MGH Division of Cardiac Anesthesia

Echocardiography Examination

The MGH Division of Cardiac Anesthesia Echocardiography Examination is a series of XXX questions designed to test basic knowledge in transesophageal echocardiography (TEE).

1. Which is the following concerning coronary anatomy is **true**:
    a. The obtuse marginal arteries are branches of the right coronary artery
    b. The acute marginal arteries are branches of the left anterior descending coronary artery
    c. The posterior descending artery runs in the inferior interventricular groove
    d. The septal perforating arteries are considered epicardial coronary arteries
2. A 40-year-old male presents to the emergency room with complaints of sudden onset severe "tearing" chest pain. He has no personal or family history of coronary artery disease. Which of the following is most sensitive for aortic dissection:
    a. MRI
    b. CT
    c. TEE
    d. TTE
3. A 36-year-old male is undergoing pulmonary vein isolation under conscious sedation. He complains of shortness of breath and lightheadedness. Which is the following actions is first indicated:
    a. Administer additional heparin
    b. Start nitroglycerin
    c. Ask the cardiologist to perform an echocardiogram
    d. Increase sedation and analgesia
4. You are called to the cardiac surgical intensive care unit to see a patient that is 12 hours post coronary artery bypass grafting. Blood pressure is 90/58, HR 120 (irregular), CVP 13, CO 3.1 L/min, CI 1.8 L/min/m^2, PA pressure 42/20. Which is the **most likely** diagnosis?
    a. Tamponade
    b. Right heart failure
    c. Ischemia
    d. Atrial fibrillation
5. In 2002 the American Heart Association (AHA) developed nomenclature to describe the walls of the left ventricle. The system defined how many segments?
    a. 4
    b. 8
    c. 16
    d. 17
6. The anterior wall of the left ventricle receives its blood supply from which of the coronary arteries?
    a. Left circumflex
    b. Left anterior descending

c. Right coronary artery
d. Ramus intermedius

7. Which of the following statements about the left atrial appendage (LAA) is **false**:
    a. The LAA usually consists of 2 or more lobes
    b. The walls of the LAA are more compliant than the body of the LAA
    c. The pectinate muscles are attached to the walls of the LAA
    d. The LAA length is consistently between 20 and 25 mm.
8. Which of the following statements about the pulmonary valve (PV) is **false**:
    a. The PV consists of 3 leaflets
    b. The names of the leaflets are the anterior, left, and right.
    c. The PV may be removed and placed in the position of the aortic valve is a "Ross procedure"
    d. The pulmonary valve leaflets are attached to the walls of the pulmonary artery.
9. Which of the following statements about the mitral valve (MV) are **true**:
    a. The MV consists of 3 leaflets.
    b. The MV is attached to the pulmonary valve at the intervalvular fibrosa
    c. The mitral valve leaflets are connected to the papillary muscles by chordate tendinae
    d. The three papillary muscles in the left ventricle have the same names as the 3 leaflets of the mitral valve
10. Which of the following is **true** concerning the anatomy of the mitral valve:
    a. Approximately 60 % of the valve area is made up of the posterior leaflet.
    b. The chordate tendinae of the posteriormedial papillary muscle attach excusively to the posterior leaflet.
    c. The leaflets of the mitral valve attach to the endocardium at the valvular annulus.
    d. The anterior leaflet of the mitral valve is connected to the pulmonary valve via the intervalvular fibrosa.
11. The attachment of the aorta to the pulmonary artery is called the:
    a. Ligamentum venosum
    b. Ligamentum flavum
    c. Falciform ligament
    d. Ligamentum arteriosum
12. Which is the following findings is commonly associated with an aortic coarctation:
    a. Left ventricular dilatation
    b. Pulmonary hypertension
    c. Bicuspid aortic valve
    d. Cleft in the mitral valve
13. The base of the left ventricle contains how many segments according to the AHA classification:
    a. 6
    b. 4
    c. 8
    d. 17
14. The apical region of the left ventricle contains how many segments according to the AHA classification:
    a. 1

b. 6
c. 2
d. 4

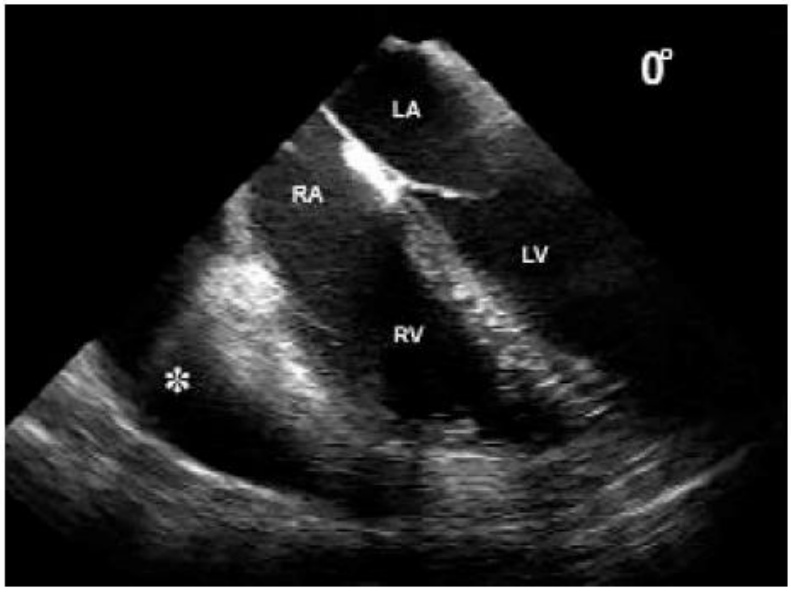
15. Transesophageal echocardiography reveals an enlarged coronary sinus and bubbles entering the right atrium near the inferior vena vava when adgitated saline is injected through an IV in the left basilic vein. Which of the following is likely:
    a. Patent foramen ovale (PFO)
    b. Ventricular septal defect (VSD)
    c. Aortic coarctation
    d. Left sided superior vena cava
16. A patient is undergoing a replacement of the mitral valve. Approximately 5 minutes after cross clamp removal dramatic elevation of the ST segments in EKG lead II is noted. Which of the following is likely:
    a. Protamine reaction
    b. Air entry into the left main coronary artery
    c. Air entry into the coronary sinus
    d. Air entry into the right coronary artery
17. A surgeon is performing coronary artery bypass grafting. She must know the following anatomic relationships to perform grafting appropriately:
    a. The LAD is located in the anterior inter-ventricular groove.
    b. The left circumflex is located in the inferior inter-ventricular groove
    c. The obtuse marginal arteries are branches of the right coronary artery
    d. The posterior descending coronary artery is also referred to as the posterior left ventricular artery (PLV)
18. Which of the following statements is **false** about the right ventricle (RV):
    a. The RV mass is less than the mass of the left ventricle (LV)
    b. The total volume of the right ventricle is more than the LV
    c. The ejection fraction of the RV and LV are equal
    d. The size of the RV in a mid-esophageal 4 chamber view of the heart is approximately 2/3 of the LV
19. A 27-year-old female experiences sudden onset chest pain 15 minutes after delivery of a healthy baby boy via Cesarean section. She is intubated and transesophageal echocardiography reveals dilatation of the right ventricle (RV), tricuspid regurgitation (TR), and a "D" shaped left ventricle that is small and hyperkinetic. Which of the following is **least likely**:
    a. Pulmonary emboli
    b. Amniotic fluid embolism
    c. Dissection of the right coronary artery
    d. Aspiration
20. A 63-year-old non-smoking, 72 inch tall and 87 kg presents with sudden onset back pain described as "ripping". A transesophageal echocardiography examination does not identify a dissection but an intermural hematoma is noted in the ascending aorta. Which of the following actions is indicated:
    a. Preparation of an operation room for emergent surgery
    b. Initiation of beta-blockade and referral to a vascular surgeon for potential stent repair.

c. No action. This is a common and benign finding.
d. Anticoagulation followed by coronary angiography

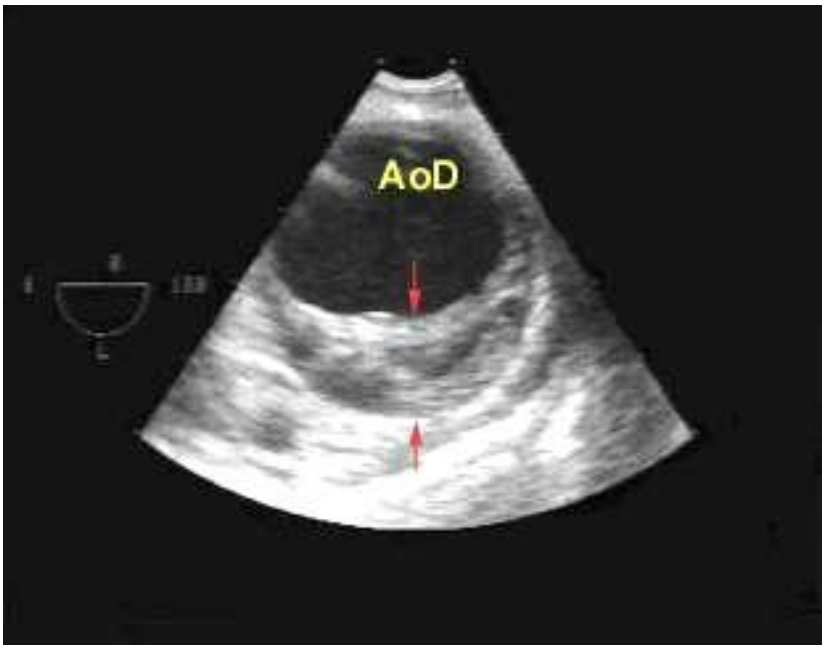
21. A 63-year-old male is diagnosed with a dissection of the ascending aorta. Which of the following complications may complicate induction of anesthesia:
    a. Hypertension and extension of dissection
    b. Coronary ischemia
    c. Aortic insufficiency
    d. Tamponade
    e. All of the above
22. A 54-year-old male presents on referral from an outside hospital with a Type A aortic dissection. Physical examination reveals a diastolic murmur in the right upper sterna border. Which of the following is **most likely**:
    a. Ischemia of the right coronary artery
    b. Pericardial effusion
    c. Rupture
    d. Aortic insufficiency
23. You are called to perform a transesophagel echocardiogram on a patient during a hip replacement. The following is related to you – He developed sudden onset hypotension associated with chest pain. His heart rate increased. Which of the following **argues against massive pulmonary emboli**:
    a. Right ventricular dilatation
    b. Tricuspid regurgitation
    c. A "D" shape of the left ventricle.
    d. A left ventricle that appears to be filled
24. Which of the following is necessary for diagnosis of an aortic dissection by transesophageal echocardiography:
    a. Undulating flap of tissue seen in 2 different views
    b. A dissection "entry point"
    c. Aortic insufficiency
    d. Tamponade
25. Which of the following systems is used to classify descending thoracic aortic aneurysms:
    a. DeBakey
    b. Stanford
    c. Crawford
    d. None of the above
26. You are called to the electrophysiology lab. A 73 year-old-male patient with a history of multivessel coronary artery disease treated with stenting is undergoing ablation for ventricular tachycardia under conscious sedation. The patient complains of shortness of breath. Blood pressure is 70/50 with a heart rate of 110 beats per minute in sinus rhythm. Intra-cardiac ultrasound demonstrates a fluid collection of 2 cm within the pericardium. The right atrium and ventricle are compressed. Which of the following actions is indicated:
    a. Immediate intubation with propofol.
    b. Anticoagulation for coronary ischemia
    c. Beta-blockade

d. Ask the electrophysiologist if the collection can be drained with a catheter

27. A 48-year-old female has suffered an acute massive pulmonary embolization. She is on 10L oxygen via a facemask. She is to undergo open pulmonary embolectomy in the cardiac operating suite. Which of the following options are appropriate for anesthetic induction:
    a. Bypass cannulation placement in the femoral vessels prior to induction
    b. Induction with etomidate
    c. Induction with ketamine
    d. Surgical presence in the operating room prior to induction
    e. All of the above
28. A 24-year-old male is undergoing stent placement for a coarctation of the aorta in the cardiac catheterization suite. Immediately after stent deployment he complains of chest pain. Blood pressure suddenly decreases to 50/30 and heart rate is 130 beats per minute. Which of the following is correct:
    a. Bypass via the femoral blood vessels will likely be effective
    b. Coronary artery dissection is likely
    c. Placement of an intra-aortic balloon pump is indicated.
    d. Immediate preparation of an operating room is necessary
29. What is noted by the "*":

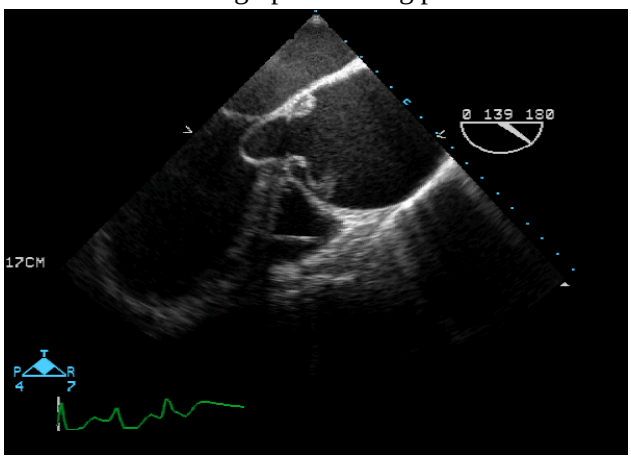


    a. Pleural effusion
    b. Pericardial effusion
    c. Pneumothorax
    d. Normal pericardial space
30. Which of the following is demonstrated by the image:



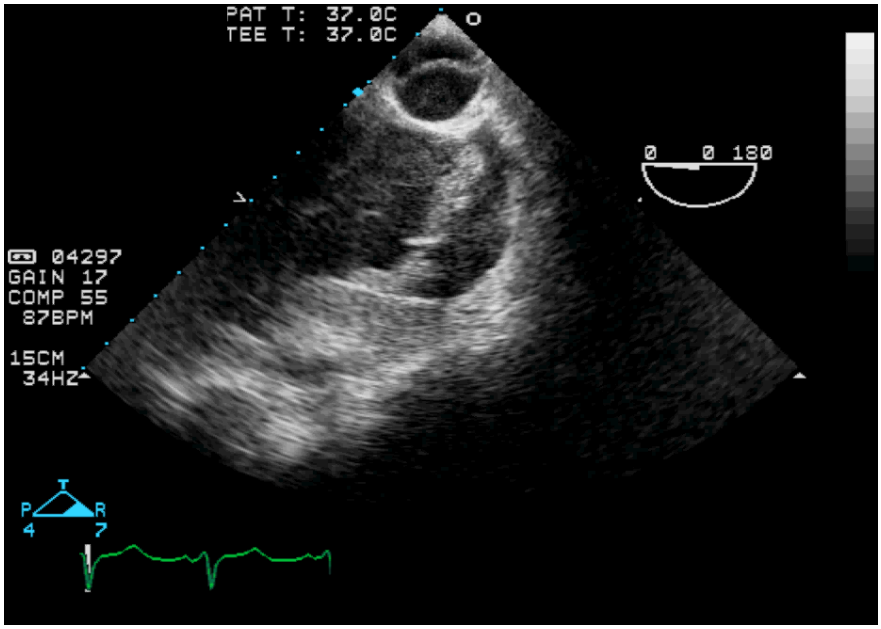
a. Aortic atheroma
b. Aortic dissection
c. Intermural hematoma
d. Pseudoaneurysm

31. The echocardiographic finding pictured below is an example of a:



a. Intramural hematoma
b. Pseudoaneurysm
c. Aortic dissection
d. Aneurysm of the ascending aorta

32. The image below demonstrates which complication of an aortic dissection:



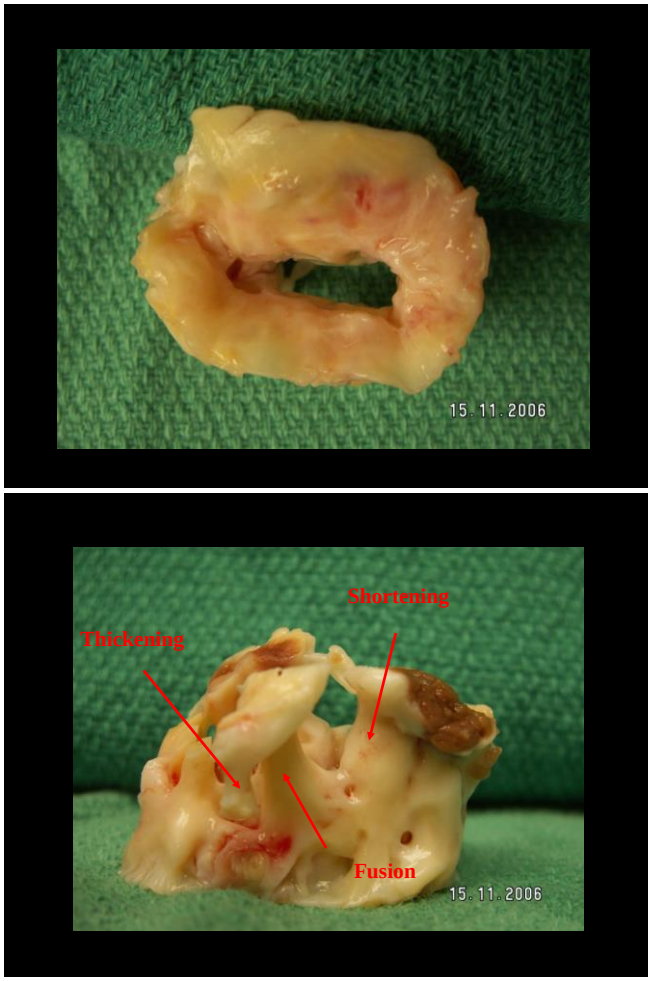
a. Pericardial effusion
b. Pseudoaneurysm
c. Tamponade
d. Pleural effusion

33. A 27-year-old female presents with complaints of acute onset shortness of breath, hemoptysis, and chest pain. What does the image below reveal:

a. Aortic dissection
b. Large pleural effusion
c. Pulmonary emboli

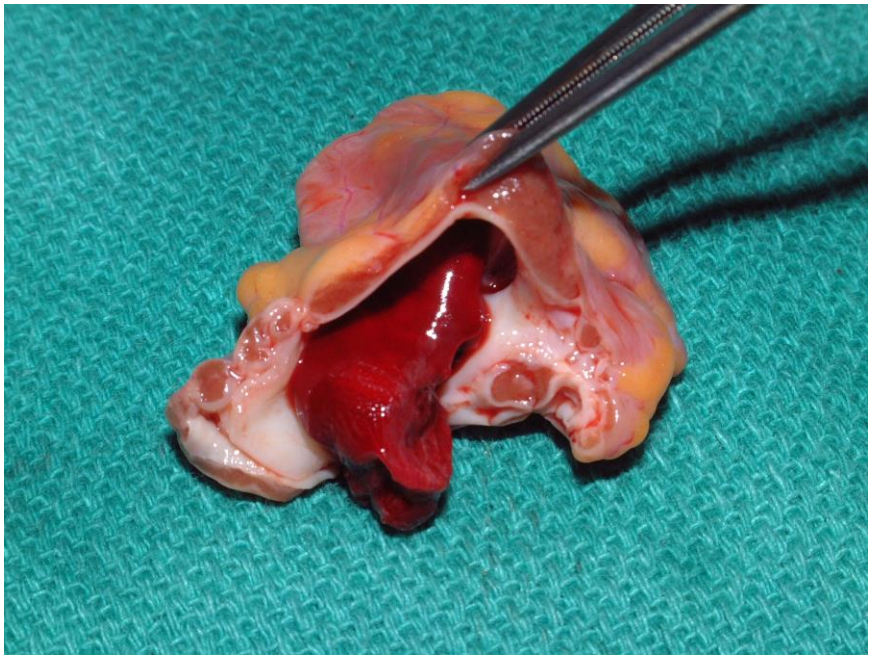
d. Occluded right mainstem bronchus

34. The following patient has a mitral valve which demonstrated thickening at the tips of the leaflets and shortening with thickening of the chordae tendinae. The valve is removed and replaced during surgery. What is the diagnosis:



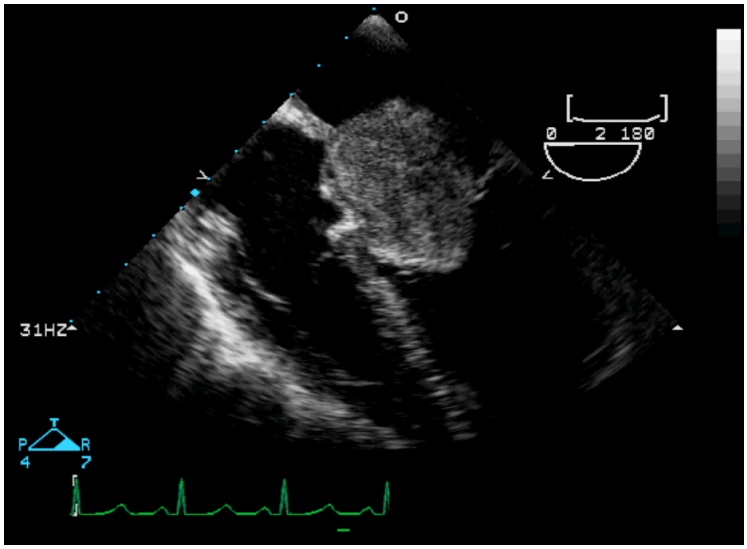
a. Calcific mitral stenosis
b. Mitral annular calcification with stenosis impairing function
c. Mitral regurgitation from mitral valve prolapse
d. Rheumatic mitral disease

35. A 77-year-old male presented with complaints of palpitations and shortness of breath. He is diagnosed with mitral valve stenosis and undergoes a mitral valve replacement and another procedure. What is the procedure and what is the diagnosis found:



a. Closure of a PFO with findings of a left atrial myxoma
b. Right atrial appendage excision with calcific debris
c. Removal of a sarcoma from the left atrium
d. Left atrial appendage amputation and discovery of a clot

