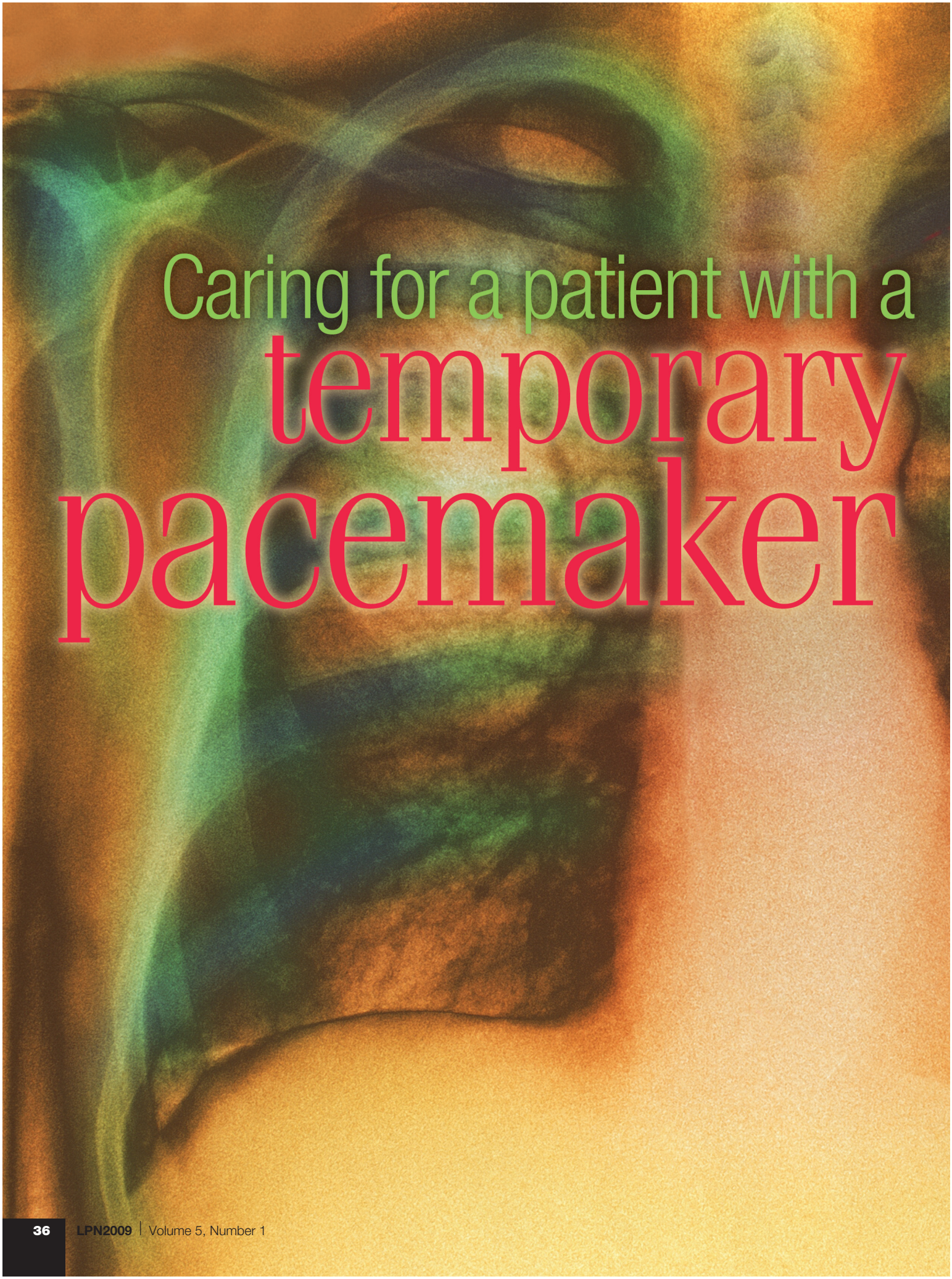
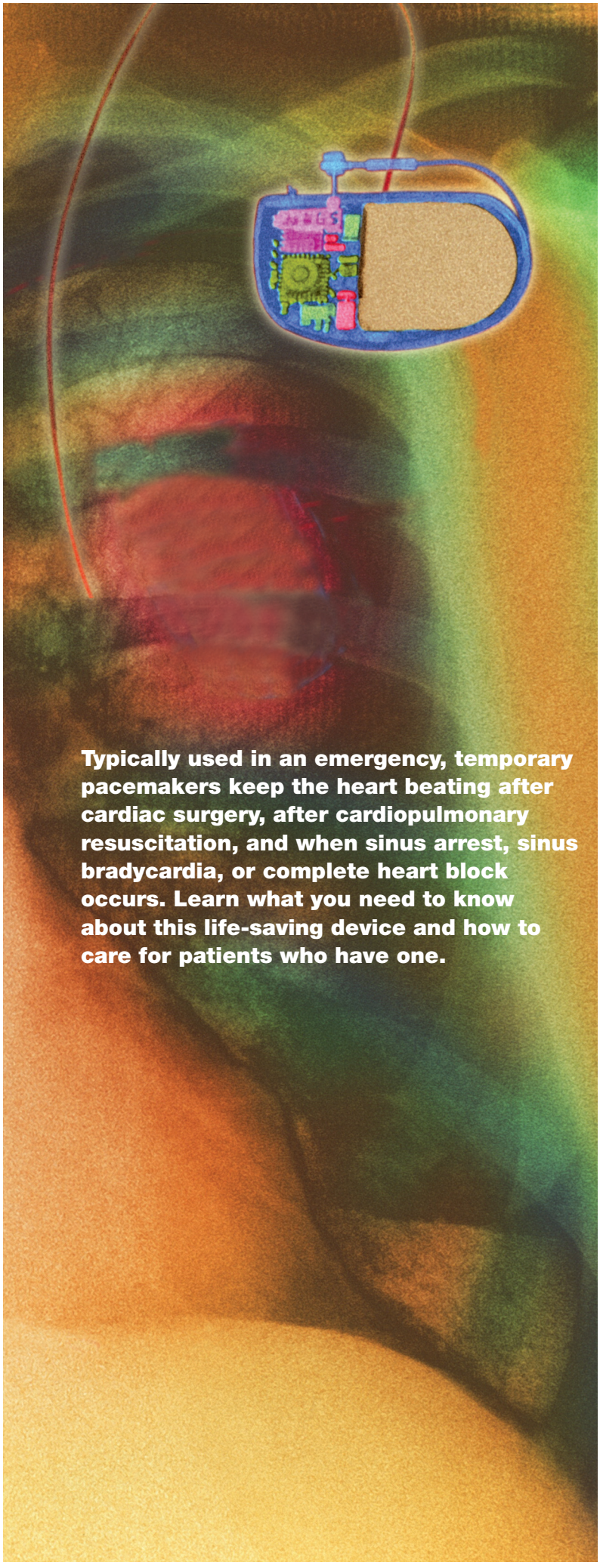


