Valve Disease
Board Review Questions

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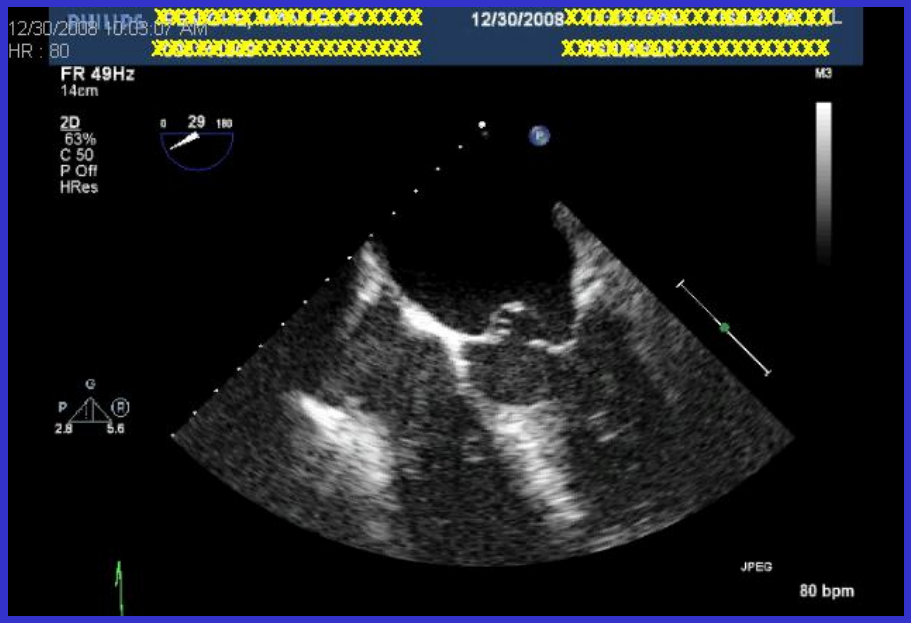
Case 1

History

- A 61 year-old man
  - Presents to hospital with worsening shortness of breath, back pain, and a 20-pound weight loss over the past 6-months.
  - Two weeks prior to presentation he developed orthopnea.
  - As an outpatient, an oral antibiotic was prescribed for presumed pneumonia.
  - Transferred from an OSH for further care.

History/Data

- PMH
  - HTN
  - Dyslipidemia
  - CAD
  - Type B aortic dissection 1996
- SH
  - Manual laborer
  - Non-smoker
  - No EtOH
  - No illicit drug use
- Exam
  - Labored breathing (50% FM); HR 80/min, regular
  - JVD
  - Bilateral rales
  - HSM apex, diastolic decresendo murmur LLSB
  - LE edema
- Labs
  - WBC 14, Hgb 9.2
  - SR 1º AVD, IRBBB, LAE
  - Pulm edema, b/l effusions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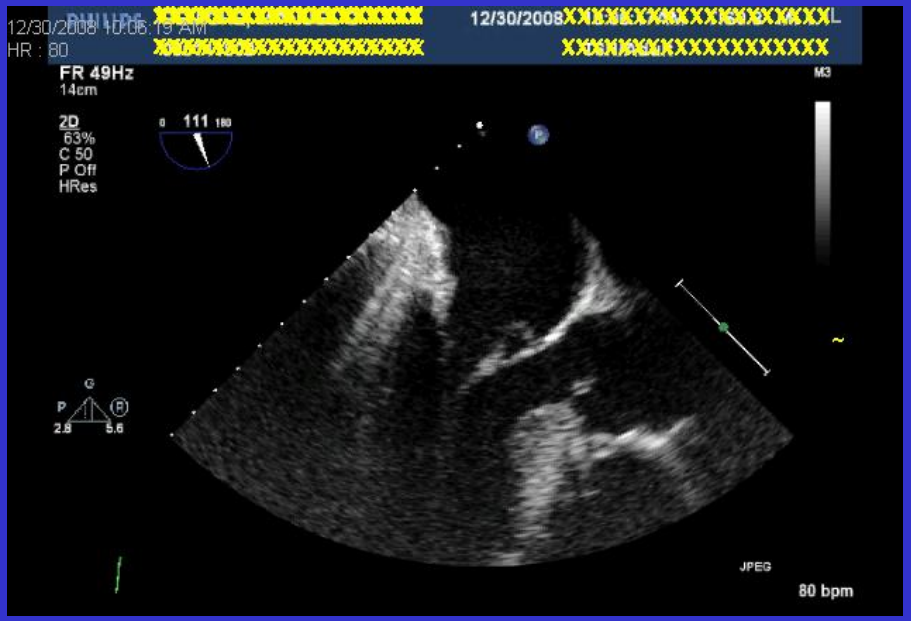
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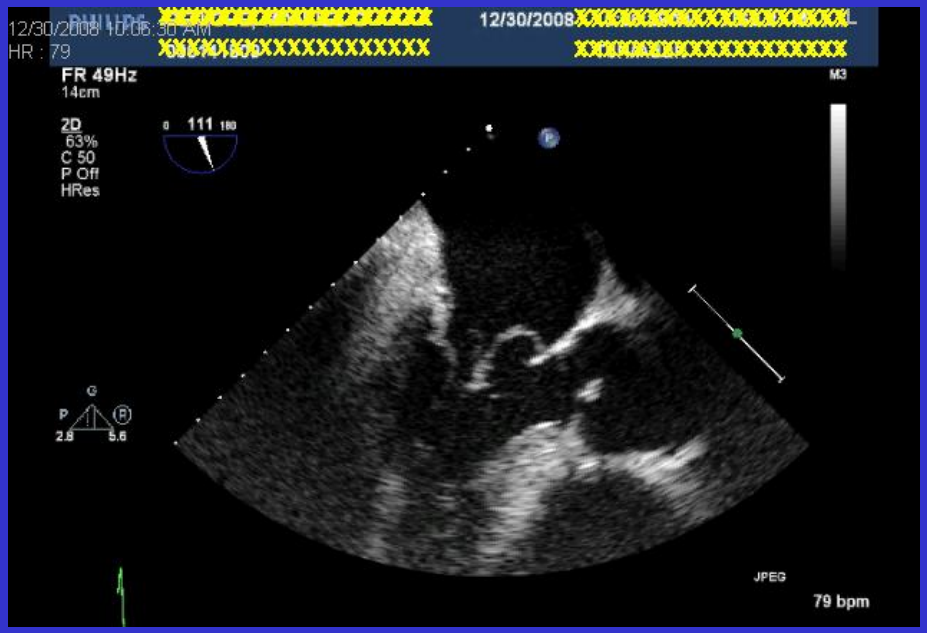
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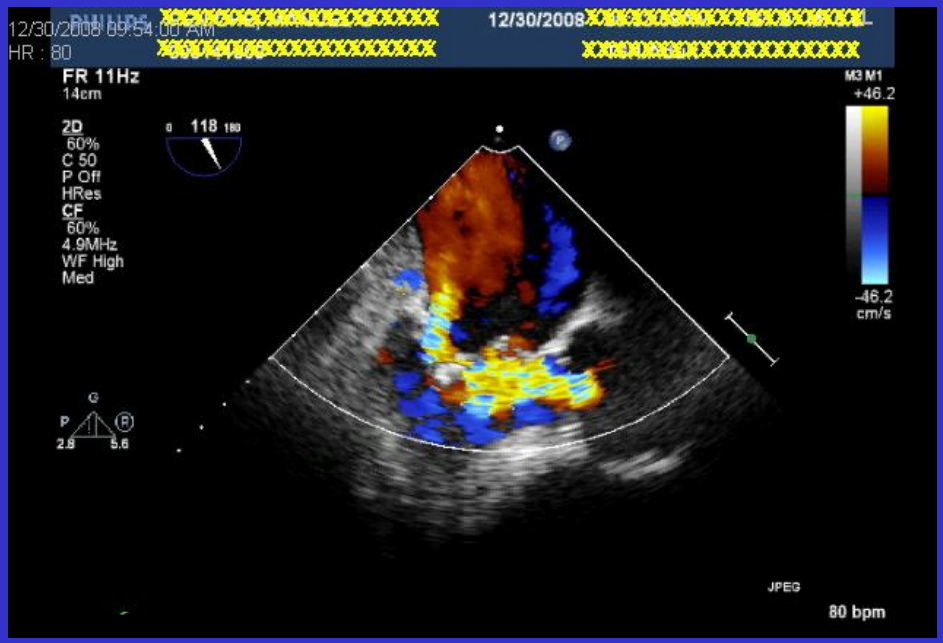
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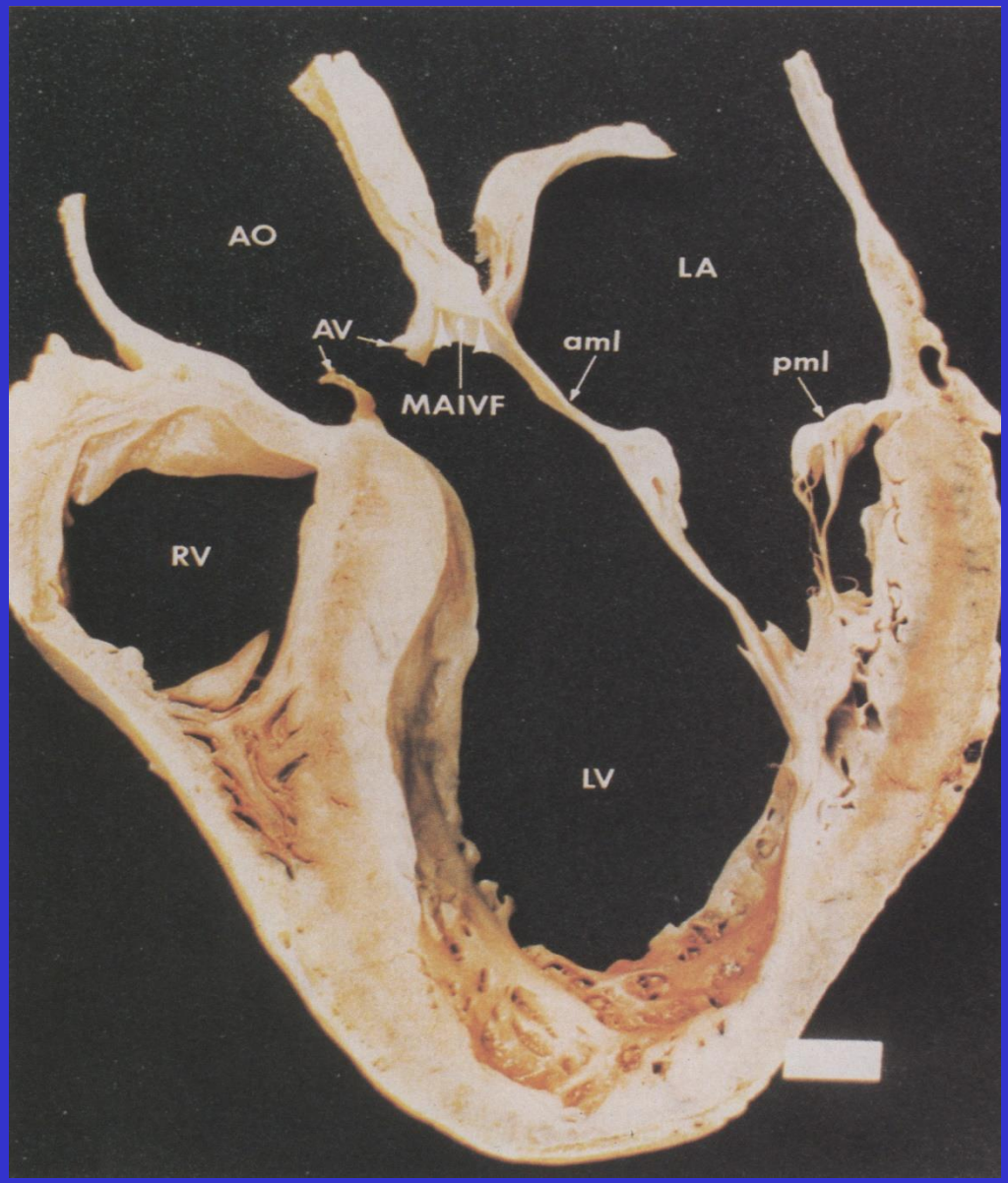
4.9MHz
WF High
Med
118
M3 M1
+46.2
-46.2
cm/s
JPEG
80 bpm

