Testing Case Scenario 1

Hypovolemic Shock
(Child)

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Scenario Lead-In

Prehospital: You have been dispatched to transport a 5 year old with a 3-day history of fever and diarrhea. She has been increasingly lethargic in the last 2 hours.

ED: You are asked to assess and manage a 5 year old with a 3-day history of fever and diarrhea. She has been increasingly lethargic in the last 2 hours. Efforts for peripheral intravenous access have been unsuccessful.

General inpatient unit: You are called to assess a 5 year old who has been admitted to the ward with a 3-day history of fever and diarrhea. She has been increasingly lethargic in the last hour and has had severe ongoing diarrhea. Her intravenous access is no longer functioning.

ICU: You are called to the bedside of a 5 year old who has been admitted to the intensive care unit with a 3-day history of fever and diarrhea. She has been increasingly lethargic in the last 2 hours and has had severe ongoing diarrhea. Her intravenous access is no longer functioning.

Vital Signs

Heart rate	140/min
Blood pressure	86/52 mm Hg
Respiratory rate	36/min
SpO_2	97% on room air
Temperature	38.0 °C
Weight	21 kg
Age	5 years

Scenario overview and learning objectives

Scenario Overview

Emphasis in this scenario should be on identification of compensated hypovolemic shock. Priorities include oxygen, immediate establishment of intravenous (IV) access, and administration of fluid bolus of isotonic crystalloid, repeated as needed to treat shock signs. Reassessment of cardiorespiratory status is needed during and after each fluid bolus. Glucose concentration should be checked early in this lethargic child.

Scenario-Specific Objectives

- Recognizes signs of compensated and hypotensive shock; this case illustrates compensated hypovolemic shock (key indicators include tachypnea without abnormal labor, tachycardia, cool and mottled skin, delayed capillary refill, and normotension)
- Summarizes signs and symptoms of hypovolemic shock; in this scenario, the child has a 3-day history of diarrhea and fever, signs of shock, poor skin turgor, and poor oral intake
- Demonstrates correct interventions for hypovolemic shock; the most important interventions in this scenario include oxygen administration, administration of one or more boluses of isotonic crystalloid, and careful reassessment during and after each fluid bolus
- Summarizes how to evaluate systemic (end-organ) perfusion; indirect indicators of end-organ perfusion include skin temperature/color, level of consciousness, and urine output

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance
- Anxious, restless

Breathing
- Fast rate, increased respiratory effort

Circulation
- Pale, dry, and significant mottling, especially in hands and feet

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Patent; no audible abnormal airway sounds (no stridor, no audible wheezing)
- Breathing/Ventilation: Respiratory rate about 36/min; minimal intercostal retractions; SpO_2 97% on room air, increases to 100% with 100% oxygen; lungs clear on auscultation
- Circulation/Perfusion: Central pulses fair, peripheral pulses weak; heart rate 140/min; blood pressure 86/52 mm Hg; capillary refill about 4 seconds; cool, mottled hands and feet

Remainder of primary assessment performed if airway, ventilation, and perfusion are adequately supported

- Disability: Poor skin turgor
- Exposure: Temperature 38.0 °C; weight 21 kg

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Identify

- Compensated shock
- Sinus tachycardia

Intervene

- Obtain vascular access (child has compensated shock, so initial attempt should focus on IV access).
- Administer a fluid bolus of 20 mL/kg of isotonic crystalloid rapidly via IV.
  - Assess perfusion and monitor cardiorespiratory status closely during and immediately after each fluid bolus.
  - Stop fluid bolus if signs of heart failure develop (eg, increased respiratory distress or development of rales or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Check point-of-care glucose concentration and treat hypoglycemia, if needed.
- Assess response to oxygen administration.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until after initial shock therapy)

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Diarrhea for 3 days
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: Conjunctivitis at 3 years
- **L**ast meal: No oral intake for 24 hours
- **E**vents (onset): 3-day history of low-grade fever and diarrhea; noted to be increasingly lethargic in last 2 hours

Physical examination

- Repeat vital signs after oxygen and one bolus of 20 mL/kg fluids: Heart rate 94/min; respiratory rate 30/min; SpO_2 98% with 100% oxygen by nonrebreathing face mask; blood pressure 90/50 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mucous membranes dry; neck supple
- Heart and lungs: Normal rate, no extra heart sounds or murmurs; lungs sound clear; capillary refill down to 3-4 seconds
- Abdomen: No palpable liver edge; nondistended; nontender; diminished bowel sounds
- Extremities: Cool hands and feet; weak peripheral pulses; capillary refill 3-4 seconds, central pulses stronger
- Back: Normal
- Neurologic: Lethargic; pupils 4 mm, equal, reactive

Identify

- Compensated hypovolemic shock

Intervene

- Repeat bolus of 20 mL/kg of isotonic crystalloid IV/intraosseous push; repeat if needed to treat persistent shock symptoms.
- Perform careful and frequent cardiorespiratory assessment during and after each fluid bolus.
  - Stop fluid bolus if signs of heart failure develop (increased respiratory distress or development of rales or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Arrange for transfer to the intensive care unit (unless child is already in intensive care.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Venous blood gas: pH 7.18, PCO_2 24 mm Hg, HCO_3 13 mEq/L, PO_2 74 mm Hg
- Glucose (point-of-care testing) 70 mg/dL (3.8 mmol/L)
- Pending: Electrolytes, blood urea nitrogen/creatinine, serum lactate
- Cultures: Blood, urine
- Temperature: 38.0 °C

Imaging

- Chest x-ray: Small heart, clear lung fields

Identify/intervene

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill children, particularly neonates and infants. Hypoglycemia should be treated immediately.
- Metabolic acidosis should correct with effective treatment of shock.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 1, Hypovolemic Shock (Child)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Assesses ABCDE, including **Vital Signs**
- Administers 100% oxygen
- Applies cardiac monitor and pulse oximeter
- Recognizes signs and symptoms of hypovolemic shock
- Categorizes shock as compensated
- Directs establishment of IV or intraosseous access
- Directs rapid administration of fluid bolus of isotonic crystalloid; monitors for signs of heart failure during and after fluid bolus
- Reassesses patient during and in response to interventions, particularly during and after each fluid bolus
- Repeats fluid bolus as needed to treat shock
- Checks glucose with point-of-care testing

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about
- how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- What are the therapeutic end points during shock management? (Answer: Normalized heart rate; improved peripheral perfusion, mental status, and urine output; normalized blood pressure; correction of metabolic/lactic acidosis)
- Which are the indirect signs of improved end-organ function? (Answer: Improved skin blood flow, increased responsiveness/improved level of consciousness, increased urine output, correction of lactic acidosis)

Testing Case Scenario 2

Lower Airway Obstruction

(Child; Asthma)

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Scenario Lead-In

Prehospital: You are responding to an emergency call for a 10-year-old girl with respiratory distress.

ED: A 10-year-old girl is brought in by first responders from her home after her mother called the local emergency response number saying that her daughter had respiratory distress.

General inpatient unit: You are called to the room of a 10-year-old girl who is being admitted from the emergency department for respiratory distress.

ICU: You are called to evaluate a 10-year-old girl just admitted to the intensive care unit for respiratory distress.

Vital Signs	
Heart rate	150/min
Blood pressure	102/62 mm Hg
Respiratory rate	30/min
SpO_2	88% on room air
Temperature	37 °C
Weight	35 kg
Age	10 years

Scenario overview and learning objectives

Scenario Overview

Emphasis in this scenario is on rapid identification and management of respiratory distress/potential respiratory failure caused by lower airway obstruction/asthma. The health care professional must quickly recognize signs of distress and provide initial therapy, including administration of 100% oxygen, nebulized albuterol, and oral corticosteroids. Nebulized ipratropium bromide may also be considered. The child improves so acceleration of care is not required. During the debriefing, the student is asked the indications for high-flow basal cannula, bilevel positive airway pressure, and endotracheal intubation.

Scenario-Specific Objectives

- Recognizes signs and symptoms of respiratory distress caused by lower airway obstruction; in this scenario, they include increased respiratory rate and effort, prolonged expiratory time, and wheezing
- Performs correct initial interventions for lower airway obstruction; in this scenario, they include administration of oxygen, albuterol nebulizer, corticosteroids, and possibly nebulized ipratropium bromide
- Discusses importance of obtaining expert consultation if a child with asthma has a history of intensive care unit (ICU) admissions and/or fails to respond to initial interventions

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Anxious; sitting up in bed

Breathing

- Increased rate and effort with retractions

Circulation

- Pink lips and nailbeds; well perfused

Identify

- Respiratory distress

Intervene

- Perform rapid cardiopulmonary assessment.
- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment

- Airway: Patent and unobstructed; nasal flaring present; no abnormal upper airway sounds are audible
- Breathing: Respiratory rate 42/min; substernal retractions; diffuse bilateral expiratory wheezes on auscultation; prolonged expiratory phase; decreased air movement throughout; SpO_2 88% on room air before provision of 100% oxygen by nonrebreathing face mask; 95% with nonrebreathing face mask
- Circulation: Heart rate 150/min; pink lips and nailbeds; strong radial pulse; capillary refill 2 seconds; blood pressure 102/62 mm Hg
- Disability: Anxious, but alert; speaking in 3- to 4-word sentences
- Exposure: Temperature 37 °C; weight 35 kg

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Identify

- Respiratory distress, failure
- Lower airway obstruction

Intervene

- Allow child to maintain position of comfort.
- Assess response to oxygen.
- Administer nebulized albuterol and nebulized ipratropium bromide.
- Administer oral corticosteroids.

Evaluate—secondary assessment

SAMPLE history

- **S**igns and symptoms: Cough; respiratory distress; family members smoke in the house
- **A**llergies: Molds and grass
- **M**edications: Inhaler that has not been refilled for several weeks
- **P**ast medical history: History of asthma; 3 ICU admissions for respiratory failure; asthma poorly controlled due to poor compliance with medical care
- **L**ast meal: Ate last meal 4 hours ago
- **E**vents (onset): Cold symptoms for the last 3 days; increased coughing and work of breathing for the past 24 hours

Physical examination

- Repeat vital signs after oxygen and fluids: Respiratory rate 24/min; heart rate 132/min; SpO_2 95%; blood pressure 124/76 mm Hg
- Head, eyes, ears, nose, and throat/neck: Airway remains patent
- Heart and lungs: Expiratory wheezes decreasing in intensity; expiratory phase not as abnormally long; improving air movement; mild substernal retractions
- Abdomen: Normal
- Extremities: Pulses 2+ peripherally; brisk capillary refill
- Back: Normal
- Neurologic: Remains anxious, but now speaking in complete sentences; no neurologic abnormalities

Identify

- Respiratory distress
- Lower airway obstruction

Intervene

- Assess response to albuterol and ipratropium.
- If wheezing and respiratory distress continue and aeration is not improved, provide continuous nebulized albuterol. Consult a health care professional with expertise in management of status asthmaticus in children to develop a plan for acceleration of care.
- Recognize that further acceleration in care of the asthma does not appear to be needed at this time (child improving), but discuss next steps in care with consulting expert.
- Continue very close observation and consider additional diagnostic testing (eg, chest x-ray).
- Arrange for transfer of child to the ICU (if the child is not already in the ICU).
- Check point-of-care glucose concentration.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Glucose (point-of-care testing) 128 mg/dL (7.1 mmol/L)

Imaging

- None

Identify/intervene

- Although laboratory tests are generally not appropriate during immediate management, a blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children. Hypoglycemia should be treated immediately.
- Additional testing (eg, chest x-ray) may be performed if child demonstrates any additional respiratory signs or symptoms.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 2, Lower Airway Obstruction (Child; Asthma)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Directs administration of 100% oxygen
- Applies cardiac monitor and pulse oximeter
- Recognizes signs and symptoms of lower airway obstruction
- Identifies respiratory distress
- Initiates therapy for asthma, including continued oxygen administration, nebulized albuterol, and corticosteroids
- Directs reassessment of patient in response to each intervention
- Summarizes additional therapy to provide if indicated (ie, give nebulized albuterol continuously, administer nebulized ipratropium bromide, consider magnesium sulfate)

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about
- how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- In this scenario, the child improved. If this child continued to deteriorate despite the care provided, and expert consultation was available, what would be the indications for bag-mask ventilation or other airway or ventilation support? (Answer includes decreased level of consciousness; decreased air movement; and decreased wheezing, bradycardia, and pulsus paradoxus.) Note that it is important to seek expert consultation before the patient deteriorates to this point.

