Practice Case Scenario 1

# Hypovolemic Shock

(Child; Uncompensated Shock)

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## Scenario Lead-In

**Prehospital:** You are dispatched to transport a 12 year old with abdominal injuries caused by flipping over bicycle handlebars. Mother reports that this happened about 4 hours ago. There was no loss of consciousness and the child was wearing a helmet. You observe the patient in obvious discomfort, and he says he has worsening abdominal pain. There are no indications of spinal injury.

**ED:** Parents arrive with their 12 year old with abdominal injuries caused by flipping over bicycle handlebars. Mother reports this happened about 4 hours ago. There was no loss of consciousness and the child was wearing a helmet. Patient appears in obvious discomfort, and he says he has worsening abdominal pain. Spinal injury has been ruled out.

**General inpatient unit:** As a member of the rapid response team, you respond to a 12 year old admitted with abdominal injuries caused by flipping over bicycle handlebars. History and physical exam are consistent with no loss of consciousness at scene, and patient was wearing a helmet. Patient is in obvious discomfort, and he says he has worsening abdominal pain. Spinal injury has been ruled out.

**ICU:** You are called to the bedside of a 12 year old who has been admitted to the intensive care unit with abdominal injuries caused by flipping over bicycle handlebars. History and physical are consistent with no loss of consciousness at scene and patient was wearing a helmet. Patient is in obvious discomfort, and he says he has worsening abdominal pain. Spinal injury has been ruled out.

**Vital Signs**

| | |
|---|---|
| **Heart rate** | 130/min |
| **Blood pressure** | 110/80 mm Hg |
| **Respiratory rate** | 30/min |
| **$SpO_2$** | 92% on room air |
| **Temperature** | 37.5 °C (99.5 °F) |
| **Weight** | 46 kg |
| **Age** | 12 years |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on identification of compensated hypovolemic shock progressing to hypotensive shock despite bolus fluid administration. Priorities include immediate establishment of intravenous (IV)/intraosseous (IO) access and administration of fluid bolus of isotonic crystalloid.

Reassessment of cardiorespiratory status is needed during and after each fluid bolus. Glucose concentration should be checked with point-of-care (POC) testing. When this child's shock does not respond to two to three 20 mL/kg boluses of isotonic crystalloid, administration of 10 mL/kg of packed red blood cells is indicated.

- If ongoing administration of packed red blood cells is needed, platelets and fresh frozen plasma should strongly be considered to avoid coagulopathy associated with multiple packed red blood cell infusions. Health care professionals must recognize the need for expert consultation (eg, pediatric trauma surgeon) and further diagnostic studies.

### Scenario-Specific Objectives

- Recognizes initial compensated shock and then hypotensive shock
- Summarizes signs and symptoms of hypovolemic shock; key indicators in this scenario include abdominal trauma, tachycardia, mottled skin, and weak pulses
- Demonstrates correct interventions for hypovolemic shock; this patient requires oxygen administration, administration of two to three 20 mL/kg boluses of isotonic crystalloid with careful reassessment during and after each fluid bolus, need for possible administration of packed red blood cells, and surgical consult
- Summarizes how to evaluate systemic (end-organ) perfusion; indicators appropriate for this scenario include skin temperature/color, level of consciousness, and urine output

### **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Awake, in obvious discomfort

**Breathing**

- Increased work of breathing, mild tachypnea

**Circulation**

- Pale, with mottled hands and feet

### Identify

- Immediate intervention needed

### Intervene

- Activate the emergency response system.
- Administer 100% oxygen by nonrebreathing 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 about 30/min; mild subcostal and intercostal retractions; mild nasal flaring; $SpO_2$ 92% on room air, increases to 98% with 100% oxygen administered via nonrebreathing mask; lungs clear to auscultation
- Circulation: Heart rate 130/min; central pulses weak, peripheral pulses barely felt; capillary refill about 4 seconds; cool and mottled hands and feet; blood pressure 110/50 mm Hg

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

- Disability: Alert
- Exposure: Oral temperature 37.5 °C (99.5 °F); weight 46 kg

**Identify**

- Respiratory distress
- Compensated shock
- Sinus tachycardia

**Intervene**

- Obtain vascular access (IV/IO); send blood sample for stat type and cross match.
- Administer a fluid bolus 20 mL/kg of isotonic crystalloid; repeat bolus x1 rapidly IV/IO; 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 POC glucose concentration and treat hypoglycemia if needed.
- Assess response to oxygen.

**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: Mechanism of injury, abdominal pain, distended abdomen
- **A**llergies: None known
- **M**edications: Albuterol inhaler
- **P**ast medical history: Mild asthma
- **L**ast meal: 6 hours ago
- **E**vents (onset): Thrown from bicycle, abdomen caught on handlebars 4 hours ago; initial pain, now worse; increased work of breathing

**Physical examination**

- Repeat vital signs after oxygen and 2 boluses of 20 mL/kg isotonic fluids: Heart rate 90-100/min; respiratory rate 15/min; $SpO_2$ 96% with 100% oxygen via nonrebreathing mask; blood pressure 90/50 mm Hg; capillary refill 4 seconds
- Head, eyes, ears, nose, and throat/neck: Mucous membranes moist
- Heart and lungs: No extra heart sounds or murmurs
- Abdomen: Distended, tender; hypoactive bowel sounds
- Extremities: Superficial abrasions; central pulses readily palpable, weak peripheral pulses; capillary refill 4 seconds
- Back: Normal
- Neurologic: Responds appropriately to questions, but clearly in pain; pupils 4 mm, equal, briskly reactive to light

**Identify**

- Hypotensive shock (likely hypovolemia related to blood loss)

**Intervene**

- Repeat bolus of 20 mL/kg of isotonic crystalloid IV/IO push if needed for 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.
- Consider administration of 10 mL/kg of packed red blood cells if signs of shock and hemodynamic instability persist despite 2-3 boluses of isotonic crystalloids.
- Arrange for transfer to surgery if patient cannot achieve hemodynamic stability.
- Obtain expert consultation (eg, from trauma surgeon or pediatric surgeon); additional diagnostic studies will be necessary.
- Arrange transfer to intensive care unit for closer monitoring if child is not already in intensive care.

# Debriefing Tool

## Practice Case Scenario 1, Hypovolemic Shock (Child; Uncompensated 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

- 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 and then hypotensive
- Establishes IV or IO access
- Directs rapid bolus administration of isotonic crystalloid; monitors for signs of heart failure during and after fluid bolus of isotonic crystalloid
- Reassesses patient during and in response to interventions, particularly during and after each fluid bolus
- Repeats fluid bolus (2-3) and administers packed red blood cells as needed to treat shock
- Checks glucose with POC testing
- Consults pediatric trauma surgeon

### 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; maintenance of blood pressure)
- 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)

## Practice Case Scenario 2

# Hypovolemic Shock

(Infant; Nonaccidental Trauma)

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### Scenario Lead-In

**Prehospital:** You are dispatched to transport a 6 month old with altered level of consciousness. The infant was picked up from day care earlier today and reportedly slept during the car ride home. Her father reports that he was unable to get the infant to take her bottle. She lies listless in father's arms.

**ED:** Emergency responders arrive with a 6 month old with altered level of consciousness. The infant was reportedly picked up from day care and slept during the car ride home. Her father reports that he was unable to get the infant to take her bottle. The infant lies listless in her father's arms. The emergency responders were unable to establish peripheral intravenous access.

