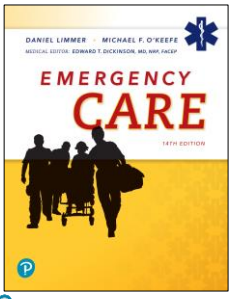
Emergency Care

Fourteenth Edition



Chapter 21

Resuscitation

Topics

The Pathophysiology of Cardiac Arrest

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The Pathophysiology of Cardiac Arrest

- Function of heart is to pump blood
  - Electrical functions and mechanical functions must work together
  - Electrical stimulation causes muscle to contract
  - Pumping muscle requires oxygenated blood
  - Without oxygenated blood, pumping fails

Mechanical Failure of the Heart

- Loss of normal heart muscle structure
- Myocardial infarction
- Chronic hypertension
- Loss of normal heart valve function
- Direct trauma
- Pulseless electrical activity (PEA) indicates mechanical failure

Electrical Dysfunction of the Heart (1 of 2)

- Cardiac conduction pathway coordinates electrical conduction through the heart
- Asystole is complete failure of the electrical system.
- Disruption of heart's electrical function generally results in dysrhythmia.

Electrical Dysfunction of the Heart (2 of 2)

- Dysrhythmias:
  - Unusually slow rhythm
  - Unusually fast rhythm
  - Ventricular tachycardia (V-tach)
  - Ventricular fibrillation (VF)
- Dysrhythmias can lead to sudden cardiac arrest.
- VF and V-tach are correctable.

Sudden vs Asphyxial Cardiac Arrest (1 of 2)

- Sudden cardiac arrest
  - Abrupt onset of dysrhythmia
  - Acute blunt trauma to the chest causes commotion cordis
  - Oxygen levels are relatively normal at beginning

Sudden vs Asphyxial Cardiac Arrest (2 of 2)

- Asphyxial cardiac arrest
  - Heart stopped pumping due to systemic hypoxia
  - Result of low oxygen levels in the blood
  - Appears with more warning than sudden cardiac arrest
  - Quality ventilations are important during CPR.

Agonal Respirations

- Agonal breathing occurs as a primal reflex during cardiac arrest.
- Small amount of oxygen allows medulla to send impulses to respiratory muscles
- A downward spiral will end in death unless someone intervenes

Effects of Cardiac Arrest

- Heart fails to pump
- Blood stops moving
- Cells are robbed of essential oxygen and nutrients
- Organs are damaged
- Organs eventually fail
- Organism will die if uncorrected
- Goal is to intervene as early as possible

Pediatric Cardiac Arrest

- Cardiac arrests in children are generally asphyxia in nature
- Caused by choking, shock or respiratory problem
- Cardiac arrest in children is usually a predictable outcome after steady decompensation

Patient Assessment

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Patient Assessment (1 of 2)

- Perceptual narrowing
  - Focusing only on the patient
- Use situational awareness

Patient Assessment (2 of 2)

- Primary assessment identifies three key features of cardiac arrest:
  - Unresponsiveness
  - Apnea
  - Absence of pulse
- If cardiac arrest is identified, begin chest compressions immediately.

Sudden Unexpected Infant Death Syndrome (SUIDS) (1 of 3)

- Three commonly reported types of SUID:
  - Sudden infant death syndrome (SIDS)
  - Unknown cause
  - Accidental suffocation and strangulation in bed

Sudden Unexpected Infant Death Syndrome (SUIDS) (2 of 3)

- Typical SUIDS patient
  - Cardiac slowdown and sleep apnea
  - Eventually will stop breathing and not start again
  - Episode will be fatal if infant not reached in time

Sudden Unexpected Infant Death Syndrome (SUIDS) (3 of 3)

- Unless there is rigor mortis, provide resuscitation.
- Provide emotional support to the parents.

