MEDAVIE HealthEd ÉduSanté

Rhythm Interpretation

Electrical Therapy

Primary Care Paramedicine

Module: 12

Section: 05

Electrical Therapy

- Multiple electrical treatment options can be utilized to alleviate certain dysrhythmias of the heart
- These include:
  - Unsynchronized Defibrillation (PCP)
  - Synchronized Cardioversion (ACP)
  - Transcutaneous Pacing (ACP)

Joules

- What is a joule?
  - Energy, work or quantity of heat
  - Joule (J) = 1 kg x m2/s2
  - Therefore 1 Joule is the energy required to move an object a certain distance in a time period
    - 1 J = Moving a 1 kg rock 1 meter in one second
    - 10 J = Moving a 10 kg rock 1 meter in 1 second
    - Thus 300 J would move a 75 kg person 4 meters in 2 seconds

MEDAVIE HealthEd ÉduSanté

Electrical Therapy

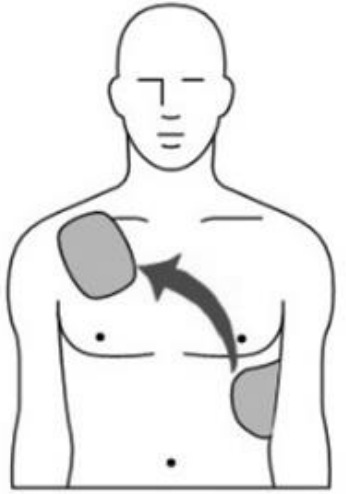
DEFIBRILLATION

Defibrillation

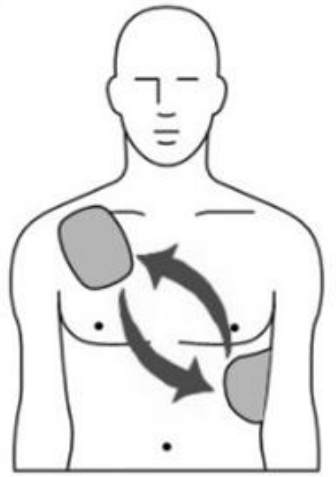
- Types
  - Manual
    - Paddles or pads
    - The operator analyzes the rhythm and performs all functions
  - Semi-Automated
    - Pads
    - The device analyzes multiple features of the ECG signal (frequency, amplitude and wave morphology) and informs operator when to defibrillate

Defibrillation

- Types
  - Monophasic
    - Current travels in one direction (+ → -)
    - Requires high amounts of energy to be effective (200-360 J)
      - may deliver more then is necessary
    - Also requires larger batteries, storage capacitors, etc.
  - Biphasic
    - Predicts energy requirements and chest wall impedance
    - Current travels in one direction, then stops and is sent back in the opposite direction
    - Requires less energy (115 – 200 J)



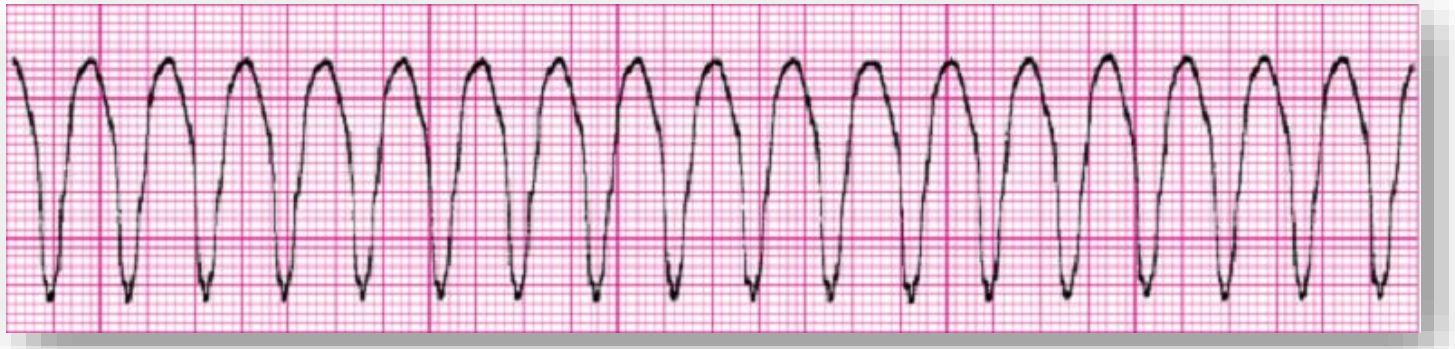
Monophasic Waveform



Biphasic Waveform

Defibrillation

- Indications for defibrillation are:
  - Ventricular tachycardia (without a pulse)



