

TRANSITION SERIES
TOPICS FOR THE EMT

TOPIC **35**

**Issues in Cardiac Arrest
and Resuscitation**

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Objectives

- Review annual cardiac arrest rates.
- Discuss pathophysiology of cardiac arrest.
- Discuss symptomatology of CHF and relate it back to the underlying pathophysiology.
- Define and integrate care interventions for a successful reversal of cardiac arrest.

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Discuss objectives.



Introduction

- Arrested patients require the highest degree of care interventions and integration.
- Delayed or ineffective treatment can within minutes make an arrest irreversible.
- It is always better to prevent cardiac arrest than to restart a stopped heart.

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When faced with a patient either deteriorating into cardiac arrest or already in cardiac arrest, the skills the EMT provides must be measured by both efficacy and time, as this patient may suffer irreversible cardiac and brain injuries in a matter of minutes if care is either delayed or inappropriate.

If the EMT can have a dramatic impact on both the patient and the patient's family in any one situation, it is here.

Whether the patient ultimately lives or dies, this situation will leave a permanent emotional mark in the memories of all.

Epidemiology

- 62 million Americans have cardiovascular disease.
 - 1.5 million will have a heart attack.
 - 500,000 will heart attacks will result in death.
 - 350,00 will arrest within 1 hour of symptoms.
 - About once a minute someone will collapse in cardiac arrest.

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Cardiovascular disease is the most prevalent chronic condition in the United States as well as the leading contributor to death.

It has been said that cardiovascular disease is actually a “young person's” disease process that results in “old age” complications.

In other words, how a younger person treats their body in the present time will have a direct impact on disease presence and progression by the time they reaches late adulthood.

In fact, with many cardiovascular disease processes, the first clinical indication of its presence may well be the patient's first heart attack, stroke, or even sudden cardiac arrest.

Pathophysiology

- Cardiac arrest is the cessation of blood circulation
 - Arrest may be medical or trauma related
 - Arrest may be “primary” or “secondary”

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With cessation of blood and the delivery of oxygen and metabolic substrates, cells become hypoxic.

There will be a shift from aerobic to anaerobic metabolism. This leads to severe acidosis, hypoxemia, ATP depletion, and cellular death.

Although cells may die at a different rate, brain cells are most susceptible to the damage from cardiac arrest—and tend to start dying within minutes of arrest.

Although a medical or traumatic incident is the “cause”, the “result” is cardiac arrest.

A “primary” arrest is when the cause of arrest is the heart itself (e.g., MI, sudden dysrhythmia), a “secondary” arrest is when another body system failed and the heart stopped due to that (e.g., sepsis, MODS, massive CVA).

Pathophysiology

- Absent or ineffective perfusion of blood
 - Without rhythmic contraction, no blood is delivered to the body
 - There may be electrical activity in the heart, but ineffective contraction or no blood flow

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With cardiac arrest, ventricular contraction is absent or ineffective, resulting immediately in the cessation of blood flow and systemic circulatory failure—in fact, it is the final common pathway to human death.

Although it is often difficult to determine the cause of cardiopulmonary arrest at the time of presentation, a working differential diagnosis of the causes can be formulated based on the patient's history, physical examination, and automated external defibrillator (AED) rhythm analysis.

With stoppage of the heart, blood flow ceases and no oxygenated blood is being delivered to the capillary beds of the body.

Lack of blood flow initially causes pulselessness and unresponsiveness in the patient, but the lack of oxygen supply to the body's cells results in irreversible tissue damage and death.



Assessment Findings

- Dispatch information
- Patient will go unresponsive
 - 10-15 seconds following the heart stopping
- Absent or agonal breathing
- Absent of perceivable pulse
- Skin often ashen and rapidly becomes cyanotic

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Discuss basic findings for a patient in cardiac arrest.

Usually this is a straight forward assessment.

Assessment Findings

- Historical information to gather
 - Was arrest witnessed?
 - Was CPR started?
 - Was the AED used?
 - What was the estimated down time?
 - What was the patient doing when arrest was identified?
 - What is the patient's past medical history, and what are the current meds?

