ACLS Algorithms


Comprehensive Emergency Cardiovascular Care Algorithm
### Using Automated External Defibrillators

All automated external defibrillators (AEDs) operate using the following basic steps:

<table>
<thead>
<tr>
<th>Step</th>
<th>Details of Operation</th>
</tr>
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<tbody>
<tr>
<td>1. <strong>POWER ON</strong></td>
<td>Turn power on.</td>
</tr>
<tr>
<td>2. <strong>Attachment</strong></td>
<td>Attach to the patient.</td>
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<tr>
<td></td>
<td>- Open adhesive defibrillator pads.</td>
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<td></td>
<td>- Attach defibrillator cables to padds.</td>
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<td></td>
<td>- Expose adhesive surface.</td>
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<td></td>
<td>- Attach padds to the patient (upper right sternal border and cardiac apex).</td>
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<tr>
<td>3. <strong>Analysis</strong></td>
<td>Place in ANALYZE mode.</td>
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<tr>
<td></td>
<td>- Announce to the team members, “Analyzing rhythm—stand clear!” (Verify that there is no patient movement and that no one is in contact with the patient.)</td>
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<tr>
<td></td>
<td>- Press the ANALYZE control (some AEDs omit this control).</td>
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<tr>
<td>4. <strong>Shock</strong></td>
<td>Press the SHOCK button.</td>
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<td></td>
<td>If VF/VT is present, the device will charge to 150 to 360 J and signal that a shock is indicated. Some AEDs use biphasic waveforms with a constant (nonescalating) energy setting.</td>
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<tr>
<td></td>
<td>- Announce, “Shock is indicated—stand clear!”</td>
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<td></td>
<td>- Verify that no one is touching the patient.</td>
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<td></td>
<td>- Press the SHOCK button when signaled to do so.</td>
</tr>
</tbody>
</table>

Repeat these steps until VF/VT is no longer present. The device will signal “no shock indicated.” In general, shock in sets of 3 without interposed CPR or pulse checks. After a set of 3 shocks, provide 1 minute of CPR.
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Treatment Algorithm for Emergency Cardiovascular Care

Pending Arrival of Emergency Medical Personnel

Unresponsive—911—AED:
• Check if unresponsive
• Call 911 (or emergency response number)
• Get AED
• Identify and respond to special situations

Start the ABCDs:
• Airway: open airway
• Breathing: check breathing (look, listen, and feel)

Unresponsive

Yes, Breathing

• If breathing is adequate: place in a recovery position
• If breathing is inadequate: start rescue breathing
  (1 breath every 5 seconds)
• Monitor signs of circulation* (every 30 to 60 seconds)

Not Breathing

• Provide 2 slow breaths
  (2 seconds per breath)
• Circulation: check for signs*

Yes, Circulation

No Circulation

Start rescue breathing (1 breath every 5 seconds)
• Monitor signs of circulation* (every 30 to 60 seconds)

Perform CPR (until AED arrives and is ready to attach):
• Start chest compressions (100/min)
• Combine compressions and ventilations
• Ratio of 15 compressions to 2 breaths

• Attempt Defibrillation (AED on scene):
  • POWER ON the AED first!
  • ATTACH AED electrode pads (stop chest compressions for pad placement)
  • ANALYZE (“Clear!”)
  • SHOCK (“Clear!”) up to 3 times if advised

After 3 shocks or after any “no shock indicated”:
• Check for signs of circulation*
• If no signs of circulation: perform CPR for 1 minute

Check for signs of circulation.* If absent:
• Press ANALYZE
• Attempt to defibrillate
• Repeat up to 3 times

Memory aid for “no shock indicated”:
• Check for signs of circulation*
• If signs of circulation* present: check breathing
• If inadequate breathing: start rescue breathing
  (1 breath every 5 seconds)
• If adequate breathing: place in a recovery position
• If no signs of circulation,* analyze rhythm: repeat
  “shock indicated” or “no shock indicated”
  sequences

*Note: Signs of circulation: lay rescuers check for
normal breathing, coughing, or movement (typically
assessed after 2 rescue breaths delivered to the
unresponsive, nonbreathing victim).
**Tachycardia**
With serious signs and symptoms related to the tachycardia

If ventricular rate is >150 bpm, prepare for immediate *cardioversion.* May give brief trial of medications based on specific arrhythmias. Immediate cardioversion is generally not needed if heart rate is ≤150 bpm.

