SIMULATION

Prehospital Cardiac Arrest Management Simulation

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Submitted: May 21, 2018; Accepted: July 25, 2018; Electronically Published: October 15, 2018; https://doi.org/10.21980/J8V057

ABSTRACT:

Audience: This simulation is for emergency medicine educators to use when teaching prehospital cardiac arrest management to emergency medical technicians (EMTs), paramedics, critical care transport providers, medical students, and emergency medicine residents.

Introduction: Prehospital cardiac arrest resuscitation is a key area in healthcare provider training. Over 350,000 cardiac arrests yearly occur in the prehospital environment.[1] Successful prehospital cardiac arrest resuscitation necessitates mastery of basic and advanced life support techniques, including cardiopulmonary resuscitation (CPR), defibrillation, airway management, and advanced pharmacotherapies.[2–5] Effective communication skills and leadership are requisite for performing these actions in a high-quality, team-focused CPR approach.[6–8] It is difficult to perform a well-organized cardiac arrest resuscitation due to the stressful nature of and infrequent exposure to the event. This simulation is designed to empower learners to develop a systematic approach to cardiac arrest resuscitation while also reinforcing the importance of teamwork.

Objectives: At the end of this simulation learners will be able to:

1. Perform team-focused CPR using effective leadership and communication skills during prehospital resuscitation.
2. Employ high-quality CPR with an emphasis on compressions and early defibrillation.
3. Demonstrate appropriate airway management utilizing an oropharyngeal airway and bag-valve-mask, blind-insertion airway device, and/or endotracheal intubation during cardiac arrest.
4. Recognize and appropriately defibrillate pulseless ventricular tachycardia and ventricular fibrillation.
5. Formulate an appropriate differential diagnosis for pulseless electrical activity.

Method: This simulation can be taught using a high-fidelity simulation model. It may also be adopted for use with a low-fidelity simulation model or as an oral boards case.

Topics: Cardiopulmonary resuscitation (CPR), prehospital cardiac arrest, emergency medical services (EMS), team-focused CPR, simulation.

USER GUIDE

List of Resources:

Learner Audience:
Medical Students, Interns, Junior Residents, Senior Residents, Prehospital Providers including Emergency Medical Technicians (EMTs), paramedics, and critical care transport providers

Time Required for Implementation:
Instructor Preparation: 15-30 minutes
Time for case: 10 minutes
Time for debriefing: 10-15 minutes

Recommended Number of Learners per Instructor:
1 primary learner per instructor; may have up to 2 secondary learners acting as confederates

Topics:
Cardiopulmonary resuscitation (CPR), prehospital cardiac arrest, emergency medical services (EMS), team-focused CPR, simulation.

Objectives:
By the end of this simulation session, the learner will be able to:

1. Perform team-focused CPR using effective leadership and communication skills during prehospital resuscitation.
2. Employ high-quality CPR with an emphasis on compressions and early defibrillation.
3. Demonstrate appropriate airway management utilizing an oropharyngeal airway and bag-valve-mask, blind-insertion airway device, and/or endotracheal intubation during cardiac arrest.
4. Recognize and appropriately defibrillate pulseless ventricular tachycardia and ventricular fibrillation.
5. Formulate an appropriate differential diagnosis for pulseless electrical activity.

Linked objectives, methods and results:
This simulation requires learners to perform an effective, team-focused resuscitation of a patient experiencing prehospital cardiac arrest. To meet Objective 1, learners must demonstrate leadership, delegate roles, issue clear commands, and provide feedback and instructions to partners as needed. Objective 2 requires that learners prioritize effective compressions and early defibrillation over other parts of the resuscitation, particularly airway management. Satisfying Objective 3 requires that learners manage the patient's airway at the appropriate time and with the appropriate tools. Essential to Objectives 4 and 5 are recognizing and knowing how to manage lethal cardiac dysrhythmias. Particularly, learners must know to defibrillate pulseless ventricular tachycardia and ventricular fibrillation, and they must be able to identify the reversable causes of pulseless electrical activity. These objectives ensure that learners engage in a prehospital cardiac arrest resuscitation and learn best practices. If necessary, this resource can be adapted for use with a low-fidelity simulation model or as an oral boards case.

Recommended pre-reading for instructor:

- The instructor should be familiar with the latest American Heart Association (AHA) Basic Life Support (BLS) and Advanced Cardiovascular Life Support (ACLS) guidelines. The instructor should also be familiar with local prehospital emergency medical services protocols.