**General inpatient unit:** As a member of the rapid response team, you respond to a 6-month-old infant with altered level of consciousness who was admitted directly from her physician's office. The father reported that he picked up the infant from day care and she slept during the car ride home. The father reports that he was unable to get the infant to take her bottle. The infant lies listless in the crib. The ward team has been unable to establish peripheral intravenous access.

**ICU:** You are asked to assess and manage a 6 month old with altered level of consciousness. The infant was picked up from day care by her father, who reports that the infant slept during the car ride home. The father reports that he was unable to get the infant to take a bottle. The infant lies listless in the crib. The infant's peripheral intravenous access has infiltrated.

**Vital Signs**

| | |
|---|---|
| **Heart rate** | 160/min |
| **Blood pressure** | 64/36 mm Hg |
| **Respiratory rate** | 10-18/min |
| **$SpO_2$** | 93% on room air |
| **Temperature** | 37.0 °C (98.6 °F) |
| **Weight** | 8.6 kg |
| **Age** | 6 months |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on identification of hypotensive hypovolemic shock. Priorities include immediate establishment of intravenous (IV)/intraosseous (IO) 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 with point-of-care (POC) testing. This infant's shock is complicated by signs of increased intracranial pressure, probably associated with intracranial injury. Health care professionals must recognize the need for expert consultation and further diagnostic studies.

### Scenario-Specific Objectives

- Recognizes signs of compensated and hypotensive shock; this scenario illustrates hypotensive hypovolemic shock, complicated by increased intracranial pressure (key indicators include decreased level of consciousness, tachycardia, cool and mottled skin, delayed capillary refill, and hypotension)
- Summarizes signs and symptoms of hypovolemic shock; key indicators in this case include signs of shock with signs of trauma
- Demonstrates correct interventions for hypovolemic shock; this case requires administration of oxygen, administration of an isotonic fluid bolus with careful reassessment during and after the fluid bolus, and consulting someone with surgical expertise (eg, general pediatric or neurosurgeon)
- Summarizes how to evaluate systemic (end-organ) perfusion; indicators appropriate for this include skin temperature/color, level of consciousness, and urine output
- Recognizes need for reporting and intervention for possible abuse

## **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Lethargic

**Breathing**

- Irregular and shallow breaths

**Circulation**

- Pale with significant mottling in extremities

## Identify

- Immediate intervention needed

## Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Provide bag-mask ventilation with 100% oxygen.
- Attach 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 10-18/min and irregular; mild subcostal and intercostal retractions; $SpO_2$ 93% on room air, increases to 95% with 100% oxygen with bag-mask ventilation; lungs clear to auscultation
- Circulation: Heart rate 160/min; pale; central pulses fair, peripheral pulses weak; capillary refill about 6 seconds; mottled arms and legs; cool and dusky hands and feet; blood pressure 64/36 mm Hg
- Disability: Lethargic, responds to pain; pupils are 4 mm bilaterally and sluggish but equally reactive to light
- Exposure: Rectal temperature 37.0 °C (98.6 °F); weight 8.6 kg

**Identify**

- Respiratory failure
- Hypotensive shock
- Sinus tachycardia
- Possible increased intracranial pressure

**Intervene**

- Obtain vascular access (IV/IO).
- Administer a fluid bolus of 20 mL/kg of isotonic crystalloid rapidly IV/IO; 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 POC glucose concentration and treat hypoglycemia if needed.
- Assess response to oxygen.

**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, irregular breathing
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: Term newborn
- **L**ast meal: 6 hours ago
- **E**vents (onset): Patient reportedly was "normal self" before being dropped off at day care. Day care told dad that the infant took second nap before being picked up. Infant has demonstrated increasing lethargy, decreased work of breathing, and irregular respiratory rate.

**Physical examination**

- Repeat vital signs after oxygen and fluids: Heart rate 140/min; respiratory rate 30/min with bag-mask ventilation; $SpO_2$ 99% during bag-mask ventilation with 100% oxygen; blood pressure 70/42 mm Hg
- Head, eyes, nose, and throat/neck: Anterior fontanelle is open and bulging; bruising to ears
- Heart and lungs: Rapid rate, no extra heart sounds or murmurs; lungs sound clear
- Abdomen: Distended, scattered bruises of various ages; patient cries because of light touching of abdomen; bowel sounds are absent; unable to appreciate any hepatosplenomegaly
- Extremities: Normal skin turgor
- Back: Normal
- Neurologic: Lethargic; left pupil 4 mm, sluggish reaction to light; right pupil 6 mm and unreactive to light

**Identify**

- Hypotensive hypovolemic shock
- Respiratory failure with disordered control of breathing (decreased level of consciousness)
- Possible intracranial injury

**Intervene**

- Repeat bolus of 20 mL/kg of isotonic crystalloid IV/IO push; repeat boluses needed for persistent shock symptoms.
- Perform careful and frequent cardiorespiratory assessment during and after each fluid bolus.
  - Stop fluid bolus if signs of heart failure (increased respiratory distress or development of rales or hepatomegaly).
- Continue to provide bag-mask ventilation; prepare for insertion of advanced airway.
- Obtain expert consultation (eg, from trauma surgeon, pediatric surgeon, or neurosurgeon).
  - Additional diagnostic studies will be necessary.
- Arrange transfer to intensive care unit for closer monitoring if infant is not already in intensive care.

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

**Lab data**

- Capillary gas: pH 7.20, $PCO_2$ 55 mm Hg, $PO_2$ 34 mm Hg, base excess −9, hemoglobin 10 g/dL
- Glucose (POC) 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: Computed tomography (CT)/magnetic resonance imaging (MRI)/ultrasound stat**

- Chest x-ray: Small heart, clear lung fields
- Head CT
- Abdominal imaging (eg, ultrasound, x-ray[s], CT)

**Identify/intervene**

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children. Hypoglycemia should be treated immediately.
- Mixed respiratory and metabolic acidosis should improve with support of ventilation and oxygenation and treatment of possible hypovolemic shock.
- Additional studies will be needed to evaluate the child's head for injuries because of level of consciousness, unreactive pupil, and bruising to ears (eg, CT scan).
- Additional studies will be needed to evaluate the etiology for the child's abdominal exam findings, which is likely the source of the child's hypovolemic shock.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 2, Hypovolemic Shock (Infant; Nonaccidental Trauma)

### 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 hypotensive and then hypovolemic
- Establishes IV or IO access
- Directs rapid administration of fluid bolus of isotonic crystalloid; monitors for signs of heart failure during and after fluid bolus
- Reassesses patient 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; maintenance of blood pressure)
- 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)

## Practice Case Scenario 3

# Lower Airway Obstruction

(Child; Severely Ill)

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**Scenario Lead-In**

**Prehospital:** You are responding to a 911 call for a 10 year old with breathing difficulty.

**ED:** A 10-year-old girl is brought in by first responders from her home after her mother called 911 saying that her daughter had difficulty breathing.

**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.

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

| Vital Signs | |
|---|---|
| **Heart rate** | 140/min |
| **Blood pressure** | 106/68 mm Hg |
| **Respiratory rate** | 40/min |
| **$SpO_2$** | 86% on room air |
| **Temperature** | 98.4 °F/36.9 °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 (severe tachypnea and hypoxemia on room air) and provide initial therapy, including administration of 100% oxygen, nebulized albuterol, and ipratropium and oral corticosteroids. Continuous nebulized albuterol may also be needed. Early consultation with an expert in the care of children with status asthmaticus is required because this child has a history of status asthmaticus requiring multiple intensive care unit (ICU) admissions. The child improves, so acceleration of care is not required. During the debriefing, the student is asked the indications for positive-pressure ventilation.

