Mitral Valve Disease

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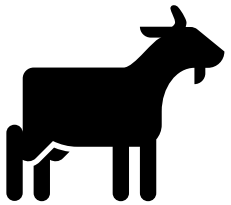
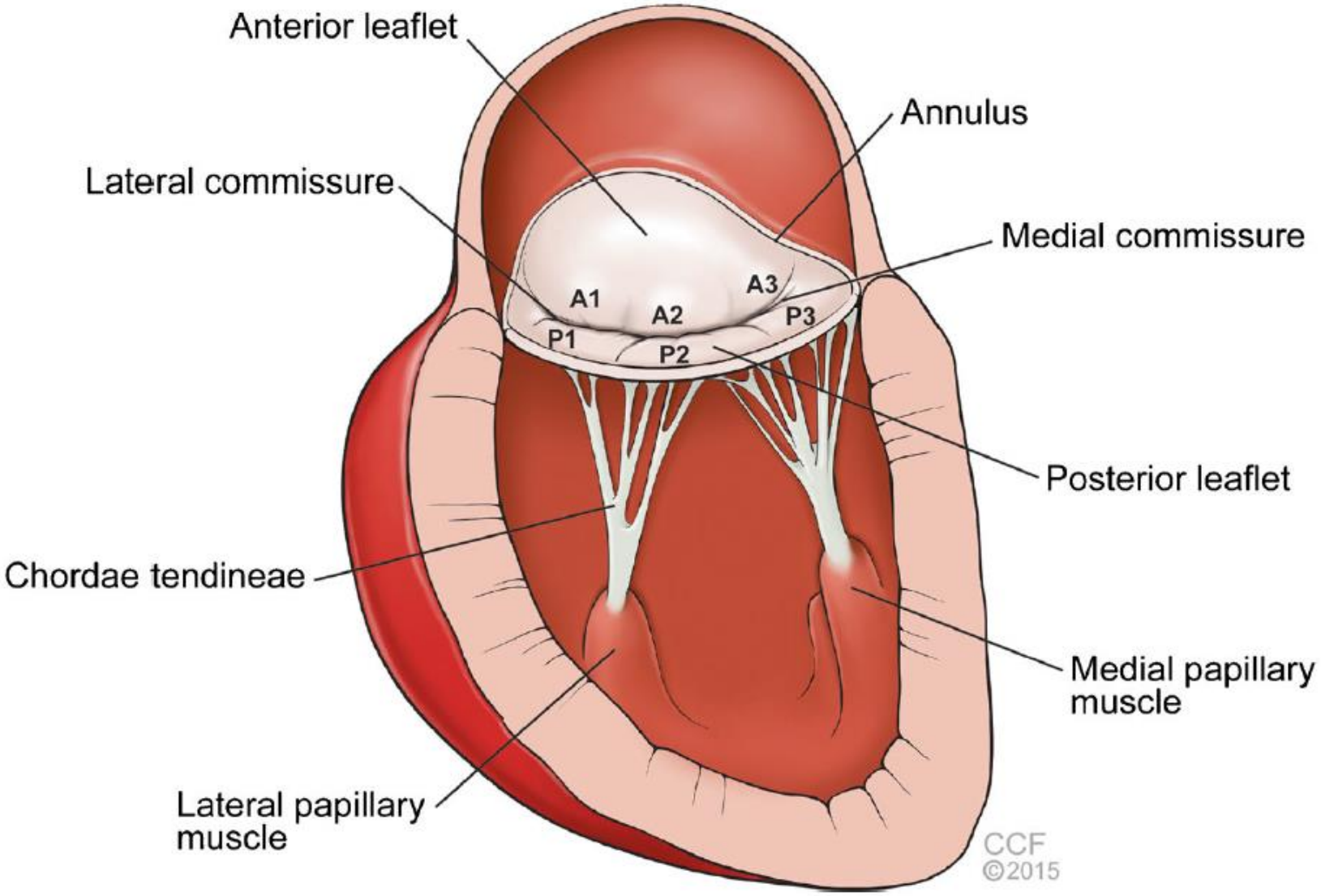
SAVE

Objectives



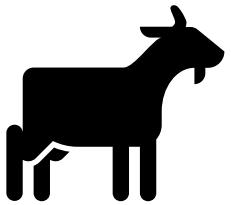
1. Define the anatomy of the mitral valve and terms of mitral valve disorders
2. What are the three parameters we use to quantify MS, and what numbers are considered severe in the first two?
3. When is exercise echocardiography stress testing helpful is MS?
4. Who should get intervention for MS?
5. What is the definition of severe MR?
6. Which features suggest that surgical repair will be effective?


Anterior leaflet
Annulus
Lateral commissure
Medial commissure
A1
A2
A3
P1
P2
P3
Posterior leaflet
Chordae tendineae
Medial papillary muscle
Lateral papillary muscle
CCF ©2015

MV Stenosis - Etiology

- **Rheumatic heart disease (RHD**) most common cause in world, especially in developing countries.
  - Related to immune response by cross-reactivity between streptococcal antigen and valve tissue.
  - Although any cardiac valve may be involved, the mitral valve is almost always affected.
  - Commissural fusion – "**Fish-mouth"** appearance of the MV orifice
  - Leaflet thickening, especially at the free edges – Shortening and fusion of the chordae
    - **hockey-stick** appearance of the leaflet, particularly the anterior, on echocardiography.
- **Radiation valvulitis:** which typically manifests 10 to 20 years after mediastinal radiation therapy
- **Congenital causes:** very rare, such as cor triatriatum, parachute mitral valve, double-orifice mitral valve, or supravalvular mitral ring
- **Systemic inflammatory disorders** such as lupus erythematous and RA may occasionally lead to valvulitis and resulting MS.
- **Obstructing lesions** such as a large atrial myxoma or infected vegetation which may cause functional MS.
- **Mitral annular calcification (MAC):** common in elderly and w/ advanced renal disease, rare cause of mitral stenosis.

