

Murmurs on Murmurs: When to ECHO, When to Refer

Up to half of all children will develop a murmur as they grow up and “wear and tear” degenerative valve changes make murmurs increasingly common in our aging population. In this article, Dr. Sonnenberg details how to distinguish benign murmurs from life-threatening problems.



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Murmurs simply reflect turbulent blood flow in the heart. Almost any high cardiac output state can generate a flow murmur (exercise, anxiety, *etc.*). Up to half of all children will develop a murmur as they grow up and “wear and tear” degenerative valve changes make murmurs increasingly common in our aging population.

However, not all murmurs are benign, with a population-based study from the Mayo clinic showing a 1% to 6% prevalence of moderate or severe left-sided valve lesions. It is critical to be able to distinguish benign murmurs from serious potentially life-threatening problems. Echocardiography has become the logical test to check valve function after a physical exam has raised concerns about major valve problems.

The American College of Cardiology consensus has very liberal guidelines for ordering an ECHO for a murmur. Any diastolic or continuous murmur is much more likely to be from serious valve pathology and deserves at least one ECHO. Similarly, a loud, holosystolic, or late-peaking systolic murmur should be investigated, as should a murmur in the presence of cardiac symptoms. An asymptomatic, soft, early or mid-peaking systolic murmur is much more likely to just be benign and does not require an ECHO (Figure 1).

Julia’s Case

Julia, 78, presents to your office for a routine physical exam. She feels fine, but has several coronary risk factors.

On physical examination you hear a harsh mid-systolic murmur at the base of the heart radiating widely. You wonder if you are missing serious valve pathology, but want to save the healthcare system the cost of an unnecessary ECHO.

[Read on to find out what can be done for Julia...](#)

What are we listening for?

The vast majority of concerning murmurs in adults reflect left-sided valve disease. I will briefly review the four left-sided valve lesions to remind us what to listen for and what to expect on an ECHO report.

Mitral stenosis (MS)

Almost invariably, due to prior rheumatic mitral valve damage, MS is the hardest murmur to hear and often requires the patient to lie on their left side in held expiration, listening over apex for the soft diastolic rumble (Figure 2). There is no damaging effect on the left ventricle (LV), but bad MS causes high pressure in the left atrium that causes the same symptoms as “left heart

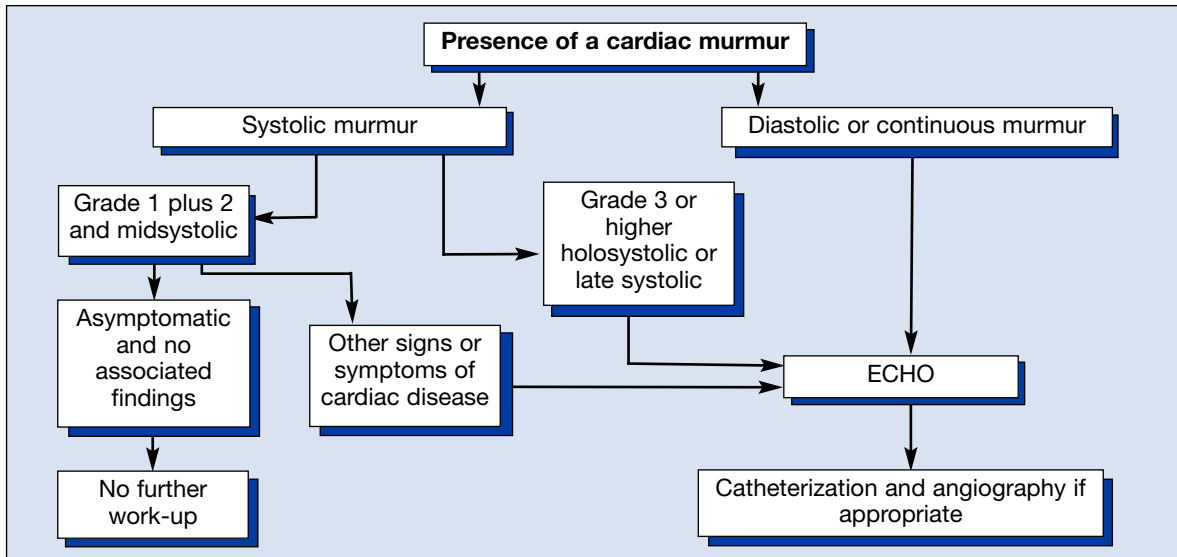


Figure 1. When to order an ECHO.¹

failure.” Eventual pulmonary hypertension and right ventricle (RV) failure are end stage findings.

