BLS Healthcare Provider Adult Cardiac Arrest Algorithm—2015 Update

Verify scene safety.

Victim is unresponsive. Shout for nearby help. Activate emergency response system via mobile device (if appropriate). Get AED and emergency equipment (or send someone to do so).

Monitor until emergency responders arrive.

Normal breathing, has pulse

Look for no breathing or only gasping and check pulse (simultaneously). Is pulse definitely felt within 10 seconds?

No normal breathing, has pulse

No breathing or only gasping, no pulse

Provide rescue breathing: 1 breath every 5-6 seconds, or about 10-12 breaths/min.
- Activate emergency response system (if not already done) after 2 minutes.
- Continue rescue breathing; check pulse about every 2 minutes. If no pulse, begin CPR (go to “CPR” box).
- If possible opioid overdose, administer naloxone if available per protocol.

By this time in all scenarios, emergency response system or backup is activated, and AED and emergency equipment are retrieved or someone is retrieving them.

CPR
Begin cycles of 30 compressions and 2 breaths. Use AED as soon as it is available.

AED arrives.

Check rhythm. Shockable rhythm?

Yes, shockable

Give 1 shock. Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.

No, nonshockable

Resume CPR immediately for about 2 minutes (until prompted by AED to allow rhythm check). Continue until ALS providers take over or victim starts to move.
Adult Cardiac Arrest Algorithm—2015 Update

1. **Start CPR**
   - Give oxygen
   - Attach monitor/defibrillator

2. **Rhythm shockable?**
   - Yes
   - **VF/pVT**
   - **Shock**

3. **CPR 2 min**
   - **IV/IO access**

4. **Rhythm shockable?**
   - Yes
   - **Shock**

5. **CPR 2 min**
   - **Epinephrine** every 3-5 min
   - Consider advanced airway, capnography

6. **Rhythm shockable?**
   - Yes
   - **Shock**

7. **CPR 2 min**
   - **Amiodarone**
   - Treat reversible causes

8. **Rhythm shockable?**
   - Yes
   - **Shock**

9. **Asystole/PEA**

10. **CPR 2 min**
    - **IV/IO access**
    - **Epinephrine** every 3-5 min
    - Consider advanced airway, capnography

11. **Rhythm shockable?**
    - Yes
    - **Shock**

12. **Rhythm shockable?**
    - Yes
    - **Go to 5 or 7**
    - **If no signs of return of spontaneous circulation (ROSC), go to 10 or 11**
    - **If ROSC, go to Post-Cardiac Arrest Care**
    - **Go to 5 or 7**
Adult Cardiac Arrest Circular Algorithm — 2015 Update

CPR Quality
- Push hard (at least 2 inches [5 cm]) and fast (100-120/min) and allow complete chest recoil.
- Minimize interruptions in compressions.
- Avoid excessive ventilation.
- Rotate compressor every 2 minutes, or sooner if fatigued.
- If no advanced airway, 30:2 compression-ventilation ratio.
- Quantitative waveform capnography
  - If PETCO₂ <10 mm Hg, attempt to improve CPR quality
  - Intra-arterial pressure.
  - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Shock Energy for Defibrillation
- Biphasic: Manufacturer recommendation (eg, initial dose of 120-200 J); if unknown, use maximum available. Second and subsequent doses should be equivalent, and higher doses may be considered.
- Monophasic: 360 J

Drug Therapy
- Epinephrine IV/IO dose: 1 mg every 3-5 minutes
- Amiodarone IV/O dose: First dose: 300 mg bolus. Second dose: 150 mg.

