2010 Resuscitation Guidelines Overview
From ILCOR/AHA/ERC

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Core Content

- **Executive Summary**
- **Basic Life Support**
- **Electrical Therapies**
- **Adult Advanced Life Support**
- **Acute Coronary Syndrome**
- **Acute Stroke**
- **Pediatric Life Support**
- **Neonatal Life Support**
- **Education, Implementations and Teams**

From 2005 to 2010 (ILCOR)

- ***Factors Affecting Lay Rescuer CPR Performance***
  - During the past 5 years, there has been an effort to simplify CPR recommendations and emphasize the importance of high-quality CPR.
  - Large observational studies from investigators in member countries of the RCA, the newest member of ILCOR, and other studies have provided significant data about the effects of bystander CPR.

From 2005 to 2010 (ILCOR)

- ***CPR Quality***
  - Strategies to reduce the interval between stopping chest compressions and delivery of a shock (the preshock pause) will improve the chances of shock success.
  - Data downloaded from CPR-sensing and feedback-enabled defibrillators can be used to debrief resuscitation teams and improve CPR quality.

From 2005 to 2010 (ILCOR)

- ***In-Hospital CPR Registries***
  - The National Registry of CPR (NRCPR) and other registries are providing valuable information about the epidemiology and outcomes of in-hospital resuscitation in adults and children.

From 2005 to 2010 (ILCOR)

- ***Insufficient Evidence on Devices and ALS Drugs***
  - Many devices remain under investigation, and at the time of the 2010 Consensus Conference there was insufficient evidence to recommend for or against the use of any mechanical devices.
  - There are still no data showing that any drugs improve long-term outcome after cardiac arrest. Clearly further information is needed.

From 2005 to 2010 (ILCOR)

- ***Importance of Post–Cardiac Arrest Care***
  - Although it is not yet possible to determine the individual effect of many of these therapies, it is clear that this "bundle of care" can improve outcome.
  - Therapeutic hypothermia has been shown independently to improve outcome after adult witnessed out-of-hospital VF cardiac arrest and after neonatal hypoxic-ischemic insult.
  - It is now recognized that the use of therapeutic hypothermia invalidates the prognostication decision criteria that were established before hypothermia therapy was implemented: recent studies have documented occasional good outcomes in patients who would previously have met criteria predicting poor outcome (Cerebral Performance Category 3, 4, or 5).

From 2005 to 2010 (ILCOR)

- ***Education and Implementation, Including Retraining***
  - Basic and advanced life support knowledge and skills can deteriorate in as little as 3 to 6 months. Quality of education, frequent assessments and, when needed, refresher training are recommended to maintain resuscitation knowledge and skills.

Chain of Survival (AHA)

Immediate Recognition and Activation	Early CPR	Rapid Defibrillation	Effective ALS	**Integrated Post-Cardiac Arrest Care**

Chain of Survival (ERC)

Major Changes in Adult BLS (ILCOR)

- Lay rescuers begin CPR if the adult victim is unresponsive and not breathing normally (ignoring occasional gasps) **without** assessing the victim's pulse.
- Following initial assessment, rescuers begin CPR with chest compressions rather than opening the airway and delivering rescue breathing. **ABC → CAB**
- All rescuers, trained or not, should provide chest compressions to victims of cardiac arrest. A strong emphasis on delivering high-quality chest compressions remains essential: push hard to a depth of at least 2 inches (5 cm) at a rate of at least 100 compressions per minute, allow full chest recoil after each compression, and minimize interruptions in chest compressions.
- Trained rescuers should also provide ventilations with a compression-ventilation ratio of 30:2.
- EMS dispatchers should provide telephone instruction in chest compression-only CPR for untrained rescuers.

Major Changes in Adult BLS (ILCOR)

- Chest Compression:
  - hand position, position of the rescuer, position of the victim, compression depth, chest recoil, and duty cycle
  - Compression depth should at least be 2 inches (5 cm)
- Compressions Only and Compressions Plus Ventilations
  - Laypersons:
    - Untrained: Chest compressions alone
    - Trained: Chest compressions with ventilations
  - Professional rescuers should provide chest compressions with ventilations (No evidence within the first few minutes)
- Airway and Ventilation: No changes

Major Changes in Adult BLS (ILCOR)

- Compression-Ventilation Sequence:
  - CAB
  - minimize interruptions in chest compressions
  - 30:2 when no advanced airway is in place
- Special Situations (Cervical Spine Injury, Facedown)
- EMS System
  - EMS dispatchers:
    - early recognition (the victim's absence of consciousness and quality of breathing (normal/not normal))
    - compression-only CPR instructions to untrained rescuers
    - Rescue breathing followed by chest compressions for suspected asphyxial arrest
- Risks to the Victims: No serious harm

ILCOR Universal Algorithm

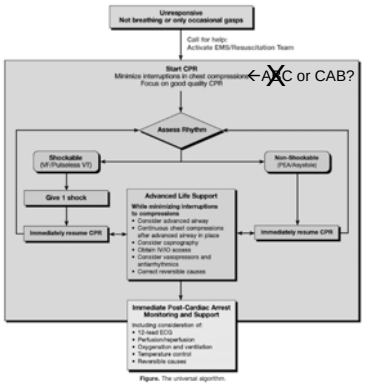


Figure. The universal algorithm.

← ~~A-B-C~~ or CAB?

Major Changes in Adult BLS (AHA)

- The vast majority of cardiac arrests occur in adults, and the highest survival rates from cardiac arrest are reported among patients of all ages with witnessed arrest and a rhythm of VF or pulseless ventricular tachycardia (VT). In these patients the critical initial elements of CPR are chest compressions and early defibrillation.
- In the A-B-C sequence chest compressions are often delayed while the responder opens the airway to give mouth-to-mouth breaths or retrieves a barrier device or other ventilation equipment. By changing the sequence to C-A-B, chest compressions will be initiated sooner and ventilation only minimally delayed until completion of the first cycle of chest compressions (30 compressions should be accomplished in approximately 18 seconds).

Major Changes in Adult BLS (AHA)

- Fewer than 50% of persons in cardiac arrest receive bystander CPR. There are probably many reasons for this, but one impediment may be the A-B-C sequence, which starts with the procedures that rescuers find most difficult: opening the airway and delivering rescue breaths. Starting with chest compressions might ensure that more victims receive CPR and that rescuers who are unable or unwilling to provide ventilations will at least perform chest compressions.
- It is reasonable for healthcare providers to tailor the sequence of rescue actions to the most likely cause of arrest. For example, if a lone healthcare provider sees a victim suddenly collapse, the provider may assume that the victim has suffered a sudden VF cardiac arrest; once the provider has verified that the victim is unresponsive and not breathing or is only gasping, the provider should immediately activate the emergency response system, get and use an AED, and give CPR. But for a presumed victim of drowning or other likely asphyxial arrest the priority would be to provide about 5 cycles (about 2 minutes) of conventional CPR (including rescue breathing) before activating the emergency response system. Also, in newly born infants, arrest is more likely to be of a respiratory etiology, and resuscitation should be attempted with the A-B-C sequence unless there is a known cardiac etiology.

