



Chain of Survival

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Pediatric Chain of Survival

Introduction After completing the Pediatric Chain of Survival, you should be able to

- identify the key elements (links) in the pediatric “Chain of Survival”
 - recognize that prevention of illness and injury is the most effective component of the Chain of Survival to improve the healthcare status of children
 - understand the roles of the community at large, the caregiver, and the healthcare provider in the prevention and treatment of critical illness and injury in children
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AHA Pediatric Chain of Survival



Figure 1. AHA pediatric Chain of Survival

Concept

The pediatric Chain of Survival illustrates a sequence of critical interventions to prevent death in children. Whether citizens, caregivers, or healthcare providers, all rescuers share the common purpose of reducing death in children caused by illness or injury. The Chain of Survival does not begin with CPR; it begins with the prevention of injury and cardiac arrest as the first link and continues with critical interventions performed in both the out-of-hospital and in-hospital settings.

The pediatric Chain of Survival is a series of 4 links:

Link		Description
1	Prevention of injury or arrest	Prevention of injury and arrest is an effective and important step in reducing death and improving health care for children.

2	Early recognition of cardiac arrest and effective CPR	The provider must recognize cardiac arrest and initiate CPR immediately. The provider must give high-quality CPR: push hard, push fast, allow full chest recoil after each compression, and minimize interruptions.
3	Early activation of EMS or ERS	When a critical illness or injury has been identified in the out-of-hospital setting, the emergency medical services (EMS) system should be notified as quickly as possible, usually by dialing 911. The lone rescuer finding an unresponsive child in the out-of-hospital setting (ie, not a sudden collapse) should provide 2 minutes of CPR and then activate the EMS system. Notify the emergency response system (ERS) if appropriate.
4	Early advanced life support (ALS)	PALS providers must treat illness and injury within the scope of their training and experience.

The pediatric Chain of Survival is a reminder that reducing injury and death in children is a shared responsibility. Saving a child's life involves a combination of efforts by the community at large, caregivers, and healthcare professionals.

First Link



The first link, prevention of injury or arrest, is in the long term the most effective way to prevent deaths in infants and children. Major causes

of death in infants and children include¹

- injury
- respiratory arrest
- sudden infant death syndrome (SIDS)
- sepsis
- neurologic disease

Injury is the leading cause of death in children and young adults, and it results in more childhood deaths than all other causes combined.¹

Many injuries can be prevented. This is why they are referred to as “injuries” rather than “accidents.” The most common causes of preventable fatal childhood injuries are motor vehicle passenger injuries, pedestrian injuries, bicycle injuries, drownings, burns, and firearm injuries. Choking is another preventable cause of death.²

Prevention of injuries in children is everyone’s responsibility. As citizens of the larger community, we can promote safety standards to protect children where they live and play. As healthcare providers we can educate and encourage parents and caregivers to adopt preventive measures to protect their children. Important prevention initiatives include the following:

- Reducing the risk of SIDS
- Preventing motor vehicle injuries
- Increasing correct use of child passenger restraint systems
- Reducing the severity of bicycle-related injuries, especially by increasing the correct use of bicycle helmets
- Preventing pedestrian injuries
- Preventing drowning
- Preventing burn injuries
- Preventing firearm injuries
- Preventing choking (foreign-body airway obstruction)

Increased support and implementation of these initiatives may substantially reduce disability and death among children.

Second Link



The second link, early and effective CPR, is a component of basic life support (BLS).

Whether the responder is a lay rescuer or healthcare provider, *early and effective CPR* is critical to the outcome of pediatric cardiac arrest. Both successful return of spontaneous circulation and neurologically intact survival in children are associated with prompt CPR.^{3, 4}

Not only must CPR be initiated rapidly, but also CPR must be effective. CPR is often not performed well, even by professionals.^{5, 6} The quality of CPR is compromised when compressions are too shallow or too slow, compressions are interrupted too frequently (causing reduced coronary perfusion pressure), or too much ventilation is provided.

Bystanders should initiate CPR immediately, and the CPR must be high quality. The following are characteristics of good chest compressions:

- **Push hard**—push with sufficient force to depress the chest approximately one third to one half the anterior/posterior diameter. *Release completely*, allowing the chest to fully recoil.
- **Push fast**—push at a rate of approximately 100 compressions per minute.
- **Allow full chest recoil**—allow the chest to completely return to its normal position between compressions to allow the heart to refill with blood.
- **Minimize interruptions in chest compressions.**

When providing chest compressions, push hard, push fast, allow full chest recoil, and minimize interruptions.

