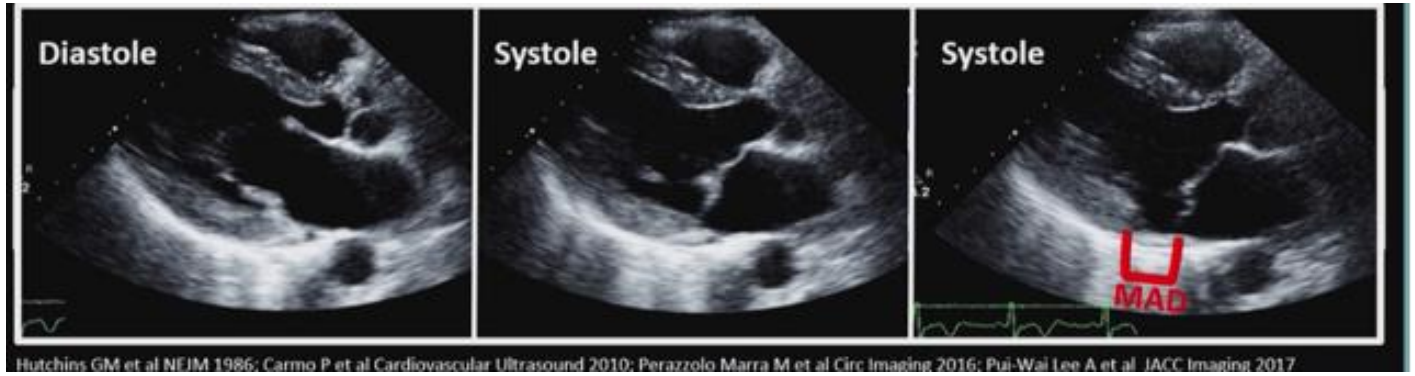
- Epidemiology:
  - Can be present in 15-31% of individuals with MVP
  - Strongly associated with bileaflet prolapse, marked leaflet redundancy and female sex
  - While MVP and MAD often coexist, MAD can also be present in the absence of MVP and still confer arrhythmic risk

- Risk stratification:
  - Echocardiography
  - CMR (assess for myocardial fibrosis)
  - Holter (quantifies ventricular ectopy and arrhythmia burden which is the most robust predictor of mortality)

- Management:
  - Close follow up and individualized risk assessment



Mehrotra et.al. Mitral Annular Disjunction-an underdiagnosed anatomic morphology: review of literature IJSHR Volume 9;Issue 4;Oct-Dec 2024



Hutchins GM et al NEJM 1986; Carmo P et al Cardiovascular Ultrasound 2010; Perazzolo Marra M et al Circ Imaging 2016; Pui-Wai Lee A et al JACC Imaging 2017

Surgical intervention for secondary mitral regurgitation has been shown to improve long-term survival

TRUE

False

Surgical intervention for secondary mitral regurgitation has been shown to improve long-term survival

False

Surgery for secondary mitral regurgitation has not demonstrated a survival benefit and is reserved for select cases after guideline-directed medical therapy fails

CASE 1

65-year-old woman, NS
Applying for 3Million

Medical history disclosed:

- Hypertension
- Heart murmur noted by primary physician for “many years”
- On hydrochlorothiazide 25 mg daily

APS ordered:

- Average 2- year blood pressure: 132/78 mmHg
- BMI: 27
- No history of CAD, CHF, diabetes, or smoking
- Recent echocardiogram (ordered for murmur):
  - Mitral valve prolapse of the posterior leaflet
  - Mild-to-moderate mitral regurgitation (MR)
  - Normal LVEF (60%)
  - No LVH

Risk Assessment:

Favorable:

Hypertension: Controlled
LV Function: Preserved
Asymptomatic

Unfavorable:

Mitral Regurgitation: Mild to moderate

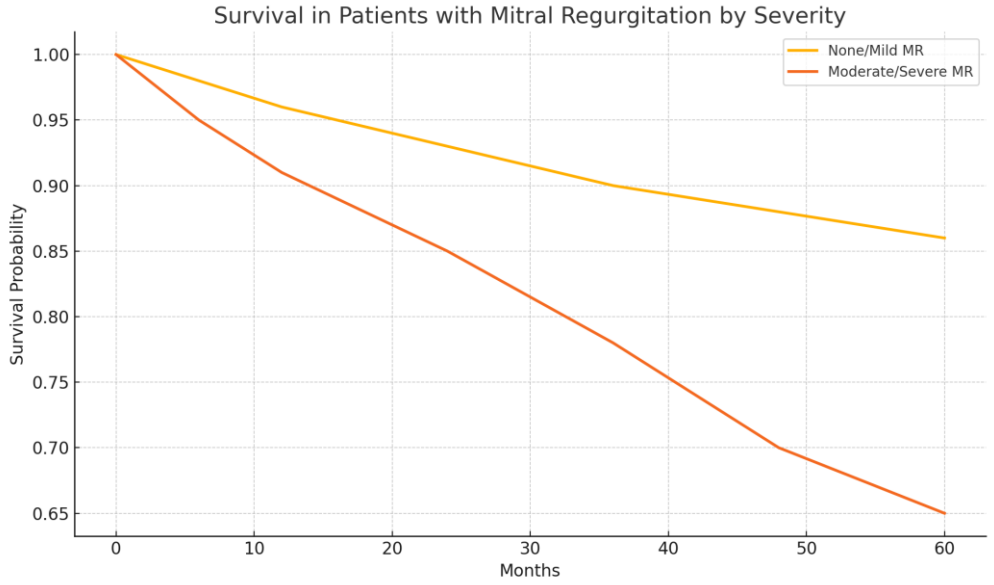
Thoughts? Do we need any additional information?