MV Stenosis - Quantification

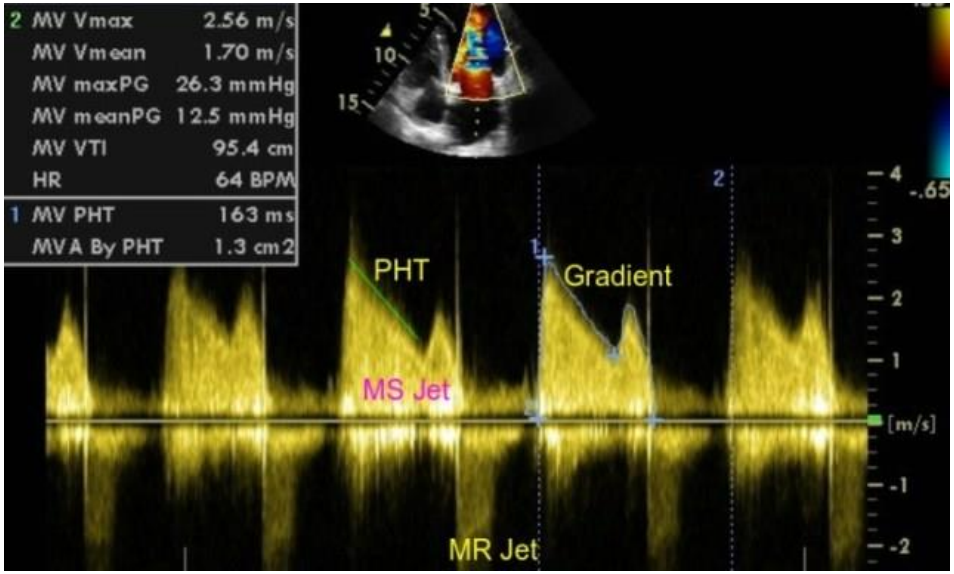


1. Mean diastolic trans-mitral pressure gradient
2. MV area
3. Secondary changes including LA enlargement and right sided increased chamber size and pressure

Severe MV stenosis by gradient

2nd year

- Mean gradient >10 mmHg → Severe MS
- 5–10 mmHg → Moderate MS
- <5 mmHg → Mild MS



MVA - Severity

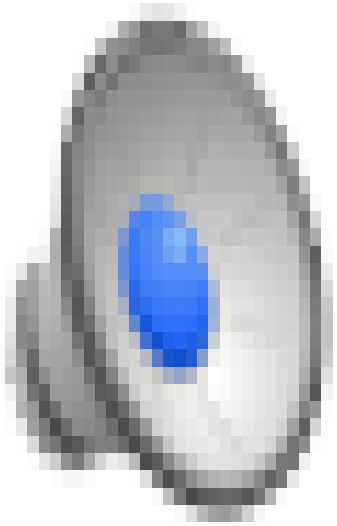
- Very severe if MVA ≤1 cm2
  - Severe if it is ≤1.5 cm2

Secondary changes of MS

- At area less than $2cm^2$, a diastolic pressure gradient develops between the LA and LV → increased LA pressures and decreased forward flow
- Tachycardia is BAD! in MS
  - shortens the diastolic filling time, leading to an increase in the the transmitral gradient.
- Consequences of increased LA pressures:
  - LA enlargement with increased risk of atrial arrhythmias, particularly atrial fibrillation, and systemic thromboembolism (valvular a fib…)
  - Increased pulmonary pressures with resultant pulmonary edema and pulmonary hypertension → RV failure
- Consequences of decreased forward flow:
  - Low cardiac output: due to poor LV filling.

When should stress testing be ordered for MS assessment?

Third Year



MV stenosis stress testing (stress echocardiogram)

Discrepancy between the reported symptoms and the severity of MS.

- "Asymptomatic" with severe MS → exercise testing can help confirm if the patient is able to achieve an adequate workload without the development of symptoms.
- Moderate MS and "severe" symptoms → stress testing can unmask hemodynamically significant MS during exercise.
- Typically, in addition to recording symptoms, MV gradients and estimated right-sided pressures should be measured during the stress test and these results included in the decision-making regarding intervention.

Medical Management of MS

- Decrease pulmonary congestion with diuretics
- **Control HR**, primarily with beta-blockers, for symptomatic relief and to **decrease gradient via increasing filling time**
- Anticoagulation with **warfarin** is recommended in cases of atrial fibrillation.
- Novel oral anticoagulants should **NOT** be used in cases of MS

Intervention should be performed on all of the following except?

2nd year

A. Asymptomatic patients with very severe MS
B. Asymptomatic patients with severe MS who have new onset of AF
C. Symptomatic patients with moderate MS if there is evidence of hemodynamically significant MS during exercise
D. Preoperatively, in asymptomatic severe MS undergoing elective moderate- or high-risk non-cardiac surgery.
E. Asymptomatic patients with severe MS
F. Preconception, in symptomatic women with moderate or severe MS (mitral valve area ≤1.5 cm2).

