Internal Medicine Board Review: Cardiology Cases

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Medical Content Category	% of Exam
Allergy and Immunology	2%
Cardiovascular Disease	14%
Dermatology	3%
Endocrinology, Diabetes, and Metabolism	9%
Gastroenterology	9%
Geriatric Syndromes	3%
Hematology	6%
Infectious Disease	9%
Nephrology and Urology	6%
Neurology	4%
Obstetrics and Gynecology	3%
Medical Oncology	6%
Ophthalmology	1%
Otolaryngology and Dental Medicine	1%
Psychiatry	4%
Pulmonary Disease	9%
Rheumatology and Orthopedics	9%
Miscellaneous	2%
Total	**100%**

Hypertension	5%
Pericardial Disease	<2%
Ischemic Heart Disease	<2%
Dysrhythmias and conduction defects	<2%
Congenital Heart disease in adults	<2%
Valvular Heart Disease	<2%
Myocardial Disease	<2%
Endocarditis and other CV infections	<2%
Vascular Disease	<2%
Syncope	<2%
Preoperative Consultations	<2%
Lipid Disorders	<2%
Antithrombotics in CV disease	<2%
Miscellaneous	<2%

CASE #1

A 50 year old male presents with progressive exertional dyspnea and chest pressure. He has no significant past medical history.

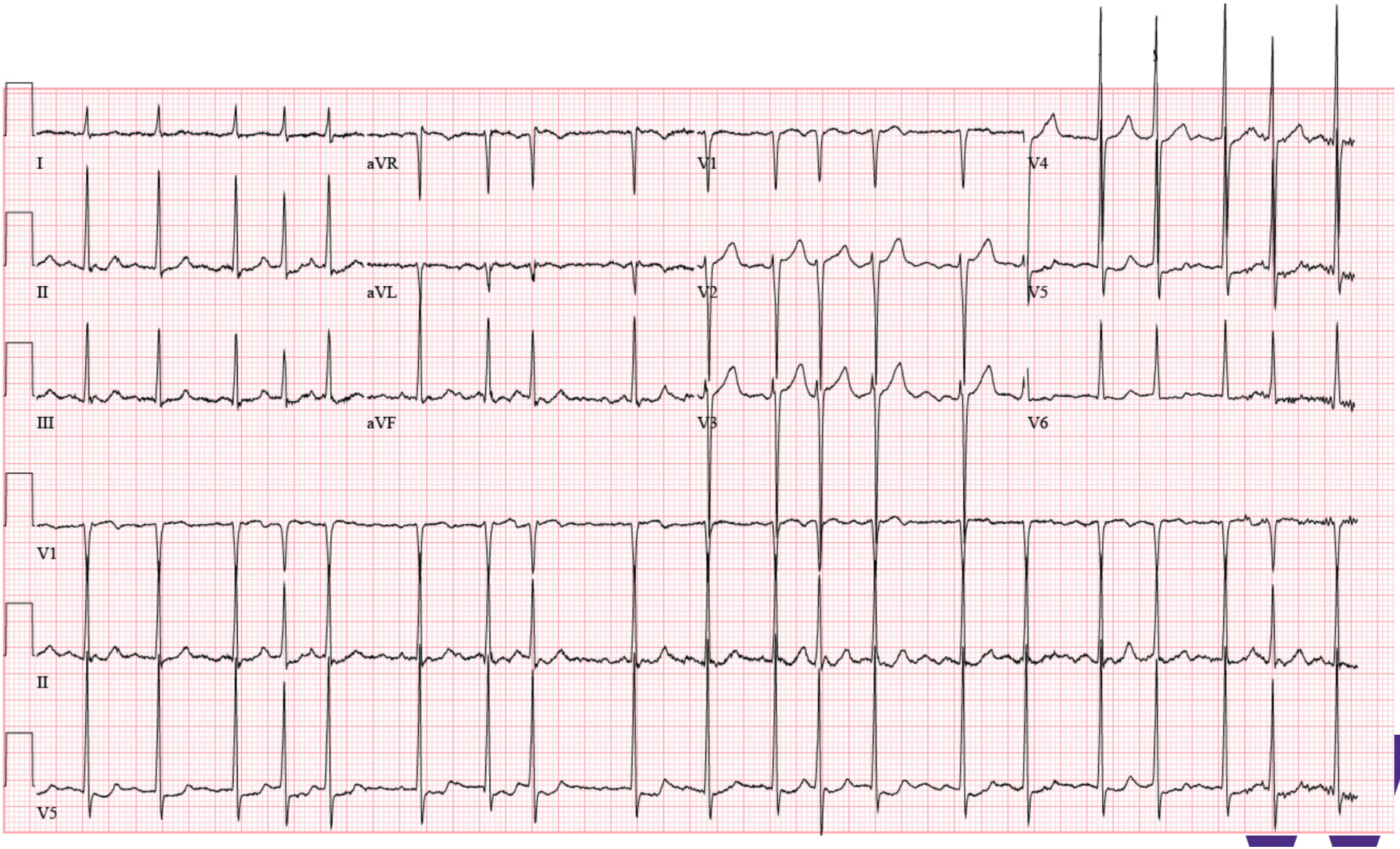
On exam he is noted to have an irregularly irregular rhythm. He also has a 3/6 crescendo-decrescendo systolic murmur at the left lower sternal border. When squatting the murmur decreases in intensity and when standing the murmur increases in intensity. With handgrip the murmur decreases in intensity.

Blood pressure is 126/80 mmHg and heart rate is 90 bpm.

ECG is shown below.

What is the most likely diagnosis in this patient?

A. Bicuspid Aortic Valve with Stenosis
B. Hypertrophic Cardiomyopathy
C. Tachycardia Mediated Cardiomyopathy
D. Pulmonic Stenosis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V5
III
aVF
V3
V6
V1
II
V5

A 50 year old male presents with progressive exertional dyspnea and chest pressure. He has no significant past medical history.

On exam he is noted to have an irregularly irregular rhythm. He also has a 3/6 systolic ejection murmur at the right upper sternal border. When squatting the murmur decreases in intensity and when standing the murmur increases in intensity.

Blood pressures are 126/80 and heart rate is 90 bpm.

ECG is shown below.

What is the most likely diagnosis in this patient?

A. Bicuspid Aortic Valve with Stenosis
B. Hypertrophic Cardiomyopathy
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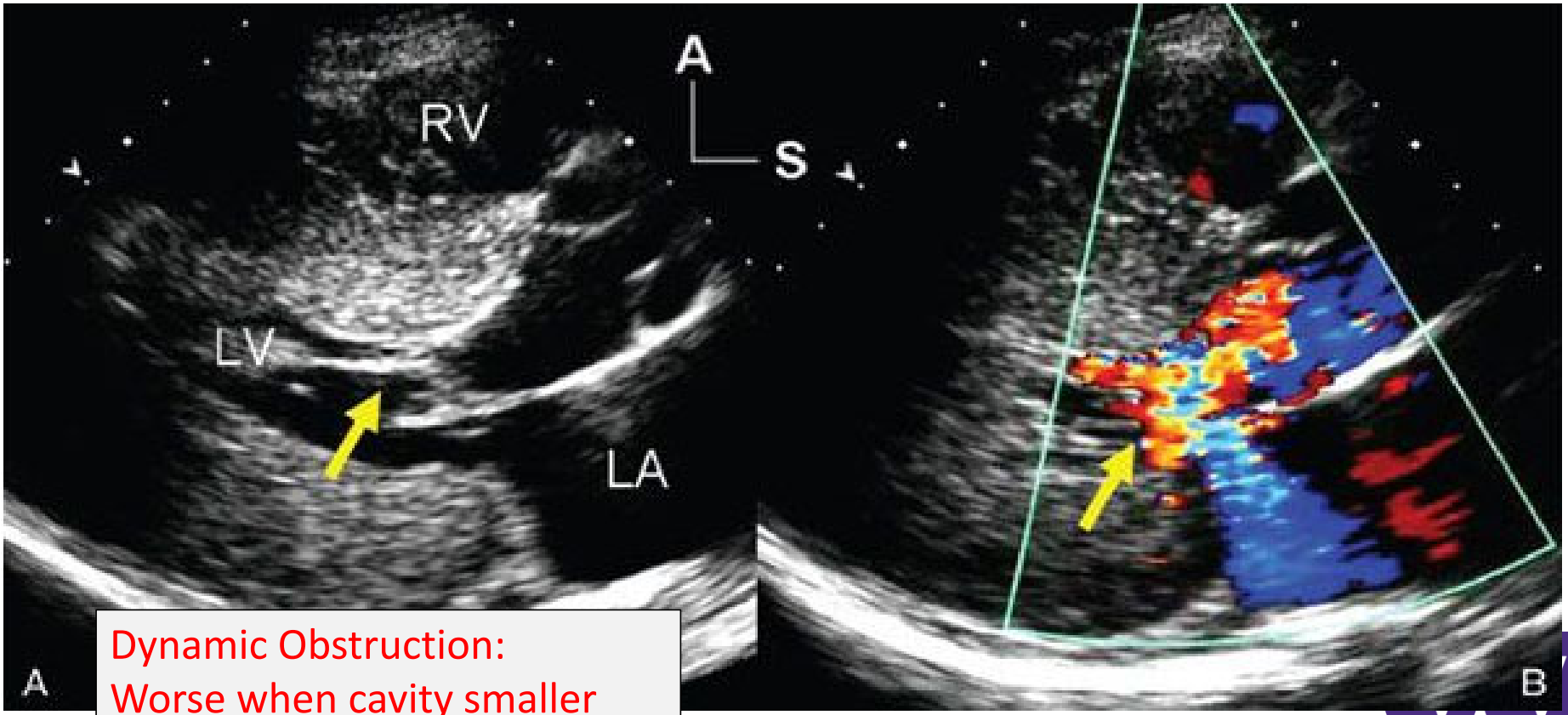
D. Pulmonic Stenosis

The patient has a transthoracic echocardiogram which showed normal left ventricular function with evidence of asymmetric septal hypertrophy. The septum measures 2.5cm. He is also noted to have a left ventricular outflow tract obstruction with a peak gradient of 40mmHg.