Testing Case Scenario 3

Upper Airway Obstruction
(Infant)

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Scenario Lead-In

Prehospital: You are called to a home in the middle of the night for a 9-month-old infant who is having difficulty breathing. He has had upper respiratory congestion and a low-grade fever for the past 2 days.

ED: A 9-month-old infant presents with sudden onset of noisy breathing during the night. He has had upper respiratory congestion and a low-grade fever for the past 2 days.

General inpatient unit: A 9-month-old infant has just been admitted from his pediatrician's office after presenting with difficulty breathing. He has had upper respiratory congestion and a low-grade fever for the past 2 days.

ICU: A 9-month-old infant admitted 2 days ago with newly diagnosed diabetes has developed noisy breathing.

Vital Signs	
Heart rate	140/min
Blood pressure	86/58 mm Hg
Respiratory rate	48/min
SpO_2	89% on room air
Temperature	38 °C
Weight	8 kg
Age	9 months

Scenario overview and learning objectives

Scenario Overview

Emphasis in this scenario is on rapid recognition and management of respiratory distress associated with upper airway obstruction. Appropriate therapies include allowing the infant to assume a position of comfort and administering oxygen, nebulized epinephrine, and dexamethasone. The health care professional must demonstrate frequent reassessment to verify continued improvement in response to therapy and must be able to describe the clinical signs of deterioration that would indicate the need to obtain immediate expert consultation to provide advanced monitoring and care.

Scenario-Specific Objectives

- Identifies the signs and symptoms of respiratory distress caused by upper airway obstruction; in this scenario, they include tachypnea, increased respiratory effort, and stridor
- Recognizes importance of allowing the infant to maintain a position of comfort and for health care professionals to minimize stimulation; in this scenario, health care professionals should avoid unnecessary venipuncture for laboratory studies and establish an intravenous access only if it is absolutely necessary
- Performs correct interventions for significant upper airway obstruction; in this scenario, these include administration of oxygen, nebulized epinephrine, and dexamethasone
- Reassesses patient frequently to determine response to each intervention

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance
- Crying and fussy; being held by parent in attempt to console

Breathing
- Tachypneic with increased work of breathing, severe stridor with agitation, mild stridor at rest

Circulation
- Appears pale

Identify

- Respiratory distress

Intervene

- Perform rapid cardiopulmonary assessment.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment

- Airway: Unobstructed but noisy; high-pitched inspiratory stridor when agitated, stridor minimal but still audible when resting
- Breathing: Respiratory rate 48/min; suprasternal retractions; transmitted upper airway noises to lung fields-otherwise, lung fields are clear; good aeration bilaterally; no wheezing; SpO_2 89% before oxygen administration and 98% after provision of oxygen by face mask, or nasal cannula
- Circulation: Heart rate 140/min; skin pink and well perfused; strong peripheral pulses; capillary refill 2 seconds; blood pressure 86/58 mm Hg
- Disability: Awake and alert; fussy but consolable
- Exposure: Temperature 38.0 °C; weight 8 kg

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Identify

- Respiratory
- Upper airway obstruction

Intervene

- Administer oxygen by face mask or nasal cannula. Assess response to oxygen.
- Allow infant to maintain position of comfort; encourage parent to hold infant.
- Give nebulized epinephrine.

Evaluate—secondary assessment

SAMPLE history

- **S**igns and symptoms: Awoke with barking, seal-like cough; restless; crying; had upper respiratory infection and low-grade fever for the past 2 days
- **A**llergies: None known
- **M**edications: Acetaminophen for fever given by mother 2 hours ago
- **P**ast medical history: Otitis media at 6 and 8 months
- **L**ast meal: Ate well 2 hours ago
- **E**vents (onset): Cold symptoms (nasal discharge; dry, barky cough; low-grade fever) for the last 2 days; symptoms worsen at night but improve during the day

Physical examination

- Repeat vital signs after oxygen and nebulized epinephrine: Heart rate 158/min; respiratory rate 32/min; SpO_2 99% on supplemental oxygen; blood pressure 92/66 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mild nasal flaring; yellowish nasal discharge; stridor now present with agitation but resolved at rest
- Heart and lungs: Lungs clear; transmitted upper airway sounds (less pronounced); suprasternal retractions improved
- Abdomen: Normal
- Extremities: Normal
- Back: Normal
- Neurologic: Fussy; cries vigorously; moving all extremities; parent able to console

Identify

- Respiratory distress
- Upper airway obstruction

Intervene

- Reassess cardiorespiratory status after epinephrine administration.
- Attempt to minimize stimulation of the infant.
- Monitor for at least 2 hours for recurrent airway edema/stridor. If signs recur, consider the following:
  - If oxygenation remains adequate, and health care professional is familiar with its use, consider use of heliox.
  - Be prepared to obtain expert consultation to develop plan of care (expertise is required to perform intubation and provide advanced monitoring and care).
- Administer oral/intravenous/intramuscular corticosteroid (eg, dexamethasone).
- Wean supplemental oxygen as tolerated.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- None at his time

Imaging

- Lateral soft tissue neck radiographs are generally not necessary

Identify/intervene

- Laboratory tests are generally not appropriate during initial stabilization to minimize stimulation and prevent agitation that may be associated with more respiratory distress and respiratory compromise.
- A blood glucose concentration should generally be checked as soon as reasonably possible in all critically ill infants and children. However, this infant has upper airway obstruction, and any agitation can worsen respiratory distress. In addition, the infant is alert and has fed well recently. As a result, in this case, the glucose evaluation should be deferred.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 3, Upper Airway Obstruction (Infant)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Administers humidified oxygen as needed
- Applies cardiac monitor and pulse oximeter
- Recognizes signs and symptoms of upper airway obstruction
- Identifies respiratory distress rather than failure
- Provides appropriate initial management of upper airway obstruction, including allowing the infant to assume a position of comfort and administering humidified oxygen, nebulized epinephrine, and dexamethasone
- Reassesses the infant frequently and evaluates response to interventions
- Recognizes the need to obtain early expert consultation from practitioners able to provide skilled intubation and advanced monitoring and care

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about
- how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- This infant was stable in the scenario. However, if your interventions were not successful, what would be the signs of deterioration and possible indications for bag-mask ventilation or other airway or ventilation support? (Answer: Very rapid or inadequate respiratory rate or irregular breathing pattern; signs of significantly increased work of breathing; decreased breath sounds or aeration; deterioration in level of consciousness, hypoxemia, or cyanosis) Note that advanced expertise is needed for intubation and mechanical ventilation.

Testing Case Scenario 4

Asystole

(Child; Arrest)*

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Scenario Lead-In

Prehospital: You are dispatched to a house where a 6-year-old boy is pulled from a pool and is pulseless. Parents started CPR and called the local emergency response number.

ED: An ambulance is en route to the emergency department with a 6-year-old drowning victim. CPR is ongoing.

General inpatient unit: You are called as a member of the rapid response team to see a 6 year old who became limp and unresponsive. Child was admitted after being pulled from a pool for treatment of pneumonia. CPR is in progress.

ICU: You are called to see a 6 year old who became progressively limp and unresponsive. The child was admitted for intravenous antibiotics for pneumonia after being pulled from a pool. X-rays that showed a possible small pleural effusion 6 hours ago. The remainder of the emergency department workup was unremarkable. CPR is in progress.

Vital Signs	
Heart rate	CPR in progress
Blood pressure	CPR in progress
Respiratory rate	Bag-mask ventilation (CPR)
SpO_2	Not obtainable
Temperature	Deferred
Weight	23 kg
Age	6 years

Scenario overview and learning objectives

Scenario Overview

This scenario focuses on the identification and management of the child with cardiac arrest and a "nonshockable" rhythm. Emphasis is placed on immediate delivery of high-quality CPR and early administration of epinephrine. The student should identify potential reversible causes of asystole (H's and T's), submersion-caused hypoxia and cardiac arrest in this scenario. Although not required for successful completion of the scenario, the instructor may (if time allows) discuss important elements of post–cardiac arrest care, including titration of inspired oxygen concentration to maintain SpO_2 of 94%-99%; targeted temperature management (especially avoidance or aggressive treatment of fever); hemodynamic support; support of airway, ventilation, and perfusion; and support of neurologic and other end-organ function.

Scenario-Specific Objectives

- Identifies cardiac arrest with a nonshockable rhythm; in this scenario, the child has asystole
- Describes correct dose and rationale for epinephrine administration
- Summarizes potentially reversible causes of asystole and considers possible reversible causes of cardiac arrest (recalled by conditions beginning with H's and T's); in this child, submersion and hypoxia are the causes
- Discusses principles of post–cardiac arrest care; for this scenario, these include titration of inspired oxygen concentration as tolerated; targeted temperature management (especially prevention of fever); hemodynamic support; support of airway, oxygenation, and ventilation; and support of neurologic and other end-organ function

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Extremities appear to be limp; no spontaneous movement and no visible reaction to noise

Breathing

- No spontaneous breathing

Circulation

- Cyanotic/pale extremities and lips; severe mottling

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Check for response (no response) and perform simultaneous check for breathing (none) and carotid or femoral pulse (none).
- Immediately begin high-quality CPR.

Evaluate—primary assessment (Deferred to provide immediate basic life support)

- No response to tap and shout
- No breathing
- No pulse
- Weight 23 kg using color-coded length-based resuscitation tape

*Could also use as pulseless electrical activity case if needed.

Identify

- Cardiopulmonary arrest

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Intervene

- Use a CPR feedback device to guide CPR delivery.
- When defibrillator arrives, apply pads/leads and turn on monitor.
- Identify rhythm (asystole); immediately resume high-quality CPR and check rhythm every 2 minutes.
- Obtain vascular access (intravenous [IV]/intraosseous [IO]).
- Give epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO during chest compressions. Follow with saline flush. Repeat every 3-5 minutes during cardiac arrest.
- Apply blood pressure cuff (per local protocol, may be deferred until return of spontaneous circulation [ROSC]).
- Apply pulse oximeter (per local protocol, may be deferred until ROSC).

Evaluate—secondary assessment (Deferred except to identify reversible causes)

SAMPLE history (deferred until ROSC or only to extent needed to evaluate reversible causes, ie, the H's and T's; do not interrupt resuscitation)

- **S**igns and symptoms: History as reported in Scenario Lead-In
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: 4 hours ago
- **E**vents (onset): As specified in Scenario Lead-In

Physical examination (deferred until ROSC or only to extent needed to evaluate reversible causes)

- Vital signs after ROSC following high-quality CPR and 2 doses of epinephrine: Sinus rhythm; heart rate 150/min; respiratory rate 20/min (with bag-mask ventilation); SpO_2 98%; blood pressure 85/50 mm Hg; temperature 36 °C

If no epinephrine is delivered or CPR quality is poor, asystole continues.