Improving Cardiac Arrest Survival

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Chain of Survival

- Five elements
  1. Recognition and activation of the emergency response system
  2. Immediate high-quality CPR
  3. Rapid defibrillation
  4. Basic and advanced EMS
  5. Advanced life support and postarrest care
- Teamwork
- Coordination

Link One: Recognition and Activation of the Emergency Response System

- Efforts must begin before arrival of EMTs
- Train citizens to:
  - Recognize cardiac arrest
  - Activate EMS
  - Begin resuscitation
- Dispatcher-aided CPR or pre-arrival instructions
- EMTs can participate in public CPR training

Link Two: Immediate High-Quality CPR (1 of 8)

- Cardiopulmonary resuscitation (CPR) moves blood through the cardiovascular system.
- CPR maintains cerebral and coronary perfusion pressures.

Link Two: Immediate High-Quality CPR (2 of 8)

- Hand placement
  - Lower third of patient's sternum
  - Adults – heel of one hand on center of patient's chest and heel of other hand on top of the first
  - Children – same as adult but second hand may not be needed
  - Infant
    - One rescuer – two-finger chest compression
    - Two rescuers – two-thumb encircling hands

Link Two: Immediate High-Quality CPR (3 of 8)

- Compression depth
  - Compress the chest at least 2 inches in adults
  - Allow for full recoil on the upstroke of compressions
  - Spending half of each compression on the downstroke and half on the upstroke
  - For infants and children, compress one-third of the anterior-posterior diameter of the chest

Link Two: Immediate High-Quality CPR (4 of 8)

- Compression depth
  - Hands should overlap with interlocked fingers
  - Elbows should be locked
  - Weight of shoulders should drive compression
  - Pivot point should be the waist, not the elbows
  - Compress no longer than 2 minutes and switch with another provider

Proper CPR Form

For long description, see slide 81: Appendix 1

Link Two: Immediate High-Quality CPR (5 of 8)

- Compression rate
  - Compress the chest 100-120 times per minute
  - Compressing too slowly does not generate adequate cerebral and coronary perfusion pressure
  - Compressing too rapidly does not allow the heart time to refill with blood

Link Two: Immediate High-Quality CPR (6 of 8)

- Minimize pauses in compressions
  - Aim for a compression fraction above 90 percent
  - Take steps to avoid pausing chest compressions
  - Initiate chest compressions immediately upon arrival
  - Clear rescuers during analysis phase

Link Two: Immediate High-Quality CPR (7 of 8)

- Minimize pauses in compressions
  - Preplan compressor change-out to avoid delays
  - Minimize urgency of transport in the initial phase
  - Train as a team in realistic situations
  - Train with the tools of resuscitation

Link Two: Immediate High-Quality CPR (8 of 8)

- Rescue breathing
  - Ventilations should be integrated at a ratio of 2 ventilations to 30 compressions
  - In pediatric patients with two rescuers, adjust ratio to 2:15
  - Follow local protocols for ventilations

Mechanical CPR Devices (1 of 2)

- Mechanical devices assist EMTs to provide high-quality compressions.
- Using the LUCASCPR device
  - Stop CPR just long enough to put the LUCAS base plate under the patient.
  - Apply stabilization strap before moving the patient.
  - Upon termination of arrest or return of spontaneous circulation, power down.

Mechanical CPR Devices (2 of 2)

- Using the Zoll AutoPulse
  - Align the patient on the AutoPulse platform.
  - Provide bag-mask ventilation at a rate of 2 ventilations for every 30 compressions.
  - After 2 minutes of CPR, reassess for shockable rhythm.

Link Three: Rapid Defibrillation (1 of 5)

- To achieve successful resuscitation, the heart must begin pumping again.
- An AED is used to correct life-threatening dysrhythmias.