### 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, nebulized albuterol, and ipratropium bromide and corticosteroids
- Discusses importance of obtaining expert consultation if child with asthma has a history of ICU admissions and/or fails to respond to initial interventions

### **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Anxious; moderate distress; sitting upright

**Breathing**

- Increased work of breathing; retractions

**Circulation**

- Pale skin

### 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: Unobstructed
- Breathing: Moderate suprasternal and intercostal retractions; prolonged expiratory time; expiratory wheezes in the lower lobes; respiratory rate 40/min; $SpO_2$ 86% on room air, just before 100% oxygen administration
- Circulation: Heart rate 140/min; pale skin; strong radial pulse; capillary refill 2 seconds; blood pressure 106/68 mm Hg
- Disability: Awake; speaks in 2- to 3-word sentences
- Exposure: Afebrile; no rashes; weight 35 kg

**Identify**

- Respiratory distress, possible respiratory failure
- Lower airway obstruction

**Intervene**

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

**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: Cough; respiratory distress
- **A**llergies: Molds and grass
- **M**edications: Inhaler that has not been refilled for several months
- **P**ast medical history: Known asthmatic, poorly controlled; 3 ICU admissions for respiratory failure; family members smoke in the house
- **L**ast meal: 3 hours ago
- **E**vents (onset): Cold symptoms for the last 3 days; increased cough and distress for past 24 hours

**Physical examination**

- Repeat vital signs after oxygen and fluids: Heart rate 140/min; respiratory rate 32/min; $SpO_2$ 94% when receiving 100% oxygen via nonrebreathing face mask; blood pressure 112/71 mm Hg
- Head, eyes, ears, nose, and throat/neck: Normal
- Heart and lungs: Wheezing on expiration in lower lobes; poor air movement; persistent moderate suprasternal and intercostal retractions
- Abdomen: Normal
- Extremities: Normal
- Back: Normal
- Neurologic: Anxious; no other abnormalities; now speaking in 3- to 4-word sentences

**Identify**

- Respiratory distress
- Lower airway obstruction

**Intervene**

- Assess response to albuterol and ipratropium.
- If wheezing and aeration are not improved, consider provision of continuous nebulized albuterol.
- Obtain vascular access.
- Consider obtaining expert consultation about the management of pediatric status asthmaticus.
- If no improvement in signs of lower airway obstruction despite continuous albuterol and administration of ipratropium bromide, consider additional interventions (eg, magnesium sulfate) and diagnostic testing (chest x-ray), and consult an expert in the management of pediatric status asthmaticus (if not already done).
- Arrange for transfer of child to the ICU (if the child is not already in the ICU) so that child may receive additional monitoring and therapy.
- If child's condition does improve, be prepared to initiate heated high-flow nasal cannula or continuous positive air pressure, as tolerated, to keep $SpO_2$ 94% or greater.

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

**Lab data**

- Glucose (point-of-care testing) 126 mg/dL (7.0 mmol/L)

**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 all critically ill infants and children. Hypoglycemia should be treated immediately.

**Additional testing** (eg, chest x-ray) may be performed if pneumonia or a pneumothorax is suspected. Re–evaluate-identify-intervene after each intervention.

# Debriefing Tool

## Practice Case Scenario 3, Lower Airway Obstruction (Child; Severely Ill)

### 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
- Initiates therapy for asthma, including continued oxygen administration, nebulized albuterol, and corticosteroids
- Directs establishment of intravenous or intraosseous access
- 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)
- States the importance of early consultation with expert in the care of children with status asthmaticus

### 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 gradually 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 and bradycardia.)

## Practice Case Scenario 4

# Upper Airway Obstruction

(Child; Moderate to Severe)

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**Scenario Lead-In**

**Prehospital:** You are responding to a 911 call for a 1 year old with breathing difficulty.

**ED:** A 1-year-old girl is brought in by first responders from her home after mother called 911 because the child was having difficulty breathing.

**General inpatient unit:** You are called to the room of a 1-year-old girl who is being admitted from the emergency department for respiratory distress and croup-like symptoms.

**ICU:** You are called to the room of a 1-year-old girl who is being admitted from the emergency department for respiratory distress and croup-like symptoms.

| Vital Signs | |
|---|---|
| **Heart rate** | 154/min |
| **Blood pressure** | 75/43 mm Hg |
| **Respiratory rate** | 64/min |
| **$SpO_2$** | 84% on room air |
| **Temperature** | 36.3 °C (97.4 °F) |
| **Weight** | 10 kg |
| **Age** | 1 year |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis in this scenario is on rapid recognition and management of respiratory distress associated with significant upper airway obstruction. The child's lethargy, signs of increased respiratory effort, and stridor at rest all indicate the need to remove the child from the parents, position the child to open the airway and suction the nares, administer nebulized epinephrine and dexamethasone, and prepare for more-advanced care, including early expert consultation. Discussion during the debriefing addresses estimation of endotracheal tube size.

### Scenario-Specific Objectives

- Identifies the signs and symptoms of significant upper airway obstruction; in this scenario, they include significant tachypnea and increased work of breathing, inspiratory stridor, slightly shallow respirations, and decreased level of consciousness
- Recognizes that removing the child from the parent's arms is indicated for this child; in this scenario, the child is lethargic with only fair chest rise and mild cyanosis
- Performs correct interventions for significant upper airway obstruction; in this scenario, these include positioning to open airway, suctioning of nares, oxygen administration, nebulized epinephrine (may be repeated), administration of dexamethasone, and preparation for respiratory support
- Identifies the need to obtain expert consultation to be available

### **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Being held by parent; appears lethargic, not moving much

**Breathing**

- Tachypneic with increased work of breathing; high-pitched inspiratory stridor; slightly shallow respirations noted

**Circulation**

- Mild cyanosis of lips

### Identify

- Immediate intervention needed

### Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Place patient on bed and reposition to open airway using head tilt–chin lift.
- 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 oral obstruction
- Breathing: High-pitched, faint, inspiratory stridor; respiratory rate 64/min; moderate, suprasternal, intercostal, and subcostal retractions; $SpO_2$ 84% before oxygen administration, then 95% after provision of 100% inspired oxygen; nasal flaring present with copious secretions; improved chest rise with repositioning; lung sounds are clear with the exception of transmitted upper airway sounds with overall poor air entry
- Circulation: Heart rate 154/min; mild cyanosis of lips before oxygen administration (lips now pink); warm skin centrally and peripherally; strong central and peripheral pulses; capillary refill 3 seconds; blood pressure 75/43 mm Hg
- Disability: Lethargic, but withdraws and whimpers to tactile stimulation; anterior fontanel soft and flat
- Exposure: Temperature 36.3 °C (97.4 °F); weight 10 kg

**Identify**

- Respiratory distress or failure
- Upper airway obstruction

**Intervene**

- Continue positioning/oxygen administration.
- Administer nebulized epinephrine.
- Contact expert help to be available if child fails to improve or deteriorates further and to develop plan of care.