36. This large mass seen on attached to the left side of the intra-atrial septum by a thin stalk is most likely a:

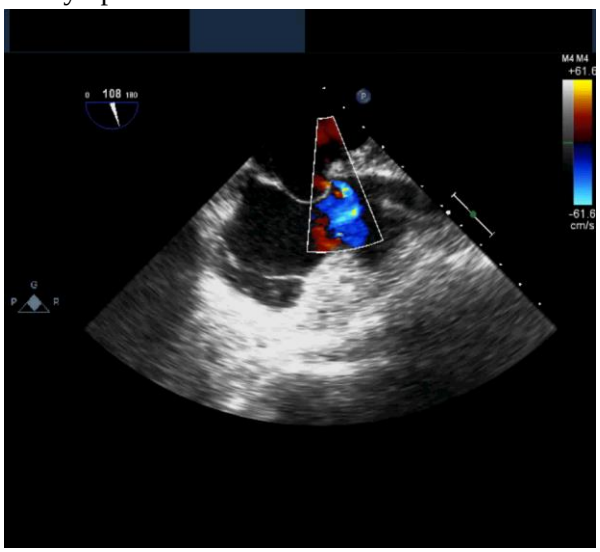


a. Fibroelastoma
b. Thrombus
c. Myxoma
d. Sarcoma

37. The pathology in the image below may be associated with which of the following disorders

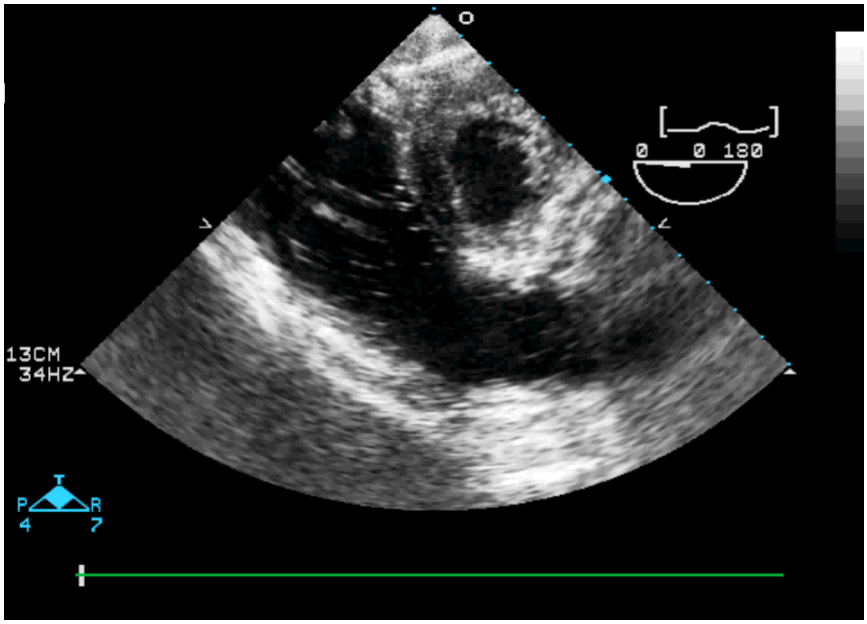
a. Coarctation of the aorta
b. Aortic aneurysm
c. Endocarditis
d. All of the above

38. A 34-year-old female noted transient blurred vision. What is the finding below that explains her symptoms:



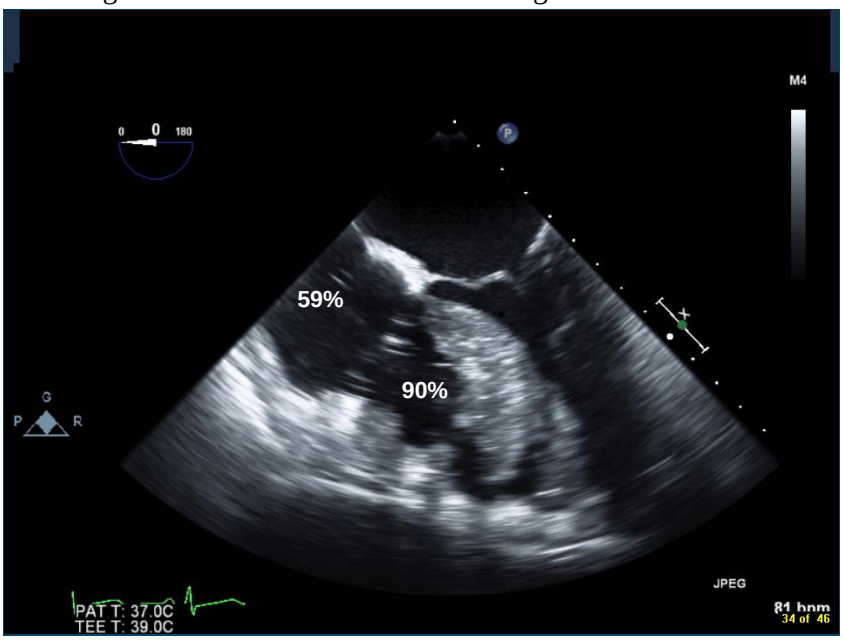
a. Ventricular septal defect with right to left shunting
b. Primum atrial septal defect with right to left shunting
c. Sinus venosus defect with left to right shunting
d. Secundum atrial septal defect

39. The transgastric view of heart seen in the image demonstrates what:



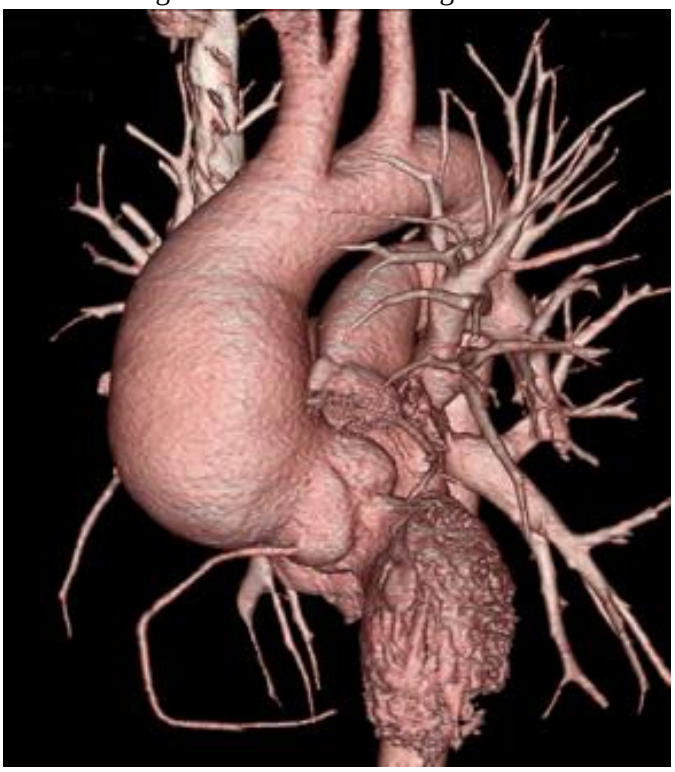
a. Right ventricular compression due to pericardial effusion
b. Left ventricular dilatation
c. A normal left ventricle
d. A "D" shaped left ventricle due to acute right ventricular pressure overload

40. A 56-year-old male presented with a history of chronic stable angina presented 5 days ago with a complaint of severe chest pain. He was treated and released. He returns 5 days later in shock despite normal ventricular function by echocardiography. Cardiac catheterization reveals the following arterial saturations. What is the diagnosis:



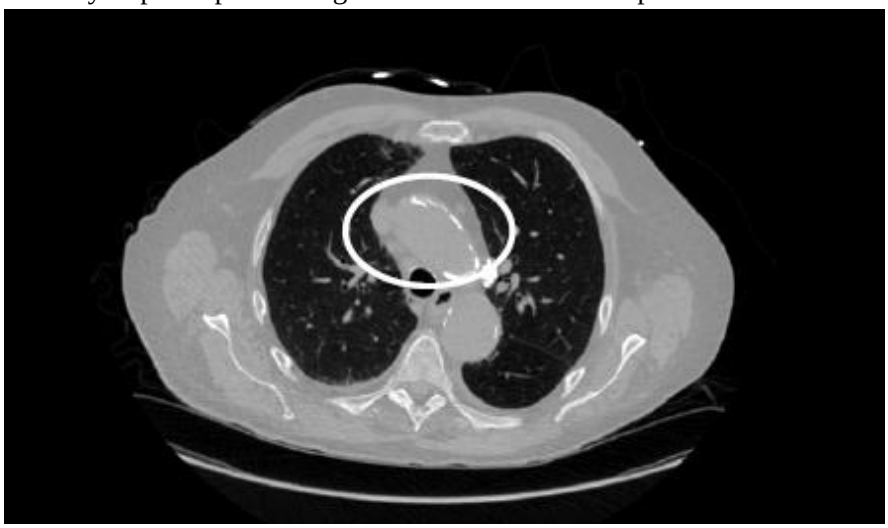
a. Sepsis
b. Atrial septal defect with right-to left-shunting
c. Pulmonary embolization
d. Ventricular septal defect.

41. The following 3D reconstruction image demonstrates which of the following:



    a. Dilation of the ascending aorta
    b. Rupture of the aortic arch
    c. Aortic dissection
    d. Aneurysm of the aortic arch

42. Based upon the findings demonstrated in the computerized tomography below, what technique may improve positioning for the aortic cross clamp:

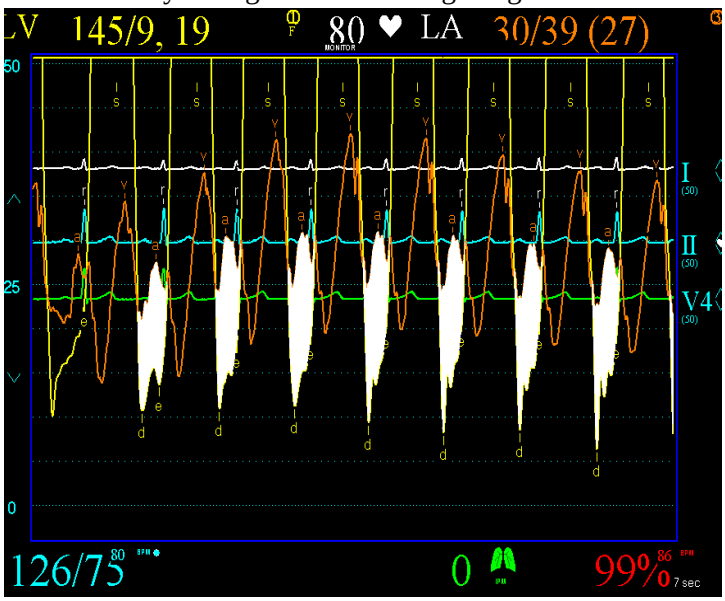


    a. Transesophageal echocardiography
    b. Transthoracic echocardiography
    c. Surgical palpitation
    d. Epiaortic ultrasound

43. A patient underwent a pulmonary thromboendarterectomy. The pathology sample below was obtained. Which is the following statements is **false**?

a. Removal of fibrotic material is easiest from the distal portion of the pulmonary arterioles.
b. Removal of larger debris from the proximal pulmonary arteries is associated with a better outcome.
c. Generally more debris is recovered from the right pulmonary artery.
d. The surgeon starts their removal of debris from the wall opposite the incision in the pulmonary artery.

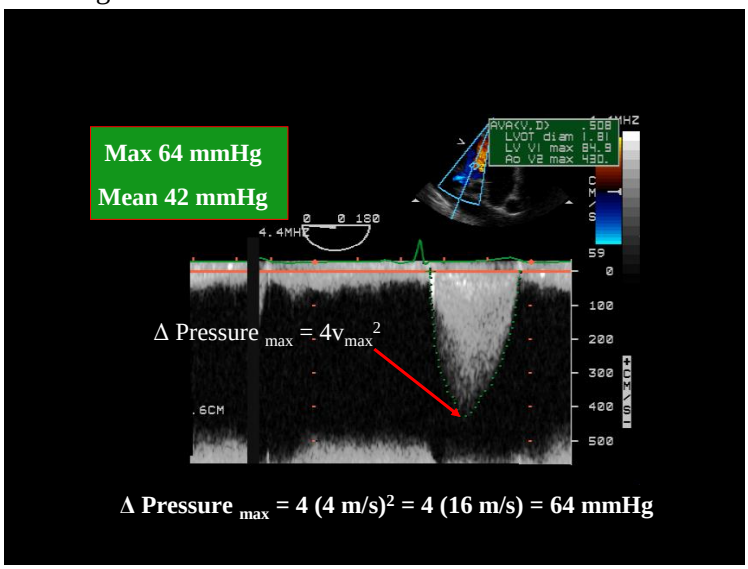
44. A 64-year old female presents with shortness of breath with exertion. She has a history of Scarlet Fever 40 years ago. The following image demonstrates that the patient **likely has**:



a. Aortic stenosis by a gradient across the aortic valve during systole.
b. Rheumatic mitral stenosis

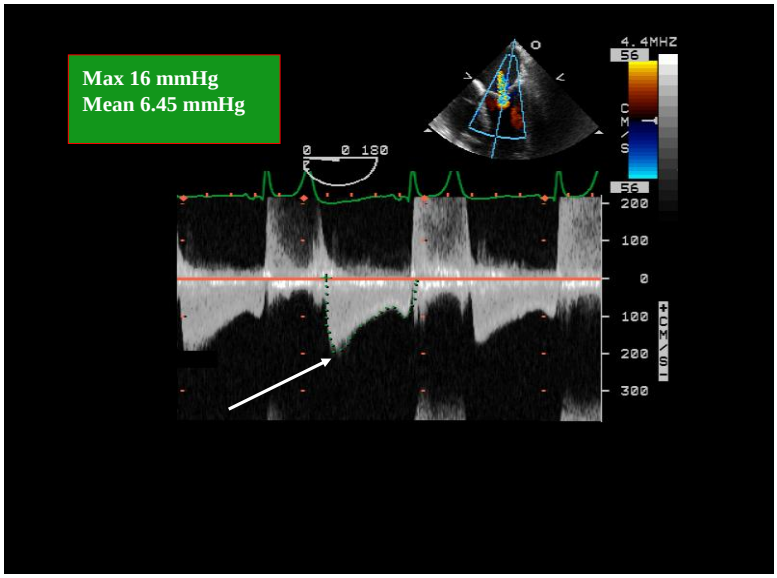
c. Mitral regurgitation
d. Aortic regurgitation

45. Which equation or law is utilized to calculate the gradient across the aortic valve depicted in the image:



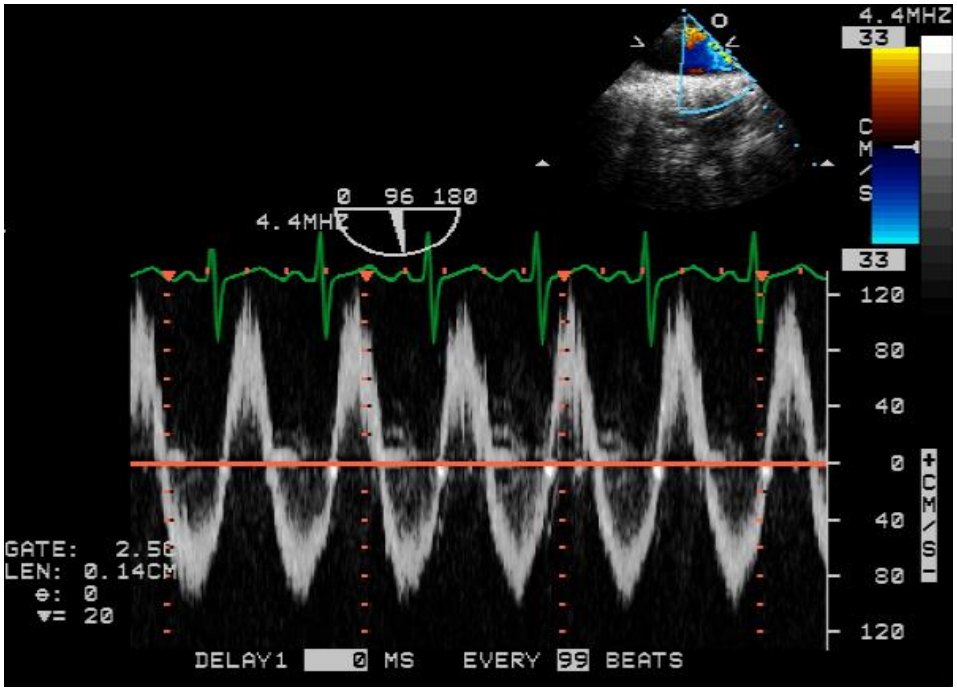
a. The Gorlin equation
b. The Hagen-Pousille law
c. The Bernoulli equation
d. The Venturi Effect

46. The "wave" indicated by the arrow reflects what:



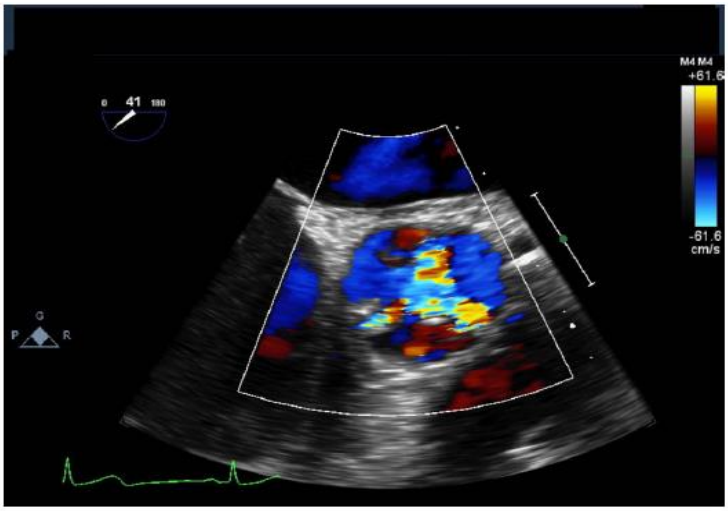
a. The atrial "kick"
b. The gradient across the aortic valve during systole
c. Early diastolic filling
d. Mitral regurgitation

47. The image obtained below obtained from pulse wave imaging across the aortic arch supports which finding in a patient with a diastolic murmur best heard in the right upper sternal border:



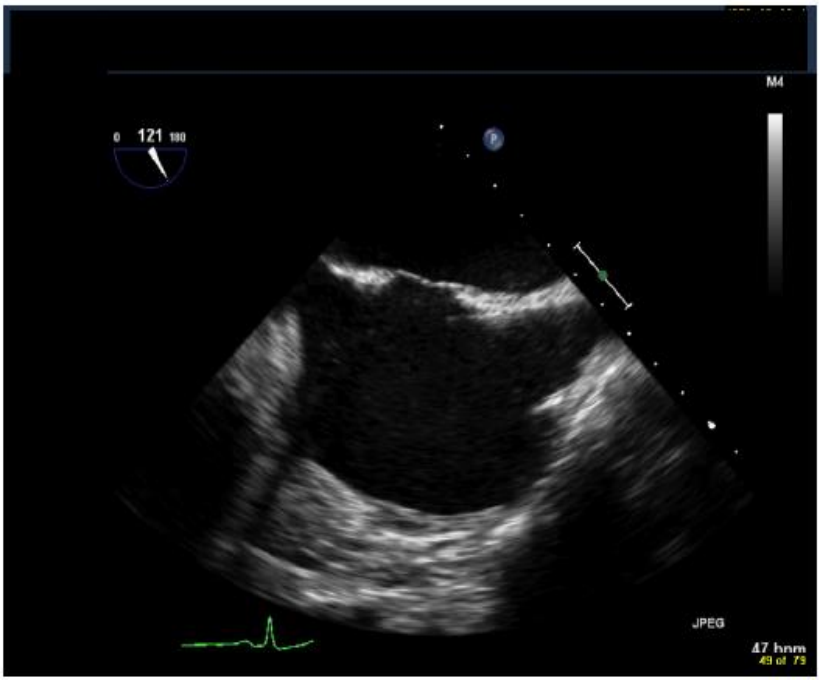
a. Mitral stenosis
b. Mitral regurgitation
c. Aortic regurgitation
d. Aortic stenosis

48. A 36-year-old male with Trisomy 21 presents for an echocardiogram. He has a known ventricular septal defect (VSD). His EKG shows right ventricular hypertrophy. His room air saturation is 86% and he appears cyanotic but otherwise healthy. His hematocrit is 56%. CXR shows prominent pulmonary vasculature. What is the likely diagnosis:
    a. Eisenmenger's syndrome from the VSD.
    b. Left ventricular failure
    c. Tricuspid regurgitation with an atrial septal defect.
    d. Pulmonary embolism.
49. How old is the patient with the following pathology?



