



# When the heart stops: Life-giving updates on cardiac arrest

Timely intervention saves lives.

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## “NO PULSE! Someone help!”

When these words ring out, healthcare professionals respond immediately. Time is life when the heart stops beating, and interventions must occur within minutes. Across the United States, nurses working in hospitals encounter over 550 patients in sudden cardiac arrest (SCA) each day. The American Heart Association’s (AHA’s) “Get with the guidelines—Resuscitation” data from 2016 show that:

- More than 559,000 people in the United States experience SCA each year inside and outside of hospitals.
- An estimated 325,000 don’t survive.
- In-hospital SCA incidence is more than 200,000 adults and 6,000 children each year.
- Each day, 1,000 Americans die from SCA, about one person every 2 minutes.
- 88% to 95% of SCA victims die before help arrives or before transportation to the hospital.

As first responders and caregivers, nurses can save more lives when their skills and knowledge are up-to-date. Here are some key questions and answers for busy hospital nurses concerned about SCA in hospitalized adults.

### What’s SCA?

SCA is caused by an electrical disturbance in the heart that significantly reduces cardiac output, resulting in immediate unconsciousness and death within 3 to 5 minutes without effective intervention. Historically, ventricular fibrillation was the primary cause of SCA. Recent trends indicate that cardiac arrests in which ventricular fibrillation is the initial heart rhythm are decreasing significantly. In some populations, such as people with substance misuse or medication overdose, 80% of initial rhythms are nonshockable and include asystole, bradyarrhythmias, and pulseless electrical activity. The increase in nonshockable rhythms may be related to escalat-

ing incidences of medication overdoses and substance misuse.

### What’s the survival outlook?

SCA survival rates are slowly improving. For individuals who have an in-hospital cardiac arrest (IHCA), the survival rate to discharge is nearly 25%. This is low, but the rate has been trending upward for 15 years. Survival rates can reach 40% when the SCA occurs in a critical care unit. Only 20% of inpatients who arrest on non-critical care units survive to discharge.

The highest risk of death falls within the first 90 days after discharge. For patients who survive to discharge after an IHCA, 59% are alive after 1 year, and only one-third of first-year survivors are readmitted to the hospital for any reason. Survival and readmission rates differ based on patient age, sex, race, and neurologic status at discharge.

Even when patients survive an IHCA, their quality of life—cognitive

# BLS updates

Stay current with basic life support (BLS) for adults with these selected updates.

## BLS updates for adults

## Rationale

|   |  |
|---|--|
| When an advanced airway (tracheal tube or supraglottic device) is inserted during cardiopulmonary resuscitation (CPR), perform continuous compressions with positive-pressure ventilation without pausing chest compressions for breaths. | Continuous chest compressions are preferable to interrupting them for breaths, which reduces effectiveness of compressions.                                  |
| CPR-trained rescuers can provide a 30:2 compression-to-ventilation ratio for adults in cardiac arrest.  | Trained rescuers can expertly deliver two breaths without compromising the effectiveness of the compressions. Untrained rescuers may give compressions only. |
| Upper limit of compressions is 120/minute.  | Allows for adequate depth and recoil.  |
| Reduce pauses in compressions before and after shock.   | Maintains perfusion.   |
| Limit compression depth to 2 to 2.4 inches for adult victims.   | Optimizes perfusion without injuring chest.  |
| Avoid leaning on the patient's chest.   | Promotes full chest recoil.  |
| Monitor the effectiveness of compressions using direct observation, technological devices, and physiologic monitoring (such as arterial pressure monitoring).   | Ensures adequate compressions.   |
| Monitor continuous waveform capnography and clinical assessments to check correct advanced airway placement.  | Ensures adequate ventilation.  |
| Perform 10 breaths per minute (one every 6 seconds) with bag mask or advanced airway.   | Avoids excessive ventilation; both methods are effective.  |
| Obtain code cart or automated external defibrillator within 30 seconds.   | Increases chance of survival and decreases incidence of post-cardiac arrest syndrome.  |
| Administer naloxone if opioid overdose suspected.   | Reverses the effects of opioids.   |

Source: American Heart Association. 2017.

and functional ability, physiologic stability, return to work or lifestyle, resumption of social and leisure activities, and quality of interpersonal relationships—may be compromised. And they may face a variety of complex medical issues (post-cardiac arrest syndrome) caused by cellular changes from wide-spread ischemia during SCA and subsequent reperfusion from return of circulation. Brain injury, myocardial dysfunction, pulmonary complications,

and infections can reduce survival and long-term quality of life. For victims who don't respond to verbal stimuli after an SCA, tests to predict neurologic outcomes (including electrophysiologic measures, imaging studies, clinical assessment, and blood or cerebrospinal fluid markers of brain injury) can be performed 72 hours after the SCA.

