

The Science and Application of Cardiopulmonary Resuscitation (CPR)

Introduction

Cardiopulmonary Resuscitation (CPR) is a **life-saving technique** that combines **chest compressions** with **artificial ventilation** to maintain **circulatory flow** and **oxygenation** during **cardiac arrest**. Timely and effective CPR can significantly increase the chances of survival and neurological recovery in affected individuals.



Understanding Cardiac Arrest

Definition and Causes

Cardiac arrest is the sudden loss of **heart function**, **breathing**, and **consciousness**, usually caused by **electrical disturbances** in the heart, such as **ventricular fibrillation** or **asystole**. Common causes include:

- **Myocardial infarction** (heart attack)
- **Arrhythmias**
- **Trauma**
- **Drowning**
- **Drug overdose**



Physiological Impact

Without circulation, **brain cells** begin to die within **4 to 6 minutes** due to a lack of **oxygen (hypoxia)**. Immediate CPR is critical to prevent **irreversible brain damage**.

Components of Effective CPR

Chest Compressions

Chest compressions are the most important part of CPR. They manually pump blood through the heart and body. Key points include:

- **Compression depth:** At least **5 cm** in adults
- **Compression rate:** **100–120 compressions per minute**
- Allow full **recoil** of the chest between compressions
- Minimize **interruptions**

Rescue Breaths

Rescue breaths provide **oxygen** to the lungs of a non-breathing victim. They should be given using:

- A **pocket mask** or **bag-valve-mask** when possible
- A **ratio of 30 compressions to 2 breaths** in adult victims

Types of CPR

Basic Life Support (BLS)

BLS includes **recognition of cardiac arrest**, **activation of emergency response**, and immediate **high-quality CPR**. It can be performed by both healthcare professionals and trained laypersons.

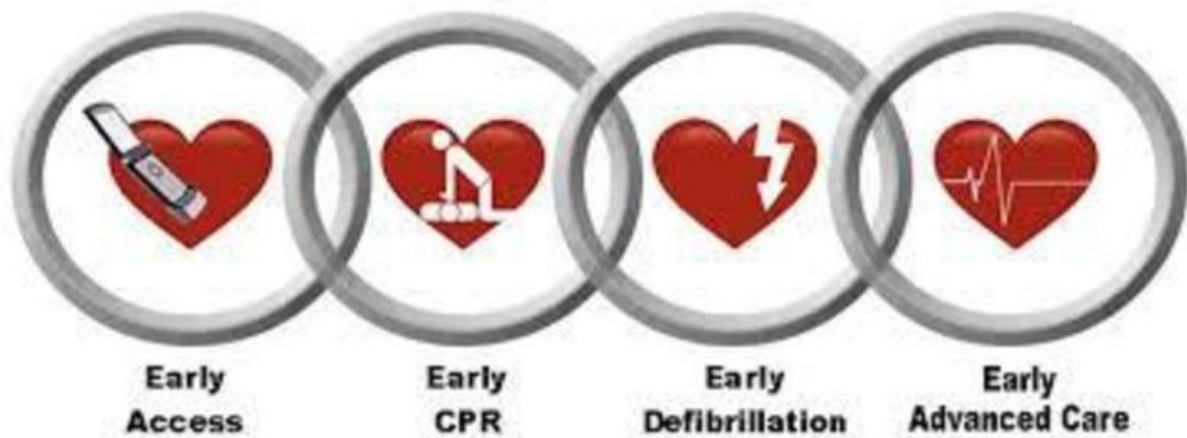


Advanced Life Support (ALS)

ALS involves **airway management**, **intravenous medications**, and the use of **defibrillators** by trained medical personnel. It follows established **resuscitation algorithms** such as

those provided by the **American Heart Association (AHA)**.

The Importance of Early Defibrillation



Defibrillation delivers an **electric shock** to the heart to restore a **normal rhythm** in cases of **ventricular fibrillation**. It is most effective when performed within the first few minutes of arrest.

- Use of an **Automated External Defibrillator (AED)** is strongly encouraged in public settings.



Conclusion

CPR is a vital intervention that can mean the difference between life and death. Training in **CPR techniques**, widespread availability of **AEDs**, and public education are essential to improving **survival rates** in out-of-hospital cardiac arrests. Regular updates and adherence to international **resuscitation guidelines** ensure the effectiveness of CPR across different populations and settings.

Reading Comprehension

Here are 10 multiple-choice questions based on the CPR scientific text.

1. What is the primary purpose of Cardiopulmonary Resuscitation (CPR)?

- A) To diagnose cardiac conditions
- B) To prevent infections
- C) To maintain blood circulation and oxygenation during cardiac arrest
- D) To stop bleeding

2. How soon do brain cells begin to die without oxygen after cardiac arrest?

- A) 1 to 2 minutes
- B) 2 to 3 minutes
- C) 4 to 6 minutes
- D) 10 to 12 minutes

3. What is the recommended compression depth for adult chest compressions during CPR?

- A) 2 cm
- B) 3 cm
- C) 5 cm or more
- D) 10 cm

4. What is the correct rate of chest compressions per minute for effective CPR in adults?

- A) 50–70
- B) 80–100
- C) 100–120
- D) 130–150

5. What is the compression-to-breath ratio recommended for adult CPR?

- A) 15:1
- B) 30:2
- C) 10:3
- D) 20:2

6. Which of the following is NOT a common cause of cardiac arrest?

- A) Myocardial infarction
- B) Drug overdose
- C) Fractured bone
- D) Drowning

7. Which equipment delivers an electric shock to restore normal heart rhythm during cardiac arrest?

- A) ECG machine
- B) AED (Automated External Defibrillator)
- C) Pulse oximeter
- D) Blood pressure monitor

8. Which of the following best describes Basic Life Support (BLS)?

- A) CPR with advanced airway and medication use
- B) CPR performed with surgical intervention
- C) CPR with recognition, emergency activation, and high-quality compressions
- D) CPR using only rescue breaths

9. What organization is commonly referenced for resuscitation guidelines?

- A) WHO
- B) Red Cross
- C) CDC
- D) American Heart Association (AHA)

10. Why is allowing full chest recoil important during compressions?

- A) It reduces fatigue for the rescuer
- B) It increases ventilation
- C) It prevents rib fractures
- D) It helps refill the heart with blood

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