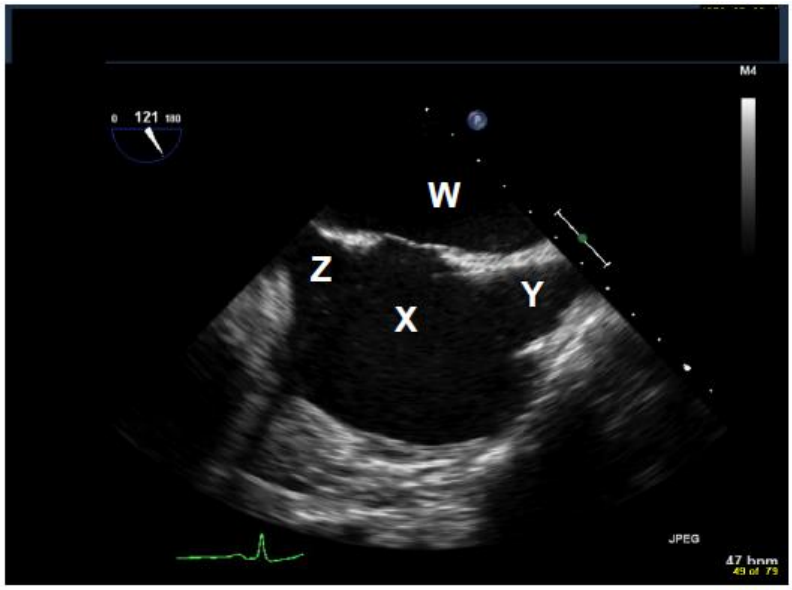
a. 20 years
b. 50 years
c. 80 years
d. 10 years

50. Which view is presented below:



a. Mid esophageal 2 chamber
b. Transgastric short axis
c. Mid esophageal bicaval view
d. Right ventricular inflow-outflow view

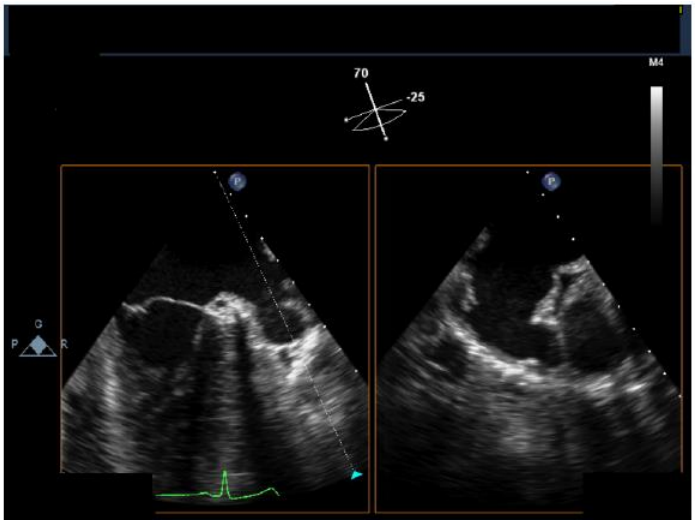
51. Which of the structures is marked with the "X" in the image below:



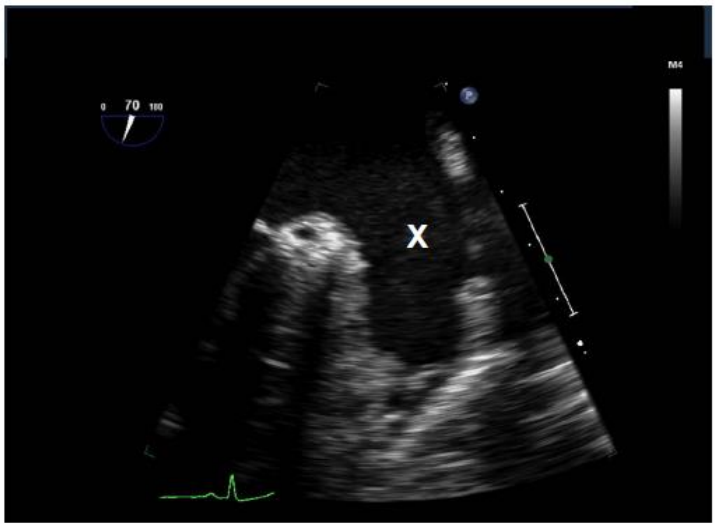
a. Left atrium

b. Right atrium
c. Right ventricle
d. Left ventricle

52. Which structure is marked with the “Y”:
    a. Coronary sinus
    b. Ascending aorta
    c. Superior venacava
    d. Inferior vena cava
53. Which structure is marked with the “W”
    a. Right atrium
    b. Left ventricle
    c. Left atrium
    d. Pleural space
54. Which structure is indicated by the “Z”:
    a. Inferior vena cava
    b. Superior vena cava
    c. Coronary sinus
    d. Left superior vena cava
55. How is the structure being interrogated in the following image:

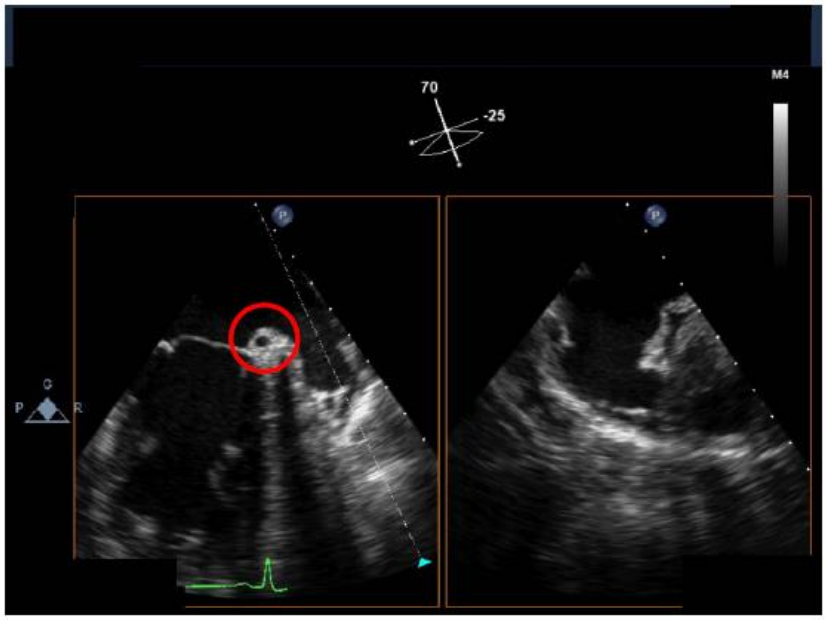


    a. “X” plane analysis
    b. M-mode
    c. Live 3D
    d. Pulse wave
56. What is the structure annotated by the “X” in the image below:



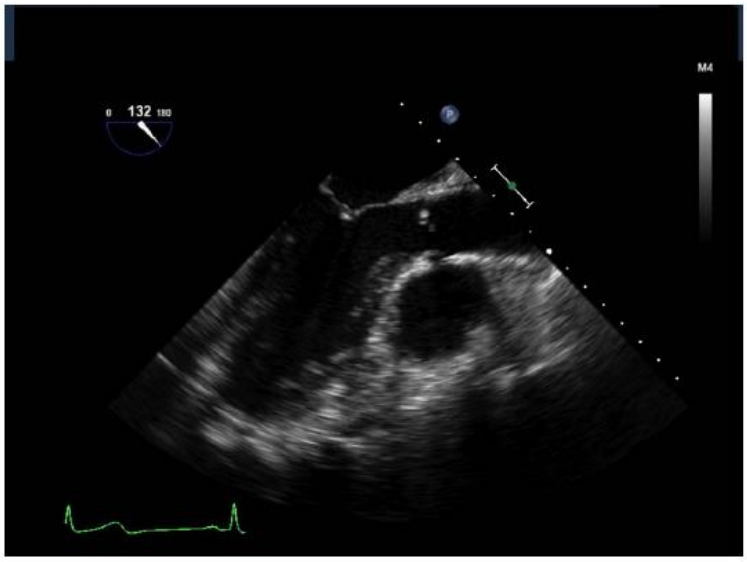
a. Right atrial appendage
b. Pleural effusion
c. Left atrial appendage
d. Pericardial effusion

57. What is the vascular structure in the circle:



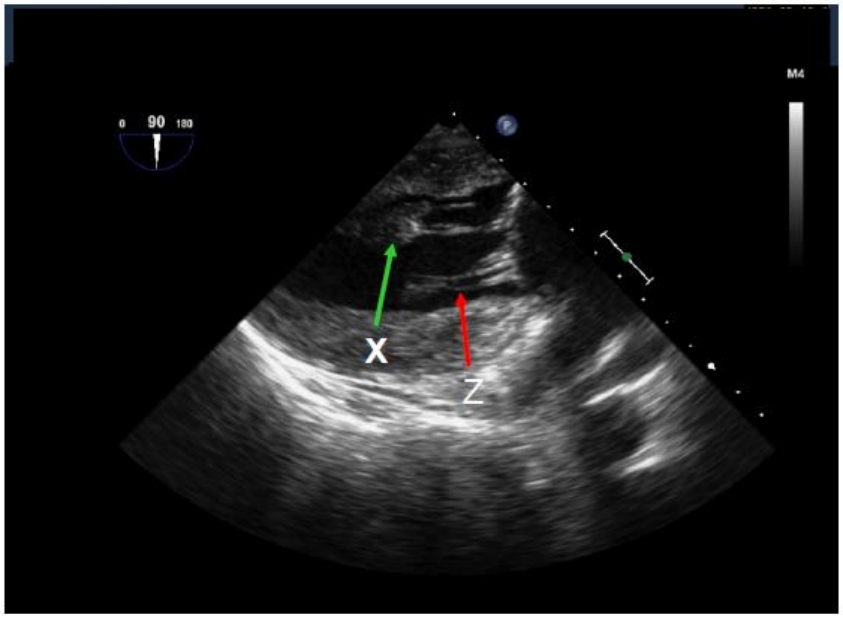
a. Left circumflex coronary artery
b. Coronary sinus
c. Left main coronary artery
d. Left anterior descending coronary artery

58. What is the view presented below:



a. Mid esophageal 3 chamber view
b. Mid esophageal 4 chamber view
c. Right ventricular inflow-outflow view
d. Deep transgastric view

59. What structure is indicated by the red arrow and the "Z":



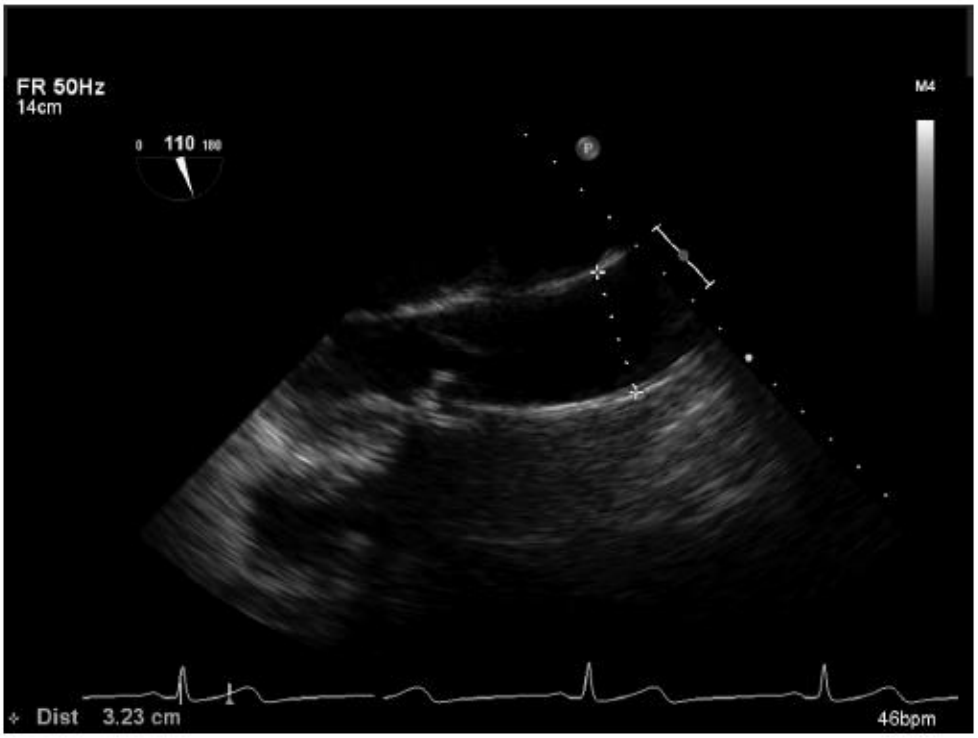
a. The tricuspid valve
b. The intraatrial septum
c. The christa terminalis
d. The chordae tendinae

60. What structure is annotated by the green arrow and the "X":

a. The anterolateral papillary muscle
b. The posteromedial papillary muscle
c. The anterior wall of the left ventricle

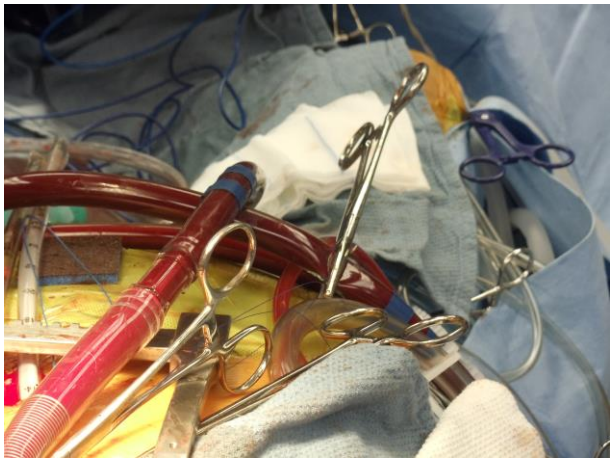
d. Clot in the left atrium

61. Which of the following is **false** in the image below:



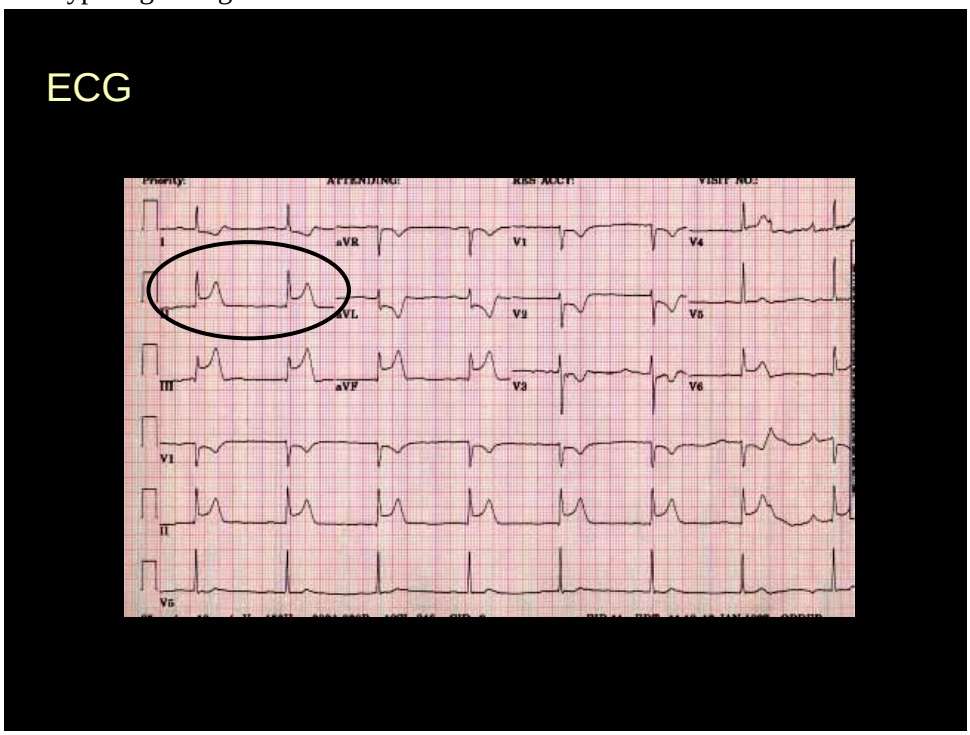
a. The image depth is 20 cm
b. The Omniplane is 110 degrees
c. The diameter of the ascending aorta is 3.23 cm
d. The image is obtained at a heart rate of 46 beats per minute

62. How does the central venous pressure (CVP) and pulmonary artery pressure (PA) respond when the action depicted in the image below occurs:



a. CVP falls, PA pressure falls
b. CVP rises, PA pressure falls
c. CVP rises, PA pressure rises
d. CVP falls, PA pressure rises

63. The circled EKG finding may be seen with which potential complication of coronary artery bypass grafting:

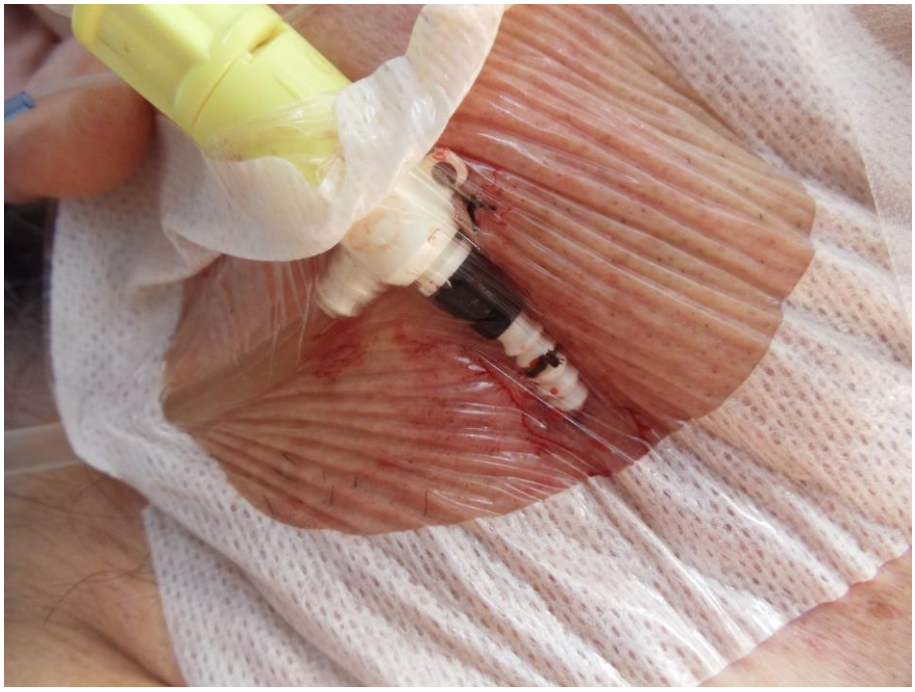


a. Air entry into the right coronary arterial graft
b. Air entry kinking of the LIMA to the LAD
c. Accidental surgical ligation of the left circumflex during mitral valve replacement
d. Spasm of a diagonal artery

64. A 56-year-old male is undergoing an aortic valve replacement and coronary artery bypass grafting. Retrograde cardioplegia is administered and fails to induce cardiac arrest. A second dose is administered and again fails to induce arrest. The image below demonstrates a significant finding (note that both the right and left ventricles have been cropped from the image). What is the diagnosis:

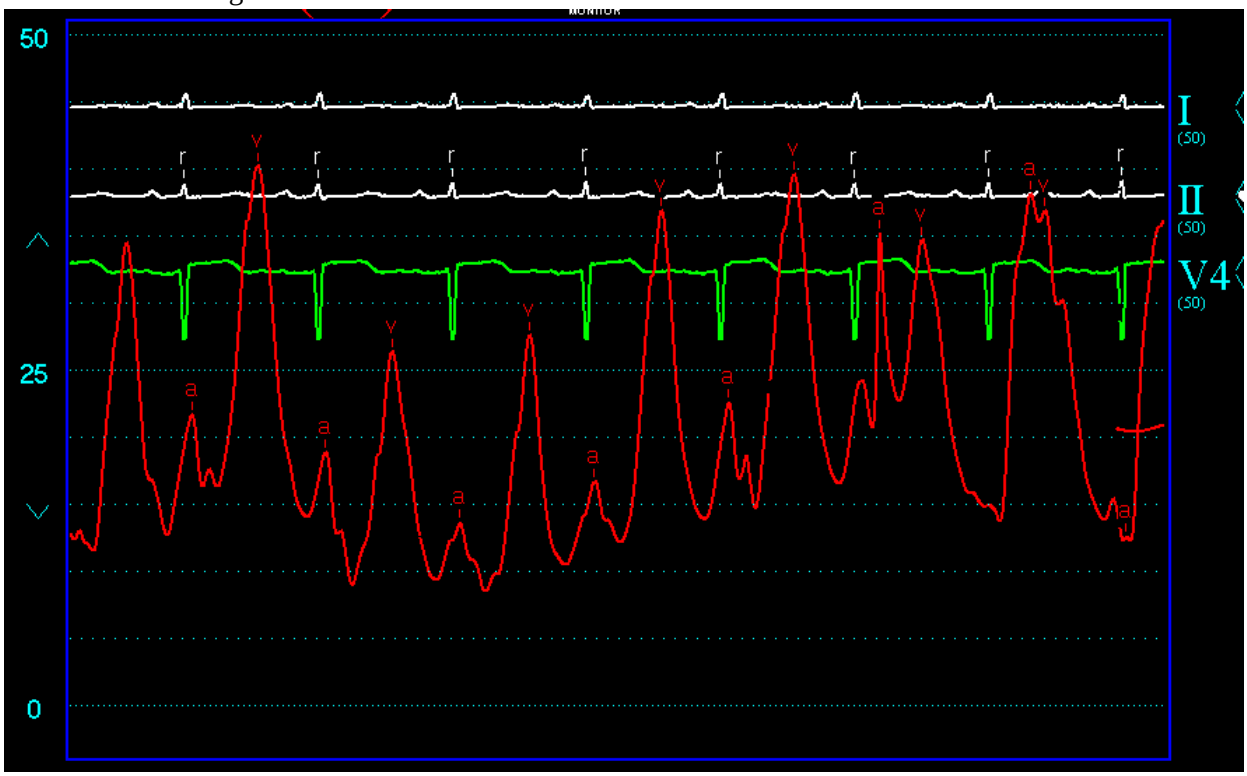
a. Absent coronary sinus
b. Duplicate IVC
c. Left sided superior vena cava
d. Dissection in the coronary sinus

65. Which of the following is **false** about "redo" cardiac surgery:
    a. Injury to cardiac structures is more common during sternotomy compared with dissection *after* sternotomy
    b. Mortality increases with number of "redo" procedures
    c. Risk of injury to cardiac structures increases with number of "redo" procedures
    d. The structure most commonly injured during sternotomy in a "redo" procedure is the innominate vein
66. Which of the following factors increases the risk of injury to a thoracic structure during a "redo" procedure:
    a. Previous radiotherapy
    b. Number of prior sternotomies
    c. A patent internal thoracic artery graft
    d. All of the above
67. According to the Katz system for classification of aortic atheroma, Grade 5 atheroma refers to:
    a. Severe intimal thickening but no raised atheroma
    b. Raised atheroma < 5 mm
    c. Raised atheroma > 5 mm
    d. Any size atheroma with mobile elements
68. A patient underwent a tricuspid valve replacement. Twenty-fours post op the ICU nurse reports that the pulmonary artery catheter (PA) cannot be removed from the introducer. The patient is brought back to the operating room for surgical removal of the PA line. What is your advice to the surgeon:



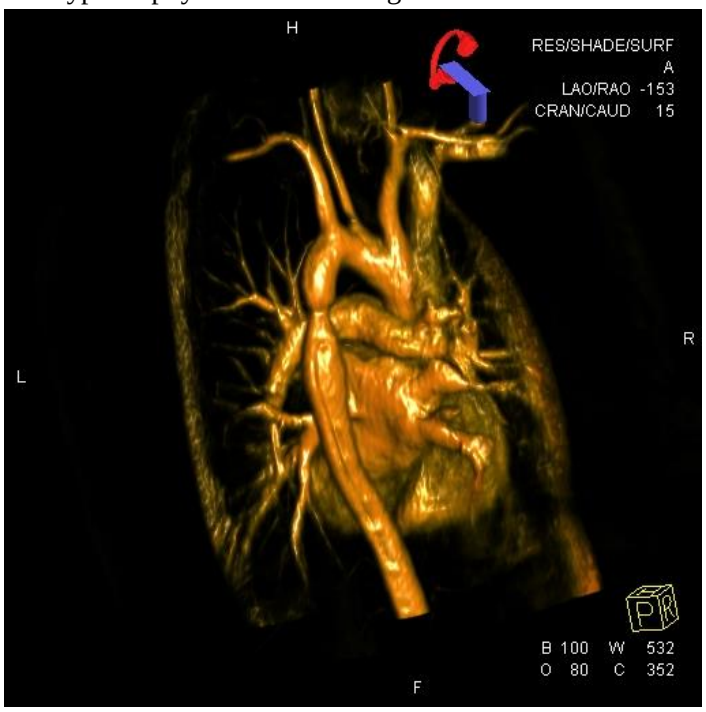
a. Perform a sternotomy as the PA line is likely sutured into the SVC.
b. The PA line is likely sutured into the tricuspid valve
c. The suture used to secure the PA line introducer is incorrectly positioned.
d. The PA line is likely sutured into the IVC

69. A patient presents with a new onset systolic murmur in the left lower sternal border associated with pulmonary edema. Right heart catheterization demonstrates the following wedge pressures. What is the diagnosis:



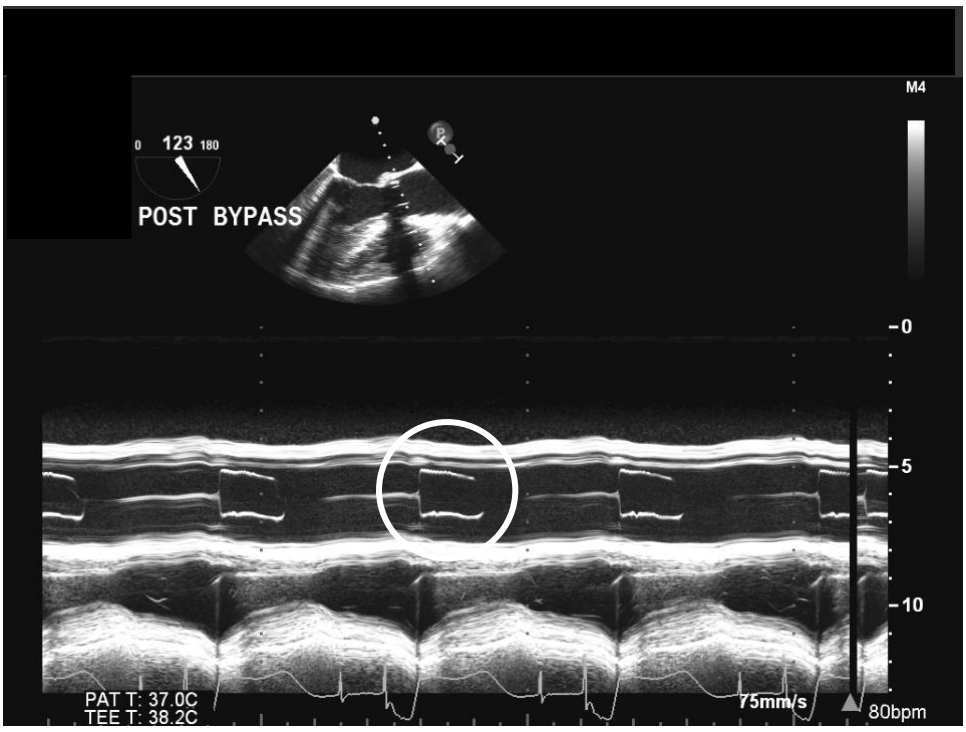
a. Mitral stenosis
b. Ventricular septal defect
c. Atrial septal defect
d. Mitral regurgitation

70. A 45 –year-old female presents with a long history of a systolic murmur associated with an transthoracic echocardiogram (TTE) that is completely normal except for left ventricular hypertrophy. What is the diagnosis:



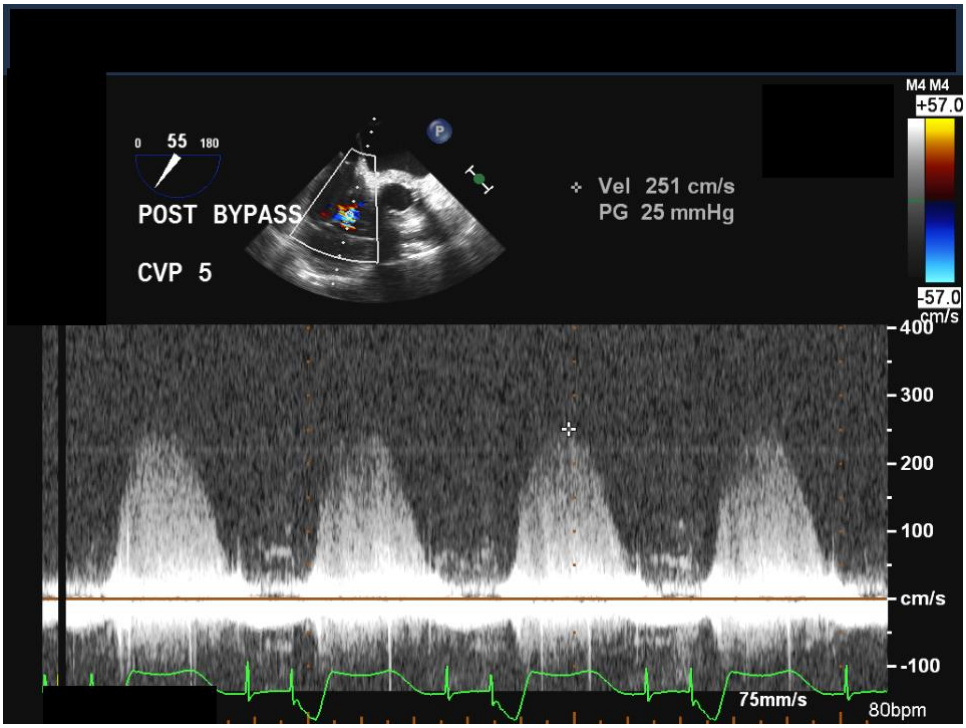
a. Aortic stenosis
b. Aortic coarctation
c. Aortic dissection
d. Aortic aneurysm

71. The image below represents:



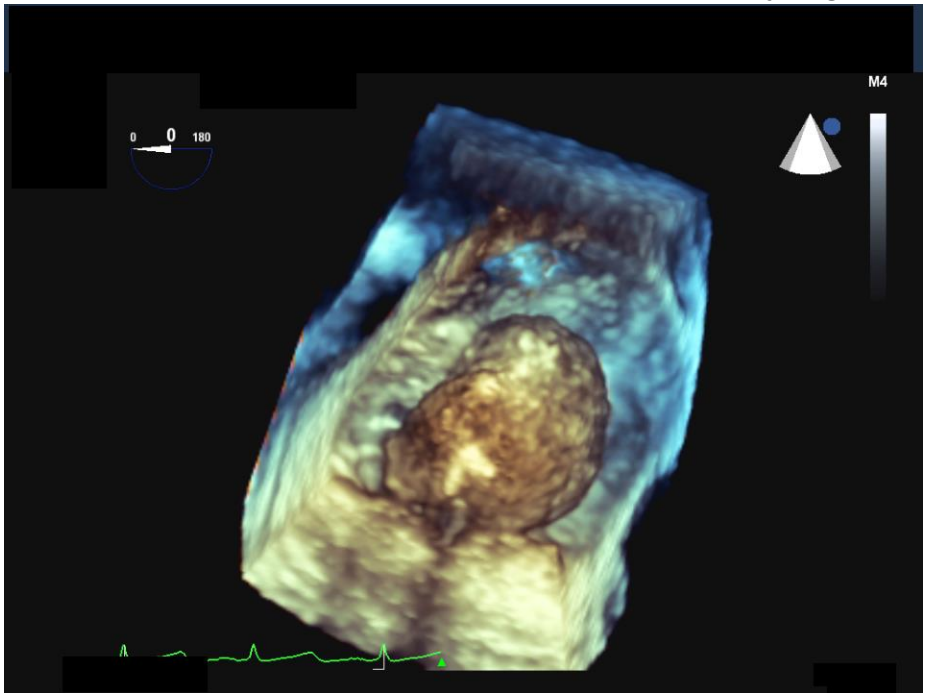
a. 3D echocardiography
b. M-Mode echocardiography
c. Pulse wave analysis
d. Continuous wave analysis

72. The event circled in the image above represents what:
    a. Opening of the mitral valve
    b. Closure of the tricuspid valve
    c. Opening of the aortic valve
    d. Closure of the aortic valve
73. What is the right ventricular systolic pressure with the information provided:



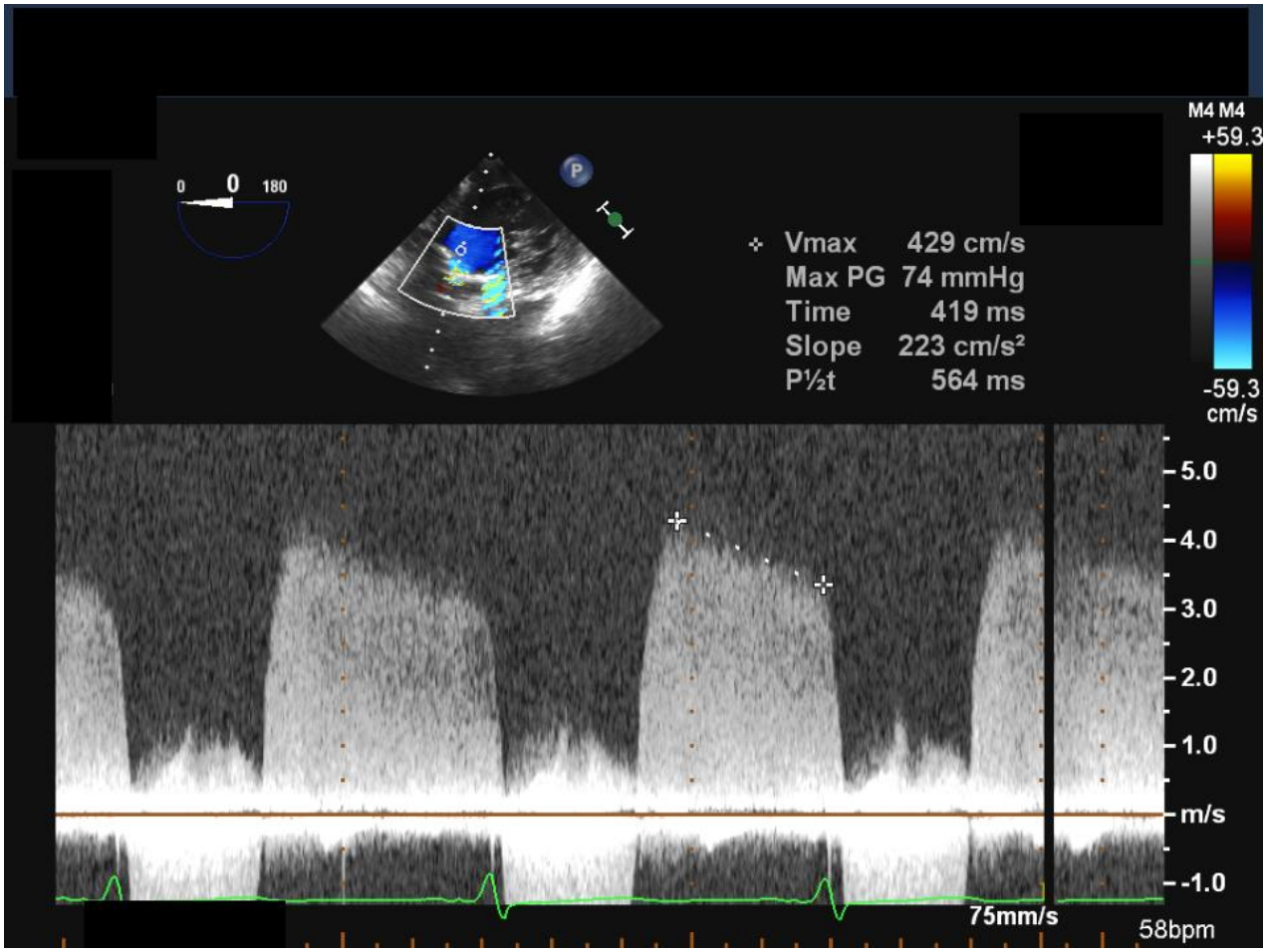
a. 5
b. 20
c. 30
d. 25

74. The 3D image below of the left atrium and the pathology provided were obtained from a 43 year old female with a series of transient attacks. What is the likely diagnosis:



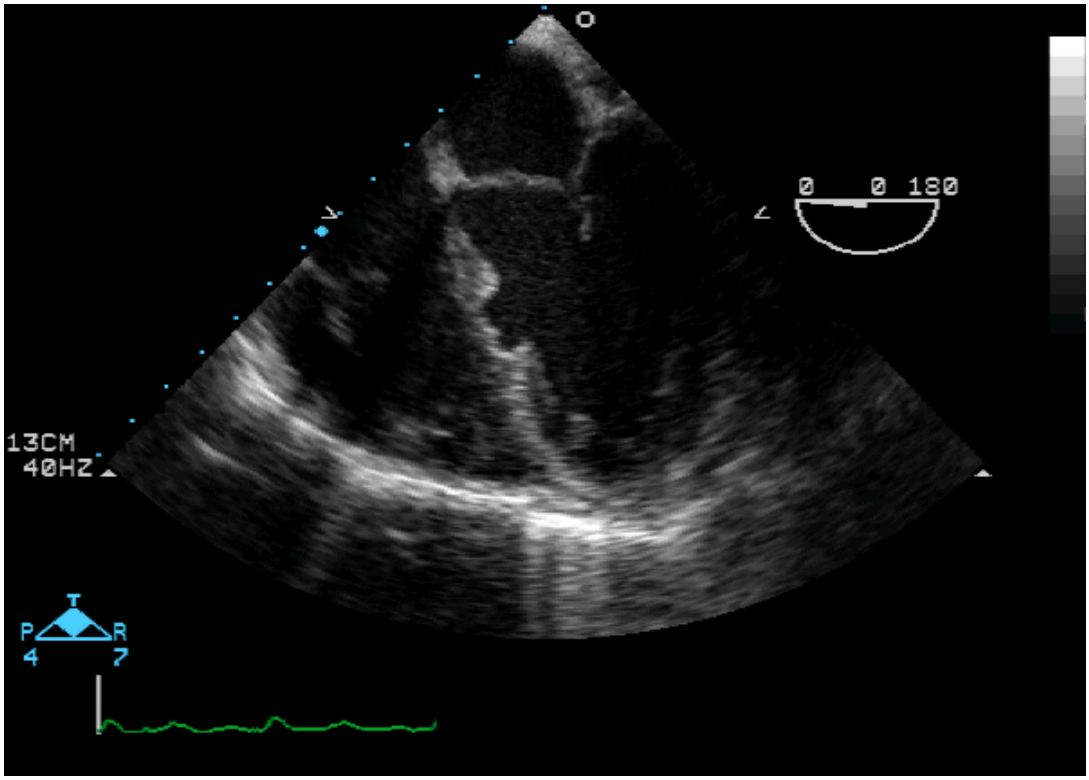
a. Thrombus
b. Fibroelastoma
c. Atrial myxoma
d. Metastatic lung carconima

75. The information below was obtained in a 82 year old male with a prominent systolic murmur and a slight diastolic murmur. Which of the following is true:



a. The deceleration time reflects the time for the ventricle and aorta to reach equilibrium
b. The higher the slope velocity the more severe the aortic insufficiency
c. The shorter the pressure half time the more severe the regurgitation
d. All of the above

76. A 36 year old male underwent a septal myectomy for hypertrophic obstructive cardiomyopathy. What is your concern after the procedure:



a. Ventricular septal defect
b. Atrial septal defect
c. Heart block
d. A and C

77. A 30-year-old, 70 kilogram, female patient suffers a cardiac arrest at an outside institution associated with massive aspiration upon intubation. She is placed on veno-arterial extracorporeal membrane oxygenation (ECMO) via a catheter in the right femoral vein and left femoral artery. Immediately prior to transfer she is placed on dopamine at 350 mcg/minute and milrinone at 0.75 mcg/kg/minute. Pulsatility returns to the left radial arterial line. Upon arrival at the MGH 2 blood gas analysis are obtained on 100% oxygen (Table). What is the likely diagnosis:

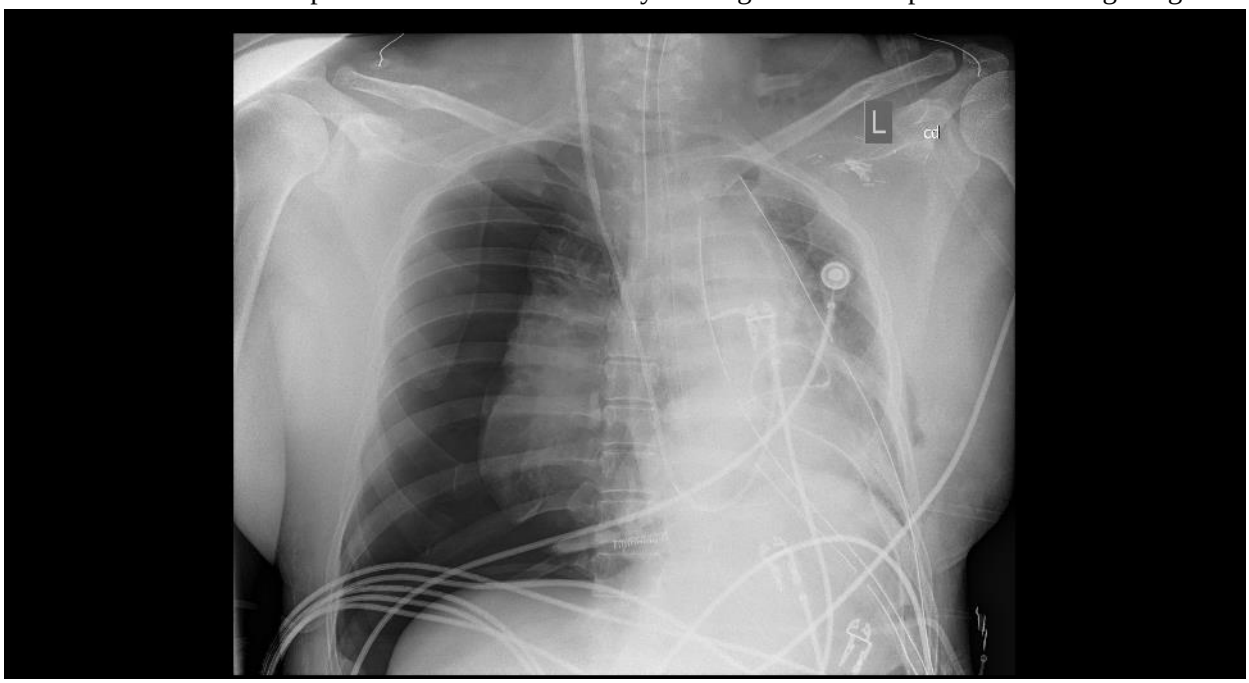
Location	**PaO_2**
ECMO circuit beyond oxygenator	457 mmHg
Right radial artery	35 mmHg

a. Failure of the membrane in the ECMO circuit
b. Inadequate FiO_2 from the wall source
c. Shunting of blood through the lungs
d. Methemoglobinemia

78. Bypass is initiated and optimal flows are established. The hemodynamic tracings below are obtained. Venous drainage is adequate. What is the most likely etiology of the tracing:

a. Impaired venous return
b. Hypervolemia
c. Inadequate flows
d. Aortic insufficiency

79. A 44 year old female is admitted to the surgical intensive care unit after a replacement of the descending aorta via a left thoracotomy. At the end of the case, the double lumen endotracheal tube is replaced with a single lumen tube over a bronchial blocker. Upon arrival in the intensive care unit her ventral venous pressure which was 5 is now 14 and continues to gradually increase to 19 while her blood pressure decreases. What is your diagnosis based upon the following image:



a. Simple pneumothorax
b. Tension pneumothorax
c. Left hemothorax

d. Pulmonary emboli

80. The event circled represents which phase of the cardiac cycle.

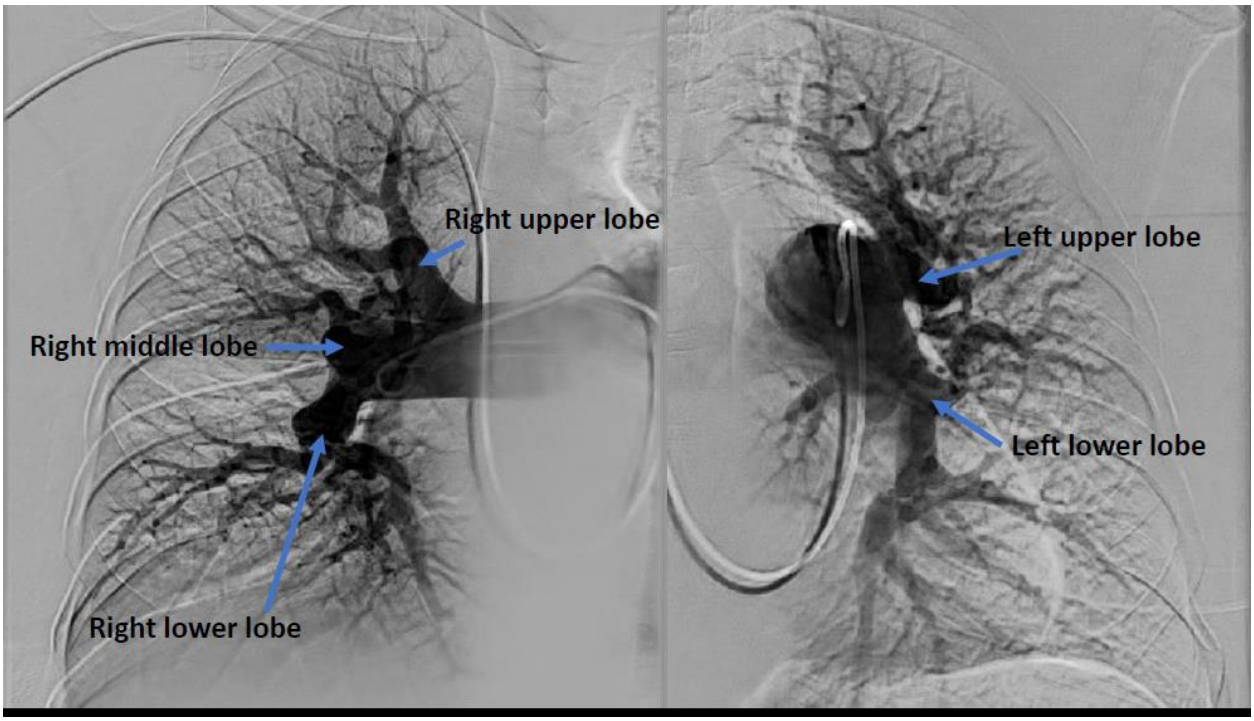
a. Isovolumic contraction
b. Isovolumic relaxation
c. Diastole
d. Diastasis