**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: Awoke yesterday with fever, barking, and seal-like cough; seemed to improve yesterday, but worse overnight
- **A**llergies: None known
- **M**edications: Acetaminophen for fever given by mother 2 hours ago
- **P**ast medical history: Otitis media at 10 and 11 months
- **L**ast meal: 8 hours ago; refused bottle and breakfast this morning
- **E**vents (onset): Symptoms worse at night; increased work of breathing and more lethargic this morning

**Physical examination**

- Repeat vital signs after oxygen and nebulized epinephrine: Heart rate 161/min; respiratory rate 56/min; $SpO_2$ 99% on supplemental oxygen; blood pressure 77/48 mm Hg
- Head, eyes, ears, nose, and throat/neck: Nasal flaring persists; less nasal secretions; airway remains patent with support and positioning; moist mucous membranes
- Heart and lungs: Lungs clear; transmitted upper airway sounds (less pronounced); suprasternal, intercostal, and subcostal retractions improved; improved bilateral chest rise; stridor is louder
- Abdomen: Normal
- Extremities: Normal
- Back: Normal
- Neurologic: Becoming more alert

**Identify**

- Respiratory distress
- Upper airway obstruction

**Intervene**

- Evaluate response to nebulized epinephrine.
- Repeat nebulized epinephrine and reassess response.
- Health care professionals may consider use of heliox, but it can't be used if the child requires a high concentration of inspired oxygen.
- Check glucose using point-of-care testing.
- Administer oral/intravenous/intramuscular corticosteroids (eg, dexamethasone); administer oral corticosteroids if child is sufficiently alert.
- Be prepared to provide initial advanced care, such as immediate bag-mask ventilation, if the child's condition fails to improve or deteriorates further.
- Arrange for the child to have careful, close observation as severe symptoms may recur, requiring transfer to intensive care unit (ICU) (if child is not already in ICU).

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

**Lab data**

- Glucose 72 mg/dL (4.0 mmol/L)
- Consider complete blood count and electrolytes

**Imaging**

- Imaging may be contraindicated. Removing the child from her parents and a position of comfort may cause distress, leading to an exacerbation of stridor and airway obstruction.

**Identify/intervene**

- Laboratory tests are generally not appropriate during the immediate management (initially, health care professionals should minimize stimulation until child's airway obstruction and work of breathing are more stable).
- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children.
  - This child has not been eating well, so it will be important to check the glucose. Hypoglycemia should be treated immediately.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 4, Upper Airway Obstruction (Child; Moderate to Severe)

### 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
- Recognizes signs of severe upper airway obstruction
- Provides appropriate initial management of significant upper airway obstruction, including positioning the child and opening the airway, suctioning the nares, providing oxygen, and giving nebulized epinephrine and dexamethasone
- Reassesses the child frequently and evaluates response to interventions, watching closely for signs of deterioration
- Identifies the need to obtain early expert consultation to develop plan of care should the child deteriorate further, including possible insertion of an advanced airway and other advanced care and monitoring
- Arranges transfer of child to ICU (if child is not already in ICU)

### 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 somewhat after interventions to relieve upper airway obstruction. 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 increased work of breathing; decreased breath sounds or aeration; deterioration in level of consciousness, hypoxemia, or cyanosis)

## Practice Case Scenario 5

# Asystole

(Infant; Arrest)

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### Scenario Lead-In

**Prehospital:** You are dispatched to a house where a 6-month-old infant has had respiratory distress; she is now unresponsive.

**ED:** An ambulance is en route to the emergency department with a 6-month-old infant who was found unresponsive in her crib; CPR is ongoing.

**General inpatient unit:** You are called as a member of the rapid response team to see a 6 month old who was admitted with respiratory distress, but she has now become limp and unresponsive.

**ICU:** You are called to see a 6 month old who became progressively limp and unresponsive. The infant was admitted with respiratory distress with the remainder of the emergency department workup unremarkable.

| 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** | 7 kg |
| **Age** | 6 months |

## Scenario overview and learning objectives

### Scenario Overview

This scenario focuses on the identification and management of 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); respiratory distress and failure may have caused hypoxia and acidosis 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 infant has asystole
- Describes correct dose and rationale for epinephrine administration
- Summarizes potentially reversible causes of asystole; during the scenario, the student considers possible reversible causes of cardiac arrest (recalled by conditions beginning with H's and T's); in this infant, respiratory distress may have produced hypoxia and acidosis
- 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) while checking for 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 7 kg using color-coded length-based resuscitation tape

### 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 (asystole); immediately resume high-quality CPR, rotating compressors and checking 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 170/min; respiratory rate 20/min (with bag-mask ventilation); $SpO_2$ 99%; blood pressure 73/42 mm Hg; temperature 36 °C (96.8 °F)

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 bag-mask device, until someone with intubation skills or an advanced care professional is available.
- After ROSC
  - 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 of neurologic and other end-organ function.

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

**Lab data (as appropriate)**

- Blood glucose 96 mg/dL (5.3 mmol/L) (after ROSC)
- Arterial/venous blood gas, electrolytes, calcium, magnesium

**Imaging after ROSC**

- 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

## Practice Case Scenario 5, Asystole (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 monitor leads/pads and activation of monitor
- Identifies asystole in 2 leads
- 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 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…
- 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; and support of neurologic and other end-organ function.)

Practice Case Scenario 6

# Pulseless Electrical Activity

(Child; Arrest)

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### Scenario Lead-In

**Prehospital:** You are dispatched to a house where a 3-year-old child is now unresponsive. Prescription pills, including his grandmother's oral antihyperglycemic agent (glyburide), are scattered throughout the child's room.

**ED:** An ambulance is en route to the emergency department with a 3-year-old child who was found unresponsive in his bed. Prescription pills, including his grandmother's oral hypoglycemic agent, were scattered throughout the child's room.

**General inpatient unit:** You are called as a member of the rapid response team to see a 3 year old who was admitted with lethargy; he has now become limp and unresponsive. Emergency responders had found prescription pills, including his grandmother's oral hypoglycemic agent, scattered throughout the child's room.

**ICU:** You are called to see a 3 year old who was admitted with lethargy; he now has become progressively limp and unresponsive. Emergency responders found prescription pills, including his grandmother's oral hypoglycemic agent, scattered throughout the child's room.

**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** | 17 kg |
| **Age** | 3 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 causes of pulseless electrical activity (PEA) (H's and T's). The child has significant hypoglycemia that must be corrected, and other drug toxicities may be present (the team must identify the drugs collected by emergency responders). 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 PEA
- Describes correct dose and rationale for epinephrine administration
- Summarizes potentially reversible causes of PEA; during the scenario, the student or health care professional considers possible reversible causes of cardiac arrest (recalled by conditions beginning with H's and T's); in this child, significant hypoglycemia and possible other toxic drugs have contributed to the arrest
- Discuss 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 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) while checking for carotid 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 17 kg using color-coded length-based resuscitation tape

## Identify

- Cardiopulmonary arrest

## Intervene

- Use a CPR feedback device to guide CPR delivery.
- When defibrillator arrives, apply pads/leads and turn on monitor.
- Organized sinus rhythm with a rate of 70/min (PEA); immediately resume high-quality CPR, rotating compressors and checking 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: 5 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)

- Blood glucose 18 mg/dL (1.0 mmol/L); all other H's and T's within normal limits
- Vital signs after ROSC following high-quality CPR and 2 doses of epinephrine: Sinus rhythm; heart rate 172/min; respiratory rate 20/min (with bag-mask ventilation and 100% oxygen); $SpO_2$ 98%; blood pressure 90/60 mm Hg; temperature 36 °C (96.8 °F)

If no epinephrine is delivered, CPR quality is poor, or hypoglycemia is not corrected, PEA continues and deteriorates to asystole.

