

Paramedic Synchronized Cardioversion vs Defibrillation Study Guide

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Same box, same pads, two very different jobs. Synchronized cardioversion and defibrillation both push current across the heart, but one is timed to the patient's own QRS and the other is not, and mixing them up can turn a patient with a pulse into a patient without one. This guide walks through what each shock is for, why timing matters, monophasic versus biphasic, adult versus pediatric pad placement, what to do about medication patches and implanted devices, where the shock sits relative to epinephrine and amiodarone or lidocaine, and how the 2025 AHA guidelines sort shockable from non-shockable rhythms. It is written for paramedics and ACLS providers.

Guideline version verified: 2025 American Heart Association Guidelines for CPR and Emergency Cardiovascular Care (published October 22, 2025, in *Circulation*), Part 6 (Pediatric BLS), Part 7 (Adult BLS), Part 8 (PALS), and Part 9 (Adult ALS). Checked October 30, 2026: no 2026 AHA guideline or focused update has replaced them. AHA's February 6, 2026 change notice for the 2025 print edition corrects only algorithm wording (for example, "1 breath every 6 seconds" with an advanced airway). Medication patch and implanted-device guidance comes from the 2010 AHA guidelines, which the 2025 parts do not restate (see Section 6).

Disclaimer: This is a study aid, not official. For PDF, copy into a word processor and export. Always follow current local protocols, medical direction, NREMT skill sheets, your defibrillator manufacturer's instructions, and the latest AHA 2025 ACLS/PALS guidelines.

Section 1: Two Shocks, Two Purposes

	Defibrillation (Unsynchronized)	Synchronized Cardioversion
Timing	Fires the moment you press the shock button, wherever the patient is in the cardiac cycle.	The monitor marks each R wave and delivers the shock on the QRS complex.
Patient	Pulseless: VF or pulseless VT. Also polymorphic VT, which the AHA calls always unstable.	Has a pulse but is unstable from a tachyarrhythmia: wide-complex (monomorphic VT) or narrow-complex (SVT, atrial fibrillation, atrial flutter).
Goal	Depolarize enough myocardium at once to stop chaotic electrical activity so an organized rhythm can return.	Interrupt the tachyarrhythmia without dropping a shock on the vulnerable T wave.
Energy	Adult: per manufacturer; if unknown, the maximum may be considered. Pediatric: 2–4 J/kg first, then 4 J/kg, up to 10 J/kg or the adult maximum.	Adult AF: ≥200 J. Adult flutter: 200 J (new in 2025). Pediatric: 0.5–1 J/kg, then 2 J/kg.

Instability is what moves a tachycardia toward electricity. AHA examples include hypotension, acutely altered mental status, signs of shock, ischemic chest discomfort, and acute heart failure. The 2025 ALS guideline recommends synchronized cardioversion for unstable wide-complex and narrow-complex tachycardias. For a stable patient, there is time for a 12-lead, vagal maneuvers, adenosine, or antiarrhythmics per protocol.

Section 2: Why Synchronization Matters (R-on-T and the Vulnerable Period)

On the ECG, the T wave is repolarization. Part of it is a **relative refractory (vulnerable) period**: some cells have recovered and others haven't. A stimulus landing there, whether a PVC (the classic “R-on-T”), a precordial thump, or an unsynchronized shock, can set up the re-entry that becomes VF. The 2025 ALS guideline says it directly: when VT is of uniform

morphology, “electric cardioversion synchronized to the QRS complex minimizes the risk of provoking VF during the vulnerable period of the cardiac cycle (T wave).”

- **Polymorphic VT cannot be synchronized reliably.** The QRS keeps changing shape, so the monitor can’t pick a dependable R wave. AHA guidance is a high-energy (maximum manufacturer setting) *unsynchronized* shock.
- **Confirm the sync markers** sit on the R waves, not on tall T waves or artifact, before every synchronized shock. Know how your monitor behaves after a shock (some return to unsynchronized mode) per the manufacturer’s instructions and your training.
- **If the patient deteriorates into VF** while you are in sync mode, there is no QRS to sync to. Turn sync off and defibrillate.
- **Sedation:** consider it for the awake patient when it won’t delay care for a crashing patient, per protocol.

