TEMPORARY PACEMAKERS HINTS
(DUAL CHAMBER 5392 PACER)

TYPES OF PACERS

TRANSCUTANEOUS: (VENTRICULAR pacing only)
- Through the skin via gel electrode pads placed on the chest and back.
- Disadvantage: Pain / discomfort
- Potential loss of capture with movement or sweating

TRANSVENOUS: (VENTRICULAR pacing only)
- Electrode wires placed via 6 Fr introducer through the subclavian or intrajugular vein:
  - The wire is threaded through the R atrium into the R ventricle where it is in contact with the endocardial layer of the heart.
  - Temporary: until a permanent pacers is placed or dysrhythmia is corrected
  - May also be through a specialized Swanz Ganz catheter (PACING SWAN)

EPICARDIAL (TRANSTHORACIC):
- Wires are placed on the epicardial surface of the heart during surgery
- Atrial, Ventricular, and AV Sequential pacing possible.
- RIGHT wires are always ATRIAL
- LEFT wire are always VENTRICULAR

PERMANENT: implanted subcutaneously : usually has 2 leads and poles.

CARE OF PATIENT with NEW PERMANENT PACER

1) Restrict limb movement for 24-48 hours
2) No shower or bath for 48 hours
3) Teach & observe site for bleeding and infection
4) Monitor VS and teach accurate pulse taking
5) Medic alert bracelet
6) Activity intolerance may still be present regardless of the new pacer
7) Avoid electromagnetic interference: MRI, hand wands at airports, electrolysis.
8) Avoid constrictive clothing over the pacer site.

WHAT DO THE LETTERS MEAN?

1st letter: the chamber PACED
2ND letter: the chamber SENSED
3RD letter: what happens when pacer senses the beat
4TH letter : Programmability
5TH letter: Antitachycardia functions
(These are not applicable to temporary pacers)

<table>
<thead>
<tr>
<th>Mode</th>
<th>Paced</th>
<th>Sensed</th>
<th>Result</th>
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<tr>
<td>AAI</td>
<td>Atrial</td>
<td>Atrial</td>
<td>Inhibits</td>
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<tr>
<td>AOO</td>
<td>Atrial</td>
<td></td>
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<td>Ventricular</td>
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<td>VOO</td>
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<tr>
<td>DVI</td>
<td>A &amp; V</td>
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<tr>
<td>DOO</td>
<td>A &amp; V</td>
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DDD mode:

- Atrial (Pwave) sensed = Inhibition ( pacer does not fire )
- Atrial (Pwave) Not sensed = Trigger : pacer fires an atrial spike

If AV conduction is normal
- If QRS is sensed = Inhibition ( V pacer spike does not fire )
- If QRS is NOT sensed (absent or delayed) = Trigger : pacer fires a ventricular spike

An upper rate is set for the ventricular response to avoid tracking rapid atrial activity. (Menu 2)
INDICATIONS FOR PACING
* symptomatic bradycardia (low BP, low CO, syncope)
* advanced heart blocks or conduction disturbances (pauses)
* ventricular dysrhythmias
* absence of underlying rhythm
* overdrive pacing attempts to terminate malignant supraventricular and ventricular dysrhythmias

The heart has 2 separate mechanisms:

ELECTRICAL: deals ONLY with the stimulus and CONDUCTION system within the heart. (depolarization)

MECHANICAL: is the actual CONTRACTION of the muscle (the heart beat and movement of blood!)

REMEMBER: conduction can still happen even if the mechanical heart beat does not.

PULSELESS ELECTRICAL ACTIVITY  (the pt has no pulse)

PACER CONTROLS

RATE: normally 60-100
* the number of impulses per minute the pulse generator may send, depending upon chosen mode.

OUTPUT: The amount of energy that the pacer sends to the heart. Measured in milliamps.

mA: milliamps (measurement of current)
low .5 - 20 high

CAPTURE: The heart’s response to the pacer by DEPOLARIZING (+ a pulse) the cardiac muscle responds to the electrical stimulus.

If an open heart patient becomes bradycardic and still has their epicardial / transthoracic ….

CONNECT & START THE TEMPORARY PACER 1ST ! Don’t wait!
**STIMULATION THRESHOLD:**
The **minimal** amount of energy needed to stimulate depolarization.