## Identify

- Cardiopulmonary arrest
- PEA
- 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 PEA (H's and T's).
- Check glucose concentration with point-of-care testing. Give IV dextrose as soon as hypoglycemia is identified.
- Consider placement of an advanced airway, especially if unable to provide adequate ventilation with bag-mask device and advanced care professional is available.
- After ROSC
  - Apply pulse oximeter (if not already applied). Titrate inspired 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.
  - Repeat serum glucose and search for other possible causes of cardiac arrest.

## **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 glucose administration and ROSC
- Arterial/venous blood gas, electrolytes, calcium, magnesium

**Imaging after ROSC**

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

## Identify/intervene

- Apply blood pressure cuff.
- Blood work and chest x-ray are not available during the scenario.

## Re–evaluate-identify-intervene after each intervention.

# Debriefing Tool

## Practice Case Scenario 6, PEA (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)
- 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 on monitor 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)
- Checks glucose early with point-of-care testing because child likely ingested hypoglycemic agent
- 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: Hypoglycemia, perhaps other electrolyte imbalances)
- 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; and support of neurologic and other end-organ function.)

Practice Case Scenario 7

# Lung Tissue (Parenchymal) Disease

(Infant)

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### Scenario Lead-In

**Prehospital:** You respond to a 6 month old in respiratory distress.

**ED:** Emergency responders arrive with a 6-month-old boy brought from home with respiratory distress.

**General inpatient unit:** You are called to the room of a 6-month-old boy being directly admitted for respiratory distress.

**PICU:** You are called to the room of a 6-month-old boy just admitted to the intensive care unit for respiratory distress.

| Vital Signs | |
|---|---|
| **Heart rate** | 160/min |
| **Blood pressure** | 90/60 mm Hg |
| **Respiratory rate** | 80/min |
| **$SpO_2$** | 82% on room air |
| **Temperature** | 39.2 °C (102.5 °F) |
| **Weight** | 6 kg |
| **Age** | 6 months |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis in this scenario is on rapid recognition of respiratory failure associated with lung tissue (parenchymal) disease. Recognition of signs of respiratory failure (including significant respiratory effort, hypoxemia despite high-flow supplemental oxygen, decreased level of consciousness, and cyanosis) should prompt immediate initiation of appropriate therapy, starting with administration of 100% oxygen and bag-mask ventilation. The health care professional should quickly consult someone with advanced expertise when the infant fails to improve. This infant needs intubation and mechanical ventilation by an expert in the care of children with respiratory failure. Pediatric intensive care unit care is required. 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 expertise are readily available.

### Scenario-Specific Objectives

- Distinguishes between respiratory distress and respiratory failure; in this scenario, the infant's clinical signs are consistent with respiratory failure
- Identifies signs and symptoms 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, those interventions include administration of a high concentration of oxygen, appropriate monitoring, reassessing the infant, and advancing to more support of oxygenation and ventilation when the infant fails to improve
- Recalls the common causes of lung tissue disease; common causes include pneumonia and aspiration

## **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Lethargic

**Breathing**

- Shallow, rapid respirations; grunting

**Circulation**

- Pale skin; cyanosis

## 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: Shallow, rapid respirations; mild intercostal and subcostal retractions; bilateral crackles; no stridor or wheezing; expiratory phase is not prolonged; respiratory rate 80/min; $SpO_2$ 82% on room air and increased to 85% on 100% oxygen via a nonrebreathing face mask
- Circulation: Heart rate 160/min; pale skin; cyanosis; strong central and peripheral pulses; capillary refill 2 seconds; blood pressure 90/60 mm Hg
- Disability: Lethargic; arousable by voice
- Exposure: Temperature 39.2 °C (102.5 °F); weight 6 kg

**Identify**

- Respiratory failure
- Lung tissue disease

**Intervene**

- Assess response to oxygen.
- Provide bag-mask ventilation with 100% oxygen while preparing for high-flow nasal cannula, BiPAP, or intubation.

**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: Sudden onset of respiratory distress after an episode of vomiting; no previous cold symptoms or cough
- **A**llergies: None known
- **M**edications: Metoclopramide
- **P**ast medical history: Reflux
- **L**ast meal: 2 hours ago
- **E**vents (onset): Previously well other than history of severe gastroesophageal reflux

**Physical examination**

- Repeat vital signs after bag-mask ventilation with 100% oxygen: Respiratory rate 30/min (rate at which patient is receiving bag-mask ventilation); heart rate 160/min; $SpO_2$ 96% with bag-mask ventilation; blood pressure 100/70 mm Hg
- Head, eyes, ears, nose, and throat/neck: Normal
- Heart and lungs: Diminished breath sounds; bilateral diffuse crackles
- Abdomen: Normal
- Extremities: Normal
- Back: Normal
- Neurologic: Lethargic; becoming less responsive and more difficult to arouse

**Identify**

- Respiratory distress
- Lung tissue disease

**Intervene**

- Continue bag-mask ventilation.
- Contact a health care professional with more-advanced expertise.
  - *Note:* If the child's level of consciousness improves and continuous monitoring is provided, critical care professionals may consider use of noninvasive ventilation support (CPAP or noninvasive positive-pressure ventilation) if there is equipment and appropriate expertise for rapid intubation immediately available.
- Obtain vascular access.
- Obtain arterial/venous blood gas.
- Check glucose with point-of-care testing.
- Prepare equipment and skilled personnel for endotracheal intubation using a cuffed tracheal tube.
- 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**

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

**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 diffuse bilateral airspace disease.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 7, Lung Tissue (Parenchymal) Disease (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**
- Directs administration of 100% oxygen via nonrebreathing face mask and evaluates response
- Establishes cardiac monitoring and pulse oximeter
- Identifies respiratory failure
- Identifies signs of lung tissue disease
- Reassesses child and identifies need for additional intervention (beyond administration of 100% oxygen via nonrebreathing face mask)
- Provides or directs bag-mask ventilation
- Directs establishment of intravenous or intraosseous access
- Performs frequent reassessment of patient
- Identifies need for involvement of advanced health care professional with expertise in pediatric intubation and mechanical ventilation
- Summarizes specific interventions for lung tissue disease
- 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…
- This infant requires intubation. How will 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.

## Practice Case Scenario 8

# Distributive Shock

(Adolescent; Septic Shock)

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### Scenario Lead-In

**Prehospital:** You are dispatched to transport a 12-year-old girl with a 24-hour history of high fever and lethargy. She has become progressively more confused in the last hour.

**ED:** Parents arrive with their 12-year-old girl who has a 24-hour history of high fever and lethargy. She has become progressively more confused in the last hour.

**General inpatient unit:** You have just received a 12-year-old girl directly admitted to the ward from her physician's office. She has a 24-hour history of high fever and lethargy. She has become progressively more confused in the last hour. You are unable to establish intravenous access.

