14. ELECTRICAL THERAPY: AUTOMATED EXTERNAL DEFIBRILLATION (AED)

a) INDICATIONS

Sudden cardiac arrest (patients with no pulse and not breathing).

Neonate (1 hour to 28 days of life) to less than 1 year of age	Manual defibrillator preferred. (If unavailable, an AED with pediatric capability is preferred over an adult AED.)
1 year of age to 8 years of age	AED with pediatric capability, using the pediatric capability, is preferred over an adult AED.
Child 8 years of age or greater	Adult AED

b) CONTRAINDICATIONS

Patient exhibiting signs of life
Newly born patients (up to one hour after birth)

ALERT USE OF THE AED IN THE MANUAL MODE IS RESERVED FOR ALS.

c) POTENTIAL ADVERSE EFFECTS/COMPLICATIONS

(1) Burns to skin
(2) Deactivation of patient's implanted pacemaker
(3) Injury to patient, self, and/or bystanders

d) PRECAUTIONS

(1) Make sure the patient and the environment are dry.
(2) Avoid placing pads over cardiac pacemakers/defibrillators or nitroglycerin patches.
(3) DO NOT touch the patient while the AED is analyzing the patient or discharging energy.
(4) ENSURE that no one is touching the patient when the shock button is pushed.
(5) Never defibrillate while moving the patient or when in a moving ambulance.

e) PROCEDURE

(1) Initiate analysis of rhythm.
(2) If shock is indicated:
  (a) Ensure all individuals are clear of the patient.
  (b) Initiate shock to the patient.
  (c) Immediately perform 5 cycles of CPR between shocks, then initiate analysis of rhythm.
  (d) If patient remains pulseless, continue this cycle of CPR and shocks until the AED prompt states "no shock advised," or ROSC is achieved or ALS arrives or the patient is transported or the Termination of Resuscitation Protocol is initiated.

(3) If shock is not indicated and the patient remains in cardiac arrest:
   (a) Perform 5 cycles of CPR.
   (b) Initiate analysis of rhythm.
   (c) If shock is indicated, see “If shock is indicated” section above.
   (d) If shock is not indicated, continue CPR until ALS arrives or ROSC is achieved or the patient is transported or the Termination of Resuscitation protocol is initiated.
(4) If shock is not indicated and patient regains pulse, treat per Return of Spontaneous Circulation (ROSC) protocol.

f) SPECIFIC DOCUMENTATION

(1) Document the number of analyses and shocks delivered, times of assessments and treatments, and the patient’s response to shocks/CPR. Specify the type of AED, location of AED, bystander and provider contact, and the triggering event.
(2) If using an AED with EKG strip recorder, generate 2 recordings.
(3) Give one to the ALS provider or hospital and attach the other to your patient care report.
(4) Record the name of the contact for accessing AED data download summary.
(5) Consider bringing the AED to the hospital for downloading.

15. ELECTRICAL THERAPY: CARDIOVERSION

a) PURPOSE

Emergency cardioversion involves the delivery of a synchronized electric current to the myocardium of a patient who is exhibiting supraventricular or ventricular tachydysrhythmias that results in hemodynamic compromise (i.e., a systolic BP less than 80 mmHg with shock-like signs and symptoms). Emergency cardioversion is appropriate in the field only in those patients where there is hemodynamic compromise or where it is evident that the patient's condition may further deteriorate.

b) INDICATIONS

Symptomatic rate-related tachycardia (age-specific) with serious signs and symptoms related to tachycardia. Signs and symptoms may include chest pain, shortness of breath, decreased level of consciousness, low blood pressure, shock, pulmonary edema, congestive heart failure, and/or acute myocardial infarction.

c) DOSAGE

(1) Adult
   (a) For symptomatic PSVT or atrial flutter:
      (i) Initial 50 J
      (ii) Subsequent 100 J, 200 J, 300 J, 360 J
   (b) For symptomatic atrial fibrillation:
      (i) Initial 200 J
      (ii) Subsequent 200 J, 300 J, 360 J
   (c) For other symptomatic tachydysrhythmias
      (i) Initial 100 J
      (ii) Subsequent 200 J, 300 J, 360 J

(2)  Pediatric

Symptomatic tachydysrhythmias
   (a) Initial 0.5 J/kg; if the calculated joules setting is lower than the defibrillation device is able to deliver, use the lowest joules setting possible or obtain medical consultation.
   (b) Subsequent 1 J/kg; repeat at 2 J/kg

(3) If the patient exhibits ventricular fibrillation following emergency cardioversion, immediately turn off the synchronizer and defibrillate with appropriate delivered energy (200 to 360 J for adults and 2 to 4 J/kg for pediatric patients) and refer to defibrillation and/or other appropriate protocol.

d) CONTRAINDICATIONS

Tachydysrhythmias due to digitalis toxicity

e) POTENTIAL ADVERSE EFFECTS/COMPLICATIONS

An unsynchronized shock can result in ventricular fibrillation.

f) PRECAUTIONS

(1) If the calculated joules setting is lower than the cardioversion device is able to deliver, use the lowest joules setting possible or obtain medical consultation.