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Historical information gathered from on scene family or bystanders may provide key information regarding etiology and potential outcome.

If the cardiopulmonary arrest is witnessed, there exists a potential for bystander/health care provider CPR, which increases the likelihood of a successful resuscitation.

If the cardiac arrest occurs prior to arrival of the EMT, then information obtained from family, bystanders, or other emergency personnel may provide key information that will assist in resuscitation of the patient.

Emergency Medical Care

- Establish down time
 - >4-5 minutes, initiate CPR for 2 minutes prior to AED analysis
 - <4 minutes, analyze with AED to shock if needed, then perform CPR for 2 minutes
- Open airway and assess breathing
 - Open airway manually, insert OPA, initiate PPV

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The standard ABC sequence of initial assessment is altered to CAB in suspected cardiac arrest patients.

In cardiac arrest, chest compressions (C) are immediately initiated and continued for one cycle, followed by opening the airway (A) and the first two ventilations (B).

This sequence reduces the delay to first compressions.

Emergency Medical Care

- Open airway and assess breathing
 - Open airway manually, insert OPA, initiate PPV with high-flow oxygen, synch ventilations with compressions (30:2 ratio)
 - Once advanced airway is placed, ventilations and compressions become asynchronous
 - Ventilate patient at 8-10 per minute

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Remember, in the cardiac arrest patient, chest compressions precede opening the airway and ventilation (CAB).

Adequate resources are often available in the prehospital setting to perform airway management simultaneously with chest compressions.

The key is to not interrupt or compromise the chest compressions.

Figure 35-1 Direct ventilation with high-concentration oxygen.



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Emergency Medical Care

- Assessing for a pulse and providing compressions
 - Push hard and push fast
 - Rate at least 100/min
 - Pulse checks no longer than 10 seconds
 - If uncertain if pulse present, start CPR

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Pulse checks should be done at carotid location, by provider on that side of the patient (never reach across).

It has been well-documented in previous research that even perfectly performed compressions can achieve only a small portion of normal cardiac output.

It has been more recently documented in the literature that shallow compressions, slow compressions, or frequent interruptions of compressions results in reduced cardiac output, which ultimately translates into poor survival rates.

Figure 35-2 Checking the patient's carotid pulse (maximum 10 seconds).



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Emergency Medical Care

- Assessing for a pulse and providing compressions
 - Any interruption in compressions stops blood flow immediately
 - Resumption of compressions will still require another 45 seconds of pumping to achieve cardiac output

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The EMT must also realize that any interruption of compressions, even for brief periods, causes the cardiac output and coronary perfusion to drop to nothing.

On resumption of compressions it can take up to 45 seconds of constant compressions to return cardiac output to what it was prior to ceasing compressions.

As such, always minimize the number of times you have to stop compressions and minimize the length of time compressions have to be stopped (this is also why the compression/ventilation ratio is now 30:2 and why the initial focus in cardiac arrest is on chest compressions).

Over ventilation of the patient in cardiac arrest can cause decrease in cardiac output achieved through compressions.



Emergency Medical Care

- Other cardiac arrest considerations
 - Compression adjuncts
 - Controlled hypothermia

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One device is a mechanical CPR adjunct that will alleviate one EMT from performing CPR; because it is mechanical in nature, it may provide more consistent compressions; however, no adjunct to date has been proven to be superior to standard manual CPR.

Another intervention is the use of “controlled hypothermia” during the post arrest resuscitation phase. It has been learned through controlled clinical trials that by carefully lowering the body core temperature, metabolic demands decrease, edema diminishes, and increased survival rates have been realized.

Figure 35-3 The AutoPulse™ Model 100: (A) applied to a patient



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Figure 35-3 (continued) The AutoPulse™ Model 100: (B) close-up view.



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Case Study

You are called for a “man down” at a local hotel. Upon your arrival, you are escorted to a first-floor room where a man was found collapsed on the floor by the cleaning crew. The patient has no pulse, is not breathing, and is unresponsive. He is still warm to the touch, and minimal cyanosis is present.