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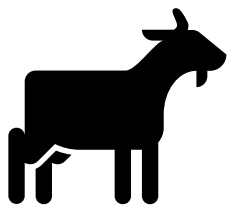
Indications for MV stenosis intervention



A. Asymptomatic patients with very severe MS (Class IIA recommendation).
B. Asymptomatic patients with severe MS who have new onset of AF (Class IIB recommendation).
C. Symptomatic patients with moderate MS if there is evidence of hemodynamically significant MS during exercise (Class IIB recommendation).
D. Preoperatively, in asymptomatic severe MS undergoing elective moderate- or high-risk non-cardiac surgery.
E. Symptomatic patients with severe MS (Class I recommendation).
F. Preconception, in symptomatic women with moderate or severe MS (mitral valve area ≤1.5 cm2).

QUESTION

First year

A 33-year-old man is evaluated for a 5-month history of exercise intolerance and shortness of breath when walking up stairs. He has no significant medical history and takes no medications.

On physical examination,: BP: 140/70 mm Hg, HR: 62/min, and RR 16/min.. Irregularly irregular rhythm. An opening snap is heard after S2, followed by a grade 1/6 diastolic rumble at the apex.

EKG shows atrial fibrillation. TTE findings are consistent with rheumatic valve disease, showing a mildly thickened mitral valve with minimal calcification and mild restriction in leaflet motion. The subchordal apparatus is mildly thickened, and there is mild mitral regurgitation and marked left atrial enlargement. Mean gradient across the mitral valve is 13 mm Hg. Mitral valve area is 1.2 cm2. TEE shows no left atrial appendage thrombus and confirms TTE findings.

In addition to anticoagulation therapy, which of the following is the most appropriate management?

A. Medical management; repeat echocardiogram in 6 months

B. Mitral valve replacement

C. Percutaneous mitral balloon valvuloplasty

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QUESTION

A 45-year-old woman is evaluated for a 12-month history of exertional dyspnea. She experiences shortness of breath during mild exertion, such as house chores and walking on flat surfaces. She describes her symptoms as debilitating, as they have interfered with her activities of daily living. She has not had symptoms at rest, and she has had no palpitations. She takes hydrochlorothiazide for hypertension.

On physical examination, temperature is normal, blood pressure is 112/72 mm Hg, pulse rate is 76/min, and respiration rate is normal. The apical impulse is slightly sustained but not displaced. S1 is increased. There is an early diastolic sound followed by a soft rumble heard best at the apex. S2 is normal.

An echocardiogram shows findings consistent with moderate rheumatic mitral stenosis and minimal mitral regurgitation. The mean gradient across the mitral valve is 8 mm Hg, and the mitral valve area is calculated to be 1.8 cm2. The mitral valve is pliable. Moderate pulmonary hypertension is present, with an estimated pulmonary artery systolic pressure of 45 mm Hg.

Which of the following is the most appropriate next step in management?

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B Medical therapy

C Percutaneous balloon mitral valvuloplasty

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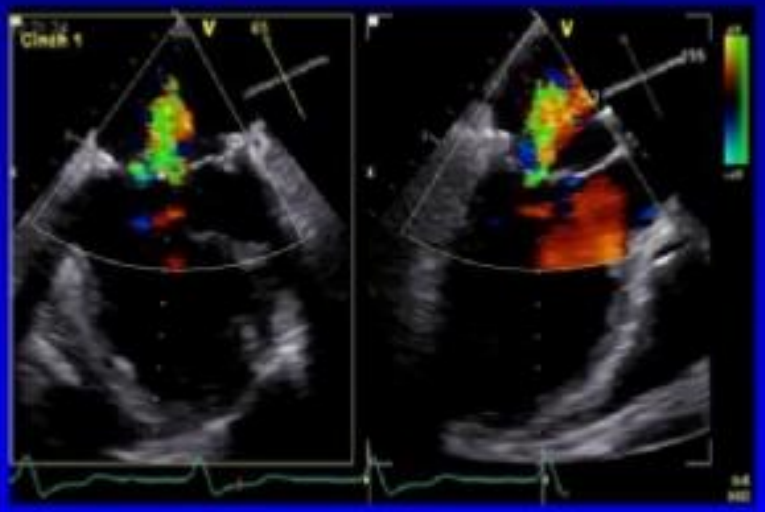
Mitral Rergurgitation

1) Is the regurgitation severe ?

2) What is the mechanism of the regurgitation?

3) Is the patient symptomatic ?



4) Are there contra-indications to any intervention on the valve ?

6) Is a transcatheter intervention feasible?

7) What is the final decision of the heart team ?

5) Is surgery contraindicated /high risk ?