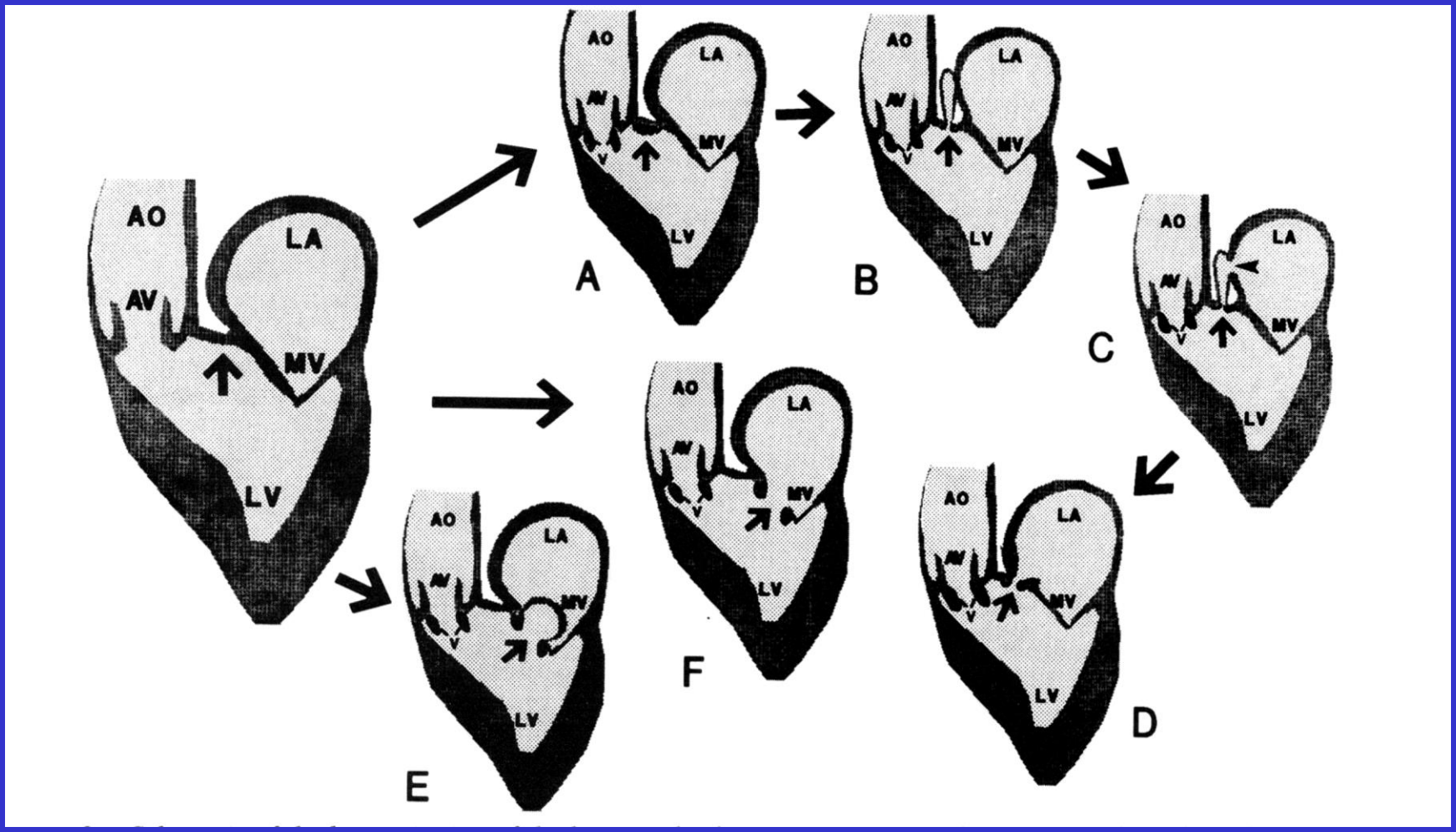
Based on the history and TEE images, which one of these conditions most likely explains the mitral valve findings?

- A. Myxomatous degeneration
- B. Congenital diverticulum
- C. Pseudoaneurysm of the mitral-aortic intervalvular fibrosa
- D. Endocarditis involving the aortic valve
- E. Blood cyst of the mitral valve

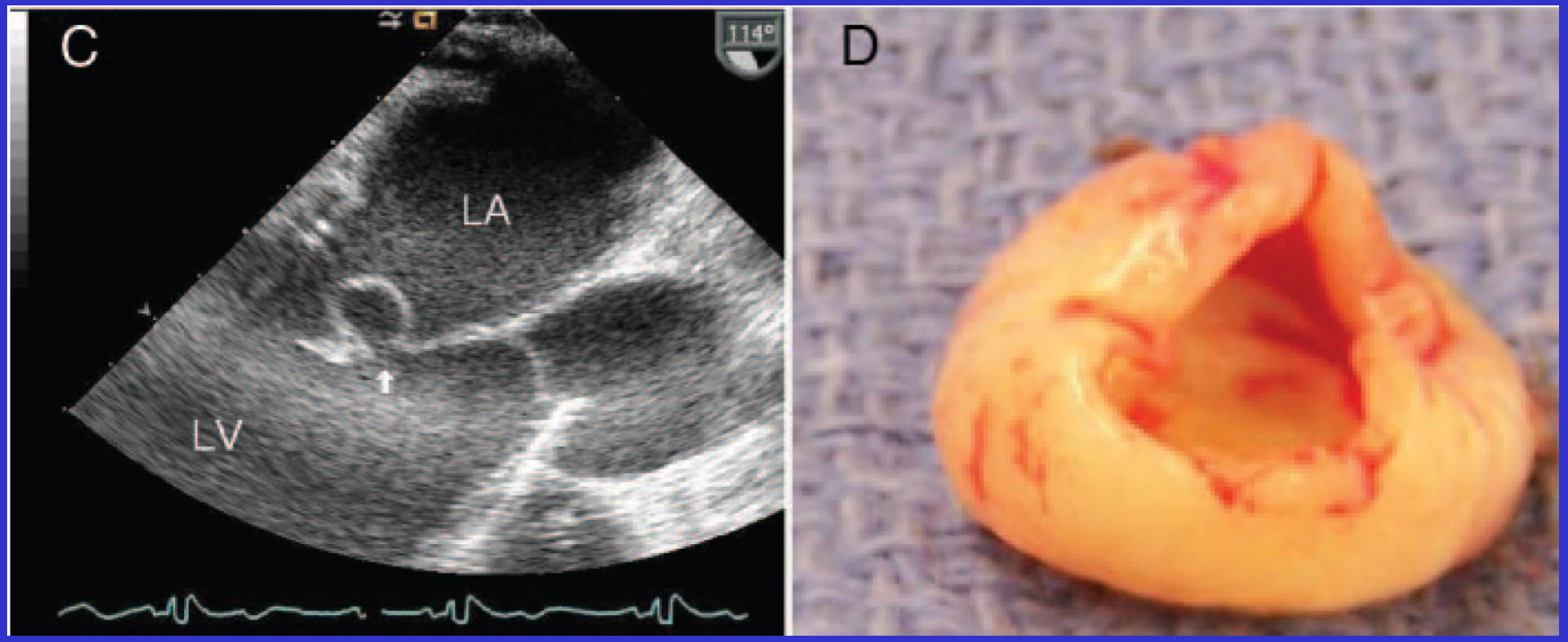


Karalis DG et al. Circulation 1992;86:353.