Chest compressions and ventilation should be coordinated as follows:

1-Rescuer CPR

The lone rescuer should perform 30 chest compressions followed by 2 effective ventilations (ratio of 30:2) with as short a pause in chest compressions as possible. Open the airway before giving ventilations.

2-Rescuer CPR

If 2 rescuers are present, one should perform chest compressions while the other maintains the airway and performs ventilations at a ratio of 15:2 with as short a pause in compressions as possible.

Note: For a complete discussion of the performance of CPR in children, see the American Heart Association *Basic Life Support for Healthcare Providers Manual*.

Third Link



The third link, early EMS or ERS activation, is also a component of BLS. In the hospital or workplace an ERS may take the place of the EMS system. When the first responder is alone in the setting of pediatric cardiac arrest, good judgment should be used to determine whether to perform CPR first or to activate EMS/ERS first.

- Do CPR first:

If the arrest is not witnessed, assume that it is a respiratory (asphyxial) arrest. Because pediatric cardiac arrest is commonly the result of progressive respiratory failure, oxygenation and ventilation are needed. The lone rescuer should give 5 cycles (about 2 minutes) of CPR before leaving the child to activate EMS (phone 911) or ERS.

Administering 5 cycles of CPR before phoning 911 is the default approach to early EMS or ERS activation when the lone rescuer finds an unresponsive infant or child.

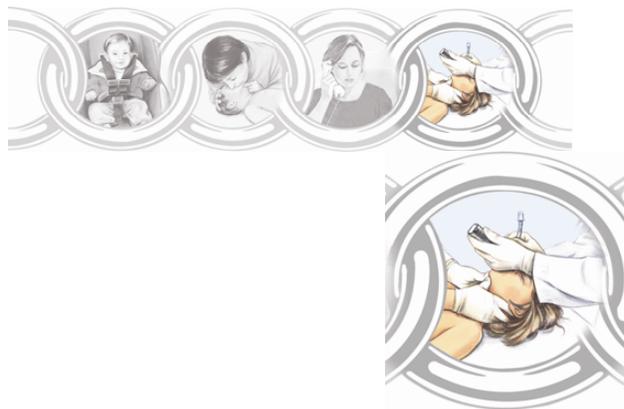
- Activate EMS or ERS first:

If the arrest is witnessed and sudden, the healthcare provider should suspect a primary arrhythmic cardiac arrest (ie, ventricular fibrillation or pulseless ventricular tachycardia). Because early CPR and early defibrillation are critical to survival from sudden cardiac arrest, a lone rescuer should activate the EMS system (by phoning 911 or other emergency response number) or ERS before starting CPR for sudden witnessed arrest.^{4, 7, 8} When a child collapses suddenly, the rescuer should

- obtain an AED (if available) when phoning the EMS or ERS system
- then return to the child to begin the steps of CPR
- use the AED as appropriate

When 2 or more rescuers are present for a victim of any age, the second and third links should be accomplished simultaneously: one rescuer should begin CPR while the other activates EMS/ERS and gets the AED and other emergency equipment appropriate to the setting.

Fourth Link



The fourth link, prompt pediatric ALS, includes stabilization, transport, and postresuscitation care. The first 3 links can be accomplished by any responsible person, but the fourth link is the responsibility of healthcare professionals. Not only must the PALS provider be diligent

in efforts to recognize and treat critical illness and injury before the child's condition leads to cardiac arrest, but he or she must also effectively use ALS skills to provide resuscitation and postresuscitation care when cardiac arrest occurs.

Healthcare providers have varying levels of training and experience, yet all have a responsibility to respond within their scope of practice to a pediatric emergency. The AHA PALS courses provide education and training in basic and more complex levels of pediatric emergency and critical care. For more information please call 877-AHA-4CPR (242-4277) or contact www.americanheart.org/CPR.

Conclusion

Once pediatric cardiac arrest is in progress, the chance of a good outcome (particularly neurologically intact survival) drops substantially. *The focus of the PALS Provider Course is the prevention of pediatric injury and avoidance of pediatric cardiac arrest through early recognition and prompt, appropriate treatment of respiratory failure or shock.* It is the intent of the AHA that the student enrolled in a PALS course will learn the important information and skills necessary to treat respiratory failure and shock, prevent some episodes of cardiac arrest, and provide optimal care for children with life-threatening events.

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