Results and tips for successful implementation:
This case was implemented over 150 times during a three-year period (2015-2017) as a quality improvement training initiative. Five board-certified emergency medicine physicians who provide medical direction for paramedics conducted the simulations. Similar oral boards style cases were presented to emergency medicine residents during their residency EMS experience.

After several trial simulations, the scenario was modified so that compressions were already underway upon the learner arriving on-scene. This was done to force learners to assume command of the scene from the bystander and to determine if CPR was clinically indicated. Additionally, the instructors began having learners conclude the case with a simulated radio call where the learner verbally narrated the case and management to the receiving hospital in order to prepare the hospital for the incoming patient. This allowed the learner to reflect upon the care rendered.

At the end of the simulation period, seventy-six simulation learners provided post-training assessments. The number of learners expressing "confidence" in their ability to perform a successful prehospital cardiac arrest resuscitation increased from 56% to 79% after the simulation (4-5/5 modified Likert-scale). Over half (51%) of the learners found the simulation "very helpful" (4/5 modified Likert-scale) and 5% of learners found it maximally helpful (5/5 modified Likert-scale). 99% of

learners requested additional simulation training, with 85% of learners requesting it at least annually and 51% requesting it biannually.

All learners participated in a debriefing situation, where both they and the physician evaluators discovered that the most common points of failure included failing to recognize poor-quality chest compressions, not effectively rotating compressors every 200 compressions, and not using a metronome to help with compression timing. Other points of concern were not pre-charging the defibrillator at the 180th compression to decrease the peri-shock pause time, having prolonged pulse checks, and prematurely interrupting compressions for airway management.

Modified Likert-scale surveys of the facilitating physicians demonstrated 96% maximal satisfaction with the usability of the materials, appropriateness for use with prehospital healthcare providers, and alignment with current clinical practice guidelines. All physicians agreed that it takes fewer than 30 minutes to administer the simulation and that they would use the simulation again.

Physicians commented that this simulation is "a must for all providers that take care of patients in cardiac arrest" and that it "improves choreography of an appropriate out-of-hospital cardiac arrest resuscitation, calling attention to continuous and uninterrupted chest compressions, decreased peri-shock pause time, and improved airway management techniques." Physicians found the case to be limited by its being a simulation in nature and by its having a limited emphasis on post-arrest care for the unstable patient.

Associated Content:

- Appendix A: Debriefing PowerPoint

References/suggestions for further reading:

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INSTRUCTOR MATERIALS

Case Title: Prehospital Cardiac Arrest Management Simulation

Case Description & Diagnosis (short synopsis): The patient is a 65-year-old male who experiences prehospital cardiac arrest while mowing his yard. The learner arrives on-scene to find a bystander performing 911 dispatch-aided CPR. If the learner utilizes high-quality, team-focused CPR, then the patient will have return of spontaneous circulation (ROSC). Shortly thereafter, the learner should conclude the scenario with a simulated call to the receiving hospital where the learner describes the case and care rendered in order to prepare the hospital for the incoming patient.

Equipment or Props Needed:
High-fidelity patient simulation model (Laerdal SimMan, CAE Healthcare METIman, or another appropriate model)
Personal protective equipment (PPE)
Portable heart monitor with 12-lead electrocardiogram (ECG) and defibrillation capabilities
Pulse oximeter
Blood pressure cuff
Stethoscope
Glucometer
End-tidal CO_2 ($EtCO_2$) monitoring equipment
Airway supplies (airway adjuncts; nasal cannula; non-rebreather face mask; bag-valve mask; blind-insertion airway device such as a King Airway, Laryngeal Mask Airway (LMA), iGel, etc.; endotracheal tubes; direct laryngoscopes; intubation supplies; oxygen supply)
Medication bag with ACLS medications such as epinephrine, amiodarone, and/or lidocaine as well as medications for sedation, rapid sequence intubation, and analgesia
Intravenous (IV) and intraosseous (IO) catheters and lines
Normal saline
Needle decompression kit
Radio or cell phone

Confederates needed:
Daughter, who will be performing CPR upon the learner's arrival on-scene and will provide the patient's medical history if requested
EMT partner, who will perform as directed by the learner and may assist with CPR, assessment, and interventions

INSTRUCTOR MATERIALS

Stimulus Inventory:

#1 Ventricular tachycardia rhythm strip
#2 Ventricular fibrillation rhythm strip
#3 Pulseless electrical activity (PEA) masquerading as sinus tachycardia rhythm strip
#4 Left bundle branch block 12-lead ECG

Background and brief information: This information is to be given to the learner as a simulated 911 dispatch: "Respond to 123 Main Street in reference to a 65-year-old male with a reported seizure who is now in suspected cardiac arrest. Dispatch-aided bystander CPR is in progress."

