Adult Cardiac Arrest Circular Algorithm—2015 Update

Advanced Cardiovascular Life Support

Start CPR
- Give oxygen
- Attach monitor/defibrillator

2 minutes

Check Rhythm

Return of Spontaneous Circulation (ROSC)

If VF/pVT Shock
Post-Cardiac Arrest Care

Drug Therapy
IV/IO access
Epinephrine every 3-5 minutes
Amiodarone for refractory VF/pVT

Consider Advanced Airway
Quantitative waveform capnography

Treat Reversible Causes

Continuous CPR
Monitor CPR Quality

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 PETCO$_2$ <10 mm Hg, attempt to improve CPR quality.
  - Intra-arterial pressure
    - If relaxation phase (diastolic) pressure <20 mm Hg, attempt to improve CPR quality.

Drug Therapy
- Epinephrine IV/IO dose:
  1 mg every 3-5 minutes
- Amiodarone IV/IO 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 PETCO$_2$ (typically >40 mm Hg)
- Spontaneous arterial pressure waves with intra-arterial monitoring

Reversible Causes
- Hypovolemia
- Hypoxia
- Hydorgen ion (acidosis)
- Hypo-/hyperkalemia
- Hypothermia
- Tension pneumothorax
- Tamponade, cardiac
- Toxins
- Thrombosis, pulmonary
- Thrombosis, coronary

Shock Energy for Defibrillation
- Biphasic: Manufacturer recommendation (e.g., 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

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Adult Bradycardia
With a Pulse Algorithm

Advanced Cardiovascular Life Support

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

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

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

Monitor and observe

No

Yes

Atropine
if atropine ineffective:
- Transcutaneous pacing
- Dopamine infusion
- Epinephrine infusion

Consider:
- Expert consultation
- Transcutaneous 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

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

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

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

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

No

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
- 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
- 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.
Acute Coronary Syndromes Algorithm—2015 Update

Advanced Cardiovascular Life Support

Symptoms suggestive of ischemia or infarction

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

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)

Immediate ED general treatment
- If O₂ sat <90%, start oxygen at 4 L/min, titrate
- Aspirin 160 to 325 mg (if not given by EMS)
- Nitroglycerin sublingual or spray
- Morphine IV if discomfort not relieved by nitroglycerin

ECG interpretation

ST elevation or new or presumably new LBBB; strongly suspicious for injury
ST-elevation MI (STEMI)

- Start adjunctive therapies as indicated
- Do not delay reperfusion

Time from onset of symptoms ≤12 hours?

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

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

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

See AHA/ACC NSTE-ACS Guidelines

Consider admission to ED chest pain unit or to appropriate bed for further monitoring and possible intervention

Troponin non-elevated or low-risk patient
Consider early medical strategy if:
- Pain at rest, crescendo angina
- Persistent chest discomfort, new onset of heart failure
- Persistent ST deviation

Low-/Intermediate-risk ACS

See AHA/ACC NSTE-ACS Guidelines
Adult Suspected Stroke Algorithm

Advanced Cardiovascular Life Support

Identify signs and symptoms of possible stroke
Activate Emergency Response

Critical EMS assessments and actions
- Support ABCs; give oxygen if needed
- Perform prehospital stroke assessment
- Establish time of symptom onset (last normal)
- Triage to stroke center
- Alert hospital; consider direct transfer to CT scan
- Check glucose if possible

Immediate general assessment and stabilization
- Assess ABCs, vital signs
- Provide oxygen if hypoxemic
- Obtain IV access and perform laboratory assessments
- Check glucose; treat if indicated
- Perform neurologic screening assessment
- Activate stroke team
- Order emergent CT scan or MRI of brain
- Obtain 12-lead ECG

Immediate neurologic assessment by stroke team or designee
- Review patient history
- Establish time of symptom onset or last known normal
- Perform neurologic examination (NIH Stroke Scale or Canadian Neurological Scale)

Does CT scan show hemorrhage?

No hemorrhage
- Probable acute ischemic stroke; consider fibrinolytic therapy
  - Check for fibrinolytic exclusions
  - Repeat neurologic exam: are deficits rapidly improving to normal?

Hemorrhage
- Consult neurologist or neurosurgeon; consider transfer if not available

Patient remains candidate for fibrinolytic therapy?

Not a candidate
- Administer aspirin

Candidate
- Review risks/benefits with patient and family.
  - Give rtPA
  - No anticoagulants or antiplatelet treatment for 24 hours

- Begin post-rtPA stroke pathway
- Aggressively monitor:
  - BP per protocol
  - For neurologic deterioration
  - Emergent admission to stroke unit or intensive care unit

- Begin stroke or hemorrhage pathway
- Admit to stroke unit or intensive care unit

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Return of spontaneous circulation (ROSC)

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

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

12-Lead ECG: STEMI or high suspicion of AMI

Coronary reperfusion

Yes

No

Initiate targeted temperature management

Follow commands?

Yes

Advanced critical care

No

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
BLS Healthcare Provider
Adult Cardiac Arrest
Algorithm—2015 Update

Advanced Cardiovascular Life Support

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).

- Normal breathing, has pulse
  - Monitor until emergency responders arrive.
- No normal breathing, has 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.

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

- No breathing or only gasping, no pulse
  - 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.

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.

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