What is the next best step in management for this patient?

A. Start him on Metoprolol 25mg BID and Apixaban 5mg BID
B. Start him on Metoprolol 25mg BID
C. Order an Event Monitor
D. A and C
E. B and C

HOCM and LVOT obstruction with SAM



Dynamic Obstruction:
Worse when cavity smaller

HOCM vs Aortic Stenosis Murmur

- **HOCM-** Dynamic Obstruction
- **Aortic Stenosis-** Fixed obstruction

	Squatting	Leg Raise	Standing	Valsalva	Hand Grip
HOCM	Decreases	Decreases	Increases	Increases	Decrease
Aortic Stenosis	Increases	Increases	Decreases	Decreases	Increases

Increase Preload

Decrease Preload

Increase Afterload

Other HOCM Pearls

- Class I indication to anticoagulated **ALL** patients with HCM regardless of CHA2DS2-VASc
- **Risk Factors for SCD**
  - Septum >3cm
  - Personal hx of unexplained syncope
  - Family hx of SCD
  - LGE on cMRI
  - Significant NSVT on **Event Monitor**
  - Abnormal BP response to stress
- **Medical Treatment**
  - Beta blockers
  - Non dihydropyridine CCB
  - Disopyramide
  - Avoid diuretics and afterload reducing agents
- **Genetic Testing indicated for family screening**

CASE #2

At 67 year old male presented with sudden onset shortness of breath. He also reports that about 1 week ago he had an episode of substernal chest pressure with associated nausea and diaphoresis. He did not seek medication attention at that time. He continued to also have exertional chest pressure since that time and then developed the acute onset shortness of breath today.

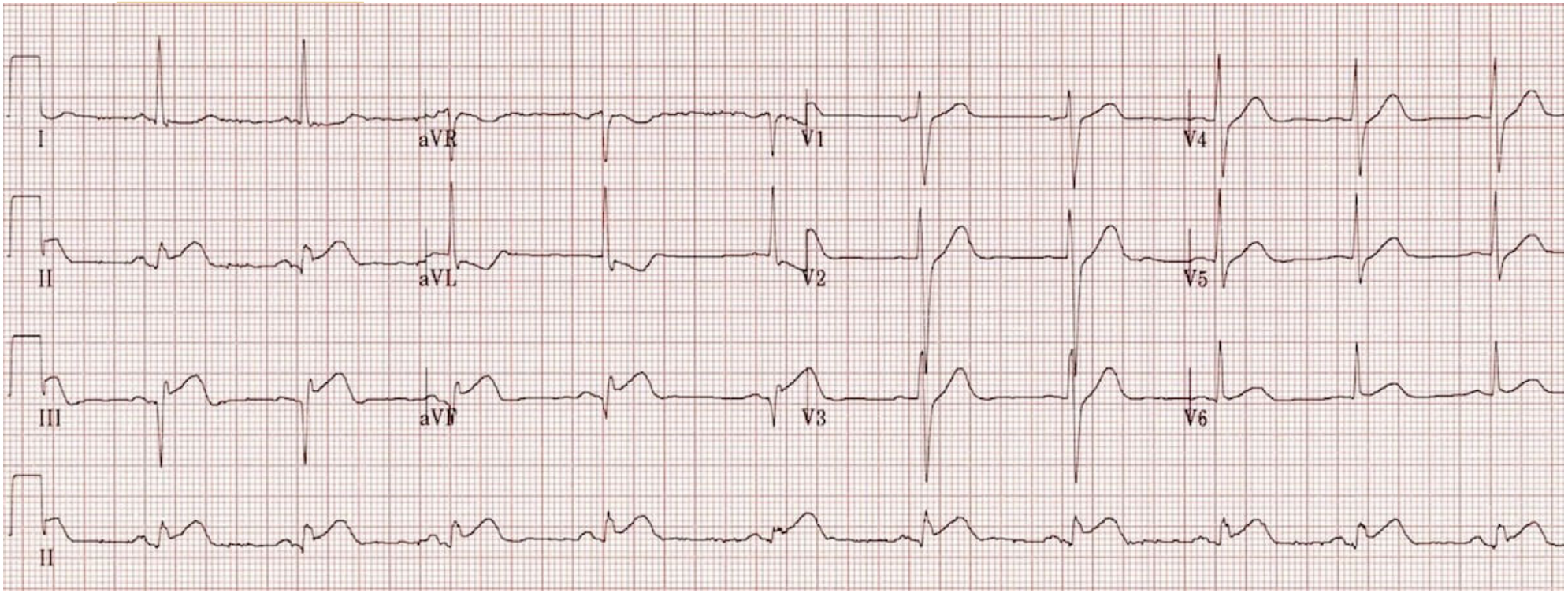
He has a past medical history of tobacco use, hypertension, hyperlipidemia and diabetes.

On physical examination he is noted to be in respiratory distress. Blood pressure is 90/55 mmHg, heart rate is 110 bpm, O2 sat is 90% on 3L. Physical examination reveals elevated JVD and an early systolic murmur at the apex as well as diffuse crackles on lung exam. Chest X ray reveals pulmonary edema.

ECG is shown below.

What is the most likely diagnosis?

A. Acute STEMI
B. Mitral regurgitation
C. Ventricular septal defect
D. Aortic stenosis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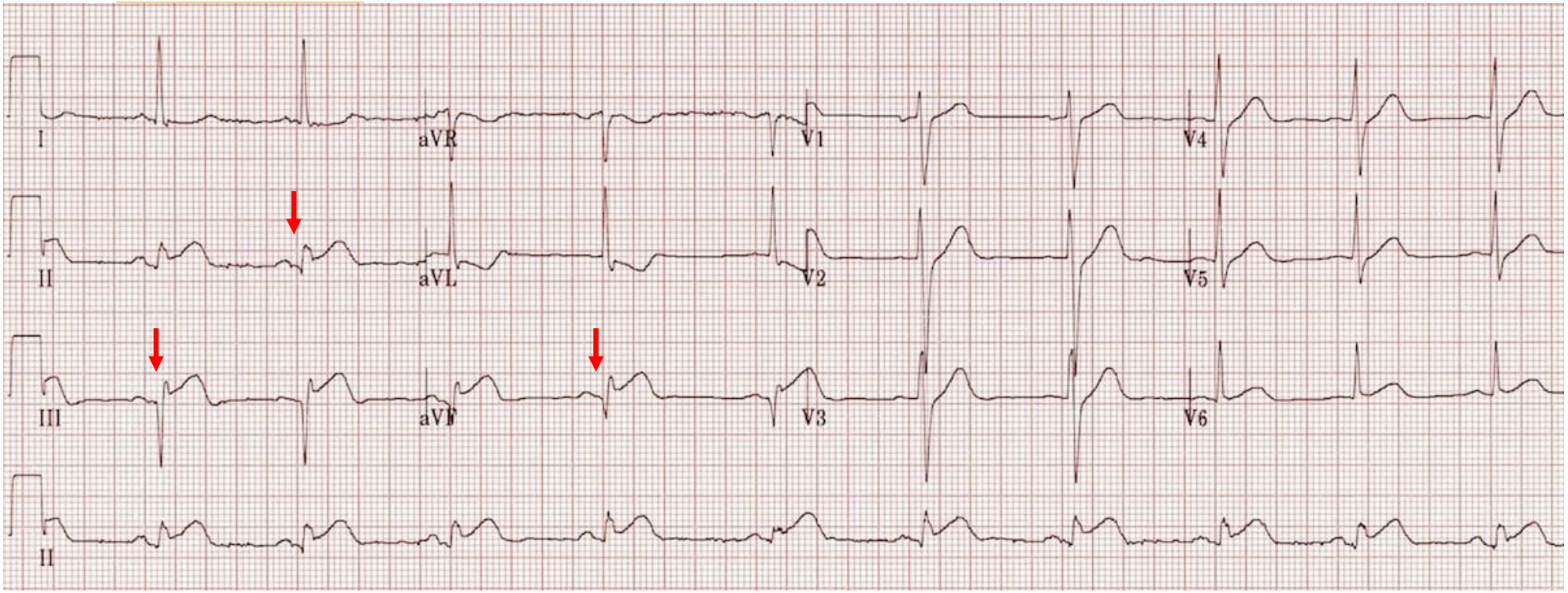


Inferior ST Elevation with inferior Q waves

Mechanical Complications of an MI

- Subacute STEMI with delayed presentation
- Mechanical complications
  - Ischemic VSD
  - Free wall rupture
  - Papillary muscle rupture
- Occur within in the 1st week of an MI, usually on those with late presentation or no revascularization

Papillary Muscle Rupture

- **Anterolateral Papillary Muscle**
  - Blood supply from **BOTH** the LAD and LCx
- **Posteromedial Papillary Muscle**
  - Blood supply **ONLY** from LCx or RCA (depending on dominance)
  - More prone to rupture
- Present with acute pulmonary edema from acute mitral regurgitation, cardiogenic shock from low output
- Murmur is early systolic and not holosystolic (chronic MR) as acute MR results in rapid rise in left atrial pressure

CASE #3

A 72 year old male with a past medical history of treated pulmonary tuberculosis presents with progressive dyspnea on exertion, lower extremity edema and abdominal distention.