Initial presentation: Upon arrival, the 65-year-old male patient is unresponsive and pulseless with irregular, agonal respirations occurring every 12 seconds. He is lying next to his push lawn mower, which is still running. His daughter is crying and performing chest compressions.

How the scenario unfolds: The learner should assume care of the patient and establish him/herself as the team leader. The learner may show team-focused CPR techniques by clearly being the resuscitation team leader, by assigning roles, by issuing specific commands to people by name, and by coaching team members as needed. The learner should perform a rapid pulse check and conclude that high-quality, team-focused CPR is indicated due to the patient being in cardiac arrest. The learner should ensure that appropriate compressions are being delivered and that early defibrillation is performed while simultaneously performing a primary survey and obtaining relevant medical history from the patient's daughter. Airway management and intravenous therapies should be secondary priorities. If high-quality, team-focused CPR is performed and the patient's shockable ventricular dysrhythmias are treated, then the patient will have a spike in his $EtCO_2$ and have ROSC. At this point, the learner should conduct a simulated call to the receiving hospital and describe the case and care rendered. If the learner does not use these resuscitation best practices, then the patient will not have a spike in his $EtCO_2$ or have ROSC. If this occurs, the instructor may provide guidance and instruction to help advance the simulation.

Critical Actions:

1. Makes sure the scene is safe and dons PPE
2. Establishes him/herself as the team leader
3. Conducts an appropriate and rapid primary survey (Airway, Breathing, Circulation, Disability, Exposure)

4. Performs high-quality CPR (appropriate position, depth, rate, minimizes non-compression time, and rotates compressors every 2 minutes)
5. Prioritizes compressions and early defibrillation over airway interventions and intravenous pharmacotherapies
6. Recognizes and treats shockable ventricular dysrhythmias (both pulseless ventricular tachycardia and ventricular fibrillation)
7. Considers reversible causes of PEA

INSTRUCTOR MATERIALS

Case Title: Prehospital Cardiac Arrest Management Simulation

Chief Complaint: This information and chief complaint should be given to the learner as a simulated 911 dispatch: "Respond to 123 Main Street in reference to a 65-year-old male with a reported seizure. Dispatch-aided bystander CPR is now in progress."

Vitals: *Heart Rate (HR)* 0 *Blood Pressure (BP)* 0/0 *Respiratory Rate (RR)* 5
Temperature (T) 98°F *Oxygen Saturation (O_2Sat)* not measurable

General Appearance: Unresponsive male with agonal respirations and bystander CPR in progress. A lawn mower is running next to the patient.

Primary Survey:

- **Airway:** patent
- **Breathing:** irregular, agonal respirations every 12 seconds
- **Circulation:** pulseless

History:

- **History of present illness:** The daughter initially called 911 due to the patient having seizure-like activity. The patient became unresponsive with agonal respirations. Dispatch-aided bystander CPR was initiated at this time.
- **Past medical history:** Hypertension, hypercholesterolemia
- **Past surgical history:** None
- **Patients medications:** Aspirin (daily), atenolol, atorvastatin
- **Allergies:** Lisinopril
- **Social history:** Non-smoker, drinks alcohol occasionally, no drug use
- **Family history:** None

Secondary Survey/Physical Examination:

- **General appearance:** Unresponsive male with agonal respirations and bystander CPR in progress. A lawn mower is running next to the patient.
- **HEENT:**
    - **Head:** within normal limits
    - **Eyes:** pupils fixed bilaterally
    - **Ears:** within normal limits
    - **Nose:** within normal limits

  - **Throat:** within normal limits.
- **Neck:** Jugular venous distention (JVD) is present when the patient is supine
- **Heart:** Pulseless; carotid and femoral pulses are present with compressions
- **Lungs:** Agonal breathing with limited airflow bilaterally
- **Abdominal/GI:** within normal limits
- **Genitourinary:** within normal limits
- **Rectal:** within normal limits
- **Extremities:** within normal limits
- **Back:** within normal limits
- **Neuro:** unresponsive
- **Skin:** Mottled, warm, diaphoretic
- **Lymph:** within normal limits
- **Psych:** unable to assess

INSTRUCTOR MATERIALS

Results:

Ventricular Tachycardia

Burns, E. Ventricular tachycardia. In: Life in the Fast Lane. https://lifeinthefastlane.com/ecg-library/ventricular-tachycardia/. Updated March 19, 2017. CC BY-NC-SA 4.0.