Identify

- Cardiopulmonary arrest
- Asystole
- ROSC

Intervene

- Continue high-quality CPR.
- Reassess rhythm and rotate compressors every 2 minutes; minimize interruptions in chest compressions, limiting any pause to less than 10 seconds.
- Consider potentially reversible causes of asystole (H's and T's).
- Consider placement of an advanced airway, especially if unable to provide adequate ventilation with a bag-mask device and an advanced care professional is available.
- After ROSC (as time allows)
  - Apply pulse oximeter (if not already applied). Titrate inspired oxygen concentration to maintain SpO_2 of 94%-99%.
  - Provide targeted temperature management, including prevention or rapid treatment of fever.
  - Titrate vasoactive drugs to maintain blood pressure in normal range.
  - Support airway, oxygenation, and ventilation.
  - Support neurologic and other end-organ function.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data (as appropriate)

- Blood glucose 108 mg/dL (6.0 mmol/L) (after ROSC)
- Arterial/venous blood gas, electrolytes, calcium, magnesium

Imaging ROSC

- Chest x-ray (after ROSC): Normal heart size and moderate pulmonary edema

Identify/intervene

- Blood work and chest x-ray are not available during the scenario.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 4, Asystole (Child; Arrest)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Identifies cardiac arrest
- Directs immediate initiation of high-quality CPR with the use of a feedback device (if available)
- Directs placement of monitor leads/pads and activation of monitor
- Identifies asystole
- Directs establishment of IV or IO access
- Directs preparation and administration of epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO bolus at appropriate intervals
- Directs checking rhythm approximately every 2 minutes while minimizing interruptions in chest compressions
- Identifies at least 3 potential reversible causes of pulseless electrical activity (recalled by the H's and T's)
- Performs appropriate reassessments

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about
- how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- Of the potential reversible causes of asystole in this patient, which are most likely? (Answer: Hypoxia)
- Although not covered in this scenario, what are the key elements of post–cardiac arrest care? (Answer should include titration of oxygen; targeted temperature management; hemodynamic support and support of airway, oxygenation, and ventilation; support of neurologic and other end-organ function.)

Testing Case Scenario 5

Pulseless Electrical Activity

(Infant; Arrest)*

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Scenario Lead-In

Prehospital: You are dispatched to a house where a 9-month-old infant with a 2-day history of high fever is now unresponsive.

ED: An ambulance is en route to the emergency department with a 9-month-old infant who was found unresponsive in her crib. There is a 2-day history of high fever. CPR is ongoing.

General inpatient unit: You are called as a member of the rapid response team to see a 9 month old who was admitted with sepsis but has now become limp and unresponsive.

ICU: You are called to see a 9 month old who became progressively limp and unresponsive. The infant was admitted with sepsis and was found to be hypotensive at the time of the emergency department visit, though the remainder of the emergency department workup was unremarkable.

Vital Signs	
Heart rate	CPR in progress
Blood pressure	CPR in progress
Respiratory rate	100% bag-mask ventilation (CPR)
SpO_2	Not obtainable
Temperature	Deferred
Weight	8 kg
Age	9 months

Scenario overview and learning objectives

Scenario Overview

This scenario focuses on the identification and management of the infant with cardiac arrest and a "nonshockable" rhythm. Emphasis is placed on immediate delivery of high-quality CPR and early administration of epinephrine. The student should identify potential causes of pulseless electrical activity (PEA) (H's and T's). The infant's history of high fever suggests that sepsis/septic shock and hypovolemia may be the cause of deterioration and arrest. Although not required for successful completion of the scenario, the instructor may (if time allows) discuss important elements of post–cardiac arrest care, including titration of inspired oxygen concentration to maintain SpO_2 of 94%-99%; targeted temperature management (especially avoidance or aggressive treatment of fever); hemodynamic support; support of airway, ventilation, and perfusion; and support of neurologic and other end-organ function.

Scenario-Specific Objectives

- Identifies cardiac arrest with a nonshockable rhythm; in this scenario, the infant has PEA
- Describes correct dose and rationale for epinephrine administration
- Summarizes potentially reversible causes of PEA and considers possible reversible causes of cardiac arrest (recalled by conditions beginning with H's and T's); in this infant, the history of high fever suggests sepsis/septic shock with resultant hypovolemia as a cause
- Discusses principles of post–cardiac arrest care; these include titration of inspired oxygen concentration as tolerated; targeted temperature management (especially prevention of fever); hemodynamic support; support of airway, oxygenation, and ventilation; and support of neurologic and other end-organ function

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance
- Appears to be limp; no spontaneous movement; no visible reaction to noises

Breathing
- No spontaneous breathing

Circulation
- Cyanotic/pale extremities and lips; severe mottling

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Check for response (no response) and perform simultaneous check for breathing (none) and brachial pulse (none).
- Immediately begin high-quality CPR.

Evaluate—primary assessment (Deferred to provide immediate basic life support)

- No response to tap and shout
- No breathing
- No pulse
- Weight 8 kg per color-coded length-based resuscitation tape

*Could also use as asystole case if needed.

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Identify

- Cardiopulmonary arrest

Intervene

- Use a CPR feedback device to guide CPR delivery.
- When defibrillator arrives, apply pads/leads and turn on monitor.
- Identify rhythm (PEA); immediately resume high-quality CPR, and check rhythm every 2 minutes.
- Obtain vascular access (intravenous [IV]/intraosseous [IO]).
- Give epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO during chest compressions; follow with saline flush. Repeat every 3-5 minutes during cardiac arrest.
- Apply blood pressure cuff (per local protocol, may be deferred until return of spontaneous circulation [ROSC]).
- Apply pulse oximeter (per local protocol, may be deferred until ROSC).

Evaluate—secondary assessment (Deferred except to identify reversible causes)

SAMPLE history (deferred until ROSC or only to extent needed to evaluate reversible causes, ie, the H's and T's; do not interrupt resuscitation)

- **S**igns and symptoms: History as reported in Scenario Lead-In
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: 2 hours ago
- **E**vents (onset): As specified in Scenario Lead-In

Physical examination (deferred until ROSC or only to extent needed to evaluate reversible causes)

- Vital signs after ROSC following high-quality CPR and 1 dose of epinephrine: Sinus rhythm; heart rate 170/min; blood pressure 75/50 mm Hg; respiratory rate 20/min with bag-mask ventilation; SpO_2 98%; temperature 36 °C

If no epinephrine is delivered or CPR quality is poor, PEA continues.

Identify

- Cardiac arrest
- PEA
- ROSC

Intervene

- Continue high-quality CPR.
- Reassess rhythm and rotate compressors every 2 minutes while minimizing pauses in compressions, limiting any pause to less than 10 seconds.
- Consider potentially reversible causes of PEA (H's and T's).
- The advanced care professional may consider hypovolemia as a cause of PEA in a child with a high likelihood of sepsis and give a fluid bolus of 10-20 mL/kg isotonic crystalloid.
- Consider placement of an advanced airway, especially if unable to provide adequate ventilation with a bag-mask device and an advanced care professional is available.
- After ROSC (as time allows)
  - Apply pulse oximeter (if not already applied). Titrate oxygen to maintain SpO_2 of 94%-99%.
  - Provide targeted temperature management, including prevention or rapid treatment of fever.
  - Titrate vasoactive drugs to maintain blood pressure in normal range.
  - Support airway, oxygenation, and ventilation.
  - Support neurologic and other end-organ function.
  - Evaluate for possible infection, septic shock.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data (as appropriate)

- Blood glucose 108 mg/dL (6.0 mmol/L) (after ROSC)
- Arterial/venous blood gas, electrolytes, calcium, magnesium, blood culture

Imaging

- Chest x-ray (after ROSC): Normal heart and lung fields

Identify/intervene

- Blood work and chest x-ray are not available during the scenario.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 5, PEA (Infant; Arrest)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Identifies cardiac arrest
- Directs immediate initiation of high-quality CPR with the use of a feedback device (if available)
- Applies cardiac monitor and pulse oximeter
- Identifies PEA
- Directs establishment of IV or IO access
- Directs preparation and administration of epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO bolus at appropriate intervals
- Directs checking rhythm approximately every 2 minutes while minimizing interruptions in chest compressions
- Identifies at least 3 potential reversible causes of PEA (recalled by the H's and T's)
- Performs appropriate
- reassessments

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- Of the potential reversible causes of PEA in this patient, which are most likely? (Answer: Hypovolemia with sepsis)
- Although not covered in this scenario, what are the key elements of post–cardiac arrest care? (Answer should include titration of oxygen; targeted temperature management; hemodynamic support and support of airway, oxygenation, and ventilation; support of neurologic and other end-organ function.)

Testing Case Scenario 6

Lung Tissue (Parenchymal) Disease

(Child)

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Scenario Lead-In

Prehospital: You are responding to an emergency call for a 3-year-old boy in respiratory distress.

ED: A 3-year-old boy is brought in by first responders from his home after his mother called the local emergency response number saying that her child had respiratory distress.

General inpatient unit: You are called to the room of a 3-year-old boy who is being admitted from the emergency department for respiratory distress.

ICU: You are evaluating a 3-year-old boy at change of shift with new-onset respiratory distress.

Vital Signs	
Heart rate	160/min
Blood pressure	110/78 mm Hg
Respiratory rate	38/min
SpO_2	80% on room air
Temperature	38.5 °C
Weight	12 kg
Age	3 years

Scenario overview and learning objectives

Scenario Overview

Emphasis in this scenario is on rapid recognition and initial management of respiratory failure associated with lung tissue (parenchymal) disease. Immediate administration of 100% oxygen is required. Signs of respiratory failure indicate the need for assisted ventilation and contacting an advanced care professional with appropriate expertise. During debriefing, the method to estimate endotracheal tube size is discussed. Although not required for successful completion of the scenario, the possible use of continuous positive airway pressure (CPAP) or noninvasive ventilation can be addressed with emphasis that such therapy must be provided in appropriate settings where continuous monitoring is provided, and intubation equipment and appropriate health care professional expertise are readily available.

Scenario-Specific Objectives

- Distinguishes between respiratory distress and respiratory failure; in this scenario, the child's clinical signs are consistent with respiratory failure
- Identifies signs of lung tissue disease in a pediatric patient; in this scenario, the signs of lung tissue disease include tachypnea, increased respiratory effort, grunting, crackles (rales), tachycardia, and hypoxemia despite oxygen administration
- Implements correct interventions for lung tissue disease; in this scenario, interventions include administration of a high concentration of oxygen, appropriate monitoring, frequent reassessment, and more advanced support of the child's oxygenation and ventilation (eg, typically with bag-mask ventilation and then with intubation and positive-pressure ventilation)
- Describes how noninvasive ventilatory support, such as CPAP or noninvasive positive-pressure ventilation, may improve oxygenation in lung tissue disease; in this scenario, CPAP or noninvasive positive-pressure ventilation may increase alveolar volume and improve matching of ventilation and perfusion (and oxygenation)
- Recalls the common causes of lung tissue disease; common causes of lung tissue disease include pneumonia and aspiration

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance
- Lethargic

Breathing
- Rapid respirations; grunting

Circulation
- Pale skin

Identify

- Immediate intervention needed

Intervene

- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Unobstructed but noisy; grunting
- Breathing: Rapid respirations; moderate intercostal and subcostal retractions; crackles heard over right chest; no stridor or wheezing; expiratory phase is not prolonged; respiratory rate 38/min; SpO_2 80% on room air
- Circulation: Heart rate 160/min; pale skin; strong radial pulse; capillary refill 2 seconds; blood pressure 110/78 mm Hg
- Disability: Arouses to verbal stimuli
- Exposure: Temperature 38.5 °C; weight 12 kg

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Identify

- Respiratory failure
- Lung tissue disease

Intervene

- Allow child to maintain position of comfort.
- Assess response to oxygen.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until after stabilization of airway, oxygenation, and ventilation)

SAMPLE history

- **S**igns and symptoms: Worsening respiratory distress, cough, and fever for the past 2 days
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: 8 hours ago
- **E**vents (onset): Child recently diagnosed with influenza

Physical examination

- Repeat vital signs after oxygen: Respiratory rate 38/min; heart rate 160/min; SpO_2 still 80% with 100% oxygen by nonrebreathing face mask; blood pressure 110/74 mm Hg
- Head, eyes, ears, nose, and throat/neck: Normal
- Heart and lungs: Aeration fair; retractions increasing with occasional grunting; crackles now heard over right chest; central and peripheral pulses remain strong; capillary refill remains 2 seconds
- Abdomen: Normal
- Extremities: Normal
- Back: Normal
- Neurologic: Lethargic; becoming less responsive; only arouses to painful stimuli

Identify

- Respiratory failure
- Lung tissue disease

Intervene

- Begin bag-mask ventilation with 100% oxygen (verify chest rise with ventilation) and contact an advanced care professional with appropriate expertise to assist with intubation and initiation of mechanical ventilation.
  - *Note:* If the child's level of consciousness improves and the child can be continuously monitored, critical care professionals may consider a brief trial of noninvasive ventilation support (noninvasive positive-pressure ventilation) if there is equipment and appropriate expertise for rapid intubation immediately available.
- Prepare equipment and skilled personnel for endotracheal intubation using a cuffed tracheal tube.
- Obtain vascular access.
- Obtain arterial/venous blood gas.
- Treat fever with antipyretics.
- Arrange transfer of the child to an intensive care unit (unless the child is already in intensive care).
- Consider specific interventions for lung tissue disease (eg, antibiotics for suspected pneumonia).