Section 3: Shockable vs Non-Shockable Rhythms (2025)

Rhythm	Shock?	Core 2025 Actions
Ventricular fibrillation	Yes: defibrillate	Single shock, then immediately resume CPR starting with compressions. Stacked shocks are not preferred.
Pulseless VT	Yes: defibrillate	Same pathway as VF.
Asystole	No	High-quality CPR and epinephrine as soon as feasible. Pacing is not recommended in established arrest.
PEA	No	High-quality CPR, epinephrine as soon as feasible, and hunt for reversible causes.

Time is the enemy. The 2025 Adult BLS guideline reports that each minute of delay to the first shock was associated with about a 6% lower probability of survival to discharge. For witnessed or monitored VF/pVT, defibrillate immediately, with brief CPR only while the defibrillator is readied.

Section 4: Monophasic vs Biphasic

- **Monophasic:** current flows in one direction, pad to pad. AHA notes monophasic units were last manufactured in the late 1990s, though some may still be in service.
- **Biphasic:** current flows one way, then reverses. It gets equal or better shock efficacy at lower peak current.
- **2025 adult recommendation:** biphasic is preferred over monophasic for defibrillation (Class 2a). Whether to use fixed or escalating energy follows the device manufacturer. If you don't know the effective dose, the maximum available dose may be considered.
- **Cardioversion:** the 2025 ALS guideline notes that a low-energy monophasic shock was more likely to provoke VF.
- **Pediatric:** PALS 2025 notes that biphasic defibrillators need less energy and cause fewer side effects, so monophasic has fallen out of favor.

Section 5: Pad Placement: Adults vs Children, and Can You Swap Them?

Adults (Part 7, 2025):

- Use anterolateral (AL) or anteroposterior (AP) placement.
- For AL, put the lateral pad at the mid-axillary line, not too far forward.
- Use electrodes larger than 8 cm in diameter (Class 2a). Larger pads (8–12 cm) lower transthoracic impedance.
- Adjusting a bra rather than removing it may be reasonable (2b). Don't delay the shock.

Infants and Children (Parts 6 and 8, 2025):

- Pediatric guidelines apply from infancy until **puberty**. Once signs of puberty are present, use adult guidelines.
- **AED with a pediatric attenuator** is recommended for children under 8 years (Class 1). Attach it as soon as possible.

- Use the **largest pads that fit** on the chest with good separation, at least 1–2 cm. AP or AL placement may be reasonable (2b).
- For pediatric AL, the right pad goes vertically just below the clavicle and the left pad horizontally at the mid-axillary line, off breast tissue and the abdomen.
- Manual defibrillators are reasonable for trained professionals because they let you titrate the dose by weight.

Swapping Pads:

Situation	Answer	Why
Adult pads / no attenuator on a child	Yes, if nothing else is available. If adult pads won't fit without touching, go AP.	AHA: if neither a manual defibrillator nor an attenuated AED is available, an AED without an attenuator may be considered (2b). Unattenuated AEDs deliver 120–360 J, more than recommended for a child under 25 kg. But defibrillation is the only effective therapy for VF/pVT, and AHA cites reports of safe use. Larger pads also lower impedance.
Pediatric pads / attenuator on an adult (or a post-pubertal teen)	No.	The attenuator deliberately cuts the dose to a child-sized amount, and smaller pads raise impedance. An adult would be underdosed. Post-pubertal patients get adult care.
Pads touching	Never.	Current arcs pad to pad across the skin instead of through the heart. Keep them separated.

Section 6: Medication Patches, Pacemakers, and ICDs

The 2025 Adult BLS and ALS parts don't restate guidance on transdermal patches or implanted devices. The 2025 guideline documents state that existing guidelines remain relevant unless specifically updated. The most recent AHA statements are in the 2010 Electrical Therapies part:

- **Transdermal medication patches** (nitroglycerin, nicotine, fentanyl, and others): don't place pads on top of a patch. It can block energy delivery and cause small skin burns. If it won't delay the shock, remove the patch and wipe the area before attaching the pad (2010, Class IIb).
- **Pacemakers and ICDs:** the bulge is usually under the left or right clavicle. Pad placement should **not delay defibrillation**. It might be reasonable to avoid placing a pad directly over the device (2010, IIb), and AP or AL positioning is acceptable. One study found placement at least 8 cm from the device was safe. A pad very close to the device can cause device malfunction.
- **Pacer spikes** may confuse an AED's rhythm analysis.
- **ICD actively firing:** 2010 guidance allowed 30–60 seconds for the ICD to complete its cycle before attaching an AED.
- After any shock, the device needs evaluation at the hospital. Report it at handoff.