Ventricular fibrillation

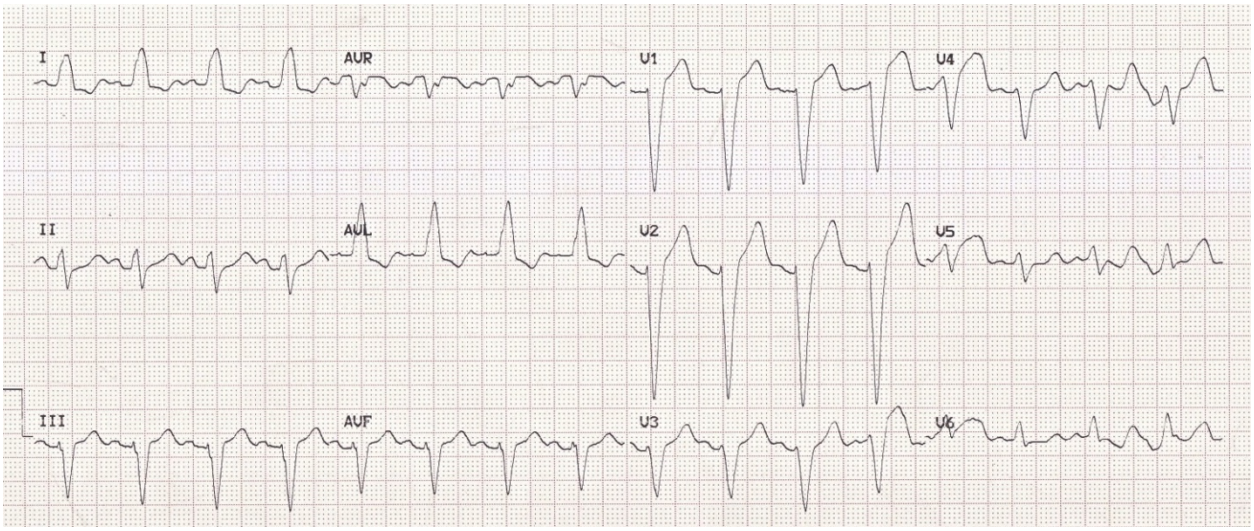
Burns, E. Tdp to VF. In: Life in the Fast Lane. https://lifeinthefastlane.com/ecg-library/ventricular-fibrillation/. 2017. Updated March 13, 2017. CC BY-NC-SA 4.0.

Pulseless electrical activity masquerading as sinus tachycardia

Burns, E. Sinus tachycardia. In: Life in the Fast Lane. https://lifeinthefastlane.com/ecg-library/sinus-tachycardia/. Updated March 13, 2017. CC BY-NC-SA 4.0.

INSTRUCTOR MATERIALS

Left bundle branch block.
Burns, E. Sinus tachycardia. In: Life in the Fast Lane. https://lifeinthefastlane.com/ecg-library/basics/left-bundle-branch-block/. Updated April 16, 2017. CC BY-NC-SA 4.0.



OPERATOR MATERIALS

SIMULATION EVENTS TABLE:

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
00:00 (Baseline) Arrival On-Scene	1. Performs scene size- up and determines if additional resources are needed 2. Assesses and addresses scene safety 3. Dons PPE	There is only one patient. An additional EMS unit, first responder unit, or EMS supervisor may be dispatched if the learner requests backup. The scene will be deemed safe once the lawn mower is turned off. If the learner fails to address the lawn mower, then the instructor should cue them by asking, "Is the scene safe? Are there any life threats to you and your partner in the area?" If prompting is required, this should be discussed in the debriefing.	No vital signs available
00:15-2:00 First Phase	1. Establishes team leader 2. Circulation: Performs rapid pulse check and rapidly examines the patient from head to toe for massive hemorrhage (blood sweep) (<10 seconds) 3. Airway assessment 4. Breathing assessment 5. Disability assessment 6. Ensures adequate exposure 7. Initiates high-quality, team-focused CPR 8. Places defibrillator pads 9. Manages airway 10. Initiates $EtCO_2$ monitoring 11. Obtains vascular access 12. Gathers history from daughter 13. Provides effective team communication	The daughter will be performing poor-quality chest compressions. The learner should assume care of the patient and establish him/herself as team leader. The patient will be unresponsive, pulseless, and have agonal respirations. High-quality chest compressions in the center of the chest that are at least 2 inches deep at a rate of 100-120 compressions per minute should be initiated. The learner must instruct his/her partner on high-quality CPR and ensure that it is being correctly performed. A metronome will ideally be used to help pace the compressions. If the learner fails to ensure that high-quality compressions are being performed, then the $ETCO_2$ will drop to 18 and ROSC will not be obtained. The instructor may prompt and/or coach the learner in effective compressions if necessary. If this is required, this should	HR: 0 BP: 0/0 RR: 5 O_2sat: Not measurable