Caring for a patient with a temporary pacemaker



Typically used in an emergency, temporary pacemakers keep the heart beating after cardiac surgery, after cardiopulmonary resuscitation, and when sinus arrest, sinus bradycardia, or complete heart block occurs. Learn what you need to know about this life-saving device and how to care for patients who have one.

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The authors have disclosed that they have no significant relationship with or financial interest in any commercial companies that pertain to this educational activity.

A TEMPORARY PACEMAKER is typically used in an emergency to achieve adequate cardiac output when a patient's heart rhythm doesn't support the perfusion of major organs. The device consists of an external, battery-powered pulse generator and a lead or electrode system.

A temporary pacemaker is often used in the emergency treatment of symptomatic bradycardia. Its indicators include hypotension with signs of major organ hypoperfusion, including altered mental status, shortness of breath, chest pain, and dizziness. A temporary pacemaker is also used until a permanent pacemaker is inserted.

To properly care for a patient with a temporary pacemaker, you'll need a working knowledge of the heart's electrical conduction system, pacemaker concepts, and the equipment itself. Let's take a closer look.

The beat goes on

The heart's conduction system generates and transmits electrical impulses that stimulate contraction of the myocardium. Under normal circumstances, the conduction system first stimulates contraction of the atria and then the ventricles. The synchronization of the atrial and ventricular contractions allows the ventricles to fill completely before ventricular ejection, maximizing the heart's output. Three characteristics of two specialized electrical cells, nodal cells and

Purkinje cells, provide this synchronization:

- *automaticity*: the ability to initiate an electrical impulse
- *excitability*: the ability to respond to an electrical impulse
- *conductivity*: the ability to transmit an electrical impulse from one cell to another.