81. The event represented by the arrow is:
a. Venous flow into the right atrium
b. The “E” wave
c. A “V” wave
d. Atrial contraction and filling of the right ventricle

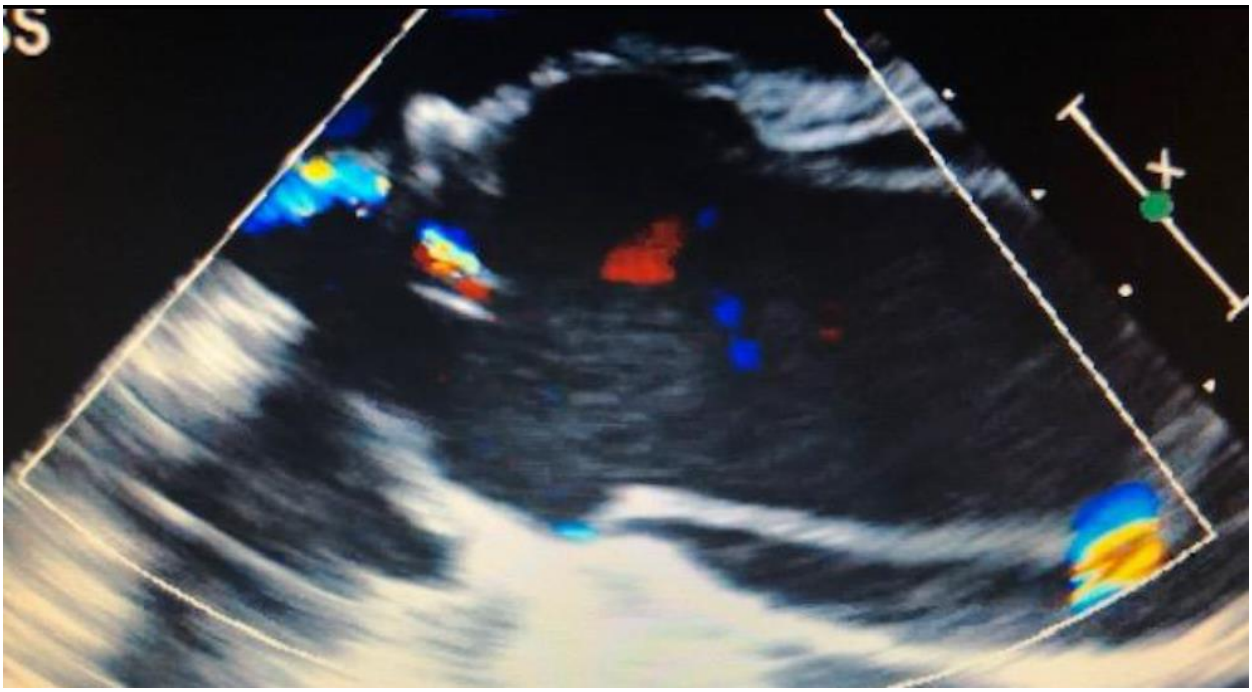
82. A 49 year old patient old patient presents with a dilated right ventricle, ascites, hepatic congestion. Her physical examination demonstrates jugular venous distention. The image below is consistent with

a. Severe pulmonary hypertension
b. Mitral regurgitation
c. Mitral stenosis
d. Severe tricuspid regurgitation

83. The “a” wave on a venous pressure tracing may correlates with
    a. Right atrial contraction
    b. Left atrial contraction
    c. The “a” wave on pulse wave across the mitral valve
    d. All of the above
84. The “x” descent on a venous pressure tracing correlates which echocardiography phenomenon”
    a. The “E” wave
    b. The “S” wave
    c. The “D” wave
    d. Tricuspid annular plane systolic excursion (TAPSE)
85. What finding is likely to be demonstrated associated with the following image?
    a. Shift of the interventricular septum to the right
    b. Shift of the interatrial septum to the right
    c. A dilated right ventricle.
    d. A filled left ventricle

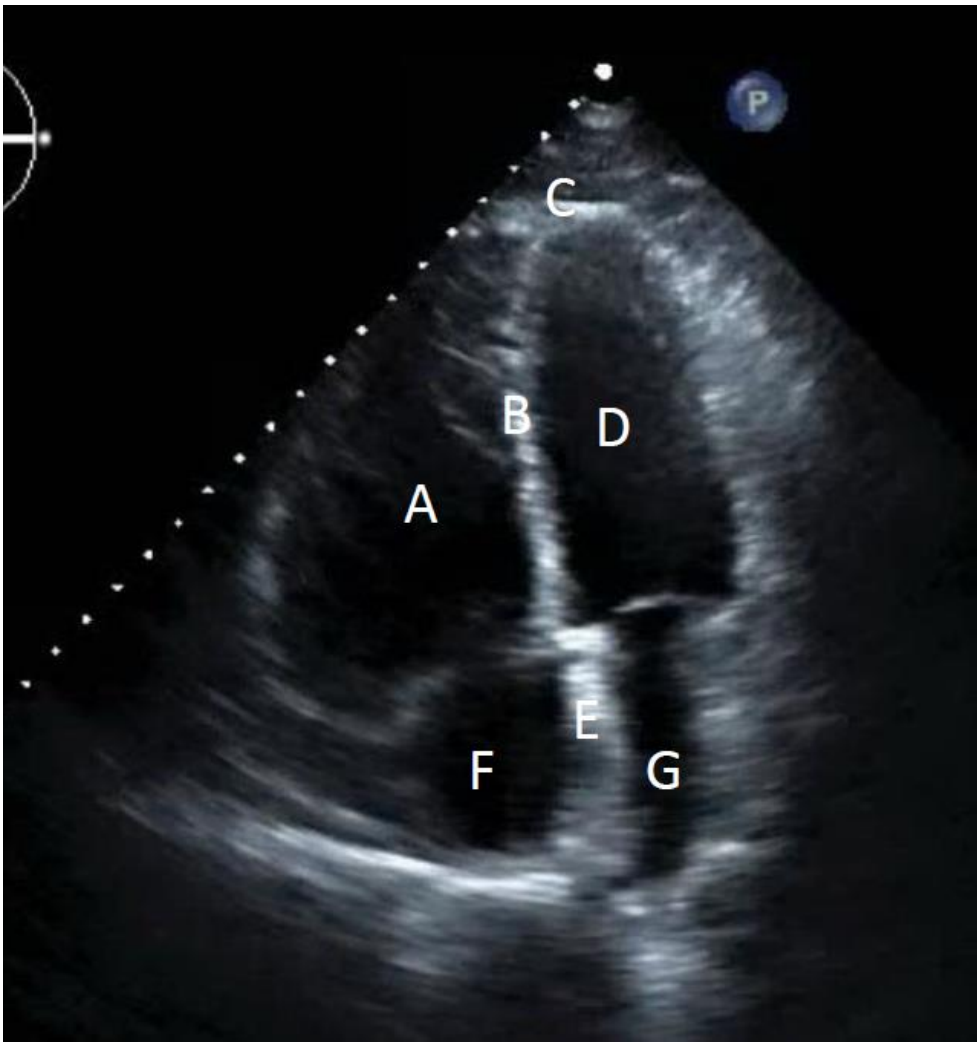


86. The following image is demonstrated just after initiation of bypass for coronary artery bypass grafting. What is the diagnosis?



a. Intramural hematoma
b. Iatrogenic aortic dissection
c. A normal aorta
d. Aortic atheroma but an otherwise normal aorta

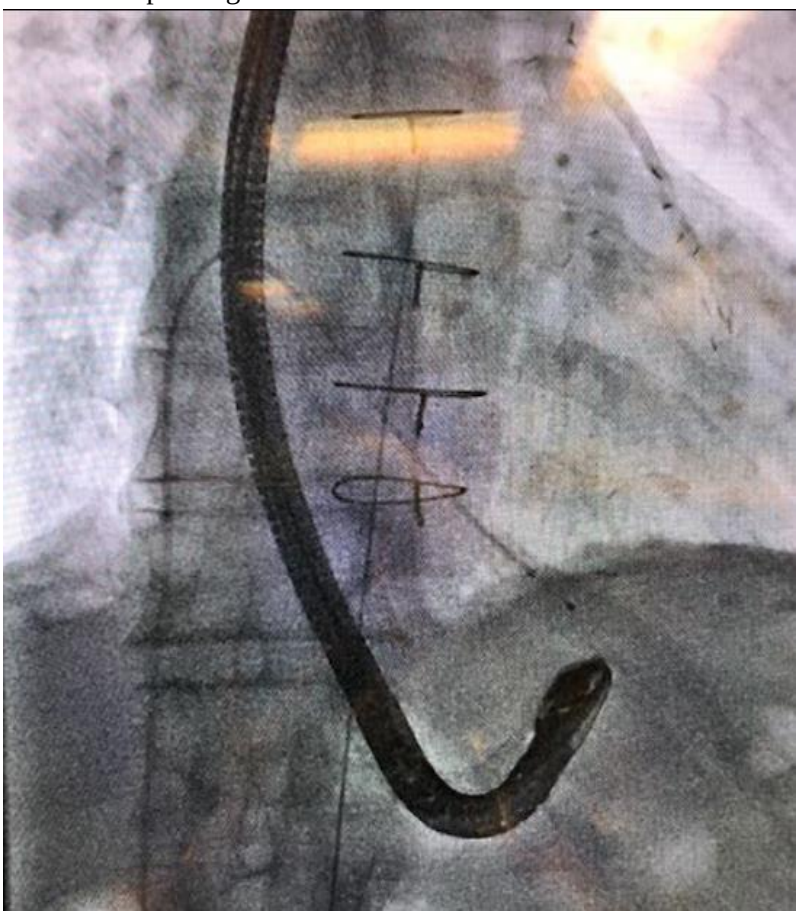
87. What is the appropriate action?
    a. Continue with planned procedure.
    b. Wean from cardiopulmonary bypass and assess.
    c. Initiate cardioplegia.
    d. Change operative plan to perform OPCAB.
88. What is the cavity indicated by “A”?
    a. Left ventricle
    b. Aorta
    c. Pulmonary artery
    d. Right ventricle



89. What condition is most likely to be present in the patient?
    a. Acute pulmonary emboli.
    b. Tricuspid stenosis
    c. Aortic stenosis
    d. Acute mitral regurgitation
90. What is indicated by “G”?

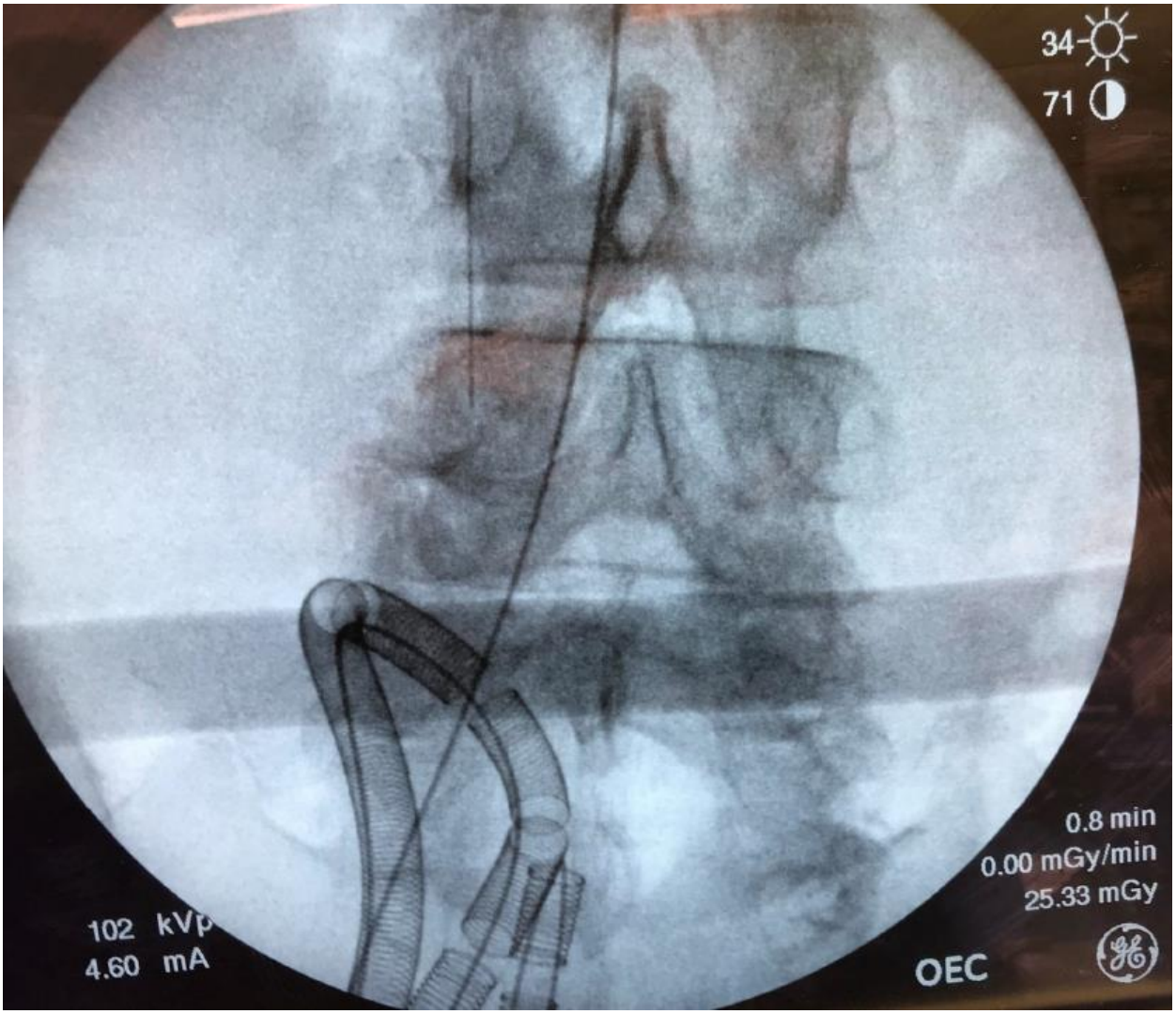
a. Left atrium
b. Right atrium
c. Superior venacava
d. Inferior venacava

91. What is indicated by “E”?
    a. Interatrial septim
    b. Interventricular septum
    c. Inferoseptal wall of the left ventricle
    d. Lateral wall of the left ventricle
92. Based upon the following fluoroscopy image, where are ECHO images being obtained?
    a. Mid-esophageal
    b. Transgastric
    c. Upper esophageal
    d. Deep transgastric

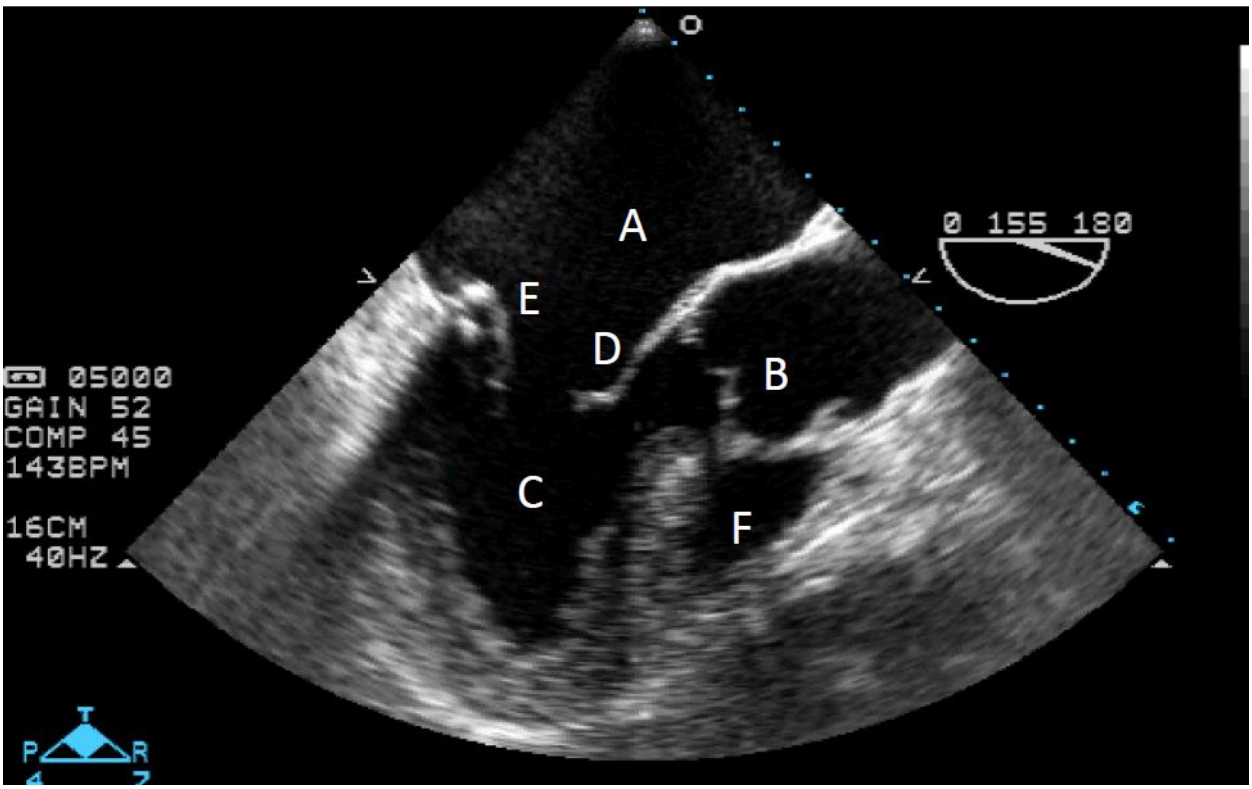


93. Which measure is most accurately obtained via this view?
    a. Gradient across the atrial septum.
    b. Gradient across the tricuspid valve
    c. Gradient across the aortic valve.
    d. Peak flow velocity in the pulmonary veins.
94. What is the complication observed in this image?
    a. Coiling of a femoral venous line in the groin.

b. Coiling of the venous line in the right atrium
c. Arterial line misplacement
d. Pneumothorax



95. What is the following image?



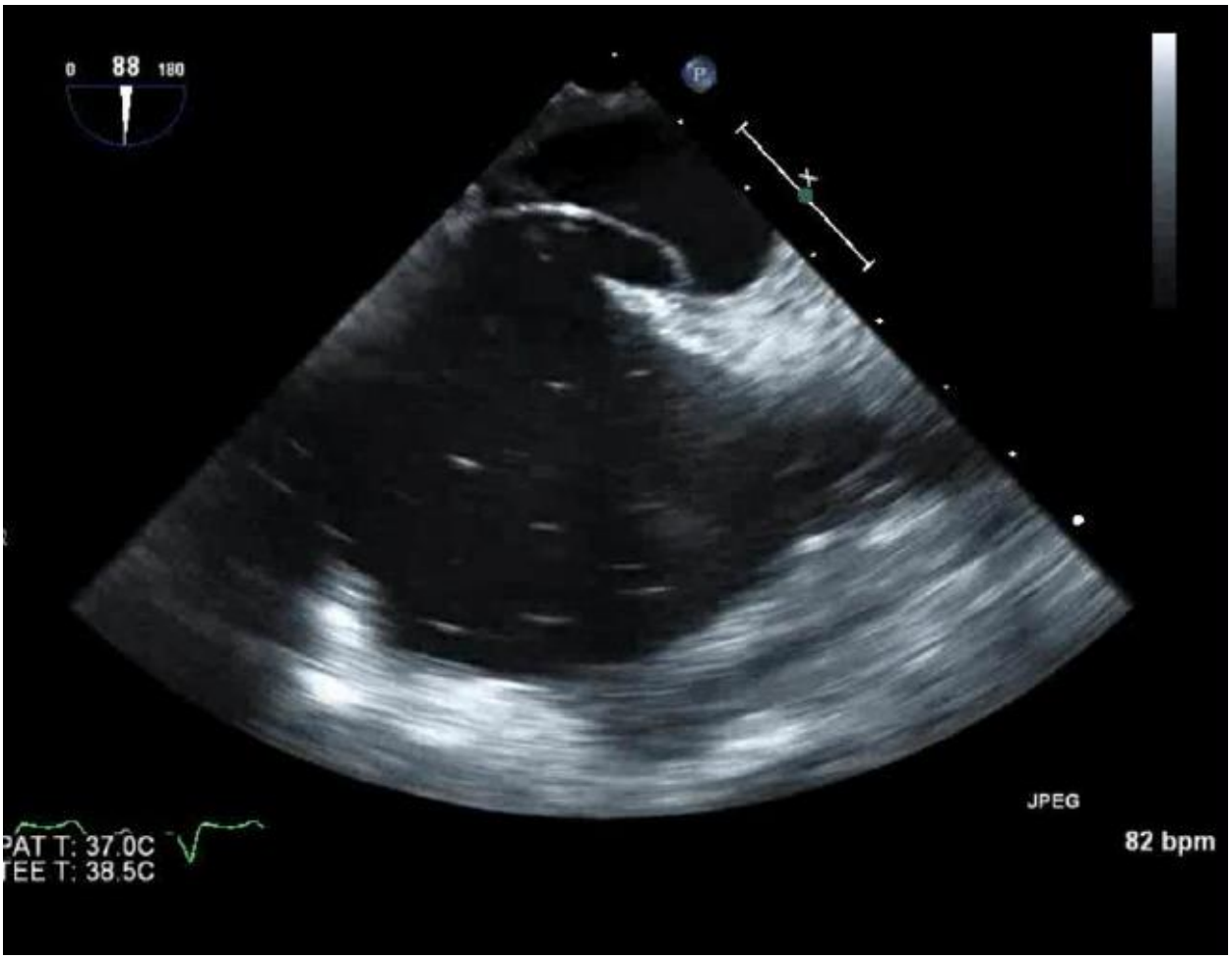
a. Mid esophageal two chamber
b. Mid esophageal 3 chamber
c. Mid esophageal aortic valve short axis view
d. Deep transgastic view