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Complete blood count, blood culture, arterial/venous blood gas pending
- Glucose (point-of-care testing) 136 mg/dL (7.5 mmol/L)

Imaging

- Chest x-ray

Identify/intervene

- Laboratory tests generally are not appropriate during the first 5-10 minutes when attempting to stabilize a hypoxemic child with
- severe respiratory distress/respiratory failure.
- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children. Hypoglycemia should be treated immediately.
- Chest x-ray shows large right-sided pneumonia with no obvious pleural effusion.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 6, Lung Tissue (Parenchymal) Disease (Child)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Directs administration of 100% oxygen via nonrebreathing face mask and evaluates response
- Applies cardiac monitor and pulse oximeter
- Identifies respiratory failure
- Identifies signs of lung tissue disease
- Evaluates response to 100% oxygen and determines need for additional intervention
- Provides or directs provision of bag-mask ventilation
- Describes methods to verify that bag-mask ventilation is effective
- Directs establishment of intravenous access
- Performs frequent reassessment of patient
- Identifies need for involvement of advanced care professional with expertise in pediatric intubation and mechanical ventilation
- Identifies indications for endotracheal intubation

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- If this child requires intubation, how would you estimate the appropriate cuffed endotracheal tube size?
- Can you explain why CPAP or noninvasive positive-pressure ventilation might improve this child's oxygenation? (Answer: It will increase alveolar ventilation and ventilation-perfusion match.) Discuss why it is important that such care be provided in a setting where continuous monitoring of the child is possible and appropriate expertise is immediately available.

Testing Case Scenario 7

Distributive Shock

(Infant; Septic Shock)

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Scenario Lead-In

Prehospital: You have been dispatched to transport a 4 month old with a 24-hour history of high fever and lethargy. She has not been feeding well.

ED: You are asked to assess and manage a 4 month old with a 24-hour history of high fever and lethargy. She has not been feeding well.

General inpatient unit: You are called to assess a 4 month old who has just been admitted to the ward with a 24-hour history of high fever and lethargy. She has not been feeding well. The intravenous access placed at the time of admission is no longer functioning.

ICU: You are called to the bedside of a 4 month old who has just been admitted to the intensive care unit with a 24-hour history of high fever and lethargy. She has not been feeding well. The intravenous access placed at the time of admission is no longer functioning.

Vital Signs	
Heart rate	192/min
Blood pressure	76/30 mm Hg
Respiratory rate	55/min
SpO_2	93% on room air
Temperature	39.0 °C
Weight	5.1 kg
Age	4 months

Scenario overview and learning objectives

Scenario Overview

Emphasis should be on identification of compensated distributive/septic shock. Priorities include immediate establishment of intravenous (IV)/intraosseous (IO) access and administration of fluid bolus(es) of isotonic crystalloid with careful reassessment of cardiorespiratory function during and after each fluid bolus. The health care professional should recognize the signs of heart failure and stop bolus fluid administration. Within the first hour of identification of signs of septic shock, health care professionals must also administer antibiotics and initiate vasoactive drug therapy if shock persists despite bolus fluid administration. The infant is lethargic, so early point-of-care (POC) glucose check is indicated.

Scenario-Specific Objectives

- Recognizes compensated vs hypotensive shock; in this scenario, the infant demonstrates compensated shock (blood pressure is not hypotensive)
- Recognizes need for early/rapid intervention with bolus administration of isotonic crystalloids and vasoactive drug therapy within the first hour if shock signs/symptoms persist despite bolus fluid administration
- Understands that the bolus recommendations, both type and amount, have changed to balanced/buffered crystalloids and 10-20 mL/kg per bolus, respectively.
- Recognizes the need for careful and frequent cardiorespiratory reassessment during and after each fluid bolus; the health care professional looks for signs of heart failure (increased respiratory distress or development of rales or hepatomegaly) and stops bolus fluid administration if signs of heart failure develop
- Recognizes need for early/rapid administration of antibiotics (during the first hour after identification of shock symptoms)

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Lethargic, does react to voices in room

Breathing

- Increased rate and effort

Circulation

- Pale, with significant mottling of extremities

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

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Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Clear
- Breathing: Respiratory rate about 55/min; mild subcostal and intercostal retractions; mild nasal flaring; SpO_2 93% on room air, increased to 97% with administration of 100% oxygen; lungs clear to auscultation
- Circulation: Central pulses fair, peripheral pulses weak; heart rate 192/min; blood pressure 74/50 mm Hg capillary refill 5 seconds; cool and mottled hands and feet
- Disability: Lethargic
- Exposure: Rectal temperature 39.0 °C; no rash; weight 5.1 kg

Identify

- Respiratory distress
- Compensated shock (likely septic shock)
- Sinus tachycardia

Intervene

- Obtain vascular access (IV/IO).
- Administer a 10-20 mL/kg bolus of isotonic crystalloid rapidly IV/IO. Reassess during and after fluid bolus.
  - Stop fluid bolus if signs of heart failure develop (eg, increased respiratory distress or development of rales or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Administer antibiotics within the first hour after recognition of shock (if not already done).
- Obtain blood culture, if possible, before antibiotic administration, but do not delay antibiotic or fluid administration to obtain cultures.
- Check POC glucose concentration and treat hypoglycemia, if needed.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until after initial shock therapy)

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Lethargy and high fever for 24 hours before, rapid breathing
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: Term newborn
- **L**ast meal: Formula several hours ago
- **E**vents (onset): 24-hour history of fever and increasing lethargy; increased work of breathing noticed this morning

Physical examination

- Repeat vital signs after oxygen and fluids: Heart rate 160-175/min; respiratory rate 50/min; SpO_2 100% with 100% oxygen; blood pressure 76/52 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mucous membranes slightly dry
- Heart and lungs: Rapid rate, no extra heart sounds or murmurs; lungs sound clear
- Abdomen: No palpable liver edge; nondistended; nontender; hypoactive bowel sounds
- Extremities: Cool hands and feet; dusky, capillary refill 4 seconds
- Neurologic: Lethargic; pupils 4 mm, equal, reactive

Identify

- Compensated distributive shock (likely sepsis)

Intervene

- If signs of shock persist, repeat fluid bolus of 10-20 mL/kg of balanced/buffered crystalloid as needed. Reassess during and after each fluid bolus. Stop fluid bolus if signs of heart failure develop (eg, increased respiratory distress or development of rales or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Begin vasoactive drug therapy if systemic perfusion fails to improve after 40-60 mL/kg of fluid therapy.
  - Consider administration of epinephrine or norepinephrine infusion.
- Ensure that bolus fluid therapy, administration of appropriate antibiotics, and initiation of vasoactive therapy (if shock is fluid refractory) are all accomplished within first hour after the identification of signs of septic shock.
- Assess response to oxygen administration.
- Arrange for transfer to appropriate setting (unless infant is already in the intensive care unit).

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Capillary gas: pH 7.18, PCO_2 24 mm Hg, PO_2 20 mm Hg, base deficit/excess −18; hemoglobin 11 g/dL
- Glucose (POC) 185 mg/dL (10.3 mmol/L)
- Pending: Electrolytes, blood urea nitrogen/creatinine, calcium, complete blood count with differential, prothrombin time/international normalized ratio/partial thromboplastin time
- Cultures: Blood, urine

Imaging

- Chest x-ray: Small heart, clear lung fields

Identify/intervene

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill children, particularly neonates and infants. Hypoglycemia should be treated immediately.
- Metabolic acidosis with partial respiratory compensation should correct with effective treatment of shock.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 7, Distributive Shock (Infant; Septic Shock)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Administers 100% oxygen
- Applies cardiac monitor and pulse oximeter
- Identifies signs and symptoms of septic shock in an infant
- Categorizes shock as compensated
- Directs establishment of IV or IO access
- Directs rapid administration of 10-20 mL/kg fluid bolus of isotonic crystalloid
- Reassesses patient during and in response to interventions, particularly during and after each fluid bolus; stops fluid bolus if signs of heart failure develop
- Repeats fluid bolus as needed to treat shock, with careful reassessment during and after each fluid bolus
- Checks glucose with POC testing early in the care of the lethargic infant
- Directs early (ie, within first hour after identification of shock) administration of antibiotics
- Directs initiation of vasoactive drug therapy within the first hour after the recognition of shock if shock fails to respond to fluid boluses

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (directed to the Timer/Recorder)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about
- how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- What are the therapeutic end points during shock management? (Answer: Normalized heart rate; improved peripheral perfusion, mental status, and urine output; normalized blood pressure; correction of metabolic/lactic acidosis)

Testing Case Scenario 8

Supraventricular Tachycardia

(Adolescent; Stable)

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Scenario Lead-In

Prehospital: You are dispatched to a house where a 12-year-old boy has tachypnea and a racing heart.

ED: An ambulance is en route to the emergency department with a 12-year-old boy with tachypnea and a racing heart. An intravenous access has been placed.

General inpatient unit: You are called to examine a 12-year-old boy with tachypnea and a racing heart. An intravenous access is in place.

ICU: You are called to the bedside of a 12-year-old boy who says he has a racing heart. He has an intravenous access.

Vital Signs	
Heart rate	235/min
Blood pressure	100/65 mm Hg
Respiratory rate	20/min
SpO_2	94% on room air
Temperature	37.6 °C
Weight	44 kg
Age	12 years

Scenario overview and learning objectives

Scenario Overview

Emphasis should be on recognition and management of supraventricular tachycardia (SVT) in a stable child, including the use of vagal maneuvers and adenosine. Provision of synchronized cardioversion is beyond the scope of this scenario, but discussion regarding indications for synchronized cardioversion, including appropriate dose and safe delivery, should occur during the scenario debriefing. Expert consultation with a pediatric cardiologist is strongly recommended before providing synchronized cardioversion, and synchronized cardioversion preceded by sedation requires expertise to minimize hemodynamic impact of the sedative.

Scenario-Specific Objectives

- Differentiates between SVT and sinus tachycardia; the child in this scenario has SVT
- Describes potential vagal maneuvers used for a child with SVT; vagal maneuvers used in children include blowing through a narrowed straw or bearing down and grunting
- Demonstrates the proper rapid bolus technique to administer adenosine
- Describes safe administration of synchronized cardioversion (if needed) with the appropriate dose in a patient with SVT
- Discusses the reason that expert consultation is advised before performing synchronized cardioversion in a stable child with SVT

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Awake; alert; anxious

Breathing

- Increased rate and mildly increased effort

Circulation

- Warm with brisk capillary refill

Identify

- No immediate intervention needed

Intervene

- Proceed to primary assessment.

Evaluate—primary assessment

- Airway: Clear
- Breathing: Respiratory rate 20/min; SpO_2 94% before supplemental oxygen administration, 100% when receiving 2 L oxygen via nasal cannula; clear lung fields
- Circulation: Heart rate 235/min; strong central and peripheral pulses; warm skin; capillary refill about 2 seconds; blood pressure 100/65 mm Hg
- Disability: Awake; alert; interactive
- Exposure: Temperature 37.6 °C; weight 44 kg

Identify

- Narrow-complex, regular tachycardia with a pulse and adequate perfusion (stable)

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Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Administer oxygen.
- Apply pads/leads and turn on monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.
- Establish or verify existing intravenous (IV) access.
- Guide child to perform vagal maneuvers.
- Prepare adenosine dose and saline flush.
  - Record rhythm strip during administration.
  - Administer first dose of adenosine 0.1 mg/kg (maximum dose: 6 mg) rapid IV push, by rapid saline flush.
  - If no response to initial adenosine dose, may give second dose of 0.2 mg/kg (maximum dose 12 mg) rapid IV push, followed by saline flush. Ensure that rapid push administration technique is used.
  - If SVT continues, strongly consider obtaining expert consultation.
- If SVT persists despite adenosine administration and the child continues to be hemodynamically stable, consult a pediatric cardiologist because other medications can be considered.

