PROCEDURE

45 Atrial Overdrive Pacing AP (Perform)

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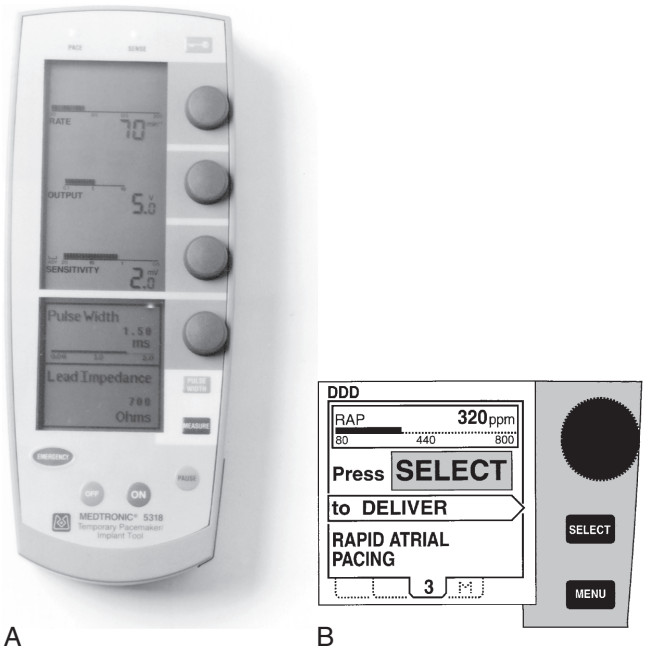
PURPOSE: The purpose of atrial overdrive pacing is to attempt to restore sinus rhythm in the setting of reentrant atrial dysrhythmias, especially atrial flutter, by intermittently pacing at a rate faster than the tachycardia. Sinus rhythm enhances cardiac output by allowing atrial contraction to contribute to ventricular filling.

PREREQUISITE NURSING KNOWLEDGE

- Knowledge of the anatomy and physiology of the cardiovascular system, principles of cardiac conduction, and basic and advanced dysrhythmia interpretation is necessary.
- Supraventricular dysrhythmias (e.g., atrial flutter, reentrant atrial tachycardia, atrioventricular [AV] nodal reentry tachycardia, reentrant tachycardias that use an accessory pathway, such as Wolff-Parkinson-White [WPW] syndrome) sometimes can be terminated by overdrive atrial pacing.[1,2]
- Atrial fibrillation occasionally terminates with overdrive atrial pacing, but this is not a reliable therapy for atrial fibrillation. Many contemporary permanent pacemakers have arrhythmia response algorithms that include antitachycardia pacing, but research has not yet shown that continuous atrial overdrive pacing prevents the progression to permanent atrial fibrillation or reduces other major adverse cardiac events.[3,4]
- Knowledge of pacemaker function and patient response to pacemaker therapy is needed.
- Principles of general electrical safety need to be applied with use of temporary invasive pacing.
- Gloves always should be worn when handling pacemaker electrodes to prevent microshock because even small amounts of electrical current can cause serious dysrhythmias if they are transmitted to the heart.[5,9–12]
- Clinical and technical competence related to the use of a temporary atrial pacemaker pulse generator and the rapid atrial pacing feature is needed (Fig. 45-1).
- Advanced cardiac life support knowledge and skills are necessary.
- In the acute care setting, overdrive atrial pacing is performed most commonly with epicardial atrial pacing wires placed during cardiac surgery. A transvenous atrial pacing lead with an active fixation tip to help keep the lead in the atrium also can be used.
- Overdrive atrial pacing involves the delivery of short bursts of rapid pacing stimuli through an epicardial atrial pacing wire or a transvenous lead in the atrium. The physician or advanced practice nurse determines the duration and rate of the burst.
  - One approach to overdrive pacing is to atrial pace the heart with 20 milliampere (mA) at a rate 20% to 30% faster than the intrinsic atrial rate for 30 seconds, then abruptly stop pacing. An alternate approach is to initiate atrial pacing at a rate 20 beats/min faster than the intrinsic atrial rate; if 1:1 capture does not occur after 30 seconds, the paced rate can be increased by 20 beats/min; repeat every 30 seconds until 1:1 capture is achieved. Continue pacing until the heart rate decreases from AV block (e.g., 2:1, 3:1) or 1 to 2 minutes of 1:1 pacing have occurred, then stop pacing.[6]
  - Successive bursts usually are performed at gradually increasing rates (maximal capability of the pulse generator for overdrive atrial pacing is 800 pulses/min) and may be delivered for up to 2 minutes.[7]
- The atrial pacing wire or atrial pacing lead needs to be accurately identified with initiation of overdrive pacing because pacing the ventricle at rapid rates may induce ventricular tachycardia or ventricular fibrillation.
- Rapid atrial pacing may result in degeneration of the atrial rhythm to atrial fibrillation with a rapid ventricular response. This pacemaker-induced atrial fibrillation usually does not sustain itself for more than a few minutes before it converts to normal sinus rhythm.[6]
- If an accessory pathway is present, rapid atrial pacing can result in conduction to the ventricles over the accessory pathway, leading to ventricular fibrillation.
- Overdrive suppression of the sinus node may result in periods of bradycardia, asystole, junctional or ventricular escape rhythms, or polymorphic ventricular tachycardia.
- Conversion of an atrial tachydysrhythmia can result in dislodgment of atrial thrombus and embolization of clots to the pulmonary or systemic circulation.

