American Heart Association.

HIGHLIGHTS

of the 2024 American Heart Association and American Academy of Pediatrics Focused Update on Special Circumstances: Resuscitation Following Drowning: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care

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Introduction

These Highlights summarize the key points of the "2024 American Heart Association and American Academy of Pediatrics Focused Update on Special Circumstances: Resuscitation Following Drowning: An Update to the American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care."[1,2] The guidelines contained in that document serve as an update on topics from the 2020 American Heart Association Guidelines for Cardiopulmonary Resuscitation and Emergency Cardiovascular Care.[3] The 2024 American Heart Association (AHA)/American Academy of Pediatrics (AAP) focused update on special circumstances is based on 7 systematic reviews recently completed under the direction of the International Liaison Committee on Resuscitation (ILCOR) Basic Life Support (BLS) Task Force.[4,5]

Process Overview for Developing Guidelines Focused Updates

Updated AHA/AAP guidelines for special circumstances are developed in concert with ILCOR's continuous evaluation of new resuscitation science. The methods used by ILCOR to perform evidence evaluations[4] and by the AHA to translate these evidence evaluations into resuscitation guidelines[6] have been published in detail. The AHA and the AAP have rigorous conflict of interest policies and procedures to minimize the risk of bias or improper influence during the development of guidelines. Before their appointment, writing group members disclosed all relevant commercial relationships and other potential (including intellectual) conflicts.

For the 2024 focused update, the AHA/AAP Special Circumstances writing group analyzed and discussed the relevant systematic reviews,[4,5] carefully considered the treatment recommendations and good practice statements drafted by the ILCOR BLS Task Force, synthesized the evidence, and incorporated new data published since the systematic reviews were completed. The writing group also developed treatment recommendations by using standardized methodology and assigned each recommendation a Class of Recommendation and Level of Evidence by using standard AHA definitions (Table).

Table. Applying Class of Recommendation and Level of Evidence to Clinical Strategies, Interventions, Treatments, or Diagnostic Testing in Patient Care (Updated May 2019)*

CLASS (STRENGTH) OF RECOMMENDATION	
CLASS 1 (STRONG)	**Benefit >>> Risk**
Suggested phrases for writing recommendations: • Is recommended • Is indicated/useful/effective/beneficial • Should be performed/administered/other • Comparative-Effectiveness Phrases†: – Treatment/strategy A is recommended/indicated in preference to treatment B – Treatment A should be chosen over treatment B	
CLASS 2a (MODERATE)	**Benefit >> Risk**
Suggested phrases for writing recommendations: • Is reasonable • Can be useful/effective/beneficial • Comparative-Effectiveness Phrases†: – Treatment/strategy A is probably recommended/indicated in preference to treatment B – It is reasonable to choose treatment A over treatment B	
CLASS 2b (WEAK)	**Benefit ≥ Risk**
Suggested phrases for writing recommendations: • May/might be reasonable • May/might be considered • Usefulness/effectiveness is unknown/unclear/uncertain or not well-established	
CLASS 3: No Benefit (MODERATE) **(Generally, LOE A or B use only)**	**Benefit = Risk**
Suggested phrases for writing recommendations: • Is not recommended • Is not indicated/useful/effective/beneficial • Should not be performed/administered/other	
CLASS 3: Harm (STRONG)	**Risk > Benefit**
Suggested phrases for writing recommendations: • Potentially harmful • Causes harm • Associated with excess morbidity/mortality • Should not be performed/administered/other	

LEVEL (QUALITY) OF EVIDENCE‡	
LEVEL A	
• High-quality evidence‡ from more than 1 RCT • Meta-analyses of high-quality RCTs • One or more RCTs corroborated by high-quality registry studies	
LEVEL B-R	**(Randomized)**
• Moderate-quality evidence‡ from 1 or more RCTs • Meta-analyses of moderate-quality RCTs	
LEVEL B-NR	**(Nonrandomized)**
• Moderate-quality evidence‡ from 1 or more well-designed, well-executed nonrandomized studies, observational studies, or registry studies • Meta-analyses of such studies	
LEVEL C-LD	**(Limited Data)**
• Randomized or nonrandomized observational or registry studies with limitations of design or execution • Meta-analyses of such studies • Physiological or mechanistic studies in human subjects	
LEVEL C-EO	**(Expert Opinion)**
• Consensus of expert opinion based on clinical experience	

COR and LOE are determined independently (any COR may be paired with any LOE).