CPR Overview (AHA)

Recommendations			
Component	Adults	Children	Infants
Recognition	Unresponsive (for all ages)		
	No breathing, not breathing normally (eg, only gasping)	No breathing or only gasping	
	No pulse palpated within 10 seconds (HCP Only)		
CPR Sequence	CAB	CAB	CAB
Compression Rate	At least 100/min		
Compression Depth	At least 2 inches (5 cm)	At least 1/3 AP Depth About 2 inches (5 cm)	At least 1/3 AP Depth About 1 1/2 inches (4 cm)
Chest Wall Recoil	Allow Complete Recoil Between Compressions HCPs Rotate Compressors Every 2 minutes		
Compression Interruptions	Minimize Interruptions in Chest Compressions Attempt to limit interruptions to less than 10 seconds		
Airway	Head tilt-chin lift (HCP suspected trauma: jaw thrust)		
Compression to Ventilation Ratio (until advanced airway placed)	30:2 (1 or 2 rescuers)	30:2 Single Rescuer 15:2 2 HCP Rescuers	30:2 Single Rescuer 15:2 2 HCP Rescuers
Ventilations: When rescuer Untrained or Trained and Not Proficient	Compressions Only		
Ventilations with advanced airway (HCP)	1 breath every 6–8 seconds (8–10 breaths/min) Asynchronous with chest compressions About 1 second per breath Visible Chest Rise		
Defibrillation	Attach and use AED as soon as available. Minimize interruptions in chest compressions before and after shock, resume CPR beginning with compressions immediately after each shock		

CPR Overview (AHA)

成人、兒童和嬰兒 BLS 操作法摘要

要素	成人	兒童	嬰兒
確認	無反應 (所有年齡層)		
	沒有呼吸或 沒有正常呼吸 (只打電有喘氣)	沒有呼吸或僅有喘氣	
	10 秒內沒有觸摸到脈搏		
CPR 程序	C-A-B		
按壓速率	至少 100 次/分鐘		
按壓深度	至少 2 英吋 (5 公分)	至少胸部前後徑尺寸的 ⅓ 約 2 英吋 (5 公分)	至少胸部前後徑尺寸的 ⅓ 約 1½ 英吋 (4 公分)
胸壁回彈	確保每次按壓後完全的胸部回彈 每 2 分鐘輪換施壓者		
按壓中斷	儘量避免中斷胸部按壓的施行 重試將中斷時間限制為 10 秒以內		
呼吸道	採頭後仰 (懷疑發生創傷：下顎前推)		
按壓與換氣比率 (適用高級呼吸道裝置其它)	30：2 1 或 2 名施救者	30：2 單一施救者 15：2 2 名施救者	
使用高級呼吸道進行通氣	每 6-8 秒 1 次呼氣 (8-10 次呼氣/分鐘) 與胸部按壓非同步進行 每次吹氣約 1 秒 可見的胸部起伏情形		
去顫	盡快連接並使用 AED， 在電擊前後儘量避免中斷胸部按壓， 每次電擊後立即以按壓重新開始 CPR。		

縮寫：AED (Automated External Defibrillator，自動體外去顫器)；AP (anterior-posterior，前方-後方)；CPR (cardiopulmonary resuscitation，心肺復甦)。

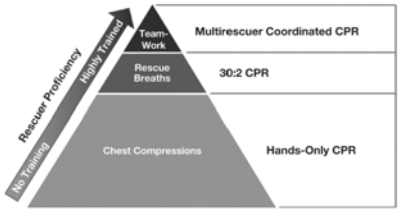
Major Changes in Adult BLS (AHA)

- Immediate recognition of SCA based on assessing unresponsiveness and absence of normal breathing (ie, the victim is not breathing or only gasping)
- "Look, Listen, and Feel" removed from the BLS algorithm
- Encouraging Hands-Only (chest compression only) CPR (ie, continuous chest compression over the middle of the chest) for the untrained lay-rescuer
- Sequence change to chest compressions before rescue breaths (**CAB** rather than ABC)
- Health care providers continue effective chest compressions/CPR until return of spontaneous circulation (ROSC) or termination of resuscitative efforts

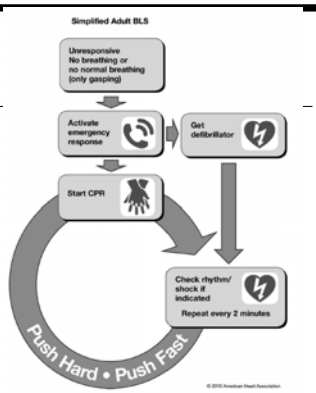
Major Changes in Adult BLS (AHA)

- Increased focus on methods to ensure that high-quality CPR (compressions of adequate rate and depth, allowing full chest recoil between compressions, minimizing interruptions in chest compressions and avoiding excessive ventilation) is performed
- Continued de-emphasis on pulse check for health care providers
- A simplified adult BLS algorithm is introduced with the revised traditional algorithm
- Recommendation of a simultaneous, choreographed approach for chest compressions, airway management, rescue breathing, rhythm detection, and shocks (if appropriate) by an integrated team of highly-trained rescuers in appropriate settings

Building Blocks of CPR (AHA)

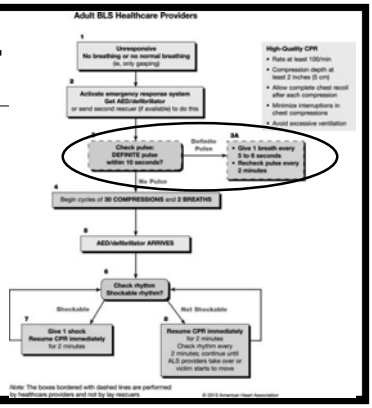


Simplified Adult BLS (AHA)

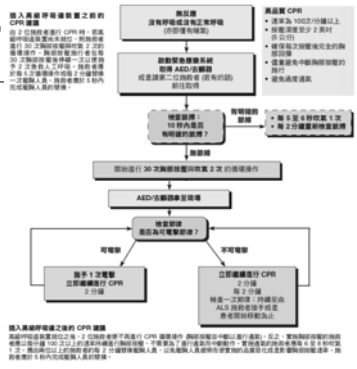


Adult BLS Algorithm for HCPs (AHA)

Open Airway or Not? →



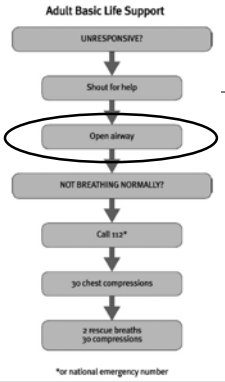
Adult BLS Algorithm for HCPs (AHA)



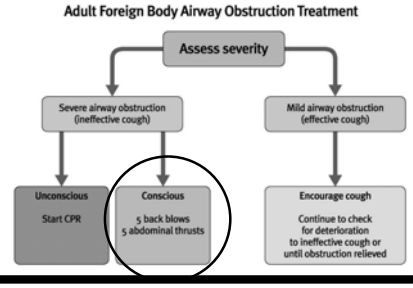
Major Changes in Adult BLS (ERC)

- Dispatchers should be trained to interrogate callers with strict protocols to elicit information. This information should focus on the recognition of unresponsiveness and the quality of breathing. In combination with unresponsiveness, absence of breathing or any abnormality of breathing should start a dispatch protocol for suspected cardiac arrest. The importance of gasping as sign of cardiac arrest is emphasised.
- All rescuers, trained or not, should provide chest compressions to victims of cardiac arrest. A strong emphasis on delivering high quality chest compressions remains essential. The aim should be to push to a depth of at least 5 cm at a rate of at least 100 compressions min^{-1}, to allow full chest recoil, and to minimise interruptions in chest compressions. Trained rescuers should also provide ventilations with a compression–ventilation (CV) ratio of 30:2. Telephone-guided chest compression-only CPR is encouraged for untrained rescuers.
- The use of prompt/feedback devices during CPR will enable immediate feedback to rescuers and is encouraged. The data stored in rescue equipment can be used to monitor and improve the quality of CPR performance and provide feedback to professional rescuers during debriefing sessions.

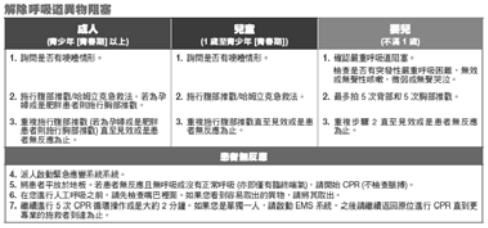
Adult BLS Algorithm (ERC)



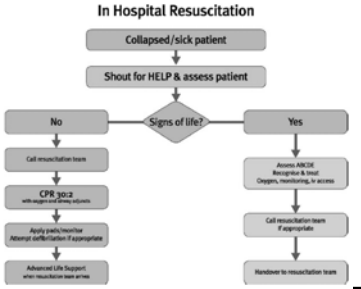
Adult FBAO Algorithm (ERC)



FBAO Algorithm (AHA)



In-Hospital Resuscitation Algorithm (ERC)



Major Changes in Defibrillation (ILCOR)