Little research exists on long-term quality of life for victims of IHCA. A few published studies con-

cur that inpatients who survive can achieve an acceptable quality of life, if cognitive function is preserved. Rates of neurologic disability at hospital discharge remain near 50% for survivors of IHCA, and many of these survivors have long-term difficulty with logical thought, memory loss, social engagement, and fatigue. Cognitive deficits are more common among older adults and people who experience coma or delirium post-arrest. Even if physically functional, more than a quarter of survivors and family members may experience post-traumatic stress disorder, anxiety, and depression for months or years.

## What's the financial impact?

The costs of SCA are high for individuals, families, workplaces, and society.

- The estimated annual societal burden of SCA death is between 1.3 and 2 million years of life lost, which is more than the economic burden estimates related to cancer and other morbidities.
- Employers may pay up to 175% of a worker's annual salary to replace an SCA victim.
- SCA associated with hospitalization can cost from \$10,000 to \$500,000, depending on the cause and specific interventions required.

Economic impact alone creates a strong impetus for aggressively pursuing new approaches to SCA prevention and timely intervention to increase the chances of optimal quality of life.

## What's new in BLS and ACLS guidelines?

Major revisions to cardiopulmonary resuscitation (CPR) guidelines occurred in 2012, with updates in 2015 and 2017. As a nurse, you can take the lead in implementing recent updates when responding to an IHCA (See *BLS updates* and *ACLS updates*). Quickly deliver precise breaths and compressions, along with rapid de-

# ACLS updates

As a nurse, you can help ensure advanced cardiac life support (ACLS) updates are implemented.

| ACLS updates for adults   | Rationale  |
|---|--|
| Don't routinely administer vasopressin.   | Vasopressin provides no added benefit over epinephrine alone, so it was removed from the algorithm for simplicity.   |
| Providers may consider low end-tidal carbon dioxide (ETCO <sub>2</sub> ) after 20 minutes of cardiopulmonary resuscitation (CPR), in combination with other factors, to help determine when to terminate resuscitation. | Low ETCO <sub>2</sub> in intubated patients after 20 minutes of CPR is associated with a very low likelihood of resuscitation.   |
| Steroids may provide some benefit when bundled with epinephrine to treat in-hospital cardiac arrest.  | Steroids reduce systemic inflammatory response and increase cerebral perfusion.  |
| When rapidly implemented, extracorporeal CPR (ECPR) can be effective in some patients.  | ECPR may provide time to treat potentially reversible conditions or arrange for cardiac transplant for patients who aren't resuscitated by conventional CPR.   |
| In cardiac arrest patients with nonshockable rhythm, early administration of epinephrine is suggested.  | Administering epinephrine within 1 to 3 minutes may increase the return of circulation, survival to hospital discharge, and neurologically intact survival.  |
| Routine use of lidocaine isn't recommended except immediately after resuscitation from ventricular fibrillation (VF) or pulseless ventricular tachycardia (pVT) cardiac arrest.   | Research has not shown harm or benefit of using lidocaine routinely.   |
| Initiation or continuation of an oral or I.V. beta-blocker may be considered early in the resuscitation effort when cardiac arrest is due to VF or pVT.   | Beta blockers can cause life-threatening complications in some patients, so providers should evaluate patients individually for their suitability.   |
| When supplementary oxygen is available, use the maximal feasible inspired oxygen concentration during CPR.  | Detrimental effects of hyperoxia are unlikely to occur during CPR.   |
| Consider ultrasound if a qualified sonographer is present and its use won't interfere with standard cardiac arrest treatment protocol.  | Ultrasound can help assess myocardial contractility and identify potentially treatable causes of cardiac arrest, such as hypovolemia, pneumothorax, pulmonary thromboembolism, or pericardial tamponade. However, the routine use of ultrasound may not affect outcomes. |
| A bag-mask device or an advanced airway may be used for oxygenation and ventilation during CPR—both in and out of the hospital.   | The two approaches lead to similar outcomes.   |
| Continuous waveform capnography is recommended.   | In addition to clinical assessment, capnography is the most reliable method of confirming and monitoring correct placement of an endotracheal tube.  |
| Targeted temperature management may be considered when the patient is comatose.   | This treatment preserves tissue viability.   |

Source: American Heart Association. 2017.

fibrillation as appropriate, which doubles or triples the chance of survival. For optimal outcomes from CPR, start compressions within 10 seconds of recognizing the arrest. For every minute without CPR and defibrillation, the victim's chance of survival decreases by 7% to 10%.