Sub-aortic Complications of IE



Karalis DG et al. Circulation 1992;86:353.



Stechert MM et al. Anesthesia-Analgesia 2012;114:86.

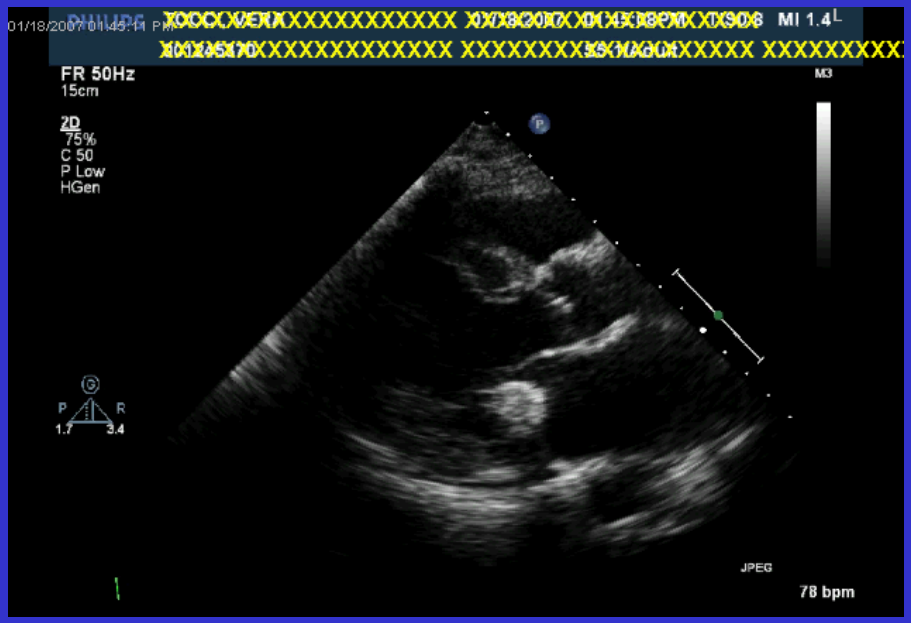
Table 1. Differential Diagnosis of Mitral Valve Aneurysm

	Mitral valve aneurysm	Mitral valve diverticulum	Mitral valve dissection	Mitral valve prolapse	Cardiac tumors
Appearance	Saccular with distinct mouth and neck	Saccular with distinct mouth and neck	Saccular. Absence of distinct neck and mouth	Myxomatous thickening with redundant tissue. Absence of distinct neck and mouth	Typically solid. Rare cystic changes. Absence of distinct neck and mouth
Location and shape	Mouth facing left ventricle, aneurysmal sac bulging into left atrium	Mouth facing left atrium with diverticulum bulging into left ventricle	Double layer pouch. May resemble flail leaflet	Bowing of mitral leaflet may approximate a semicircle	Shape variable. Myxomas rarely found attached to valves
Changes in appearance during the cardiac cycle	Systolic expansion into left atrium, ↓ size or collapse in diastole	Absence of systolic expansion	Absence of systolic expansion	Leaflet tip bulging into left atrium with systole	Absence of significant changes
Doppler findings	Color flow swirling in sac. Perforation of sac may mimic mitral regurgitation	Color flow swirling in sac. Perforation not reported	Color flow swirling (?). May be associated with mitral regurgitation	Posteriorly directed mitral regurgitant jet may be demonstrated	Absence of color flow swirling in cases of cystic changes

Stechert MM et al. Anesthesia-Analgesia 2012;114:86.