Severe asymptomatic MS should be referred to a cardiologist, especially when there are symptoms of heart failure, atrial fibrillation (AF) or signs of pulmonary hypertension, the patient may need mitral valve ballooning or valve surgery.

Mitral regurgitation (MR)

MR occurs when anything interferes with the apparatus preventing mitral leaflets being blown back into left atrium (LA) during LV systole (LV wall/papillary muscles/chords/leaflets/mitral annulus). Common causes are:

- degenerative chordal stretching causing prolapse (degenerative or myxomatous),
- post-infarct distorted LV shape (misnamed ischemic MR), or
- functional MR from anything that dilates the LV causing dilated mitral annulus.

The excess volume of severe MR cycling between LV and LA inevitably causes LV and

LA dilation. Unfortunately, there is eventual LV damage causing LV failure, or atrial dilation causing AF, later pulmonary hypertension and RV failure.

Therefore, a physical exam should show a displaced and diffuse LV apex. The murmur of MR starts when LV pressure is higher than LA pressure and continues until LV pressure falls below LA pressure in diastole, causing a pan- or holo-systolic murmur (from S1 into S2), maybe with an S3 (indicating LV volume load), possibly a soft diastolic mitral inflow rumble (from doubled flow across the mitral valve in diastole) (Figure 3).

Referral to a cardiologist (with view to surgery) should occur if patient shows:

- heart failure,
- any LV dysfunction (ejection fraction (EF) < 60% or end-systolic dimension on ECHO > 40 mm),
- AF, or
- pulmonary hypertension (> 60 mmHg) with or without RV frank right heart failure.

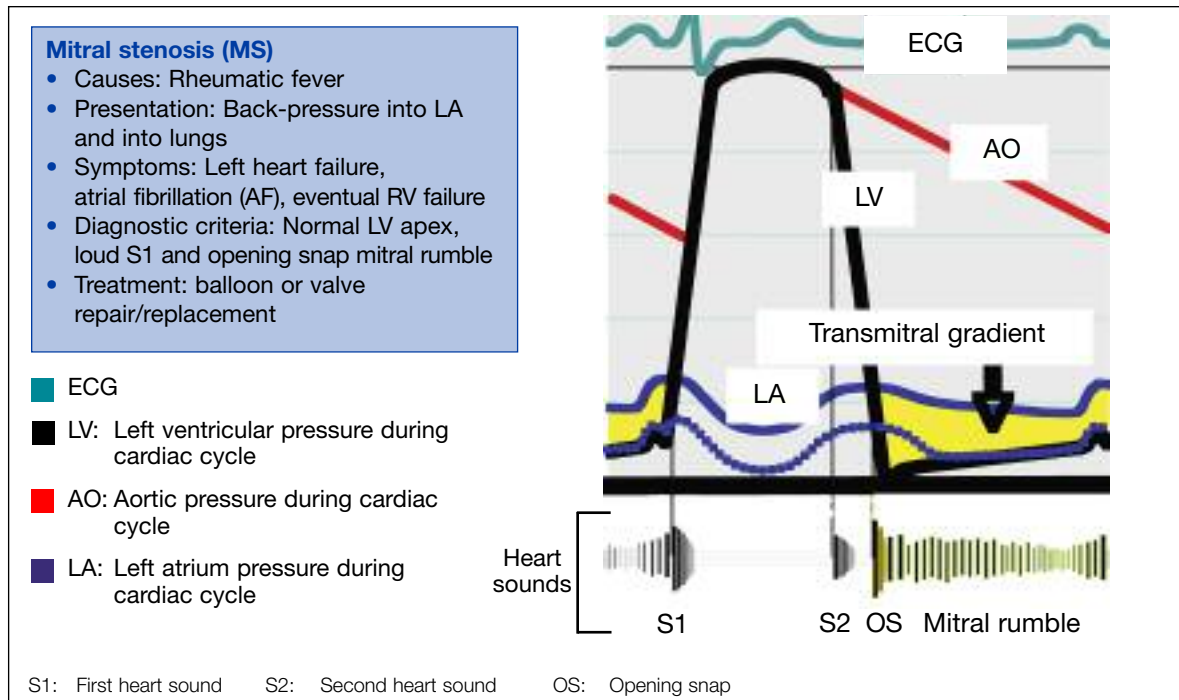


Figure 2. Cardiac pressures and heart sounds in MS.