- CPR Before Defibrillation: inconsistent evidence to support or refute delay in defibrillation to provide a period of CPR
- Self-Adhesive Defibrillation Pads vs. Paddles:
  - Biphasic: Self-adhesive defibrillation pads are safe and effective and are an acceptable alternative to standard defibrillation paddles for both defibrillation and AF cardioversion.
  - Monophasic: Hand-held paddles are preferable in AF cardioversion.
- Placement of Paddles/Pads: anterior-lateral position
  - anterior-posterior (for paddles/pads) and apex-posterior (for pads) as an alternative
  - Large breast / excessive chest hair
- Size: >8 cm being reasonable
- Waveforms, Energies, Strategies:
  - Biphasic better; monophasic acceptable; no biphasic waveform recommendation
  - 150 – 200J for BTE; 360 J for monophasic for VF/pulseless VT
- One-Shock Compared With 3-Stacked Shock Protocols
  - Uninterrupted CPR
  - Second and following shock: increase energy if possible; the same energy acceptable

Major Changes in Defibrillation (ILCOR)

- Shock Using Manual Versus Semi-Automatic Mode
  - No significant survival differences, but the semiautomatic mode is preferred because it is easier to use and may deliver fewer inappropriate shocks.
- Cardioversion Strategy in Atrial Fibrillation
  - Biphasic defibrillators are preferred
  - For monophasic defibrillators, a high initial energy (360 J) seems preferable.
- Pacing
  - Fist pacing may be considered in hemodynamically unstable bradyarrhythmias until an electric pacemaker (TC or TV) is available.
- ICD
  - at least 8 cm from the generator position
  - anterior-posterior and anterior-lateral

Technique of Percussion Pacing

Eich C et al. Br. J. Anaesth. 2007;98:429-433

BJA British Journal of Anaesthesia

Major Changes in Electrical Therapies (AHA)

- Defibrillation plus CPR:
  - Shock First Versus CPR First
    - OHCA:
      - Unwitnessed: EMS may initiate CPR while checking the ECG rhythm and preparing for defibrillation
      - CPR should be performed while a defibrillator is being readied (Class I, LOE B).
    - IHCA: No evidence
      - in monitored patients, the time from VF to defibrillation should be under 3 minutes.
      - When 2 or more rescuers are present, one rescuer should begin CPR while the other activates the emergency response system and prepares the defibrillator.

Major Changes in Electrical Therapies (AHA)

- Defibrillation plus CPR:
  - 1-Shock Protocol Versus 3-Shock Sequence
    - First-shock efficacy for biphasic shocks is comparable or better than 3 monophasic shocks.
    - 360J for first monophasic shock
    - minimize the hands-off interval between stopping compression and administering shock (Class IIa)
      - 2-rescuers: shock without rescue breathing (Class IIa)

Major Changes in Electrical Therapies (AHA)

- Waveforms and Energy Levels
  - *Defibrillation* (shock success): defined as termination of VF for at least 5 seconds following the shock
  - No specific waveform characteristic (either monophasic or biphasic) is consistently associated with a greater incidence of ROSC or higher survival.
  - Lower-energy biphasic waveform shocks have equivalent or higher success for termination of VF than either MDS or MTE monophasic waveform shocks.
  - The optimal energy for first-shock biphasic waveform defibrillation has not been determined.
  - Pediatric:
    - Initial dose of 2 to 4 J/kg (Class IIa)
    - For refractory VF, it is reasonable to increase the dose to 4 J/kg. Subsequent energy levels should be at least 4 J/kg, and higher energy levels may be considered, not to exceed 10 J/kg or the adult maximum dose (Class IIb)
  - **Fixed and Escalating Energy**
    - Second and subsequent energy levels should be at least equivalent and higher energy levels may be considered, if available (Class IIb)

Major Changes in Electrical Therapies (AHA)

- **Current-Based Defibrillation**
  - The optimal current for ventricular defibrillation
  - appears to be 30 to 40 A MDS.
- **Electrodes**
  - Electrode Placement
  - Defibrillation with ICD
  - Electrode Size: 8-12cm
- AED ……

Major Changes in Electrical Therapies (ERC)

- Early, uninterrupted chest compressions
- Minimising the duration of the preshock and post-shock pauses → the continuation of compressions during charging of the defibrillator is recommended.
- Resumption of chest compressions following defibrillation → Delivery of defibrillation should be achievable with an interruption in chest compressions of no more than 5 s.
- The safety of the rescuer: Small risk of harm to a rescuer from a defibrillator, particularly if the rescuer is wearing gloves. → Rapid safety check to minimise the pre-shock pause
- When treating out-of-hospital cardiac arrest, emergency medical services (EMS) personnel should provide good-quality CPR while a defibrillator is retrieved, applied and charged → routine delivery of a specified period of CPR (e.g., 2 or 3 min) before rhythm analysis and a shock is delivered is no longer recommended. (No evidence to support or Refute)
- The use of up to three-stacked shocks may be considered if VF/VT occurs during cardiac catheterisation or in the early postoperative period following cardiac surgery. This three-shock strategy may also be considered for an initial, witnessed VF/VT cardiac arrest when the patient is already connected to a manual defibrillator.
- Encouragement of the further development of public and residential AED programmes

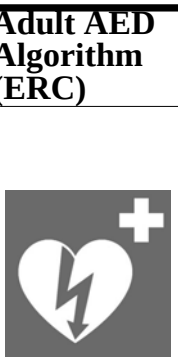
Adult BLS and Use of AED (ERC)

- Dispatchers should be trained to interrogate callers with strict protocols to elicit information. This information should focus on the recognition of unresponsiveness and the quality of breathing. In combination with unresponsiveness, absence of breathing or any abnormality of breathing should start a dispatch protocol of suspected cardiac arrest. The importance of gasping as sign of cardiac arrest should result in increased emphasis on its recognition during training and dispatch interrogation.
- All rescuers, trained or not, should provide chest compressions to victims of cardiac arrest. A strong emphasis on delivering high quality chest compressions remains essential. The aim should be to push to a depth of at least 5 cm at a rate of at least 100 compressions per minute, to allow full chest recoil, and to minimise interruptions in chest compressions.
- Trained rescuers should also provide ventilations with a compression–ventilation ratio of 30:2.
- Telephone-guided CPR is encouraged for untrained rescuers who should be told to deliver uninterrupted chest compressions only.

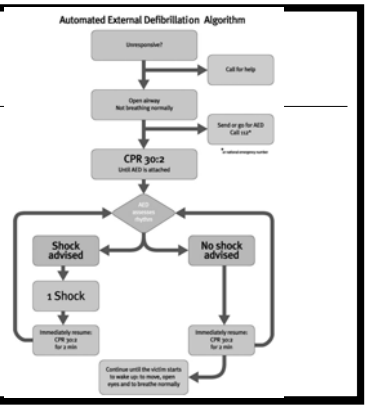
Adult BLS and Use of AED (ERC)

- In order to maintain high-quality CPR, feedback to rescuers is important. The use of prompt/feedback devices during CPR will enable immediate feedback to rescuers, and the data stored in rescue equipment can be used to monitor the quality of CPR performance and provide feedback to professional rescuers during debriefing sessions.
- When rescuers apply an AED, the analysis of the heart rhythm and delivery of a shock should not be delayed for a period of CPR; however, CPR should be given with minimal interruptions before application of the AED and during its use.
- Further development of AED programmes is encouraged—there is a need for further deployment of AEDs in both public and residential areas.

Adult AED Algorithm (ERC)



Universal AED Signage



Major Changes in ALS (ILCOR)

- The use of capnography to confirm and continually monitor tracheal tube placement and quality of CPR.
- More precise guidance on control of glucose in adults with sustained ROSC. Blood glucose values 180 mg/dL (10 mmol/L) should be treated and hypoglycemia avoided.
- Additional evidence, albeit lower level, for use of therapeutic hypothermia for comatose survivors of cardiac arrest initially associated with nonshockable rhythms.
- Recognition that many accepted predictors of poor outcome in comatose survivors of cardiac arrest are unreliable, especially if the patient has been treated with therapeutic hypothermia. There is inadequate evidence to recommend a specific approach to predicting poor outcome in post–cardiac arrest patients treated with therapeutic hypothermia.
- The recognition that adults who progress to brain death after resuscitation from out-of-hospital cardiac arrest (OHCA) should be considered for organ donation.
- The recommendation that implementation of a comprehensive, structured treatment protocol may improve survival after cardiac arrest.