1) Set the mA to a low number  
2) Dial up the mA until capture is obtained  
   (spike followed by depolarization/capture + pulse )  
3) Then **ADD 2** ( to make sure you keep the capture ! )  
or  
Some physicians prefer to start at mA 20  
then dial down until you loose capture : but always ADD 2

**LOSS OF CAPTURE**  
WHAT’S THE PROBLEM ???  
1) the **PACER**  
2) the **WIRES**  
3) the **PATIENT**

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<tr>
<td>PACER</td>
<td>WIRES</td>
<td>PATIENT</td>
</tr>
<tr>
<td>• Batteries</td>
<td>• Dislodged</td>
<td>• Heart tissue is refractory</td>
</tr>
<tr>
<td>• Faulty generator</td>
<td>• Disconnected</td>
<td>• Electrolyte imbalance</td>
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<tr>
<td></td>
<td>• Damaged</td>
<td>• MI, ischemia, hypertrophy</td>
</tr>
<tr>
<td></td>
<td>• Transvenous wire not touching the heart tissue</td>
<td>• Severe acidosis, hypoxemia</td>
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**TO CORRECT THE PROBLEM**

<table>
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<tr>
<th>Change the batteries</th>
<th>Check the wires</th>
<th><strong>INCREASE</strong> the mA</th>
</tr>
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<tr>
<td>Change the pacer</td>
<td>Check the connections</td>
<td>Correct O2 or acid imbalance</td>
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<td></td>
<td>Changing position of the patient (on to side)</td>
<td>Initiate CPR if necessary.</td>
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<td></td>
<td>For transvenous pacer</td>
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**A V INTERVAL**

- Amount of time between the **atrial spike** (stimulus) and the **ventricular spike** in AV Sequential pacing  
- 120 to 200 msec normal  
- measured in **milliseconds** *(like the PR interval in secs)*  
- Promote adequate ventricular filling from atrial kick

1) Scroll **↓** to select AV interval  
2) Press **←** **ENTER**  
   **AV Interval changes automatically when pacer rate is changed**  
   **Rarely** is this manually changed
SENSITIVITY .5 - 20

The pacer's ability to "sense" or "see" the pt's intrinsic heart beat
When the pacer senses the intrinsic beat it INHIBITS the pacer (It should not fire)

REMEMBER the T wave is the most vulnerable wave of the cycle.
A stimulus sent when the heart is repolarizing can cause V fib (R on T phenomenon)

The higher the number the lower the sensitivity
The lower the number the higher the sensitivity

HIGH # [20] = LOW sensitivity
- Problem: UNDERSENSING
- Pacer does not sense an intrinsic beat so it fires a stimulus.
- UNDERSENSING ➔ OVERPACING!
- DANGER: a stimulus hits the R wave = R on T lead to V fib

LOW # [.5] = HIGH sensitivity
- Problem: OVERSENSING; Too sensitive
- Pacer senses everything and thinks it is a beat: hiccups, outside electrical interference, IV pumps, electric razors
- OVERSENSING ➔ UNDERPACING
- DANGER: the pacer will NOT fire even when you need it to!

DEMAND PACING
- Uses Sensitivity to determine when to fire and NOT to fire.
- Pacer delivers stimulus ONLY IF the patient's heart fails to fire as fast as the predetermined rate (the distance between R-R interval is timed)

EXAMPLE:
- Demand pacer is set at rate of 72
- The white arrow illustrates the pacing interval (the distance from spike to spike)
- The pacer MUST wait this long before it fires another stimulus
- If the pacer senses a beat before the end of the interval: it should not fire

QRS was sensed: Pacer DID NOT fire!

Pacing (Green) Flashes
Sensing (Blue) Light

OVERSENSING
DOES NOT FIRE WHEN YOU NEED IT TO!
= ASYSTOLE

UNDERPACING
DOESN'T SEE
DOESN'T CARE
FIRES ANYWAY!

OVERPACING

UNDERSENSING

OVERPACING
**ASYNCHRONOUS PACING**

Turns OFF sensitivity + turns UP mA

- Position dial at MOST sensitive setting (1mV)
- mA = 20
- V mA = 25

The Strongest / Fastest stimulus will win!

Pacer delivers set rate of impulses per minute regardless of the patient’s intrinsic rhythm
NO sensitivity: pacer will fire no matter what!

Not usually necessary in Ventricular Pacing
Pacer must be stronger and faster than intrinsic heart rate!
Overdrive: set rate must be faster than pt

To discontinue DOO press the key

DOO button works even if the controls are locked or the pacer is OFF

If the pacer is OFF: the DOO button will turn the pacer ON & activate Asynchronous mode

[This is a quick way in an emergent situation: to turn on the pacer / mA goes to max to get capture / press to immediately get your sensitivity back!]

**TO SET SENSITIVITY (PHYSICIAN ONLY)**

- Position dial at MOST sensitive setting (1mV)
- Adjust pacer rate to 10 less than pt intrinsic rate
- Reduce mA to minimum
- (to prevent pacer from competing with intrinsic rhythm)
- Turn the sensitivity dial counterclockwise (higher mV) until:
  - VENT. SENSE (orange light) stops flashing and
  - VENT. PACE (green light) starts flashing
  (This is sensitivity threshold)
- Adjust the sensitivity indicator to half threshold value
- RESET the mA and RATE TO THEIR ORIGINAL SETTINGS!