AP This procedure should be performed only by physicians, advanced practice nurses, and other healthcare professionals (including critical care nurses) with additional knowledge, skills, and demonstrated competence per professional licensure or institutional standard.



A B

Figure 45-1 **A,** Temporary dual-chamber pulse generator with overdrive atrial pacing capability. **B,** Enlargement of lower screen on the pacemaker showing rapid atrial pacing controls. *(Courtesy Medtronic, Inc.)*

EQUIPMENT

- Nonsterile gloves
- External pulse generator capable of rapid atrial pacing
- Connecting cable (between the pulse generator and the patient's pacemaker leads)
- Cardiac monitor and recorder
- Electrocardiogram (ECG) electrodes
- Double alligator clip or wire with connector pins (if needed to create a ground wire)
- Materials for epicardial pacing wire site care:
  - Antiseptic pads or swab sticks (e.g., 2% chlorhexidine-based preparation)
  - Gauze pads
  - Tape
- Insulating material for epicardial pacing wires or transvenous pacing electrode connector pins (e.g., finger cot, needle cap, needle barrel, glove, ear plug)
- Blood pressure monitoring system

Additional equipment, to have available as needed, includes the following:

- Defibrillator
- Emergency medications
- Airway management equipment
- Standard pulse generator or transcutaneous pacemaker and equipment
- Subcutaneous needle for a ground wire

PATIENT AND FAMILY EDUCATION

- Explain the procedure and its purpose to the patient and family. ***Rationale:*** This explanation may decrease patient and family anxiety and promote cooperation with the procedure.
- Reassure the patient that atrial pacing usually cannot be felt and that any sensation most likely will be a "fluttering" feeling in the chest. ***Rationale:*** This reassurance prepares the patient and may decrease the patient's anxiety.

PATIENT ASSESSMENT AND PREPARATION

Patient Assessment

- Assess the patient's ECG rhythm and intervals, verifying atrial and ventricular rates. ***Rationale:*** This assessment determines baseline cardiac conduction.
- Assess the patient's vital signs and hemodynamic parameters. ***Rationale:*** This assessment determines baseline cardiovascular function.
- Assess for signs and symptoms that might be caused by the dysrhythmia (e.g., shortness of breath, dizziness, nausea, chest pain, signs of poor peripheral perfusion). ***Rationale:*** The patient's response to the dysrhythmia is determined.
- Assess the patency of the intravenous access. ***Rationale:*** Intravenous access is needed for possible administration of fluids and medications.
- Note any medications that might have an effect on the patient's cardiac rhythm or hemodynamic parameters (e.g., beta blockers, calcium channel blockers, antidysrhythmics, and digoxin). ***Rationale:*** Knowledge of medication therapy can alert the healthcare providers to potential cardiac rhythms (e.g., bradycardia or atrioventricular block) after termination of the atrial dysrhythmia.
- Verify the patient's coagulation study results. ***Rationale:*** Therapeutic coagulation levels may decrease the risk of embolization.[2,6–8]

Patient Preparation

- Verify that the patient is the correct patient using two identifiers. ***Rationale:*** Before performing a procedure, the nurse should ensure the correct identification of the patient for the intended intervention.
- Obtain informed consent (may not be possible in an emergency). ***Rationale:*** Informed consent protects the rights of the patient and makes a competent decision possible for the patient.
- Ensure that the patient and family understand preprocedural teaching. Answer questions as they arise and reinforce information as needed. ***Rationale:*** This communication evaluates and reinforces understanding of previously taught information.
- Perform a preprocedure verification and time out, if nonemergent. ***Rationale:*** Ensures patient safety.
- Initiate continuous bedside cardiac monitoring (if not already in place). ***Rationale:*** The patient's cardiac rate and rhythm must be visible at the bedside during the procedure to determine atrial capture during pacing and to evaluate the response of the patient's cardiac rate and rhythm after pacing.