**ICU:** You are called to the bedside of a 12-year-old girl who has been admitted to the intensive care unit with a 24-hour history of high fever and lethargy. She has become progressively more confused in the last hour. The intravenous access placed at the time of admission has infiltrated.

| Vital Signs | |
|---|---|
| **Heart rate** | 130/min |
| **Blood pressure** | 80/30 mm Hg |
| **Respiratory rate** | 35/min |
| **$SpO_2$** | 93% on room air |
| **Temperature** | 39.0 °C (102.2 °F) |
| **Weight** | 41 kg |
| **Age** | 12 years |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on identification of hypotensive 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 be able to discuss the importance of detection of signs of heart failure and need to stop bolus fluid administration if such signs develop. Within the first hour of identification of signs of septic shock, health care professionals must give bolus fluid therapy, administer antibiotics, and initiate vasoactive drug therapy (if shock persists despite bolus fluids). The health care professional should also make plans to transfer the child to an appropriate setting (unless the child is already in the intensive care unit [ICU]).

### Scenario-Specific Objectives

- Recognizes hypotensive (previously referred to as *decompensated*) vs compensated shock; in this scenario, the child has hypotensive shock
- 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 isotonic 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 the need to stop 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; irritable; mumbling

**Breathing**

- Increased rate but no distress

**Circulation**

- Pale and mottled

### 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 about 35/min; $SpO_2$ 93% on room air, increased to 97% with administration of 100% oxygen; lungs clear to auscultation
- Circulation: Heart rate 130/min; central pulses good, peripheral pulses bounding; flash capillary refill (less than 1 second); warm but mottled hands and feet; blood pressure 80/30 mm Hg
- Disability: Lethargic; mumbling; confused
- Exposure: Rectal temperature 39.0 °C (102.2 °F); petechial-purpuric rash over extremities and torso; weight 41 kg

**Identify**

- Hypotensive 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 (if not already done) within first hour after recognition of shock. If possible, obtain blood culture before antibiotic administration, but don't delay antibiotic or fluid administration.
- Check point-of-care (POC) glucose 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: Fever and lethargy for 24 hours
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: No oral intake for 6 hours
- **E**vents (onset): 24-hour history of fever and increasing lethargy; noted to be confused in last 2 hours

**Physical examination**

- Repeat vital signs after oxygen and fluids: Heart rate 122/min; respiratory rate 35/min; $SpO_2$ 100% with 100% inspired oxygen; blood pressure 84/32 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mucous membranes slightly dry; neck supple
- Heart and lungs: Rapid rate; no extra heart sounds or murmurs; lungs sound clear
- Abdomen: No palpable liver edge; nondistended; nontender; normal bowel sounds
- Extremities: Warm hands and feet; mottled; bounding peripheral pulses
- Back: Normal
- Neurologic: Lethargic; pupils 4 mm, equal, reactive

**Identify**

- Hypotensive distributive/septic shock

**Intervene**

- If signs of shock persist, repeat fluid bolus of 10-20 mL/kg of isotonic crystalloid IV/IO as needed. Reassess during and after each fluid bolus.
- Stop fluid bolus if signs of heart failure develop (eg, development of respiratory distress, rales, or hepatomegaly) or if vital signs fail to improve or begin to deteriorate.
- Begin vasoactive drug therapy within first hour after the recognition of shock if systemic perfusion fails to improve after 2-3 boluses of fluid therapy. (The total amount of fluid boluses will depend on the amount of fluid that can be given in the first hour.)
- Consider administration of epinephrine or norepinephrine infusion.
- Ensure that bolus fluid therapy, administration of antibiotics, and initiation of vasoactive therapy (if shock is fluid refractory) are all accomplished within the first hour after the identification of signs of septic shock.
- Assess response to oxygen administration.
- Arrange for transfer to ICU for closer monitoring if child is not already in the ICU.

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

**Lab data**

- Capillary gas: pH 7.16; $PCO_2$ 20 mm Hg; $PO_2$ 20 mm Hg; base deficit/excess −10; 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

**Identify/intervene**

- The blood glucose concentration should be checked with POC testing whenever the infant or child is critically ill. Hypoglycemia should be treated immediately.
- Metabolic acidosis with partial respiratory compensation should correct if shock resuscitation is effective.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 8, Distributive Shock (Adolescent; 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 distributive (septic) shock in an adolescent
- Categorizes shock as hypotensive
- 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 signs) 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
- Verbalizes therapeutic end points during shock management (normalization of heart rate and blood pressure; improvement in peripheral perfusion, mental status, and urine output)

### 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)

## Practice Case Scenario 9

# Supraventricular Tachycardia

(Adolescent; Unstable)

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### Scenario Lead-In

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

**ED:** An ambulance is en route to the emergency department with a 12-year-old boy with lethargy, tachypnea, and a racing heart.

**General inpatient unit:** You are called to examine a 12-year-old boy with lethargy, tachypnea, and a racing heart.

**ICU:** You are called to the bedside of a 12-year-old boy who says he has a racing heart and now has lethargy.

| Vital Signs | |
|---|---|
| **Heart rate** | 235/min |
| **Blood pressure** | 70/40 mm Hg |
| **Respiratory rate** | 34/min |
| **$SpO_2$** | 92% on room air |
| **Temperature** | 37.6 °C (99.7 °F) |
| **Weight** | 50 kg |
| **Age** | 12 years |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on diagnosis 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. If time allows, the instructor may briefly discuss the need for expert consultation before administering a precardioversion sedative to a child with hemodynamic instability.

### Scenario-Specific Objectives

- Differentiates between SVT and sinus tachycardia; in this scenario, the child has SVT
- Differentiates between stable and unstable SVT; in this scenario, the child has unstable SVT
- Demonstrates the proper rapid bolus technique to administer adenosine
- Discusses indications for synchronized cardioversion; in this scenario, the child has unstable SVT evidenced by poor perfusion, including hypotension, acutely altered mental status (new lethargy), and signs of shock
- Demonstrates safe delivery of synchronized cardioversion with appropriate dose in a patient with SVT and poor perfusion

### **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Moaning; minimal response to caregivers

**Breathing**

- Increased rate and effort, including nasal flaring

**Circulation**

- Pale and mottled

### 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 34/min; $SpO_2$ 92% before supplemental oxygen and 100% after; crackles throughout lung fields
- Circulation: Heart rate 235/min; weak central pulses, thready peripheral pulses; cool/mottled skin; capillary refill about 6 seconds; blood pressure 75/55 mm Hg
- Disability: Deferred until after successful rhythm conversion
- Exposure: Temperature 37.6 °C (99.7 °F); weight 50 kg

## Identify

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

## Intervene

- Establish IV/IO access in a location close to the heart (eg, antecubital fossa) if possible but do not delay cardioversion if IV/IO access is not readily available.
- Only if functional IV is in place or is established immediately, administer adenosine.
  - Begin recording continuous rhythm strip.
  - Give adenosine 0.1 mg/kg (max 6 mg) IV/IO by rapid bolus followed by rapid saline flush.
  - If first dose of adenosine is unsuccessful, administer adenosine 0.2 mg/kg rapid bolus (max 12 mg), if it can be given more rapidly than synchronized cardioversion. Ensure that rapid bolus technique is used to administer the drug.
- Provide immediate cardioversion if adenosine is ineffective or if there is any delay in the ability to administer adenosine.
- 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.)
  - Sedation in patients with hemodynamically unstable SVT is not routinely recommended.
  - As soon as a monitor/defibrillator arrives, attach pads and begin recording rhythm strip.
  - "Clear" and perform synchronized cardioversion (0.5-1 J/kg).
  - If synchronized cardioversion results in no rhythm change, "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: Tachycardia; lethargy; hypotension
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: History of SVT about 4 years ago
- **L**ast meal: Ate 6 hours ago
- **E**vents (onset): Acute onset 30 minutes ago