96. What is “A”?
    a. Left atrium
    b. Right atrium
    c. Left ventricle
    d. Right ventricle
97. What is “F”?
    a. Left atrium
    b. Right atrium
    c. Right ventricle
    d. Pulmonary artery
98. What is indicated by “B”?
    a. Aortic root
    b. Left atrium
    c. Pulmonary artery
    d. Descending thoracic aorta
99. A patient is noted to have a dilated right atrium and right ventricle along with severe tricuspid regurgitation and mitral regurgitation. The patient presents for a tricuspid annular ring and repair of the mitral valve. A TEE probe is placed and the following abnormality is noted. What is the diagnosis?

a. Primus ASD
b. Sinus venosus ASD
c. Coronary sinus ASD
d. Patent foramen ovale

100. What other abnormality is likely to be found?
a. Anomalous return of the pulmonary veins
b. Cleft in the mitral valve
c. Aortic stenosis
d. Aortic coarctation

101. What is demonstrated in the image?
a. Atrial septal shift to the left
b. Aortic dissection
c. Pleural effusion
d. Pericardial effusion

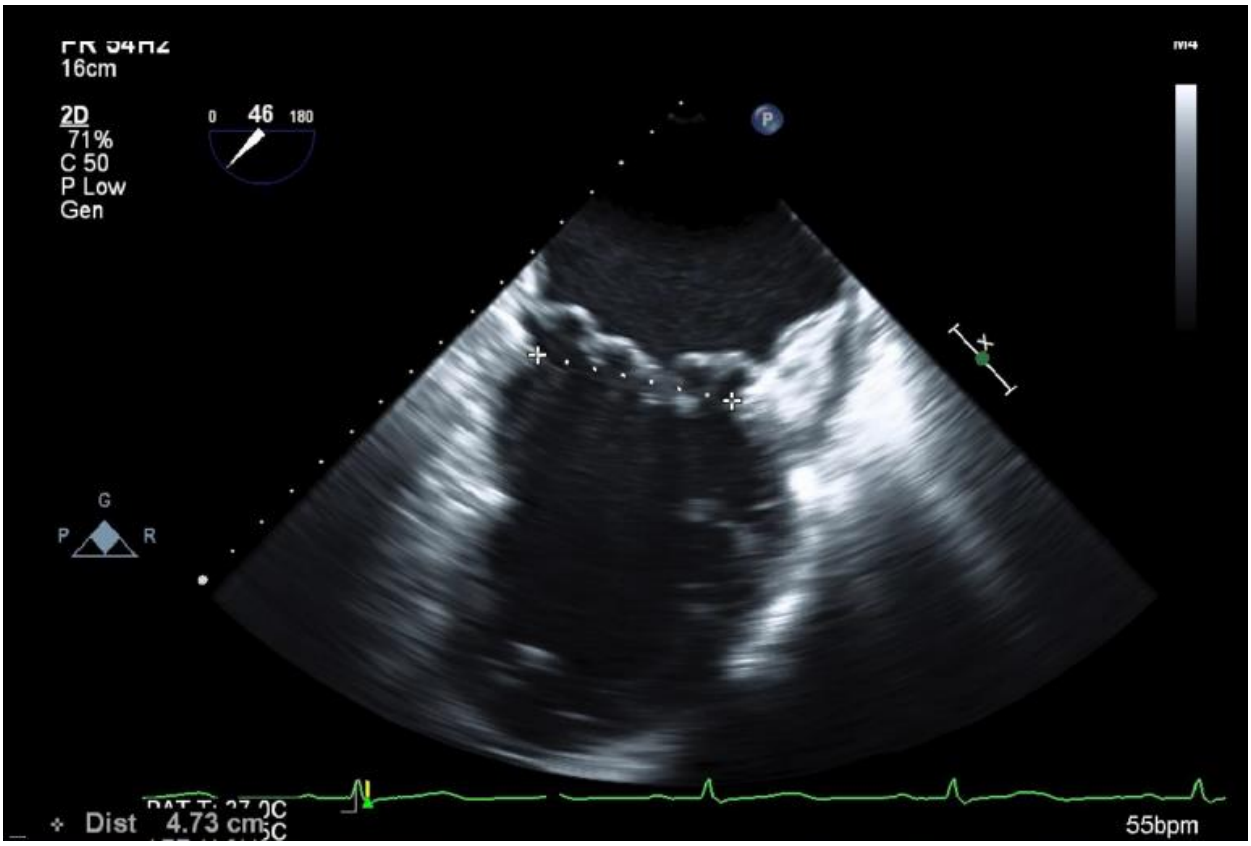


102. The patient with the transgastric view of the left ventricle below will likely have which of the following findings?

a. Very short deceleration time
b. Significantly increased E/A ratio
c. Left atrial volume > 34 ml/m^2
d. All of the above

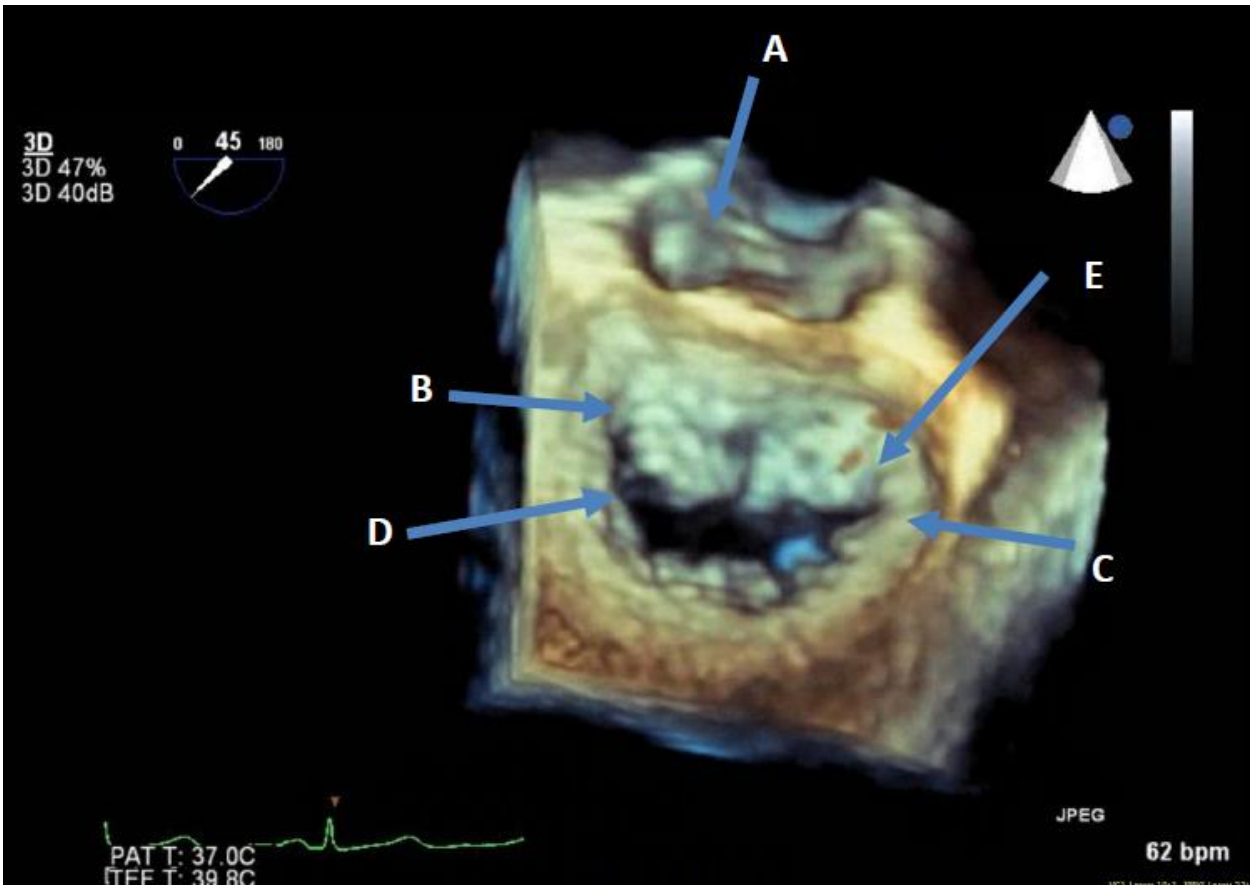
103. What is demonstrated in the midesophageal 2 chamber view below?

a. Flail mitral leaflet
b. Mitral stenosis
c. Barlow's valve
d. Normal left atrial size.



104. What is labeled “A” below?

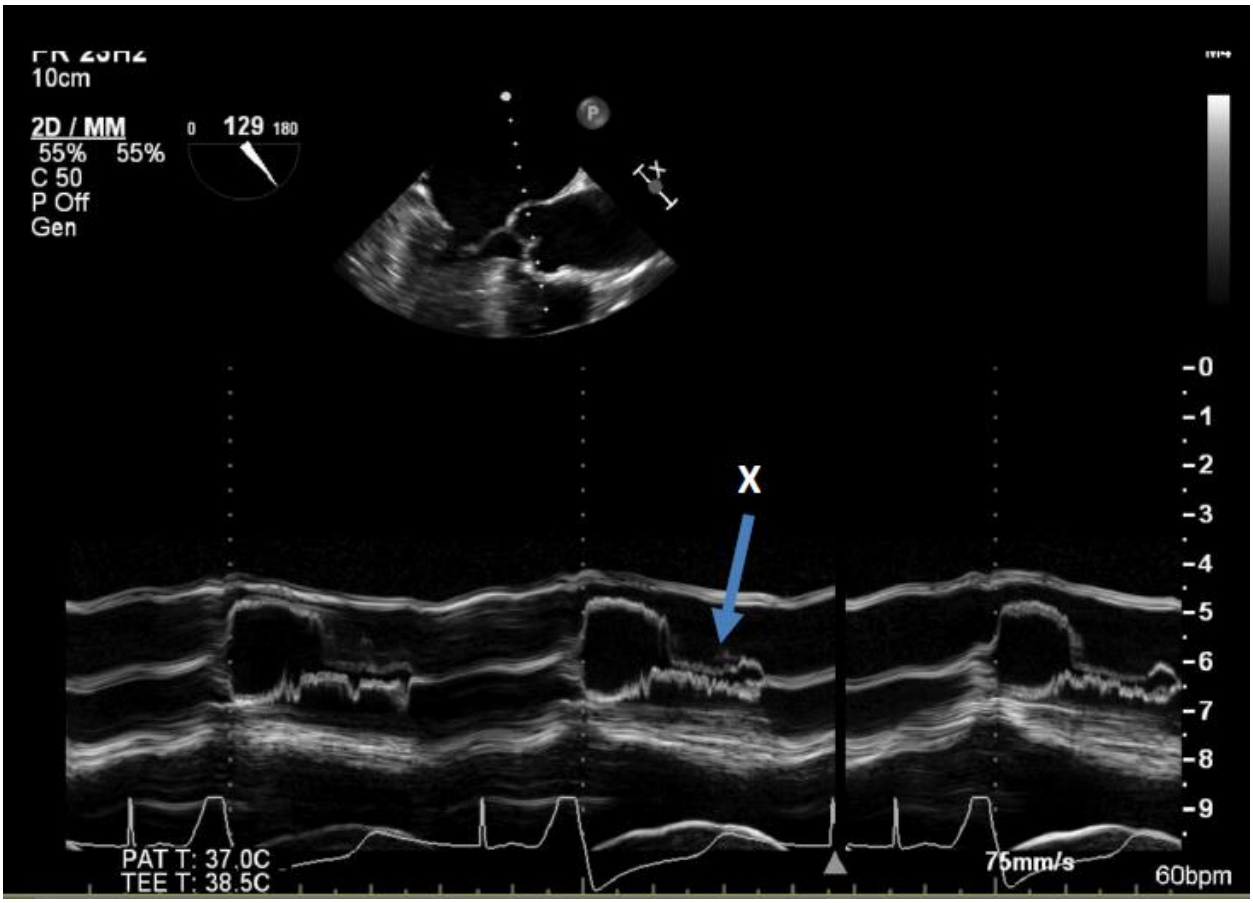
a. Pulmonary valve
b. Aortic valve
c. Atrial septum
d. Left atrium



105. What is labeled “B”?
   a. Anterolateral commissure
   b. Posteromedial commissure
   c. Intervalvular fibrosa
   d. P2 mitral leaflet

106. What is labeled “E”?
   a. P1
   b. A2
   c. P3
   d. A3

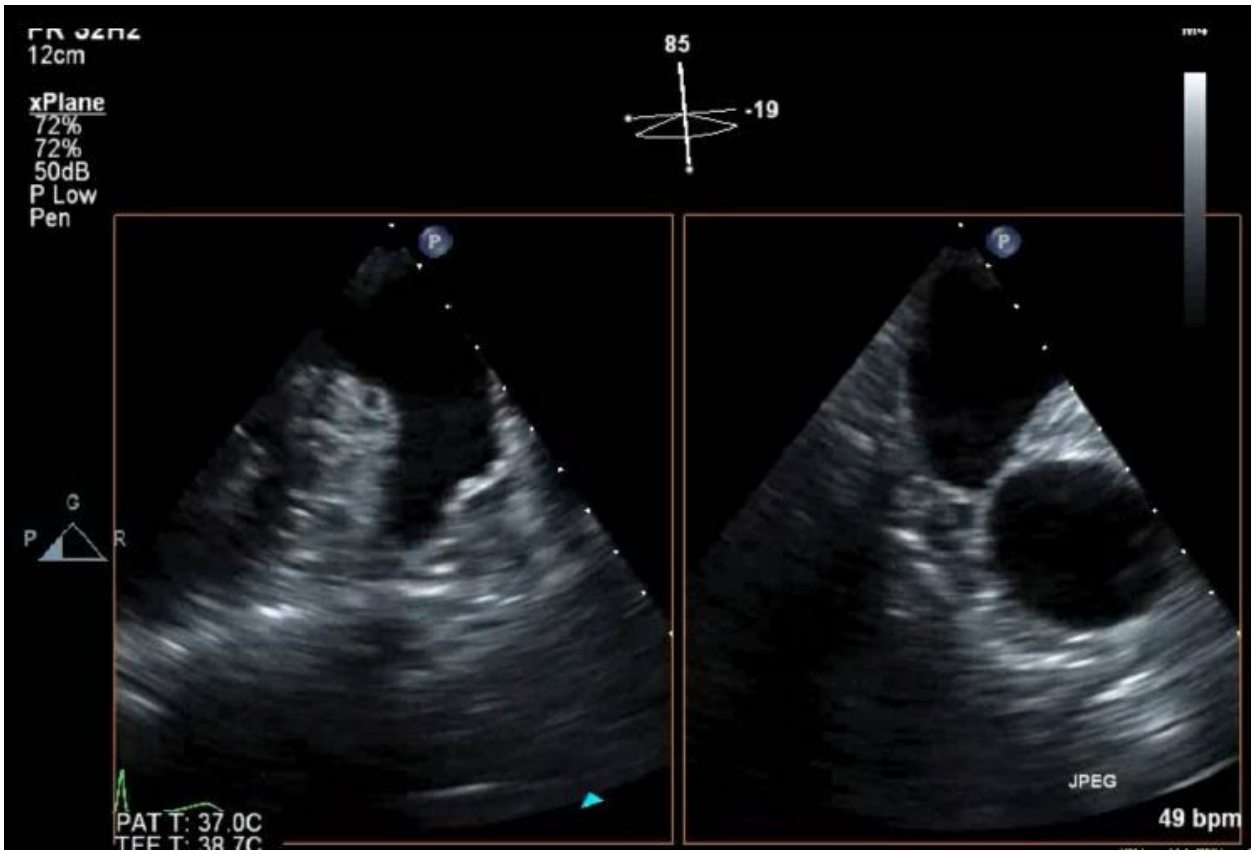
107. What is identified by “X”?
   a. Fluttering of the aortic valve leaflets
   b. Aortic stenosis
   c. Narrowing of the right ventricular outflow tract
   d. Movement of the atrial septum



108. What condition is this seen with?
   a. Hypertrophic obstructive cardiomyopathy (MOCM) and systolic anterior motion of the aortic valve (SAM)
   b. Aortic stenosis
   c. Bradycardia
   d. Increased afterload

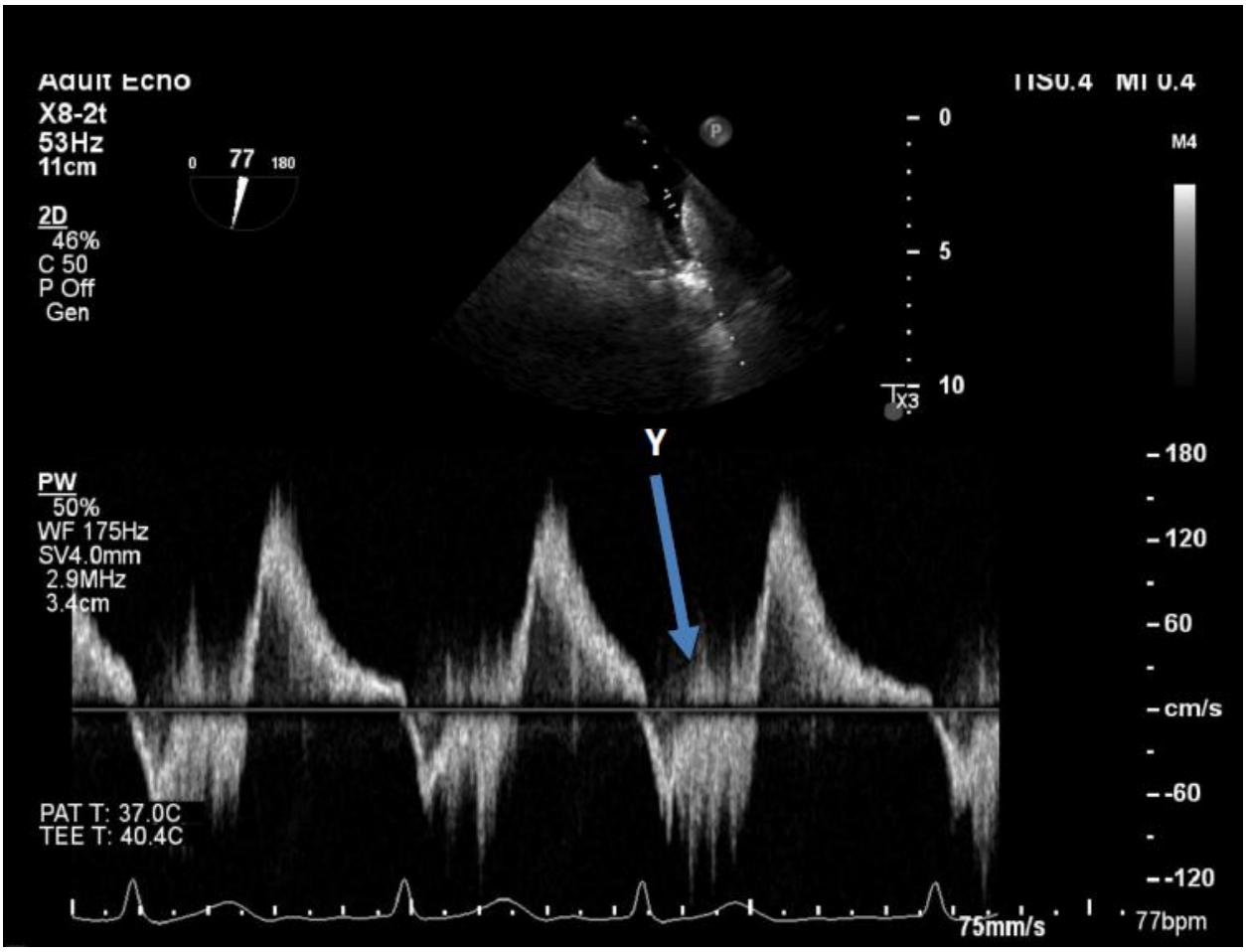
109. What is an appropriate agent for management of the condition?
   a. Epinephrine
   b. Milrinone
   c. Dopamine
   d. Phenylephrine

110. What is the structured being interrogated in this image?
   a. Pleural space
   b. Pericardial space
   c. Left atrial appendage
   d. Pulmonary artery