Evaluate—secondary assessment

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Heart racing; tachycardia
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: Last ate 6 hours ago
- **E**vents (onset): Sudden

Physical examination

- Repeat vital signs after oxygen, vagal maneuvers, and first dose of adenosine: Heart rate 235/min; respiratory rate 20/min; SpO_2 99% on 30% face mask; blood pressure 100/65 mm Hg
  - After second dose of adenosine, brief bradycardia converts to heart rate 70/min sinus rhythm
- Head, eyes, ears, nose, and throat/neck: Normal
- Heart and lungs: Tachycardic; no murmur, gallop, or rub appreciated; clear lungs on auscultation; central and peripheral pulses remain strong; capillary refill remains brisk
- Abdomen: Liver not palpable below the right costal margin
- Extremities: No edema; no rash; warm skin
- Back: Normal
- Neurologic: Awake; alert

Identify

- SVT with adequate perfusion converts to sinus rhythm if 2 doses of adenosine provided correctly

Intervene

- After rhythm conversion
  - Continue to monitor cardiorespiratory function.
  - Evaluate for signs of heart failure (enlarged liver, extra heart sounds or murmurs, crackles/rales).
  - Obtain 12-lead electrocardiogram (if not already done).
  - Wean supplemental oxygen as tolerated.
  - Seek expert consultation (if not already done).

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Blood glucose 88 mg/dL
- Electrolytes

Imaging

- Chest x-ray, electrocardiogram in SVT and in sinus tachycardia; ideally capture the adenosine dose being given by running a rhythm strip simultaneously

Identify/intervene

- Laboratory tests are generally not appropriate during the immediate management of a hemodynamically stable child in SVT.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 8, SVT (Adolescent; Stable)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Applies cardiac monitor and pulse oximeter
- Directs administration of supplemental oxygen
- Identifies SVT with stable perfusion and distinguishes it from sinus tachycardia
- Knows how to help child perform appropriate vagal maneuvers
- Directs establishment of IV or intraosseous access
- Directs preparation and administration of correct doses of adenosine using rapid bolus technique
- Explains the rationale for expert consultation before synchronized cardioversion if stable child with SVT fails to respond to vagal maneuvers and adenosine
- Discusses indications for and safe delivery of correct doses (initial and subsequent) of synchronized cardioversion
- Performs frequent reassessment

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- The patient in this scenario did not require synchronized cardioversion. Please describe the indications for synchronized cardioversion, the appropriate first and second energy doses, and how to safely deliver synchronized cardioversion.

Testing Case Scenario 9

Supraventricular Tachycardia

(Infant; Unstable)

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Scenario Lead-In

Prehospital: You are dispatched to a house where a 3-month-old infant has respiratory distress and lethargy.

ED: An ambulance is en route to the emergency department with a 3-month-old infant with respiratory distress and lethargy. An intravenous access has been placed.

General inpatient unit: You are called to examine a 3-month-old infant with respiratory distress and lethargy. The infant has an intravenous access in place.

ICU: You are called to the bedside of a 3-month-old infant with respiratory distress and lethargy. The infant has intravenous access.

Vital Signs	
Heart rate	235/min
Blood pressure	50/32 mm Hg
Respiratory rate	60/min
SpO_2	92% on room air
Temperature	37.6 °C
Weight	5 kg
Age	3 months

Scenario overview and learning objectives

Scenario Overview

Emphasis should be on recognition and management of supraventricular tachycardia (SVT) in an unstable patient, including possible rapid bolus administration of adenosine (only if intravenous [IV]/intraosseous [IO] access is readily available) and the safe delivery of synchronized cardioversion using appropriate doses. Vagal maneuvers may be performed while preparing adenosine or synchronized cardioversion but should not delay intervention.

Scenario-Specific Objectives

- Differentiates between SVT and sinus tachycardia; in this scenario, the infant has unstable SVT
- Describes potential vagal maneuvers used for an infant with SVT; a potential maneuver used in infants is ice to the face
- Demonstrates the proper rapid bolus technique to administer adenosine
- Discusses indications for synchronized cardioversion; in this scenario, the infant has signs of shock, including poor perfusion, hypotension, and altered mental status
- Demonstrates safe delivery of synchronized cardioversion with appropriate dose in a patient with SVT and poor perfusion

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Lethargic; minimal response to surrounding noises and caregivers

Breathing

- Increased rate and effort, including significant retractions; grunting

Circulation

- Mottled skin; pulses

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Clear
- Breathing: Respiratory rate 60/min; moderate intercostal retractions; SpO_2 92% before supplemental oxygen and 100% after 100% oxygen administered; crackles throughout lung fields; grunting
- Circulation: Adequate central pulses, weak peripheral pulses; heart rate 235/min; blood pressure 50/32 mm Hg; cool skin; capillary refill about 4 seconds
- Disability: Moans and withdraws to pain
- Exposure: Temperature 37.6 °C; weight 5 kg

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Identify

- Altered level of consciousness
- Regular, narrow-complex tachycardia/SVT with a pulse and signs of poor perfusion
- Respiratory distress vs respiratory failure
- Hypotensive shock

Intervene

- Establish IV/IO access or verify function of existing access but do not delay synchronized cardioversion if IV/IO access not readily available.
- Perform vagal maneuvers if they do not delay adenosine or cardioversion.
- If functional IV is in place or is established immediately, administer adenosine.
  - Begin recording continuous rhythm strip via defibrillator.
  - Give adenosine 0.1 mg/kg (maximum dose: 6 mg) IV/IO by rapid bolus followed by rapid saline flush.
  - If first dose of adenosine results in no change in rhythm, administer adenosine 0.2 mg/kg rapid bolus (maximum dose: 12 mg) if it can be given more rapidly than providing synchronized cardioversion. Ensure that rapid bolus technique is used to administer the drug.
  - If adenosine is ineffective, provide synchronized cardioversion.
- Deliver synchronized cardioversion as soon as it is available, unless other therapies (eg, adenosine) have worked by the time synchronized cardioversion can be delivered. (*Note:* Do not delay cardioversion to attempt other therapies if synchronized cardioversion can be provided immediately.)
  - As soon as monitor/defibrillator arrives, attach pads and begin recording rhythm strip.
  - "Clear" and perform synchronized cardioversion (0.5-1 J/kg).
  - If initial synchronized cardioversion is unsuccessful, "clear" and perform synchronized cardioversion with 2 J/kg.
- Prepare to assist ventilation (with bag-mask device) if needed.

Evaluate—secondary assessment (Deferred until after rhythm conversion)

SAMPLE history

- **S**igns and symptoms: Respiratory distress; lethargy; shock
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: Full-term infant
- **L**ast meal: Breast fed 4 hours ago; emesis after
- **E**vents (onset): Noted faster breathing, decreased oral intake today

Physical examination

- Repeat vital signs after successful rhythm conversion: Heart rate 155/min (sinus tachycardia); respiratory rate 54/min; SpO_2 97%; still receiving 100% oxygen via nonrebreathing mask; blood pressure improves to 80/60 mm Hg; capillary refill improves to 3 seconds
- Head, eyes, ears, nose, and throat/neck: Clear; no audible abnormal breath sounds
- Heart and lungs: Sinus rhythm; no murmur, gallop, or rub appreciated; retractions mild; breath sounds clear
- Abdomen: Liver palpable 3 cm below the right costal margin
- Extremities: No edema; no rash; arms and legs warm and fingertips and toes slightly cooler; peripheral pulses stronger; capillary refill is 3 seconds
- Back: Normal
- Neurologic: Cries with cardioversion; more reactive now in sinus rhythm
- Point-of-care (POC) glucose concentration (see the Evaluate and Identify/intervene boxes that follow) if no adenosine or cardioversion
- Vital signs: Heart rate 235/min; respiratory rate 60/min; SpO_2 falls to 90%; blood pressure 48/36 mm Hg; weak central and peripheral pulses; cool skin; capillary refill about 5 seconds; mottling more severe

Identify

- SVT with poor perfusion converts to sinus rhythm if rapid adenosine or cardioversion is provided

Intervene

- After rhythm conversion
  - Reassess and monitor cardiorespiratory status. Evaluate for signs of worsening heart failure (more enlarged liver, extra heart sounds or murmurs, crackles/rales).
  - Prepare to insert advanced airway if needed.
  - Wean supplemental oxygen as tolerated if infant stabilizes.
  - Obtain 12-lead electrocardiogram.
  - Check glucose with POC testing.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Blood glucose
- Electrolytes

Imaging

- Chest x-ray, electrocardiogram in SVT and in sinus tachycardia

Identify/intervene

- Although laboratory tests are generally not appropriate during the immediate management, a blood glucose concentration should be checked as soon as reasonably possible in critically ill infants and children. Hypoglycemia should be treated immediately.
- Laboratory studies (other than POC glucose testing) are deferred until rhythm is converted and systemic perfusion and hemodynamic function improved.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 9, Supraventricular Tachycardia (Infant; Unstable)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Applies cardiac monitor and pulse oximeter
- Directs administration of supplemental oxygen
- Identifies rhythm as SVT with poor perfusion and distinguishes it from sinus tachycardia
- Knows how to perform appropriate vagal maneuvers for an infant
- Directs establishment of IV or IO access if it will not delay synchronized cardioversion
- Directs preparation and rapid bolus administration of appropriate dose of adenosine
- Directs safe delivery of attempted cardioversion at dose of 0.5 J/kg; if ineffective, increases dose to 2 J/kg
- Performs frequent reassessments after each intervention

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- Instructor should ask students to state the indications for synchronized cardioversion
- If time allows, discuss the need for expert consultation before administering a precardioversion sedative to an infant with SVT and hemodynamic instability.

Testing Case Scenario 10

Ventricular Fibrillation

(Child; Arrest)

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Scenario Lead-In

Prehospital: You are en route to a school where a 7 year old suddenly collapsed in the gym. The teacher started CPR and called the local emergency response number.

ED: You are called to evaluate a 7-year-old child who suddenly collapsed after saying he was dizzy while playing vigorously. CPR is in progress.

General inpatient unit: You are called as a member of the code team to see a 7 year old who suddenly became limp and gray. The child was admitted for observation after syncope at playground. CPR is in progress.

ICU: You are called to see a 7 year old who suddenly became limp and gray. The child was admitted for observation after collapsing at basketball practice. CPR is in progress.

Vital Signs	
Heart rate	CPR in progress
Blood pressure	CPR in progress
Respiratory rate	No spontaneous breathing
SpO_2	100% bag-mask ventilation (CPR)
Temperature	Deferred
Weight	25 kg
Age	7 years

Scenario overview and learning objectives

Scenario Overview

This scenario focuses on the identification and management of the child with cardiac arrest and a "shockable" rhythm. Emphasis is placed on immediate delivery of high-quality CPR and integration of shock delivery while minimizing interruptions in CPR. One shock, followed by CPR, and then (when ventricular fibrillation [VF] persists) a second shock, followed by CPR + epinephrine, and then (when VF persists) a third shock, followed by CPR + antiarrhythmic (amiodarone or lidocaine) are administered before return of spontaneous circulation (ROSC). Identification of potential causes (H's and T's) should be discussed during debriefing. Insertion of advanced airway and post-ROSC care are beyond the scope of this scenario. Post-ROSC care is addressed with the asystole scenario.