Case 2

- An 84-year old woman with Stage IV chronic kidney disease and systemic hypertension presents to an outside hospital with worsening shortness of breath.
  - Physical examination and chest radiography were consistent with pulmonary edema
    - Diuretics were given
  - Transthoracic echocardiography was performed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2D
75%
C 50
P Low
HGen
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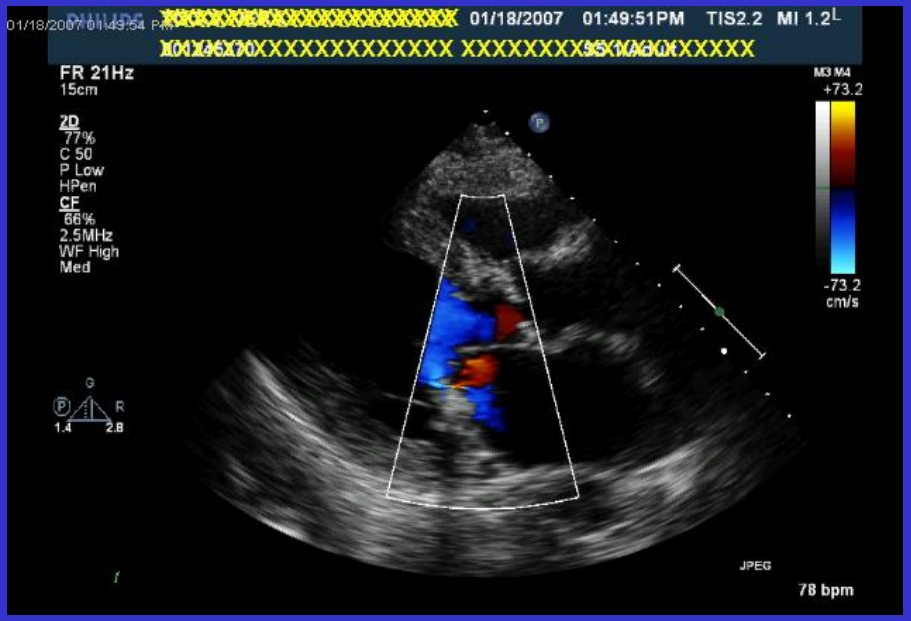
JPEG
78 bpm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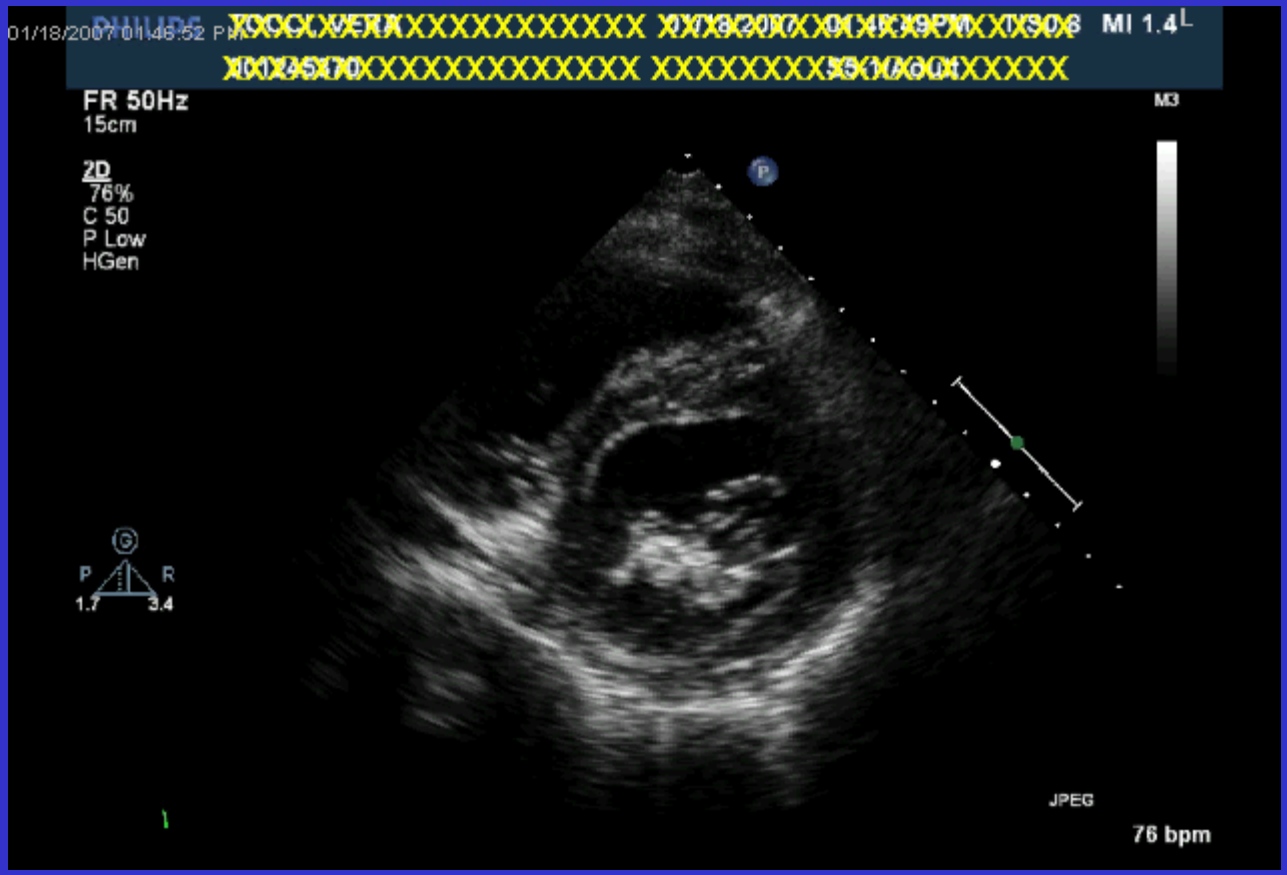
+73.2
-73.2
cm/s
JPEG
78 bpm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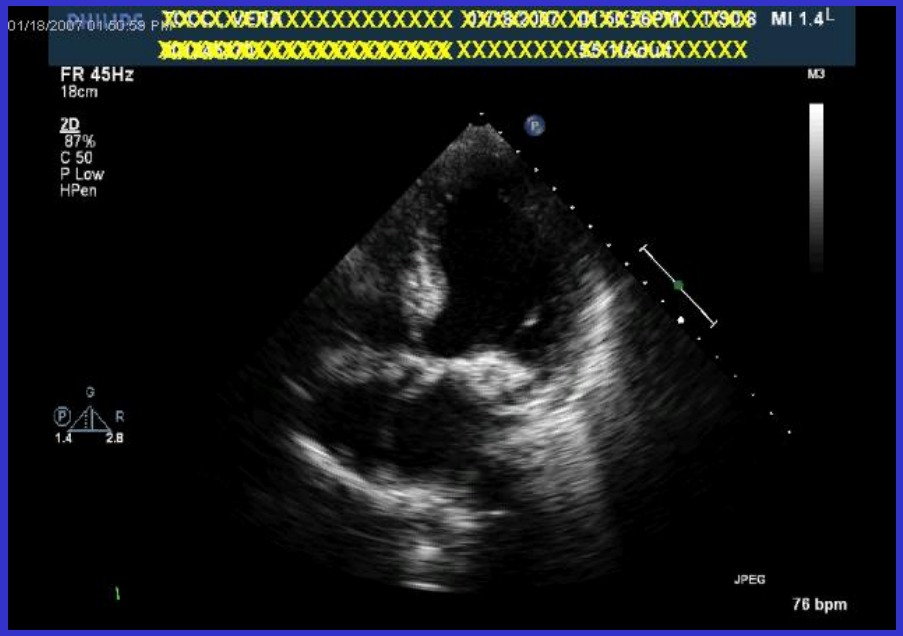
15cm
2D
76%
C 50
P Low
HGen
M3
P
R
1.7
3.4
JPEG
76 bpm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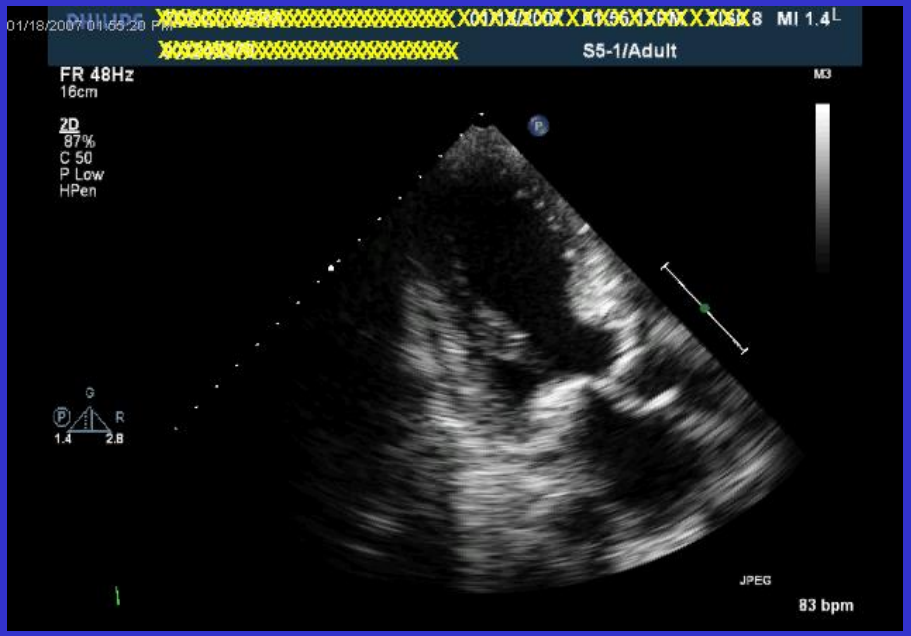
HPen
M3
JPEG
76 bpm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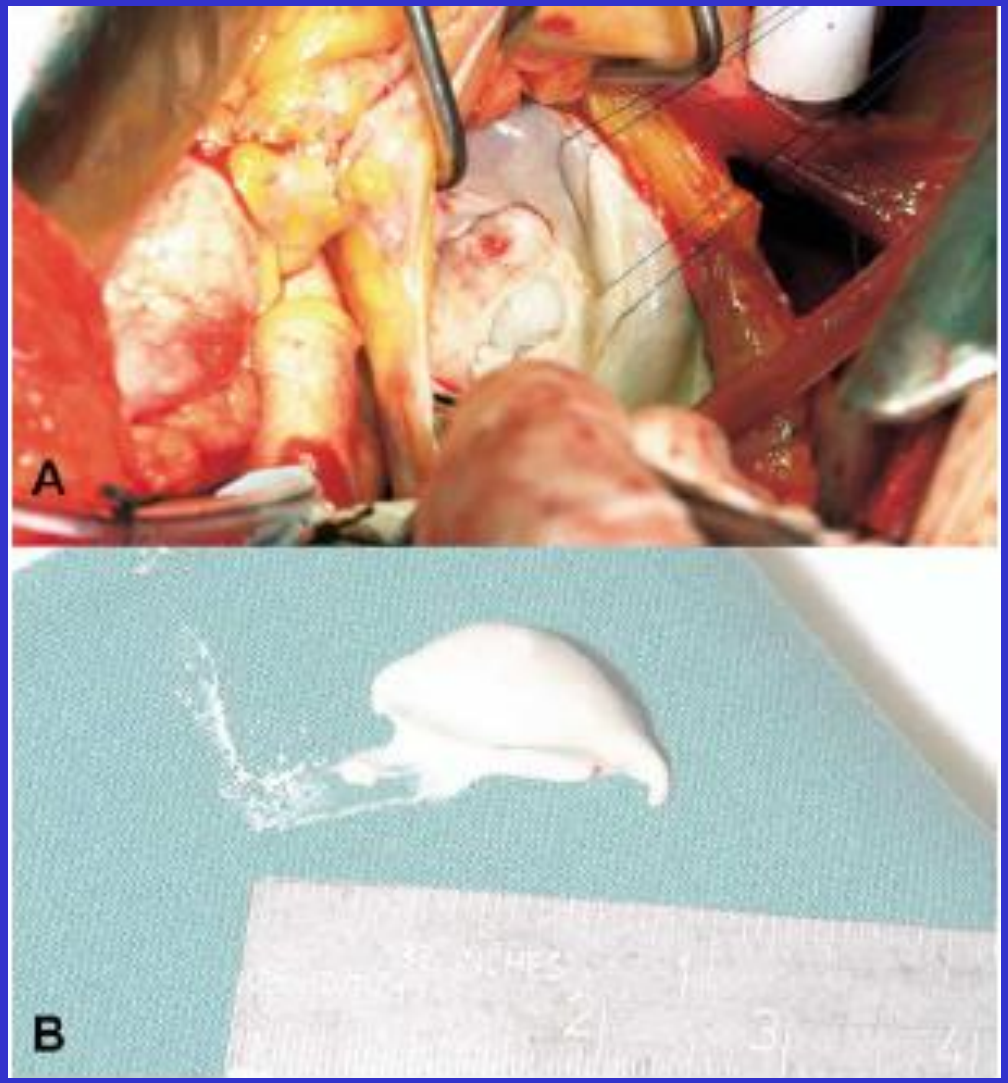
S5-1/Adult
FR 48Hz
16cm
2D
87%
C 50
P Low
HPen
M3
JPEG
83 bpm

Which of the following entities constitutes the most likely etiology for the finding shown?