Both the sinoatrial (SA) node and the atrioventricular (AV) node are composed of nodal cells. The SA node, the heart's primary pacemaker, is located at the junction of the superior vena cava and the right atrium (see *Cardiac conduction system*). In a normal resting adult heart, the SA node initiates firing at 60 to 100 impulses/minute, but the rate can change in response to the metabolic demands of the body.

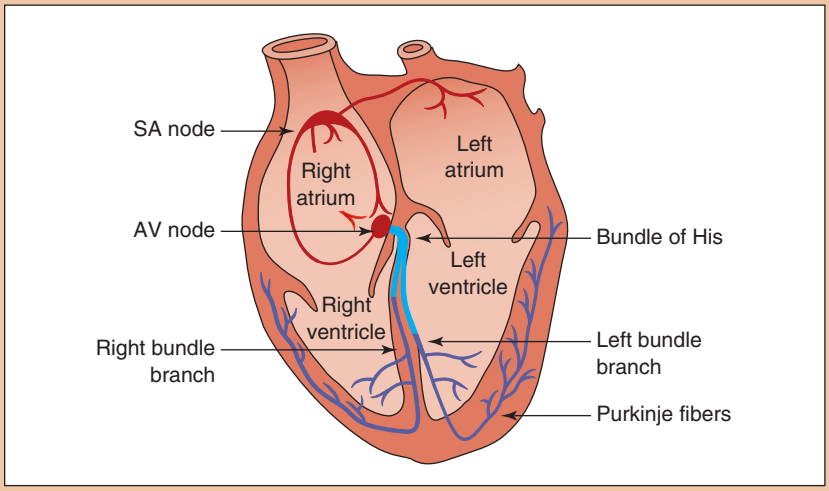
The electrical impulses initiated by the SA node are conducted along the myocardial cells of the atria via internodal pathways. The impulses cause electrical stimulation and subsequent contraction of the atria. The impulses are then conducted to the AV node located in the right atrial wall near the tricuspid valve. The AV node coordinates these incoming electrical impulses. After a slight delay (giving the atria time to contract and complete ventricular filling), it relays the impulse to the ventricles.

The impulse in the ventricles is initially conducted through a bundle of specialized conducting tissue called the bundle of His, which then divides into the right bundle branch (conducting impulses to the right ventricle) and the left bundle branch (conducting impulses to the left ventricle). To transmit impulses to the left ventricle, the heart's largest chamber, the left bundle branch divides into the left anterior and left posterior bundle branches. Impulses travel through the bundle branches to reach the Purkinje fibers (the terminal point in the conduction system). The Purkinje cells rapidly conduct the impulses through the thick walls of the ventricles. At this point, the myocardial cells are stimulated, causing ventricular contraction.

Impulses can occur in various sites within the heart. Heart rate is determined by the myocardial cells with the fastest inherent firing rate. Normally, the SA node has the highest inherent rate, 60 to 100 impulses/minute. The AV node has an inherent rate of 40 to 60 impulses/minute, and ventricular pacemaker sites have the lowest inherent rate, at 30 to 40 impulses/minute. If the SA node malfunctions, the AV node generally takes over the heart's pacemaker function at its inherently lower rate. Should both the SA and the AV nodes fail in their pacemaker function, a pacemaker site in the ventricle will fire at its inherent bradycardic rate of 30 to 40 impulses/minute.

When the heart's conduction system fails, your patient will need a temporary pacemaker to maintain heart rhythm. Let's review the different types.