Major Changes in ALS (ILCOR)

- Airway and Ventilation
  - The routine use of cricoid pressure to prevent aspiration in cardiac arrest is not recommended. [Avoid to impede ventilation / advanced airway placement]
  - OPA and NPA: reasonable
  - Tracheal tube vs. Supraglottic airway devices (LMA, ETC, I-gel)
    - Precise circumstances and competence of rescuers
    - Supraglottic airway: backup or rescue in difficult airways
  - Waveform capnography: confirm and continuously monitor
  - 100% oxygen: reasonable (vs. room air)
  - Passive oxygen delivery vs. PPV: No evidence to support or refute
  - Monitoring peak pressure and minute ventilation: No evidence

Major Changes in ALS (ILCOR)

- Support of Circulation during Cardiac Arrest
  - IV assess and drugs vs. No treatment: improve ROSC; no diff.in survival, neurological outcome and 1-y follow-up
  - Optimal time of dosing and order: No evidence
  - Extracopeal support: No evidence
  - Peri-Arrest Arrhythmias
    - Narrow-QRS complex tachycardia (excluding atrial fibrillation): Cardioversion if hemodynamically unstable; Vagal, IV adenosine, verapamil, diltiazem if stable (consider nadolol, sotalol, propafenone, amiodarone)
    - Atrial fibrillation: prompt cardioversion if hemodynamically unstable
      - Rate Control: Beta-blockers or Diltilazem; digoxin and amiodarone for CHF (magnesium, clonidine)
      - Rhythm Control: ibutilide, dofetilide, and flecainide > amiodraone > quinidine, procainamide > propafenone
    - Wide-QRS complex tachycardia: electric conversion and chemical conversion
      - mVT without CHF / AMI: procainamide , amiodarone
      - mVT (including with AMI): sotalol

Major Changes in Adult ACLS (AHA)

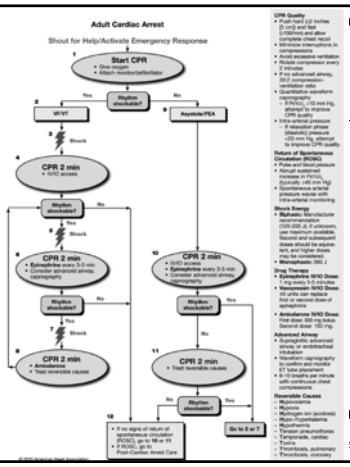
- Continuous quantitative waveform capnography is recommended for confirmation and monitoring of endotracheal tube placement.
- Cardiac arrest algorithms are simplified and redesigned to emphasize the importance of high-quality CPR (including chest compressions of adequate rate and depth, allowing complete chest recoil after each compression, minimizing interruptions in chest compressions and avoiding excessive ventilation).

Major Changes in Adult ACLS (AHA)

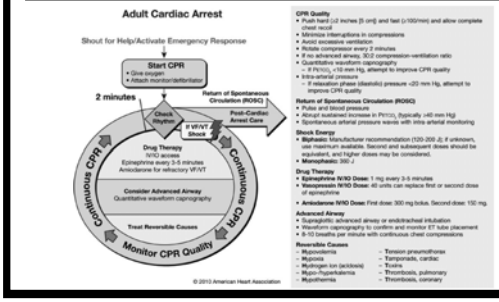
- Atropine is no longer recommended for routine use in the management of pulseless electrical activity (PEA)/asystole.
- Chronotropic drug infusions are recommended as an alternative to pacing in symptomatic and unstable bradycardia. (TCP ↓)
- Adenosine is recommended as a safe and potentially effective therapy in the initial management of stable undifferentiated regular monomorphic wide-complex tachycardia.
- There is an increased emphasis on physiologic monitoring to optimize CPR quality and detect ROSC.

ACLS Cardiac Arrest Algorithm (AHA)

Drug after 2nd Shock →



ACLS Cardiac Arrest Circular Algorithm (AHA)



Major Changes in Adult ALS (ERC)

- Increased emphasis on the importance of minimally interrupted high-quality chest compressions throughout any ALS intervention: chest compressions are paused briefly only to enable specific interventions.
- Increased emphasis on the use of 'track and trigger systems' to detect the deteriorating patient and enable treatment to prevent in-hospital cardiac arrest.
- Increased awareness of the warning signs associated with the potential risk of sudden cardiac death out of hospital.
- Removal of the recommendation for a pre-specified period of cardiopulmonary resuscitation (CPR) before out-of-hospital defibrillation following cardiac arrest unwitnessed by the emergency medical services (EMS).

Major Changes in Adult ALS (ERC)

- Continuation of chest compressions while a defibrillator is charged—this will minimise the preshock pause.
- The role of the precordial thump is de-emphasised.
- The use of up to three quick successive (stacked) shocks for ventricular fibrillation/pulseless ventricular tachycardia (VF/VT) occurring in the cardiac catheterisation laboratory or in the immediate post-operative period following cardiac surgery.
- Delivery of drugs via a tracheal tube is no longer recommended—if intravenous access cannot be achieved, drugs should be given by the intraosseous route.

Major Changes in Adult ALS (ERC)

- When treating VF/VT cardiac arrest, adrenaline 1mg is given after the third shock once chest compressions have restarted and then every 3–5 min (during alternate cycles of CPR). Amiodarone 300mg is also given after the third shock.
- Atropine is no longer recommended for routine use in asystole or pulseless electrical activity.
- Reduced emphasis on early tracheal intubation unless achieved by highly skilled individuals with minimal interruption to chest compressions.
- Increased emphasis on the use of capnography to confirm and continually monitor tracheal tube placement, quality of CPR and to provide an early indication of return of spontaneous circulation (ROSC).

Major Changes in Adult ALS (ERC)

- The potential role of ultrasound imaging during ALS is recognised.
- Recognition of the potential harm caused by hyperoxaemia after ROSC is achieved: once ROSC has been established and the oxygen saturation of arterial blood (SaO2) can be monitored reliably (by pulse oximetry and/or arterial blood gas analysis), inspired oxygen is titrated to achieve a SaO2 of 94–98%.
- Much greater detail and emphasis on the treatment of the postcardiac arrest syndrome.
- Recognition that implementation of a comprehensive, structured post-resuscitation treatment protocol may improve survival in cardiac arrest victims after ROSC.

Major Changes in Adult ALS (ERC)

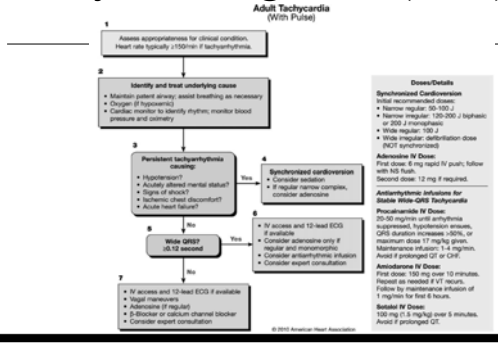
- Increased emphasis on the use of primary percutaneous coronary intervention in appropriate, but comatose, patients with sustained ROSC after cardiac arrest.
- Revision of the recommendation for glucose control: in adults with sustained ROSC after cardiac arrest, blood glucose values >10mmoll^{-1} (>180mgdl^{-1}) should be treated but hypoglycaemia must be avoided.
- Use of therapeutic hypothermia to include comatose survivors of cardiac arrest associated initially with non-shockable rhythms as well shockable rhythms. The lower level of evidence for use after cardiac arrest from non-shockable rhythms is acknowledged.

Major Changes in Adult ALS (ERC)

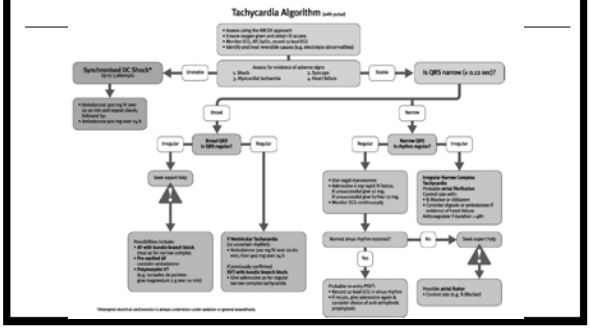
- Recognition that many of the accepted predictors of poor outcome in comatose survivors of cardiac arrest are unreliable, especially if the patient has been treated with therapeutic hypothermia.