A recommendation with LOE C does not imply that the recommendation is weak. Many important clinical questions addressed in guidelines do not lend themselves to clinical trials. Although RCTs are unavailable, there may be a very clear clinical consensus that a particular test or therapy is useful or effective.

* The outcome or result of the intervention should be specified (an improved clinical outcome or increased diagnostic accuracy or incremental prognostic information).

† For comparative-effectiveness recommendations (COR 1 and 2a; LOE A and B only), studies that support the use of comparator verbs should involve direct comparisons of the treatments or strategies being evaluated.

‡ The method of assessing quality is evolving, including the application of standardized, widely-used, and preferably validated evidence grading tools; and for systematic reviews, the incorporation of an Evidence Review Committee.

COR indicates Class of Recommendation; EO, expert opinion; LD, limited data; LOE, Level of Evidence; NR, nonrandomized; R, randomized; and RCT, randomized controlled trial.

Updated Recommendations

Systematic reviewers and content experts from the BLS Task Force performed comprehensive reviews of the scientific literature for drowning for in-water resuscitation vs delayed resuscitation; oxygen administration; automated external defibrillator (AED) first vs cardiopulmonary resuscitation (CPR) first in cardiac arrest; chest compressions, airway, breathing vs airway, breathing, chest compressions; implementation of public access defibrillation (PAD) programs; ventilation with vs without equipment before hospital arrival; and compression-only CPR. In addition to updating recommendations from the 2020 guidelines, the 2024 focused update provides new guidance for resuscitation following drowning.

The scope of this focused update is to provide guidance on the application of BLS and advanced life support for the resuscitation of adults and children in the special circumstance of drowning. The recommendations are designed for health care professionals, trained rescuers, and untrained lay rescuers; *trained rescuers* are defined as individuals with appropriate training to perform the task discussed in a given recommendation.

Drowning Chain of Survival

An important concept highlighted in this focused update is the Drowning Chain of Survival (Figure). When put into action by trained rescuers or untrained lay rescuers, the actions within the links may reduce mortality associated with drowning. The Drowning Chain of Survival outlines a series of interventions that focuses on the prevention of drowning, early recognition of a drowning individual, and considerations for safe rescue and resuscitation.

Figure. Drowning Chain of Survival.

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In-Water Rescue Breathing

2024 (Updated): It may be reasonable for appropriately trained rescuers to provide in-water rescue breathing to an unresponsive person who has drowned if it does not compromise their own safety.

2020 (Old): Mouth-to-mouth ventilation in the water may be helpful when administered by a trained rescuer if it does not compromise safety.

Why: Current evidence supports the 2020 guideline, and language was updated to "may be reasonable" to align with the class of recommendation based on level of evidence.[8] In-water rescue breathing is a specific skill common to most aquatic first responder training (ie, lifeguards) but not to health care professionals or other trained rescuers. "Appropriately" was added to the trained rescuer description to highlight this as a special skill. The qualifier "their own" was added to the phrase "does not compromise safety" to clarify reference to the rescuer's safety.

Oxygen Administration Following Drowning

2024 (New): Trained rescuers should provide supplemental oxygen if available to persons with cardiac arrest following drowning.

Why: Hypoxia is the major factor in the drowning process, which may progress on a continuum from respiratory arrest to cardiac arrest. Current adult and pediatric BLS guidelines support the use of oxygen during resuscitation. While no studies directly address oxygen use in drowned persons, it is accepted practice for trained rescuers in resuscitation following drowning, provided it does not delay initiation of high-quality CPR.[9,10]

AED First vs CPR First in Cardiac Arrest Following Drowning

2024 (New): In cardiac arrest following drowning, CPR with rescue breaths should be started before AED application.