To discontinue DOO press the key
Connection / Adapter Cables are REQUIRED:

Connecting the Pacer: Transthoracic pacing wires:

2 wires coming out of the Right side of the chest are connected to the ATRIA

2 wires coming out of the Left side of the chest are connected to the VENTRICLE

ATRIAL PACING: [AAI mode]

- Can be used when conduction system of the heart beyond the SA node is normal.
- USES: [the pacer is only stimulating a p wave: the QRS must follow from the heart!]
  - Sinus Bradycardia symptomatic
  - Sick Sinus Syndrome
  - Sinus Arrythmia
  - Sinus Rhythm: Higher heart rate to increase cardiac output (better perfusion)
  - Junctional Rhythm may work

1) Attach the 2 Right (atrial wires) to the extension cable marked ATRIAL on top of the pacer.

2) Turn the Ventricle mA to 0
   this will give you atrial pacing only

   [You can also scroll down to the bottom of the screen / choose Mode Selection
   Press Scroll to AAI mode
   Press]

Rhythm: spike will be followed by P wave then normal width QRS
VENTRICULAR PACING: [VVI mode]

- Stimulates ONLY the ventricles only.
- Disadvantages:
  1. **No atrial kick** if patient does not have their own intrinsic p waves
     Atrial kick is 20 – 30% of cardiac output decreased cardiac output
  2. **Thrombus** - no atrial contraction => blood clot in the atrium

**TO VENTRICULAR PACE with Epicardial Wires**
1. Place the 2 left VENTRICULAR wires into the ventricular poles
2. Set the pacer rate
3. Turn the Atrial mA to 0 (off)
4. Set the Ventricular mA (Stimulation threshold +2)
   [This can also be accomplished: Scroll to bottom of screen Choose Mode Selection]

Ventricular Pacing Rhythm: **spike** will be followed by a **widened QRS**.
(wider because the conduction through the ventricles is slower)
The atrium will not be stimulated by the pacer.
**AV SEQUENTIAL PACING:**
- Stimulates the atria then the ventricles in sequence
- Advantage: Atrial kick for better cardiac output and perfusion.

**TO AV SEQUENTIAL PACE**
1) Place patient’s **right wires** into the atrial (blue) poles
   Place patient’s **left wires** into the ventricle (white) poles
2) Set the Rate
3) Check the AV interval
   - This is preset by the dual chamber pacer and does not need to be changed.
   - Measured in milliseconds (correlates with PR interval)
4) Set the atrial and ventricular mA (stimulation threshold + 2)

**RAPID ATRIAL PACING**
Used to overdrive the **ATRIA** out of rhythms with rapid atrial rates (A fib and A flutter)
- **NEVER** use this with Ventricular only Pacing

1. Press ☰ to open the menu
2. Press \ arrow to Scroll down to **Rapid Atrial Pacing**
3. Press ➤ to select
4. Set the rate at which you want the ATRIA to be stimulated with turn knob
   Example A flutter: atrial rate is usually between 250 – 350
   A- Fib: atrial rate is usually 350 +
5. **Press and HOLD** the RAP button
6. The atrial pacer will continue to fire at the rapid rate until you release the button.

**Technique of Overdrive Pacing for Atrial Flutter**
(Smith and Hood 2007)
- When two atrial epicardial wires are in situ, each wire should be tested to confirm that it is recording only an atrial ECG and to measure the atrial rate.
- The pacing pulse width should be increased to 2ms and pacing begun at 20mA at 100 beats per minute to confirm the absence of ventricular capture.
- The pacing rate should be increased to 20 beats faster than the intrinsic atrial rate (typical atrial rates are 250 – 280 bpm and may be as high as 330bpm).
- The ECG should be observed to confirm atrial capture.
- After 30 seconds the pacing rate should be increased by a further 20 bpm.
- **Atrial capture is confirmed by**
  1) an increase in HR as the pacing rate is increased,
  2) a subsequent abrupt fall in heart rate as the AV conduction ratio increases (2:1 to 3:1 to 4:1)
  3) a constant relationship between the pacing spikes and the flutter wave.
- Pacing is abruptly stopped after 1 – 2 minutes of atrial capture.
  - Which typically results in the establishment of sinus rhythm.
  - If sinus rhythm is not present the process should be repeated after reversal of the atrial lead polarity.
  - If it is still unsuccessful, deliberate induction of atrial fibrillation should be attempted by burst pacing at rates of 600 per minute for 30 seconds or until Afb ensues.
  - Pacing induced atrial fibrillation is typically unstable and frequently reverts spontaneously to sinus rhythm, though reorganization of atrial flutter is possible.
SAFETY TIPS FOR TEMORARY PACERS

- **CONTROLS** Lock 60 seconds after last adjustment was made. when not manipulating pacer setting : to avoid patient tampering. (lock automatically engages)
- Press and hold the lock button the middle right corner of the pacer

**SECURE THE PACER**

- **FOR MOBILE PATIENT**: Secure pacer box to the patient using the "pacer pouch" with straps securely fastened around patient neck. (Make sure you do not impede blood flow to their head!)