(2) Pre-procedural sedation or analgesia

(a) Patient may experience moderate to severe discomfort during cardioversion. Consider pre-medication by administering opioid per Pain Management Protocol.

OR

(b) Administer midazolam 0.1 mg/kg in 2 mg increments SLOW IVP over 1–2 minutes per increment, with maximum single dose 5 mg. (Reduce by 50% for patients 69 years or older.)

(3) Pre-procedural sedation or analgesia

(a)  Patient may experience moderate to severe discomfort during cardioversion. Consider pre-medication by administering opioid per Pain Management Protocol.

OR

(b)  Administer midazolam 0.1 mg/kg in 2 mg increments SLOW IVP over 1–2 minutes per increment, with maximum single dose 5 mg.

16. ELECTRICAL THERAPY: DEFIBRILLATION

a) PURPOSE

Defibrillation involves the delivery of non-synchronized direct electric current (mono or biphasic) to the myocardium of a patient exhibiting ventricular fibrillation or ventricular tachycardia without palpable pulses/blood pressure. The objective of defibrillation is to depolarize the entire myocardium, which, it is hoped, will result in allowing a single reliable pacemaker site to assume pacemaker control at a rate capable of producing an adequate cardiac output.

b) INDICATIONS

(1) Ventricular fibrillation
(2) Ventricular tachycardia without palpable pulse or BP

c) DOSAGE

(1) Adult
  (a) Initial delivered energy monophasic 360 J or biphasic 120–200 J
  (b) Subsequent delivered energy monophasic 360 J or biphasic increasing joules setting, if device allows
(2) Pediatric
  (a) Initial delivered energy 2 J/kg (monophasic or biphasic)
  (b) Subsequent delivered energy 4 J/kg (monophasic or biphasic)
  (c) If refractory after 4 shocks, increase dosage to 6 J/kg, 8 J/kg, then 10 J/kg.

d) CONTRAINDICATIONS

None

e) POTENTIAL ADVERSE EFFECTS/COMPLICATIONS

(1) Burns to the skin
(2) Deactivation of patient's implanted pacemaker

f) PRECAUTIONS

(1) Patients who are fully digitalized may require less than the normal recommended delivered energy.
(2) If the calculated joules setting is lower than the defibrillation device is able to deliver, use the lowest joules setting possible or obtain medical consultation.

17. ELECTRICAL THERAPY: EXTERNAL TRANSCUTANEOUS CARDIAC PACING

a) PURPOSE

Non-invasive cardiac pacing, also referred to as external or transcutaneous pacing, involves the temporary application of externally applied electrodes to deliver an adjustable electrical impulse directly across an intact chest wall for the purpose of rhythmically stimulating the myocardium to increase the mechanical heart rate.

b) INDICATIONS

(1) It is indicated for the treatment of hemodynamically compromised patients in settings where cardiac output is compromised due either to the complete failure of cardiac rhythm or to an insufficient rate of the patient's intrinsic pacemaker.

(2) Bradycardia (EKG other than second-degree Mobitz Type II or third-degree AV Block)

(3) Second-degree Mobitz Type II and third-degree AV block with a systolic BP of less than 80 mmHg, or 80–100 mmHg with shock-like signs or symptoms
In the presence of Mobitz II and third-degree AV block, medical consultation is required for atropine administration.

(4) Pacing may be indicated in certain instances in which the heart rate is 60–75 BPM and shock-like symptoms persist.
Pacing in these instances requires medical consultation from a physician

(5) Pediatric patients with profound symptomatic bradycardia unresponsive to optimal airway management, oxygenation, epinephrine, and atropine

c) DOSAGE

Start pacemaker at age appropriate heart rate:
Infant (less than 1 year): 120 beats per minute
Child (1 through 12 years): 100 beats per minute
Adult/Adolescent (13 years and greater): 80 beats per minute

Start milliamperes (m.a.) as low as possible and gradually increase m.a. until palpable pulse to confirm capture or 200 m.a.

ALERT CONTINUE CHEST COMPRESSIONS FOR PEDIATRIC PATIENTS WHO REMAIN POORLY PERFUSED DESPITE PACEMAKER CAPTURE.

d) CONTRAINDICATIONS

(1) Non-witnessed cardiopulmonary arrest with asystole
(2) Patient not meeting blood pressure criteria

e) POTENTIAL ADVERSE EFFECTS/COMPLICATIONS

(1) Patient may experience moderate to severe discomfort during pacing. Consider pre-medication by administering opioid per Pain Management Protocol.
(a) Administer opioid per Pain Management Protocol.
OR
(b) Administer midazolam 0.1 mg/kg in 2 mg increments SLOW IVP over 1–2 minutes per increment, with maximum single dose 5 mg. (Reduce by 50% for patients 69 years or older.)

(2) Patient may experience moderate to severe discomfort during pacing. Consider pre-medication by administering opioid per Pain Management Protocol.
(a)  Administer opioid per Pain Management Protocol.
OR
(b)  Administer midazolam 0.1 mg/kg in 2 mg increments SLOW IVP over 1–2 minutes per increment, with maximum single dose 5 mg.

f) PRECAUTIONS

When properly applied, chest compressions can be performed directly over the insulated electrodes while the pacer is operating.