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
		be a major teaching point in the debriefing session. Defibrillator pads should be placed as early as possible. If the pads are not rapidly placed (or not placed at all), then the instructor should prompt the learner. If prompting is required, this should be a major teaching point in the debriefing session. If the pads are not placed, then the scenario will not progress and ROSC will not be obtained. Regarding defibrillation, local EMS system protocols may vary regarding immediate defibrillation versus performing one round of initial compressions before defibrillation. This step may be modified according to local system protocol. In this simulation, one full round of compressions will be performed before defibrillation occurs. The primary survey should consist of an ABCDE assessment, including airway, breathing, circulation with blood sweep, disability with mental status evaluation, and ensuring proper exposure. If a proper primary survey is not performed and vocalized, then the instructor may allow the scenario to progress, as long as the airway, breathing, and circulation deficits are being addressed. However, this should be a major teaching point because the primary survey is a critical step in prehospital patient assessment. The learner should count compressions aloud, charge the defibrillator on the	

OPERATOR MATERIALS

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
		180th compression, ensure that breaks in compressions are less than 10 seconds, and rotate compressors every 200 compressions. The airway should only be addressed after high-quality chest compressions are on-going and after the defibrillator pads have been appropriately placed. The learner may use an oropharyngeal airway adjunct in conjunction with a bag-valve mask, a blind-insertion airway device, or endotracheal intubation. This may be customized based on local EMS system protocol. Airway management, particularly endotracheal intubation, should not hinder compressions and early defibrillation. The provider must provide adequate ventilations at a rate of 8-10 breaths per minute. The airway may be addressed after the first round of compressions as well. $EtCO_2$ monitoring should be established. It will initially be 20. If poor-quality chest compressions occur, it will drop to 10. If learners do not use $EtCO_2$, then the patient will not have a spike in $EtCO_2$ to reflect ROSC. The scenario may continue without $EtCO_2$. $EtCO_2$ may be established after the first round of compressions. Vascular assess should be obtained after high-quality chest compressions are on-going and the defibrillator pads are placed. If an IV is attempted first, it will fail. IO placement will be successful. If no vascular assess is obtained, then the instructor should prompt the learner. If	

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
		prompting is required, then this should be a major teaching point in the debriefing. Vascular access may be delayed until after the first round of compressions. The learner should demonstrate team-focused CPR by being the clear leader of the resuscitation effort, giving specific commands to named people, assigning roles, and by coaching team members as needed. For example, the learner should remind and instruct his/her partner on proper chest compression techniques. If the learner does not demonstrate key team-focused CPR techniques, then the instructor should allow the simulation to progress. However, this should be a key teaching point during the debriefing. The daughter informs the learner of the patient's medical history, and she reports that he initially looked like he was having a seizure before becoming unresponsive.	
Second Phase (2:00-4:00)	1. Performs a rhythm check 2. Identifies and defibrillates pulseless ventricular tachycardia 3. Minimizes peri-shock pause time 4. Switches compressors 5. Administers epinephrine (1 mg)	At the 2:00 minute mark, a rhythm check should occur and the instructor should provide the ventricular tachycardia rhythm strip. The defibrillator should be charged at the 180th compression. The patient should be defibrillated with minimal peri-shock pause. If the learner does not recognize or defibrillate the dysrhythmia, then the instructor should allow the scenario to progress. No prompting should be given. The patient should remain in ventricular tachycardia until the learner exhausts all	HR: 0 BP: 0/0 RR: (match ventilation rate) O_2sat: Not measurable