- A. Left atrial myxoma
- B. Intracavitary thrombus
- C. Infective endocarditis
- D. Caseous calcification
- E. Papillary fibroelastoma

Caseous Calcification of the Mitral Annulus

- Relatively rare
  - Estimated prevalence of 0.07%
- Annular-based mass with echoluscencies
  - Putty-like admixture of fatty acids, cholesterol, and calcium
    - “Toothpaste” tumor
  - Rounded
  - Smooth borders
- Posterior location
- Associated conditions
  - Elderly
  - HTN
  - Women
- Natural history appears benign
  - Some cases may regress spontaneously
- Differential diagnosis
  - Abscess
  - Tumors
  - Thrombus

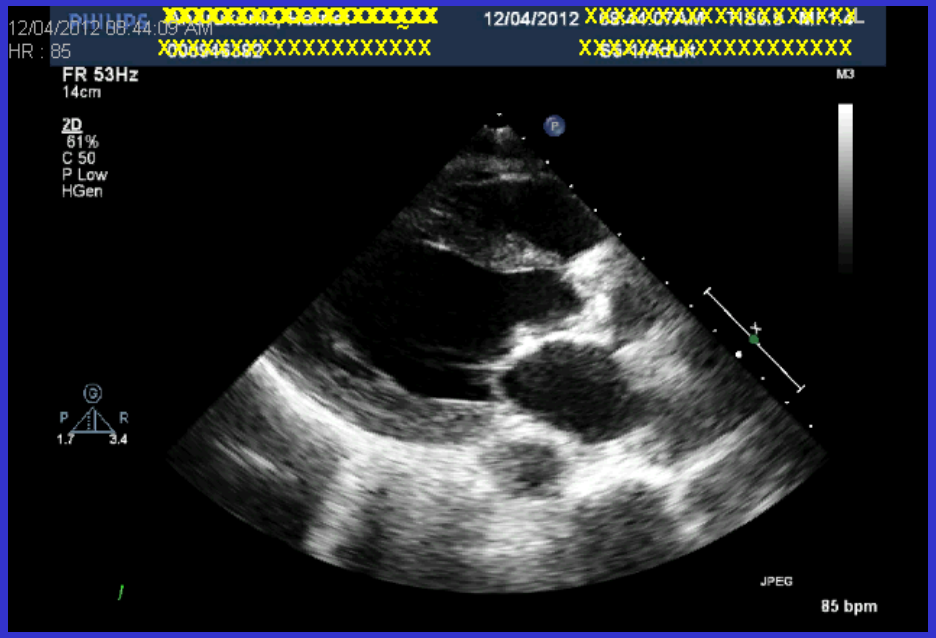


Alkadhi H et al. J Thorac Cardiovasc Surg 2005;129:1438.

Case 3

History

- A 54 year-old woman with hypothyroidism presents with worsening of shortness of breath.
  - Systolic and diastolic murmurs are auscultated
  - Transthoracic echocardiography is requested for further evaluation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HGen
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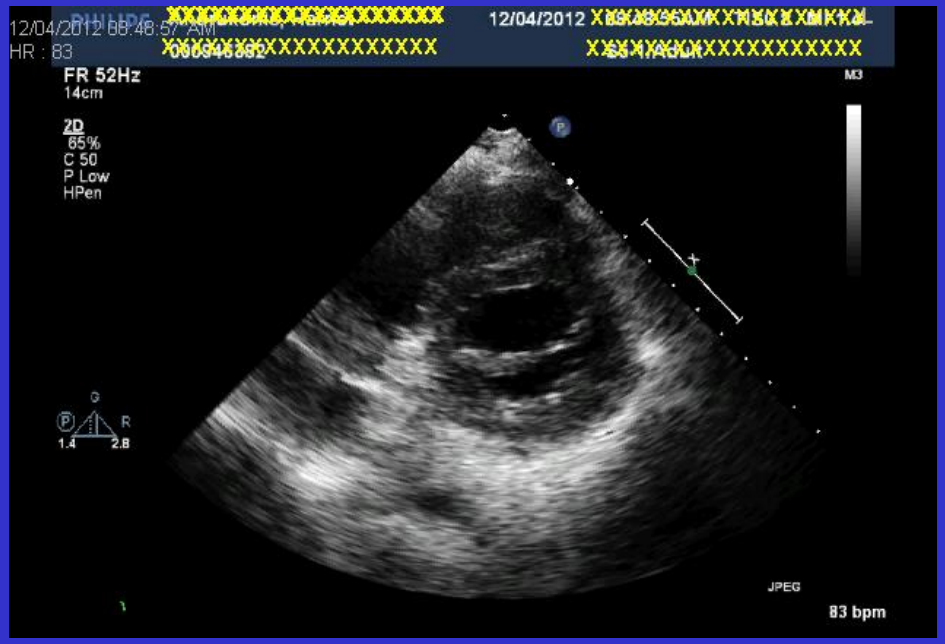
85 bpm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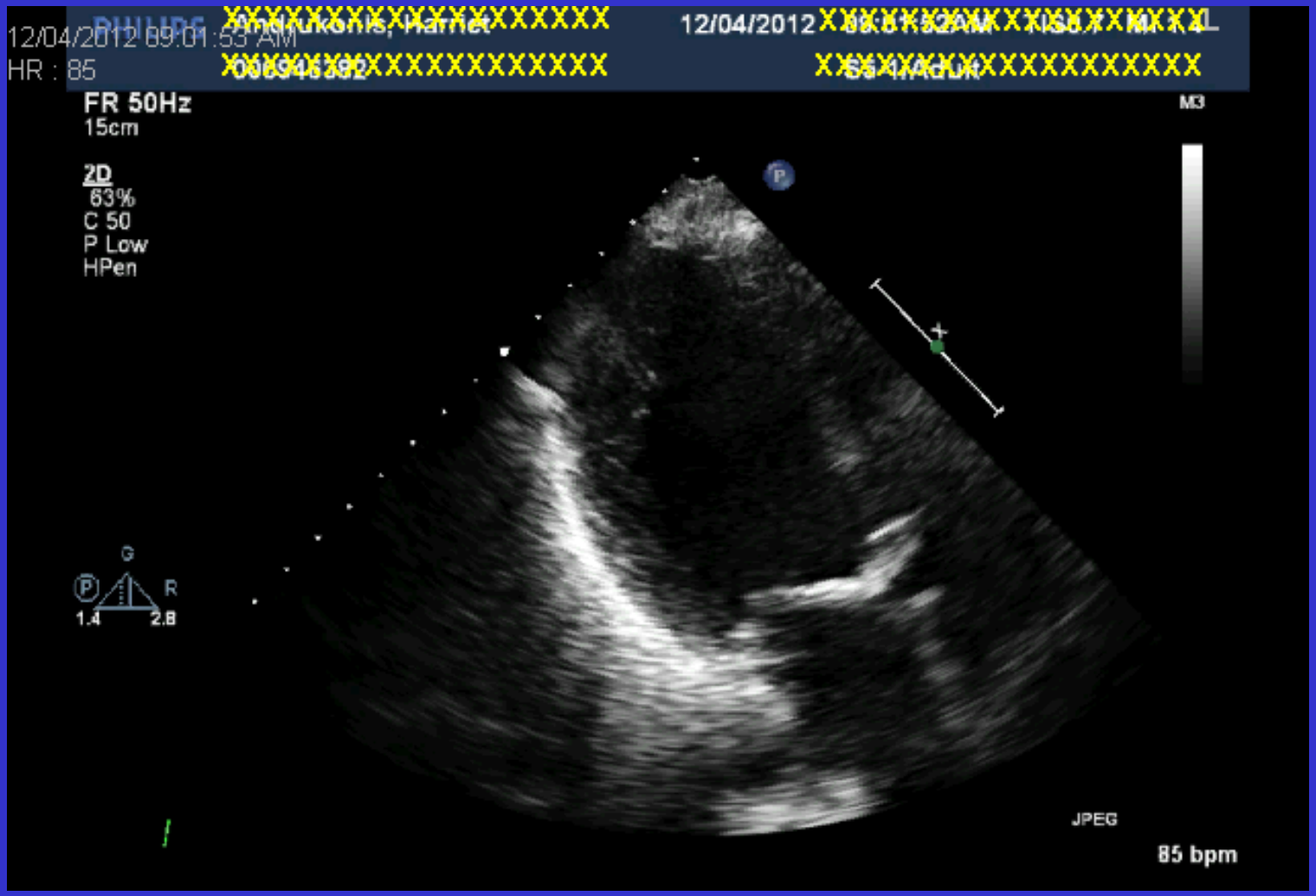
83 bpm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63%
C 50
P Low
HPen
M3
G
P
R
1.4
2.8
JPEG
85 bpm

Q1. Echocardiography confirms the presence of aortic stenosis (orifice area 0.6 cm^2) and identifies the presence of moderate aortic regurgitation. Mitral valve thickening is also described. The most likely etiology accounting for the observed valvular abnormalities is:

- A. Age-related degenerative valve disease
- B. Rheumatic heart disease
- C. Annular calcific disease
- D. Carcinoid heart disease
- E. Radiation-associated valve disease

Q2. Which of the following conditions would be an expected complication resulting from the disease process causing the observed left-sided valvular abnormalities?