Advanced Airway
- Endotracheal intubation or supraglottic advanced airway
- Waveform capnography or capnometry to confirm and monitor ET tube placement
- Once advanced airway in place, give 1 breath every 6 seconds (10 breaths/min) with continuous chest compressions

Return of Spontaneous Circulation (ROSC)
- Pulse and blood pressure
- Abrupt sustained increase in PETCO₂ (typically >40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hyper/hypokalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
CARDIOCEREBRAL RESUSCITATION (CCR)
(aka Minimally Interrupted Cardiac Resuscitation)

**EMD**
pre-arrival
COCPR
instructions

**EMS ARRIVAL**
Bystander
COCPR

**EMD**
Transport
to closest
CRC if
possible

200 chest
compressions

200 chest
compressions

200 chest
compressions

200 chest
compressions

- Resume standard
  ACLS (30:2)
- Consider ETI
  (Do NOT Interrupt
  Compressions)

**Analysis**

Single
shock if
indicated
without
pulse check
or rhythm
analysis

Single
shock if
indicated
without
pulse check
or rhythm
analysis

Single
shock if
indicated
without
pulse check
or rhythm
analysis

Chest Compressions:
- 100/min
- at least 2” in depth
- full chest recoil

Administer
1 mg IV/IO
Epinephrine

*If adequate uninterrupted bystander chest compressions are provided, EMS providers perform immediate rhythm analysis*

**COCPR**=compression-only CPR  **CRC**=cardiac receiving center  **EMD**=emergency medical medical dispatch
Positions for 6-Person High-Performance Teams

Resuscitation Triangle Roles

**Compressor**
- Assesses the patient
- Does 5 cycles of chest compressions
- Alternates with AED/Monitor/Defibrillator every 5 cycles or 2 minutes (or earlier if signs of fatigue set in)

**AED/Monitor/Defibrillator**
- Brings and operates the AED/monitor/defibrillator
- Alternates with Compressor every 5 cycles or 2 minutes (or earlier if signs of fatigue set in), ideally during rhythm analysis
- If a monitor is present, places it in a position where it can be seen by the Team Leader (and most of the team)

**Airway**
- Opens and maintains the airway
- Provides ventilation

The team owns the code. No team member leaves the triangle except to protect his or her safety.

Leadership Roles

**Team Leader**
- Every resuscitation team must have a defined leader
- Assigns roles to team members
- Makes treatment decisions
- Provides feedback to the rest of the team as needed
- Assumes responsibility for roles not assigned

**Administer Medications**
- An ALS provider role
- Administers medications

**Timer/Recorder**
- Records the time of interventions and medications (and announces when these are next due)
- Records the frequency and duration of interruptions in compressions
- Communicates these to the Team Leader (and the rest of the team)

*This is a suggested team formation. Roles may be adapted to local protocol.*
Adult Immediate Post–Cardiac Arrest Care Algorithm—2015 Update

1. Return of spontaneous circulation (ROSC)

2. Optimize ventilation and oxygenation
   - Maintain oxygen saturation ≥94%
   - Consider advanced airway and waveform capnography
   - Do not hyperventilate

3. Treat hypotension (SBP <90 mm Hg)
   - IV/IO bolus
   - Vasopressor infusion
   - Consider treatable causes

4. 12-Lead ECG: STEMI OR high suspicion of AMI

5. Coronary reperfusion

6. Follow commands?
   - Yes

7. Initiate targeted temperature management

8. Advanced critical care

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Doses/Details

Ventilation/oxygenation:
Avoid excessive ventilation. Start at 10 breaths/min and titrate to target PETCO₂ of 35-40 mm Hg. When feasible, titrate FiO₂ to minimum necessary to achieve SpO₂ ≥94%.

IV bolus:
Approximately 1-2 L normal saline or lactated Ringer’s

Epinephrine IV infusion:
0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)

Dopamine IV infusion:
5-10 mcg/kg per minute

Norepinephrine IV infusion:
0.1-0.5 mcg/kg per minute (in 70-kg adult: 7-35 mcg per minute)

Reversible Causes

- Hypovolemia
- Hypoxia
- Hydrogen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary
Adult Bradycardia With a Pulse Algorithm

1. Assess appropriateness for clinical condition. Heart rate typically <50/min if bradyarrhythmia.

2. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen (if hypoxemic)
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry
   - IV access
   - 12-Lead ECG if available; don’t delay therapy

3. Persistent bradyarrhythmia causing:
   - Hypotension?
   - Acutely altered mental status?
   - Signs of shock?
   - Ischemic chest discomfort?
   - Acute heart failure?