On physical exam, blood pressure is 110/80 mmHg and heart rate is 90 bpm. He has significant 3+ pitting edema to the thighs. JVD is elevated to the mandible and increases with inspiration and lungs are clear to auscultation. The liver is enlarged and there is noted ascites on exam.

Echocardiogram reveals normal LVEF with mild concentric hypertrophy, normal RVSP and severely elevated RA pressures with a dilated and non collapsible IVC. There is no pericardial effusion. There is also a slight septal shift noted with inspiration.

What is the diagnosis?

A. Cardiac amyloidosis
B. Restrictive cardiomyopathy
C. Constrictive Pericarditis
D. Pulmonary Hypertension

Kussmaul Sign

- **Kussmaul's sign**
  - Paradoxical increase in JVP with inspiration (normally decreases) as the RV pressures are elevated and cause the increase venous return to cause rise in JVD

  - https://www.youtube.com/watch?v=PmmN1vrsIRk

Constrictive Pericarditis

- **Risk Factors for constrictive pericarditis**
  - Prior open heart surgery
  - Prior pericardial effusion
  - Tuberculosis
  - Chest radiation
- **Hemodynamic Impact**
  - Equalization of all heart chambers
  - Interventricular interdependence or discordance--- septal shift on ECHO
- **Sign of constrictive pericarditis**
  - Right sided congestion with LE edema, ascites due to high RA pressures

CASE #4

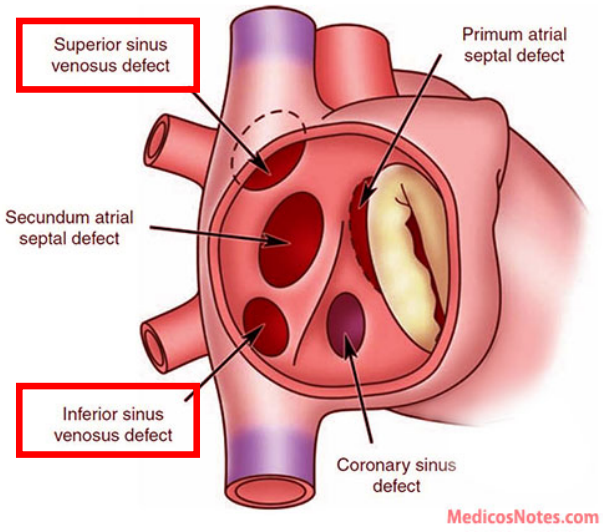
A 41 year old female presents with progressive dyspnea on exertion for the last several months. She has been told since childhood that she had heart murmurs but never sought further care.

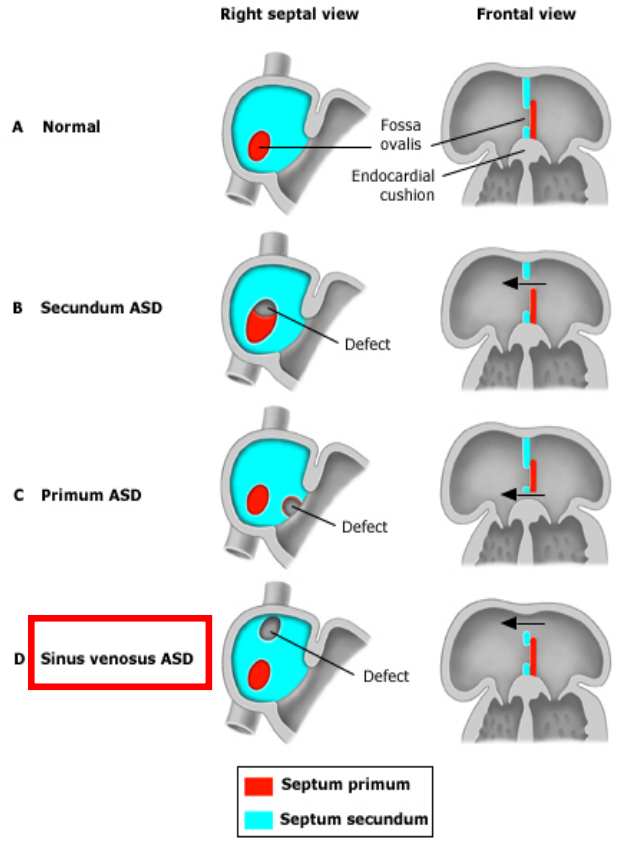
On physical exam she is noted to have elevated JVD. There is a parasternal heave at the left sternal border. There is a noted persistent fixed splitting of S2 and a grade 2/6 systolic murmur heard at the second left intercostal space as well as a different grade 3/6 holosystolic murmur at the apex.

What is the most likely diagnosis?

A. Ostium Secundum ASD
B. Sinus Venosus ASD
C. Ostium Primum ASD
D. Mitral Prolapse

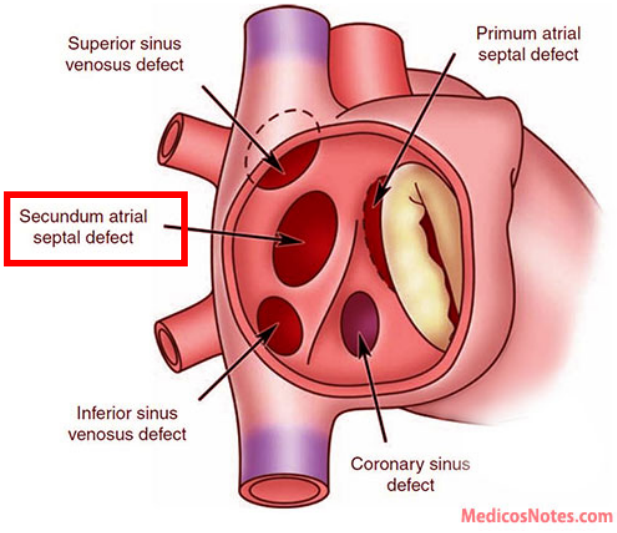
Types of ASD

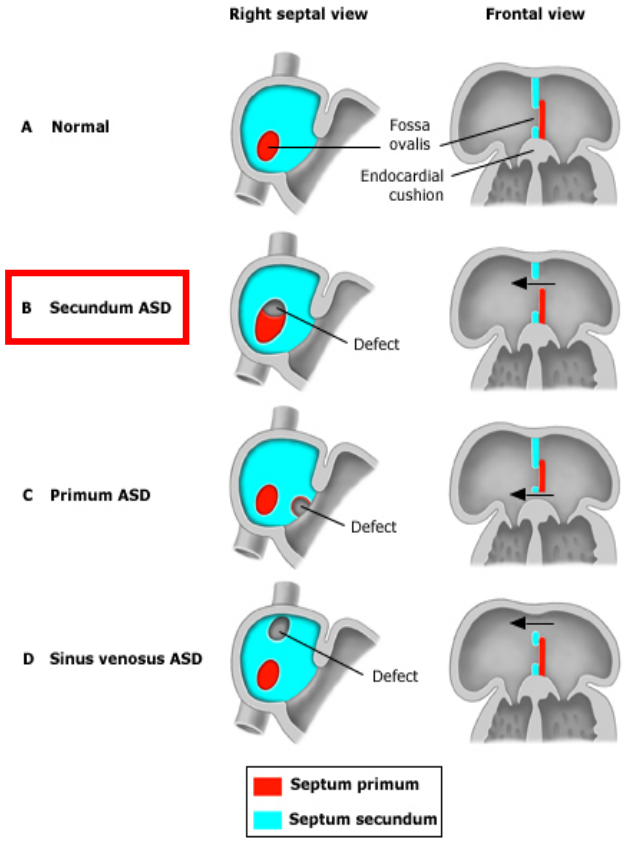




> **Sinus Venosus**
- Junction of RA and IVC or SVC
- Associated with anomalous pulmonary vein return