- Obtain a 12-lead ECG as needed. ***Rationale:*** The ECG may aid in determining the patient's baseline cardiac rhythm.
- Assist the patient to a supine position. ***Rationale:*** This position facilitates access to the epicardial pacemaker wires or the transvenous atrial pacing lead wire.
- Place a blood pressure cuff on the patient's arm and obtain the patient's blood pressure or obtain the patient's blood pressure from the arterial catheter. ***Rationale:*** This aids in assessment of the patient's baseline blood pressure and hemodynamic response to rapid atrial pacing.

Procedure for Performing Atrial Overdrive Pacing

Steps	Rationale	Special Considerations
1. HH		
2. PE		Gloves protect the patient from microshock while pacemaker wires are being handled.[5,9-12]
3. Attach the connecting cable to the external pulse generator, making sure that the positive (+) pole of the cable is connected to the (+) terminal of the pulse generator and the negative (–) pole of the cable is connected to the (–) terminal.	The connecting cable provides extra length so that the pulse generator does not have to be placed on the patient's chest or abdomen.	
4. For epicardial atrial pacing:		
A. Expose the atrial epicardial pacing wires.	The atrial epicardial wires usually exit the chest to the right of the patient's sternum (see Fig. 44-1).	The atrial epicardial pacing wires can be verified by performing an atrial electrogram (see Procedure 44).
B. Connect an atrial epicardial pacing wire to the negative terminal of the connecting cable.	The pacing current is delivered through the negative terminal of the pulse generator; an epicardial pacing wire on the atrium must be connected to the negative terminal for the atrium to receive pacing impulses.	
C. Connect a second epicardial pacing wire or a ground wire to the positive terminal of the connecting cable.	The pacing circuit is completed as energy reaches the positive electrode.	If only one atrial pacing wire is present, additional options for a ground wire include an ECG monitoring electrode on the chest near the epicardial pacing wire exit site or a subcutaneous needle in the tissue on the chest. The positive terminal of the connecting cable is connected to the metal snap of the monitoring electrode or the subcutaneous needle hub with a double alligator clip.
5. For transvenous atrial pacing:	The pacing stimulus travels from the pulse generator to the negative terminal and energy returns to the pulse generator via the positive terminal.	
A. Identify the proximal and the distal electrode connector pins on the external portion of the atrial pacing lead.		
B. Connect the distal (negative) electrode connector pin to the negative terminal of the connecting cable.	Energy from the pulse generator is directed to the distal electrode in contact with the atrium.	