Is the Valve normal?
LA Size?
Stability?

Factors to Consider in Risk Assessment:

Prognostic Factors in MR associated with increased mortality

- MR Severity
- LVEF ≤ 60% or LVESD ≥40mm
- LAE (LAVI >60mL/m2)
- Presence of heart failure symptoms and worsening functional class
- Pulmonary HTN
- Atrial Fibrillation (new-onset or chronic)
- Flail Leaflet/Arrhythmic MVP
- Older Age/Comorbidities (e.g.: DM, CAD, renal insufficiency)
- Delay in mitral valve intervention after onset of LV dysfunction



References

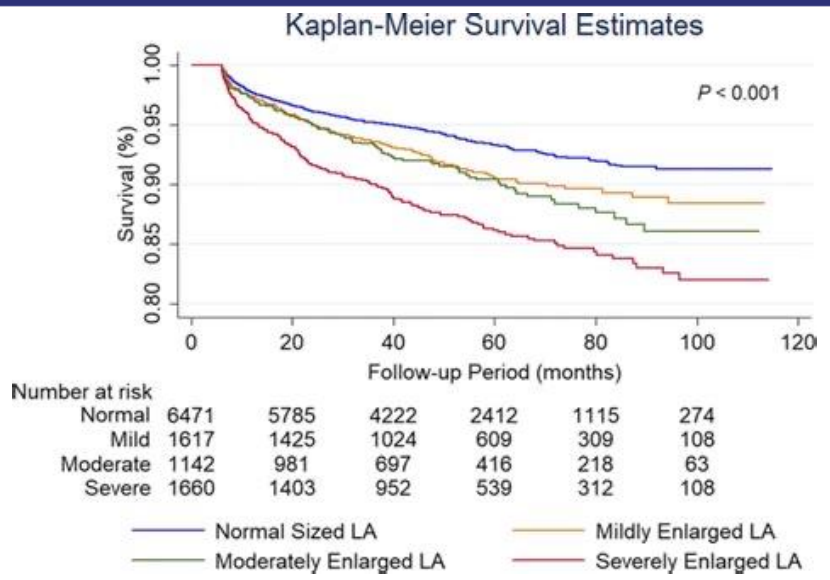
1. Dziadzko V et al. Front Cardiovasc Med. 2021;8:700222.
2. Asgar AW et al. J Am Coll Cardiol. 2015;65(12):1231–48.
3. Badhwar V et al. Ann Thorac Surg. 2015;99(3):831–8.

Applicant submits full echo report:

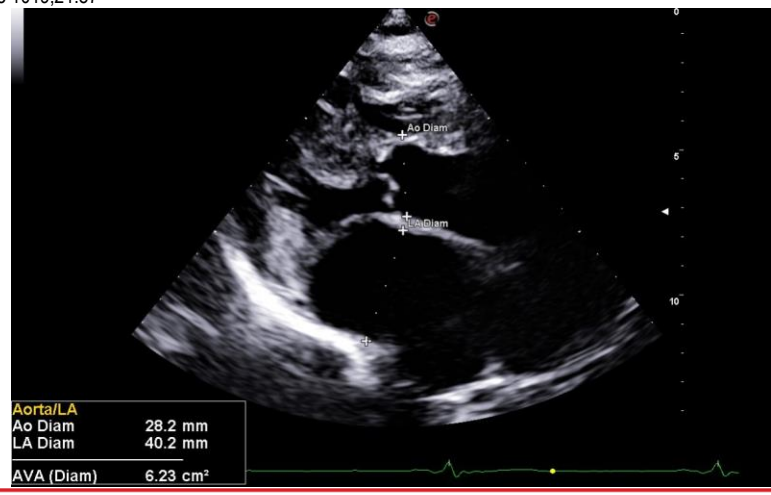
- Normal LV size
- Left atrial (LA) diameter: 4.5 cm (mildly enlarged)
- LA volume index: 40 mL/m²
- No PHTN

LAE in the setting of MR:

- Independently predicts all-cause and cardiac mortality
- Highest risk: LAVI ≥ 60 mL/m2
- MR causes LAE and LAE can worsen MR
- Reflects chronic volume overload from MR and increases risk of atrial arrhythmias, particularly atrial fibrillation (AF)



Khan et al. J Cardiovascular Magnetic Resonance 1019;21:87



Recent lab work (past 6 months) submitted with:

- NT-proBNP = 180 pg/mL

NT-proBNP:

- Inactive cleavage fragment released into the blood stream in equimolar amounts with active BNP from ventricular myocytes in response to increased wall stress, such as that caused by volume overload in mitral regurgitation
- Sensitive biomarker reflecting hemodynamic burden and subclinical myocardial dysfunction associated with chronic regurgitation (even before overt symptoms or echocardiographic evidence of LV dysfunction)
- Higher NT-proBNP levels are independently associated with increased all-cause and cardiovascular mortality even after adjustment for traditional risk factors and comorbidities

Multiple factors aside from heart failure can influence NT-PROBNP levels

TRUE

False

Multiple factors aside from heart failure can influence NT-PROBNP

TRUE

NT-proBNP is an active marker of cardiac stress

- Easily measured in the blood
- Widely used to diagnose and monitor heart failure
- Interpretation must consider factors such as :
  - Age
  - Renal function
  - Pulmonary diseases (e.g.: OSA, PAH)
  - Body composition

NT-PROBNP is a sensitive marker for heart failure but is not specific to it and must be interpreted in context

Which of the follow factors does not falsely elevate NT-PROBNP?