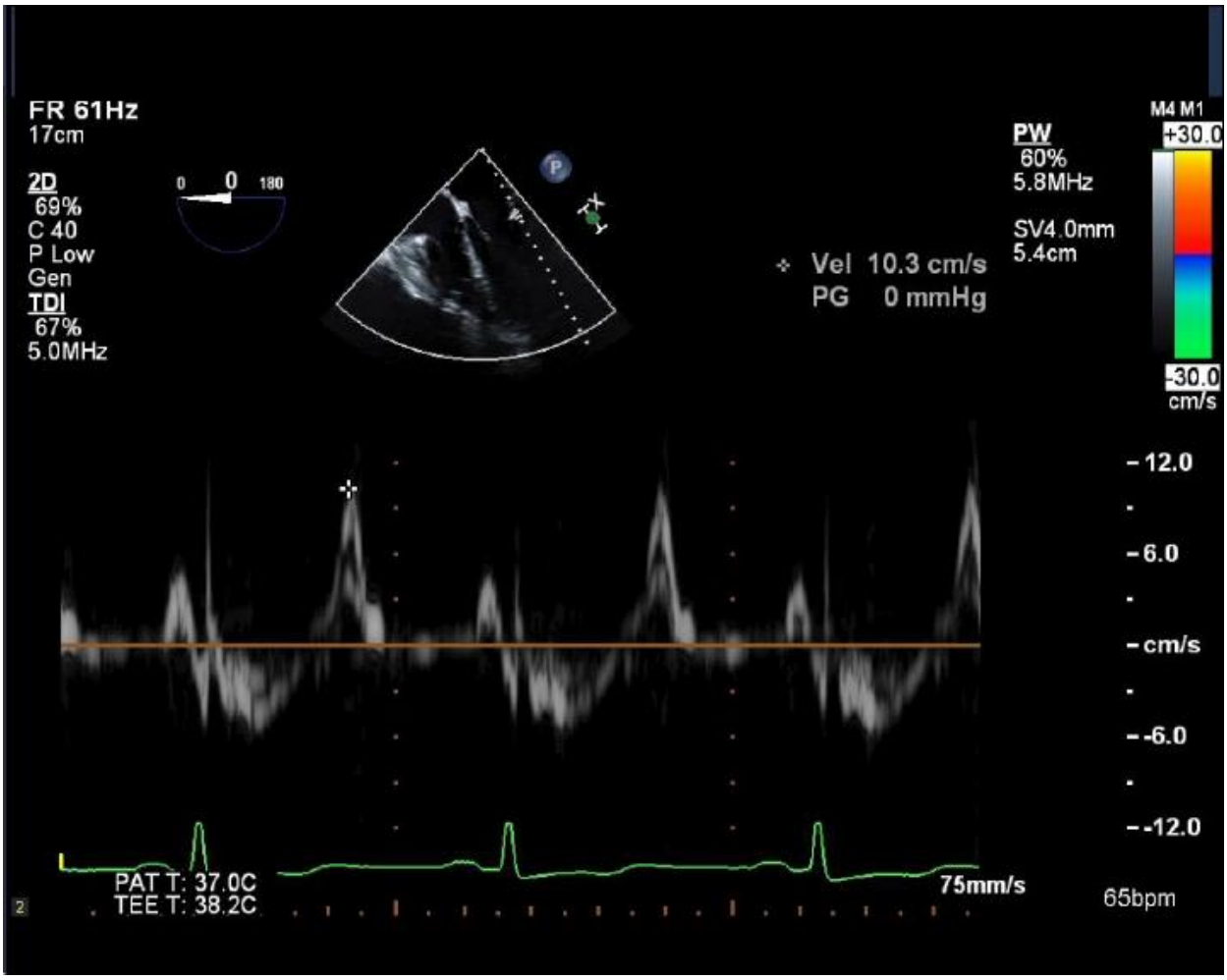


111. The orange color in the image indicates what?
   a. Blood flow away from the ultrasound probe
   b. Turbulent flow
   c. Blood flow toward the ultrasound probe.
   d. Stagnant blood

112. What pathologic state would generate "Y"?
   a. Diastolic dysfunction
   b. Mitral regurgitation
   c. Tricuspid regurgitation
   d. Aortic stenosis



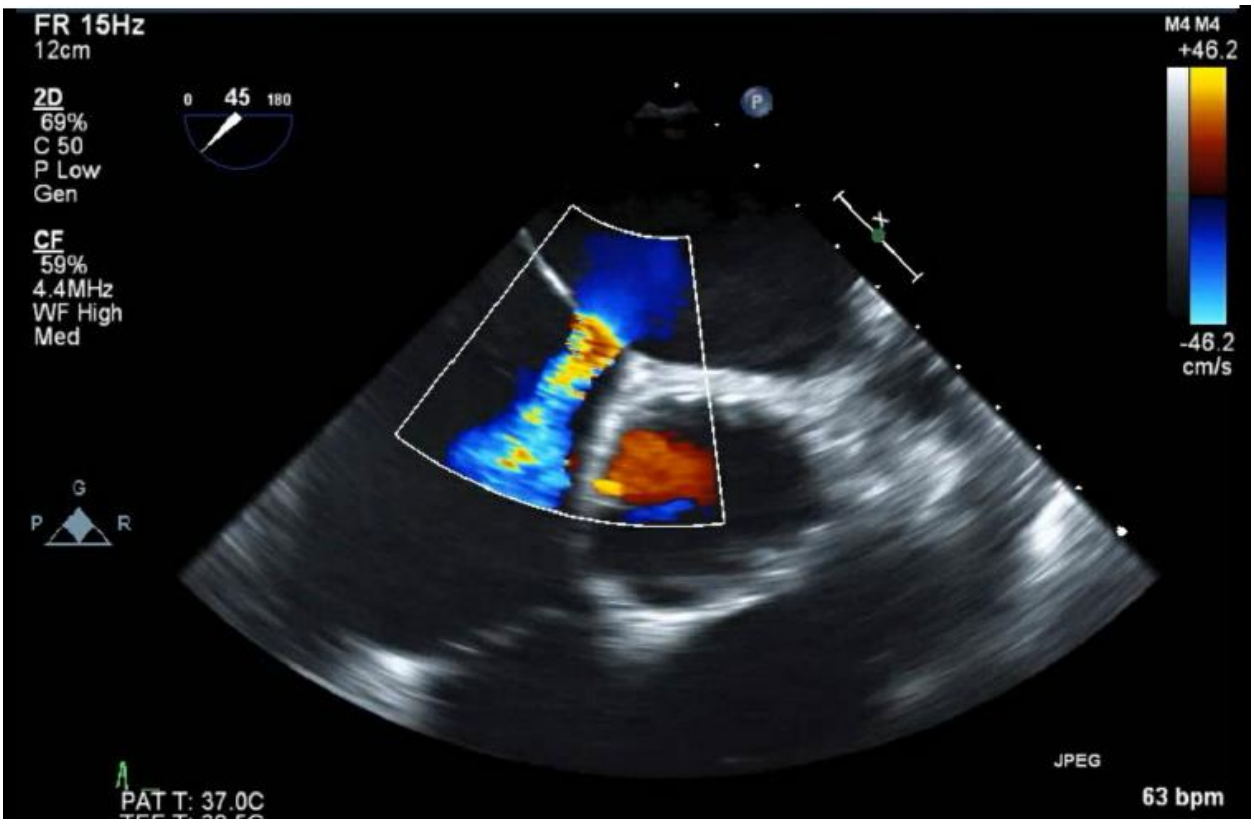
113. The image demonstrates what?



a. Assessment of the gradient across the aortic valve.
b. Assessment of flow into the left atrial appendage
c. Assessment of gradient across the mitral valve
d. Assessment of the lateral mitral annulus for diastolic function

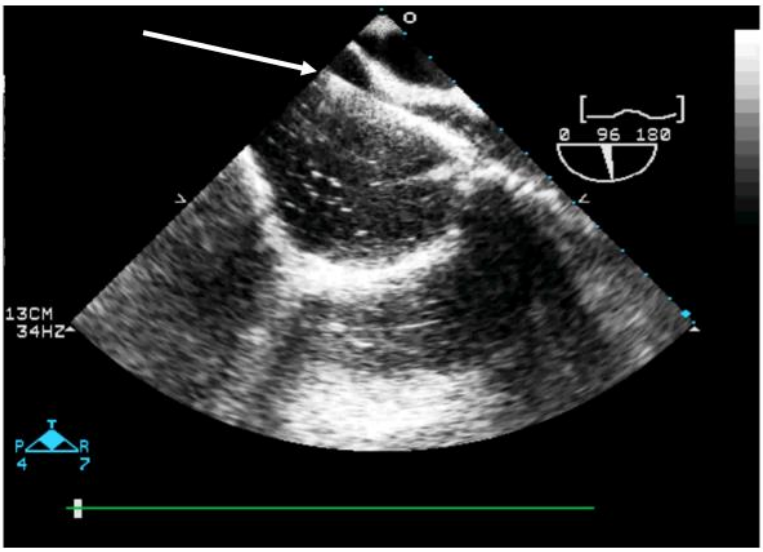
114. The image below demonstrates what?

a. Secundum atrial septal defect
b. Primum atrial septal defect
c. Blood flow from right to left
d. Normal atrial septum



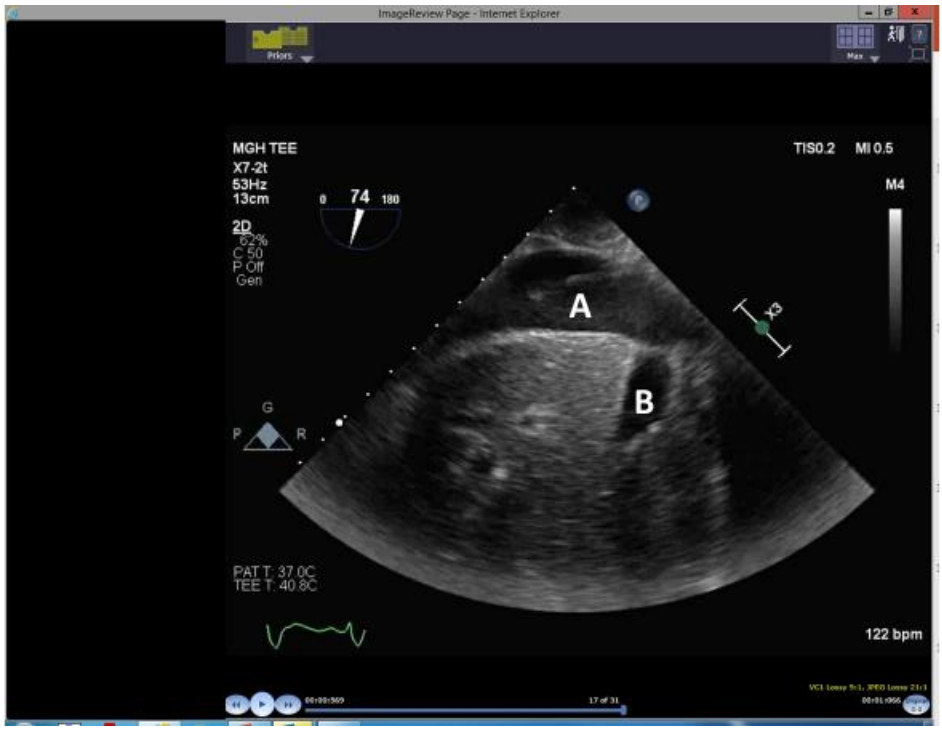
115. TEE is performed during cannulation for ECMO. The following image is obtained. What is the interpretation?

a. The guide wire is located in the aorta
b. The guide wire is noted in the inferior venacava and passes into the superior venacava.
c. No wire is noted
d. The image is inadequate to determine whether there is a wire present



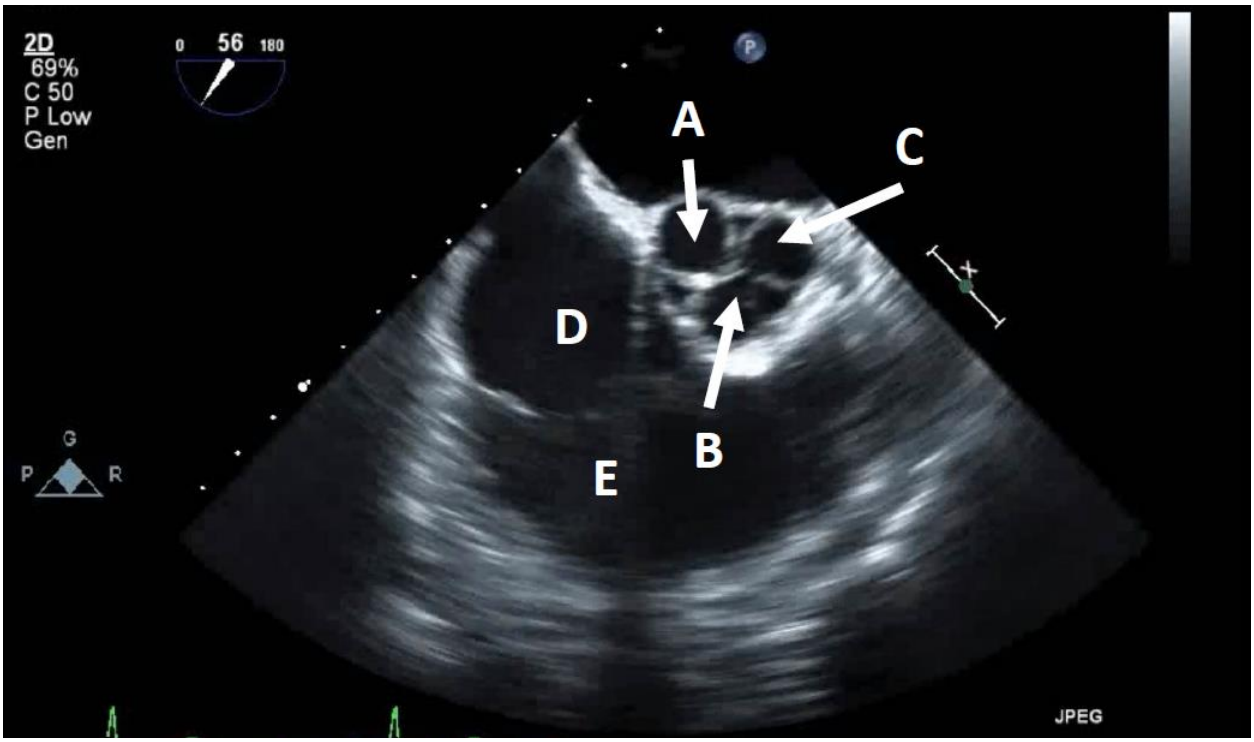
116. Which of the following statements is correct?
   a. The dimensionless index is utilized for assessment of mitral stenosis
   b. The dimensionless index reflects flow via the pulmonary veins.
   c. A dimensionless index grater than 1 indicated aortic stenosis
   d. A dimensionless index less than 0.25 indicates significant aortic stenosis

117. What structure is labeled “A” in the image below?
   a. Coronary sinus
   b. Descending aorta
   c. Pulmonary artery
   d. Hepatic inferior venacava



118. What structure is labeled “B” in the image above?
   a. Left brachiocephalic vein
   b. Hepatic vein
   c. Left pulmonary artery
   d. Inferior venacava

119. What view is demonstrated in the image fellow?
   a. Transgastric view
   b. Midesophageal 3 chamber view
   c. Right ventricle inflow-outflow view
   d. Upper esophageal view



120. What is labeled “A” in the image above?
   a. Left coronary leaflet
   b. Right coronary leaflet
   c. Non-coronary leaflet
   d. Anterior leaflet of the pulmonary valve.

121. What is labeled “B” in the image above?
   a. Left coronary leaflet
   b. Right coronary leaflet
   c. Non-coronary leaflet
   d. Anterior leaflet of the pulmonary valve.

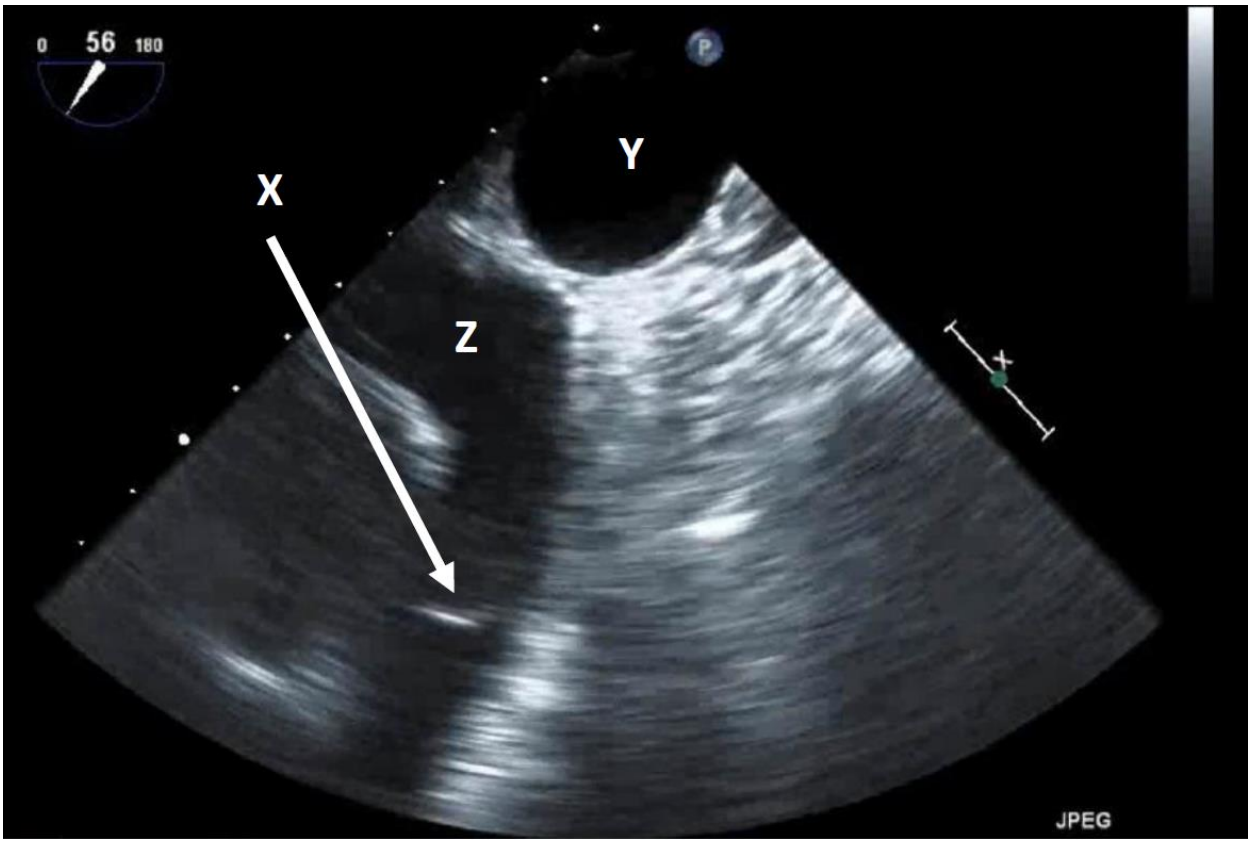
122. What is labeled “C” in the image above?
   a. Left coronary leaflet
   b. Right coronary leaflet
   c. Non-coronary leaflet
   d. Anterior leaflet of the pulmonary valve.

123. What is labeled “D” in the image above
   a. Left atrium
   b. Right atrium
   c. Inferior venacava
   d. Right ventricle

124. What is labeled “E” in the image above?
   a. Left coronary leaflet
   b. Right coronary leaflet
   c. Non-coronary leaflet

d. Anterior leaflet of the pulmonary valve.

125. What is labeled "X" in the image below?
   a. Aortic valve
   b. Thebessian valve
   c. Eustascian valve
   d. Pulmonary valve
   e. Atrial septum

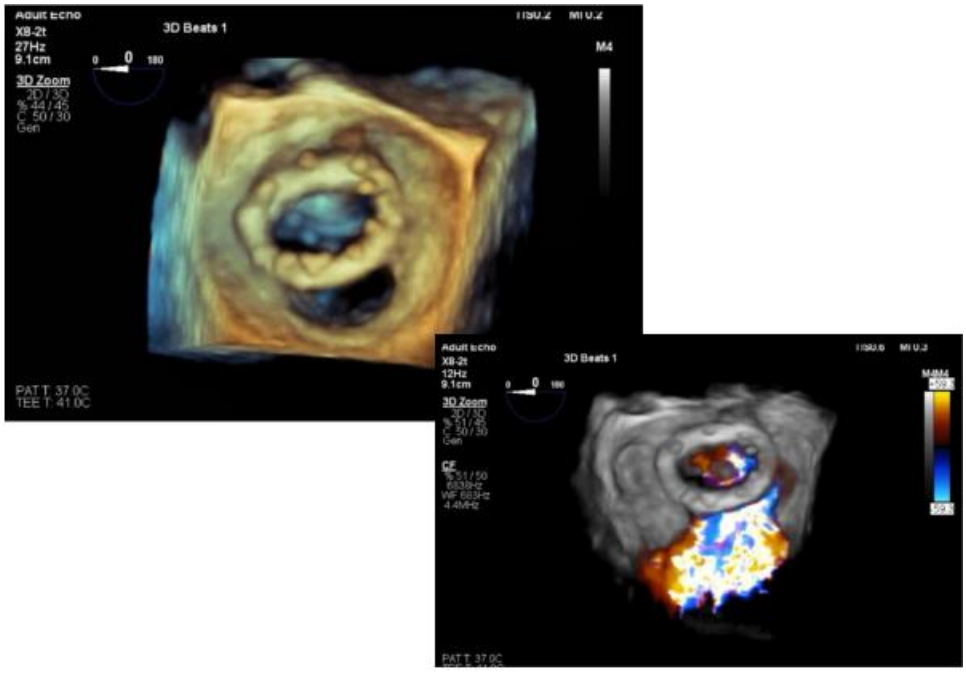


126. What is labeled "Z" in the image above?
   a. Ascending aorta
   b. Right pulmonary artery
   c. Inferior venacava
   d. Right atrium

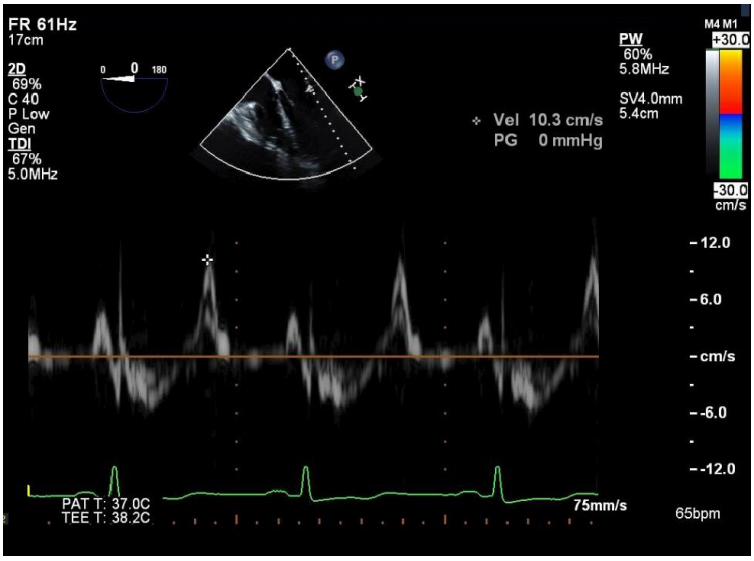
127. What is labeled "Y" in the image above?
   a. Descending aorta
   b. Hepatic IVC
   c. Pleural effusion
   d. Left atrium