Link Three: Rapid Defibrillation (2 of 5)

- AED is two devices in one
  - Sensor to recognize ventricular fibrillation and ventricular tachycardia
  - Defibrillator to discharge energy through electrodes and into the patient

Link Three: Rapid Defibrillation (3 of 5)

- How AEDs Work
  - Most common conditions resulting in cardiac arrest are shockable rhythms.
    - Ventricular fibrillation
    - Ventricular tachycardia

Link Three: Rapid Defibrillation (4 of 5)

AED (shown with pediatric pads).

Link Three: Rapid Defibrillation (5 of 5)

- Types of AEDs
  - Classified by type of shock delivered
    - Monophasic
      - Sends single shock from negative pad to positive pad
    - Biphasic
      - Sends shock in one direction and then the other

Link Four: Basic and Advanced Life Support (1 of 2)

- Basic life support is the key to cardiac arrest survival.
  - Quality compressions
  - Rapid defibrillation
- AEMTs and paramedics provide advanced procedures and medications.

Link Four: Basic and Advanced Life Support (2 of 2)

- Triangle of life
  - One provider delivers compressions
  - One provider attaches the AED
  - One provider manages the airway and delivers ventilations
- Team leader may add advanced life support outside the triangle if additional providers are present.

Link Five: Advanced Life Support and Postarrest Care (1 of 2)

- Coordinating numerous means of assessment and interventions that, together, maximize the chance of neurologically intact survival
- Recognize the return of spontaneous circulation
  - Heart beats on its own again
  - Recognized by patient's starting to breathe

Link Five: Advanced Life Support and Postarrest Care (2 of 2)

- Initiate immediate transport to appropriate hospital
- Manage airway, blood pressure, and ventilations
- Contact ALS
- Have suction ready
- Obtain a 12-lead ECG

Management of Cardiac Arrest (1 of 2)

- Perform one-rescuer and team-based CPR.
- Take Standard Precautions.
- Use an automated external defibrillator.
- Request ALS (when available) to continue the chain of survival.
- Use a bag-valve-mask device with oxygen.

Management of Cardiac Arrest (2 of 2)

- Lift and move patients.
- Suction patient's airway.
- Use airway adjuncts.
- Interview bystanders and family members.

A Coordinated Resuscitation Team

- Switch roles as compressors to avoid fatigue.
- Be sure you have appropriate personnel on hand.
- Integrate both BLS and ALS care.
- Facilitate teamwork.
- Assign a team leader.
- Coordinate actions using a preresuscitation huddle.

The Steps of Resuscitation

- Steps ensure that the key elements of cardiac arrest care are provided
- Sequence may be different depending on resource availability
- Tailor steps to meet needs of a situation

Step 1: Identify Cardiac Arrest and Begin the Resuscitation

- Identify cardiac arrest patient
- Organize the team
- Call for appropriate resources
- Begin chest compressions and continue without pause as much as possible
- Do not move the patient unless necessary

Step 2: Integrate the AED (1 of 7)

- Deployment of AED occurs at generally the same time as chest compressions
- One provider should start compressions while a second attaches the AED
- If responding alone:
  - Attach the AED first and then start compressions for adults
  - Begin CPR and then attach the AED for children

Step 2: Integrate the AED (2 of 7)

3. Begin chest compressions while another EMT sets up the AED.

Step 2: Integrate the AED (3 of 7)

- Use AED.
  - Turn on AED.
  - Place pads per manufacturer's recommendations
    - Remove clothing, jewelry, medication patches
    - Trim excessive hair
    - Wipe away sweat or other liquids
  - Stop CPR and analyze.
  - Clear patient and shock if indicated.

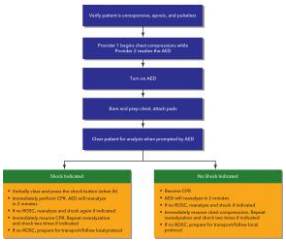
Step 2: Integrate the AED (4 of 7)

If advised by the AED, press the button to deliver a shock. Immediately resume CPR.

Step 2: Integrate the AED (5 of 7)

- Immediately begin chest compressions after delivering a shock.
- Reassess patient after providing 2 minutes of CPR.