**Have available at bedside**
- Oxygen saturation monitor
- Suction device
- IV line
- Intubation equipment

**Premedicate whenever possible**

**Synchronized cardioversion**
- Ventricular tachycardia
- Paroxysmal supraventricular tachycardia
- Atrial fibrillation
- Atrial flutter

100 J, 200 J, 300 J, 360 J monophasic energy dose (or clinically equivalent biphasic energy dose)
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Ventricular Fibrillation and Pulseless Ventricular Tachycardia Algorithm

**Primary ABCD Survey**
*Focus: basic CPR and defibrillation*
- Check responsiveness
- **Activate** emergency response system
- Call for defibrillator
  - **A**irway: open the airway
  - **B**reathing: provide positive-pressure ventilations
  - **C**irculation: give chest compressions
  - **D**efibrillation: assess for and shock VF/pulseless VT, up to 3 times (200 J, 200 to 300 J, 360 J, or equivalent biphasic) if necessary

2. **Rhythm after first 3 shocks?**

3. **Persistent or recurrent VF/VT**

**Secondary ABCD Survey**
*Focus: more advanced assessments and treatments*
- **A**irway: place airway device as soon as possible
- **B**reathing: confirm airway device placement by exam plus confirmation device
- **B**reathing: secure airway device; purpose-made tube holders preferred
- **B**reathing: confirm effective oxygenation and ventilation
- **C**irculation: establish IV access
- **C**irculation: identify rhythm → monitor
- **C**irculation: administer drugs appropriate for rhythm and condition
- **D**ifferential Diagnosis: search for and treat identified reversible causes

4. **Epinephrine** 1 mg IV push, repeat every 3 to 5 minutes
   or
   **Vasopressin** 40 U IV, single dose, 1 time only

5. **Resume attempts to defibrillate**
   1 × 360 J (or equivalent biphasic) within 30 to 60 seconds

7. **Consider antiarrhythmics:**
   - **Amiodarone** (IIIb for persistent or recurrent VF/pulseless VT)
   - **Lidocaine** (indeterminate for persistent or recurrent VF/pulseless VT)
   - **Magnesium** (IIIb if known hypomagnesemic state)
   - **Procainamide** (Indeterminate for persistent VF/pulseless VT; IIIb for recurrent VF/pulseless VT)

8. **Resume attempts to defibrillate**
Pulseless Electrical Activity
(PEA = rhythm on monitor, without detectable pulse)

1

Primary ABCD Survey
Focus: basic CPR and defibrillation
- Check responsiveness
- Activate emergency response system
- Call for defibrillator
A Airway: open the airway
B Breathing: provide positive-pressure ventilations
C Circulation: give chest compressions
D Defibrillation: assess for and shock VF/pulseless VT

2

Secondary ABCD Survey
Focus: more advanced assessments and treatments
A Airway: place airway device as soon as possible
B Breathing: confirm airway device placement by exam plus confirmation device
B Breathing: secure airway device; purpose-made tube holders preferred
B Breathing: confirm effective oxygenation and ventilation
C Circulation: establish IV access
C Circulation: identify rhythm → monitor
C Circulation: administer drugs appropriate for rhythm and condition
C Circulation: assess for occult blood flow ("pseudo-EMD")
D Differential Diagnosis: search for and treat identified reversible causes

3

Review for most frequent causes
- Hypovolemia
- Hypoxia
- Hydrogen ion—acidosis
- Hyper/hypokalemia
- Hypothermia
- "Tablets" (drug OD, accidents)
- Tamponade, cardiac
- Tension pneumothorax
- Thrombosis, coronary (ACS)
- Thrombosis, pulmonary (embolism)

4

Epinephrine 1 mg IV push, repeat every 3 to 5 minutes

5

Atropine 1 mg IV (if PEA rate is slow), repeat every 3 to 5 minutes as needed, to a total dose of 0.04 mg/kg
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Asystole Algorithm