Equally important is skilled communication among team members

during a resuscitation event. You can model and coach skilled communication by:

- providing verbal feedback to colleagues on CPR technique in real-time
- ensuring all team members verbally confirm the role they will fill, such as medication nurse or documenter

- speaking respectfully and calmly
- addressing team members by name
- conveying orders clearly and acknowledging orders verbally
- offering periodic verbal summaries of the resuscitation event.

You also can help ensure that these Joint Commission IHCA requirements are addressed:

## Rounding nurse in action

Tom Morris, a patient with a history of coronary artery disease, is admitted to the medical unit for community-acquired pneumonia. Lauren, the primary care nurse, notices that he's paler and more lethargic and nauseated than earlier in the day. She decides to watch Mr. Morris because his symptoms are vague.

When Brian, the critical care nurse, rounds, Lauren alerts him to Mr. Morris. Brian knows that pneumonia is a common antecedent for sudden cardiac arrest (SCA) among inpatients, so, despite the absence of chest pain, he contacts Mr. Morris' provider to obtain an electrocardiogram (ECG). If new abnormalities are noted on the ECG, Mr. Morris can be smoothly transferred to a higher level of care before complications, such as SCA, occur.

- on-site presence at all times of an interprofessional emergency response team prepared to implement current ACLS guidelines
- certification in BLS, including how to use an automated external defibrillator (AED), for all hospital staff who care for patients
- standardization of AEDs and resuscitation supply carts across an entire facility so users can easily find supplies and recall how to use the AED
- placement of AEDs for transportation to a patient's bedside in less than 30 seconds.

In a recent study, education of the emergency response team was identified as a best practice to significantly improve survival of patients who experience an IHCA. Popular training approaches include high-fidelity simulators, simulated mock codes (both announced and unannounced), online practice scenarios, unit-based low-fidelity simulations to focus on selected aspects of resuscitation, and debriefing with all members of the resuscitation team after a mock code, simulation, or live event.

### Is earlier detection possible?

Early detection can occur through nursing assessments; however, assessments at specific intervals don't always catch subtle, trending changes that predict IHCA. Technology can help. For example, you can enter patient data into the electronic medical record or other electronic device, and early-warning

An *innovative*  
alternative for early  
detection is to have a  
full-time RN with strong  
critical care experience  
who *rounds* on  
inpatients throughout  
a hospital or a section  
of a hospital.

systems (EWS) will compare the data to weighted pre-set standards. The EWS then signals when a patient's data is outside of a predetermined range. Although EWSs weren't designed specifically for early detection of SCA, they can identify a deteriorating patient by evaluating heart rate, respiratory rate, oxygen saturation, use of supplemental oxygen, temperature, systolic blood pressure, and level of consciousness.

Across a body of research on clinical antecedents of SCA, typical findings 1 to 12 hours before an SCA include elevated respiratory rate, lower mean arterial pressure, lower systolic blood pressure, and elevated heart rate, with secondary findings of low bicarbonate level

and elevated central venous pressure. However, not all patients whose data trigger an early alert develop a life-threatening condition, calling into question the cost-effectiveness of these alerts. Over 30 different monitoring systems are available or in testing to detect clinical deterioration early for a range of crisis conditions.

The usefulness of EWSs depends on the accuracy of your assessments and data entry. Some EWSs collect data directly through a continuous monitoring system, which removes any clinician errors.

Some hospitals may elect to continuously monitor all patients to reduce rates of failure to rescue. Continuous monitoring systems improve the likelihood of early detection, ideally through a wireless system to avoid patient complaints of wires and pads. Research has yet to determine the cost-benefit of continuous patient monitoring for large numbers of inpatients and which data points, or constellations of data points, call for crisis intervention in specific patient populations.