A) Female Sex
B) Renal Dysfunction
C) Older Age
D) Obesity

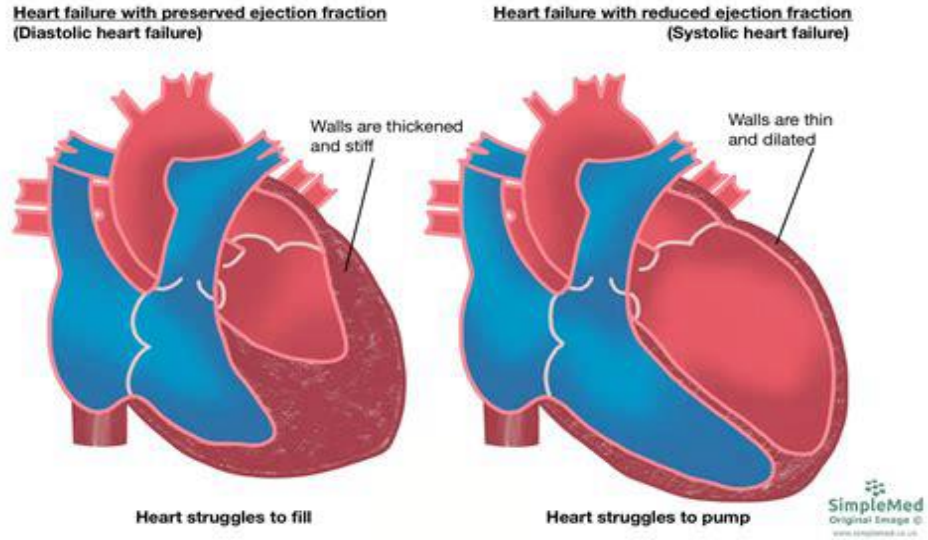
Heart Failure

HRrEF (Systolic Heart Failure)

- Impaired LV contraction
- **EF ≤ 40-50**
- Dilated LV, poor forward flow
- Causes: Ischemic heart disease, DCM
- Symptoms: Dyspnea, fatigues

HFpEF (Diastolic Heart Failure):

- Stiff LV, poor filling
- **EF ≥ 50%**
- Nondilated, may be hypertrophied (leads to elevated filling pressures)
- Causes: HTN, aging
- Symptoms: Dyspnea, fatigue



STAGE	DESCRIPTION
A	At Risk for HF: No symptoms, structural heart disease or cardiac biomarkers of stretch or injury
B	Pre-HF: Structural disorders but no symptoms
C	Structural heart disease with current or previous symptoms of HF
D	Advanced HF: Marked symptoms that interfere with daily life and recurrent hospitalization despite GDT

Revised Risk Assessment:

Favorable:

Hypertension: Controlled
Function: Preserved
??Asymptomatic

Unfavorable:

MR: Mild to moderate
Left Atrial Enlargement
Mildly Elevated NT-proBNP

- A LAVI (left atrial volume index) of 40mL/m2 is a threshold where long-term mortality and cardiac event risk begin to rise in degenerative MR, independent of MR severity (greatest risk LAVI≥60mL/m2)
- Increased NT-PROBNP indicates early cardiac stress with a higher risk for progression to symptomatic heart failure

Holter Monitor Results Provided:
Holter (done for palpitations) reveals:

- Predominant Rhythm: SR
- Paroxysmal atrial fibrillation, total burden ~7% over 48 Hours
- No sustained VT, no pauses >2 sec

Which of the following are established risk factors for the development of atrial fibrillation?