**Physical examination**

- Repeat vital signs after successful rhythm conversion: Heart rate 104/min; sinus rhythm; respiratory rate 28/min; $SpO_2$ 100% on 100% oxygen by nonrebreathing mask; blood pressure 100/60 mm Hg
- Head, eyes, ears, nose, and throat/neck: Clear; no audible breath sounds
- Heart and lungs: Sinus rhythm; central and peripheral pulses strong; capillary refill 3 seconds; no murmur, gallop, or rub appreciated; fine scattered crackles at bases on auscultation
- Abdomen: Liver not palpable 2-3 cm below the costal margin
- Extremities: Cool peripherally
- Back: Unremarkable
- Neurologic: Moans with cardioversion; opens eyes and moves spontaneously, answering questions with single words or shortphrases
- Point-of-care (POC) glucose concentration (see the Evaluate and Identify/intervene boxes that follow)

If no rhythm conversion or delay in administering adenosine or cardioversion

- Vital signs: Heart rate 235/min; weak central pulses, peripheral pulses barely palpable; cool/mottled skin; capillary refill about 6 seconds; respiratory rate 34/min; $SpO_2$ 93% despite 100% oxygen via nonrebreathing mask; crackles throughout lung fields; blood pressure 72/54 mm Hg

## Identify

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

## Intervene

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

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

**Lab data**

- Electrolytes

**Imaging**

- Chest x-ray, rhythm strip from defibrillator, 12-lead electrocardiogram in sinus rhythm

**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 all 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 are improved.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 9, SVT (Adolescent; 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 a pulse and poor perfusion and distinguishes it from sinus tachycardia
- Describes how to perform appropriate vagal maneuvers for a child
- Directs establishment of IV/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…
- Ask students to state the indications for synchronized cardioversion.
- If time allows, discuss need for expert consultation before administering precardioversion sedative to child with SVT and hemodynamic instability.

Practice Case Scenario 10

# Wide-Complex Tachycardia, Possible Ventricular Tachycardia

(Infant; Stable)

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### Scenario Lead-In

**Prehospital:** You are en route to a call for a 3-month-old infant with irritability and cold-like symptoms.

**ED:** You are called to the emergency department to help out with a 3-month-old infant with irritability and cold-like symptoms.

**General inpatient unit:** You are called to the bedside of a 3-month-old infant who was admitted with irritability and cold-like symptoms.

**ICU:** You are called to see a 3-month-old infant who was admitted to the intensive care unit for irritability and cold-like symptoms.

| Vital Signs | |
|---|---|
| **Heart rate** | 220/min |
| **Blood pressure** | 96/54 mm Hg |
| **Respiratory rate** | 36/min |
| **$SpO_2$** | 90% on room air; 97% while receiving supplemental oxygen by face mask |
| **Temperature** | Afebrile |
| **Weight** | 6 kg |
| **Age** | 3 months |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on the recognition of wide-complex tachycardia, assessing the patient as stable, and not requiring urgent/emergent electrical therapy and/or antiarrhythmic medication administration. Health care professionals should search for and treat reversible causes (eg, hypokalemia, hyperkalemia). Stable patients with monomorphic, regular wide-complex tachycardia can be safely administered adenosine, which may be therapeutic and/or diagnostic. Expert consultation with a pediatric cardiologist is strongly recommended in any patient with wide-complex tachycardia, regardless of stability, because of the potential for hemodynamic decline.

### Scenario-Specific Objectives

- Differentiates between pulseless ventricular tachycardia (VT) and wide-complex tachycardia (possible VT) with a pulse
- Discusses reason that expert consultation is advised before performing synchronized cardioversion in a stable child with VT
- Differentiates when adenosine would be appropriate to consider in a child with wide-complex tachycardia

## Evaluate—initial assessment (Pediatric Assessment Triangle)

**Appearance**

- Awake; crying

**Breathing**

- Spontaneous; nasal congestion; no increased work of breathing apparent

**Circulation**

- Pale skin

## Identify

- No immediate intervention needed

## Intervene

- Proceed to primary assessment.

## Evaluate—primary assessment

- Airway: Crying
- Breathing: Upper airway congestion; bilateral air entry; no use of accessory muscles; no nasal flaring; respiratory rate 36/min; $SpO_2$ 97% when receiving supplemental oxygen by face mask
- Circulation: Heart rate 220/min; blood pressure 96/54 mm Hg; pale skin; capillary refill 3 seconds; strong central pulses, palpable peripheral pulses; QRS complexes are monomorphic and occur at regular intervals
- Disability: Awake; fussy; eyes open
- Exposure: Afebrile; weight 6 kg

## Identify

- Wide-complex tachycardia (possible VT) with a pulse and adequate perfusion (stable)
- Regular rhythm with wide monomorphic complexes

## Intervene

- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Administer supplemental oxygen if needed.
- Apply cardiac monitor.
- Apply blood pressure cuff.
- Apply pulse oximeter.
- Identify rhythm: regular wide-complex tachycardia (possible VT) with a pulse and adequate perfusion.
- Obtain 12-lead electrocardiogram.
- Search for and treat reversible causes.
- Obtain vascular access (intravenous).
- Consider adenosine if rhythm is regular with monomorphic wide-complex QRS complexes.
  - Record continuous rhythm strip during administration.
  - Consult pediatric cardiology.

## Evaluate—secondary assessment

**SAMPLE history**

- **S**igns and symptoms: Fussy; agitated since early morning
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: Delivery at 39 weeks; no problems
- **L**ast meal: 1 oz formula 4 hours ago
- **E**vents: Admitted to floor 6 hours ago with fussiness, agitation, and cold-like symptoms

**Physical examination**

- Repeat vital signs (adenosine has no effect): Heart rate 218/min (wide-complex tachycardia persists); blood pressure 96/56 mm Hg; respiratory rate 24/min; $SpO_2$ 97% on room air
- Head, eyes, ears, nose, and throat/neck: Normal
- Heart and lungs: No murmur, gallop, or rub; lungs clear; capillary refill 3 seconds; peripheral pulses weak
- Abdomen: Nondistended; nontender; no masses; normal bowel sounds; no hepatomegaly
- Extremities: No edema; no rash; cool hands and feet
- Back: Normal
- Neurologic: Pupils equal and reactive equal

## Identify

- Persistent stable, wide-complex tachycardia with a pulse and adequate perfusion

## Intervene

- Monitor cardiorespiratory function for signs of heart failure (enlarged liver, extra heart sounds or murmurs, crackles/rales).
- Search for and treat reversible causes.
- Obtain 12-lead electrocardiogram.
- Obtain expert consultation with pediatric cardiology.

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

**Lab data**

- Blood glucose
- Electrolytes
- A blood gas (arterial, venous, or capillary blood gas) not indicated in the immediate management of this infant, but could be considered after stabilization to guide further management

**Imaging**

- Not indicated

## Identify/intervene

- Although laboratory tests are generally not appropriate during the immediate management, a blood glucose concentration should be checked with point-of-care testing as soon as reasonable in all critically ill children. Hypoglycemia should be treated immediately.
- Serum electrolytes should also be checked as soon as possible. An electrolyte abnormality such as hypokalemia or hyperkalemia may cause ventricular arrhythmias.