4. Monitor and observe
   - No

5. Yes
   - Atropine
     - If atropine ineffective:
       - Transcutaneous pacing or
       - Dopamine infusion or
       - Epinephrine infusion

6. Consider:
   - Expert consultation
   - Transvenous pacing

Doses/Details

Atropine IV dose:
First dose: 0.5 mg bolus. Repeat every 3-5 minutes. Maximum: 3 mg.

Dopamine IV infusion:
Usual infusion rate is 2-20 mcg/kg per minute. Titrate to patient response; taper slowly.

Epinephrine IV infusion:
2-10 mcg per minute infusion. Titrate to patient response.
Adult Tachycardia With a Pulse Algorithm

1. Assess appropriateness for clinical condition. Heart rate typically ≥150/min if tachyarrhythmia.

2. Identify and treat underlying cause
   - Maintain patent airway; assist breathing as necessary
   - Oxygen (if hypoxic)
   - Cardiac monitor to identify rhythm; monitor blood pressure and oximetry

3. Persistent tachyarrhythmia causing:
   - Hypotension?
   - Acutely altered mental status?
   - Signs of shock?
   - Ischemic chest discomfort?
   - Acute heart failure?

4. Synchronized cardioversion
   - Consider sedation
   - If regular narrow complex, consider adenosine

5. Wide QRS? ≥0.12 second
   - Yes
     - IV access and 12-lead ECG if available
     - Consider adenosine only if regular and monomorphic
     - Consider antiarrhythmic infusion
     - Consider expert consultation
   - No

6. Synchronized cardioversion
   - Consider sedation
   - If regular narrow complex, consider adenosine

7. IV access and 12-lead ECG if available
   - Vagal maneuvers
   - Adenosine (if regular)
   - β-Blocker or calcium channel blocker
   - Consider expert consultation

Doses/Details

Synchronized cardioversion:
Initial recommended doses:
- Narrow regular: 50-100 J
- Narrow irregular: 120-200 J
  - Biphasic or 200 J monophasic
- Wide regular: 100 J
- Wide irregular: defibrillation dose (not synchronized)

Adenosine IV dose:
First dose: 6 mg rapid IV push; follow with NS flush.
Second dose: 12 mg if required.

Antiarrhythmic Infusions for Stable Wide-QRS Tachycardia

Procainamide IV dose:
20-50 mg/min until arrhythmia suppressed, hypotension ensues, QRS duration increases >50%, or maximum dose 17 mg/kg given. Maintenance infusion: 1-4 mg/min. Avoid if prolonged QT or CHF.

Amiodarone IV dose:
First dose: 150 mg over 10 minutes. Repeat as needed if VT recurs. Follow by maintenance infusion of 1 mg/min for first 6 hours.

Sotalol IV dose:
100 mg (1.5 mg/kg) over 5 minutes. Avoid if prolonged QT.

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Acute Coronary Syndromes Algorithm—2015 Update

1. Symptoms suggestive of ischemia or infarction

2. EMS assessment and care and hospital preparation:
   - Monitor, support ABCs. Be prepared to provide CPR and defibrillation
   - Administer aspirin and consider oxygen, nitroglycerin, and morphine if needed
   - Obtain 12-lead ECG; if ST elevation:
     - Notify receiving hospital with transmission or interpretation; note time of onset and first medical contact
   - Notified hospital should mobilize hospital resources to respond to STEMI
   - If considering prehospital fibrinolysis, use fibrinolytic checklist

3. Concurrent ED assessment (<10 minutes)
   - Check vital signs; evaluate oxygen saturation
   - Establish IV access
   - Perform brief, targeted history, physical exam
   - Review/complete fibrinolytic checklist; check contraindications
   - Obtain initial cardiac marker levels, initial electrolyte and coagulation studies
   - Obtain portable chest x-ray (<30 minutes)