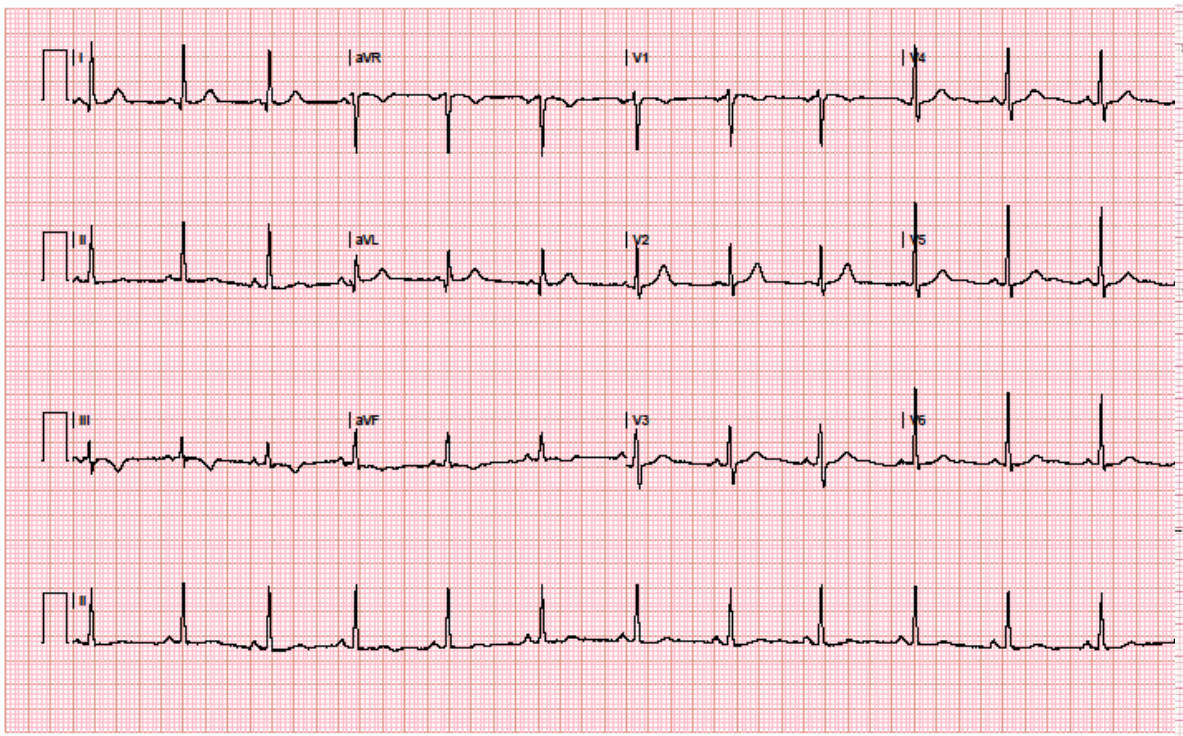
A) Hypertension
B) Obesity
C) Obstructive Sleep Apnea
D) Diabetes Mellitus
E) All of the above

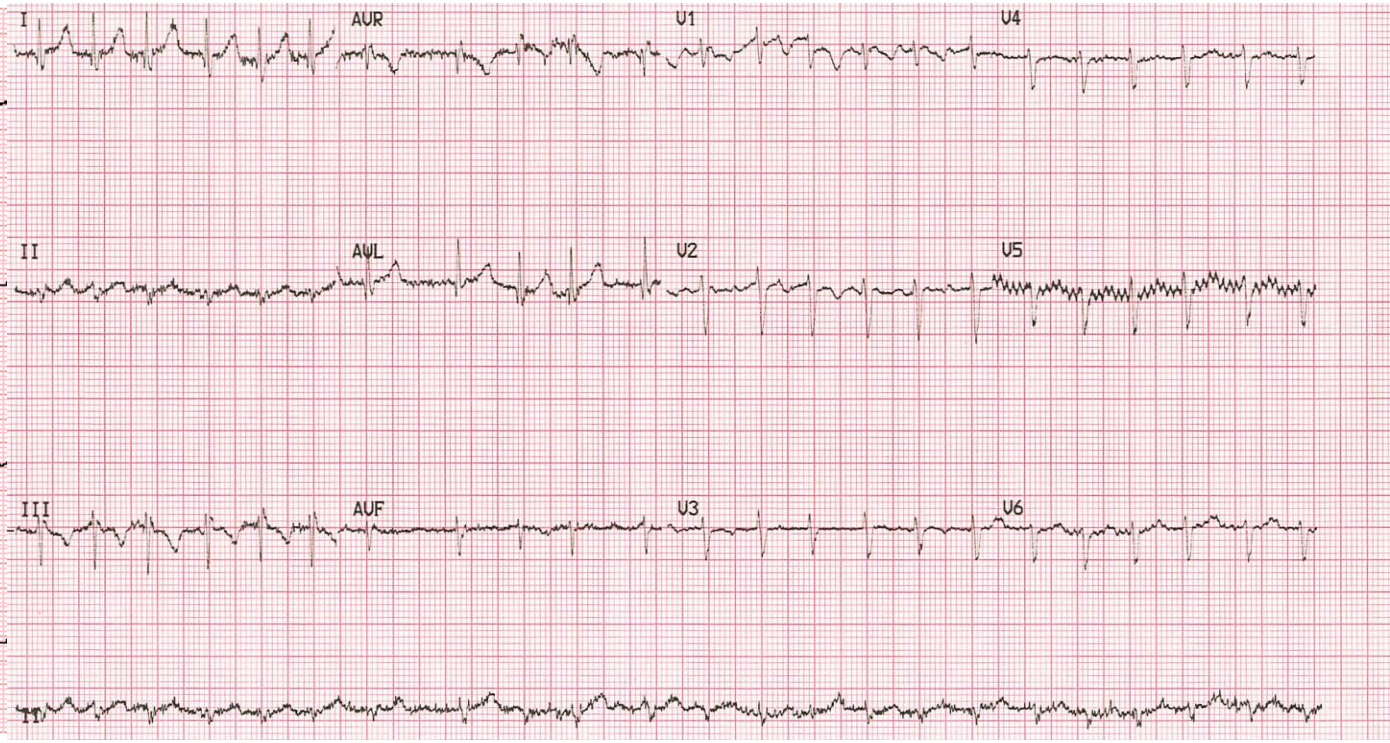
AF risk factors are multifactorial but some of the more common ones include:

- Advanced age
- Congenital Heart Disease
- Underlying heart disease (e.g.: CAD, valvular disease, structural heart disease)
- Increased ETOH consumption
- HTN (systemic or pulmonary)
- OSA
- Endocrine Disorder (e.g.: DM, pheochromocytoma, hyperthyroidism)

Atrial Fibrillation:

- Most common sustained arrhythmia in adults
- Characterized by rapid, disorganized and irregular electrical activation of the atria, resulting in ineffective atrial contraction and irregularly irregular ventricular response
- ECG: No p waves, irregular R-R intervals, +/-: fibrillatory waves





Atrial Fibrillation

- Types:
  - Paroxysmal (<7 days)
  - Persistent (>7 days or requiring intervention)
  - Long-standing persistent (continuous >12 months)
  - Permanent (joint decision is made not to pursue rhythm control)
- Symptoms: asymptomatic (up to 40% of individuals), palpitations, fatigue, dyspnea, dizziness or stroke (may be the first presentation)
- Prevalence of AF increases with age and is strongly linked to underlying CV disease, HTN, obesity, diabetes and sleep apnea
- Associated with ~1.5-2-fold increased risk of death compared to individuals without AF (♀ >♂)
- 2-5-fold increased risk of stroke and heart failure
- Risk of Increased mortality due to both arrhythmia itself and its association with comorbidities such as heart failure, stroke, dementia
- Complications:
  - Stroke, Heart Failure, Tachycardia-induced cardiomyopathy
- Management:
  - Stroke prevention (anticoagulation guided by risk scores)
  - Rate or Rhythm Control
  - Disease management (underlying comorbidities)

The risk of stroke in individuals with atrial fibrillation increases with age

TRUE

False

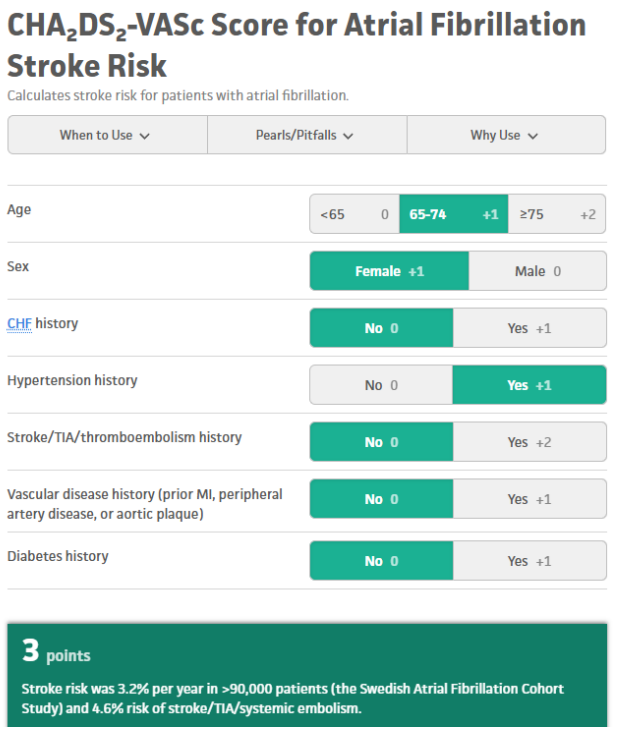
The risk of stroke in individuals with atrial fibrillation increases with age

TRUE

CHA_2DS_2-VASc Score – Stroke Risk Stratification in AF

Risk Factor	Points
Congestive heart failure	1
Hypertension	1
Age ≥75 years	2
Diabetes mellitus	1
Stroke/TIA/thromboembolism	2
Vascular disease (MI, PAD, aortic plaque)	1
Age 65–74 years	1
Sex (female)	1

Source: Lip GYH, et al. Chest. 2010;137(2):263–272. doi:10.1378/chest.09-1584



Anticoagulation generally indicated ≥ 2 in ♂, ≥3 in ♀

Revised Risk Assessment:

Favorable:

Hypertension: Controlled

Function: Preserved

Treatment: Conservative

Unfavorable:

Mitral Regurgitation: Mild to moderate

Left Atrial Enlargement

Elevated NT-proBNP

Symptomatic

Paroxysmal Atrial Fibrillation (CHA2DS2-VASc Score:3)

PAF confers a clinically significant risk of stroke, heart failure, mortality

Key points for risk assessment in MR:

- MR Severity and etiology
- LV size and function
- LA size
- Rhythm disturbances
- Pulmonary HTN
- Symptoms
- Comorbidities

CASE 2

32M
NS
BMI: 25
Applying for 5 Million Term

Part 2:
Indicates recent Cardiology evaluation “all good”

APS Ordered:

- BP average: 132/76mmHg
- ECG: NSR
- Echocardiogram:
  - Normal LVEF
  - Bicuspid Aortic Valve
  - No aortic regurgitation or stenosis
  - Aortic root 3.8cm

Bicuspid Aortic Valve is the one of the most common types of congenital heart defects