Mitral Regurgitation

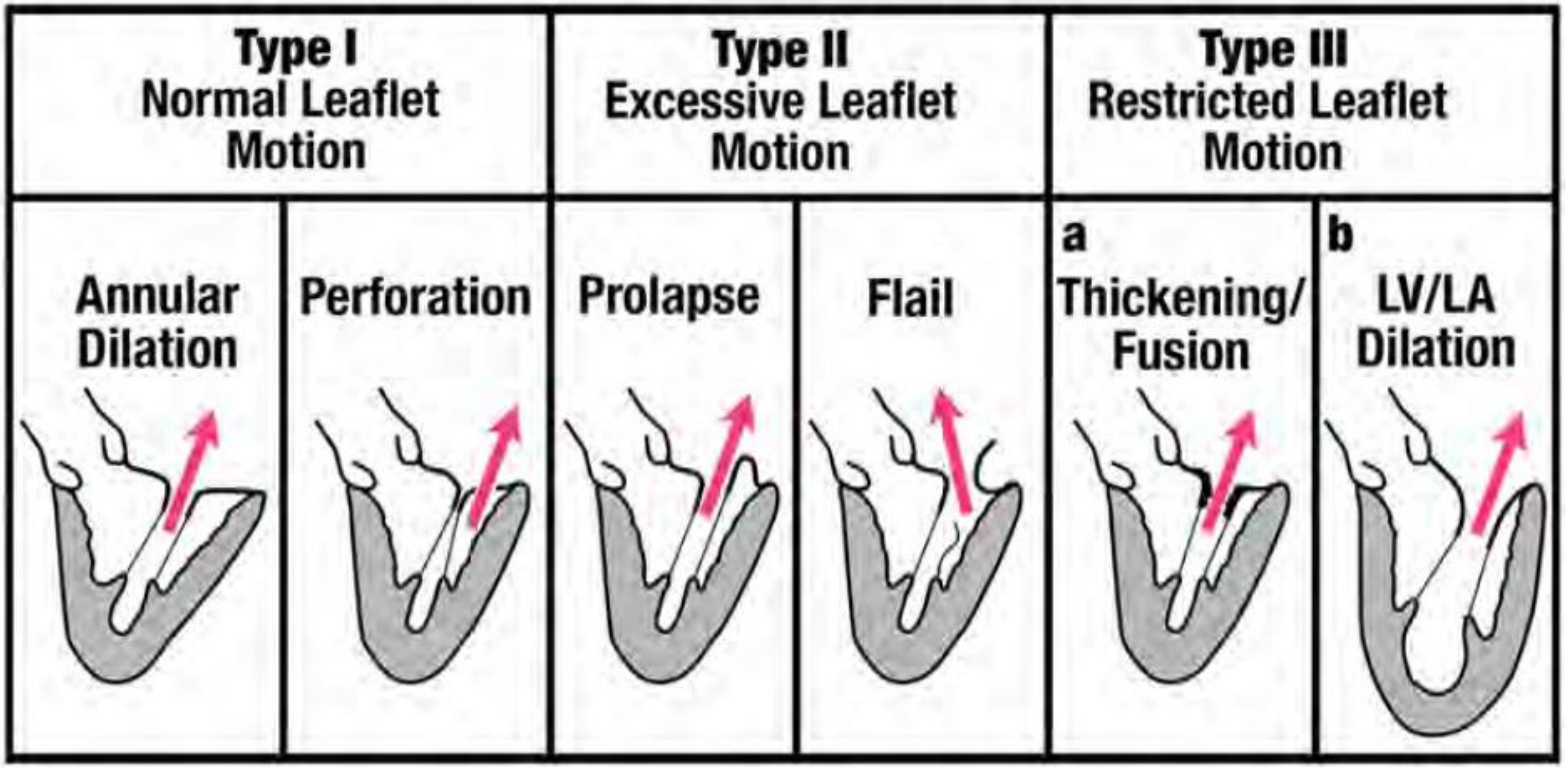
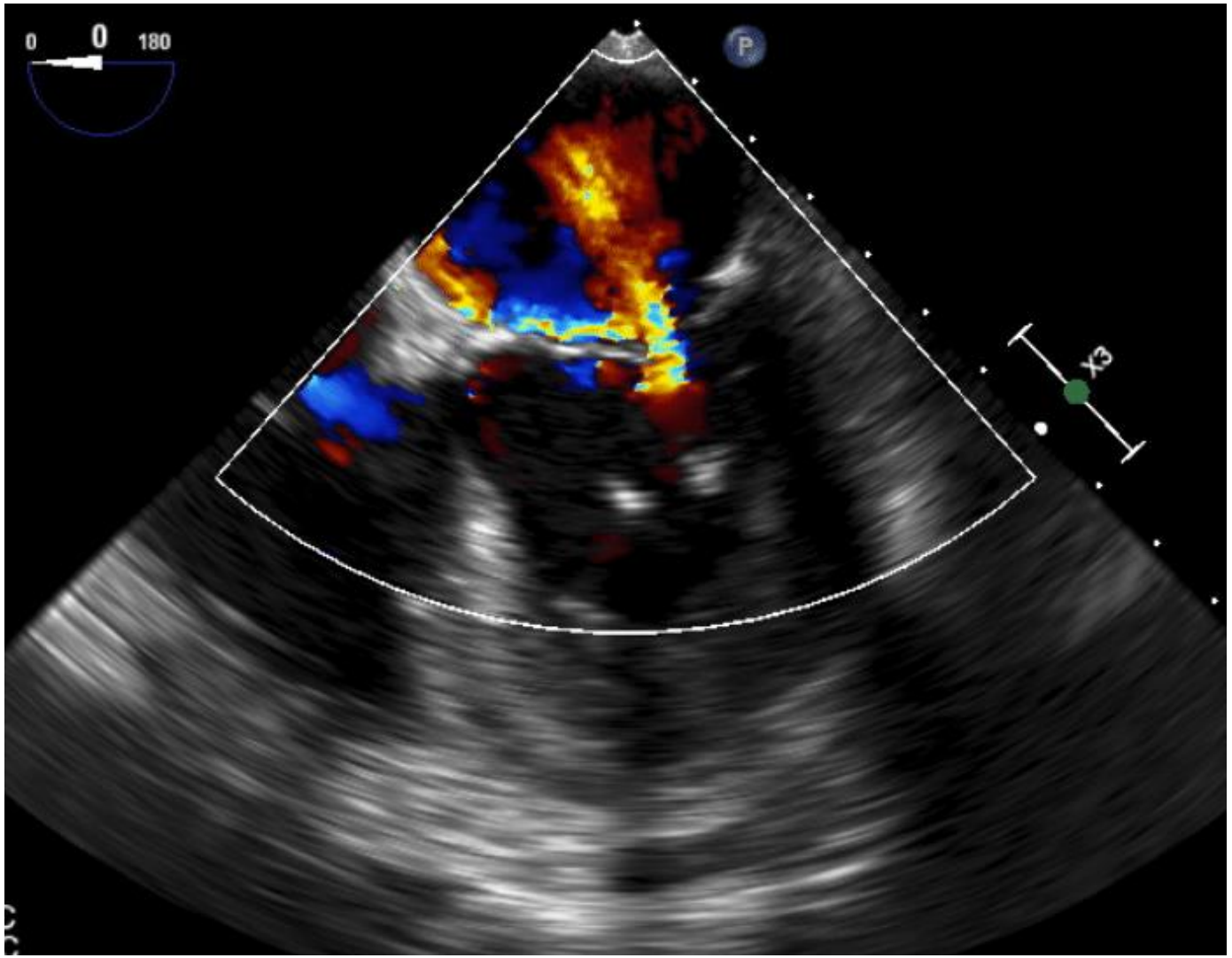