Scenario-Specific Objectives

- Identifies cardiac arrest with a shockable rhythm; in this scenario, the child has VF
- Demonstrates safe shock delivery with appropriate dose and minimal interruption of chest compressions; the correct initial dose is 2 J/kg, second shock is 4 J/kg, and subsequent doses are at least 4 J/kg (maximum 10 J/kg or adult dose for the defibrillator)
- Describes correct dose and rationale for epinephrine administration
- Uses appropriate antiarrhythmic in VF/pulseless ventricular tachycardia; the *2025 AHA Guidelines for CPR and ECC* noted that either amiodarone or lidocaine was equally acceptable
- Identifies reversible causes of persistent VF; during the debriefing, the student should be asked to recall possible reversible causes of cardiac arrest (recalled by conditions beginning with H's and T's)

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Extremities appear to be limp; no spontaneous movement; no visible reaction to noise

Breathing

- No spontaneous breathing

Circulation

- Cyanotic/pale extremities and lips; overall gray color

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Check for response (no response) and perform simultaneous check for breathing (none) and carotid or femoral pulse (none).
- Immediately begin high-quality CPR.

Evaluate—primary assessment (Deferred to provide immediate basic life support, and then focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Should verify appearance, breathing, and circulation support
- Monitor reveals VF
- Weight 25 kg per color-coded length-based resuscitation tape

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Identify

- Cardiopulmonary arrest
- VF cardiac arrest

Intervene

- Use a CPR feedback device, if available, to guide CPR delivery.
- When defibrillator arrives, apply pads/leads and turn on monitor.
- Identify rhythm (VF, shockable).
- Attempt defibrillation with 2 J/kg as soon as possible.
- Resume high-quality CPR immediately after shock delivery.
- Obtain vascular access (intravenous [IV]/intraosseous [IO]).
- Apply blood pressure cuff (per local protocol, may be deferred until ROSC).
- Apply pulse oximeter (per local protocol, may be deferred until ROSC).

Evaluate—secondary assessment (Deferred except to identify reversible causes)

SAMPLE history (deferred until ROSC or only to extent needed to evaluate reversible causes, ie, the H's and T's; do not interrupt resuscitation)

- **S**igns and symptoms: Child suddenly became limp; no precursors
- **A**llergies: Penicillin
- **M**edications: Adderall
- **P**ast medical history: Attention-deficit disorder/attention-deficit/hyperactivity disorder
- **L**ast meal: 2 hours ago
- **E**vents (onset): As specified in Scenario Lead-In

Physical examination (deferred until ROSC or only to extent needed to evaluate reversible causes)

- ROSC occurs after high-quality CPR, 3 shocks delivered, 1 dose of epinephrine and 1 antiarrhythmic (amiodarone or lidocaine). Scenario can be shortened with ROSC after 2 shocks and 1 dose of epinephrine, with debriefing discussion of antiarrhythmic.
- Sinus rhythm; heart rate 130/min; respiratory rate 20/min with bag-mask ventilation; SpO_2 100% during bag-mask ventilation with 100% oxygen; blood pressure 92/60 mm Hg; temperature 36.1 °C

Identify

- Cardiopulmonary arrest
- VF
- ROSC

Intervene

- Continue high-quality CPR; reassess rhythm every 2 minutes.
- If a shockable rhythm persists at next rhythm check, give second shock of 4 J/kg, followed by immediate CPR.
- Prepare epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO and administer during chest compressions.
  - Repeat every 3-5 minutes during cardiac arrest.
- If shockable rhythm persists at next rhythm check, deliver shock, resume CPR, and prepare and administer antiarrhythmic drug for persistent VF/pulseless ventricular tachycardia during chest compressions.
  - Amiodarone 5 mg/kg IV/IO bolus (maximum single dose 300 mg) or lidocaine 1 mg/kg IV/IO. Avoid amiodarone in the context of long QT syndrome.
  - Any subsequent shocks should be at dose of 4 J/kg or higher (maximum: 10 J/kg or adult dose for that defibrillator).
- Consider placement of an advanced airway, especially if unable to provide adequate ventilation with a bag-mask device and an advanced health care professional is available.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab/diagnostic data (as appropriate)

- Rapid bedside blood glucose 96 mg/dL (5.3 mmol/L) (after ROSC)
- Arterial/venous blood gas, electrolytes, calcium, magnesium, consider toxicology studies
- Electrocardiogram once the child is stable and consultation with Cardiology

Imaging

- Chest x-ray (after ROSC): Normal heart size and lung fields

Identify/intervene

- Blood work and chest x-ray are not available during the scenario.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 10, VF (Child; Arrest)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Identifies cardiac arrest
- Directs immediate initiation of high-quality CPR with the use of a feedback device (if available) and monitors quality throughout resuscitation
- Directs placement of monitor leads/pads and activation of monitor
- Identifies VF cardiopulmonary arrest
- Directs safe performance of first shock of 2 J/kg
- After each shock, directs immediate resumption of high-quality CPR, beginning with chest compressions
- Directs establishment of IV or IO access
- If VF persists at second rhythm check, directs safe delivery of a second shock, using a dose of 4 J/kg; any subsequent shocks should use a dose of 4 J/kg or higher (maximum 10 J/kg or standard adult dose)
- Directs preparation and administration of appropriate IV/IO dose of epinephrine (0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) at appropriate intervals
- After each shock, directs immediate resumption of CPR, beginning with compressions
- If VF persists at third rhythm check, directs that antiarrhythmic with appropriate dose (amiodarone 5 mg/kg or lidocaine 1 mg/kg) be administered when compressions resume
- Performs appropriate reassessments

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- If the child's VF failed to respond to the therapies given, what else should you consider? (Answer: H's and T's-ie, reversible causes)
- If a third shock is needed, what dose is used? (Answer: 4 J/kg or higher; maximum 10 J/kg or adult dose for that defibrillator)

Testing Case Scenario 11

Obstructive Shock

(Child; Hypotensive; Tension Pneumothorax)

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Scenario Lead-In

Prehospital: You are on scene with an 8-year-old boy. He was intubated with an oral-endotracheal tube because of decreased mental status, and then he suddenly deteriorated and is being manually ventilated by another health care professional. Intravenous access is in place.

ED: An 8-year-old boy is being transported by emergency responders. He has been intubated with an oral-endotracheal tube for decreased level of consciousness (a Glasgow Coma Scale score of 4). He suddenly deteriorated and is being manually ventilated through the endotracheal tube. Intravenous access is in place.

General inpatient unit: You are called to the room of an 8-year-old boy who was just intubated by the rapid response team for pneumonia and hypoxemia. An endotracheal tube was placed. As the team was preparing to transport him to the intensive care unit, the child suddenly deteriorated and is being manually ventilated via the endotracheal tube. Intravenous access is in place.

ICU: You are called to the room of an 8-year-old boy who is intubated and mechanically ventilated. He has suddenly deteriorated and is being manually ventilated via the endotracheal tube. Intravenous access is in place.

Vital Signs

Heart rate	140/min
Blood pressure	80/54 mm Hg
Respiratory rate	Manual ventilation
SpO_2	68% on 100% oxygen
Temperature	37.2 °C
Weight	20 kg
Age	8 years

Scenario overview and learning objectives

Scenario Overview

Emphasis is placed on immediate recognition of respiratory failure and signs of obstructive shock. The health care professional should use the DOPE (Displacement of the tube/Distention of the abdomen, Obstruction of the tube, Pneumothorax/Positive end-expiratory pressure requirement, Equipment failure) mnemonic to quickly identify a tension pneumothorax as the cause and then must perform immediate needle decompression followed by chest tube insertion. Emphasize the importance of performing the needle decompression before obtaining a chest x-ray.

Scenario-Specific Objectives

- Recognizes compensated vs hypotensive shock; this case illustrates hypotensive shock (key indicators in this case include hypotension, tachycardia, and decreased level of consciousness)
- Summarizes signs and symptoms of obstructive shock; key indicators in this case include signs of shock combined with evidence of tension pneumothorax
- Summarizes the elements of the DOPE mnemonic for an intubated patient with sudden deterioration; in this scenario, displacement of tube, obstruction of tube, and equipment failure should be ruled out before needle decompression
- Demonstrates correct interventions for tension pneumothorax; in this scenario, interventions include needle decompression, a chest x-ray, and chest tube insertion
- Discusses conditions under which fluid bolus administration would be appropriate for treatment of obstructive shock; although fluid resuscitation is not needed in this scenario, bolus fluid administration may be helpful for cardiac tamponade, until pericardiocentesis can be performed and in massive pulmonary embolus

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- No spontaneous movement; flaccid extremities; no visible reaction to noise

Breathing

- Orally intubated; poor chest wall movement with manual ventilation using a resuscitation bag

Circulation

- Pale skin; dusky mucous membranes

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Continue manual ventilation with 100% oxygen.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

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Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Orally intubated with a 6.0 cuffed endotracheal tube (ETT); secured at 18 cm at the lip
- Breathing: Manually ventilated; asymmetric chest rise, absent breath sounds on the right; increasing inspiratory pressure needed to produce chest expansion; SpO_2 68% despite receiving 100% inspired oxygen. As student evaluates using DOPE mnemonic, provide the following responses to student queries and actions:
  - Displacement: Depth of insertion unchanged; breath sounds present on left; exhaled C02 still detectable
  - Obstruction: Normal breath sounds on left; if ETT is withdrawn slightly to detect and treat possible left main stem intubation, there is no change in the breath sounds, chest rise, or resistance to manual ventilation
  - Pneumothorax (consistent with current clinical picture)
  - Equipment failure: Ruled out by switching to manual ventilation with bag connected to oxygen with appropriate flow rate
- Circulation: Heart rate 140/min; weak pulses; capillary refill 5 seconds; blood pressure 80/54 mm Hg
- Disability: Unconscious; pupils equal and reactive to light
- Exposure: Temperature 37.2 °C; weight 20 kg

Identify

- Respiratory failure and hypotensive shock
- Probable tension pneumothorax and obstructive shock

Intervene

- Analyze rhythm (sinus tachycardia).
- Assess response to oxygen and manual ventilation (no change).
- Check waveform capnography (if applicable). Rule out endotracheal tube displacement and obstruction and equipment failure.
- Perform needle decompression on right side (inserting an 18- to 20-gauge over-the-needle catheter over the top of the child's third rib, second intercostal space in the midclavicular line).
- Obtain chest x-ray and insert chest tube.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until effective ventilation established [after needle thoracostomy])

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Orally intubated for respiratory failure; sudden deterioration
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: Nothing by mouth
- **E**vents (onset): Sudden deterioration in intubated patient

Physical examination

- Repeat vital signs after oxygen: Heart rate 175/min; manual ventilation at 24 breaths/min
  - If needle decompression performed: Anticipate air will be expelled, SpO_2 85% and rising; blood pressure increases to 110/65 mm Hg; capillary refill 3 seconds
  - If needle decompression not performed: SpO_2 58% and falling; blood pressure becomes undetectable and cardiac arrest develops; capillary refill extremely prolonged
- Head, eyes, ears, nose, and throat/neck
  - If needle decompression performed: Normal
  - If needle decompression not performed: Jugular vein distention
- Heart and lungs
  - If needle decompression performed: Breath sounds equal bilaterally and there is decreased resistance to manual ventilation
  - If needle decompression not performed: Breath sounds absent on right
- Abdomen: Normal
- Extremities
  - If needle decompression performed: 2+ central and peripheral pulses, capillary refill 3 seconds
  - If needle decompression not performed: No palpable pulses, capillary refill extremely prolonged
- Back: Normal
- Neurologic: Unconscious

Identify

- Respiratory failure
- Hypotensive obstructive shock (corrects when needle decompression performed; if needle decompression is not performed, pulseless arrest develops)
- Tension pneumothorax

Intervene

- Reassess cardiorespiratory function (particularly ventilation and perfusion); immediate improvement should be noted following needle decompression.
- Verify that intravenous catheter remains patent.
- Check glucose with point-of-care testing.
- Arrange for transfer to intensive care unit (if child is not already in intensive care) for closer monitoring and treatment of underlying conditions.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Pending: Arterial blood gas or venous blood gas

Imaging

- Chest radiograph (should not delay intervention until chest x-ray performed)

Identify/intervene

- Laboratory diagnostic testing is deferred until treatment of the tension pneumothorax.
- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill children, particularly neonates and infants. Hypoglycemia should be treated immediately.
- *Note:* Needle decompression is performed before obtaining chest x-ray (ie, the chest x-ray should follow needle decompression but can precede chest tube insertion).