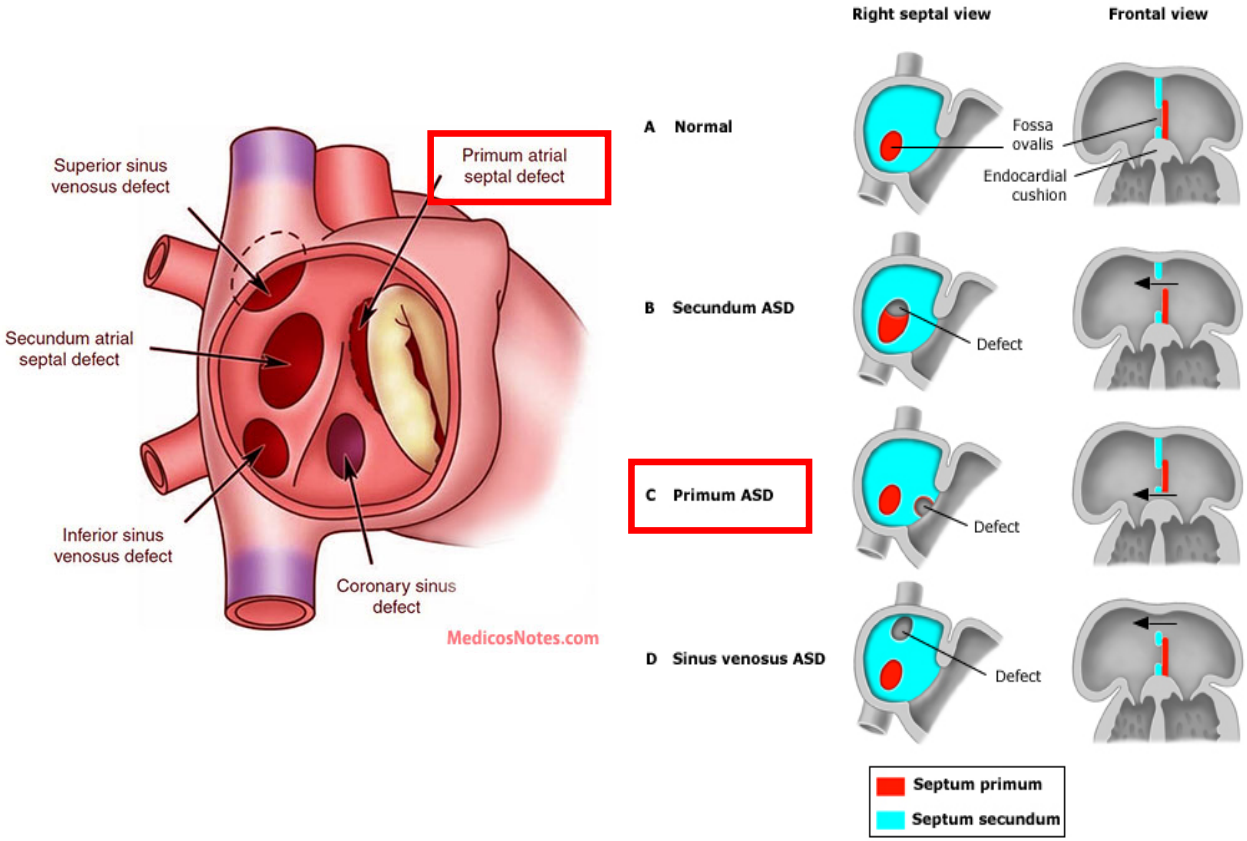
Types of ASD





> **Ostium Secundum**
- Centrally located
- Amenable to percutaneous closures

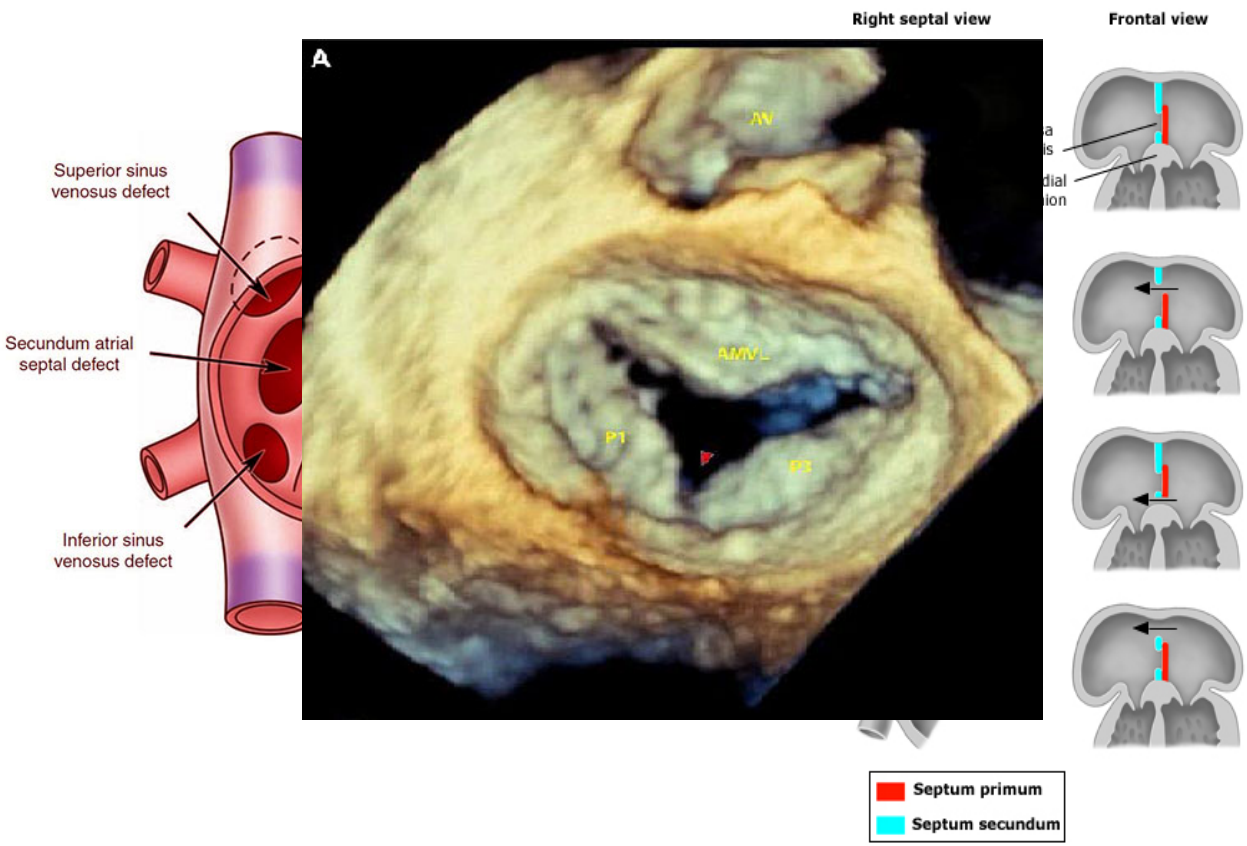
Types of ASD



> Ostium Primum

- Lower in the septum with involvement of the AV valves
- Associated with **cleft mitral valve**

Types of ASD



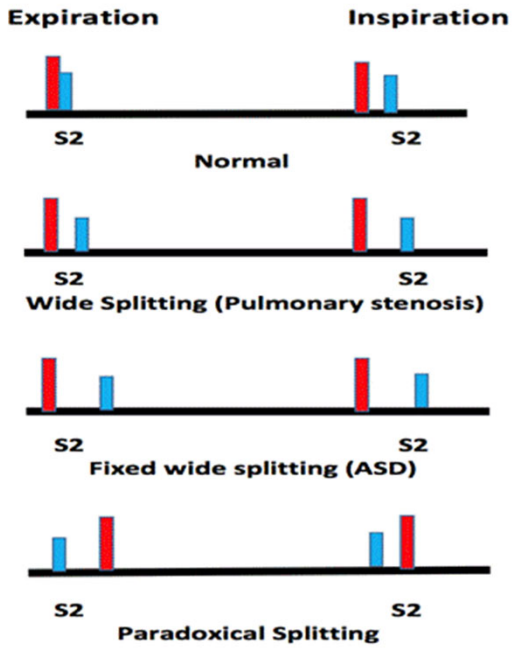
- **Sinus Venosus**
  - Junction of RA and IVC or SVC
  - Associated with anomalous pulmonary vein return
- **Secundum**
  - Centrally located
  - Amenable to percutaneous closures
- **Primum**
  - Lower in the septum with involvement of the AV valves
  - Associated with **cleft mitral valve**

Hemodynamic Impact of ASD vs VSD

- **ASD**
  - Left to Right Shunt causing RV VOLUME overload
  - RV dilation
    - Parasternal heave
    - Right sided heart failure
  - Shunt can reverse at end stage causing hypoxia and Eisenmenger's syndrome
- **VSD**
  - Left to Right shunt in systole causing PRESSURE overload that goes straight to the pulmonary circuit
  - Left sided dilation

Murmurs

- **Grade 2/6 systolic murmur heard at the second left intercostal space**
  - ASD causes increase flow and volume to the RV creating a flow murmur through the pulmonary valve
- **3/6 holosystolic murmur at the apex**
  - Cleft mitral valve with regurgitation
- **Fixed Split S2**