Figure 10 Depiction of mechanisms of MR as per the Carpentier classification.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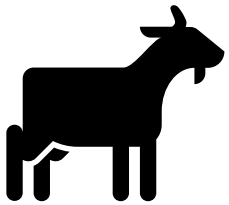
0
180
P
X3

Severity of MR



1. Color Doppler: determining severity solely on this measure is **discouraged.**

2. PW Doppler: Mitral inflow and pulmonary veins PW Doppler can provide supportive elements.

In severe MR, peak mitral inflow velocity is typically >120 cm/s.

Pulmonary venous flow is normally **antegrade** during both ventricular systole and diastole with a short **retrograde** flow during atrial systole.

With increasing MR, there is **a progressive blunting of the systolic component, with systolic flow reversal in cases of severe MR.**

3. CW Doppler: The CW jet profile is a useful adjunct in MR assessment. A very dense jet supports severe MR

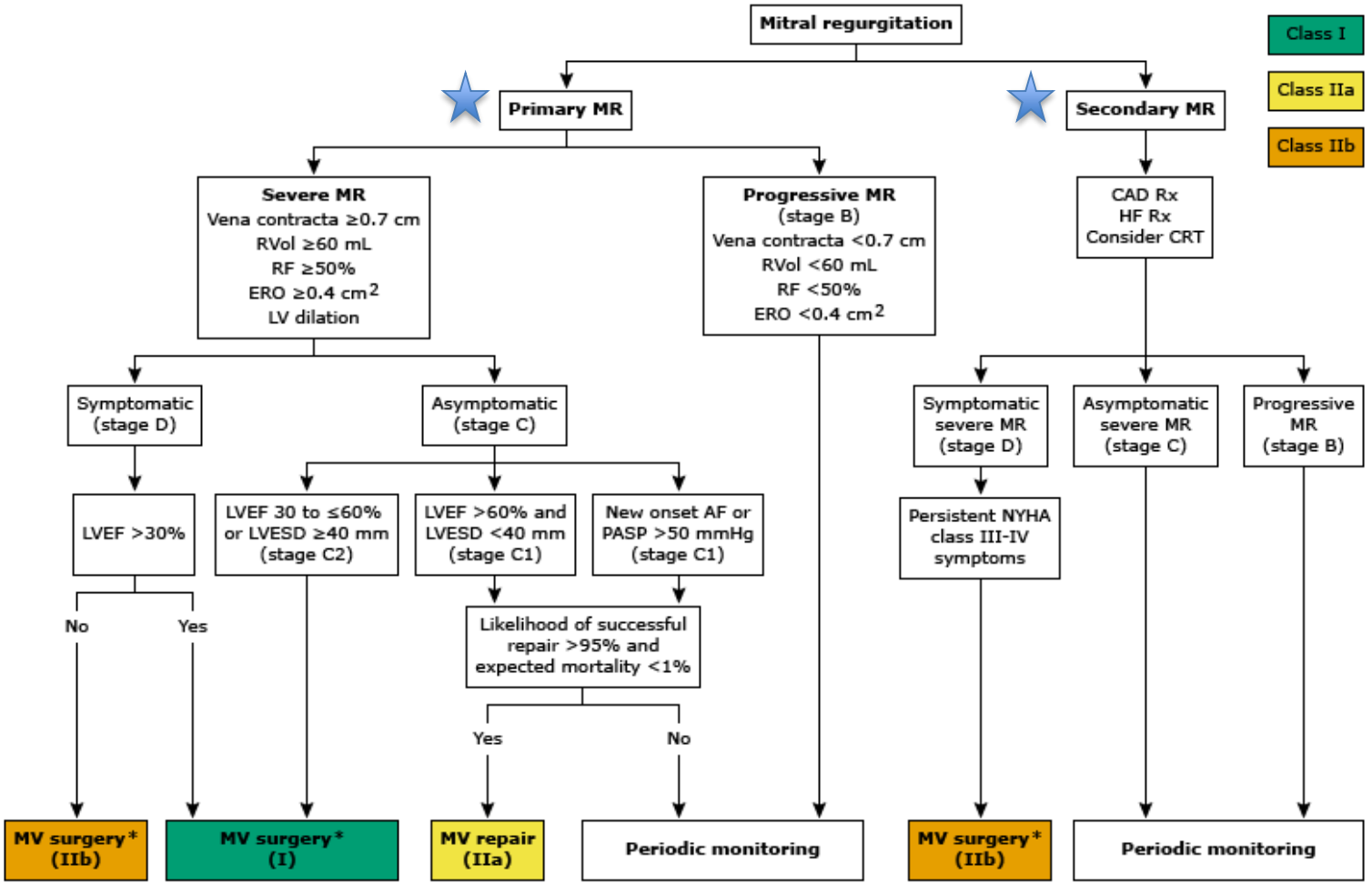
4. PISA method: when blood rushes through an orifice, it forms hemispheres with increasing velocity and decreasing surface area

Based on the continuity equation, the effective regurgitant orifice rea (EROA) of ≥0.4 cm2 implies severe

Regurgitant volume ≥60 mL, or regurgitant fraction ≥50%, calculated from EROA both indicate severe MR.