  - Ventricular fibrillation

Defibrillation

- Defibrillation (and Synchronized Cardioversion) both work by delivering a large quantity of energy to the heart, thus depolarizing the myocardium
  - This overload should cease all electrical activity of the myocardium and allow the normal pacemaker (hopefully the SA node) to begin at its intrinsic rate
    - If this occurs it is known as a Return of Spontaneous Circulation (ROSC)

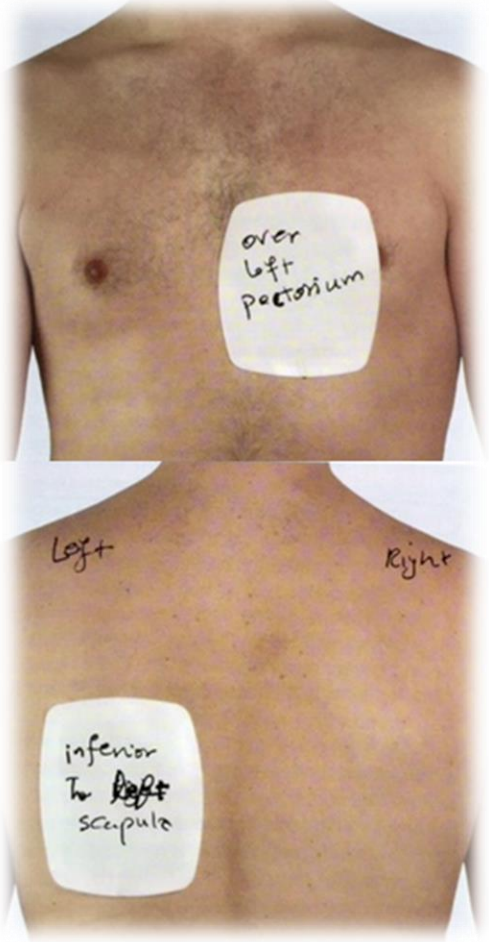
The Process

- Once you have confirmed that defibrillation is indicated, expose the chest if you haven't already done so
- Attach the defibrillator pads to the patient
  - Remove chest hair as needed
- Clean and dry the skin
  - Do not use alcohol or other wipes to prep the skin
- Apply the pads in either the anterior-lateral or anterior-posterior positions