1. **Primary ABCD Survey**
   - **Focus:** basic CPR and defibrillation
   - **Check** responsiveness
   - **Activate** emergency response system
   - **Call** for defibrillator
   - **Airway:** open the airway
   - **Breathing:** provide positive-pressure ventilations
   - **Circulation:** give chest compressions
   - **Confirm** true asystole
   - **Defibrillation:** assess for VF/pulseless VT; shock if indicated
   - **Rapid scene survey:** is there any evidence that personnel should **not** attempt resuscitation (e.g., DNAR order, signs of death)?

2. **Secondary ABCD Survey**
   - **Focus:** more advanced assessments and treatments
   - **Airway:** place airway device as soon as possible
   - **Breathing:** confirm airway device placement by exam plus confirmation device
   - **Breathing:** secure airway device; purpose-made tube holders preferred
   - **Breathing:** confirm effective oxygenation and ventilation
   - **Circulation:** confirm true asystole
   - **Circulation:** establish IV access
   - **Circulation:** identify rhythm → monitor
   - **Circulation:** give medications appropriate for rhythm and condition
   - **Differential Diagnosis:** search for and treat identified reversible causes

3. **Transcutaneous pacing**
   - If considered, perform immediately

4. **Epinephrine** 1 mg IV push, repeat every 3 to 5 minutes

5. **Atropine** 1 mg IV, repeat every 3 to 5 minutes up to a total of 0.04 mg/kg

6. **Asystole persists**
   - **Withhold or cease resuscitative efforts?**
   - **Consider quality of resuscitation?**
   - **Atypical clinical features present?**
   - **Support for cease-efforts protocols in place?**
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Ischemic Chest Pain Algorithm

This algorithm provides general guidelines that may not apply to all patients. Carefully consider proper indications and contraindications.
Bradycardia Algorithm

1. Bradycardia
   - Slow (absolute bradycardia = rate <60 bpm)
   - Relatively slow (rate less than expected relative to underlying condition or cause)

2. Primary ABCD Survey
   - Assess ABCs
   - Secure airway noninvasively
   - Ensure monitor/defibrillator is available

   Secondary ABCD Survey
   - Assess secondary ABCs (invasive airway management needed?)
   - Oxygen-IV access-monitor-fluids
   - Vital signs, pulse oximeter, monitor BP
   - Obtain and review 12-lead ECG
   - Obtain and review portable chest x-ray
   - Problem-focused history
   - Problem-focused physical examination
   - Consider causes (differential diagnoses)

3. Serious signs or symptoms? Due to the bradycardia?

4. Intervention sequence
   - Atropine 0.5 to 1.0 mg
   - Transcutaneous pacing if available
   - Dopamine 5 to 20 µg/kg per minute
   - Epinephrine 2 to 10 µg/min
   - Isoproterenol 2 to 10 µg/min

5. Type II second-degree AV block or Third-degree AV block?
   - No
     - Observe
   - Yes
     - Prepare for transvenous pacer
     - If symptoms develop, use transcutaneous pacemaker until transvenous pacer placed
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Unstable Tachycardia Electrical Cardioversion

1. Tachycardia
   With serious signs and symptoms related to the tachycardia

2. If ventricular rate is >150 bpm, prepare for immediate cardioversion. May give brief trial of medications based on specific arrhythmias. Immediate cardioversion is generally not needed if heart rate is ≤150 bpm.

3. Have available at bedside
   - Oxygen saturation monitor
   - Suction device
   - IV line
   - Intubation equipment

4. Premedicate whenever possible

5. Synchronized cardioversion
   - Ventricular tachycardia
   - Paroxysmal supraventricular tachycardia
   - Atrial fibrillation
   - Atrial flutter
   - 100 J, 200 J
   - 300 J, 360 J monophasic energy dose (or clinically equivalent biphasic energy dose)
Evaluate patient
- Is patient stable or unstable?
- Are there serious signs or symptoms?
- Are signs and symptoms due to tachycardia?