AHA GUIDELINES FOR SURGERY FOR MR

Surgical Indication	Strength
Symptoms w/ LVEF > 30%	I
Asymptomatic w/ LVEF between 30 - **60%**	I
Asymptomatic with LVESD ≥ **40** mm	I
Asymptomatic with new-onset Afib or Systolic PAP ≥ **50** mmHg	IIa
Asymptomatic with likelihood of successful and durable repair without >95% with an expected mortality <1% at a Heart Valve Center of Excellence	IIa
Asymptomatic patients with chronic severe primary MR (stage C1) and preserved LV function (LVEF >60% and LVESD <40 mm) with a progressive increase in LV size or decrease in EF on serial imaging studies	IIa



For the strength of recommendations: Class I means procedure/treatment should be performed/administered. Class IIa means it is reasonable to perform procedure/administer treatment. Class IIb means the procedure/treatment may be considered. Class III means that procedure or treatment is not useful/effective and may be harmful.
For the level of evidence: Level A means multiple populations evaluated; data derived from multiple randomized clinical trial or meta-analyses. Level B means limited populations evaluated; data derived from a single randomized trial or nonrandomized studies. Level C means very limited populations evaluated; only consensus opinion of experts, case studies, or standard of care.

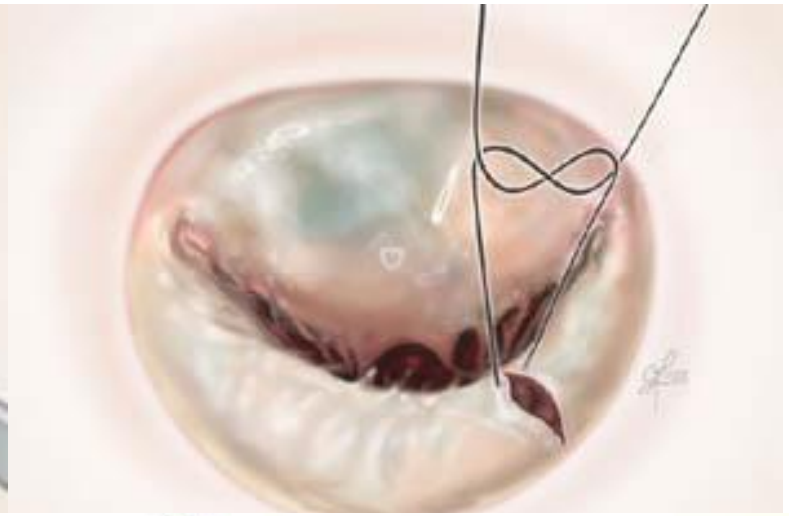
Surveillance

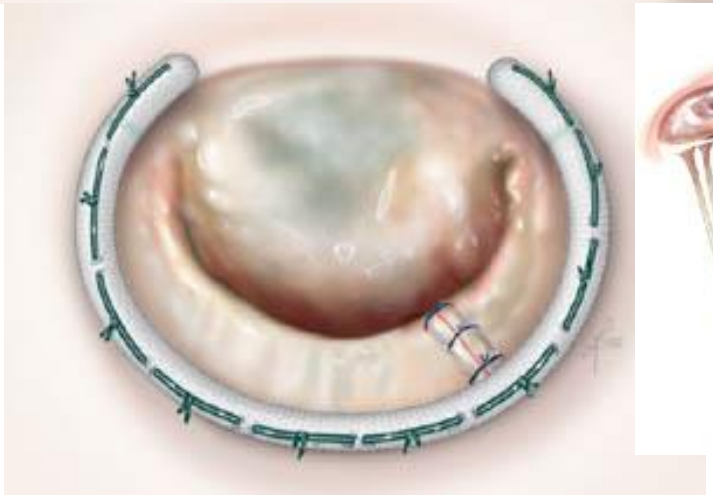
- In patients with **asymptomatic severe mitral regurgitation** with **preserved LV function** who do not have an indication for surgery → clinical and echocardiographic surveillance every **6 to 12 months is recommended**