TRUE

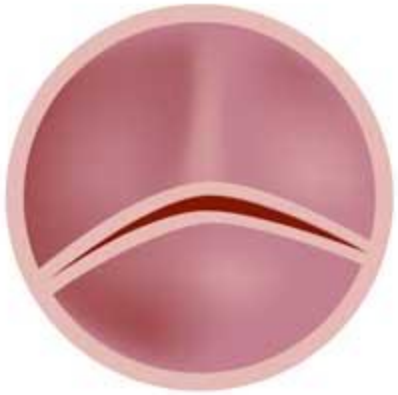
False

Bicuspid Aortic Valve is one of the most common types of congenital heart defects

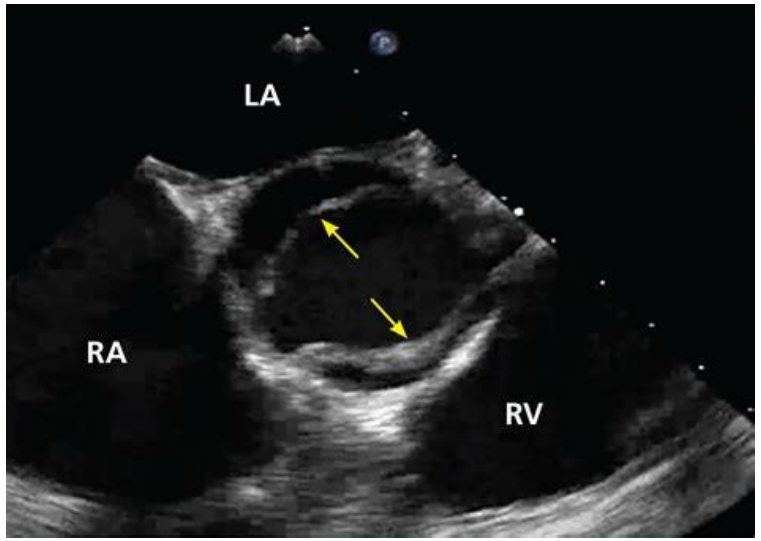
TRUE

- Bicuspid Aortic Valve is one of the most common types of congenital heart defects
- Prevalence ~.5-2% in the general population

Normal tricuspid valve

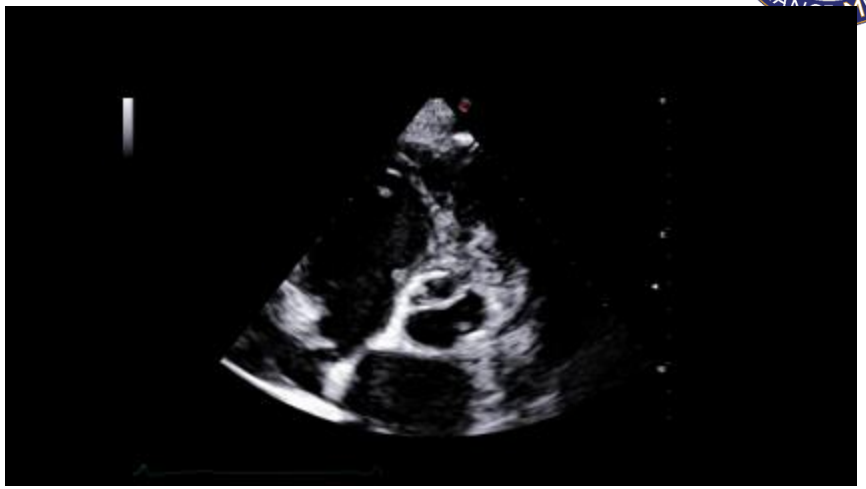


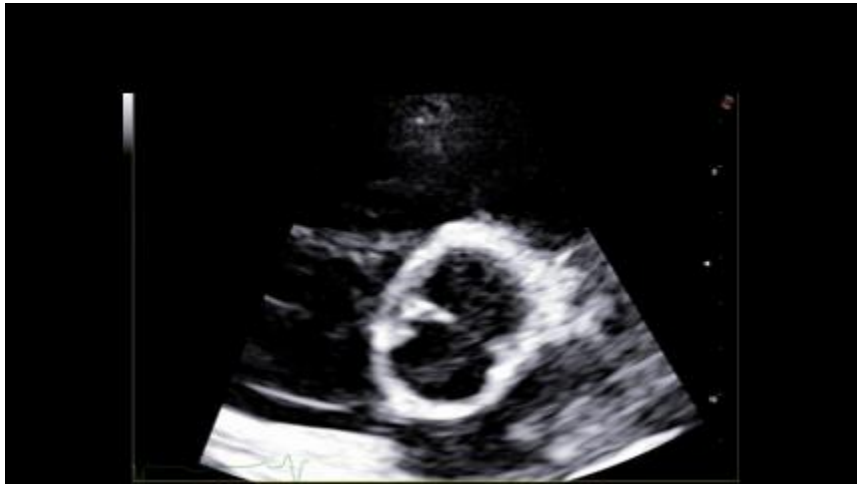
Bicuspid aortic valve



Bicuspid Aortic Valve

- Congenital defect: Aortic valve has 2 cusps (normal =3)
- Affects ~1% of the population, more common in males (2-3:1)
- Higher prevalence in:
  - Coarctation of the aorta (30-50%)
  - Turner Syndrome (30%)
- Can be sporadic or inherited (autosomal dominant with variable penetrance)
- Familial clustering
  - First-degree relatives need to be screened
- Associated risks:
  - Valve dysfunction:
    - Abnormal valve structure leads to altered blood flow and faster degeneration
    - Aortic stenosis (AS): ~70%, common in older adults due to calcification
    - Aortic Regurgitation (AR): ~30%, occurs at a younger age, more in males
  - Infective endocarditis
  - Aortic wall disease (aortopathy):
    - Seen in ~1/3 cases
    - Includes ectasia, aneurysm (≥1.5 x normal), dissection
  - ~50% of individuals with BAV will undergo procedure for AV pathology
  - ~25% of individuals with BAV will undergo procedure for aortopathy