Aortic stenosis (AS)

AS comes from degenerative fibrosis/calcification of the valve due to age and atherosclerotic risk factors, occurring faster if there is a bicuspid valve. Severe AS requires higher LV pressures to maintain output, leading to concentric LV hypertrophy. However, over time, the LV becomes stiffer and LV oxygen demands rise, eventually leading to symptoms and/or LV dysfunction. Symptoms are a “SAD” story (syncope/angina/dyspnea).

A very tight aortic valve only generates a reduced, delayed carotid upstroke (though masked by aging). The apex should be sustained (> 50% systole) not displaced. In sinus rhythm, a stiff LV leads to an S4. The AS murmur starts a

bit after S1 (mid-systolic or ejection systolic). The worse the AS, the later the peak intensity of the crescendo/decrescendo murmur (Figure 4). Often the harsh late-peaking AS murmur at the base of the heart fades along the sternum, to reappear at the apex with more blowing frequencies, mistaken for a separate MR murmur (Gallavardin’s phenomenon).

Even asymptomatic severe AS can quickly progress to symptoms and likely should lead to referral to a cardiologist. If symptoms occur, patients need urgent evaluation for aortic valve replacement, with an unfixed mortality of 1% to 2% per month.

Aortic regurgitation (AR)

AR comes from leaflet problems (usually age-related, or from bicuspid valve), or from aortic root dilation pulling leaflets apart. Severe AR leads to a huge backwash of aortic blood into the LV during diastole, requiring a much higher cardiac output to still maintain net forward flow to

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body. This inevitably leads to marked LV dilation and failure and also high pressure in the aorta (from excessive forward flow). Over time, LV dilation leads to myocardial damage and heart failure. Symptoms are a “PAD” story (palpitations/angina/dyspnea).

On exam, the dramatic systolic forward surge and diastolic backwash causes a large pulse pressure and very high amplitude pulses. The LV apex is dramatically enlarged while heart sounds may show an S4 and S3 from increased LV volume and mass. The murmur of aortic insufficiency starts with S2 and goes into S1, usually high pitched, at the base, best heard with the patient holding held expiration, sitting upright (the murmur often sounds like breath sounds) (Figure 5).

Refer to cardiologist if severe AR is suspected, especially if there are any hints of symptoms, mostly unusual dyspnea or angina. The cardiologist should discuss the role for a vasodilating calcium channel blocker in slowing the need to have surgery performed. Usual symptoms are a

PAD story with palpitations less important for surgery. Even if asymptomatic, refer patients if there is massive LV dilation (end-systolic dimension > 50 mm), or even a mild drop in EF < 50% to 55%, since these are worrisome indicators of need for valve replacement.

Right-sided valve dysfunction

This is much less common, usually tricuspid regurgitation from left-sided cardiac overload or other causes of pulmonary hypertension (e.g., lung disease), rarely isolated primary right-sided valve disease.

Little guidance is available, but consider referral to a cardiologist with any severe right sided valve lesion, especially with severe pulmonary hypertension (> 65 mmHg to 70 mmHg) or signs/symptoms of major RV dilation/dysfunction. Major peripheral edema, ascites, tender enlarged liver, elevated jugular venous pressure (JVP), or prominent parasternal heave would all be a concern.