Adult ALS Algorithm (ERC)

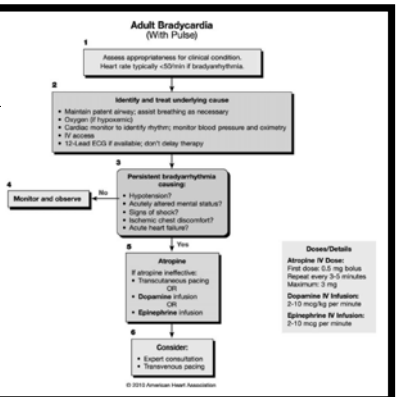
Tachycardia Algorithm (AHA)



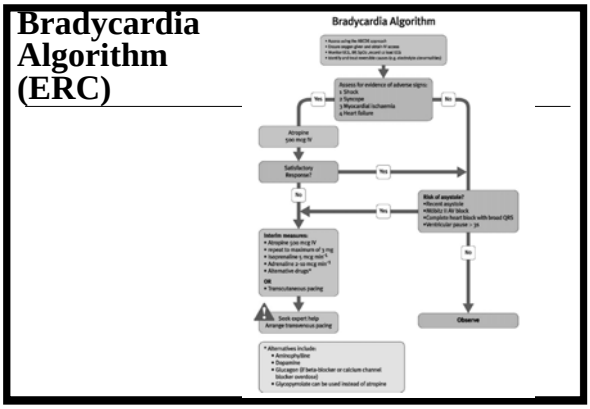
Tachycardia Algorithm (ERC)



Bradycardia Algorithm (AHA)



Bradycardia Algorithm (ERC)



Major Changes in ACS (ILCOR)

- The history and physical examination, initial ECG, and initial serum biomarkers, even when used in combination, cannot be used to reliably exclude ACS in the prehospital and ED settings.
- In contrast, chest pain observation protocols are useful in identifying patients with suspected ACS and patients who require admission or may be referred for provocative testing for coronary artery disease (CAD) to identify reversible ischemia. Such strategies also reduce cost by reducing unnecessary hospital admissions and improve patient safety through more accurate identification of NSTEMI and STEMI.

Major Changes in ACS (ILCOR)

- The acquisition of a prehospital 12-lead ECG is essential for identification of STEMI patients before hospital arrival and should be used in conjunction with pre-arrival hospital notification and concurrent activation of the catheter laboratory.
- Nonphysicians can be trained to independently interpret 12-lead ECGs for the purpose of identifying patients with STEMI, provided that appropriate and reliable STEMI criteria are used. This skill is of particular value in the prehospital setting where paramedics may independently identify STEMI, thus mitigating over-reliance on ECG transmission.

Major Changes in ACS (ILCOR)

- Computer-assisted ECG interpretation can be used to increase diagnostic accuracy of STEMI diagnosis when used alone or in combination with ECG interpretation by a trained healthcare provider.
- STEMI systems of care can be implemented to improve the time to treatment. The following measures have been shown to reduce the time to primary percutaneous coronary intervention (PPCI): institutional commitment, use of a team-based approach, arranging single-call activation of the catheterization laboratory by the emergency physician or prehospital provider, requiring the catheterization laboratory to be ready in 20 minutes, having an experienced cardiologist always available, and providing real-time data feedback.

Major Changes in ACS (ILCOR)

- Intravenous (IV) -blockers should NOT be given routinely in the ED or prehospital setting, but may be useful in a subset of patients with hypertension or tachycardia in the setting of ACS.
- The routine use of high-flow supplemental oxygen in ACS is NOT recommended. Instead, oxygen administration should be guided by arterial oxygen saturation.
- Reinforce the need for time targets for reperfusion beginning from the time of first medical contact (FMC). The clinical circumstances that favor fibrinolysis and PCI are discussed, including the role of prehospital fibrinolytics.

Major Changes in ACS (ILCOR)

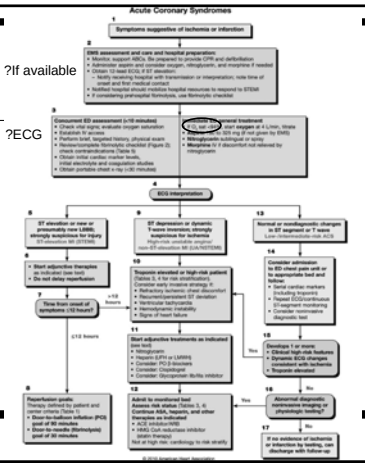
- The prophylactic use of antiarrhythmics is discouraged.
- Angiography and percutaneous coronary intervention (PCI) may be considered in patients with out-of-hospital cardiac arrest (OHCA) and return of spontaneous circulation (ROSC). It may also be acceptable to perform angiography in selected patients, despite the absence of ST segment elevation on the ECG or prior clinical findings such as chest pain.

ACS Algorithm (AHA)

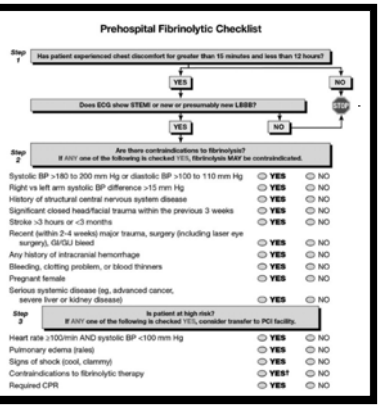
- Morphine
  - I → IIa
- Avoid hyperoxemia
- Beta blocker
  - Early iv → oral 24h after hospitalization

?If available

?ECG



Fibrinolytics Checklist (AHA)



ACS Algorithm (AHA)

Table 1. ST-Segment Elevation or New or Presumably New LBBB: Evaluation for Reperfusion

Step 1: Assess time and risk	
Time since onset of symptoms	
Risk of STEMI	
Risk of fibrinolysis	
Time required to transport to skilled PCI catheterization suite	
Step 2: Select reperfusion (fibrinolysis or invasive) strategy	
Note: If presentation <3 hours and no delay for PCI, then no preference for either strategy.	
Fibrinolysis is generally preferred if:	An invasive strategy is generally preferred if:
• Early presentation (≤3 hours from symptom onset)	• Late presentation (symptom onset >3 hours ago)
• Invasive strategy is not an option (eg, lack of access to skilled PCI facility or difficult vascular access) or would be delayed	• Skilled PCI facility available with surgical backup
– Medical contact-to-balloon or door-balloon >90 minutes	• Medical contact-to-balloon or door-to-balloon <90 minutes
– (Door-to-balloon) minus (door-to-needle) is >1 hour	• (Door-to-balloon) minus (door-to-needle) is <1 hour
• No contraindications to fibrinolysis	• Contraindications to fibrinolysis, including increased risk of bleeding and ICH
	• High risk from STEMI (CHF, Killip class is >3)
	• Diagnosis of STEMI is in doubt

Modified from ACC/AHA 2004 Update Recommendations

ACS Likelihood (AHA)

Table 2. Likelihood That Signs and Symptoms Represent ACS Secondary to CAD

Feature	High Likelihood *Any of the following:*	Intermediate Likelihood *Absence of high-likelihood features and presence of any of the following:*	Low Likelihood *Absence of high- or intermediate-likelihood features but may have the following:*
History	Chest or left arm pain or discomfort as chief symptom reproducing prior documented angina; known history of CAD including MI	Chest or left arm pain or discomfort as chief symptom; age >70 years; male sex; diabetes mellitus	Probable ischemic symptoms in absence of any intermediate-likelihood characteristics; recent cocaine use
Examination	Transient MR murmur, hypotension, diaphoresis, pulmonary edema, or rales	Extracardiac vascular disease	Chest discomfort reproduced by palpation
ECG	New or presumably new transient ST-segment deviation (≥1 mm) or T-wave inversion in multiple precordial leads	Fixed Q waves ST depression 0.5 to 1 mm or T-wave inversion >1 mm	T-wave flattening or inversion <1 mm in leads with dominant R waves Normal ECG
Cardiac markers	Elevated cardiac TnI, TnT, or CK-MB	Normal	Normal

CAD indicates coronary artery disease; CK-MB, MB fraction of creatine kinase; ECG, electrocardiogram; MI, myocardial infarction; MR, mitral regurgitation; TnI, troponin I; and TnT, troponin T.