128. A 70 year old female with a history of mitral regurgitation repaired with a mitral ring presents with fatigue and a new onset systolic murmur. What is the diagnosis?
   a. Dehiscence of the mitral annular ring.
   b. Perforation of the anterior leaflet of the mitral valve

c. Ventricular septal defect
d. Aortic insufficiency

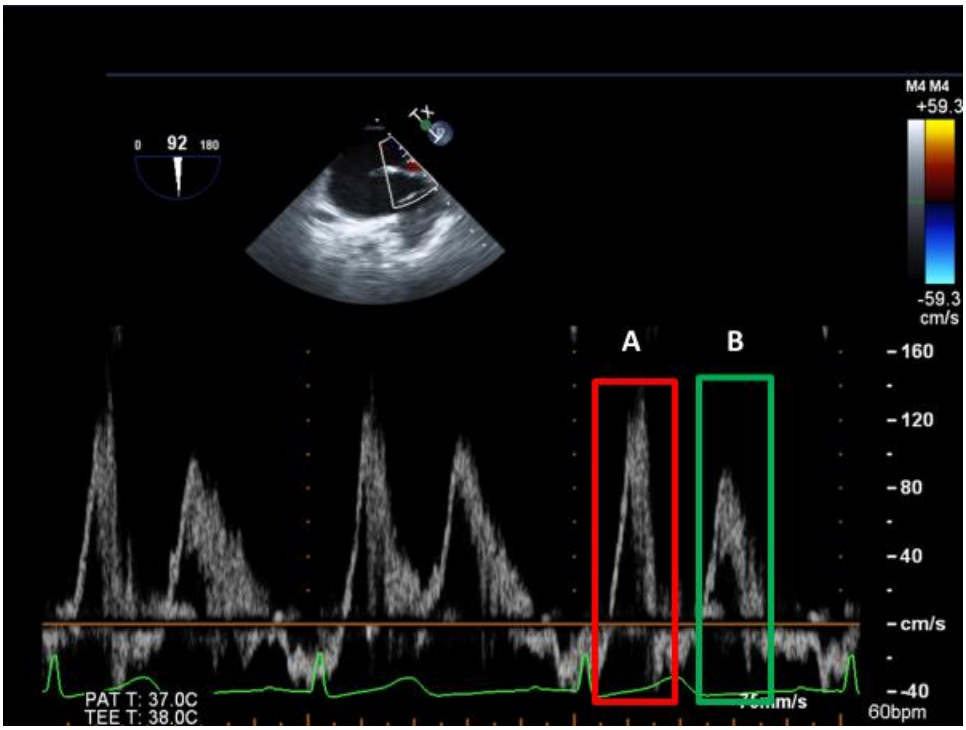


129. What is being interrogated in the image below?
a. Velocity of the medial mitral annulus during systole
b. Gradient of aortic stenosis
c. Velocity of the lateral mitral annulus during diastole to determine diastolic function
d. Pulmonary vein flow



130. What structure is being interrogated in the image below?
a. Left atrial appendage
b. Intraatrial septum

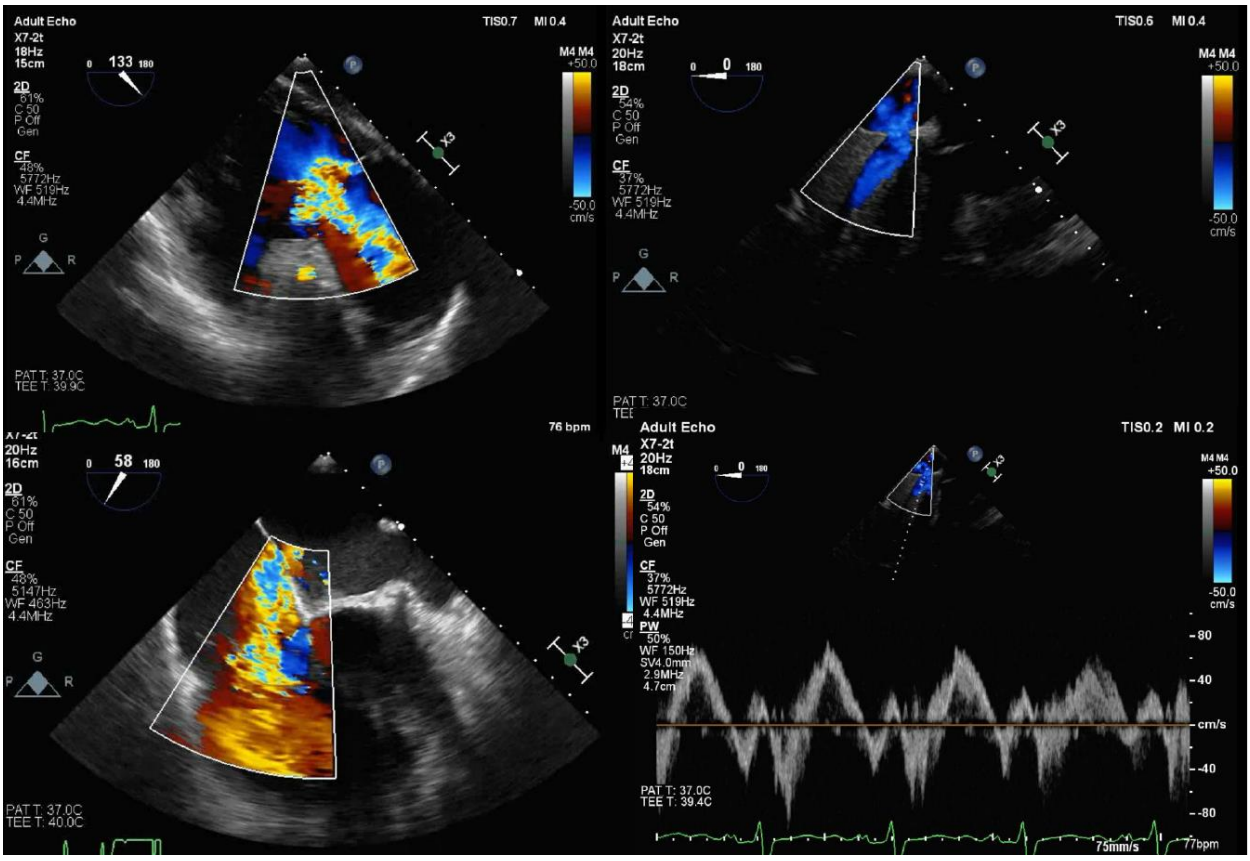
c. Left upper pulmonary vein
d. Right upper pulmonary vein



131. What is demonstrated by "A" (red box)?
a. Pulmonary vein flow during systole.
b. Pulmonary vein flow during diastole
c. Transmitral "E" wave
d. Transmitral "A" wave

132. What is labeled "B" (green box) above?
a. Pulmonary vein flow during systole.
b. Pulmonary vein flow during diastole
c. Transmitral "E" wave
d. Transmitral "A" wave

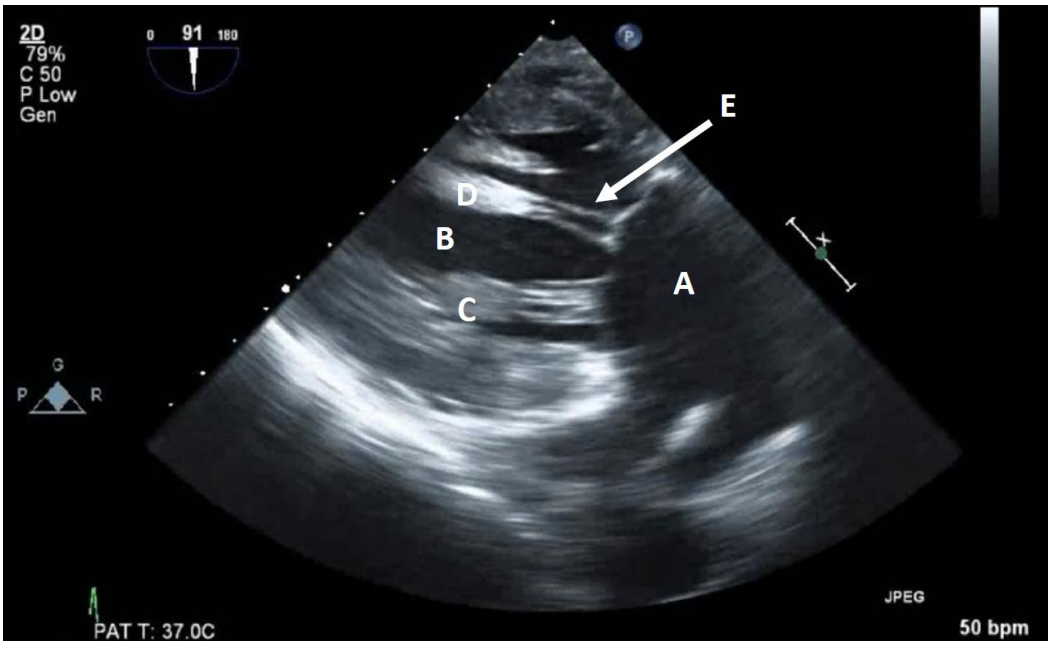
133. A patient presents with ascites, fatigue, and jugular venous distension. What is the diagnosis based upon the 4 images below?
a. Tricuspid stenosis
b. Mild tricuspid regurgitation
c. Atrial septal defect
d. Severe tricuspid regurgitation



134. What is the image below?

a. Transgastric 2 chamber view
b. Deep transgastric view
c. Mid esophageal 2 chamber view
d. Transgastric RV long axis view

135.



136. What is indicated by "A" in the image above?
   a. Left atrium
   b. Right atrium
   c. Left ventricle
   d. Right ventricle

137. What is indicated by "B" in the image above?
   a. Left atrium
   b. Right atrium
   c. Left ventricle
   d. Right ventricle

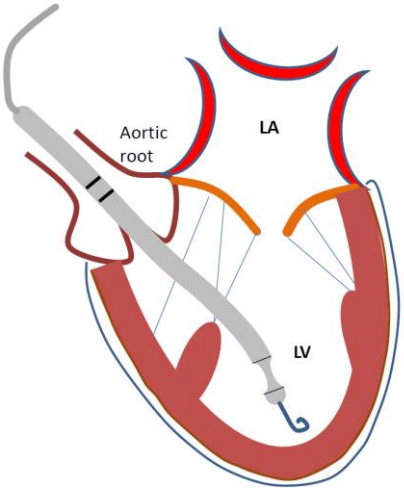
138. What is indicated by "C" in the image above?
   a. Anterolateral papillary muscle
   b. Posteromedial papillary muscle
   c. Moderator band
   d. False cord

139. What is indicated by "D" in the image above?
   a. Anterolateral papillary muscle
   b. Posteromedial papillary muscle
   c. Moderator band
   d. False cord

140. What is indicated by "E" in the image above?
   a. False cord
   b. Chordae tendinae
   c. Moderator band
   d. Atrial septum

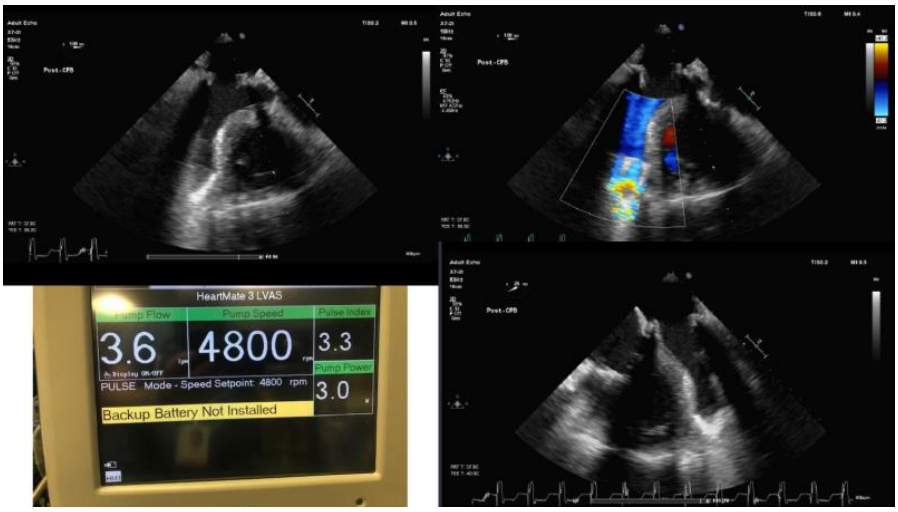
141. The appropriate position of the Impella inflow port in the left ventricle from the annulus of the aortic valve is how many centimeters?

a. < 2.5 cm
b. 2.5-3.5 cm
c. 3.5-4.5 cm
d. More than 4.5 cm



142. A patient is undergoing placement of a Heartmate III left ventricular assist device. The patient is hypotensive and flows cannot be increased without a suction event. What is the likely diagnosis?

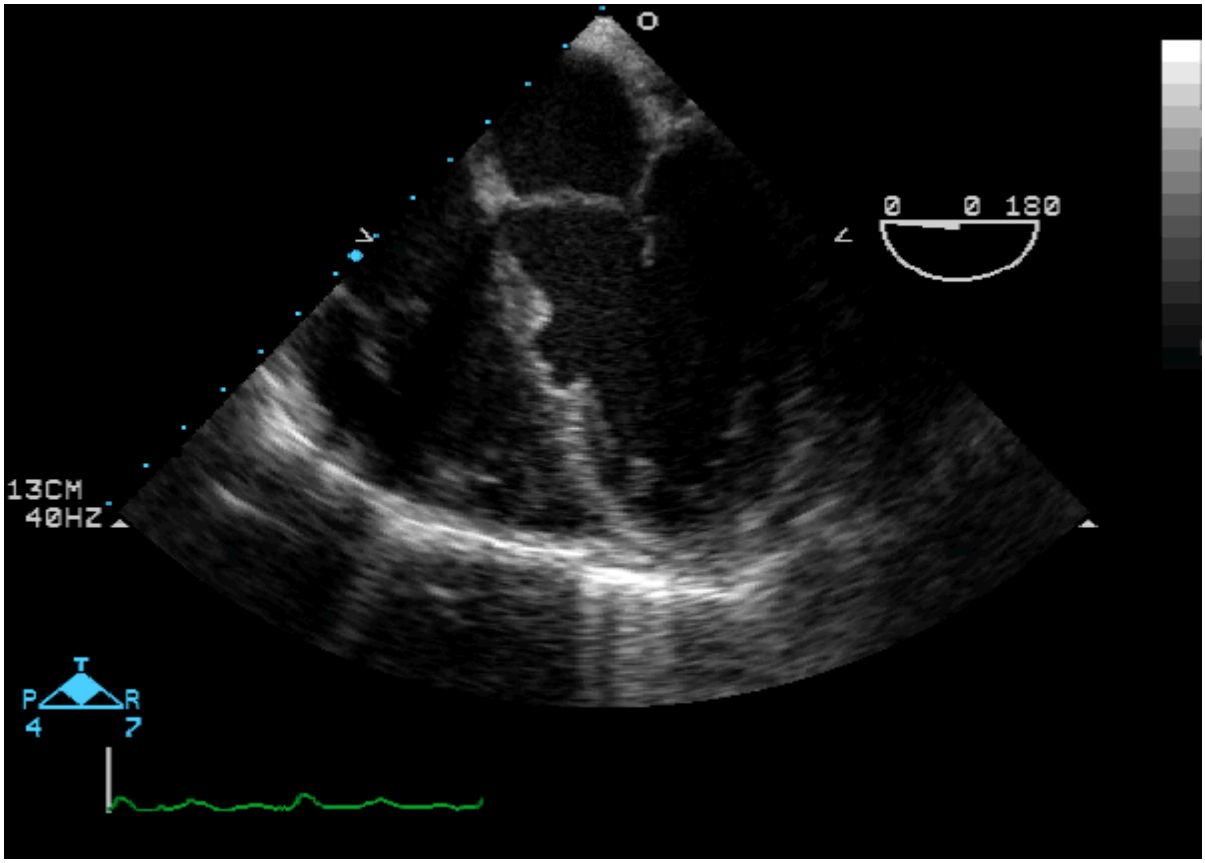
a. Systemic hypovolemia
b. Tamponade
c. Right ventricular failure
d. Aortic insufficiency



143. A 47 year old female has undergone a septal myectomy for hypertrophic obstructive cardiomyopathy. After cardiopulmonary bypass the following image is obtained. What condition should be evaluated further?

a. Atrial septal defect

b. Presence of a ventricular septal defect
c. Presence of a ventricular clot
d. Evidence of a lateral wall motion abnormality



144. Which of the following would indicate the presence of a coronary fistula after septal myectomy rather than a ventricular septal defect?
   a. A low velocity, diastolic jet of blood flow that is perpendicular to the wall.
   b. A high velocity jet of systolic flow that is perpendicular to the wall
   c. A low velocity systolic jet parallel to the wall
   d. None of the above

145. A 24 year old female patient presets in cardiogenic shock and complete heart block. The family notes that she has had 3-5 days of malaise. Echocardiogram shows normal left ventricular end diastolic diameter with an ejection fraction of 12% with an intracardiac thrombus. Walls are symmetrically thickened walls with a pericardial effusion. Which condition is most likely?
   a. Acute non-fulminant myocarditis
   b. Amyloidosis
   c. Acute right coronary dissection
   d. Fulminant myocarditis

146. A 42 year old male patient presents with shortness of breath, pulmonary edema, and fatigue. He notes that he was previously very healthy until he has viral symptoms about 4-5 months ago and has never fully returned to health. Echocardiogram shows a dilated left ventricle with thin walls. What is the diagnosis?

a. Acute fulminant myocarditis
b. Acute non-fulminant myocarditis
c. Amyloidosis
d. Danon Disease

147. Clinical ultrasound is performed with what frequency?
a. 1-10 hz
b. 10-20 Hz
c. 20-20,000 Hz
d. 2-10 MHz

148. What is the speed of sound in tissue?
a. 1540 c/sec
b. 1540 mm/sec
c. 1540 m/sec
d. 1450 km/sec

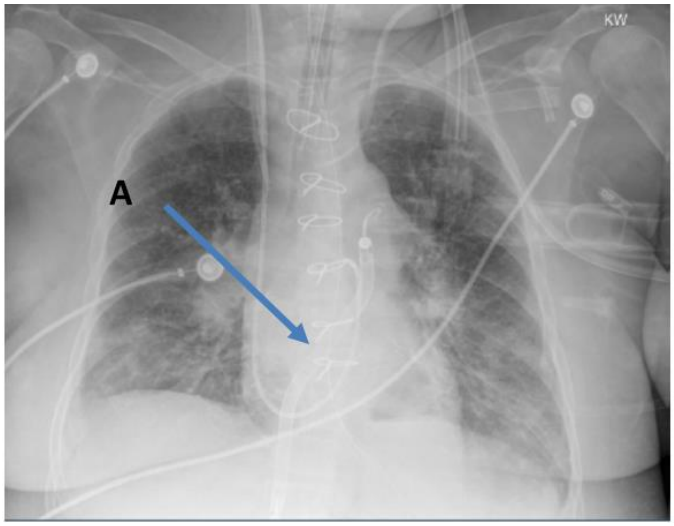
149. Ultrasound travels slowest in which medium?
a. Air
b. Lung
c. Fat
d. Bone

150. Which of the following has the highest frame rate?
a. M-mode
b. B-mode
c. A-mode
d. None of the above

151. Where does the best elevational and lateral resolution occur?
a. Near field (Fresnel)
b. Focal zone
c. Far Field (Fraunhofer)
d. Most distal extend of the beam

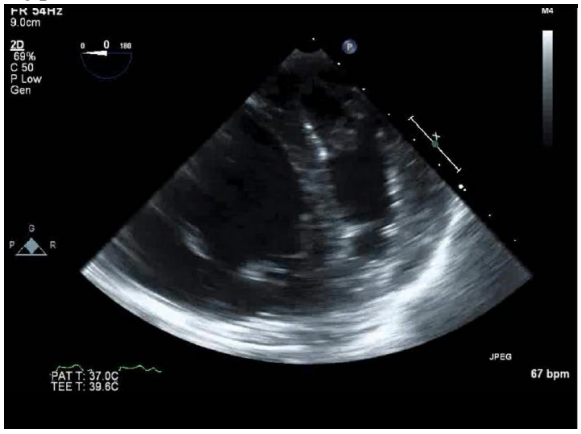
152. The phenomenon when a sound beam bends but continues to travel on a forward direction is called?
a. Reflection
b. Specular reflection
c. Raleigh scattering
d. Refraction

153. The device indicated by "A" is primarily for:
a. Extracorporeal membrane oxygenation (ECMO)
b. Support of the left ventricle
c. Improved perfusion of the coronary arteries
d. Support of the right ventricle



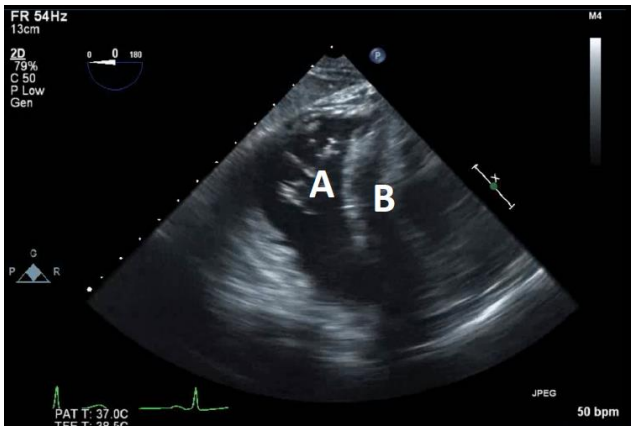
154. A 78-year-old male is undergoing left hip pinning by the orthopedic service one week after he suffered a fracture. Approximately 15 minutes after induction he developed hypotension and cardiovascular collapse while positioning the leg. TEE is performed. What is noted on the follow image:

a. Shift of the interatrial septum to the left
b. Shift of the interventricular septum to the left
c. Normal filling if the left ventricle.
d. Hypovolemia



155. What is indicated by "A" in the image below?

a. Anterior tricuspid leaflet
b. Lateral tricuspid leaflet
c. Septal tricuspid leaflet
d. Posterior septal leaflet



156. What is indicated by “B” in the image above?

a. Anterior wall of the left ventricle
b. Interventricular septum
c. Lateral wall of the left ventricle
d. Lateral wall of the right ventricle.