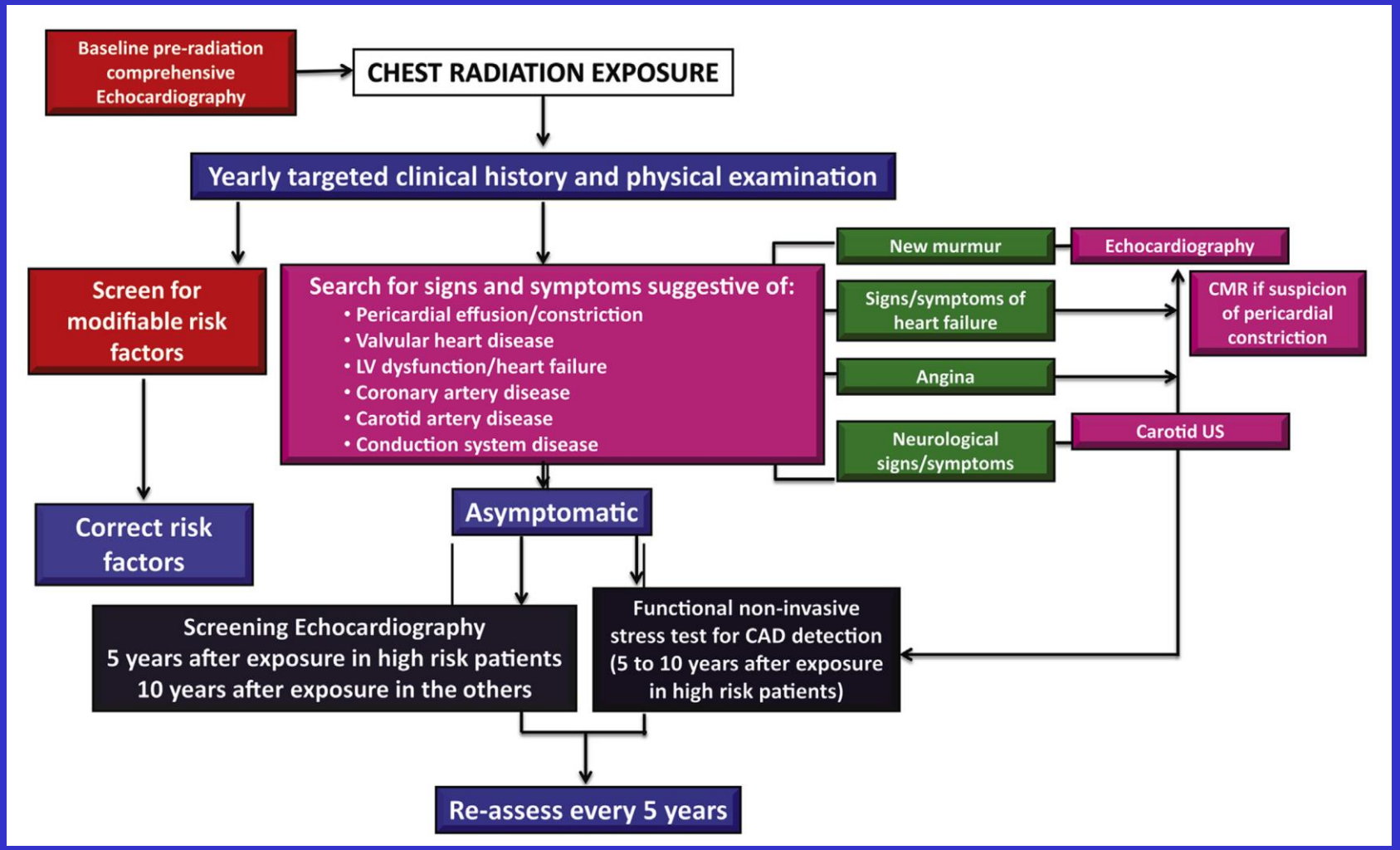
- A. Flushing
- B. Constrictive pericarditis
- C. Coronary artery spasm
- D. Hypertrophic cardiomyopthy
- E. Cardioembolic stroke

Radiation-Associated Valve Disease

- Frequent complication
- Regurgitant lesions > Stenotic lesions
  - Left sided > right sided
- Risk greater with ≥30 Gy
- Women > men
- Suggestive echocardiographic appearance
  - Calcification and thickening of aortic-mitral curtain
  - Anterior changes more profound than posterior (vs MAC)
  - No leaflet doming/commissural involvement (vs RHD)
  - Aortic root calcification increases the likelihood
- Progressive
- Periodic screening required

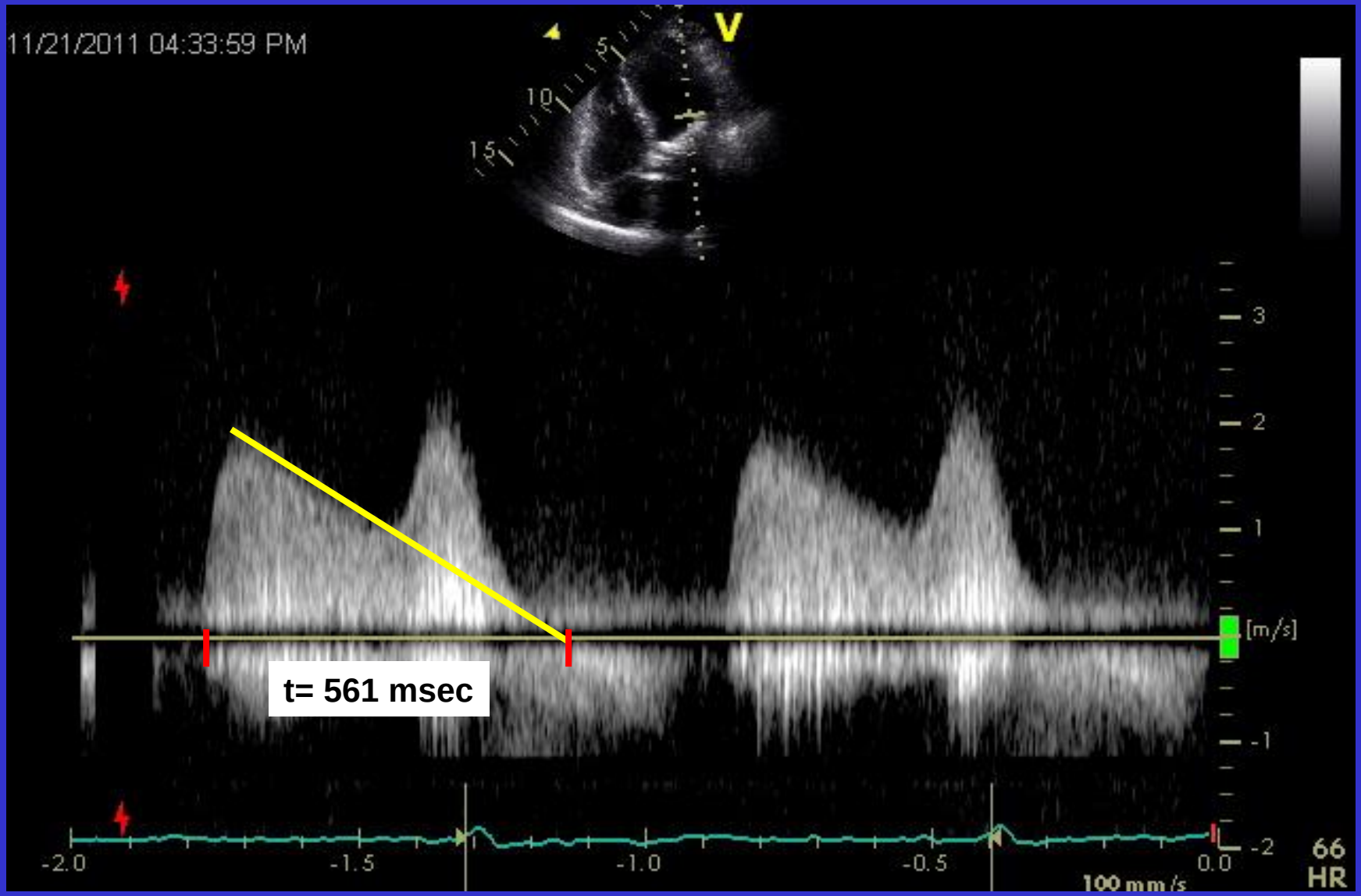
Radiation Therapy

- Cardiovascular complications
  - Coronary artery disease
  - Cardiomyopathy
    - Restrictive or dilated
  - Pericardial effusion
  - Constrictive pericarditis
  - Conduction system/arrhythmias
  - Valvular heart disease
  - Carotid artery disease



Lancellotti P et al. J Am Soc Echocardiogr 2013;26:1013.

Case 4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[m/s]
3
2
1
-1
-2
-2.0
-1.5
-1.0
-0.5
0.0
100 mm/s
66
HR

