

Ventricular Tachycardia and Ventricular Fibrillation

A plain-English guide for you and your family

WHAT IS HAPPENING

Your heart has four rooms. The bottom two, called ventricles, do the heavy lifting—they squeeze hard to push blood to your lungs and body. Normally, electricity flows down in an orderly way from the top of the heart, telling the ventricles exactly when to squeeze. In ventricular a fast heart rate (tachycardia), the ventricles fire their own fast signal, ignoring the normal pacemaker. The heart races so fast it can't fill with blood between beats, so blood pressure drops. In ventricular fibrillation, the ventricles shake wildly instead of squeezing—no blood moves at all. Both can be caused by a blocked artery that starved part of the heart muscle and left a scar, by dangerously low potassium or magnesium, by certain drugs, by an inherited electrical problem in the heart, or by a very weak heart muscle. If the person still has a pulse but feels dizzy or has chest pain, doctors shock the heart or give medicine to reset the rhythm. If there is no pulse, it is a cardiac arrest—CPR and a defibrillator shock are the only things that can bring the person back. After the first episode, an implantable defibrillator is often placed under the skin to shock any future dangerous rhythm automatically and prevent sudden death.

What you might feel

- Fast, wide heartbeat pattern on the monitor (ventricular a fast heart rate (tachycardia)) or chaotic squiggly line (ventricular fibrillation)
- Sudden collapse or loss of consciousness
- No pulse or very weak pulse
- Chest pain or pressure
- Sudden shortness of breath or gasping
- Dizziness or lightheadedness
- Pounding or fluttering feeling in the chest (palpitations)
- Pale, cold, sweaty skin

Call the doctor right away if...

- No pulse and no breathing (cardiac arrest — start CPR and call for a defibrillator immediately)
- Sudden collapse or complete loss of consciousness
- Chest pain with a very fast heart rate and low blood pressure
- Ventricular fibrillation on the monitor (the heart is just quivering and must be shocked right away)

What the care team will do

- Check for a pulse within 10 seconds. If no pulse, start chest compressions immediately at 100 to 120 pushes per minute, pushing down 2 inches on the center of the chest.
- Attach defibrillator pads to the bare chest. Charge to 200 joules (biphasic energy level) and deliver shock immediately if the rhythm is ventricular fibrillation or pulseless ventricular a fast heart rate (tachycardia). Resume compressions right after the shock without checking pulse.
- Give epinephrine 1 milligram IV push (intravenous injection) every 3 to 5 minutes during CPR. Continue until the patient has a pulse and normal rhythm.
- Give amiodarone 300 milligrams IV push after the second shock if the rhythm does not change. If the dangerous rhythm continues and we shock again, give another 150 milligrams of amiodarone IV push.
- Draw blood immediately for potassium and magnesium levels. Give magnesium sulfate 2 grams IV over 15 minutes if levels are low or if we suspect low levels. Replace potassium through IV if the blood test shows less than 4.0.
- Prepare for advanced airway placement with an endotracheal tube (breathing tube inserted into the windpipe) if CPR continues past 2 minutes. Give 100 percent oxygen through a bag-mask until the tube is placed.
- Check the medication list and IV pumps. Stop any QT-prolonging drugs like ciprofloxacin, ondansetron, or haloperidol that might have triggered torsades de pointes (a twisting type of ventricular a fast heart rate (tachycardia)).
- After successful rhythm conversion, start a continuous amiodarone IV drip at 1 milligram per minute for 6 hours, then 0.5 milligrams per minute for 18 hours. Keep the patient on a cardiac monitor with alarm limits set.

Medicines you may be given — and why

Epinephrine (adrenaline)

Epinephrine tightens blood vessels all over the body so blood pressure climbs back up, and it pushes the heart to squeeze harder and beat faster. During a cardiac arrest (when the heart has stopped pumping), this helps blood reach the brain and heart muscle itself, buying time until the rhythm can be fixed.

Amiodarone

Amiodarone slows down and smooths out the electrical signals running through heart muscle. It does this by blocking several gates (potassium, sodium, and calcium channels) that let charged particles in and out of heart cells, and it also lightly blocks adrenaline receptors. The result is a longer, steadier heartbeat cycle that is harder to flip into chaos.

Lidocaine

Lidocaine blocks fast sodium channels in heart muscle, which slows down the runaway electrical signals that cause ventricular a fast heart rate (tachycardia). It works best in injured or oxygen-starved heart tissue (like after a heart attack), because damaged cells let sodium leak in and become electrically irritable. Lidocaine quiets those irritable spots without slowing the whole heart much.

Magnesium sulfate

Magnesium is a charged particle (electrolyte) that helps stabilize the heart's electrical system. It blocks calcium from rushing into heart cells, which calms overly excited signals. It is especially important for a twisted form of ventricular a fast heart rate (tachycardia) called torsades de pointes, which happens when the heart's reset time (QT interval) is too long. Magnesium can also help if the person's magnesium or potassium level is low.

Procainamide

Procainamide slows the electrical signals in the heart by blocking sodium channels (which slows the upstroke of each heartbeat wave) and potassium channels (which lengthens the reset time between beats). This double action stops re-entry circuits—abnormal loops of electricity that spin around scar tissue or damaged muscle and cause ventricular a fast heart rate (tachycardia). It is an alternative when amiodarone is not available or did not work.

Beta blockers (e.g. metoprolol, esmolol)

Beta blockers attach to beta-1 receptors on heart cells and block adrenaline (epinephrine and norepinephrine) from speeding the heart or making it squeeze harder. This lowers heart rate, reduces oxygen demand, and calms electrical irritability. In people with ventricular a fast heart

rate (tachycardia) triggered by stress or adrenaline surges (catecholamine-sensitive VT), beta blockers can prevent or stop the arrhythmia. They are also part of long-term treatment after a heart attack or in heart failure to protect the heart and lower the risk of sudden death.

Potassium and other electrolyte replacement

Potassium (K⁺) is a charged particle that heart cells pump in and out to create the electrical wave of each heartbeat. Low potassium (hypokalemia) makes cells fire extra beats and can trigger or worsen ventricular a fast heart rate (tachycardia) and fibrillation. Replacing potassium (and often magnesium at the same time) stabilizes the cell membrane and restores normal electrical flow, lowering the chance of chaotic rhythms. The goal is to keep potassium between 4.0 and 5.0 mEq/L in anyone at risk for dangerous rhythms.

Where this information comes from

- AHA/ACC 2017 Guideline for Management of Patients With Ventricular Arrhythmias
- AHA Advanced Cardiovascular Life Support (ACLS) 2020
- European Society of Cardiology 2022 Ventricular Arrhythmia Guideline
- UpToDate Clinical Overview: Ventricular Tachycardia and Fibrillation

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