OPERATOR MATERIALS

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
		other options and has time to reflect. If the learner still fails to identify the rhythm, then the instructor may prompt the learner to ensure continuation of the simulation. This should be a major teaching point in debriefing. Compressors should switch and compressions should immediately resume after defibrillation. Epinephrine should be administered and repeated in 3-5 minute intervals.	
Third Phase (4:00-6:00)	1. Performs a rhythm check 2. Identifies and defibrillates ventricular fibrillation 3. Minimizes peri-shock pause time 4. Switches compressors 5. Administers amiodarone (300 mg) or lidocaine (1-1.5mg/kg) (may vary depending on local system protocol)	At the 4:00 minute mark, a rhythm check should occur and the instructor should provide the ventricular fibrillation rhythm strip. The defibrillator should be charged at the 180th compression. The patient should be defibrillated with minimal peri-shock pause. Compressors should switch and compressions should immediately resume. Antidysrhythmic medication (amiodarone or lidocaine) should be administered. If anti-dysrhythmic medications are not given, then the instructor should debrief the learner on this important step at the end of the simulation. No prompting should be given and the simulation should progress.	HR: 0 BP: 0/0 RR: (match ventilation rate) O_2sat: Not measurable

OPERATOR MATERIALS

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
Fourth Phase (6:00-8:00)	1. Performs a rhythm check 2. Identifies PEA 3. Minimizes non-compression time 4. Switches compressors 5. Investigates and treats reversible causes of PEA 6. Administers epinephrine (1mg)	At the 6:00 minute mark, a rhythm check should occur and the instructor should provide the pulseless electrical activity masquerading as sinus tachycardia rhythm strip. The learner should perform a pulse check and determine the rhythm to be PEA. If PEA is not recognized and if reversible causes are not explored, then the patient should become asystolic. The instructor should not prompt the learner as the simulation is near completion. If this occurs, then this should be a major teaching point during the debriefing. The defibrillator should be charged at the 180th compression. The patient should NOT be defibrillated. If the patient is defibrillated while in PEA, then the patient will become asystolic and the scenario will end at the instructor's discretion. Compressors should switch and compressions should immediately resume. Reversible causes should be explored and verbalized during this time: • Hypovolemia • Hypoxia • Hydrogen ions (acidosis) • Hypothermia • Hypo/hyperkalemia • Hypoglycemia • Tension pneumothorax • Tamponade (cardiac) • Toxin • Thrombus (pulmonary embolus and myocardial infarction)	HR: 0 BP: 0/0 RR: (match ventilation rate) O_2sat: Not measurable

OPERATOR MATERIALS

Minute (State)	Participant action/ Trigger	Patient Status (Simulator response) & Operator Prompts	Monitor Display (Vital Signs)
		A saline bolus should be administered. The patient's fingerstick blood sugar will be 180. The learner should consider giving glucagon since the patient takes a beta blocker. The learner may also consider needle decompression. Epinephrine should be administered. Even if saline and epinephrine are not administered, the scenario may continue normally.	
ROSC (8:00-9:00)	1. Observes a spike in the $EtCO_2$ to 40 if high-quality, team-focused CPR is underway 2. Performs a pulse check 3. Assesses vital signs 4. Administers saline if the patient is hypotensive (will be unless saline previously given) 5. May consider induced hypothermia per local system protocol 6. Obtains and interprets a 12-lead ECG	The learner should note a spike in the patient's $EtCO_2$, indicating likely ROSC. A pulse check should be performed for confirmation. If a saline bolus was previously administered, the patient's BP will be 110/80. If not, the patient will be hypotensive at 86/60, in which case the learner should administer a saline bolus. If a saline bolus is not administered, then the patient will remain hypotensive. This should be a point of discussion in the debriefing. The learner should consider induced hypothermia if it is part of the local EMS system protocol. The learner should obtain a 12-lead ECG. The instructor should provide the left bundle branch block ECG.	HR: 95 BP: 110/80 if saline bolus administered in the Fourth Phase (if not, then 86/60) RR: 12 O_2sat: 94% if airway/breath-ing are being appropriately managed; 85% if not being appropriately managed
End of Case (10:00	1. Performs a simulated call to the receiving emergency department	The learner should perform a simulated call to the receiving hospital and succinctly communicate the patient's initial condition, the prehospital therapies performed, and the patient's current status.	

