

Mitral Stenosis

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THE STORY IN ONE SENTENCE

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“Mitral narrowing (stenosis) (narrowed heart valve) is usually from rheumatic fever damage. Atrial fibrillation (an irregular, quivering heartbeat) (chaotic heartbeat) raises stroke risk sharply. Balloon valvuloplasty (stretching the valve open with a balloon) can help.”

Normal anatomy — the body's job

The mitral valve sits between the left atrium (top left heart chamber) and the left ventricle (bottom left pumping chamber). When your heart relaxes between beats, this valve opens wide—about the size of a dime—to let blood flow smoothly from the top chamber down into the main pumping chamber. This quiet flow keeps your lungs clear and your body supplied with oxygen-rich blood.

BODY'S JOB

The mitral valve's job is to open fully during the heart's relaxation phase (diastole) so the left ventricle can fill with blood from the lungs, then snap shut when the ventricle squeezes to prevent backflow. A healthy valve opening is about 4–6 square centimeters, letting blood glide through without resistance or backup.

1. Oxygen-rich blood returns from your lungs into the left atrium (top left chamber).
2. When your heart relaxes, the mitral valve opens wide like a door.
3. Blood flows smoothly down into the left ventricle (bottom left pumping chamber).
4. When the ventricle squeezes, the mitral valve snaps shut to prevent backflow.
5. The ventricle pumps blood out through the aorta to your whole body.

What breaks

Rheumatic fever—an immune reaction that can follow untreated strep throat—scars and thickens the mitral valve flaps, gluing their edges together so the opening shrinks from dime-size to pinhole-size. Blood can no longer flow easily from the left atrium into the left ventricle.

CLINICAL TERM

Rheumatic heart disease causes fusion of the mitral commissures (the edges where the valve flaps meet) and thickening of the leaflets and chordae tendineae (the stringy cords that anchor the flaps). The valve orifice narrows from a normal 4–6 cm² to less than 1.5 cm² in severe narrowing (stenosis). This obstruction raises left atrial pressure, which backs up into the pulmonary veins and lung capillaries.

How the body compensates

For years, your body hides the problem by raising pressure in the left atrium to push blood through the narrowed valve. You may feel fine at rest, but symptoms appear with exercise or stress. Once atrial fibrillation (an irregular, quivering heartbeat) starts or the right heart begins to fail, the safety margin disappears and symptoms accelerate.

1. {'what': 'The left atrium pumps harder and stretches (dilates) to push blood through the tight valve opening.', 'why': 'Higher pressure forces enough blood through at rest, so you may not notice symptoms for years.'}
2. {'what': 'Your heart rate stays low at rest to give more filling time.', 'why': 'A slower heart rate allows more time for blood to trickle through the narrow valve each beat, keeping the ventricle filled enough to pump.'}
3. {'what': 'Lung vessels constrict reflexively (called reactive pulmonary vasoconstriction).', 'why': 'This protective reflex tries to limit backward pressure into the delicate lung capillaries, but over time it raises pressure on the right heart.'}
4. {'what': 'The right ventricle muscle thickens (hypertrophies) to pump against higher lung pressure.', 'why': 'The right heart compensates for pulmonary high blood pressure (hypertension) by building more muscle, but this only works for a while before it weakens.'}
5. {'what': 'Symptoms appear first with exertion, fever, pregnancy, or atrial fibrillation (an irregular, quivering heartbeat).', 'why': 'These situations demand higher heart rate or cardiac output, but the narrow valve cannot let more blood through, so pressure spikes and fluid floods the lungs.'}

6. {'what': 'Once atrial fibrillation (an irregular, quivering heartbeat) starts, compensation collapses rapidly.', 'why': 'The chaotic, fast rhythm eliminates the atrial 'kick' that helps push blood through the tight valve and shortens filling time, causing sudden worsening and raising stroke risk sharply.'}
7. {'what': 'Watch the trajectory, not just today's numbers.', 'why': 'A patient who feels okay today but has worsening exercise tolerance, new palpitations, or rising right heart pressure is on a downhill slope—the crash point (acute pulmonary edema (fluid flooding the lungs), stroke, right heart failure) is near.'}