Section 7: When the Shock Comes Relative to the Drugs

Shockable (VF/pVT) Adult Pathway:

1. CPR, attach the defibrillator, analyze, and **shock** as soon as possible.
2. Resume CPR immediately for 2 minutes. Establish IV access; use IO if IV fails.
3. **Epinephrine** 1 mg every 3–5 minutes, given **after initial defibrillation attempts have failed**. In the AHA algorithm that falls after the second shock.
4. **Amiodarone or lidocaine** may be considered for VF/pVT unresponsive to defibrillation (2b). In the algorithm that falls after the third shock. Dose per the ACLS algorithm and your protocol.
5. Every 2 minutes: rhythm check, shock if still shockable, and minimize the pause.

Non-Shockable (Asystole/PEA):

- Give epinephrine **as soon as feasible**, then every 3–5 minutes.
- Check the rhythm every 2 minutes. If it converts to VF/pVT, switch to the shockable pathway.

Other 2025 Points:

- Routine calcium, sodium bicarbonate, and magnesium are not recommended in arrest. Hyperkalemia and poisonings are addressed in Part 10.
- For persisting VF/pVT after 3 or more shocks, the usefulness of a vector change or double sequential defibrillation is not established.
- Pediatric: rapid defibrillation is the priority. Give epinephrine if defibrillation is not immediately possible.

Section 8: What Changed From 2020

- **AF/flutter cardioversion energy:** 2025 gives starting energies (AF ≥ 200 J, Class 2a; flutter 200 J, 2b). Previously this deferred to the manufacturer.
- **Polymorphic VT** is emphasized as always unstable and is treated with a high-energy unsynchronized shock.
- **Pediatric AED:** attach as soon as possible, with a pediatric attenuator recommended under age 8. The puberty cutoff for adult versus pediatric care is restated.
- **Biphasic preferred** over monophasic and **single shocks** over stacked shocks, both reaffirmed with updated evidence. Vector change and double sequential defibrillation were reviewed, and their usefulness remains not established.

Section 9: Putting It Together

Question: Your 64-year-old patient has a regular wide-complex tachycardia at 190, BP 72/40, and is confused. While you prepare to cardiovert, the rhythm becomes polymorphic, then degenerates into VF. What do you do with the sync button?

Answer: Start with synchronized cardioversion for the unstable monomorphic VT. When the rhythm turns polymorphic, turn sync off and deliver a high-energy unsynchronized shock. Once it is VF, defibrillate (unsynchronized), resume CPR immediately, and follow the shockable pathway: epinephrine after initial shocks fail, then consider amiodarone or lidocaine.

Reasoning: Synchronization exists to keep the shock off the vulnerable T wave in a heart that still has an organized rhythm. Once the QRS becomes polymorphic, the monitor cannot

sync reliably. Once it is VF, there is no QRS to sync to, and every second of waiting costs survival.

Sources (American Heart Association only)

- Part 7: Adult Basic Life Support: 2025 AHA Guidelines for CPR and ECC. *Circulation*. 2025;152(suppl 2):S448–S478. doi:10.1161/CIR.0000000000001369
- Part 9: Adult Advanced Life Support: 2025 AHA Guidelines for CPR and ECC. *Circulation*. 2025;152(16 suppl 2):S538–S577. doi:10.1161/CIR.0000000000001376
- Part 6: Pediatric Basic Life Support: 2025 AHA and AAP Guidelines for CPR and ECC. *Circulation*. 2025;152(suppl 2):S424–S447. doi:10.1161/CIR.0000000000001370
- Part 8: Pediatric Advanced Life Support: 2025 AHA and AAP Guidelines for CPR and ECC. *Circulation*. 2025. doi:10.1161/CIR.0000000000001368; and the AHA 2025 PALS Tachyarrhythmia Algorithm (cpr.heart.org)
- Part 1: Executive Summary: 2025 AHA Guidelines for CPR and ECC. *Circulation*. 2025. doi:10.1161/CIR.0000000000001372
- Part 6: Electrical Therapies: 2010 AHA Guidelines for CPR and ECC. *Circulation*. 2010;122(suppl 3):S706–S719. doi:10.1161/CIRCULATIONAHA.110.970954 (medication patches, pacemakers, ICDs)
- AHA. Change Notice, 2025 AHA Guidelines for CPR and ECC (updated February 6, 2026). cpr.heart.org