CASE #5

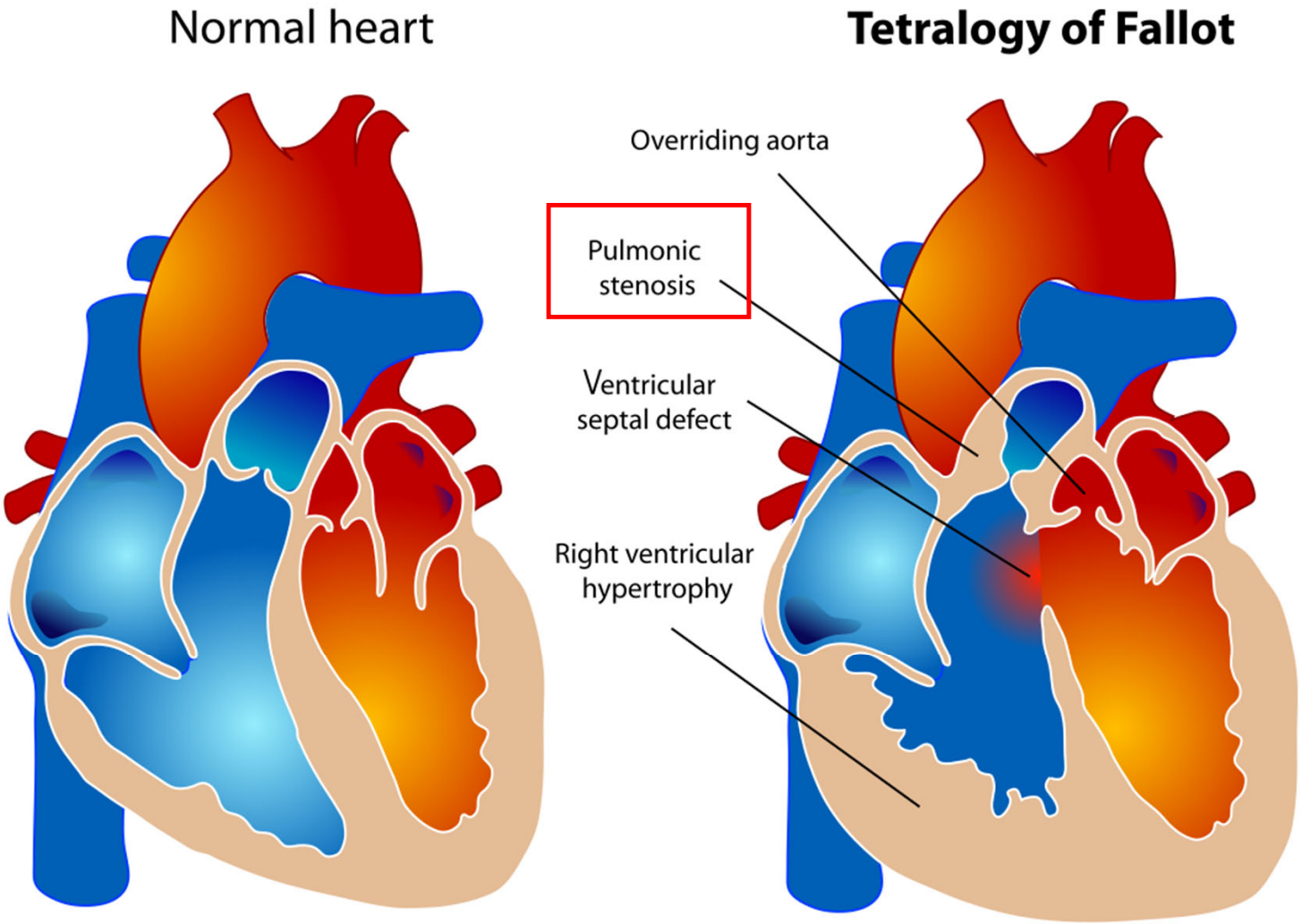
At 35 year old male with a past medical history of tetralogy of Fallot with prior surgical repair. He is unclear of the type of repair and has not followed with a cardiologist for several years.

He is presenting with progressive decreased exercise capacity.

On physical exam he has elevated JVD with a parasternal heave at the left sternal border. S1 is normal and S2 is single with a soft early systolic murmur at the second left intercostal space. There is also a grade 3/6 diastolic decrescendo murmur at the left sternal border that increases with inspiration.

What is the most likely diagnosis?

A. Mitral stenosis
B. Aortic regurgitation
C. Residual ventricular septal defect
D. Pulmonary regurgitation


Normal heart
Tetralogy of Fallot
Overriding aorta
Pulmonic stenosis
Ventricular septal defect
Right ventricular hypertrophy

Treatment for Pulmonary Stenosis

- Resection of subpulmonic stenosis
- Valve replacement or Repair
- Conduit with valve
- Increased risk for pulmonary regurgitation in the long term

Pulmonary Regurgitation Hemodynamics and Murmur

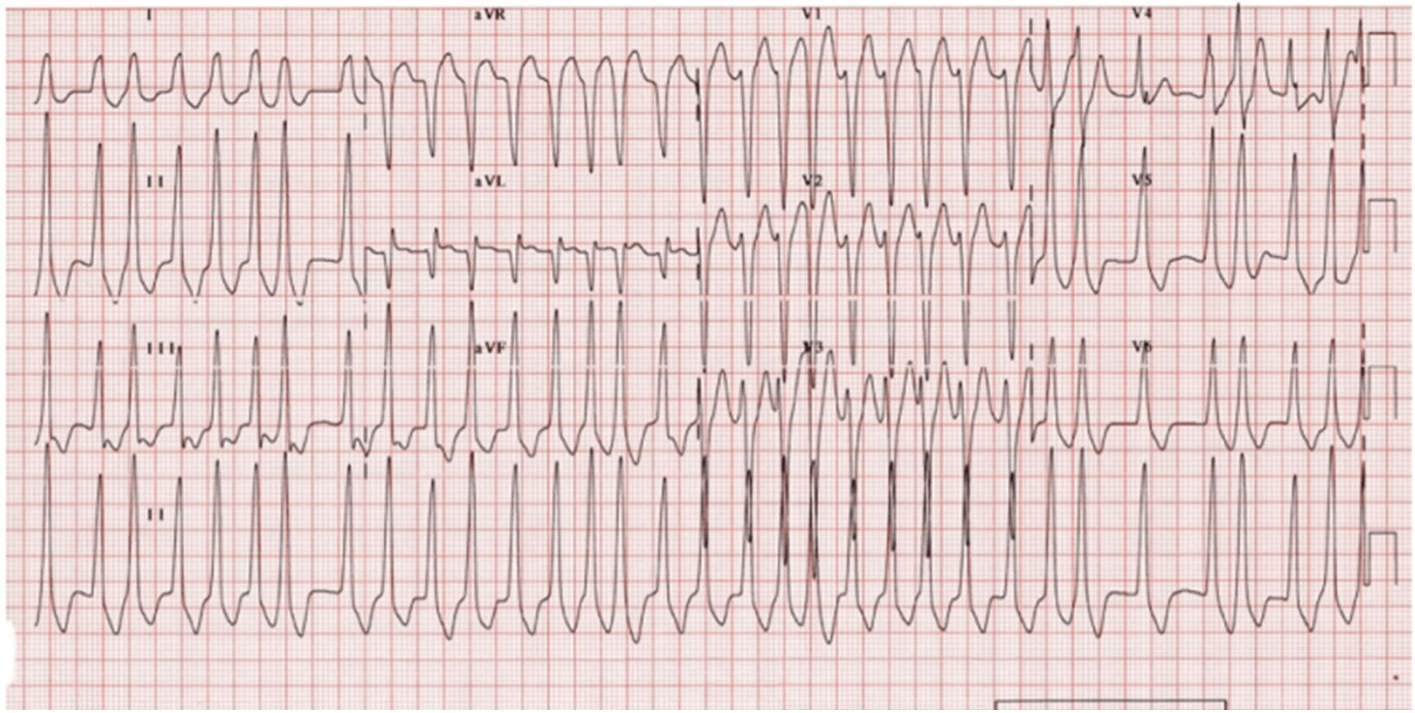
- **Causes a VOLUME load to the RV**
  - RV dilation (already RVH from ToF pathology)
  - Signs of RV dysfunction
  - Elevated RA pressures, JVD
- **3/6 diastolic decrescendo murmur at the left sternal border that increases with inspiration**
  - Pulmonary regurgitation in diastole
  - Increase negative intrathoracic pressure with inspiration, increase regurgitation
- **Soft early systolic murmur at the second left intercostal space**
  - Pulmonary flow murmur