CASE 2

32M
NS
BMI: 25
Applying for 5 Million Term

Part 2:
Indicates recent Cardiology evaluation ”all good”

APS Ordered:

- BP: average: 132/76mmHg
- ECG: NSR
- Echocardiogram:
  - Normal LVEF
  - Bicuspid Aortic Valve
  - No aortic regurgitation or stenosis
  - Aortic root 3.8cm

Risk Assessment:

Favorable:
No aortic regurgitation or stenosis
Normal aortic root
No HTN

Unfavorable:
Young Age

Thoughts? Do we need any additional information?

He did not like his risk assessment
One year later reapplies…
We receive an updated APS due to concerns noted during UW

We receive an updated APS

- ER visit for atypical CP and palpitations after a long flight
- CTPA performed to rule out PE demonstrated no PE but an incidental finding of a dilated ascending aorta
- A dedicated CTA performed:
  - Aortic root 4.0cm
  - Ascending aorta 4.3cm

Risk Assessment:

Favorable:
No aortic regurgitation or stenosis
No HTN

Unfavorable:
Aortic root is ULN (increased from prior measurement)
Dilated ascending aorta
Young Age

Thoughts? Do we need any additional information?

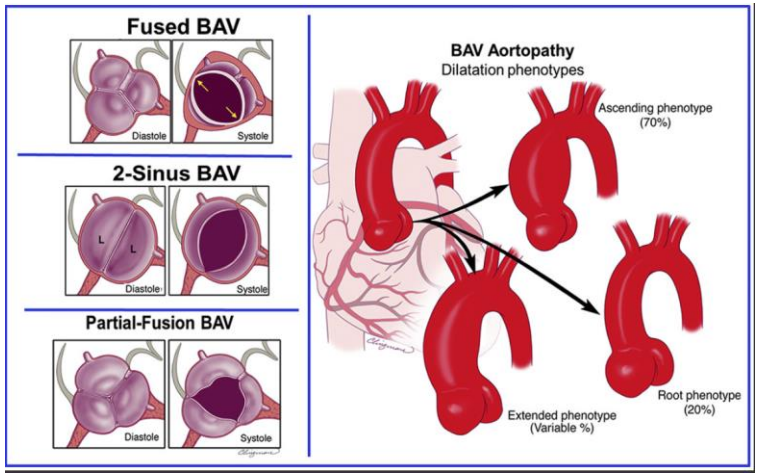
Which of the following statements about bicuspid aortic valve- associated aortopathy is correct?

A) The risk of aortic dissection in individuals with BAV is lower than that of the general population
B) Aortopathy is BAV is exclusively due to turbulent blood flow from valvular stenosis
C) BAV-associated aortopathy only affects the aortic root and never the ascending aorta
D) Aortic dilation in BAV can occur when the valve is functionally normal

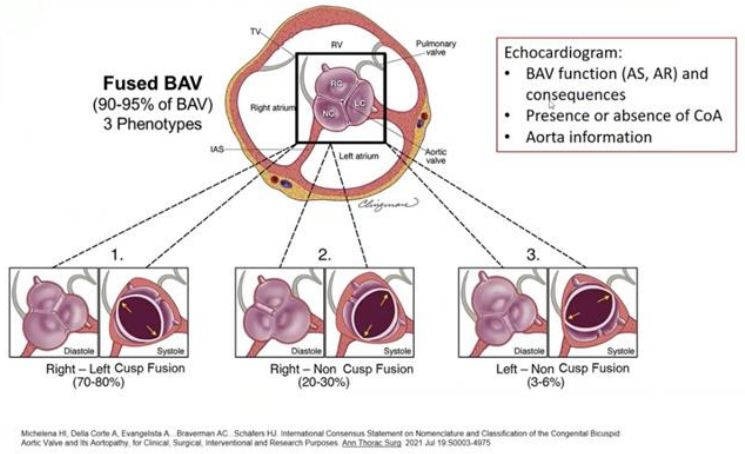
- BAV-associated aortopathy is multifactorial
- Involves both genetic and hemodynamic mechanisms
- Aortic dilation may develop independent of valve dysfunction

AORTOPATHY in BAV

- Structural & Functional changes in the proximal aorta
- Pathogenesis is multifactorial:
  - Genetic predisposition
  - Abnormal hemodynamic forces
- Occurs in 20-40% of cases
- Can develop independently of valve function
- Increased risk of aortic aneurysm and, less commonly, aortic dissection (risk of dissection is higher than the general population but lower than in syndromic connective tissue disorders (e.g.: Marfan, Loeys-Dietz, EDS [type IV]) but rises substantially in the presence of significant aortic enlargement or a family history of dissection
- Two major phenotypes:
  - Ascending
  - Root