TIMI Risk Score (AHA)

Table 3. TIMI Risk Score for Patients With Unstable Angina and Non–ST-Segment Elevation MI: Predictor Variables

Predictor Variable	Point Value of Variable	Definition
Age ≥65 years	1	
≥3 risk factors for CAD	1	Risk factors • Family history of CAD • Hypertension • Hypercholesterolemia • Diabetes • Current smoker
Aspirin use in last 7 days	1	
Recent, severe symptoms of angina	1	≥2 anginal events in last 24 hours
Elevated cardiac markers	1	CK-MB or cardiac-specific troponin level
ST deviation ≥0.5 mm	1	ST depression ≥0.5 mm is significant; transient ST elevation ≥0.5 mm for <20 minutes is treated as ST-segment depression and is high risk; ST elevation ≥1 mm for more than 20 minutes places these patients in the STEMI treatment category
Prior coronary artery stenosis ≥50%	1	Risk predictor remains valid even if this information is unknown

Calculated TIMI Risk Score	Risk of ≥1 Primary End Point* in ≈14 Days	Risk Status
0 or 1	5%	Low
2	8%	Low
3	13%	Intermediate
4	20%	Intermediate
5	26%	High

*Primary end points: death, new or recurrent MI, or need for urgent revascularization.

Fibrinolytics Contraindication (AHA)

Table 5. Fibrinolytic Therapy

Contraindications and cautions for fibrinolytic use in STEMI from ACC/AHA 2004 Guideline Update*

Absolute Contraindications
- Any prior intracranial hemorrhage
- Known structural cerebral vascular lesion (eg, AVM)
- Known malignant intracranial neoplasm (primary or metastatic)
- Ischemic stroke within 3 months EXCEPT acute ischemic stroke within 3 hours
- Suspected aortic dissection
- Active bleeding or bleeding diathesis (excluding menses)
- Significant closed head trauma or facial trauma within 3 months

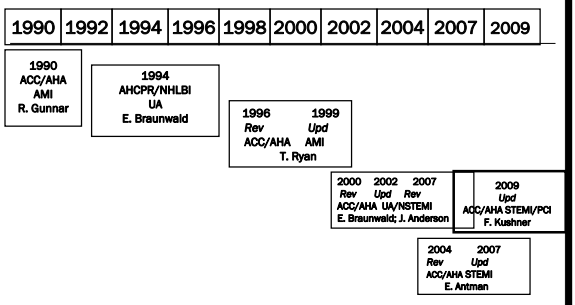
Relative Contraindications
- History of chronic, severe, poorly controlled hypertension
- Severe uncontrolled hypertension on presentation (SBP >180 mm Hg or DBP >110 mm Hg)†
- History of prior ischemic stroke >3 months, dementia, or known intracranial pathology not covered in contraindications
- Traumatic or prolonged (>10 minutes) CPR or major surgery (<3 weeks)
- Recent (within 2 to 4 weeks) internal bleeding
- Noncompressible vascular punctures
- For streptokinase/anistreplase: prior exposure (>5 days ago) or prior allergic reaction to these agents
- Pregnancy
- Active peptic ulcer
- Current use of anticoagulants: the higher the INR, the higher the risk of bleeding

CPR, cardiopulmonary resuscitation; AVM indicates arteriovenous malformation; SBP, systolic blood pressure; DBP, diastolic blood pressure; INR, International Normalized Ratio.

*Viewed as advisory for clinical decision making and may not be all-inclusive or definitive.

†Could be an absolute contraindication in low-risk patients with myocardial infarction.

Evolution of Guidelines for ACS



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ACS Classification (AHA)

- ***ST-segment elevation MI (STEMI)*:** ST-segment elevation or presumed new LBBB is characterized by ST-segment elevation in 2 or more contiguous leads.
  - Threshold values for ST-segment elevation consistent with STEMI are J-point elevation 0.2 mV (2 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (men 40 years old); J-point elevation 0.25 mV (2.5 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (men 40 years old); J-point elevation 0.15 mV (2.5 mm) in leads V2 and V3 and 0.1 mV (1 mm) in all other leads (women).
- ***UA/NSTEMI:*** Ischemic ST-segment depression 0.5 mm (0.05 mV) or dynamic T-wave inversion with pain or discomfort. Nonpersistent or transient ST-segment elevation 0.5 mm for 20 minutes is also included in this category.
  - Threshold values for ST-segment depression consistent with ischemia are J-point depression 0.05 mV (-.5 mm) in leads V2 and V3 and -0.1 mV (-1 mm) in all other leads (men and women).
- ***Nondiagnostic*:** The nondiagnostic ECG with either normal or minimally abnormal (ie, nonspecific ST-segment or T-wave changes. This ECG is nondiagnostic and inconclusive for ischemia, requiring further risk stratification.
  - This classification includes patients with normal ECGs and those with ST-segment deviation of 0.5 mm (0.05 mV) or T-wave inversion of 0.2 mV.

2009 Focused Update of STEMI

10 Points to Remember

- 0. Triage and Transfer at ED / Non-PCI and PCI capable Hospitals
- 1. In patients undergoing primary PCI, it is reasonable to consider use of abciximab or tirofiban or eptifibatide in the catheterization laboratory.
- 2. In patients undergoing primary PCI for STEMI, the benefit of glycoprotein IIb/IIIa receptor antagonists for patients with STEMI before their arrival in the cardiac catheterization laboratory (upstream use) is uncertain.

2009 Focused Update of STEMI
10 Points to Remember

- 3. In patients undergoing primary PCI for STEMI, a loading dose of clopidogrel (300 or 600 mg) or prasugrel (60 mg) should be administered as soon as possible.
  - In patients with STEMI who are treated with a bare-metal or a drug-eluting stent (DES), clopidogrel 75 mg a day or prasugrel 10 mg daily should be continued (if possible) for a year.
  - Continuation of prasugrel or clopidogrel beyond 15 months may be considered in patients treated with DES.
  - In patients treated with clopidogrel, routine use of proton pump inhibitors should be avoided.
  - Prasugrel should be avoided in patients with prior history of stroke or transient ischemic attack.

2009 Focused Update of STEMI
10 Points to Remember

- 4. Bivalirudin can be considered a suitable alternative anticoagulant in patients undergoing primary PCI. Bivalirudin may be especially valuable in patients at high risk of bleeding.
- 5. It is reasonable to use an insulin-based regimen to achieve and maintain glucose levels less than 180 mg/dl while avoiding hypoglycemia for patients with STEMI.

2009 Focused Update of STEMI
10 Points to Remember

- 6. Aspiration thrombectomy should be considered in patients undergoing primary PCI for STEMI.
- 7. DES can be considered as an alternative to bare-metal stents in patients undergoing primary PCI. It is important to consider possible social, financial, and medical barriers to prolonged use of thienopyridine therapy prior to implanting a DES.

2009 Focused Update of STEMI
10 Points to Remember

- 8. In patients with chronic kidney disease undergoing angiography (who are not undergoing chronic dialysis), either an isosmolar contrast medium (Iodixanol) or a low-molecular-weight contrast medium other than ioxaglate or iohexol should be used.

2009 Focused Update of STEMI
10 Points to Remember

- 9. Fractional flow reserve (FFR) can be used to guide need for PCI of a specific coronary lesion and is a useful alternative to noninvasive functional testing in determining the hemodynamic assessment of intermediate coronary stenoses (30-70% luminal narrowing) in patients with anginal symptoms.
  - Routine determination of FFR in patients with angina and a concordant positive, noninvasive functional study is not recommended.

2009 Focused Update of STEMI
10 Points to Remember

- 10. Stent-based PCI of the left main coronary artery can be considered as an alternative to CABG in patients with suitable anatomy or in those who are at high surgical risk.
  - Routine surveillance angiography is no longer recommended in patients undergoing left main artery stenting.

Recommendations for Triage and Transfer for PCI (for STEMI)

NEW Recommendation

Each community should develop a STEMI system of care following the standards developed for *Mission Lifeline* including:

- Ongoing multidisciplinary team meetings with EMS, non-PCI-capable hospitals (STEMI Referral Centers), & PCI-capable hospitals (STEMI Receiving Centers)

Recommendations for Triage and Transfer for PCI (for STEMI) (cont.)