An innovative and less expensive alternative for early detection is to have a full-time RN with strong critical care experience who doesn't take patient assignments but instead rounds on inpatients throughout a hospital or a section of a hospital. (See *Rounding nurse in action*.) This RN can quickly evaluate unstable patients and those who "just don't look right." Before a patient is in crisis, the RN assesses, institutes protocols to order diagnostic tests and interventions, communicates with interprofessional team members, arranges for transfers to higher levels of care as needed, and provides support to primary nurses when patients have an uncertain status or are destabilizing. The rounding nurse can detect predictors of SCA, as well as many other life-threatening conditions, and prevent failure to rescue. (See *Do rapid response teams help?*)



## Do rapid response teams help?

The goal of a rapid response team (RRT) when cardiac arrest is imminent in an inpatient is to move resources quickly to that patient. RRTs typically include specially trained nurses who deliver pre-arrest preventive care based on the hospital's protocols.

However, RRTs aren't consistently activated across organizations. For example, if they're called based on one abnormal vital sign reading that falls outside of a predetermined range, the risk of cardiovascular instability may be quite low and this resource isn't being used efficiently. At the other end of the spectrum, RRTs may be alerted too late and may overlap with emergency response teams arriving for a full resuscitation.

Although published accounts of RRTs suggest that they reduce failure-to-rescue in selected populations, their overall benefit and cost-effectiveness aren't well-documented. Research limitations include a lack of standardized activation criteria, multiple monitoring methods, and varying RRT compositions.

### What's the best post-arrest management?

Survival after the initial return of spontaneous circulation depends on many factors, and post-arrest care is based on the cause of SCA and the pattern of ischemic organ injury. The following interventions may increase the chances of post-arrest survival and good quality of life.

- Evidence-based practice recommendations include a 12-lead electrocardiogram as soon as spontaneous circulation returns to detect acute ST elevation indicating cardiac injury. Of patients who survive initial resuscitation, over 70% have coronary artery stenosis. When treated with rapid coronary angiography and recanalization, post-arrest survival rates and quality of life increase.
- Medications to stabilize blood pressure are crucial in the immediate post-arrest hours. Maintaining systolic blood pressure above 90 mm Hg improves chances of survival.
- Targeted temperature management (TTM), previously known as induced therapeutic hypothermia, may be effective for post-arrest patients who don't respond to verbal commands. Lowering body temperature to between 32° C and 36° C (89.6° F and 96.8° F) for 12 to 24 hours may salvage tissue placed

at risk by diminished perfusion. Research is still mixed on this intervention, but a cluster of studies show that IHCA victims who qualify for and receive TTM have better outcomes after 6 months.

- Hospitals with protocols for rapid cardiac catheterization and recanalization plus TTM have better patient survival rates and quality of life at discharge after SCA.
- For patients at high risk for ventricular tachycardia or fibrillation, implantable cardioverter defibrillators can rapidly treat the lethal heart rhythm by delivering a shock in less than 1 minute. Wearable cardioverter defibrillators can be a temporary source of monitoring and shocking, as needed.

### Is there hope for more improvement?

To improve the quality of CPR, the AHA has mandated that, by January 31, 2019, instrumented directive feedback devices (manikins) will be required in all AHA courses that teach adult CPR. Technological innovations (flashing lights and automated voice feedback) are in development to monitor and provide pointers on ventilation and compressions during CPR. In addition, technique refinement—such as reduced time off compressions, prop-

er compression depth, and excessive ventilation prevention—will lead to better outcomes.

To hasten advances in emergent treatment of IHCA, healthcare professionals need more national-level data from large numbers of inpatients and more analysis of the data to guide quality improvement. The AHA's "Get with the guidelines—Resuscitation" collects data on IHCA and CPR from hospitals nationwide, creates evidence-based guidelines for inpatient CPR, and provides additional resources and tools for healthcare professionals and laypersons. In the future, the Centers for Disease Control and Prevention may expand the Cardiac Arrest Registry to Enhance Survival to include both in-hospital and out-of-hospital data. This all-inclusive registry would:

- bolster data analysis on the effectiveness of new interventions
- furnish data to clearly identify factors that influence survival
- increase hospitals' accountability for SCA outcomes
- allow hospitals to accurately calculate their survival rates and predictors
- supply evidence for performance improvement initiatives and tailoring of interventions to individuals and target populations.

Every day, in unannounced tragic intrusions, SCA steals life from patients and those who love them. Through up-to-date knowledge and quick action, nurses can detect EWSs, provide breath and blood flow, and partner with colleagues for post-arrest remedies. ★

Visit [americannursetoday.com/?p=37534](http://americannursetoday.com/?p=37534) for a list of selected references.

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