4. ECG interpretation

5. ST elevation or new or presumably new LBBB; strongly suspicious for injury
   
6. ST elevation MI (STEMI)
   - Start adjunctive therapies as indicated
   - Do not delay reperfusion

7. Time from onset of symptoms ≤12 hours?

8. ≤12 hours
   - Reperfusion goals:
     - Therapy defined by patient and center criteria
     - Door-to-balloon inflation (PCI) goal of 90 minutes
     - Door-to-needle (fibrinolysis) goal of 30 minutes

9. ST depression or dynamic T-wave inversion; strongly suspicious for ischemia
   - High-risk non-ST-elevation ACS (NSTE-ACS)

10. Troponin elevated or high-risk patient
    - Consider early invasive strategy if:
      - Refractory ischemic chest discomfort
      - Recurrent/persistent ST deviation
      - Ventricular tachycardia
      - Hemodynamic instability
      - Signs of heart failure
    - Start adjunctive therapies (eg, nitroglycerin, heparin) as indicated

11. Normal or nondiagnostic changes in ST segment or T wave
    - Low-/Intermediate-risk ACS

12. Consider admission to ED chest pain unit or to appropriate bed for further monitoring and possible intervention.
Prehospital Fibrinolytic Checklist

**Step 1**
Has patient experienced chest discomfort for greater than 15 minutes and less than 12 hours?

- **YES**
- **NO**

**Step 2**
Does ECG show STEMI or new or presumably new LBBB?

- **YES**
- **NO**

Are there contraindications to fibrinolysis?
If ANY of the following is CHECKED YES, fibrinolysis MAY be contraindicated.

- Systolic BP >180 to 200 mm Hg or diastolic BP >100 to 110 mm Hg
- Right vs left arm systolic BP difference >15 mm Hg
- History of structural central nervous system disease
- Significant closed head/facial trauma within the previous 3 months
- Stroke >3 hours or <3 months
- Recent (within 2-4 weeks) major trauma, surgery (including laser eye surgery), GI/GU bleed
- Any history of intracranial hemorrhage
- Bleeding, clotted problem, or blood thinners
- Pregnant female
- Serious systemic disease (eg, advanced cancer, severe liver or kidney disease)

**Step 3**
Is patient at high risk?
If ANY of the following is CHECKED YES, consider transfer to PCI facility.

- Heart rate ≥100/min AND systolic BP <100 mm Hg
- Pulmonary edema (rales)
- Signs of shock (cool, clammy)
- Contraindications to fibrinolytic therapy
- Required CPR

*Contraindications for fibrinolytic use in STEMI are viewed as advisory for clinical decision making and may not be all-inclusive or definitive. These contraindications are consistent with the 2004 ACC/AHA Guidelines for the Management of Patients With ST-Elevation Myocardial Infarction.

*Consider transport to primary PCI facility as destination hospital.

Opioid-Associated Life-Threatening Emergency (Adult) Algorithm—New 2015

Assess and activate.
Check for unresponsiveness and call for nearby help. Send someone to call 9-1-1 and get AED and naloxone. Observe for breathing vs no breathing or only gasping.

Begin CPR.
If victim is unresponsive with no breathing or only gasping, begin CPR.* If alone, perform CPR for about 2 minutes before leaving to phone 9-1-1 and get naloxone and AED.

Administer naloxone.
Give naloxone as soon as it is available. 2 mg intranasal or 0.4 mg intramuscular. May repeat after 4 minutes.

Does the person respond?
At any time, does the person move purposefully, breathe regularly, moan, or otherwise respond?

Yes
Continue CPR and use AED as soon as it is available. Continue until the person responds or until advanced help arrives.

No
Stimulate and reassess. Continue to check responsiveness and breathing until advanced help arrives. If the person stops responding, begin CPR and repeat naloxone.

*CPR technique based on rescuer’s level of training.

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