Stable
2A
- Stable patient: no serious signs or symptoms
  - Initial assessment identifies 1 of 4 types of tachycardias
  1. Atrial fibrillation
  2. Narrow-complex tachycardias

2B
- Unstable patient: serious signs or symptoms
  - Establish rapid heart rate as cause of signs and symptoms
  - Rate-related signs and symptoms occur at many rates, seldom <150 bpm
  - Prepare for immediate cardioversion (see algorithm)

3A
- 4. Stable monomorphic VT
  and/or polymorphic VT

3B
- 3. Stable wide-complex tachycardia: unknown type

3C
- 2. Narrow-complex tachycardias

3D
- 1. Atrial fibrillation
  Atrial flutter

Evaluation focus: 4 clinical features
- Patient clinically unstable?
- Cardiac function impaired?
- WPW present?
- Duration <8 or >48 hours?

Attempt to establish a specific diagnosis
- 12-lead ECG
- Clinical information
- Vagal maneuvers
- Adenosine

Diagnostic efforts yield
- Ectopic atrial tachycardia
- Multifocal atrial tachycardia
- Paroxysmal supraventricular tachycardia (PSVT)

Treatment focus: clinical evaluation
- Treat unstable patients urgently
- Control the rate
- Convert the rhythm
- Provide anticoagulation

Treatment of atrial fibrillation/atrial flutter
(See following table)

Treatment of SVT
(See narrow-complex tachycardia algorithm)

Confirmed VT
11
- Wide-complex tachycardia of unknown type

Confirmed stable VT
12A
- Treatment of stable monomorphic and polymorphic VT
  (See stable VT: monomorphic and polymorphic algorithm)

Preserved cardiac function
12B
- DC cardioversion or Procaïnamide or Amiodarone

Ejection fraction <40%
Clinical CHF
12C
- DC cardioversion or Amiodarone
Stroke Algorithm

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Suspected Stroke

Immediate general assessment: <10 minutes from arrival
- Assess ABCs, vitals
- Provide oxygen by nasal cannula
- Obtain IV access; obtain blood samples (CBC, electrolytes, coagulation studies)
- Check blood sugar; treat if indicated
- Obtain 12-lead ECG; check for arrhythmias
- Perform general neurological screening assessment
- Alert Stroke Team: neurologist, radiologist, CT technician

Immediate neurological assessment: <25 minutes from arrival
- Review patient history
- Establish onset (<3 hours required for fibrinolytics)
- Perform physical examination
- Perform neurological examination
  - Determine level of consciousness (Glasgow Coma Scale)
  - Determine level of stroke severity (NIH Stroke Scale or Hunt and Hess Scale)
- Order urgent noncontrast CT scan (door-to-CT scan performed: goal <25 minutes from arrival)
- Read CT scan (door-to-CT read: goal <45 minutes from arrival)
- Perform lateral cervical spine x-ray (if patient comatose/history of trauma)

Does CT scan show intracerebral or subarachnoid hemorrhage?

Consult neurosurgery

Blood on LP

Initiate actions for acute hemorrhage
- Reverse any anticoagulants
- Reverse any bleeding disorder
- Monitor neurological condition
- Treat hypertension in awake patients
- Initiate supportive therapy as indicated
  - Consider admission
  - Consider anticoagulation
  - Consider additional conditions needing treatment
  - Consider alternative diagnoses

Probable acute ischemic stroke
- Review for CT exclusions: are any observed?
- Repeat neurological exam: are deficits variable or rapidly improving?
- Review fibrinolytic exclusions: are any observed?
- Review patient data: is symptom onset now >3 hours?
- If high suspicion of subarachnoid hemorrhage remains despite negative findings on CT scan, perform lumbar puncture. Fibrinolytic therapy is contraindicated following a lumbar puncture.

No to all of above

Patient remains candidate for fibrinolytic therapy?

Drug

Begin fibrinolytic treatment (door-to-treatment goal <60 minutes):
- Monitor neurological status: emergent CT if deterioration
- Monitor BP; treat as indicated
- Admit to critical care unit
- No anticoagulants or antiplatelet treatment for 24 hours

No blood on LP

No