NEW Recommendation

STEMI system of care standards in communities should also include:

- Process for prehospital identification & activation
- Destination protocols to STEMI Receiving Centers
- Transfer protocols for patients who arrive at STEMI Referral Centers and are primary PCI candidates, and/or are fibrinolytic ineligible and/or in cardiogenic shock

Recommendations for Triage and Transfer for PCI (for STEMI) (cont.)

NEW Recommendation

It is reasonable to transfer high risk patients who receive fibrinolytic therapy as primary reperfusion therapy at a non-PCI capable facility to a PCI-capable facility as soon as possible where either PCI can be performed when needed or as a pharmacoinvasive strategy.

Recommendations for Triage and Transfer for PCI (for STEMI) (cont.)

NEW Recommendation

Consideration should be given to initiating a preparatory antithrombotic (anticoagulant plus antiplatelet) regimen prior to and during patient transfer to the catheterization laboratory.

Recommendations for Triage and Transfer for PCI (for STEMI) (cont.)

Modified Recommendation

Patients who are not high risk who receive fibrinolytic therapy as primary reperfusion therapy at a non-PCI capable facility may be considered for transfer to a PCI-capable facility as soon as possible where either PCI can be performed when needed or as a pharmacoinvasive strategy.

Major Changes in ACS (ERC)

- Definition
  - The term non-ST-elevation myocardial infarction-acute coronary syndrome (non-STEMI-ACS) has been introduced for both NSTEMI and unstable angina pectoris because the differential diagnosis is dependent on biomarkers that may be detectable only after hours, whereas decisions on treatment are dependent on the clinical signs at presentation.

Major Changes in ACS (ERC)

- Chest Pain Units and Decision Rules for Early Discharge
  - History, clinical examinations, biomarkers, ECG criteria and risk scores are unreliable for the identification of patients who may be safely discharged early.
  - The role of chest pain observation units (CPUs) is to identify, by using repeated clinical examinations, ECG and biomarker testing, those patients who require admission for invasive procedures. This may include provocative testing and, in selected patients, imaging procedures as cardiac computed tomography, magnetic resonance imaging, etc.

Major Changes in ACS (ERC)

- Symptomatic Treatment
  - Non-steroidal anti-inflammatory drugs (NSAIDs) should be avoided.
  - Nitrates should NOT be used for diagnostic purposes.
  - Supplementary oxygen to be given only to those patients with hypoxaemia, breathlessness or pulmonary congestion. Hyperoxaemia may be harmful in uncomplicated infarction.

Major Changes in ACS (ERC)

- Causal Treatment
  - Guidelines for treatment with acetyl salicylic acid (ASA) have been made more liberal and it may now be given by bystanders with or without dispatchers assistance.
  - Revised guidance for new antiplatelet and antithrombin treatment for patients with ST elevation myocardial infarction (STEMI) and non-STEMI-ACS based on therapeutic strategy.
  - Gp IIb/IIIa inhibitors before angiography/percutaneous coronary intervention (PCI) are discouraged.

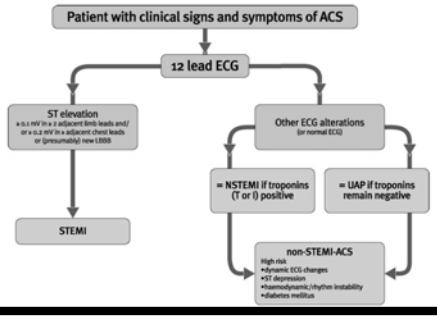
Major Changes in ACS (ERC)

- Reperfusion strategy in STEMI
  - Primary PCI (PPCI) is the preferred reperfusion strategy provided it is performed in a timely manner by an experienced team.
  - A nearby hospital may be bypassed by emergency medical services (EMS) provided PPCI can be achieved without too much delay.
  - The acceptable delay between start of fibrinolysis and first balloon inflation varies widely between about 45 and 180 min depending on infarct localisation, age of the patient, and duration of symptoms.
  - 'Rescue PCI' should be undertaken if fibrinolysis fails.
  - The strategy of routine PCI immediately after fibrinolysis ('facilitated PCI') is discouraged.
  - Patients with successful fibrinolysis but not in a PCI-capable hospital should be transferred for angiography and eventual PCI, performed optimally 6–24 h after fibrinolysis (the 'pharmacoinvasive' approach).
  - Angiography and, if necessary, PCI may be reasonable in patients with return of spontaneous circulation (ROSC) after cardiac arrest and may be part of a standardised post-cardiac arrest protocol.
  - To achieve these goals, the creation of networks including EMS, non-PCI capable hospitals and PCI hospitals is useful.

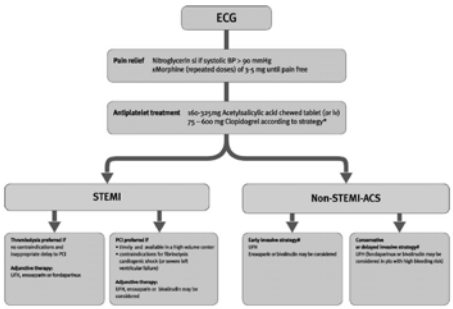
Major Changes in ACS (ERC)

- Primary and secondary prevention
  - Recommendations for the use of beta-blockers are more restricted: there is no evidence for routine intravenous beta-blockers except in specific circumstances such as for the treatment of tachyarrhythmias. Otherwise, beta-blockers should be started in low doses only after the patient is stabilised.
  - Guidelines on the use of prophylactic anti-arrhythmics, angiotensin converting enzyme (ACE) inhibitors/angiotensin receptor blockers (ARBs) and statins are unchanged.

ACS Definition (ERC)



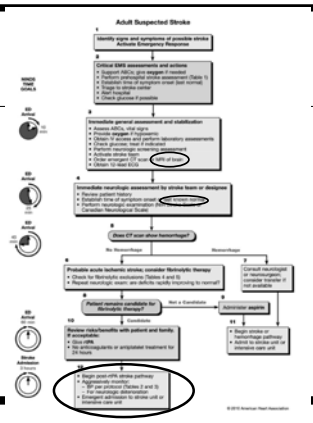
ACS Algorithm (ERC)



Major Changes in Stroke (AHA)

- Detection: Rapid recognition of stroke symptoms
- Dispatch: Early activation and dispatch of emergency medical services (EMS) system by calling 911
- Delivery: Rapid EMS identification, management, and transport
- Door: Appropriate triage to stroke center
- Data: Rapid triage, evaluation, and management within the emergency department (ED)
- Decision: Stroke expertise and therapy selection
- Drug: Fibrinolytic therapy, intra-arterial strategies
- Disposition: Rapid admission to stroke unit, critical-care unit

Acute Stroke Algorithm (AHA)



Acute Stroke Fibrinolytics Inclusion and Exclusion Criteria within 3h (AHA)

Inclusion criteria
- Diagnosis of ischemic stroke causing measurable neurologic deficit
- Onset of symptoms <3 hours before beginning treatment
- Age ≥18 years

Exclusion criteria
- Head trauma or prior stroke in previous 3 months
- Symptoms suggest subarachnoid hemorrhage
- Arterial puncture at noncompressible site in previous 7 days
- History of previous intracranial hemorrhage
- Elevated blood pressure (systolic >185 mm Hg or diastolic >110 mm Hg)
- Evidence of active bleeding on examination
- Acute bleeding diathesis, including but not limited to
  - Platelet count <100 000/mm³
  - Heparin received within 48 hours, resulting in aPTT >upper limit of normal
  - Current use of anticoagulant with INR >1.7 or PT >15 seconds
- Blood glucose concentration <50 mg/dL (2.7 mmol/L)
- CT demonstrates multilobar infarction (hypodensity >1/3 cerebral hemisphere)

Relative exclusion criteria

Recent experience suggests that under some circumstances—with careful consideration and weighing of risk to benefit—patients may receive fibrinolytic therapy despite 1 or more relative contraindications. Consider risk to benefit of rtPA administration carefully if any of these relative contraindications is present
- Only minor or rapidly improving stroke symptoms (clearing spontaneously)
- Seizure at onset with postictal residual neurologic impairments
- Major surgery or serious trauma within previous 14 days
- Recent gastrointestinal or urinary tract hemorrhage (within previous 21 days)
- Recent acute myocardial infarction (within previous 3 months)