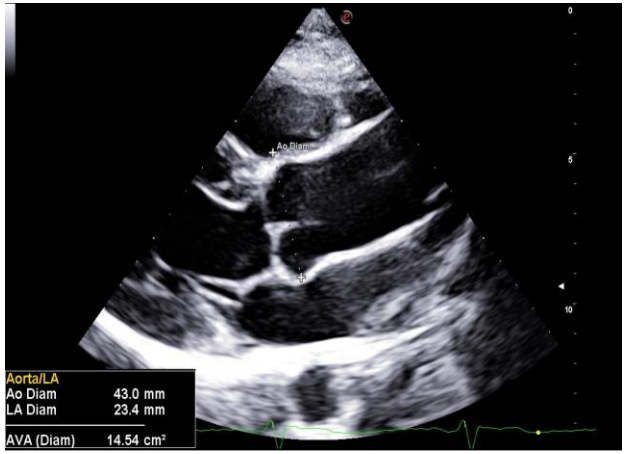
The Journal of Thoracic and Cardiovascular Surgery, Volume 162, Issue 3, e383 - e414

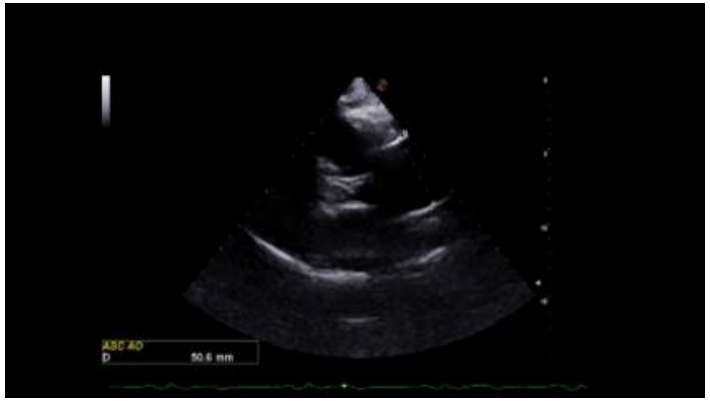


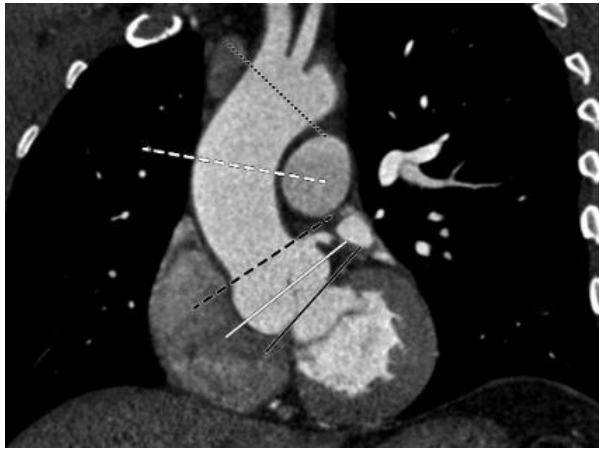
Michelena HI, Della Corte A, Evangelista A , Braverman AC , Schäfers HJ. International Consensus Statement on Nomenclature and Classification of the Congenital Bicuspid Aortic Valve and Its Aortopathy, for Clinical, Surgical, Interventional and Research Purposes. Ann Thorac Surg. 2021 Jul 19:S0003-4975

AORTOPATHY in BAV

- Screening with transthoracic echocardiogram (may be limited for visualizing the entire aorta)
- CT or MRI chest is the gold standard for diagnosis (CMR preferred over CT for serial imaging to avoid ionizing radiation)
- Lifelong serial imaging of the aorta is indicated in BAV with aortic root or ascending aorta ≥ 4.0cm (interval determined by diameter and rate of growth)
  - >4.5cm annual imaging is recommended
- Threshold for surgical intervention:
  - ≥5.5cm regardless of symptoms
  - In those with RF (e.g.: rapid growth (>.5cm/year, family history of aortic dissection, coarctation), earlier intervention 5-5.5cm should be considered







AJR Am J Roentgenol. 2013 Jun;200(6):W581-92. doi: 10.2214/AJR.12.9531.

Long-term survival for most patients with bicuspid aortic valve (BAV) is comparable to the general population, but subgroups with “complex” valvulo-aortopathy have an increased mortality ratio (relative excess mortality ≈2.25), indicating heterogeneity in mortality risk within BAV

TRUE

False

Long-term survival for most patients with bicuspid aortic valve (BAV) is comparable to the general population, but subgroups with “complex” valvulo-aortopathy have an increased mortality ratio (relative excess mortality ≈2.25), indicating heterogeneity in mortality risk within BAV

TRUE

- BAV does not generally confer excess mortality compared to the general population when managed according to current standards
- However, certain subgroups—such as those with complex valvulo-aortopathy (accelerated valve dysfunction and/or aortopathy) or concomitant congenital anomalies—have higher mortality compared to age- and sex-matched controls
- The risk of aortic dissection and aortic-specific mortality is increased in BAV when there is significant aortic dilation or a family history of thoracic aortic disease
- Infective endocarditis and aortic dissection, while rare, are the most lethal complications

Key considerations when assessing risk in BAV

- Severity in valvular dysfunction
- Aortic dilatation/aneurysm and degree of progression
- History of aortic dissection
- History of IE
- Age
- Comorbid conditions
- Associated congenital defects

Thank you for your attention and participation

Questions?