The Process

- Anterior-Lateral

Anterior-Posterior

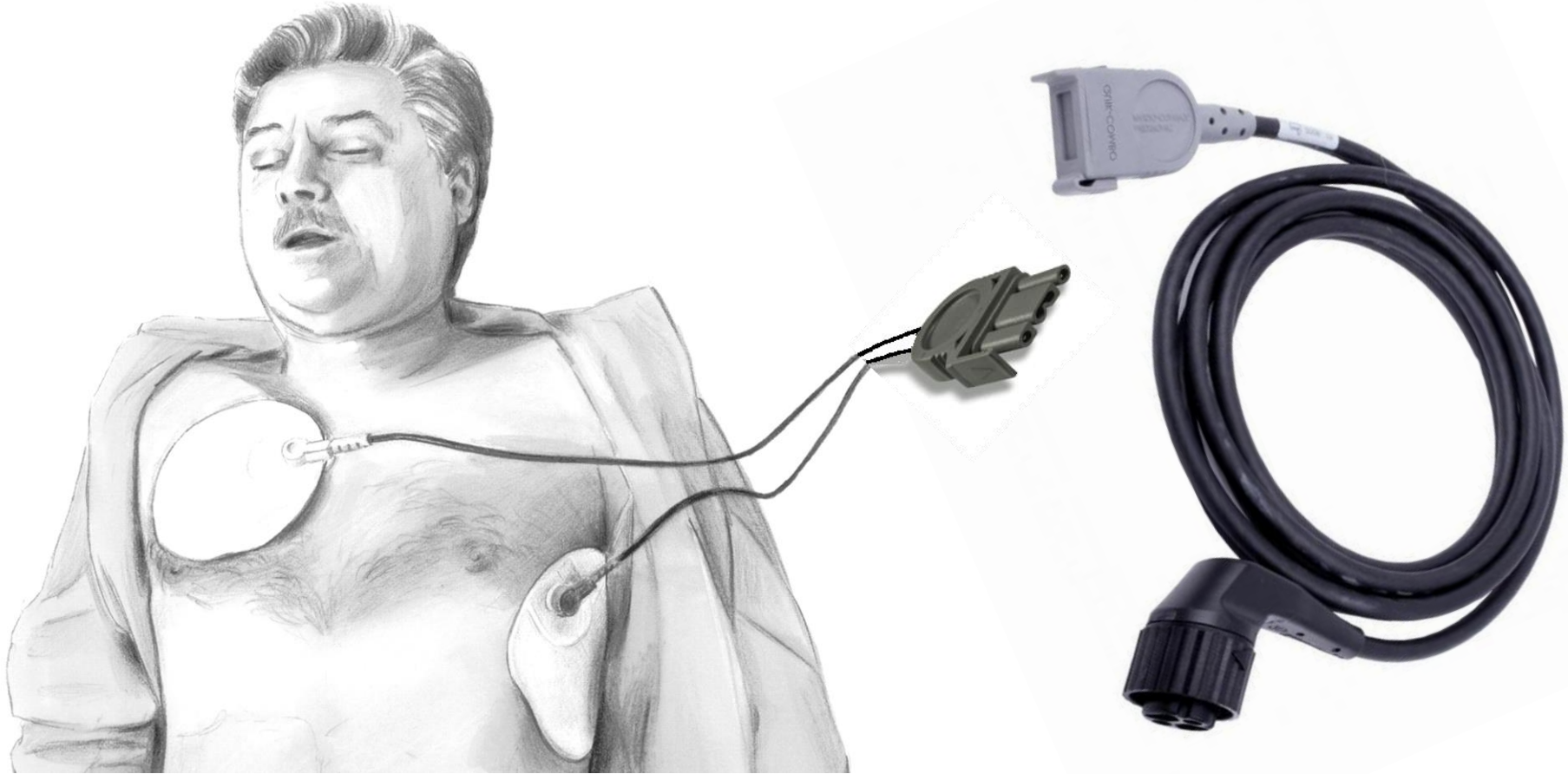


The Process

- Whether using pads or paddles:
  - Do not discharge over a pacemaker or ICD generator or nitroglycerin paste
  - Remove nitroglycerin patches before defibrillation
- Utilize the appropriate sized pads for the patient age
  - Adult pads for > 8 years old
  - Pediatric pads for 8 years and younger

The Process

- Connect the pads to the therapy cable and ensure the cable is connected to the defibrillator



The Process

- Once the defibrillator has analyzed and confirmed a shockable rhythm, prepare to deliver the shock
  - Clear all personnel from the patient, bed, and defibrillator before a defibrillation attempt
  - Do not make contact with the patient during the delivery of the shock
  - If using paddles, do not use excessive gel or coupling material that can become a contact between the patient's chest and the paddle handles

The Process

- When ready, depress the button on the defibrillator to charge the energy
- Remember that, while the defibrillator is charging, it is safe and appropriate to continue CPR

The Process

- Once charged (and the energy level has been confirmed as correct for the patient) inform all nearby care providers of your intent to shock
  - "You're clear, I'm clear, we're all clear"
- Once the defibrillator has charged and all providers are clear, while looking at the patient, press the button to delivery the shock

Defibrillator Safety

- If using a defibrillator with paddles:
  - Do not have one person perform CPR and defibrillation alternately. This will prevent gel from the patient's chest being transferred to the paddle handles
  - Apply gel or paste before turning on the defibrillator
  - Do not “open air” discharge the defibrillator to get rid of an unwanted charge
  - Turn the defibrillator off to “dump” the charge
  - Do not fire the defibrillator with the paddles placed together
  - Do not touch the metal electrodes or hold the paddles to your body when the defibrillator is on
  - Clean the paddles after use