Acute Stroke Fibrinolytics Inclusion and Exclusion Criteria within 4.5h (AHA)

Inclusion criteria
- Diagnosis of ischemic stroke causing measurable neurologic deficit
- Onset of symptoms 3 to 4.5 hours before beginning treatment

Exclusion criteria
- Age >80 years
- Severe stroke (NIHSS >25)
- Taking an oral anticoagulant regardless of INR
- History of both diabetes and prior ischemic stroke

Notes
- The checklist includes some FDA-approved indications and contraindications for administration of rtPA for acute ischemic stroke. Recent guideline revisions have modified the original FDA criteria. A physician with expertise in acute stroke care may modify this list
- Onset time is either witnessed or last known normal
- In patients without recent use of oral anticoagulants or heparin, treatment with rtPA can be initiated before availability of coagulation study results but should be discontinued if INR is >1.7 or PT is elevated by local laboratory standards
- In patients without history of thrombocytopenia, treatment with rtPA can be initiated before availability of platelet count but should be discontinued if platelet count is <100 000/mm³

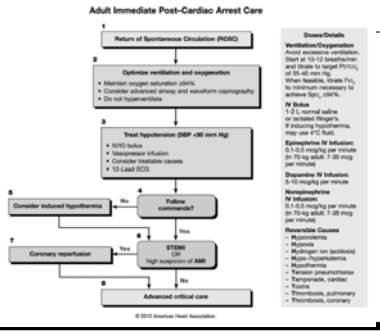
Initial Post-Cardiac Arrest Care (AHA)

- Optimize cardiopulmonary function and vital organ perfusion.
- After out-of-hospital cardiac arrest, transport patient to an appropriate hospital with a comprehensive post-cardiac arrest treatment system of care that includes acute coronary interventions, neurological care, goal-directed critical care, and hypothermia.
- Transport the in-hospital post– cardiac arrest patient to an appropriate critical-care unit capable of providing comprehensive post-cardiac arrest care.
- Try to identify and treat the precipitating causes of the arrest and prevent recurrent arrest.

Subsequent Post-Cardiac Arrest Care (AHA)

- Control body temperature to optimize survival and neurological recovery
- Identify and treat acute coronary syndromes (ACS)
- Optimize mechanical ventilation to minimize lung injury
- Reduce the risk of multiorgan injury and support organ function if required
- Objectively assess prognosis for recovery
- Assist survivors with rehabilitation services when required

Immediate Post-Cardiac Arrest Care (AHA)



Major Changes in Education (AHA)

- Bystander CPR dramatically improves survival from cardiac arrest, yet far less than half of arrest victims receive this potentially lifesaving therapy.
- Methods to improve bystander willingness to perform CPR include formal training in CPR techniques, including compression-only (Hands-Only) CPR for those who may be unwilling or unable to perform conventional CPR; educating providers on the low risk of acquiring an infection by performing CPR; and specific training directed at helping providers overcome fear or panic when faced with an actual cardiac arrest victim.

Major Changes in Education (AHA)

- EMS should provide dispatcher instructions over the telephone to help bystanders recognize victims of cardiac arrest, including victims who may still be gasping, and to encourage bystanders to provide CPR if arrest is likely. Dispatchers may also instruct untrained bystanders in the performance of compression-only (Hands-Only) CPR.
- BLS skills can be learned equally well with “practice while watching” (video-based) training as through longer, traditional instructor-led courses.
- To reduce the time to defibrillation for cardiac arrest victims, AED use should not be limited only to persons with formal training in their use. However, AED training does improve performance in simulation and continues to be recommended.

Major Changes in Education (AHA)

- Training in teamwork and leadership skills should continue to be included in ALS courses.
- Manikins with realistic features such as the capability to replicate chest expansion and breath sounds, generate a pulse and blood pressure, and speak may be useful for integrating the knowledge, skills, and behaviors required in ALS training. However, there is insufficient evidence to recommend their routine use in ALS courses.
- Written tests should not be used exclusively to assess the competence of a participant in an advanced life support (ACLS or PALS) course (ie, there needs to be a performance assessment as well).

Major Changes in Education (AHA)

- Formal assessment should continue to be included in resuscitation courses, both as a method of evaluating the success of the student in achieving the learning objectives and of evaluating the effectiveness of the course.
- The current 2-year certification period for basic and advanced life support courses should include periodic assessment of rescuer knowledge and skills with reinforcement provided as needed. The optimal timing and method for this assessment and reinforcement are not known and warrant further investigation.
- CPR prompt and feedback devices may be useful for training rescuers and may be useful as part of an overall strategy to improve the quality of CPR for actual cardiac arrests.

Major Changes in Education (AHA)

- Debriefing is a learner-focused, nonthreatening technique to assist individual rescuers or teams to reflect on and improve performance. Debriefing should be included in advanced life support courses to facilitate learning and can be used to review performance in the clinical setting to improve subsequent performance.
- Systems-based approaches to improving resuscitation performance, such as regional systems of care and rapid response systems, may be useful to reduce the variability of survival for cardiac arrest.

Major Changes in First Aid (AHA)

- Evidence suggests that, without training, laypersons and some healthcare professionals may be unable to recognize the signs and symptoms of anaphylaxis. Therefore, initial or subsequent administration of epinephrine for anaphylaxis by either of these groups may be problematic. This issue takes on added importance in view of legislation permitting the practice in some jurisdictions.
- Except in diving decompression injuries, there is no evidence of any benefit of administration of oxygen by first aid providers.

Major Changes in First Aid (AHA)

- The administration of aspirin by a first aid provider to a victim experiencing chest discomfort is problematic. The literature is clear on the benefit of early administration of aspirin to victims experiencing a coronary ischemic event except when there is a contraindication, such as true aspirin allergy or a bleeding disorder. Less clear, however, is whether first aid providers can recognize the signs and symptoms of an acute coronary syndrome or contraindications to aspirin and whether administration of aspirin by first aid providers delays definitive therapy in an advanced medical facility.

Major Changes in First Aid (AHA)

- No evidence of benefit was found for placing an unresponsive victim who is breathing in a “recovery” position. Studies performed with volunteers appear to show that if a victim is turned because of emesis or copious secretions, the HAINES (High Arm IN Endangered Spine) position is an example of a recovery position that may have some theoretic advantages.

Major Changes in First Aid (AHA)

- Since 2005 considerable new data have emerged on the use of tourniquets to control bleeding. This experience comes primarily from the battlefields of Iraq and Afghanistan. There is no question that tourniquets do control bleeding, but if left on too long, they can cause gangrene distal to the application and systemic complications, including shock and death. Protocols for the proper use of tourniquets to control bleeding exist, but there is no experience with civilian use or how to teach the proper application of tourniquets to first aid providers. Studies have shown that not all tourniquets are the same, and some manufactured tourniquets perform better than others and better than tourniquets that are improvised.

Major Changes in First Aid (AHA)

- Because of its importance, the issue of spinal stabilization was once again reviewed. Unfortunately very little new data are available, and it is still not clear whether secondary spinal cord injury is a real problem and whether the methods recommended for spinal stabilization or movement restriction are effective.
- The literature regarding first aid for snake bites was once again reviewed. In the 2005 review evidence was found for a beneficial effect from pressure immobilization for neurotoxic snake bites, but it now appears that there is a benefit even for non-neurotoxic snake bites. The challenge is that the range of pressure needed under the immobilization bandage appears to be critical and may be difficult to teach or estimate in the field.

Major Changes in First Aid (AHA)

- A new section on jellyfish stings has been added and new recommendations for treatment have been made.
- The literature on the first aid treatment of frostbite was reviewed. There continues to be evidence of potential harm in thawing of a frozen body part if there is any chance of refreezing. The literature is mixed on the benefit of nonsteroidal anti-inflammatory agents as a first aid treatment for frostbite. Chemical warmers should not be used because they may generate temperatures capable of causing tissue injury.
- Oral fluid replacement has been found to be as effective as IV fluid in exercise- or heat-induced dehydration. The best oral fluid appears to be a carbohydrate-electrolyte mixture.