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 11, Obstructive Shock (Child; Hypotensive; Tension Pneumothorax)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Assesses ABCDE, including **Vital Signs**
- Applies cardiac monitor and pulse oximeter
- Identifies signs and symptoms of obstructive shock
- Categorizes as hypotensive shock
- Verbalizes DOPE mnemonic for intubated patient who deteriorates
- Identifies tension pneumothorax
- Describes performance of needle decompression for tension pneumothorax
- Reassesses patient's response to needle decompression

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- Name 2 additional causes of obstructive shock. (Answer: Cardiac tamponade, massive pulmonary embolism, and closure of the ductus arteriosus in infants with ductal-dependent congenital heart lesions)
- Please highlight key aspects of the management of cardiac tamponade (fluid bolus and pericardiocentesis), massive pulmonary embolus (oxygen, ventilatory support, fluid bolus, and expert consultation) and ductal closure in neonates with ductal-dependent congenital heart disease (prostaglandin infusion and expert consultation).

Testing Case Scenario 12

Cardiogenic Shock

(Adolescent; Myocarditis)

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Scenario Lead-In

Prehospital: You are dispatched to transport a 16 year old who had a sudden onset of chest pain and shortness of breath at school. He has visible signs of increased work of breathing and cold extremities, and he is very pale. He experienced flu-like symptoms a few days before.

ED: Emergency responders arrive with a 16 year old who today at school complained of severe chest pain and shortness of breath. He has a history of flu-like symptoms a few days before. He is in obvious respiratory distress, has cold extremities, and is very pale. The emergency responders were unable to obtain an intravenous access.

General inpatient unit: As a member of the rapid response team, you respond to a 16 year old who was admitted after being evaluated for chest pain and shortness of breath. He is in obvious respiratory distress, has cold extremities, and is very pale. The intravenous access that was placed on admission has infiltrated.

ICU: You are called to the bedside of a 16 year old who was directly admitted to the intensive care unit with a sudden onset of chest pain. He is pale and hypotensive, demonstrates increased work of breathing, and appears confused and agitated. He has no intravenous access in place.

Vital Signs

Heart rate	140/min
Blood pressure	86/70 mm Hg
Respiratory rate	35/min
SpO_2	89% on room air
Temperature	Not obtained
Weight	82 kg
Age	16 years

Scenario overview and learning objectives

Scenario Overview

Emphasis is on identification and rapid treatment of hypotensive cardiogenic shock. Priorities include immediate establishment of vascular (intravenous [IV]) access and careful administration of a 5-10 mL/kg over 10 minutes bolus of isotonic crystalloid over 10-20 minutes, with careful reassessment of cardiorespiratory function during and after the fluid bolus. The health care professional should identify signs of worsening heart failure during the administration of the fluid bolus and should stop bolus fluid administration. The patient requires inotropic therapy to improve systemic perfusion. Expert consultation from a pediatric cardiologist and further diagnostic studies (including echocardiography) are needed.

Scenario-Specific Objectives

- Differentiates compensated vs hypotensive shock; in this scenario, the child is hypotensive, so has hypotensive shock
- Differentiates the signs and symptoms of cardiogenic shock from other types of shock; in this scenario, the combination of signs of hypotensive shock with signs of heart failure—such as shortness of breath or heavy breathing, falling asleep when feeding or too tired to eat, poor growth, cough, or sweating—point to likely cardiogenic shock
- Provides correct interventions for cardiogenic shock; in this scenario, these interventions include establishment of cardiac monitoring and pulse oximetry, careful bolus administration of isotonic crystalloids, careful reassessment during and after each fluid bolus and initiation, and titration of inotropic/vasoactive drugs
- Describes correct volume and duration of fluid bolus administration for cardiogenic shock and describes possible negative effects of excessive and/or rapid fluid bolus administration; in this scenario, the fluid bolus of 5-10 mL/kg of isotonic crystalloid should be administered over 10-20 minutes (excessive fluid administration can worsen heart failure/cardiogenic shock)

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Seems confused, keeps repeating that he feels very tired

Breathing

- Labored breathing with moderate to severe intercostal and subcostal retractions, coughing, and grunting

Circulation

- Pale, very mottled extremities

Identify

- Immediate intervention needed

Intervene

- Activate emergency response system, if appropriate.
- Administer 100% oxygen by nonrebreathing face mask.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

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Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Patent and maintainable
- Breathing: Respiratory rate 35/min; substernal and intercostal retractions, nasal flaring, and grunting; SpO_2 89% on room air, increases to 94% with administration of 100% oxygen via nonrebreathing mask
- Circulation: Central pulses present, peripheral pulses weak and thready; heart rate 140/min; blood pressure 86/70 mm Hg capillary refill 4 seconds; cold extremities; bilateral lower extremity peripheral edema noted
- Disability: Disoriented to place and time; states he is very tired and light-headed
- Exposure: Jugular vein distention and peripheral edema noted; weight 82 kg

Identify

- Respiratory distress
- Hypotensive cardiogenic shock
- Sinus tachycardia

Intervene

- Obtain vascular (IV/intraosseous [IO]) access (attempt IV access first).
- Administer a fluid bolus of 5-10 mL/kg of isotonic crystalloid over 10-20 minutes.
- Perform careful and frequent reassessment of adolescent during and after fluid bolus. Stop fluid bolus if signs of heart failure develop (eg, worsening respiratory status, development of rales or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Check glucose using point-of-care testing.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until after initial shock therapy)

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Increased work of breathing, chest pain, and lethargy
- **A**llergies: No known allergies
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: Poor intake for last 12 hours
- **E**vents (onset): Flu-like symptoms 2 days before

Physical examination

- Repeat vital signs after oxygen and first fluid bolus: Heart rate 155/min; respiratory rate 45/min; SpO_2 90% with 100% oxygen; blood pressure 80/64 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mucous membranes dry; distended jugular vein; peripheral edema
- Heart and lungs: Rapid rate; heart sounds; crackles and retractions worsening
- Abdomen: Liver edge palpable at 5 cm below right costal margin; nondistended abdomen; hypoactive bowel sounds
- Extremities: Cold arms and feet; mottled; weak peripheral pulses; capillary refill 5 seconds
- Back: Normal
- Neurologic: Lethargic; pupils 4 mm, equal, reactive

Identify

- Hypotensive cardiogenic shock
- Worsening respiratory distress after fluid bolus
- Possible respiratory failure

Intervene

- Stop fluid bolus administration (signs of heart failure worsening).
- Begin appropriate inotropic/vasoactive infusions and assess response.
- Assess response to oxygen administration.
- Administer continuous positive airway pressure or other positive-pressure ventilation support if hypoxemia and respiratory distress continue.
- Obtain 12-lead electrocardiogram.
- Obtain cardiology consultation and echocardiogram if available.
- Obtain consultation with extracorporeal membrane oxygenation team or center.
- Arrange for transfer to intensive care unit for closer monitoring if adolescent is not already in intensive care unit.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Arterial blood gas pH 7.18; PCO_2 22 mm Hg; HCO_3 10 mEq/L; PO_2 70 mm Hg; lactate 5.5 mmol/L
- Glucose (point-of-care testing) 80 mg/dL (4.4 mmol/L)
- Pending: Electrolytes, blood urea nitrogen/creatinine, calcium, complete blood count with differential, prothrombin time/international normalized ratio/partial thromboplastin time
- Cultures: Blood, urine

Imaging

- Chest x-ray: Cardiomegaly; increased pulmonary vascular markings

Identify/intervene

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill children, particularly neonates and infants. Hypoglycemia should be treated immediately.
- Arterial blood gas confirms metabolic acidosis due to low cardiac output.
- Chest x-ray shows cardiomegaly and pulmonary edema consistent with heart failure/cardiogenic shock.
- Obtain echocardiogram when available.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 12, Cardiogenic Shock (Adolescent; Myocarditis)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Applies cardiac monitor and pulse oximeter
- Administers 100% oxygen
- Recognizes signs and symptoms of cardiogenic shock
- Categorizes shock as hypotensive
- Directs establishment of IV or IO access
- Directs administration of a 5-10 mL/kg bolus of isotonic crystalloid IV or IO over 10-20 minutes
- Reassesses patient during and in response to interventions, particularly during and after each fluid bolus
- Identifies signs of worsening heart failure and stops bolus fluid administration
- Identifies need for initiation of inotropic/vasoactive support; titrates to improve cardiac function and systemic perfusion
- Obtains expert consultation from a pediatric cardiologist and obtains an echocardiogram or other diagnostic studies as recommended by cardiologist
- Obtain consultation with extracorporeal membrane oxygenation team or center

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What did the team do extremely well?
- What did the team find challenging?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- What are the therapeutic end points during shock management? (Answer: Normalized heart rate; improved peripheral perfusion, mental status, and urine output; normalized blood pressure; correction of metabolic/lactic acidosis)

Testing Case Scenario 13

Disordered Control of Breathing Disease

(Child)

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Scenario Lead-In

Prehospital: You respond to an emergency call for a 4 year old having a seizure with respiratory distress.

ED: Emergency responders arrive with a 4-year-old boy brought from his home after mother called the local emergency response number because her child had a seizure with respiratory distress.

General inpatient unit: You are called to the room of a 4-year-old boy who is being admitted after having a seizure with respiratory distress.

Vital Signs	
Heart rate	130/min
Blood pressure	98/62 mm Hg
Respiratory rate	8/min
SpO_2	80% on room air
Temperature	39.7 °C
Weight	17 kg
Age	4 years

Scenario overview and learning objectives

Scenario Overview

Emphasis of this scenario is on recognition and immediate management of a child with respiratory failure and disordered control of breathing (inadequate respiratory rate and effort), upper airway obstruction by the tongue, and decreased level of consciousness after a seizure. This child requires immediate bag-mask ventilation with 100% oxygen. During debriefing, discuss with the student the indications for intubation in this patient and methods to estimate appropriate endotracheal tube sizes.

Scenario-Specific Objectives

- Identifies respiratory distress vs respiratory failure; in this scenario, respiratory failure is present
- Summarizes signs of disordered control of breathing; in this scenario, the child demonstrated inadequate spontaneous respiratory effort with very slow, irregular, and shallow breaths
- Recalls causes of disordered control of breathing; common causes include drugs, increased intracranial pressure, and seizures
- Discusses correct interventions for disordered control of breathing; in this scenario, interventions include opening the airway and provision of bag-mask ventilation with 100% oxygen

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- Lethargic; eyes closed; no visible reaction to his mother's voice or noises in environment

Breathing

- Very slow respiratory rate with minimal chest rise; snoring

Circulation

- Dusky appearing

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Position the child to open the airway.
- Begin bag-mask ventilation with 100% oxygen.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment (Focused on assessment needed to restore airway, oxygenation, ventilation, and perfusion)

- Airway: Snoring respirations when child lying on his back, relieved when airway opened
- Breathing: Spontaneous respiratory rate 8/min; shallow and irregular; SpO_2 80% on room air, increases to 99% with bag-mask ventilation with 100% oxygen at a rate of 20/min
- Circulation: Heart rate 130/min; dusky (before bag-mask ventilation with 100% oxygen); strong radial pulse; capillary refill 2 seconds; blood pressure 98/62 mm Hg
- Disability: Lethargic; responsive to painful stimuli
- Exposure: Temperature 39.7 °C; weight 17 kg

Identify

- Respiratory failure (inadequate respiratory rate and effort)

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Intervene

- Verify chest rise with bag-mask ventilation and monitor response to bag-mask ventilation with oxygen.
- Continue bag-mask ventilation with 100% oxygen and monitor for increase in child's spontaneous respiratory effort-match ventilation with child's effort if possible.
- Consider insertion of oropharyngeal or nasopharyngeal airway.
- Establish vascular access (intravenous).
- Treat fever with antipyretic.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until after stabilization of airway, oxygenation, and ventilation)

