

Slow heartbeat

A plain-English guide for you and your family

WHAT IS HAPPENING

Your heart has a natural pacemaker called the SA node at the top that fires electrical signals to make the heart beat. This signal travels through a relay station called the AV node and then down to the bottom pumping chambers. When everything works right, your heart beats 60–100 times per minute at rest. A slow heart rate (Bradycardia) means your heart is beating slower than 60 beats per minute. This happens when the SA node fires too slowly (because of aging, medication, or disease), when the AV node blocks signals (from drugs, scar tissue, or poor blood flow), or when the electrical wiring below the AV node is damaged. A slow heart rate is only a problem if your body cannot get enough oxygen-rich blood. You might feel tired, dizzy, short of breath, or even faint. Your body tries to make up for it by squeezing harder with each beat, but if the rate stays too low, blood pressure drops and organs suffer. Most of the time, a slow heart rate can be managed by stopping the drug that caused it, treating the underlying disease, or placing a permanent pacemaker if the heart's natural system is too damaged to recover.

What you might feel

- Feeling tired and weak
- Feeling dizzy or lightheaded
- Fainting or feeling like you're about to faint
- Shortness of breath
- Chest pain or pressure
- Confusion or trouble thinking clearly
- Can't do your usual activities without getting exhausted
- Low blood pressure
- Heart fluttering or skipping beats
- Cold, clammy skin and feeling very unwell

Call the doctor right away if...

- Fainting or nearly fainting—your brain isn't getting enough blood, and you're at risk of dangerous pauses in your heartbeat.
- Chest pain or sudden trouble breathing—may mean a heart attack, heart failure, or fluid backing up into your lungs.
- Confusion or trouble staying awake—means your brain is starved for oxygen and needs emergency care.
- Blood pressure below 90 on the top number, with cold skin, weak pulse, or little urine—your body is going into shock and organs may start failing.
- New complete heart block or advanced second-degree heart block on the ECG (the electrical tracing of your heart)—the electrical signals between your heart's upper and lower chambers are failing, and your heart could stop.

What the care team will do

- Put the patient on a continuous heart monitor and watch the heart rate and rhythm every minute.
- Get IV access with at least one large IV line and prepare atropine 1 mg at the bedside, ready to push.
- Attach transcutaneous pacing (TCP) pads to the chest and turn on the pacing machine, but do not pace yet unless the patient gets worse.
- Check blood pressure every 5 to 15 minutes and watch for signs of shock like cold skin, weak pulse, confusion, or little urine.
- Draw blood for potassium, magnesium, thyroid hormone (TSH), troponin (a heart enzyme), and digoxin level if the patient takes that medicine.
- Hold (do not give) the next dose of beta-blockers, calcium channel blockers, digoxin, or other heart medicines until the doctor reviews them.
- Keep the patient lying flat or with the head of the bed only slightly up, and help them to the bathroom instead of letting them walk alone.
- Prepare for emergency transvenous pacemaker insertion by gathering sterile pacing wire kit, ultrasound machine, and lidocaine (numbing medicine) at the bedside.

Medicines you may be given — and why

Atropine

Atropine covers up the landing spots where acetylcholine—the chemical that tells your heart to slow down—normally docks. The vagus nerve (a long nerve running from your brain down to

your heart) releases acetylcholine to put the brakes on. When atropine blocks those landing spots (called muscarinic receptors), acetylcholine cannot land, so the brakes lift and the heart's natural pacemaker (the SA node, a small cluster of spark-making cells in the top-right chamber) speeds up. Think of it like unplugging the brake pedal—the engine can now go faster. Atropine works best when the slow heart is caused by too much vagus brake or by drugs that copy what the vagus does.

Epinephrine infusion

Epinephrine is synthetic adrenaline. It docks onto beta-1 receptors on heart cells and tells them to beat faster and squeeze harder. At the same time it docks onto alpha-1 receptors on the smooth muscle in blood vessel walls and tells them to tighten (constrict), which raises blood pressure. Think of it like pressing the gas pedal and squeezing a garden hose tighter at the same time—flow speeds up and pressure climbs. Epinephrine is used when atropine has failed or when the slow heart is causing dangerously low blood pressure, chest pain, confusion, or trouble breathing. It buys time until you can place a pacemaker or fix the root cause.

Dopamine infusion

Dopamine is a chemical messenger (neurotransmitter) your body makes naturally; as a drug it acts like adrenaline. At moderate to high doses (5 to 20 micrograms per kilogram per minute), dopamine binds to beta-1 receptors on heart cells to speed up the heart and make it squeeze harder, and it binds to alpha-1 receptors on blood vessel walls to tighten them and raise blood pressure. Think of it as turning up the volume on your heart and squeezing the hose tighter. Dopamine is used when atropine fails and the patient is unstable (low blood pressure, chest pain, confusion, shortness of breath). It is another temporary fix until a pacemaker is placed or the root cause is treated.

Glucagon

Glucagon is a hormone your pancreas makes to raise blood sugar when it drops too low. It also has a powerful side effect on the heart: it binds to its own glucagon receptors on heart cells and triggers a cascade (through a pathway using cyclic AMP, a chemical messenger inside cells, different from the beta-receptor pathway that adrenaline uses) that floods the cell with calcium, making the heart beat faster and squeeze much harder. Glucagon works even when beta receptors are completely blocked by beta-blocker drugs (like metoprolol, atenolol, propranolol) or when calcium channels are blocked by calcium channel blockers (like diltiazem, verapamil). Think of it as a back door into the heart that beta-blockers and calcium channel blockers cannot lock. Glucagon is the antidote when these drugs cause dangerous slow heart rate and low blood pressure (overdose or toxicity).

Isoproterenol infusion

Isoproterenol is a synthetic drug that acts only on beta receptors: beta-1 receptors in the heart (which speed up rate and strengthen squeeze) and beta-2 receptors in the lungs and blood vessels (which relax airways and widen blood vessels). It speeds up the SA node, strengthens heart squeeze, and relaxes blood vessel walls (which can drop blood pressure because vessels are wider). Because it is a pure beta drug with no alpha effect (no vessel-tightening), it is used rarely—mainly for refractory a slow heart rate (bradycardia) (slow heart that does not respond to atropine, epinephrine, or dopamine) or as a temporary bridge to pacing in heart transplant patients (who have no vagus nerve, so atropine does not work). Think of it as flooring the gas pedal but loosening the hose clamp at the same time—heart rate goes up but blood pressure may fall.

Theophylline

Theophylline blocks adenosine receptors in the heart. Adenosine is a natural chemical brake that slows the SA node and AV node; blocking adenosine receptors takes one brake off. Theophylline also mildly inhibits an enzyme called phosphodiesterase, which normally breaks down cyclic AMP (a chemical messenger inside cells), so cyclic AMP levels rise a bit and give a weak adrenaline-like boost. Theophylline is used almost exclusively in heart transplant patients (who have no vagus nerve, so atropine fails) when they develop slow heart rate and pacing is not yet in place. It is rarely used otherwise because safer, faster options (atropine, epinephrine, dopamine, pacing) exist. Think of it as cutting one of the brake cables so the engine can rev a bit higher.

Where this information comes from

- AHA/ACC/HRS 2018 Guideline on the Evaluation and Management of Patients with Bradycardia and Cardiac Conduction Delay
- European Society of Cardiology 2021 Guidelines on Cardiac Pacing and Cardiac Resynchronization Therapy
- American Heart Association
- UpToDate Clinical Decision Support

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