Domino effect

1. The scarred mitral valve narrows, blocking blood flow from left atrium to left ventricle. — Rheumatic fever scars and fuses the valve flaps together, shrinking the opening from dime-size to pinhole-size so blood cannot flow through easily.
2. Pressure builds up in the left atrium and backs into the lungs. — Blood piles up behind the narrow valve like cars behind a closed gate, raising pressure in the left atrium; that pressure transmits backward into the pulmonary veins and lung capillaries.
3. Fluid leaks into the air sacs, causing shortness of breath (pulmonary swelling (edema)). — High pressure in the lung capillaries forces fluid out through the vessel walls into the air sacs (alveoli), making it hard to breathe—especially with exercise, lying flat, or fast heart rate.
4. The left atrium stretches and starts firing chaotic signals (atrial fibrillation). — Chronic high pressure and scarring remodel the atrium's electrical system, creating disorganized circuits that cause a rapid, irregular heartbeat instead of a steady rhythm.
5. Blood swirls slowly in the quivering atrium and clots form. — In atrial fibrillation (an irregular, quivering heartbeat), the atrium quivers instead of squeezing, so blood pools and stagnates—especially in a pouch called the left atrial appendage—allowing clots to form like sediment in still water.
6. Clots break loose and travel to the brain, causing stroke. — A clot that forms in the left atrium can break off, ride the bloodstream out through the aorta, and block an artery in the brain, cutting off oxygen and causing a stroke.
7. Chronic high pressure in the lungs stiffens the blood vessels (pulmonary high blood pressure (hypertension)). — Long-term high pressure damages and thickens the walls of the lung arteries, making them stiff and narrow, which forces the right heart to pump even harder.
8. The right ventricle pumps harder and harder, then weakens and fails. — The right ventricle muscle thickens to overcome the high lung pressure, but eventually it cannot keep up; the muscle stretches, weakens, and fails to pump blood forward, causing fluid to back up into the body (swollen legs, liver congestion).

Symptoms · what the patient feels, and why

- A low, rumbling sound (murmur) happens in the middle of the heart's relaxation phase, best heard at the apex (the pointy tip of the heart at the lower left of your chest): The mitral valve (the gate between the heart's upper-left and lower-left rooms) is stiff and narrow, so when the left atrium (the top-left room) squeezes blood through it into the left ventricle (the bottom-left pumping room), the blood has to rush through a tight space—like blowing through a narrow straw—and that rushing makes the rumbling sound.
- An opening snap (a sharp extra click right after the second heart sound): The stiff, scarred mitral valve leaflets (the two flaps of the gate) pop open suddenly when the pressure in the left atrium pushes them apart, making a snapping noise—like opening a stiff, stuck door quickly.
- The first heart sound (S1) is very loud: The mitral valve leaflets are still flexible enough to slam shut hard when the left ventricle squeezes, so the closing makes a louder-than-normal thump—like a heavy door banging shut.
- Shortness of breath, especially with activity or when lying flat: The narrow mitral valve acts like a dam, blocking blood from flowing smoothly from the lungs into the left side of the heart. Pressure backs up into the lungs (pulmonary congestion), and fluid leaks into the tiny air sacs, making it hard to breathe—like trying to breathe through a wet sponge.
- Irregular, fast heartbeat (often atrial fibrillation (an irregular, quivering heartbeat)): The left atrium swells and stretches because it has to work extra hard to push blood through the tight valve. The stretched muscle becomes electrically unstable, and the heart's rhythm goes haywire—the atrium quivers instead of beating in a steady pattern.
- Coughing, sometimes with pink, frothy spit or blood-tinged mucus (hemoptysis): High pressure in the lung blood vessels (from the backup of blood) can cause small vessels to leak or even burst, or it can trigger the lungs to produce extra mucus that mixes with a bit of blood.
- A flushed, purplish color on the cheeks (malar flush): Low oxygen in the blood (because the lungs aren't working well) and high pressure in the tiny face blood vessels cause the cheeks to look dusky or purplish—like the color you see when someone is very cold.
- Swelling in the legs, ankles, or belly (edema and fluid buildup in the belly (ascites)): If the backup pressure gets bad enough, it affects the right side of the heart too. The right ventricle can't pump blood forward easily, so fluid leaks out of the blood vessels into the tissues—like water seeping out of an overfilled bucket.