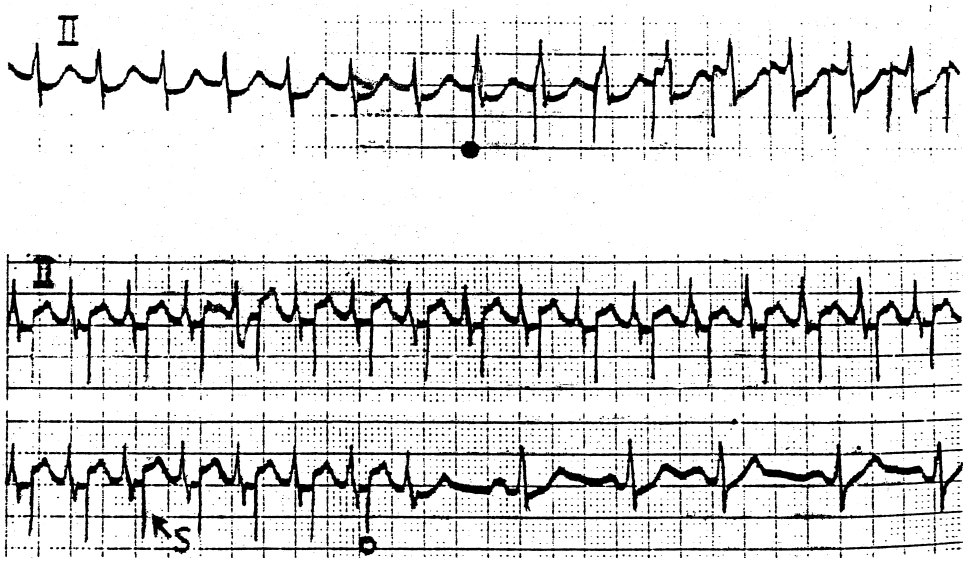


Figure 45-2 The *top trace* shows ECG lead II recorded during an episode of paroxysmal atrial tachycardia at a rate of 150 beats/min. Beginning with the eighth beat in this trace *(black dot),* rapid atrial pacing at a rate of 165 beats/min was initiated. In the *middle trace,* which begins 12 seconds after the top trace, atrial capture is shown clearly. In the *bottom trace,* which is continuous with the middle trace, sinus rhythm appears when atrial pacing is terminated abruptly *(open circle).* Paper recording speed was 25 mm/sec. *S,* Stimulus artifact. *(From Cooper TB, MacLean WAH, Waldo AL: Overdrive pacing for supraventricular tachycardia: A review of theoretical implications and therapeutic techniques, Pacing Clin Electrophysiol 1:200, 1978.)*

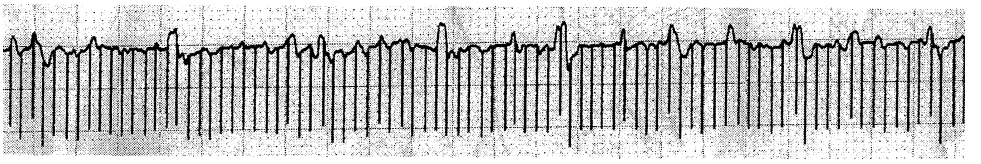


Figure 45-3 Rhythm strip shows rapid atrial pacing in an attempt to terminate atrial flutter.

Procedure for Performing Atrial Overdrive Pacing—*Continued*

Steps	Rationale	Special Considerations
C. Connect the proximal (positive) electrode connecting pin to the positive terminal of the connecting cable.	The pacing circuit is completed as energy reaches the positive electrode.	
6. Set the rate and the milliampere (mA/output) controls on the pulse generator.	The settings are based on the characteristics of the patient's dysrhythmia and the threshold needed for atrial capture.	
7. Initiate atrial overdrive pacing. Pace the atrium for a brief period of 30 seconds to 2 minutes, then abruptly terminate pacing (Figs. 45-2 and 45-3).	Short bursts of pacing stimuli at a rapid rate are intended to create refractory tissue in the atrium and interrupt the reentry circuit responsible for the tachydysrhythmia.	Bursts can be repeated at faster rates and for longer intervals until the dysrhythmia terminates or changes.
A. Pace the heart with 20 mA at a rate 20–30% faster than the intrinsic atrial rate for 30 seconds, then stop pacing.		Refer to the pulse generator's technical manual for instructions on how to initiate rapid atrial pacing.

Procedure continues on following page

Procedure for Performing Atrial Overdrive Pacing—*Continued*

Steps	Rationale	Special Considerations
B. An alternate approach is to initiate atrial pacing at a rate 20 beats/min faster than the intrinsic atrial rate; if 1:1 capture does not occur after 30 seconds, increase the paced rate by 20 beats/min; repeat every 30 seconds until 1:1 capture is achieved. Continue pacing until the heart rate decreases from AV block (e.g., 2:1, 3:1) or 1–2 minutes of 1:1 pacing have occurred, then stop pacing.[6] **(Level E*)**		On termination of the dysrhythmia, the sinus node may be suppressed for a period, resulting in bradycardia, asystole, junctional or ventricular escape rhythms, or ventricular tachycardia. Initiation of temporary atrial, ventricular, or transcutaneous pacing may be necessary until normal sinus function returns.
8. When atrial pacing is completed, disconnect the connecting cable from the epicardial pacing wires or from the transvenous pacing electrode connector pins.	Removes the rapid atrial pacemaker.	Standard pacemaker therapy can be initiated if necessary.
9. Apply a sterile occlusive dressing to the pacemaker site if not already in place.	May reduce the incidence of infection.	
10. Protect the exposed pacemaker electrode connector pins or epicardial pacemaker wires with an insulating material (e.g., finger cot, needle cap, needle barrel, glove, ear plug).[9–12] **(Level E)**	Prevents microshock, which can result in symptomatic dysrhythmias.	
11. Secure the pacing wires or connector pins.	Prevents accidental dislodgment.	
12. Label each epicardial pacemaker wire or dressing to identify atrial and ventricular pacing wires.	Aids identification of the epicardial pacemaker wires.	
13. Remove gloves and discard used supplies in appropriate receptacles.	Reduces the transmission of microorganisms; Standard Precautions.	
14. HH		

*Level E: Multiple case reports, theory-based evidence from expert opinions, or peer-reviewed professional organizational standards without clinical studies to support recommendations.