SAMPLE history

- **S**igns and symptoms: Fever, upper respiratory infection symptoms for the last 3 days
- **A**llergies: None known
- **M**edications: Acetaminophen given by mother 2 hours ago
- **P**ast medical history: None
- **L**ast meal: Ate 3 hours ago
- **E**vents (onset): Abrupt onset of tonic-clonic seizure lasting approximately 5 minutes

Physical examination

- Repeat vital signs with assisted ventilation with 100% oxygen: Respiratory rate 30/min (rate at which patient is receiving bag-mask ventilation); heart rate 136/min; SpO_2 99% with inspired oxygen concentration of 100%; blood pressure 94/58 mm Hg
- Head, eyes, ears, nose, and throat/neck: Airway clear
- Heart and lungs: Clear breath sounds; good chest rise and fall with assisted ventilation; rate and depth of spontaneous breaths increasing
- Abdomen: Normal
- Extremities: No edema; no rash
- Back: Normal
- Neurologic: Becoming more responsive

Identify

- Respiratory failure (inadequate respiratory rate and effort)
- Disordered control of breathing

Intervene

- Closely monitor patient's level of consciousness, spontaneous respiratory effort, and airway protective mechanisms (ability to cough to protect airway).
- As child's spontaneous respiratory effort improves, provide bag-mask ventilation that assists the child's spontaneous respiratory effort.
- Once the child's spontaneous respiratory rate and depth are adequate, cease bag-mask ventilation and provide nonrebreathing mask with 100% oxygen.
- Perform frequent reassessment to ensure that child continues to demonstrate adequate respiratory rate and effort and airway protective mechanisms.
- Wean supplemental oxygen concentration as tolerated.
- If slow, irregular, inadequate breathing recurs, resume bag-mask ventilation with 100% oxygen and obtain expert consultation to plan for advanced airway insertion and support of ventilation.
- Check glucose using point-of-care testing.
- Arrange for transfer of the child to a higher level of care for evaluation, observation, and care.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Glucose (bedside) 166 mg/dL (9.2 mmol/L)
- Electrolytes; blood urea nitrogen/creatinine; complete blood count with differential; blood culture

Imaging

- Chest x-ray ordered

Identify/intervene

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children. This child has had a seizure and decreased level of consciousness, so it is especially important to check the glucose. Hypoglycemia should be treated immediately.
- It is not always possible to obtain an arterial blood gas.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 13, Disordered Control of Breathing Disease (Child)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Provides or directs bag-mask ventilation with 100% oxygen
- Applies cardiac monitor and pulse oximeter
- Identifies respiratory failure
- Identifies signs of disordered control of breathing
- Directs establishment of intravenous access
- Performs frequent reassessment of patient
- Describes methods to verify that bag-mask ventilation is effective
- Identifies need for involvement of advanced health care professional with expertise in pediatric intubation and mechanical ventilation
- Summarizes specific interventions for disordered control of breathing

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
- I observed that [*insert action here*].
- I saw that [*insert action here*].

Analyze

Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- What would be the indications for endotracheal intubation in a child with disordered control of breathing? (Answer: Inadequate spontaneous respiratory effort and/or failure to maintain a patent airway)
- If the child requires intubation, how would you estimate the size endotracheal tube to use?

Testing Case Scenario 14

Bradycardia

(Infant; Hypoxia, Cardiopulmonary Failure)

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Scenario Lead-In

Prehospital: You are dispatched to the home of a 3-month-old infant with difficulty breathing.

ED: You are working in the emergency department and are asked to see a 3-month-old infant with difficulty breathing brought in by his parents.

General inpatient unit: You are a member of the emergency response team called to evaluate a 3-month-old infant admitted earlier in the day with difficulty breathing.

ICU: You are asked to see a 3-month-old infant admitted earlier in the day with difficulty breathing.

Vital Signs	
Heart rate	45/min
Blood pressure	Not obtainable
Respiratory rate	4/min
SpO_2	Not obtainable
Temperature	39.6 °C
Weight	5.7 kg
Age	3 months

Scenario overview and learning objectives

Scenario Overview

Emphasis should be on identification of cardiopulmonary failure and management of hypoxic bradycardia associated with shock and likely lung tissue disease. Priorities include immediate bag-mask ventilation with 100% oxygen. Chest compressions are also required, and epinephrine is administered. The heart rate rises, and perfusion improves. The health care professional should also be able to discuss the preparation for insertion of an advanced airway device, such as an endotracheal tube and the method to estimate appropriate cuffed tube size.

Experienced PALS health care professionals may discuss possible delivery of a fluid bolus to treat persistent shock (the infant is febrile with little oral intake). However, this discussion is beyond the scope of the scenario and is not required for successful scenario completion.

Scenario-Specific Objectives

- Demonstrates the support of oxygenation and ventilation in a patient with hypoxic bradycardia
- Recognizes indications for CPR in a bradycardic patient; in this scenario, compressions are needed in addition to bag-mask ventilation because, despite oxygenation and ventilation, the infant has a heart rate less than 60/min with signs of poor perfusion
- States 3 causes of bradycardia; these include hypoxia (most common), vagal stimulation, heart block, and drug overdose
- Describes appropriate indications for and dose of epinephrine for bradycardia

Evaluate—initial assessment (Pediatric Assessment Triangle)

Appearance

- No visible reaction to noises, caregivers

Breathing

- Very slow respiratory rate; grunting

Circulation

- Pale; cyanotic

Identify

- Immediate intervention needed

Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Check for response (no response) and perform simultaneous check for breathing (still very slow) and brachial pulse (very slow).
- Begin bag-mask ventilation with 100% oxygen.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.

Evaluate—primary assessment (Focused on assessment needed to support airway, oxygenation, ventilation, and perfusion)

- Airway: Clear
- Breathing: Respiratory rate 4/min; SpO_2 not obtainable; severe intercostal and subcostal retractions; nasal flaring; grunting; very poor air entry bilaterally; scattered wheezes
- Circulation: Heart rate 45/min (sinus bradycardia) after short period of bag-mask ventilation; peripheral pulses absent, weak central pulses; extremities cool with sluggish capillary refill; unable to obtain blood pressure using noninvasive blood pressure measurement
- Disability: Unresponsive
- Exposure: Temperature 39.6 °C; weight 5.7 kg; no rashes

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Identify

- Cardiopulmonary failure
- Sinus bradycardia

Intervene

- Continue bag-mask ventilation with 100% oxygen.
- Begin chest compressions when heart rate does not increase to 60/min or greater and signs of poor perfusion persist despite bag-mask ventilation with 100% oxygen.
- Obtain vascular access (intravenous [IV]/intraosseous [IO]).
- Administer epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO followed by a rapid saline flush.

Evaluate—secondary assessment (Identify reversible causes, but defer remainder of secondary assessment until heart rate 60/min or greater with adequate perfusion)

SAMPLE history (only to extent needed to evaluate reversible causes)

- **S**igns and symptoms: Cough; nasal secretions; respiratory distress
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: Took 1 oz from a bottle 8 hours ago
- **E**vents (onset): Upper respiratory infection symptoms for 2 days; worsening respiratory distress and lethargy today

Physical examination

- Repeat vital signs after CPR and epinephrine bolus: Heart rate increases to 130/min; SpO_2 92% with bag-mask ventilation at a rate of 16-20/min with 100% oxygen; blood pressure 63/42 mm Hg
- Head, eyes, ears, nose, and throat/neck: Apnea
- Heart and lungs: No murmur; reduced air entry with positive-pressure ventilation; diffuse crackles/wheezes; weak peripheral pulses, stronger central pulses; capillary refill 4-5 seconds
- Abdomen: Soft; no organomegaly
- Extremities: Unremarkable
- Back: Unremarkable
- Neurologic: Lethargic; difficult to rouse
- Point-of-care glucose concentration (see the Evaluate and Identify/intervene boxes that follow)

Identify

- Cardiopulmonary failure

Intervene

- Discontinue chest compressions when heart rate 60/min or greater (and rising) and perfusion improves.
- Continue bag-mask ventilation with 100% oxygen at a rate of 20-30/min.
- Prepare for advanced airway placement.
- Experienced PALS health care professionals may consider administration of a fluid bolus of 20 mL/kg of isotonic crystalloid. Reassess during and after fluid bolus. Stop fluid bolus if signs of heart failure (worsening respiratory distress, or development of hepatomegaly or rales) develop or if vital signs fail to improve or deteriorate. Repeat fluid bolus as needed to treat signs of hypovolemic shock.

Evaluate—diagnostic assessments (Perform throughout the evaluation of the patient as appropriate)

Lab data

- Blood glucose 75 mg/dL
- A blood gas (arterial, venous, or capillary) is not indicated in the immediate management of this infant.

Imaging

- A chest x-ray may be considered after intubation and stabilization to assess lung fields as well as confirming appropriate endotracheal tube positioning.

Identify/intervene

- A blood glucose concentration should be checked as soon as reasonably possible in critically ill infants and children. Hypoglycemia should be treated immediately.
- Laboratory studies (other than point-of-care glucose testing) deferred until effective bag-mask ventilation and heart rate are established and shock resuscitation has begun.

Re–evaluate-identify-intervene after each intervention.

Debriefing Tool

Testing Case Scenario 14, Bradycardia (Infant; Hypoxia, Cardiopulmonary Failure)

General debriefing principles

- Use the table that follows to guide your debriefing; also refer to the Team Dynamics Debriefing Tool.
- Debriefings are 10 minutes long.
- Address all learning objectives.
- Summarize take-home messages at the end of the debriefing.
- Encourage students to self-reflect, and engage all participants.
- Avoid mini-lectures, closed-ended questions, and dominating the discussion.
- Ask the Team Leader how the case went first; then, ask the Timer/Recorder; and finally, ask the other team members.

General management objectives

- Uses the PALS Systematic Approach Algorithm to assess and appropriately classify a patient
- Provides oxygen appropriately
- Directs delivery of high-quality CPR (including the use of a feedback device) when indicated
- Demonstrates basic airway maneuvers and use of relevant airway device as appropriate
- Demonstrates application of cardiac and respiratory monitors
- Identifies the cardiac rhythm
- Applies appropriate PBLS or PALS algorithms
- Summarizes general indications, contraindications, and doses of relevant drugs
- Discusses principles of family-centered care in pediatric cardiac arrest
- Applies the 8 elements of effective team dynamics
- Performs frequent reassessment

Action

- Directs assessment of ABCDE and **Vital Signs**
- Identifies bradycardia associated with cardiorespiratory compromise/failure
- Directs initiation of bag-mask ventilation with 100% oxygen
- Applies cardiac monitor and pulse oximeter
- Reassesses heart rate and perfusion after initiation of bag-mask ventilation with oxygen
- Recognizes indications to provide high-quality CPR (chest compressions plus ventilation) for the bradycardic patient
- Directs establishment of IV or IO access
- Directs or discusses administration of epinephrine 0.01 mg/kg (0.1 mg/mL concentration; maximum dose 1 mg) IV/IO bolus
- Discusses preparation for advanced airway placement
- Performs frequent reassessment

Gather

Student Observations

- Can you describe the events from your perspective?
- How well do you think your treatments worked?
- Can you review the events of the scenario (*directed to the Timer/Recorder*)?
- What could you have improved?
- What did the team do well?

Instructor Observations

- I noticed that [*insert action here*].
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Done Well

- How were you able to [*insert action here*]?
- Why do you think you were able to [*insert action here*]?
- Tell me a little more about how you [*insert action here*].

Needs Improvement

- Why do you think [*insert action here*] occurred?
- How do you think [*insert action here*] could have been improved?
- What was your thinking while [*insert action here*]?
- What prevented you from [*insert action here*]?

Summarize

Student-Led Summary

- What are the main things you learned?
- Can someone summarize the key points made?
- What are the main take-home messages?

Instructor-Led Summary

- Let's summarize what we learned…
- Here is what I think we learned…
- The main take-home messages are…
- In addition to hypoxia, what are 3 other causes of bradycardia in infants and children?
- This scenario did not include advanced airway insertion. In preparing for intubation, how would you estimate the correct cuffed and uncuffed endotracheal tube size for this infant?