**DO NOT PUT TAPE DIRECTLY ON THE FACE OF THE PACER!!!**

Use the hooks located on the back of the pacer when securing the pacer. The adhesive gets into the dials making them difficult to adjust.

**SECURE THE WIRES**

- Wear gloves while securing transthoracic (epicardial) pacing wires in Preservative Free test tubes Tape the tubes to the chest.

- Secure transvenous pacing wires with a stress loop before taping to prevent wires from being dislodged if the pacer gets tugged.

- **DO NOT PLACE TAPE ON THE PLASTIC SHEATH / COVER**: The sheath / cover is placed ONLY to keep the wire sterile and DOES NOT prevent the wire from being pulled. Torn plastic cover = contaminated

**Change the Battery: Medtronic Pacer**

- (2 AA Alkaline batteries)
- The New Medtronic pacer will flash a red battery picture
- When you change the battery the pacer will continue to pace for several seconds without battery.
- **To change the battery**
  1. Push the button on the bottom of the pacer (looks like a belly button)
  2. When the battery drawer pops out
  3. Replace the battery just like the picture inside the battery drawer
  4. Slide the battery door closed

**PREVENT MICROSHOCK AND ELECTRICAL INTERFERENCE**

- Wear rubber gloves when handling pacer wires
- Use only a grounded electrical bed
- Allow pt only to use rechargeable electric razor or nonelectric razor
- Keep other electrical equipment off of the bed if possible.

**OTHER CAUSES OF ELECTRICAL INTERFERENCE:**

- Electrocautery
- Defibrillation current
- Radiation therapy
- MRI devices
- TENS units (transcutaneous electrical nerve stimulation)

**LESS COMMON BUT VERY REAL COMPLICATIONS OF TEMPORARY PACING WIRES**

- Endocarditis
- Myocardial perforation
- Cardiac tamponade
- Infection
- Hiccups: dislodged wire touching diaphragm

HINTS FOR FLOATING A TRANSVENOUS PACER

6F introducer
placed via IJ or Subclav

Prior to floating the pacer wire: place the plastic sheath over the pacer wire with the lock cap at the distal end.

Once the wire is placed and capture is established: snap / lock the plastic sheath onto the introducer and stretch the plastic sheath several inches to maintain sterility of the pacer wire for repositioning.

Do Not Put Tape over the plastic sheath!

• This will not secure the catheter
• Tearing will cause contamination

1) Test the balloon by inflating with 1.5 cc
2) Connect the adapter cable to the Ventricular Pacer Port
3) Connect the pacer wires to adapter cable
**Floating the pacer wire**

(Elective)

1. Connect the Distal Negative (-) Electrode to the ECG Lead V
2. Continuously monitor the V lead on the bedside monitor
3. Pass the wire through the introducer to 20 cm.
4. Inflate the balloon
5. Advance the wire forward while observing the ECG tracing.
6. Look for ST elevation in the V lead. This indicates the pacerwire is in contact with the myocardium (May see LBBB and L axis deviation)
7. Set / Check Stimulation Threshold

Transvenous pacing use

**VVI Mode Only**

Do not use DDD mode.

* Even if you only have the V wire connected the Atrial mA continues to fire

* If the V connection senses the atrial mA, The Ventricular mA will be inhibited [it will not fire]
PACER FAMILY (LOOK FOR THE SPIKES)

RHYTHM: Atrial Pacer spike - P - normal QRS

RHYTHM: Ventricular Pacer spike - WIDE QRS

RHYTHM: A-V Sequential Pacer spike - P - spike - WIDE QRS
To check sensitivity with the rhythm:

1) Measure spike to spike
   [this is the pacing interval / timing]

2) Locate an Intrinsic [pt] beat.

3) When the pacer senses a beat; it should wait this long [pacing interval] after the beat before it fires again.

4) Failure to Sense: The pacer did not wait long enough to fire [X] if the pacer fires too soon the impulse could hit the T wave [R on T -> Vfib]

The pacer continues to fire because there are NO qRS’s