Expected Outcomes

- Return to normal sinus rhythm
- Stable or improved hemodynamic status

Unexpected Outcomes

- Continuation of the tachydysrhythmia
- Conversion to atrial fibrillation
- Prolonged period of bradycardia or asystole after termination of the tachydysrhythmia
- Rapid conduction of atrial paced impulses to the ventricle through an accessory pathway, resulting in ventricular tachycardia or ventricular fibrillation
- Emergence of a slow junctional or ventricular escape rhythm or ventricular tachycardia after termination of the tachydysrhythmia
- Microshock that results in ventricular tachycardia or fibrillation
- Pain

Patient Monitoring and Care

Steps	Rationale	Reportable Conditions
		These conditions should be reported if they persist despite nursing interventions.
1. Monitor the patient's cardiac rhythm continuously at the bedside during the procedure and after the procedure.	Allows for immediate recognition of rhythm changes or return of the initial tachydysrhythmia.	• Heart rate or rhythm changes • Return of initial tachydysrhythmia • Any significant or hemodynamically unstable dysrhythmia • Need for additional temporary pacing to maintain adequate heart rate after conversion of the tachydysrhythmia
2. Monitor the patient's vital signs before initiating overdrive pacing, every 5–10 minutes during attempts to overdrive pace, with any significant heart rate or rhythm change during the procedure, and on termination of the procedure. If the patient's condition is not hemodynamically stable after the procedure, monitor vital signs every 5–10 minutes until stable. Monitor vital signs per unit standard if the patient's condition is stable after the procedure.	Changes in vital signs may indicate significant change in the patient's condition. Blood pressure often improves with cessation of the tachydysrhythmia or restoration of normal sinus rhythm; blood pressure may deteriorate if the ventricular rate accelerates because of overdrive pacing. If the patient is receiving antidysrhythmic medications, changes in vital signs may indicate an adverse medication reaction.	• Abnormal heart rate or rhythm • Hypotension
3. Replace gauze dressings every 2 days and transparent dressings at least every 7 days.[13] Cleanse the site with an antiseptic solution (e.g., 2% chlorhexidine-based solution). Follow institution standard. **(Level D*)**	Although guidelines specific to epicardial wires and transvenous pacemaker sites do not exist, the Centers for Disease Control and Prevention (CDC) recommend replacing dressings on intravascular catheters when the dressing becomes damp, loosened, or soiled or when inspection of the site is necessary.[13]	• Redness or exudate around site • Increased white blood cell count, increased band neutrophil values • Elevated temperature
4. Monitor the patient's response to antidysrhythmic medications.	Antidysrhythmic medications may be necessary to prevent recurrence of the initial tachydysrhythmia or to control the ventricular rate.	• Prolongation of QT interval • Rhythm changes
5. Follow institution standard for assessing pain. Administer analgesia as prescribed.	Identifies need for pain interventions.	• Continued pain despite pain interventions

*Level D: Peer-reviewed professional and organizational standards with the support of clinical study recommendations.

Procedure continues on following page

Documentation

Documentation should include the following:

- Signed informed consent, if nonemergent
- Universal Protocol requirements, if nonemergent
- Patient and family education provided and an evaluation of their understanding of the procedure
- Rhythm strip documenting initial cardiac rate and rhythm
- Initial vital signs
- Pacemaker settings for each attempt of overdrive pacing: rate, mA, duration
- Rhythm strip documenting each overdrive pacing burst
- Number of pacing attempts
- Patient's response to the procedure (e.g., anxiety, pain)
- Pain assessment, interventions and effectiveness
- Post procedure rhythm strip
- Post procedure vital signs
- Any medications given during procedure
- Any unexpected outcomes
- Additional interventions

References and Additional Readings

For a complete list of references and additional readings for this procedure, scan this QR code with any freely available smartphone code reader app, or visit http://booksite.elsevier.com/9780323376624.