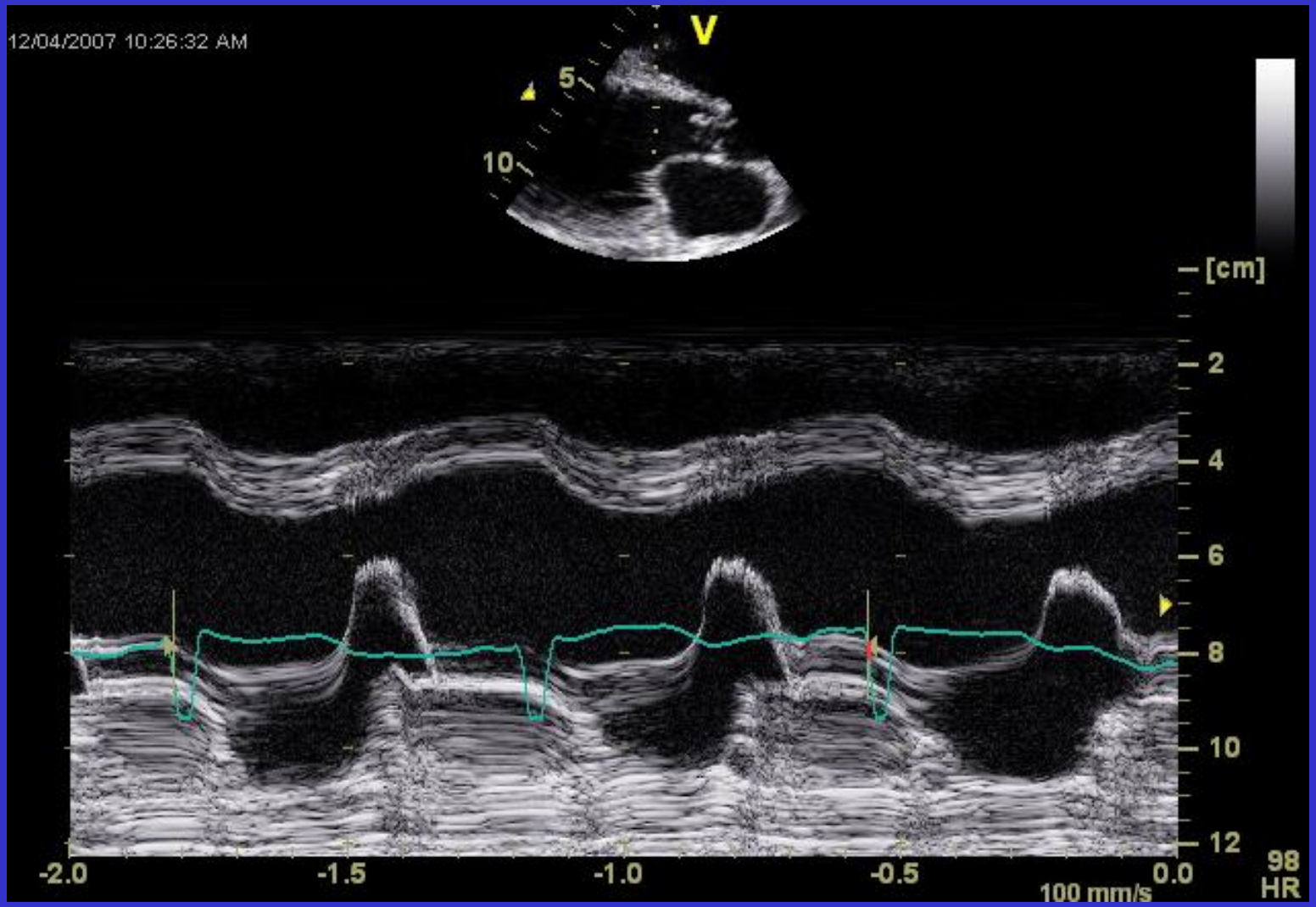
Which of the following values best estimates the mitral orifice area?

- A. 0.40 cm^2
- B. 0.75 cm^2
- C. 1.0 cm^2
- D. 1.4 cm^2
- E. 2.6 cm^2

Choice Explanations

- D. 1.4 cm^2.
- This continuous wave spectral profile of the mitral valve shows increased transvalvular velocities and a prolonged deceleration time (measured).
  - Given the known deceleration time, the relationship between deceleration time (DT) and mitral pressure half-time (PHT) is: PHT (in msec) = 0.29xDT.
  - Once the PHT is known, the Hatle formula (MVA (in cm^2) = 220/PHT) can be used to estimate the mitral orifice area.
    - In this case, the PHT = 163 msec.
- Alternatively, the formula MVA = 759/DT can be utilized.

Case 5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V
5
10
[cm]
2
4
6
8
10
12
-2.0
-1.5
-1.0
-0.5
0.0
100 mm/s
98
HR

Based on this M-mode tracing, which of the following findings is ***unlikely*** to be present?

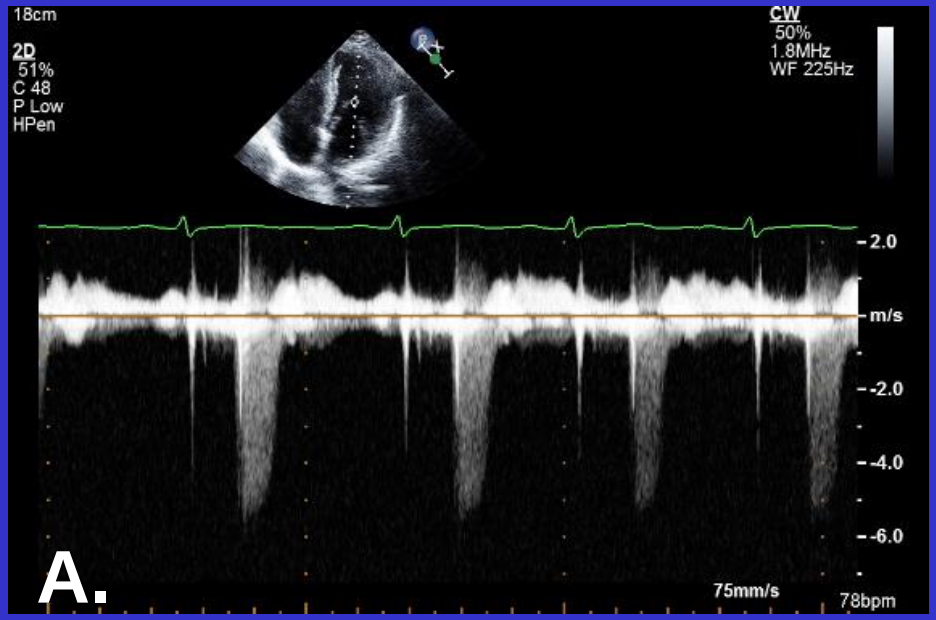
- A. Restrictive mitral inflow pattern
- B. Soft S1
- C. Diastolic mitral regurgitation
- D. Premature closure of the aortic valve
- E. Brief diastolic murmur

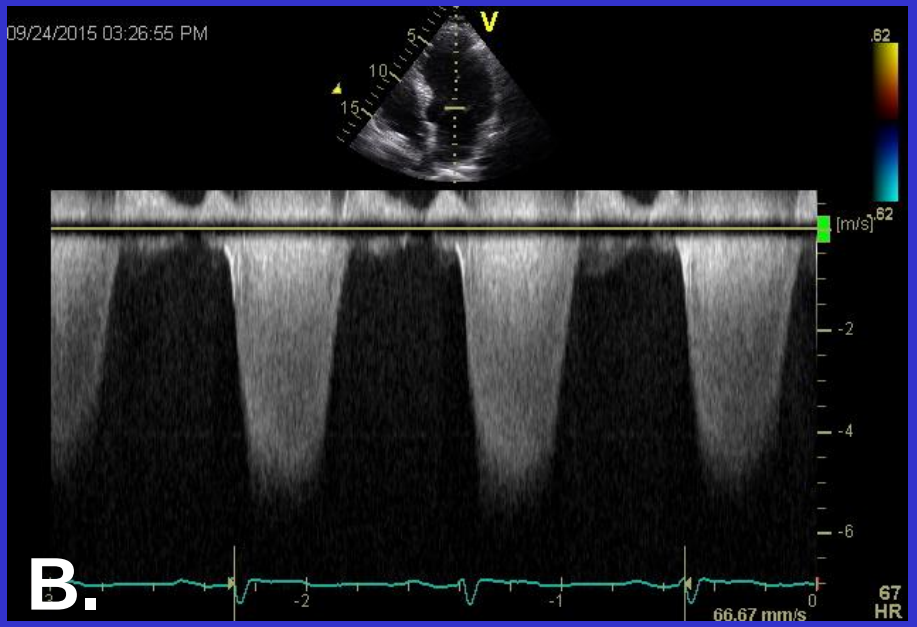
Choice Explanations

- D. Premature closure of the aortic valve. ***This is the correct answer.***
  - This M-mode tracing displays premature closure of the mitral valve along with high frequency diastolic fluttering of the anterior mitral leaflet (and the interventricular septum). This constellation of findings occurs when acute, severe aortic regurgitation is present.
  - This answer is ***false*** because the aortic valve is incompetent. With the rapid rise in LV diastolic pressure characteristic of this lesion, premature opening of the aortic valve may be observed.
- A. Restrictive mitral inflow pattern. This answer is true due to the rapid increase in LV diastolic pressure characteristic of acute severe AR.
- B. Soft S1. This answer is true because the rapidly rising LV diastolic pressure leads to premature closure of the mitral valve.
- C. Diastolic mitral regurgitation. This answer is true. Rapid increases in LV diastolic pressure can lead to transient reversal of the LA-LV pressure gradient in diastole and the occurrence of (low velocity) diastolic mitral regurgitation.
- E. Brief diastolic murmur. This answer is true. The regurgitant murmur is brief in duration because the aortic diastolic pressure rapidly equilibrates with that of the LV.