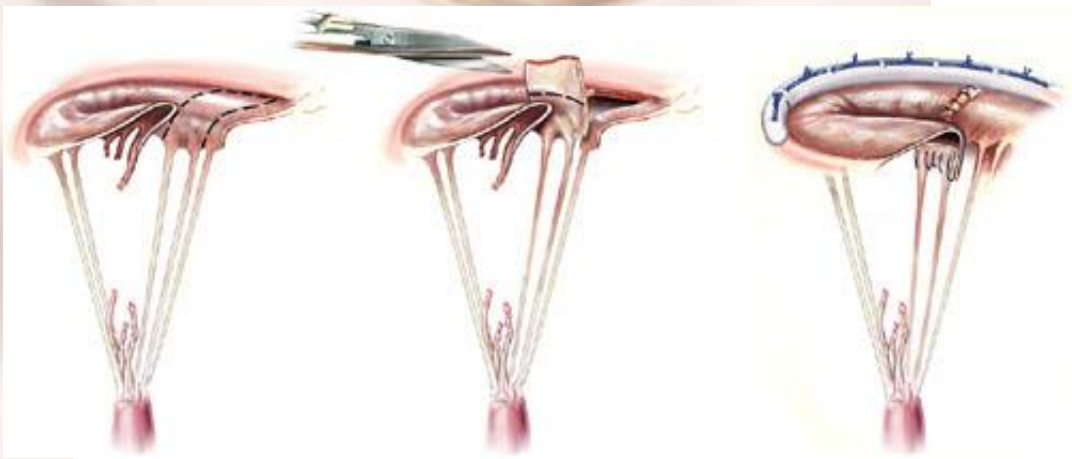
Surgery vs Repair

- In general, **mitral valve repair** is preferred to valve replacement, as it is associated with improved survival in retrospective studies.

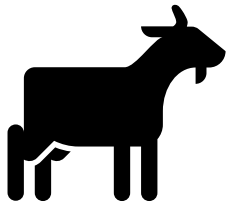
- Chordal preservation is preferred when replacement is needed, as it is associated with improved left ventricular geometry and long-term function.







Features suggestive of successful MV repair



1. **Posterior** leaflet prolapse
2. Commissural prolapse
3. Rupture chordae to the **posterior** leaflet
4. Congenital cleft
5. Small perforation

Question – MV regurgitation

A 26-year-old woman is evaluated during a visit to establish care. She has noted shortness of breath for the past 18 months that is progressively worsening. She has no significant medical history. She is active and exercises regularly. No meds

On physical examination, blood pressure is 115/70 mm Hg and pulse rate is 62/min. BMI is 45. Cardiac examination reveals a midsystolic click with a grade 3/6 late systolic murmur heard over the apex and radiating toward the axilla.

TTE shows moderate to severe mitral regurgitation with marked prolapse of the anterior leaflet, normal left ventricular systolic function with an EF of **55%**, and normal chamber sizes; the regurgitant jet is not well visualized.

Which of the following is the most appropriate management?

A. Mitral valve repair

B. Repeat TTE in 6 months

C. Start lisinopril

D. Transesophageal echocardiography

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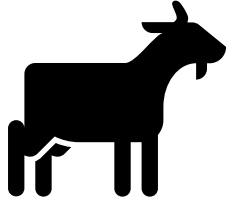
30-40-50-60 ?



First Year

- 30 LVEF > 30%
- 40 LVESD ≥ 40 mm
- 50 RVSP ≥ 50 mmHg
- 60 LVEF < 60%

Indications for reapir

Question – MV regurgitation

A 77-year-old man is evaluated during a routine examination. He has no symptoms or significant medical history. He is active and exercises regularly. He does not take any medications.

On physical examination, blood pressure is 135/70 mm Hg, pulse rate is 82/min, and respiration rate is 17/min. Cardiac examination reveals a grade 3/6 apical holosystolic murmur.

Echocardiogram shows severe mitral regurgitation and a left ventricular ejection fraction of 45% without evidence of regional wall motion abnormalities.

Which of the following is the most appropriate management?

A Vasodilator therapy
B Percutaneous mitral balloon valvuloplasty
C Repeat echocardiogram in 6 months
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Question – MV regurgitation

A 67-year-old woman is evaluated during a routine examination. She was diagnosed with a cardiac murmur in early adulthood.

She is active, healthy, and without symptoms. She takes no medications.

On physical examination, vital signs are normal.

Besides a grade 3/6 holosystolic murmur preceded by multiple clicks at apex, the physical findings are unremarkable.

A TTE shows LV EF of 50% and end-systolic dimension of LV is42 mm. Myxomatous degeneration of the mitral valve is present with severe regurgitation due to posterior leaflet prolapse.

Which of the following is the most appropriate next step in management?

A Serial clinical and echocardiographic evaluations
B Surgical mitral valve repair
C Surgical mitral valve replacement
D Transcatheter mitral valve repair

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Question – MV regurgitation

An 87-year-old woman is hospitalized for acute decompensated heart failure.
PMHx significant for a stroke 4 years ago, hypertension, severe COPD, and CKD IIId
She underwent diuresis with furosemide overnight and is now resting comfortably.
Home meds: lisinopril, atorvastatin, low-dose aspirin, tiotropium, and as-needed albuterol.

Vitals: temperature is normal, blood pressure is 95/65 mm Hg, pulse rate is 80/min, and RR is normal. Oxygen sat 90% on 2 L O2 per NC.

Bilateral crackles are noted in the bottom quarter of the lung fields. The estimated central venous pressure is elevated. S1 is diminished. A grade 3/6 holosystolic murmur and soft diastolic rumble are present at the apex.

TTE shows a flail segment involving the posterior leaflet of the mitral valve and severe regurgitation. The left ventricular ejection fraction is 60%.

Cardiac and pulmonary surgical risks are estimated to be high (estimated operative mortality, 10%).

What is the most appropriate next step?