Focused exam

- Loud first heart sound (S1) at the apex: In mitral narrowing (stenosis), the valve flaps are thick and scarred from rheumatic fever. When the left atrium (the upper left heart chamber) squeezes and pushes blood toward the stiff valve, the flaps snap shut hard. That loud snap is the S1. It tells you the valve is narrowed and stiff.
- Opening snap (a sharp click sound right after S2, early in diastole): The scarred mitral valve is stuck shut. When pressure builds high enough in the left atrium, the valve finally cracks open with a snap. The snap happens earlier than normal because high pressure forces it open faster. This snap is bedside proof that the mitral valve is narrowed.
- Low-pitched rumbling diastolic murmur at the apex, best heard with the bell of the stethoscope in the left lateral position: Blood squeezes through the narrow valve opening during filling time (diastole), making a rumbling sound. This rumble is loudest at the tip of the heart (apex). Mitral narrowing (stenosis) is one of the only conditions that gives you this specific rumble during diastole.
- Irregular heartbeat (atrial fibrillation) on exam or rhythm strip: In mitral narrowing (stenosis), high pressure backs up into the left atrium and stretches it. A stretched atrium misfires and goes into atrial fibrillation (an irregular, quivering heartbeat) (an irregular, chaotic rhythm). When the heart beats irregularly, blood pools in the atrium and clots can form. This is the biggest danger for stroke.
- Crackles (rales) at the lung bases during breathing: The narrowed mitral valve blocks blood from leaving the lungs and flowing into the left ventricle. Fluid backs up into lung tissue. Crackles mean the lungs are waterlogged, a sign that the heart is failing to pump blood forward.
- Peripheral swelling (edema) (swelling in legs and ankles) and elevated jugular venous pressure (neck veins bulge when sitting up): High pressure in the lungs pushes back into the right side of the heart. The right heart cannot handle the extra pressure and backs up into the body. Fluid leaks into tissues (edema) and neck veins bulge. These signs show right heart strain caused by mitral narrowing (stenosis).

Diagnostics · every test answers a question

- Transthoracic echocardiogram (ultrasound of the heart) → How narrow is the mitral valve opening, and how much pressure is backing up into the lungs?
- Electrocardiogram (ECG) → Is the patient in atrial fibrillation (an irregular, quivering heartbeat), and is the left atrium stretched?
- Chest X-ray → Is there fluid backing up into the lungs, and is the left atrium enlarged?
- Brain natriuretic peptide (BNP) or NT-proBNP → How much strain is the heart under from the backed-up pressure?

- International normalized ratio (INR) if on warfarin → Is the blood thin enough to prevent clots in atrial fibrillation (an irregular, quivering heartbeat)?
- Transesophageal echocardiogram (TEE, ultrasound probe down the throat) → Is there a clot in the left atrium, and can the valve be fixed with a balloon?
- Right heart catheterization (if planning surgery or if pulmonary high blood pressure (hypertension) is severe) → What is the exact pressure in the lungs, and is the right heart failing?