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Present case study.



Case Study

- Scene Size-Up
 - Standard precautions taken
 - Scene is safe, no sign of struggle
 - Elderly male, 185 pounds, appears to be in cardiac arrest
 - Patient found on floor, half dressed
 - No entry or egress obstacles

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Present case study.



Case Study

- Primary Assessment Findings
 - Patient unresponsive to painful stimuli
 - Airway appears open, no fluid/obstructions
 - Breathing is absent
 - Carotid pulse cannot be felt after 10 seconds of assessment
 - Peripheral skin is warm, slight cyanosis noted to nail beds

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Appears this patient just went into cardiac arrest.



Case Study

- Is this patient a high or low priority? Why?
- Should the EMT initiate CPR or apply the AED first? Why?

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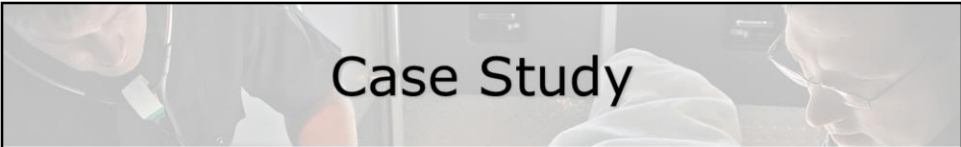
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This is obviously a high priority patient!

The EMT should initiate CPR first because there is no way to document a “down time” of < 4 minutes.

Plus, if it took 5 or 10 minutes for EMS to arrive, its already exceeded the 4 minute marker used to decide if CPR or AED is utilized first.



Case Study

- What are three clinical findings that are the most reliable for determining that an adult patient is in cardiac arrest?

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- Unresponsive
- No breathing
- No pulse



Case Study

- Medical History
 - Medical alert tag reads “Hypertension”
- Medications
 - Unknown
- Allergies
 - Unknown

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Discuss case study.



Case Study

- Pertinent Secondary Assessment Findings
 - Pupils fixed and dilated
 - Airway established, King airway placed
 - PPV with oxygen ongoing
 - Carotid pulse with each chest compression
 - AED first analysis indicates “no shock”
 - Periphery become cool and cyanotic

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Discuss case study.



Case Study

- What are four or five specific questions the EMT should always try to get answered when faced with an arrested patient?

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Historical information to gather:

- Was arrest witnessed?
- Was CPR started?
- Was the AED used?
- What was the estimated down time?
- What was the patient doing when arrest was identified?
- What is the patient's past medical history, and what are the current meds?



Case Study

- What type of cellular metabolism will the tissues enter into?
- What effect does the above answer have on success rate from cardiac arrest?

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With no management, improper management, or delayed management - the patient will shift from aerobic to anaerobic metabolism.

Anaerobic metabolism causes acid buildup and does not yield sufficient ATP.

As such, cell will start to die as the it becomes more acidic.

Both of these findings are counterproductive to successful arrest management.



Case Study

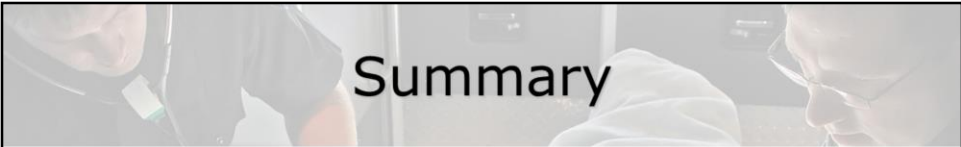
- Care provided:
 - Patient kept supine
 - King airway inserted
 - PPV 8-10/min with oxygen
 - AED applied with “no shock indicated”
 - CPR, PPV, O₂ and AED ongoing
 - ALS intercept initiated

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Discuss the approach to management for an arrested patient.



Summary

- Cardiac arrest is perhaps the most involved of patient encounters.
- Everything performed on the patient must be considered by its worth versus the time it takes to perform it.
- High quality CPR, AED utilization, and appropriate PPV offer some of the best chances for success.

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Review as appropriate.