A Mitral valve replacement
B Surgical mitral valve repair
C Transcatheter mitral valve repair
D Continue current medical therapy

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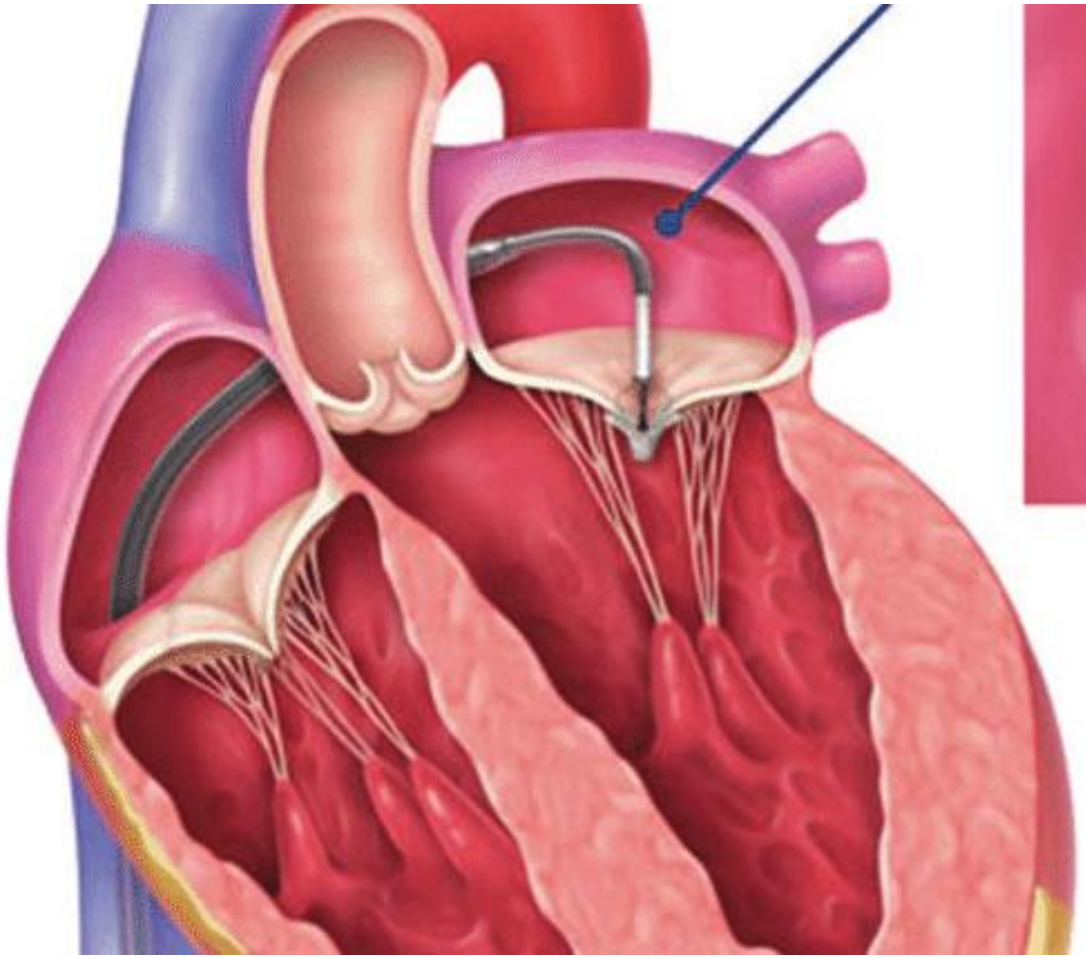
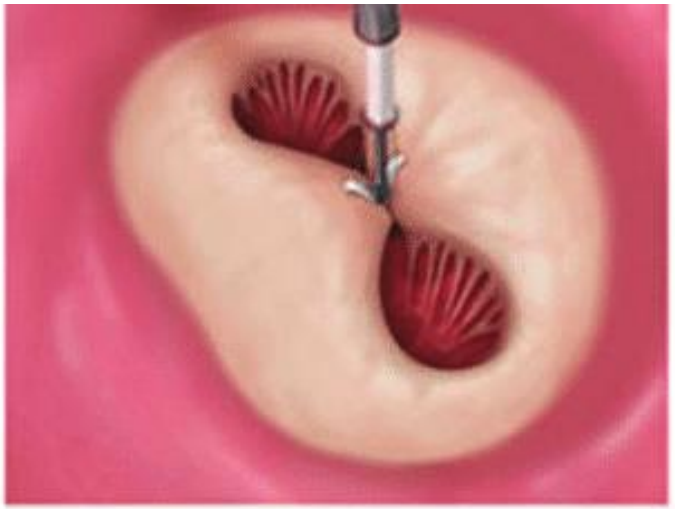
MitraClip





Atrial view

MitraClip

- Until 2018, transcatheter mitral valve repair, was indicated for symptomatic patients with **primary degenerative mitral regurgitation** who are at **prohibitive surgical risk**, such as this patient.

- With this technique, the mitral valve is plicated using an approach from the femoral vein

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FDA News Release

FDA approves new indication for valve repair device to treat certain heart failure patients with mitral regurgitation

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For Immediate March 14, 2019

Resources

1. "Mitral Valve Repair Procedure Details." Clevelandclinic.org, 14 Dec. 2018, my.clevelandclinic.org/health/treatments/17240-mitral-valve-repair/resources.
2. "Medical Knowledge Self-Assessment Program." ACP, 2016, mksap17.acponline.org/app/groups/cv/topics/.
3. Medical Knowledge Self-Assessment Program." ACP, 2018, mksap18.acponline.org/app/dashboard
4. Harb SC, Griffin BP. Mitral Valve Disease: a Comprehensive Review. Curr Cardiol Rep 2017;19:73 10.1007/s11886-017-0883-5
5. Vahanian, Alec. "Expert Review: Mitral Valve Disease." European Society of Cardiology, 23 Jan. 2019, www.escardio.org/Journals/E-Journal-of-Cardiology-Practice/Volume-16/Expert-review-mitral-valve-disease.

If extra time

https://web.stanford.edu/group/ccm_echocardio/cgi-bin/mediawiki/index.php/Mitral_regurgitation_assessment