OPERATOR MATERIALS

Diagnosis:
Cardiac Arrest

Disposition:
Transport to the nearest appropriate emergency department

DEBRIEFING AND EVALUATION PEARLS

Prehospital Cardiac Arrest Management Simulation

Cardiac arrest is the termination of life-sustaining cardiac function in the setting of unconsciousness, abnormal breathing, and lack of circulation. More than 350,000 cardiac arrests yearly occur in the prehospital environment in the United States.[1] Of these, approximately 60% are treated by prehospital emergency medical services (EMS) providers.[3] Despite the development of aggressive treatment paradigms over the past several decades, the survival rate for prehospital cardiac arrest remains low, with estimates being between 6.7%-8.4%.[3]

Treatments for prehospital cardiac arrest include cardiopulmonary resuscitation (CPR), defibrillation, airway management, advanced cardiovascular life support (ACLS) medications, and other therapies such as induced hypothermia.[2–5,9,10] Of these, chest compressions and defibrillation of shockable ventricular dysrhythmias are the best tools for achieving return of spontaneous circulation (ROSC) in the field, which itself is a strong predictor of survival to hospital discharge. [3,4]

High-quality CPR is critical for successfully treating cardiac arrest.[3,11] Rapid response, sufficient compression depth, and appropriate compression rate are key elements of high-quality CPR.[5,11–13] The American Heart Association's 2015 guidelines recommend a compression depth of at least 2 inches but no more than 2.4 inches, a rate of 100-120 compressions per minute, and maximizing the time spent doing chest compressions by minimizing interruptions.[5]

Recent emphasis on a team-focused approach to CPR shows promise for improving survival by working to maximize effective chest compressions and early defibrillation.[6,14] The team-focused CPR strategy values teamwork, communication, leadership, effective compressions, early defibrillation, maximizing the time effective compressions are being performed, and airway management with blind-insertion airway devices or bag-valve masks.[6,8] Team-focused CPR deemphasizes potential distractors from high-quality chest compressions and early defibrillation, such as intravenous medications and endotracheal intubation.[7] Minimally interrupted chest compressions improve survival rates.[14] Additionally, data from North Carolina suggest that those who receive team-focused CPR are more likely to have a favorable neurological outcome at hospital discharge compared to those who do not receive team-focused CPR.[6]

DEBRIEFING AND EVALUATION PEARLS

On-scene resuscitation of cardiac arrest is becoming the ideal model in EMS systems.[15] Due to this, it is imperative that prehospital emergency medical services providers receive the training and appropriate educational materials to be competent in cardiac arrest resuscitation.

Other debriefing points: Please see Appendix A: Debriefing PowerPoint. This should be used to facilitate self-reflection and to highlight the ideal flow of the simulation. The learner may be interested in more advanced prehospital cardiac arrest questions that are best addressed at the local EMS system level. Such questions may involve refractory pulseless ventricular tachycardia or refractory ventricular fibrillation, induced hypothermia, advanced post-arrest management, and routine versus emergency traffic transport of the post-arrest patient. Instructors should utilize their local EMS system protocols to best answer these questions.

Learners should also be encouraged to reflect on their leadership style: Did they instill confidence in their teammates? Did they use closed-loop communication? How did they communicate with the grieving daughter? Were the team's movements and transitions well-synchronized? Could better communication have resulted in fewer chest compression interruptions?

Wrap Up: The instructor should highlight one final time the importance of high-quality, team-focused CPR, particularly uninterrupted chest compressions and early defibrillation. For additional reading, the learner can study the American Heart Association's BLS and ACLS guidelines, his/her local EMS system protocols, and the aforementioned references.

SIMULATION ASSESSMENT

Prehospital Cardiac Arrest Management Simulation

Learner: _____

Assessment Timeline

This timeline is to help observers assess their learners. It allows observer to make notes on when learners performed various tasks, which can help guide debriefing discussion.

Critical Actions	0:00
1. Makes sure the scene is safe and dons PPE 2. Establishes him/herself as the team leader 3. Conducts an appropriate and rapid primary survey (Airway, Breathing, Circulation, Disability, Exposure) 4. Performs high-quality CPR (appropriate position, depth, rate, minimizes non-compression time, and rotates compressors every 2 minutes) 5. Prioritizes compressions and early defibrillation over airway interventions and intravenous pharmacotherapies 6. Recognizes and treats shockable ventricular dysrhythmias (both pulseless ventricular tachycardia and ventricular fibrillation) 7. Considers reversible causes of PEA	

SIMULATION ASSESSMENT

Prehospital Cardiac Arrest Management Simulation

Learner: _____

Critical Actions:

☐ Makes sure the scene is safe and dons PPE
☐ Establishes him/herself as the team leader
☐ Conducts an appropriate and rapid primary survey (Airway, Breathing, Circulation, Disability, Exposure)
☐ Performs high-quality CPR (appropriate position, depth, rate, minimizes non-compression time, and rotates compressors every 2 minutes)
☐ Prioritizes compressions and early defibrillation over airway interventions and intravenous pharmacotherapies
☐ Recognizes and treats shockable ventricular dysrhythmias (both pulseless ventricular tachycardia and ventricular fibrillation)
☐ Considers reversible causes of PEA