Case 6

Two Patients with Mitral Regurgitation





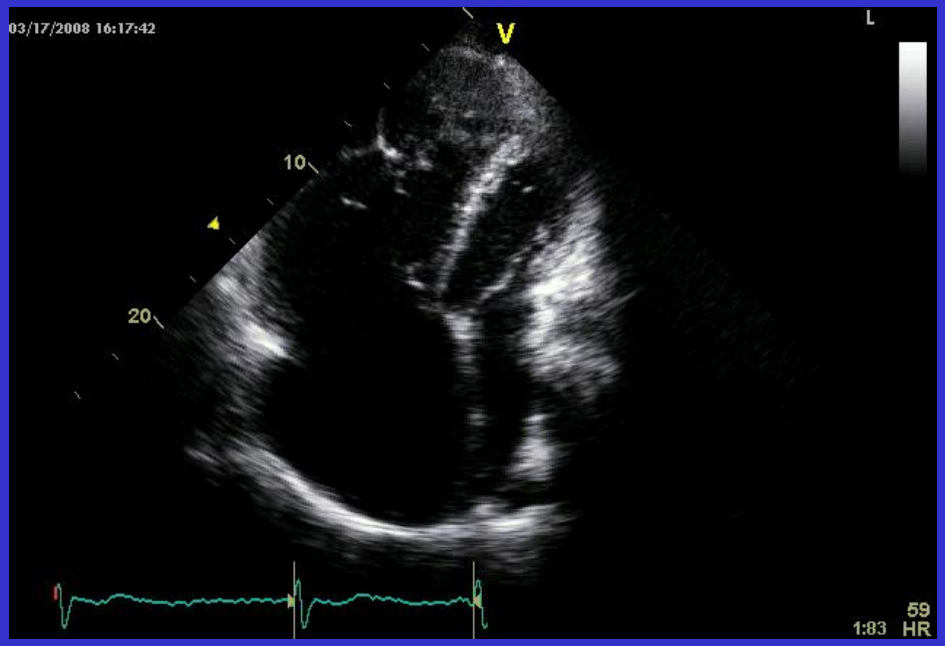
When comparing patients with MR depicted in panels A and B, which of the following statements is true?

- A. The ERO area by PISA is consistently smaller among patients depicted in panel A versus B.
- B. The peak mitral inflow velocity is consistently lower among patients in panel B versus A.
- C. Clinical outcomes are often better for patients depicted in panel A versus B.
- D. Color jet area is often smaller among patients depicted in panel A compared to B.

Case 7

History

- A 54 year-old man presents with complaints of exertional dyspnea and abdominal bloating. He denies chest pain, PND/orthopnea, weight gain or the presence of edema
  - Physical examination reveals distended neck veins, a soft early systolic murmur and an early-diastolic rumble audible at the left parasternal border
  - Echocardiography is requested to evaluate cardiac function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V
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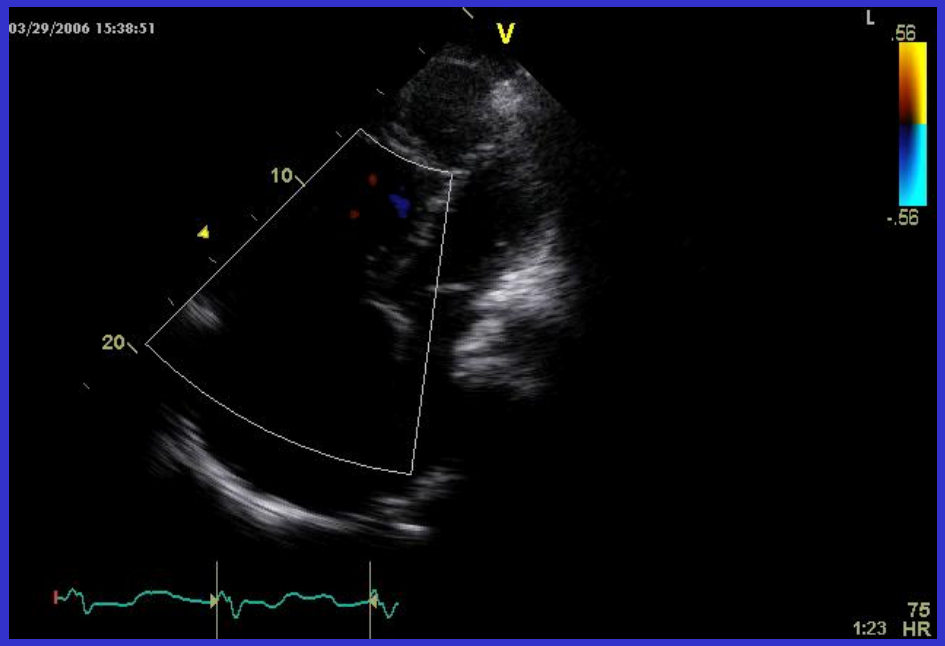
10
20
59
1:83 HR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20
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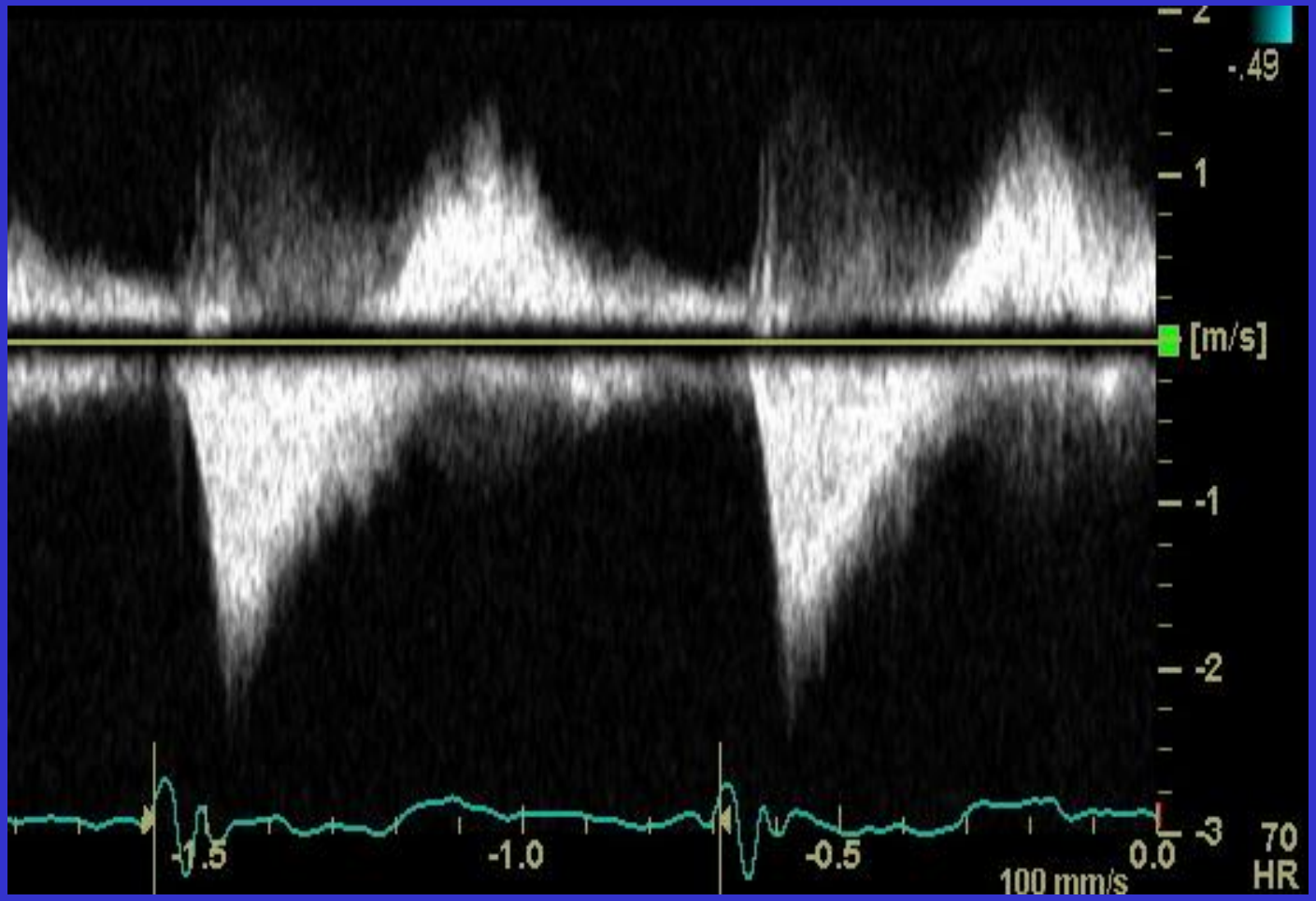
1:23 HR


-.49
1
[m/s]
-1
-2
-3
-1.5
-1.0
-0.5
0.0
100 mm/s
70
HR

Based on the clinical presentation and imaging findings which of the following statements is correct?

- A. Prominent diastolic flow reversals in the hepatic vein spectral profile are expected
- B. Pulmonary artery systolic pressure can be estimated accurately
- C. Mild-to-moderate tricuspid regurgitation is present
- D. Spatial extent of the color-flow disturbance under-estimates disease severity
- E. Tricuspid stenosis is the predominant valvular abnormality

Table 8 Echocardiographic and Doppler parameters used in grading tricuspid regurgitation severity

Parameter	Mild	Moderate	Severe
Tricuspid valve	Usually normal	Normal or abnormal	Abnormal/Flail leaflet/Poor coaptation
RV/RA/IVC size	Normal*	Normal or dilated	Usually dilated**
Jet area-central jets (cm^2)§	< 5	5-10	> 10
VC width (cm)ϕ	Not defined	Not defined, but < 0.7	> 0.7
PISA radius (cm)ψ	≤ 0.5	0.6-0.9	> 0.9
Jet density and contour–CW	Soft and parabolic	Dense, variable contour	Dense, triangular with early peaking
Hepatic vein flow†	Systolic dominance	Systolic blunting	Systolic reversal

Zoghbi WA et al. J Am Soc Echocardiogr 2003;16:777.