Cardiac conduction system

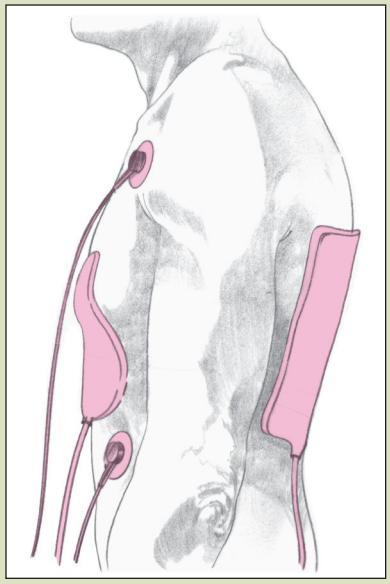


Keeping the pace

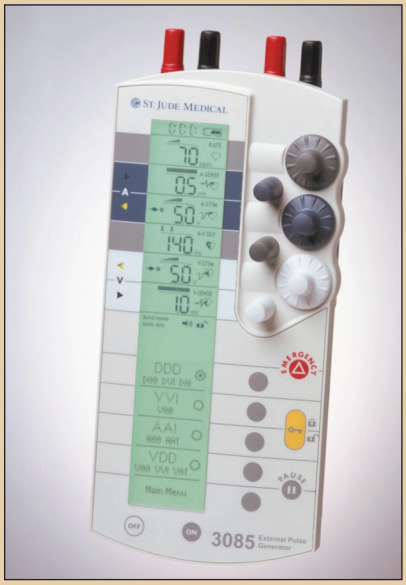
Temporary pacemakers come in three types: transcutaneous, transvenous, and epicardial. A ***transcutaneous pacemaker*** is often the best choice in life-threatening situations. Completely noninvasive and easy to set up, it works by sending an electrical impulse from the pulse generator to the patient's heart by way of two large electrodes, or pads, that are attached to the front and back of the chest. The anterior pad is placed just left of the sternum, and the posterior pad is placed just left of the spine (see *Transcutaneous pacemaker*). The pads are connected via cables to a central connection that leads to a monitor/defibrillator/pacemaker unit. Transcutaneous pacing is a bridge to a transvenous or permanent pacemaker insertion and should be used only short-term.

A ***transvenous pacemaker*** is more reliable than a transcutaneous pacemaker but takes longer to insert. It's often used to manage bradycardia, tachyarrythmias, and other conduction system disturbances. It provides better control than a transcutaneous pacemaker because the stimulus reaches the endocardium directly by way of an electrode catheter. An electrode catheter is threaded

Transcutaneous pacemaker



External pulse generators



through a vein into the patient's right atrium or right ventricle. The electrode is attached to an external pulse generator (see *External pulse generators*). The procedure can be done at the bedside or in the cardiac catheterization lab.

An ***epicardial pacemaker*** is used during cardiac surgery. Electrodes are inserted through the epicardium of the right ventricle or the right atrium. The ventricular wires commonly exit the skin on the left side of the sternum, while the atrial wires exit the right side of the sternum. The wires are coiled on the patient's chest, insulated, and covered with a dressing. If pacing is needed, the leads are uncovered and attached to a pulse generator.

Preparing the patient

Transcutaneous pacemaker. Proper ECG lead placement is important. The monitor leads and pacing pads from the same pacemaker unit must be used or the pacing function won't work. This is different from defibrillation and cardioversion, where the pads may be used simultaneously to monitor rhythm. Don't place the electrodes over a bony area because bone conducts current poorly. With a woman, place the anterior electrode under her breast but not over her diaphragm. Rate and other settings such as mode, output, and sensitivity should be set following the healthcare provider's orders.

Because the pads often cause discomfort, make sure the patient has orders for analgesics and sedation. Assess the patient's pain level and inform him of probable discomfort; using an evidence-based pain scale can help.

The electrical output or energy sent through the patient's thorax from the transcutaneous pacemaker can cause jerking of the patient's chest and abdominal muscles. This can sometimes be mistaken for a palpable pulse. Check for a femoral or brachial pulse to ensure mechanical capture.

Transvenous pacemaker. With this type of pacemaker, the insertion site is cleaned and sterilized; any excess hair is clipped. A balloon-tipped pacing catheter is typically inserted via the subclavian or jugular vein to the right atrium or ventricle.

Because the pulse generator is battery driven, make sure a new battery is available and change it according to your facility's policy. If the catheter is inserted through the brachial or femoral vein, immobilize the patient's arm or leg to avoid putting stress on the wires. Cover the insertion site with a sterile, transparent dressing and change it according to your facility's policy. Monitor the site for signs and symptoms of infection. If you note redness, edema, drainage, warmth, or other abnormalities at the insertion site, notify the healthcare provider immediately. Secure the pulse generator to the patient's gown or bed to make sure it doesn't fall and dislodge the wire.

Epicardial pacemaker. With this type of pacemaker the pacing wires will be sutured, so handling them carefully is important. You'll follow the healthcare provider's orders for the initial settings.

The site where the wires exit the chest will be covered with a sterile dressing and they should be properly secured. Secure the pulse generator to make sure it doesn't fall from the bed and dislodge the wires. If handling the wires, always wear gloves to prevent microshock, which is a stray current from a pacing lead that can cause a lethal dysrhythmia.