Defibrillator Safety

- Routinely check the defibrillator (including batteries) to make sure the equipment is functioning properly
- During your check, deliver a test shock to a load tester (“shock box”) to ensure the defibrillator is functioning correctly

Defibrillator Use in Special Environments

- A patient can be defibrillated in wet conditions, such as near water, in rain, or in snowy weather
  - The patient's chest should be kept dry between the defibrillator electrode sites
  - The operator's hands and paddle handles should be kept as dry as possible
  - If in a rainstorm, finding shelter would be safest

Pediatric

- 1st dose: 2 J/kg
- 2nd dose: 4 J/kg
- Subsequent doses >4 J/kg up to a maximum of 10 J/kg (or max adult dose)

2 J/kg **4 J/kg** **6 J/kg** **8 J/kg** **10 J/kg**

MEDAVIE HealthEd ÉduSanté

Electrical Therapy

SYNCHRONIZED CARDIOVERSION

Synchronized Cardioversion

- Synchronized cardioversion is similar to defibrillation in that the intent is to completely depolarize the myocardium in hopes that the normal pacemaker (SA node) will take over at it's intrinsic rate
- Synchronized cardioversion, however, is used to "reset" certain tachydysrhythmias in the non-cardiac arrest patient
  - Not indicated for VF or pulseless VT

Synchronized Cardioversion

- In these patients, the heart is still beating on its own in an organized rhythm
  - However, the rhythm is very tachycardic and is not sustainable
- The energy that is delivered to the patient by cardioversion should not be delivered at the same time as the relative refractory period of an underlying beat
  - This is why it must be synchronized
  - Synchronization allows for the delivery of the energy between the underlying beats

Synchronized Cardioversion

- Designed to deliver the shock about 10 ms after the peak of the QRS complex, avoiding the “vulnerable” relative refractory period
  - Decreases the potential for development of secondary complicating dysrhythmias
    - Reduces risk of VF
  - Also reduces the energy required to end the dysrhythmia

Synchronized Cardioversion

- Indications
  - Non-arrest rhythms that are or become unstable
    - AFib
    - AFlut
    - PSVT
    - Vtach (with a pulse)
  - Shock is initially delivered at 100J with subsequent shocks delivered in escalating energy if needed
    - (100J, 200J, 300J, 360J)

Synchronized Cardioversion

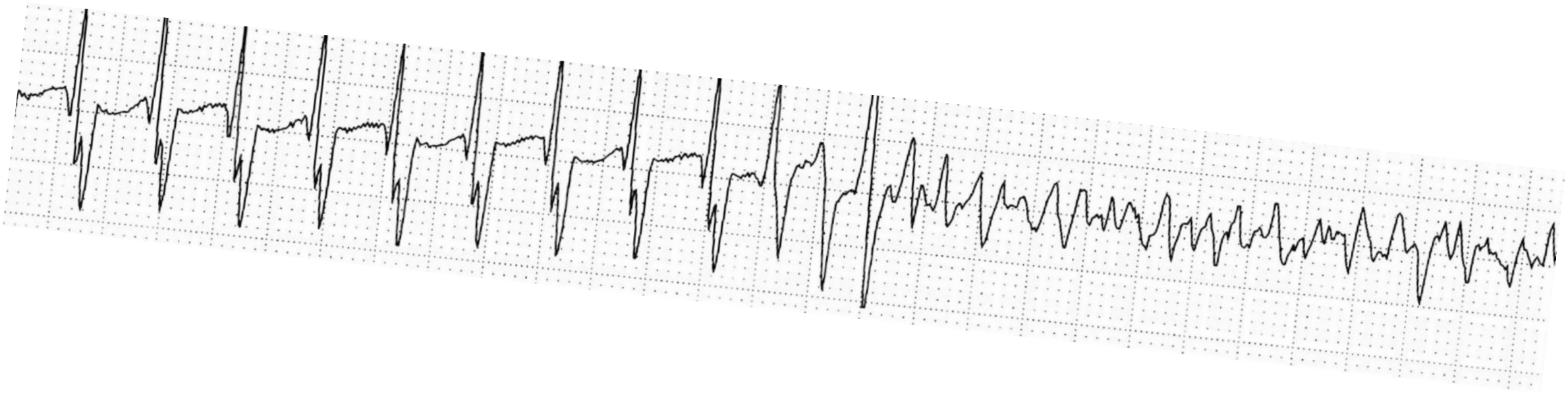
- Procedure
  - Initiate IV, oxygen, and ECG monitoring
  - Place the patient in a supine position
  - Confirm arrhythmia
  - Analgesic may be used to decrease patient anxiety and discomfort both pre and post procedure
    - Diazepam (5 - 10 mg IV)
    - Midazolam (2 - 5 mg IV)
    - Morphine IV (2.5 – 5.0 mg)
    - May need to re-administer during prolonged procedure
  - Turn on defibrillator and the Sync button
  - Confirm the marker coincides with the R wave
  - Prepare paddles or pads