Treatment logic

- Anticoagulation with warfarin (target INR 2.0–3.0) or a direct oral anticoagulant (DOAC) if atrial fibrillation (an irregular, quivering heartbeat) is present → Thins the blood to stop clots from forming in the irregular, slow-moving left atrium. Prevents strokes caused by clots traveling to the brain. Warfarin is preferred if the valve is severely narrowed; DOACs may be used in milder cases per current ACC/AHA guidelines.
- Diuretics (furosemide 20–80 mg daily) to remove excess fluid → Pulls water out of the blood through the kidneys, lowering the volume of blood the heart must pump. Reduces pressure backed up into the lungs and eases shortness of breath and leg swelling.
- Beta-blocker (metoprolol 25–100 mg twice daily) or non-dihydropyridine calcium-channel blocker (diltiazem) to slow heart rate → Slows the heart rate so the left atrium has more time to squeeze blood through the tight valve opening during each beat. This lowers pressure buildup in the atrium and lungs. Target heart rate is 60–80 beats per minute at rest.
- Percutaneous mitral balloon valvuloplasty (PMBV, also called balloon commissurotomy) → A balloon catheter is threaded into the heart and inflated inside the mitral valve to crack open the fused leaflets. This directly widens the opening, lowers the pressure gradient across the valve (goal < 5 mmHg mean), and relieves lung congestion. Works best if leaflets are flexible (Wilkins score ≤ 8) and no heavy calcium deposits.
- Mitral valve replacement (surgical) with mechanical or bioprosthetic valve → Removes the scarred, stuck valve and replaces it with a working one (mechanical metal or tissue bioprosthetic). Permanently restores normal blood flow from left atrium to left ventricle and eliminates the pressure gradient. Recommended if balloon valvuloplasty is not possible (heavy calcium, rigid leaflets, Wilkins score > 8) or if severe mitral regurgitation is also present.
- Penicillin prevention (prophylaxis) (benzathine penicillin G 1.2 million units IM every 3–4 weeks) if history of rheumatic fever → Prevents streptococcal throat infections (caused by group A Streptococcus bacteria) from triggering new rheumatic fever attacks and further scarring the valve. Continued for 10 years after the last attack or until age 40, whichever is longer (per WHO and AHA guidelines).

- Rate control or rhythm control for atrial fibrillation (an irregular, quivering heartbeat) (cardioversion, catheter ablation, or medications) → Rhythm control (cardioversion or ablation) tries to restore normal sinus rhythm, improving atrium squeeze and lowering clot risk. Rate control (beta-blockers, diltiazem, digoxin) keeps heart rate steady if rhythm cannot be restored. Both reduce symptoms and stroke risk when combined with anticoagulation.

Medications

Warfarin · Vitamin K antagonist (oral anticoagulant)

Warfarin blocks vitamin K in the liver so the liver can't make several clotting proteins. This keeps the blood thin enough that clots don't form easily in the heart chambers. In mitral narrowing (stenosis), blood pools in the left atrium (the upper left chamber of the heart) because the narrow valve slows the flow, and pooled blood can clot. Clots that break off can cause a stroke. Warfarin lowers that risk.

1. You take the pill by mouth once a day.
2. Warfarin travels to the liver.
3. It blocks an enzyme that recycles vitamin K.
4. Without recycled vitamin K, the liver can't finish building clotting factors II, VII, IX, and X.
5. Those clotting proteins drop in the blood over a few days.
6. Blood takes longer to clot, so dangerous clots are much less likely to form in the left atrium.

SAFETY WATCH

Requires regular blood tests (INR) to keep the dose in the safe zone—too much causes bleeding, too little allows clots. · Many foods (especially leafy greens high in vitamin K) and other medicines change how warfarin works, so diet and drug lists must stay steady. · Bleeding risk: even small cuts can bleed longer; bruising happens more easily; dangerous bleeding (brain, stomach, bowel) is possible if INR goes too high. · Pregnancy: warfarin can harm a developing baby, so women who might become pregnant need careful planning and often switch to heparin injections.

Beta-blocker (metoprolol, atenolol, or carvedilol) · Beta-adrenergic receptor blocker

Beta-blockers attach to special docking sites (beta receptors) on heart muscle cells and block adrenaline and noradrenaline from landing there. This slows the heart rate and gives the left ventricle more time to fill with blood through the narrow mitral valve. A slower, steadier

heartbeat improves how much blood moves forward with each beat and reduces backup into the lungs.

1. You take the pill by mouth, usually once or twice a day.
2. The beta-blocker travels through the blood to the heart.
3. It plugs into beta-1 receptors on heart cells, blocking adrenaline's 'speed up' signal.
4. The SA node fires more slowly, so the heart beats fewer times per minute.
5. The AV node also slows, which helps control the rate if atrial fibrillation (an irregular, quivering heartbeat) (a fast, irregular rhythm) develops.
6. With a slower heart rate, the left ventricle has more seconds to fill through the tight valve, so each beat pumps more blood and less backs up into the lungs.