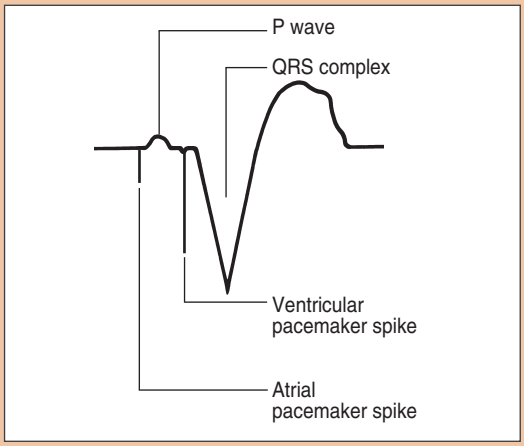
Clean the insertion site and change the dressing according to your facility's policy. Monitor the site for signs of infection. Keep the pulse generator nearby in case pacing is necessary.

Monitoring the pacemaker

Once your patient has a temporary pacemaker attached, assess his vital signs, skin color, level of consciousness, and peripheral pulses to determine the effectiveness of the paced rhythm. Perform a 12-lead ECG to serve as a baseline, then perform additional ECGs daily or with clinical changes. If possible, obtain a rhythm strip before, during, and after pacemaker placement; any time the pacemaker settings are changed; and whenever the patient receives treatment because of a complication due to the pacemaker.

Pacemaker spikes

Pacemaker spikes—the stimuli that travel from the pacemaker to the heart—are visible on the patient's ECG tracing as spikes. Large or small, pacemaker spikes appear above or below the isoelectric line. This example shows an atrial and a ventricular pacemaker spike.



Troubleshooting pacemakers

Problem	Description	Interventions
Failure to pace	No pacemaker activity on the ECG ***Possible causes:*** • pacemaker malfunction • electrolyte disturbances • myocardial scarring • lead dislodgement • wire fracture • disconnected wire or cable • generator failure	• check patient, initiate basic life support as necessary • check all connections • check battery, change as necessary • check power source • consider equipment change • change patient position (may allow lead wire to contact heart muscle) • healthcare provider may need to reposition lead
Failure to capture	Indicated by a spike without a complex ***Possible causes:*** • inadequate milliamperes (mA) • low battery • lead problem, such as loss of contact with the heart chamber, a break, or displacement • hyperkalemia • ischemia • medications	• initiate basic life support as necessary • increase mA • check all connections • change battery • check power source • change patient position • if a transcutaneous pacemaker, consider moving electrodes
Failure to sense	***Undersensing:*** Pacemaker spikes are seen where they should not occur (with the cardiac cycle) ***Oversensing:*** Pacemaker doesn't pace when the patient actually needs it	***Undersensing:*** • increase ECG height on monitor • change monitor lead • increase sensitivity (lower number on control) • reposition patient • change battery • consider changing equipment ***Oversensing:*** • lower sensitivity (increase number on control)

Monitor the ECG reading, noting capture, sensing, intrinsic beats, and competition of paced and intrinsic rhythms. If the pacemaker is sensing correctly, the sense indicator on the pulse generator should flash with each beat. Assess the patient for both electrical and mechanical capture. When you observe a pacer spike on the ECG followed by a complex, you have electrical capture (see *Pacemaker spikes*).

Record the date and time of pacemaker insertion, the type of pacemaker, the reason for insertion, and the patient's response. Note the pacemaker settings. Document any complications and measures taken to resolve them, including notification of the healthcare provider.

What can go wrong?

Temporary pacing isn't without complications. Insertion of the pacing wire in the subclavian or jugular vein can lead to pneumothorax, hemothorax, or hematoma. Air embolism, infection at the insertion site, and pericarditis are other potential complications.

Complications related to the pacing itself may require your immediate attention. *Troubleshooting pacemakers* outlines these complications and the interventions you can take. If any of these complications occur, immediately notify the healthcare provider.

Maintaining the rhythm

Caring for a patient with a temporary pacemaker presents a unique challenge that requires specific knowledge of pacemaker function. Assessment of hemodynamic status along with pacemaker function through evaluation of rhythm strips is a routine assessment parameter. When you evaluate these key indicators, your ability to recognize and intervene will be paramount in caring for this patient. **LPN**

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