Step 2: Integrate the AED (6 of 7)



For long description, see slide 82: Appendix 2

AED cardiac arrest treatment sequence.

Step 2: Integrate the AED (7 of 7)

8. Perform CPR for 2 minutes (five cycles), unless the patient wakes up, moves, or begins to breathe. Follow AED prompts.

Step 3: Continue the Resuscitation (1 of 3)

- Focus on high-quality teamwork
- Integrate additional resources as the arrive
- For the 2 minutes between analyzations:
  - Perform CPR
  - Offer advanced life support interventions if appropriate
  - Prepare for next defibrillation

Step 3: Continue the Resuscitation (2 of 3)

- If resources are available, obtain patient information
  - Patient history
  - History of the present illness
  - Secondary assessment
  - Review physical findings

Step 3: Continue the Resuscitation (3 of 3)

- Should the family watch the resuscitation?
  - Family members may have a better understanding of the efforts made to save their loved one if they watch
  - Some family members may be unprepared to watch or may get in the way of resuscitation efforts

Step 4: Transitioning Resuscitation (1 of 2)

- If resuscitation is successful, shift to postarrest care.
- Focus on:
  - Rapid, appropriate transport
  - Airway management
  - Access to ALS

Step 4: Transitioning Resuscitation (2 of 2)

- Check pulse every 30 seconds.
- If no pulse is found:
  - Stop the vehicle.
  - Start CPR if the AED is not ready.
  - Analyze the rhythm.
  - Deliver a shock, if indicated.
  - Continue with shocks separated by 2 minutes of CPR.

Terminating Resuscitation (1 of 2)

- Once you start resuscitation, you must continue until:
  - Spontaneous circulation occurs.
    - Then provide rescue breathing as needed.
  - Spontaneous circulation and breathing occur.
  - Another trained rescuer can take over for you.

Terminating Resuscitation (2 of 2)

- Once you start resuscitation, you must continue until:
  - You turn care of patient over to a person with higher level of training.
  - You are too exhausted to continue.
  - You receive a “cease resuscitation” order from a physician or other authority per local protocols.

Death Notification

- If notifying the family of unsuccessful resuscitation:
  - Be straightforward and use direct language.
  - Allow the family time with the deceased patient when possible.
  - Take time and be patient.
  - Do not suggest that you "know how they feel."
  - Be yourself.

Special Considerations in Resuscitation (1 of 7)

- Coordination with others who defibrillate before you arrive
  - Let the operator of the AED complete the shock before you take over care of the patient.
  - You may need to take the first AED to the hospital with the patient so data can be retrieved from the machine.
  - Your protocols will dictate transfer of care.

Special Considerations in Resuscitation (2 of 7)

- Resuscitation in the ambulance
  - Initial steps of resuscitation in a moving vehicle should be avoided.
  - If the patient goes into cardiac arrest during transport, stop the vehicle to perform CPR and deploy the AED.

Special Considerations in Resuscitation (3 of 7)

- Cardiac arrest care for hypothermia and submersion injuries
  - Attempt defibrillation once in a hypothermic cardiac arrest patient
  - Wait until the core temperature is at least 86°F before attempting defibrillation again
  - Do not terminate resuscitation in the field for hypothermic patients

Special Considerations in Resuscitation (4 of 7)

- Cardiac arrest care for hypothermia and submersion injuries
  - Treat a submersion-injury patient in cardiac arrest the same as any other cardiac arrest patient
  - Be aggressive with airway management and rescue breathing
  - Take precautions to make every defibrillation safe for you and your team in a water environment

Special Considerations in Resuscitation (5 of 7)

- Cardiac arrest care for hypothermia and submersion injuries
  - Do not defibrillate a soaking-wet patient
  - Dry the patient's chest or move out of the wet environment
  - Remove medication patches to prevent burning

Special Considerations in Resuscitation (6 of 7)

- Implants and surgeries
  - Defibrillation can be performed on patient with an implanted device.
  - Position defibrillation pads on patient's chest to avoid contact with the device.