Synchronized Cardioversion

- Procedure (continued)
  - Set energy level as desired and charge
  - Ensure everyone is clear
  - Depress the discharge button(s) and hold until the energy is delivered
  - If synchronization is required another time, ensure the sync button is on first

Synchronized Cardioversion

- If the patient deteriorates into VF, turn off the sync and treat as per VF arrest



MEDAVIE HealthEd ÉduSanté

Electrical Therapy

TRANSCUTANEOUS CARDIAC PACING

Transcutaneous Cardiac Pacing (TCP)

- Also called external cardiac pacing
- This is also a method of delivering energy to heart from an external source
  - TCP involves smaller amounts of energy than Defibrillation and/or Cardioversion
  - TCP is used to act as an external pacemaker of the heart when the heart's own pacemaking ability is impaired

Transcutaneous Cardiac Pacing (TCP)

- Indicated in unstable patients with the following rhythms:
  - Bradycardia refractory to medication (Atropine)
  - Second degree, Type 2 AV Block
  - Third degree AV Block
  - Pacemaker failure

Transcutaneous Cardiac Pacing (TCP)

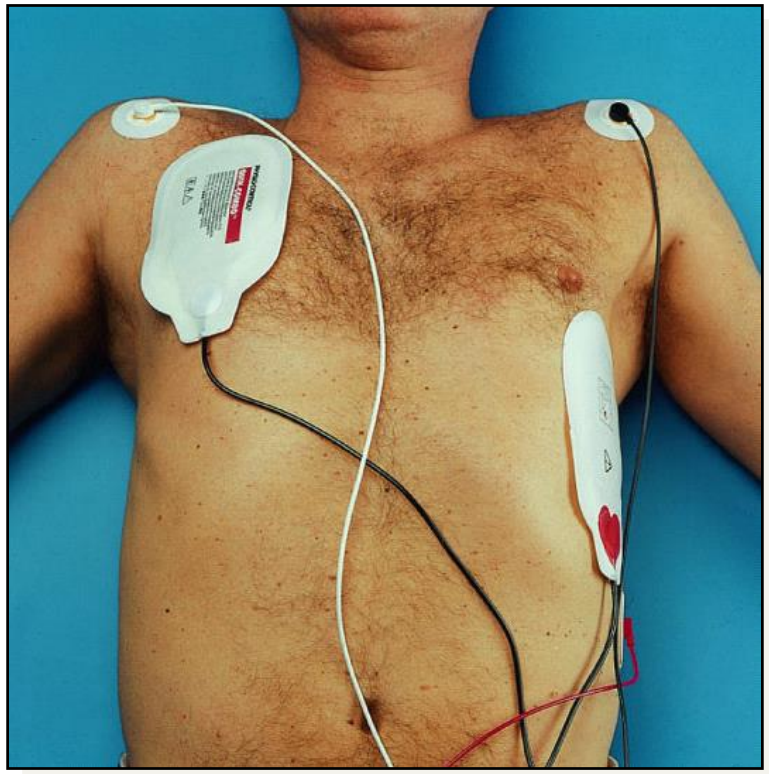
- Procedure
  - Initiate IV, oxygen, and ECG monitoring
  - Place the patient in a supine position
  - Confirm arrhythmia
  - Analgesic may be used to decrease patient anxiety and discomfort both pre and post procedure
  - Apply the pacing electrodes
  - Connect the electrodes
  - Turn pacer on