2024 (New): AED use is reasonable in cardiac arrest following drowning.

2024 (New): The initiation of CPR should not be delayed to obtain or apply an AED in cardiac arrest following drowning.

Why: AED use during resuscitation following drowning has not been addressed in prior guidelines. Shockable rhythms are present in a minority of cardiac arrests following drowning, but they may occur when a primary cardiac event happens in an aquatic setting. Although difficult to fully quantify the benefit of AED use following drowning due to the infrequency of shockable rhythms, in some studies,[11-13] AED application has conferred survival benefit when these rhythms are present.[11-13] Due to the paramount importance of ventilation in resuscitation following drowning—and of uninterrupted chest compressions when cardiac arrest is present—AED application should not delay initiation of high-quality CPR including rescue breaths and compressions. AED use before EMS arrival has been associated with a decreased likelihood of favorable neurological outcome, which may be due to such a delay.[14]

CPR in Cardiac Arrest Following Drowning

2024 (Updated): In cardiac arrest following drowning and after removal from the water, CPR with rescue breaths and chest compressions should be provided to all persons.

2020 (Old): Rescuers should provide CPR, including rescue breathing, as soon as an unresponsive submersion victim is removed from the water.

2024 (New): In cardiac arrest following drowning, if the rescuer

is unwilling, untrained, or unable to provide rescue breaths, it is reasonable to provide chest compressions only, until help arrives.

2024 (New): In cardiac arrest following drowning, it may be reasonable for trained rescuers to initiate CPR with rescue breaths followed by chest compressions.

Why: Current evidence supports the 2020 guideline, and language was updated to clarify that this recommendation is for the special circumstance of cardiac arrest following drowning. Due to the hypoxic mechanism of arrest, rescue breaths are vitally important during resuscitation efforts following drowning. Compression-only CPR by a lay rescuer has been associated with decreased survival in observational studies of both adults and children with cardiac arrest due to noncardiac etiologies, such as drowning.[15-17] Therefore, CPR with rescue breaths is recommended in cardiac arrest following drowning, unless a rescuer is untrained, unwilling, or unable to provide rescue breaths, in which case they are directed to provide chest compressions until help arrives. Chest compressions, airway, breathing became the standard order for CPR in 2010, except for the special circumstance of drowning where airway and breathing were prioritized. Currently, there is no direct evidence evaluating the sequence of CPR components in cardiac arrest following drowning. Trained rescuers may be able to provide CPR with rescue breaths before compressions without delaying high-quality CPR initiation; therefore, this option is given in the recommendation.

PAD Programs for Drowning

2024 (New): Implementation of PAD programs is reasonable in areas where there is a high risk of cardiac arrest, including aquatic environments (eg, areas with high population density, frequent utilization, other forms of exercise, long distances or response times to nearest AED).

Why: There is no direct evidence evaluating PAD programs for cardiac arrest following drowning; however, 2 studies have demonstrated feasibility of PAD programs in lifeboat and water park environments.[18,19] For out-of-hospital cardiac arrest, PAD programs have been associated with improved outcomes[5,20]; therefore, it is reasonable to implement PAD programs in aquatic environments, as described, where a primary cardiac event leading to arrest may occur.

Prehospital Ventilation With or Without Equipment

2024 (New): It is reasonable for trained rescuers to provide rescue breaths by the first means available (mouth-to-mouth, pocket mask, or bag-mask ventilation) for persons in cardiac arrest following drowning to avoid any delay in ventilation.

2024 (New): Provision of rescue breathing using equipment (bag-mask or advanced airways) should be optimized by providing rescuers a competency-based training program with regular retraining and maintenance of equipment.

Why: Multiple studies have demonstrated an association between rescue breathing and improved outcomes in cardiac arrest following drowning.[8,14,21-24] No human drowning studies have directly compared rescue breathing using equipment to no equipment or have compared the different methods to deliver rescue breaths.[11,25] Therefore, we recommend that rescuers deliver rescue breaths by the first means available and that appropriately trained rescuers may use equipment.

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