Summative and formative comments:

Milestones assessment:

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
1	**Emergency Stabilization (PC1)**	☐ Did not achieve Level 1	☐ Recognizes abnormal vital signs	☐ Recognizes an unstable patient, requiring intervention Performs primary assessment Discerns data to formulate a diagnostic impression/plan	☐ Manages and prioritizes critical actions in a critically ill patient Reassesses after implementing a stabilizing intervention

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Ashburn N, et al. Prehospital Cardiac Arrest Management Simulation. JETem 2018. 3(4):S28-53.
https://doi.org/10.5072/FK2765JP64

SIMULATION ASSESSMENT

Prehospital Cardiac Arrest Management Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
2	**Performance of focused history and physical (PC2)**	☐ Did not achieve Level 1	☐ Performs a reliable, comprehensive history and physical exam	☐ Performs and communicates a focused history and physical exam based on chief complaint and urgent issues	☐ Prioritizes essential components of history and physical exam given dynamic circumstances
3	**Diagnostic studies (PC3)**	☐ Did not achieve Level 1	☐ Determines the necessity of diagnostic studies	☐ Orders appropriate diagnostic studies. Performs appropriate bedside diagnostic studies/procedures	☐ Prioritizes essential testing Interprets results of diagnostic studies Reviews risks, benefits, contraindications, and alternatives to a diagnostic study or procedure
4	**Diagnosis (PC4)**	☐ Did not achieve Level 1	☐ Considers a list of potential diagnoses	☐ Considers an appropriate list of potential diagnosis May or may not make correct diagnosis	☐ Makes the appropriate diagnosis Considers other potential diagnoses, avoiding premature closure
5	**Pharmacotherapy (PC5)**	☐ Did not achieve Level 1	☐ Asks patient for drug allergies	☐ Selects an medication for therapeutic intervention, consider potential adverse effects	☐ Selects the most appropriate medication and understands mechanism of action, effect, and potential side effects Considers and recognizes drug-drug interactions

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SIMULATION ASSESSMENT

Prehospital Cardiac Arrest Management Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
6	**Observation and reassessment (PC6)**	☐ Did not achieve Level 1	☐ Reevaluates patient at least one time during case	☐ Reevaluates patient after most therapeutic interventions	☐ Consistently evaluates the effectiveness of therapies at appropriate intervals
7	**Disposition (PC7)**	☐ Did not achieve Level 1	☐ Appropriately selects whether to admit or discharge the patient	☐ Appropriately selects whether to admit or discharge Involves the expertise of some of the appropriate specialists	☐ Educates the patient appropriately about their disposition Assigns patient to an appropriate level of care (ICU/Tele/Floor) Involves expertise of all appropriate specialists
9	**General Approach to Procedures (PC9)**	☐ Did not achieve Level 1	☐ Identifies pertinent anatomy and physiology for a procedure Uses appropriate Universal Precautions	☐ Obtains informed consent Knows indications, contraindications, anatomic landmarks, equipment, anesthetic and procedural technique, and potential complications for common ED procedures	☐ Determines a back-up strategy if initial attempts are unsuccessful Correctly interprets results of diagnostic procedure
20	**Professional Values (PROF1)**	☐ Did not achieve Level 1	☐ Demonstrates caring, honest behavior	☐ Exhibits compassion, respect, sensitivity and responsiveness	☐ Develops alternative care plans when patients' personal beliefs and decisions preclude standard care

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SIMULATION ASSESSMENT

Prehospital Cardiac Arrest Management Simulation

Learner: _____

	Milestone	Did not achieve level 1	Level 1	Level 2	Level 3
22	**Patient centered communication (ICS1)**	☐ Did not achieve level 1	☐ Establishes rapport and demonstrates empathy to patient (and family) Listens effectively	☐ Elicits patient's reason for seeking health care	☐ Manages patient expectations in a manner that minimizes potential for stress, conflict, and misunderstanding. Effectively communicates with vulnerable populations, (at risk patients and families)
23	**Team management (ICS2)**	☐ Did not achieve level 1	☐ Recognizes other members of the patient care team during case (nurse, techs)	☐ Communicates pertinent information to other healthcare colleagues	☐ Communicates a clear, succinct, and appropriate handoff with specialists and other colleagues Communicates effectively with ancillary staff

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