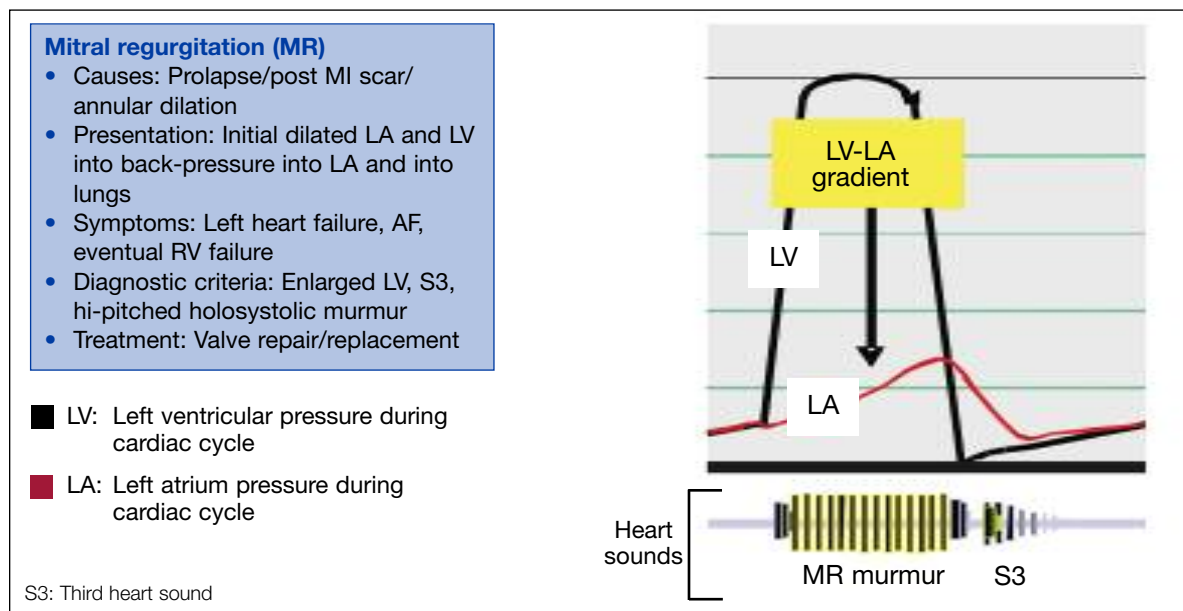


Figure 3. Cardiac pressures and heart sounds in MR.

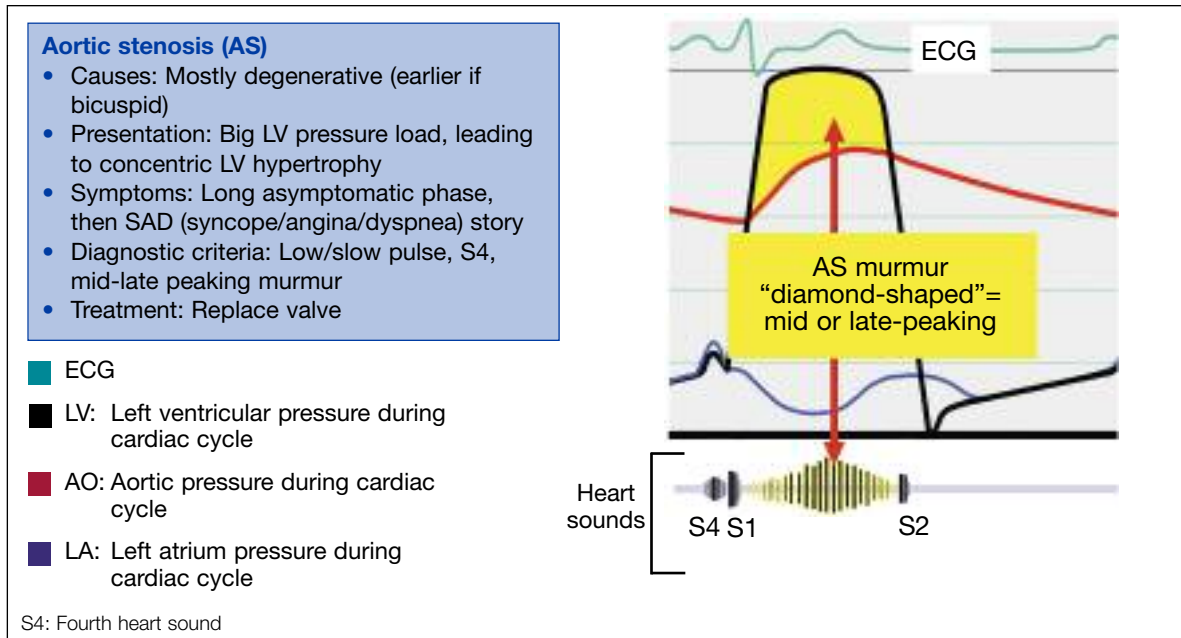


Figure 4. Cardiac pressures and heart sounds in AS.

Consider referral to a cardiologist with any severe right-sided valve lesion, especially with severe pulmonary hypertension or signs/symptoms of major RV dilation/dysfunction.

How often to re-ECHO?