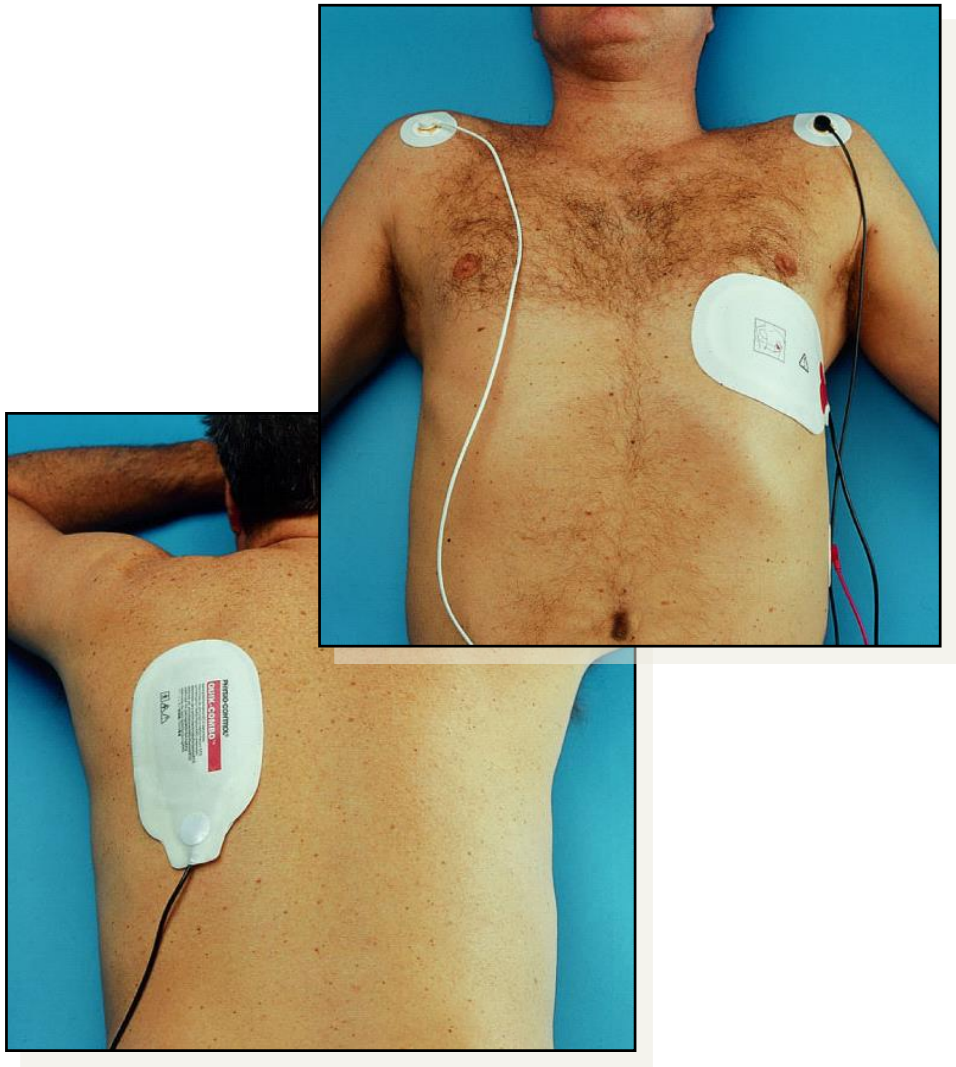
Transcutaneous Cardiac Pacing (TCP)

- Set the desired heart rate on the pacemaker
  - typically be in the range of 60 to 80 bpm
- Slowly increase the milliamperage (mA) until you note ventricular capture (electrical and mechanical)
- Check the pulse and blood pressure, and adjust the rate and milliamps as indicated
- Monitor the patient's response to treatment
- Do not delay transport

Transcutaneous Cardiac Pacing (TCP)

- Lead placement options





Transcutaneous Cardiac Pacing (TCP)

- Do not remove the 3-lead cables from the patient at any point!
  - While pacing, the pads cannot concurrently analyze the rhythm
    - This is done by the 3-lead cables
- It is safe to touch a patient while they are being paced to continue other treatments