CASE #6

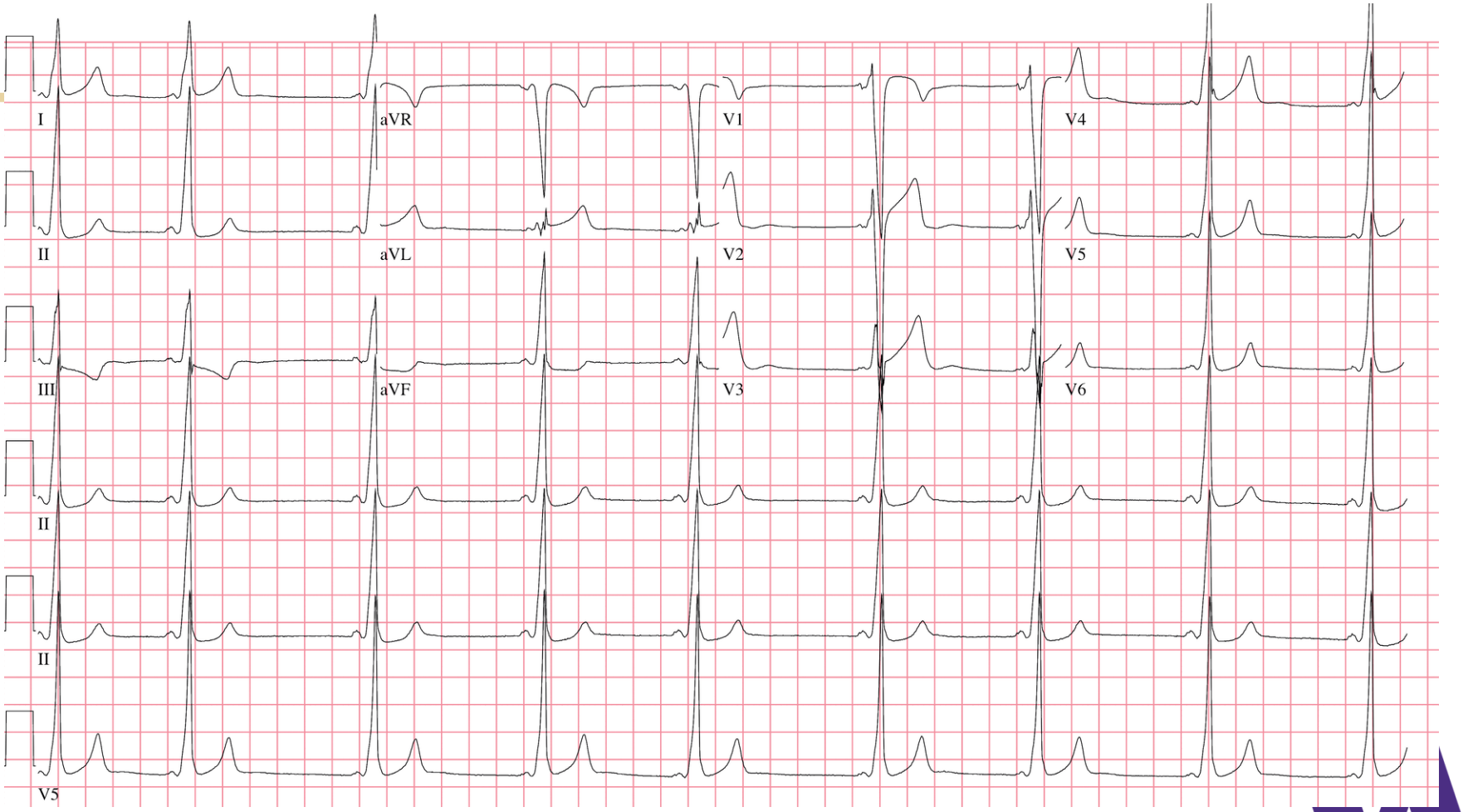
At 32 year old female presents with progressive palpitations and one episode of syncope last week. Today she again has had very persistent palpitations and associated dizziness.

Her vitals are notable for a heart rate of 151 bpm and a blood pressure of 110/75 mmHg. Physical exam reveals an irregularly irregular rhythm.

Current ECG is show below



Prior ECG is shown here.



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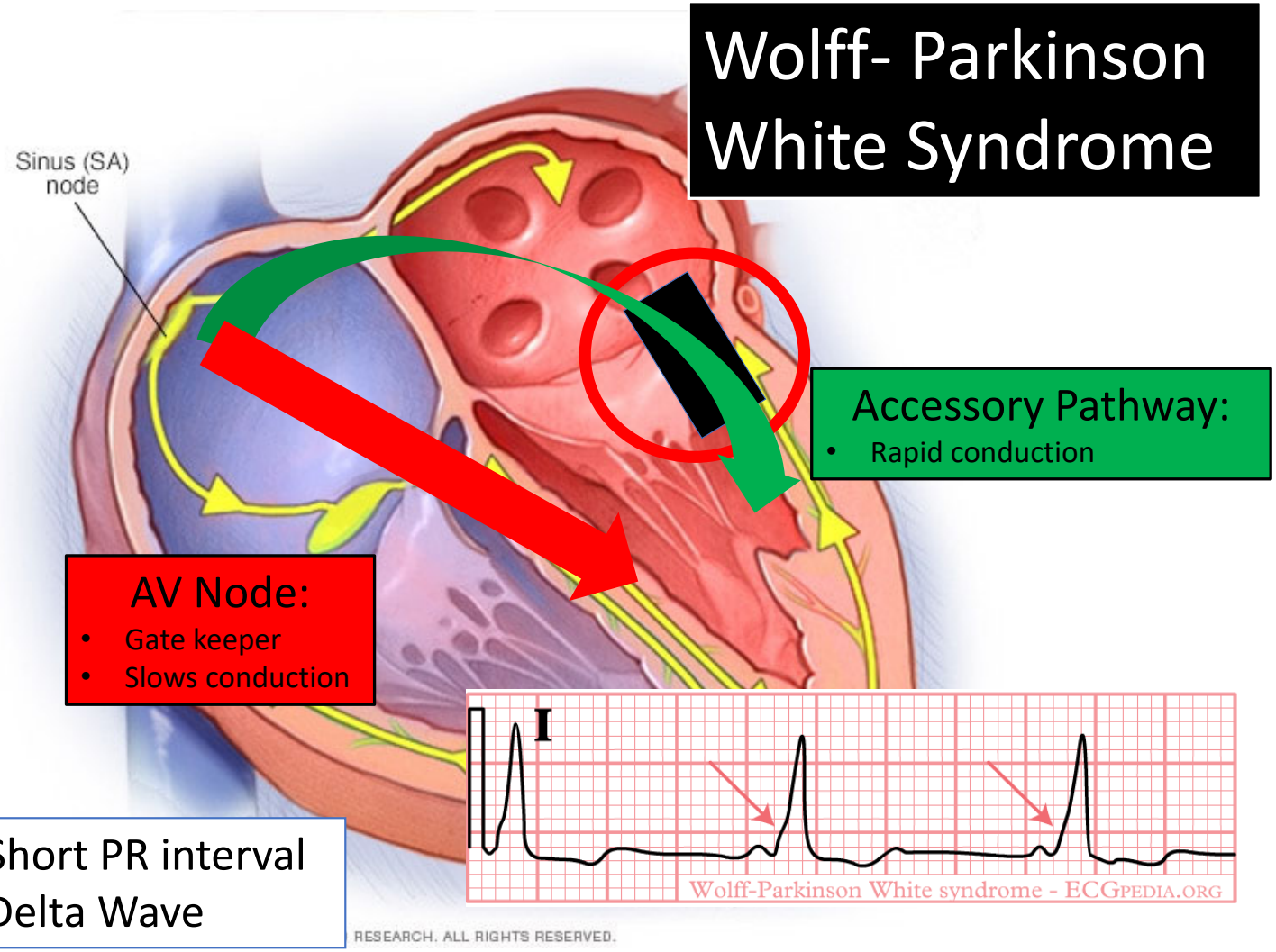
What is the best medication to administer?

A. IV Adenosine
B. IV Metoprolol
C. IV Procainamide
D. IV Diltiazem

Wolff- Parkinson White Syndrome



- Short PR interval
- Delta Wave

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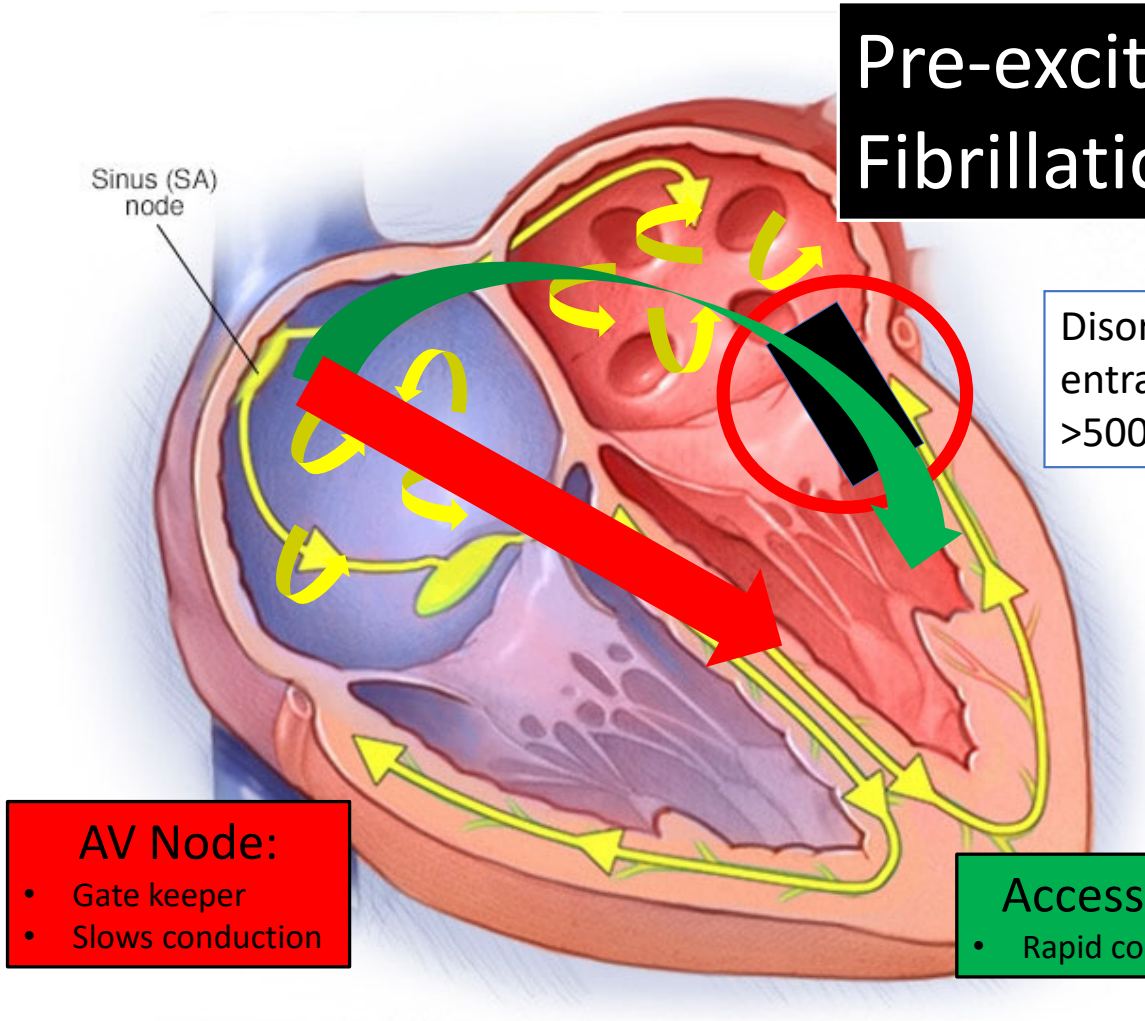
Pre-excited Atrial Fibrillation