The consensus is to re-ECHO severe left-sided valve lesions at least annually, maybe more often if findings are close to the danger zone of imminent surgery. If moderate left-sided valve disease is present you should only re-ECHO if a change in cardiac status occurs. However, since ECHO assessment of severity can under- or over-estimate a

true valve problem, every two to five years may be prudent. With mild valve lesions, do not re-ECHO unless clinical symptoms/signs have clearly changed.

Can you trust your ECHO reports?

The assessment of severity of valve problems has improved dramatically over the years, but a great deal of reader subjective interpretation remains. Some quantitative measures that sound very accurate can be extremely dependent on up to three to four different measures, each with risks of serious errors. The whole picture should fit, not just with the clinical exam, but even within the ECHO report. Otherwise, a mild to moderate lesion may be grossly overestimated (and sometimes severe valve problems may be missed). Severe AR or MR should show some LV dilation. Severe MS or AS should not only show valve areas of around 1 cm² but there

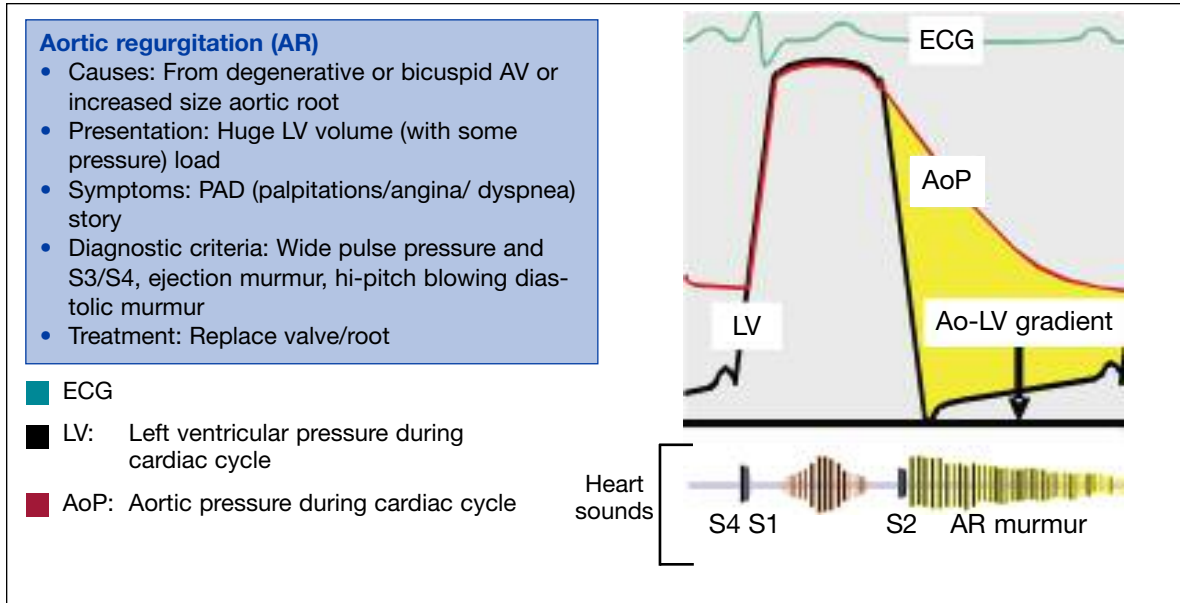


Figure 5. Cardiac pressures and heart sounds in severe AR.

should be a correspondingly high mean gradient across the valve (at least 10 mmHg/40 mmHg respectively) in most otherwise normal patients. Failure of the report to fit is a marker that a reporting error is possible.

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When to refer to a cardiologist

Referral to a cardiologist is necessary if the history presents:

- Any severe asymptomatic left-sided valve disease, especially if heart failure symptoms are present

- AF or pulmonary hypertension/RV overload in mitral disease
 - Angina or syncope in aortic disease
- Hints suggesting severe disease are worrisome physical or laboratory exam findings, including:
- high JVP,
 - signs of pulmonary congestion,
 - palpable murmur and
 - major LV dilation or dysfunction (apex big/displaced/large dimensions or poor EF on ECHO).

References

1. Bonow RO, Carabello BA, Chatterjee K, et al: ACC/AHA 2006 Guidelines for Management of Patients of Valvular Heart Disease. J Am Coll Cardiol 2006; 48(3):e1-148.
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