SAFETY WATCH

Can drop heart rate too low (bradycardia), causing dizziness or fainting. · Can drop blood pressure, especially when standing up quickly. · May worsen asthma or chronic obstructive pulmonary disease (COPD) by tightening airways in some patients (cardioselective beta-blockers like metoprolol are safer). · Do NOT stop suddenly—quitting cold can cause rebound fast heart rate or dangerous rhythm changes; always taper under a doctor's guidance. · Can mask low blood sugar symptoms in people with diabetes.

Diuretic (furosemide or bumetanide) · Loop diuretic

Loop diuretics tell the kidneys to dump much more salt and water into the urine. This shrinks the total volume of fluid in the bloodstream and tissues. In mitral narrowing (stenosis), the narrow valve causes blood to back up into the lungs, leaking fluid into the air sacs and causing shortness of breath and swelling. Removing extra fluid relieves that congestion.

1. You take the pill by mouth (or get it through an IV in the hospital).
2. The diuretic travels to the kidneys.
3. It blocks a pump (the Na-K-2Cl cotransporter) in the loop of Henle that normally pulls salt back into the blood.
4. With the pump blocked, salt stays in the urine.
5. Water follows the salt (water always moves toward higher salt) and also stays in the urine.
6. You urinate more, losing both salt and water.
7. Total blood volume drops, pressure in the veins falls, and fluid is pulled out of the lungs and tissues back into the bloodstream to be urinated away.

SAFETY WATCH

Can wash out potassium, magnesium, and other electrolytes in the urine, causing dangerous heart rhythm problems; blood tests monitor levels. · Dehydration and low blood pressure if the dose is too high or fluid intake is too low. · Can trigger gout attacks by raising uric acid. · Kidney function can worsen if volume drops too fast. · Frequent urination can be disruptive; take the dose in the morning to avoid nighttime bathroom trips.

Digoxin · Cardiac glycoside

Digoxin has two jobs in mitral narrowing (stenosis). First, it slows the electrical signals traveling through the AV node (the heart's gatekeeper between upper and lower chambers), which controls the heart rate—especially important if atrial fibrillation (an irregular, quivering heartbeat) develops. Second, it makes each heartbeat squeeze a bit harder by boosting calcium inside heart muscle cells. The main use here is rate control, not strengthening the squeeze.

1. You take the pill by mouth once a day.
2. Digoxin blocks the sodium-potassium pump (Na-K-ATPase) on heart muscle cells.
3. This raises sodium inside the cell.
4. Higher sodium reduces the activity of another pump that normally kicks calcium out of the cell.
5. Calcium builds up inside the cell, making each contraction stronger.
6. Digoxin also increases vagal tone (signals from the vagus nerve, which acts like a brake on the heart), slowing conduction through the AV node and lowering heart rate.

SAFETY WATCH

Narrow margin between helpful and toxic dose; blood levels must be checked regularly. · Toxicity causes nausea, vomiting, confusion, yellow-green vision halos, and dangerous heart rhythms (especially if potassium is low). · Kidney function affects how the body clears digoxin; dose must be adjusted in kidney disease. · Many drug interactions (antibiotics, antifungals, calcium channel blockers) raise digoxin levels.

Penicillin G benzathine (monthly injection) or oral penicillin V or amoxicillin (daily) · Beta-lactam antibiotic (penicillin)

Penicillin kills Group A Streptococcus bacteria, the germ that causes strep throat and rheumatic fever. In people who have already had rheumatic fever (the cause of most mitral narrowing (stenosis)), another strep infection can trigger another attack of rheumatic fever

and worsen valve damage. Long-term penicillin prevents new strep infections, stopping repeat valve injury.

1. You get an injection deep in the muscle once a month, or take a pill by mouth every day.
2. Penicillin circulates in the blood and bathes the tissues of the throat.
3. If Group A Streptococcus bacteria land in your throat, penicillin attaches to proteins (penicillin-binding proteins) on the bacteria's cell wall.
4. This blocks the bacteria from building and repairing their protective wall.
5. The bacteria burst and die.
6. No strep infection means no new rheumatic fever attack and no further valve damage.