Disorganized micro-entrant atrial activity >500 bpm

AV Node:
- Gate keeper
- Slows conduction

Accessory Pathway:
- Rapid conduction

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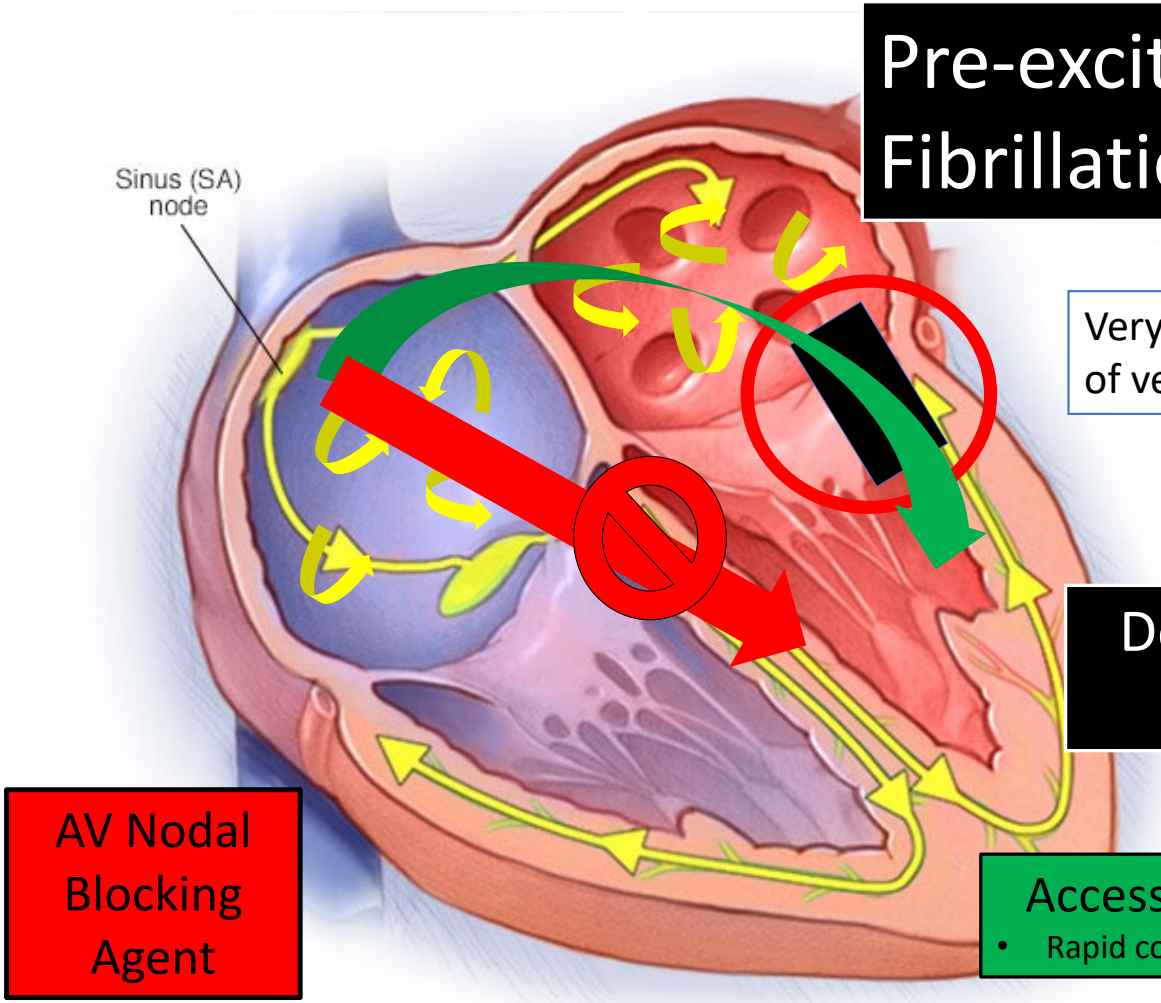

Very rapid activation of ventricle

Degenerates into VF

AV Nodal Blocking Agent

Accessory Pathway:

- Rapid conduction

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Her vitals are notable for a heart rate of 151 bpm and a blood pressure of 110/75. Physical exam reveals an irregularly irregular rhythm.

What is the best medication to administer?

~~A. Adenosine 6mg IV~~

~~B. IV Metoprolol 5mg~~

C. IV Procainamide

~~D. IV Diltiazem 10mg~~

Procainamide

- **Class IA antiarryhtmic**
  - **Sodium channel blocker**
  - **Prolongs repolarization**

CASE #7

A 45 year old male presents with fevers, chills and progressive dyspnea. He has not significant past medical history. However, he reports use of IV heroine several times a week.

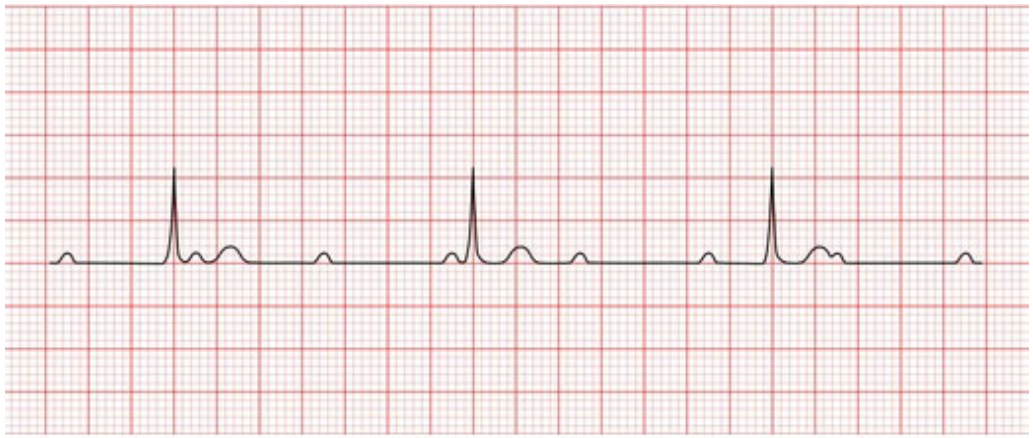
His vitals are notable for a temperature of 101.2 °F, blood pressure 100/45 mmHg and heart rate of 45 bpm. Physical exam is notable for a short early diastolic decrescendo murmur heard best at the 3rd left intercostal space. There is also a rumbling diastolic murmur heart best at the apex near the fifth intercostal space.

He has an elevate white blood cell count and blood cultures are positive for methicillin resistant Staph aureus.

Telemetry strip is shown below.

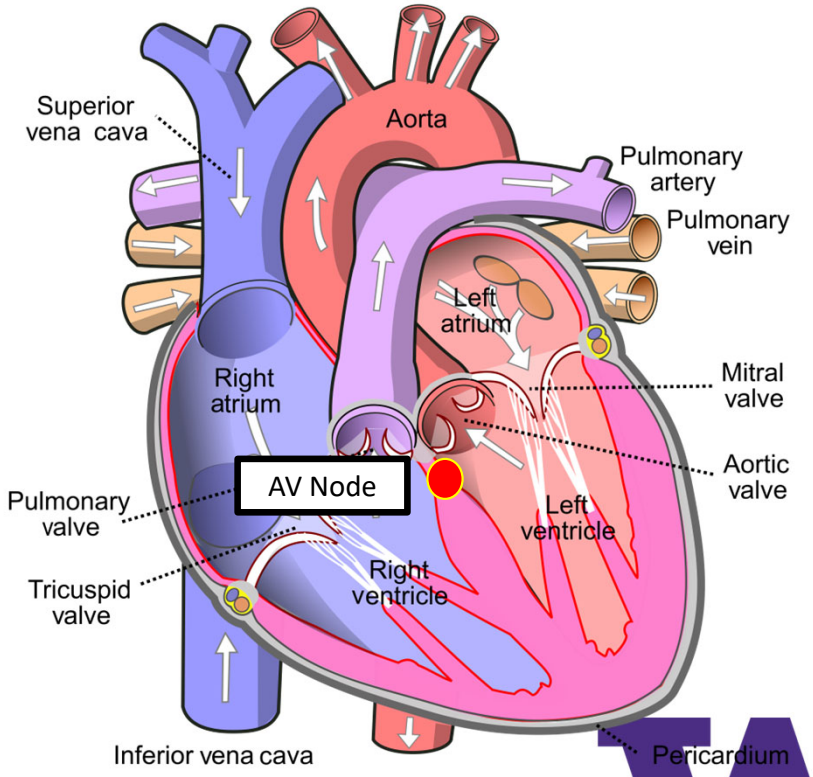
What is the most likely valvular pathology?