Special Considerations in Resuscitation (7 of 7)

- Implants and surgeries
  - Some devices and surgical implants you may observe in the field include:
    - Cardiac pacemaker
    - Implanted defibrillator
    - Ventricular assist device
    - Cardiac bypass surgery

Chapter Review

Chapter Review (1 of 5)

- Cardiac arrest occurs when the pumping of the heart stops. This is commonly caused by lethal dysrhythmias including:
  - Ventricular fibrillation
  - Ventricular tachycardia
  - Asystole
  - Pulseless electrical activity

Chapter Review (2 of 5)

- Cardiac arrest causes an immediate drop in coronary and cerebral perfusion pressure. Without immediate care, the cells of the heart and brain will die.

Chapter Review (3 of 5)

- Most cardiac arrest is sudden in nature, most commonly caused by acute coronary syndrome. Some cardiac arrest is caused by asphyxia causes (especially in pediatric arrest).
- Cardiac arrest is recognized by unresponsiveness, apnea, and pulselessness.

Chapter Review (4 of 5)

- To provide excellent care and the maximum chance of survival for patients in cardiac arrest, EMS agencies must strengthen their performance of the five elements of the chain of survival:
  - Recognition and activation of the emergency response system
  - Immediate high-quality CPR
  - Rapid defibrillation
  - Basic and advanced emergency medical services
  - Advanced life support and postarrest care

Chapter Review (5 of 5)

- Successful resuscitation is a product of teamwork and quality management.

Remember (1 of 2)

- The most important element of cardiac arrest care is the administration of high-quality chest compressions.
- The American Heart Association's chain of survival describes the key elements necessary to maximize the cardiac arrest patient's chance of survival.

Remember (2 of 2)

- Mechanical CPR devices provide automated chest compressions in cardiac arrest settings.
- AED provides early defibrillation in cardiac arrest patients with ventricular tachycardia and ventricular fibrillation.
- Post-cardiac arrest care is an essential element of cardiac arrest care.

Questions to Consider (1 of 2)

- Describe how to "clear" a patient before administering a shock.

Questions to Consider (2 of 2)

- List three safety measures to keep in mind when using an AED.
- List the steps in the application of an AED.

Critical Thinking

- A 78-year-old male has been complaining of severe shortness of breath for 20 minutes prior to your arrival. When you arrive, you find the patient unconscious and not moving. What are your immediate priorities?

Copyright

Appendix 1

An EMT, who is kneeling beside a patient lying on the floor, is pressing her arms like a piston, at the lower half of the patient's sternum. Her hips act as the fulcrum. The difference between the upstroke and down stroke positions are 1.5 to 2 inches, that is, 3.5 to 5 centimeters.

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Appendix 2 (1 of 2)

The flowchart displays five sequences as follows.

- Verify patient is unresponsive, apneic, and pulseless
- Provider 1 begins chest compressions while Provider 2 readies the AED
- Turn on AED
- Bare and prep chest, attach pads
- Clear patient for analysis when prompted by AED

A downward arrow flows between each sequence.

The last sequence branches into two stages.

If shock is indicated, the following procedure is to be followed.

- Verbally clear and press the shock button, when lit
- Immediately perform CPR. AED will reanalyze in 2 minutes
- If no ROSC, reanalyze and shock again if indicated
- Immediately resume CPR. Repeat reanalyzation and shock two times if indicated
- If no ROSC, prepare for transport and follow local protocol

Appendix 2 (2 of 2)

If shock is indicated, the following procedure is to be followed.

- Resume CPR
- AED will reanalyze in 2 minutes
- If no ROSC, reanalyze and shock if indicated
- Immediately resume chest compressions. Repeat reanalyzation and shock two times if indicated
- If no ROSC, prepare for transport and follow local protocol

Return to presentation