SAFETY WATCH

Allergic reactions range from mild rash to life-threatening anaphylaxis (throat swelling, difficulty breathing, shock); anyone with penicillin allergy must use a different antibiotic (often a macrolide like azithromycin). · Monthly injections can be painful. · Daily pills require excellent adherence—missing doses allows strep infections to take hold. · Long-term use can shift the normal bacteria in the body, sometimes causing yeast infections or diarrhea.

Red flags

- New or sudden severe shortness of breath at rest (may mean the valve has gotten much tighter or fluid is flooding the lungs)
- Chest pain, one-sided weakness, trouble speaking, or sudden vision loss (may mean a blood clot from the heart has traveled to the brain or another organ)
- Coughing up blood or pink frothy spit (means pressure in the lungs is dangerously high)
- Swelling in the legs or belly that is new or getting worse fast (means the right side of the heart is starting to fail)

Nursing priorities

1. Monitor continuous cardiac rhythm on telemetry and immediately report new irregular heartbeat or heart rate above 110 beats per minute — Atrial fibrillation (an irregular, quivering heartbeat) happens suddenly in mitral narrowing (stenosis) when the stretched left atrium cannot maintain normal rhythm. Fast rates shorten the filling time through the narrow valve and cause flash pulmonary edema (fluid flooding the lungs) (sudden lung flooding). Clots can form in minutes.

2. Keep the patient in high Fowler position (sitting upright at 60 to 90 degrees) and give oxygen to maintain saturation above 92 percent — The narrowed mitral valve causes blood to back up into the lungs. Sitting upright uses gravity to pull fluid down and away from the lung air sacs so oxygen can get through. Low oxygen means the narrowing (stenosis) is decompensating.
3. Administer diuretics like furosemide exactly as ordered and track intake and output every hour, reporting urine less than 30 milliliters per hour — Diuretics remove the extra fluid backing up behind the narrowed (stenotic) valve. Hourly monitoring catches early kidney problems from poor forward flow through the valve. Weight loss of 1 to 2 pounds daily shows the drug is working.
4. Give beta-blockers like metoprolol or calcium-channel blockers as prescribed to keep resting heart rate between 60 and 80 beats per minute — A slower heart rate gives more time for diastole (the relaxation phase when the mitral valve is open). The narrow valve needs extra seconds to let blood through. Fast rates cut filling time and cause backup into the lungs.
5. Check INR (international normalized ratio, a blood-clotting measure) results daily if the patient takes warfarin and hold the dose if INR is above 3.5 or below 2.0, notifying the provider immediately — The stretched left atrium and atrial fibrillation (an irregular, quivering heartbeat) create a perfect place for clots to form. Warfarin keeps INR between 2 and 3 to prevent strokes without causing dangerous bleeding. Outside this range, either clots or bleeding can happen fast.
6. Assess lung sounds every 4 hours, listening for crackles at the bases, and report new or worsening crackles immediately — Crackles (popping sounds) mean fluid is leaking into the lung air sacs because pressure is building behind the narrowed (stenotic) valve. New crackles signal acute decompensation and pulmonary edema (fluid flooding the lungs) requiring urgent diuretic increase or valve intervention.
7. Limit physical activity and cluster care to allow rest periods, keeping the patient on strict bedrest if symptoms happen at rest — Activity increases heart rate and blood flow. The fixed narrow valve opening cannot handle extra volume, so exertion triggers sudden lung congestion. Rest keeps the heart rate low and reduces the work the narrowed (stenotic) valve must do.
8. Monitor for signs of systemic a traveling clot lodging in a vessel (embolism) including sudden confusion, one-sided weakness, cold pale extremities, or severe abdominal pain, and activate rapid response if any occur — Clots from the left atrium can break off and block arteries to the brain (stroke), arms, legs, intestines, or kidneys. Mitral narrowing (stenosis) patients have a 20 percent lifetime stroke risk without anticoagulation. Minutes matter for clot-busting treatment.

Sources

- AHA/ACC 2020 Guideline for the Management of Patients with Valvular Heart Disease
- ESC/EACTS 2021 Guidelines for the Management of Valvular Heart Disease
- UpToDate (Wolters Kluwer)
- American College of Cardiology (ACC)

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