A. Rheumatic mitral stenosis with endocarditis
B. Endocarditis with mitral regurgitation
C. Endocarditis with aortic regurgitation
D. Endocarditis with tricuspid regurgitation



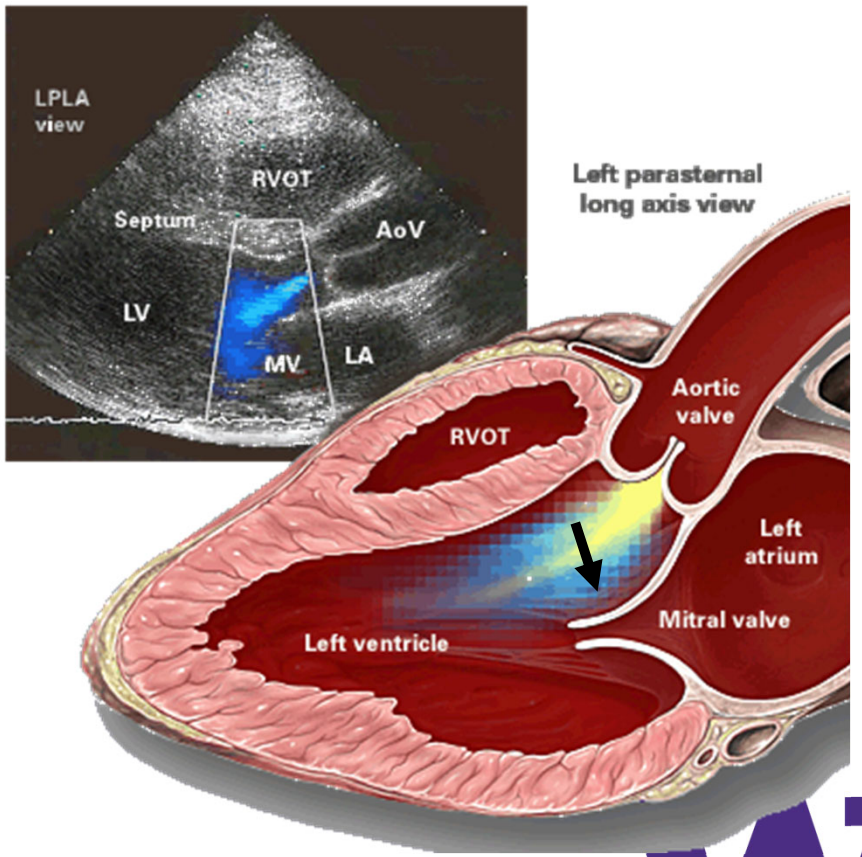
Complications of Infective Endocarditis

- **Cardiogenic Shock due to low cardiac output**
- **Aortic Valve**
  - Regurgitation
  - Aortic root abscess
  - Complete heart block
  - Systemic embolization
    - Coronary embolization



Murmurs

- **Short early diastolic decrescendo murmur heard best at the 3rd left intercostal space**
  - Acute aortic regurgitation, short murmur due to rapid increase in pressures
- **Rumbling diastolic murmur heart best at the apex near the fifth intercostal space**
  - Aortic regurgitation in diastolic will hit the anterior mitral leaflet and cause it to prematurely close, creating “mitral stenosis”
  - Austin Flint Murmur



CASE #8

A 35 year old female presents with several days of fevers, chills, nausea and vomiting. She later developed progressive dyspnea and orthopnea and weakness. She was ultimately brought into the emergency room by her family after she was found to have altered mental status.

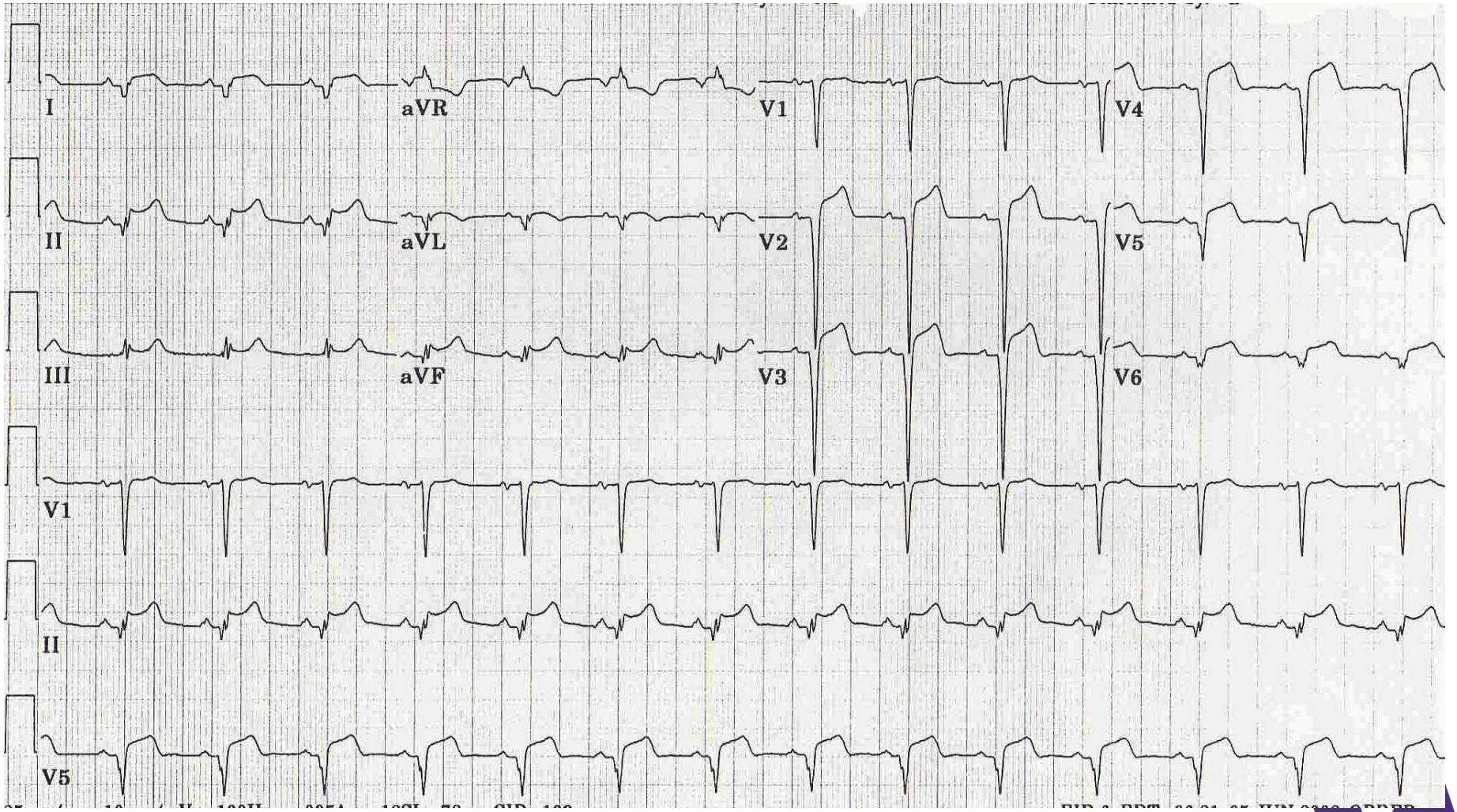
Her vitals are notable for a blood pressure of 75/55 mmHg, heart rate of 110 bmp. On physical exam she is noted to be somnolent. She has cold extremities. Cardiac exam reveals an early systolic murmur at the apex. Lung exam is notable for bibasilar crackles. JVD is elevated.

Troponins is mildly elevated. Creatinine and liver function tests are markedly elevated.

ECG is shown below. She undergoes a coronary angiogram which reveals normal coronary arteries.

What is the best test for diagnosis in this patient?

A. Pericardiocentesis
B. Computed Tomography of the Chest with Contrast
C. Endomyocardial biopsy
D. Computed Tomography of the Head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Conclusions

- Distinguish between AS and HOCM murmurs
- Understand indications for anticoagulation in HOCM
- Recognize mechanical complication of MIs
- Recognize the clinical presentation of constrictive pericarditis
- Be familiar with adult presentation of congenital heart disease
- Identify WPW on ECG and understand acute management of pre-excited atrial fibrillation
- Recognize complications of endocarditis
- Recognize clinical presentation of acute myocarditis