## Re–evaluate-identify-intervene after each intervention.

# Debriefing Tool

## Practice Case Scenario 10, Wide-Complex Tachycardia, Possible VT (Infant; 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 VT with a pulse and stable perfusion
- Directs establishment of intravenous access
- Identifies when it would be appropriate to obtain expert consultation
- Discusses preparation and administration of adenosine using rapid bolus technique. It is reasonable to consider adenosine in a patient who is hemodynamically stable with a regular, monomorphic, wide-complex tachycardia
- Explains the rationale for expert consultation before synchronized cardioversion or antiarrhythmics
- States the reason it is important to search for and treat reversible causes of wide-complex tachycardias
- 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.

Practice Case Scenario 11

# Wide-Complex Tachycardia (Possible Ventricular Tachycardia) With a Pulse and Poor Perfusion

(Child; Unstable)

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| Vital Signs | |
|---|---|
| **Heart rate** | 210/min |
| **Blood pressure** | 74/35 mm Hg |
| **Respiratory rate** | 46/min |
| **$SpO_2$** | 82% on room air |
| **Temperature** | 37.6 °C (99.7 °F) |
| **Weight** | 30 kg |
| **Age** | 10 years |

### Scenario Lead-In

**Prehospital:** You are en route to a house where a 10-year-old child has acutely developed difficulty breathing.

**ED:** You are called to the emergency department to help out when a 10-year-old child is brought in after acutely developing difficulty breathing.

**General inpatient unit:** You are called as a member of the rapid response team to see a 10-year-old child admitted for syncopal event who acutely developed difficulty breathing.

**ICU:** You are called to see a 10-year-old child who was admitted to the intensive care unit for a syncopal episode earlier in the day; he is now having acute difficulty breathing.

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on diagnosis and management of unstable wide-complex tachycardia to convert the rhythm and improve systemic perfusion and hemodynamic function. This is accomplished immediately with synchronized cardioversion. Sedation in patients with hemodynamically unstable supraventricular tachycardia (SVT) is not routinely recommended. Health care professionals should also search for and treat reversible causes. Expert consultation is advised. Administration of adenosine or other antiarrhythmics is beyond the scope of this scenario, but discussion regarding indications for adenosine and vagal maneuvers will verify student familiarity with treatment of other tachycardias with a pulse (eg, SVT with a pulse and adequate perfusion).

### Scenario-Specific Objectives

- Differentiates between narrow-complex (likely SVT) and wide-complex tachycardia/possible ventricular tachycardia (VT) with a pulse and poor perfusion
- Differentiates between pulseless VT and wide-complex tachycardia (possible VT) with a pulse
- Describes the indications for synchronized cardioversion for wide-complex tachycardia with a pulse and poor perfusion; in this scenario, the child demonstrates hypotension, acutely altered mental status, and signs of shock—these are indications for immediate synchronized cardioversion
- Demonstrates safe delivery of synchronized cardioversion with appropriate shock dose in a patient with wide-complex tachycardia with a pulse
- Describes the reason for caution and need for expertise when considering giving sedative before cardioversion for a child who has tachycardia with a pulse and poor perfusion

## **Evaluate—initial assessment** (Pediatric Assessment Triangle)

**Appearance**

- Lethargic; opens eyes to voice but not talking spontaneously

**Breathing**

- Spontaneous, rapid rate; significant retractions; grunting

**Circulation**

- Pale; mottled

## 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 or monitor/defibrillator.
- 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 46/min; $SpO_2$ 82% (improves to 94% with 100% oxygen via nonrebreathing mask); subcostal and intercostal retractions; nasal flaring
- Circulation: Heart rate 210/min; blood pressure 74/35 mm Hg; central pulses weak, peripheral pulses very weak; cool peripherally; capillary refill 4-5 seconds
- Disability: Opens eyes to voice; intermittently moaning
- Exposure: Temperature 37.6 °C (99.7 °F); weight 30 kg

**Identify**

- Altered level of consciousness
- Wide-complex tachycardia, possible VT, with a pulse and poor perfusion
- Participant may also note
  - Respiratory distress vs respiratory failure
  - Hypotensive shock

**Intervene**

- Obtain vascular access (intravenous/intraosseous), but do not delay 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.)
- Sedation in patients with hemodynamically unstable SVT is not routinely recommended.
  - Attach pads and begin recording rhythm strip.
  - "Clear" and perform synchronized cardioversion (0.5-1 J/kg).
  - If initial synchronized cardioversion is unsuccessful, immediately "clear" and perform synchronized cardioversion with 2 J/kg.

**Evaluate—secondary assessment** (Identify reversible causes, but defer remainder of secondary assessment until rhythm conversion)

**SAMPLE history** (review with parent/primary caretaker only to identify reversible causes)

- **S**igns and symptoms: Developed acute shortness of breath and difficulty breathing; no chest pain; no recent illnesses
- **A**llergies: None
- **M**edications: None
- **P**ast medical history: Fractured clavicle at age 6
- **L**ast meal: Supper with family
- **E**vents: Sudden shortness of breath and difficulty breathing

**Physical examination if cardioversion correctly performed**

- Repeat vital signs after cardioversion: Heart rate 124/min; sinus rhythm; respiratory rate 28/min; $SpO_2$ 97% with 100% oxygen via nonrebreathing mask; blood pressure 105/78 mm Hg
- Head, eyes, ears, nose, and throat/neck: Clear; no abnormal audible breath sounds
- Heart and lungs: No murmur, gallop, or rub; subcostal and intercostal retractions less pronounced; breath sounds equal bilaterally; no wheezes or crackles; central pulses now strong; peripheral pulses; capillary refill 3 seconds
- Abdomen: Nondistended; nontender; no masses; normal bowel sounds
- Extremities: Warming
- Back: Normal
- Neurologic: Pupils equal and reactive; now opens eyes and moves all extremities spontaneously; answers health care professionals' questions
- Point-of-care glucose: 88 mg/dL

If no cardioversion

- Vital signs: Heart rate 210/min; blood pressure 68/33 mm Hg; worsening perfusion (weak central and very faint peripheral pulses); capillary refill 6-7 seconds

**Identify**

- Altered level of consciousness
- Wide-complex tachycardia (possible VT) with a pulse and poor perfusion converts to sinus rhythm if synchronized cardioversion provided correctly
- Respiratory distress vs respiratory failure

**Intervene**

- Obtain expert consultation.
- Search for and treat reversible causes.
- After rhythm conversion
  - Reassess and monitor cardiorespiratory status.
  - Evaluate for signs of heart failure (enlarged liver, extra heart sounds or murmurs, crackles).
  - Assist ventilation with bag-mask device if needed.
  - Prepare to insert advanced airway if needed.
  - Wean supplemental oxygen as tolerated if child remains stable after cardioversion.
  - Obtain 12-lead electrocardiogram.
  - Check glucose with point-of-care testing.

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

**Lab data**

- Blood glucose: 88 mg/dL
- Electrolytes
- A blood gas (arterial, venous, or capillary blood gas) and electrolytes not indicated in the immediate management of this child, but could be considered after stabilization to guide further management

**Imaging**

- Chest x-ray (evaluate for cardiomegaly, pulmonary edema, or effusions)
- Repeat electrocardiogram

**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 all critically ill infants and children. Hypoglycemia should be treated immediately.
- Serum electrolytes should also be checked as soon as possible. An electrolyte abnormality such as hypokalemia or hyperkalemia may cause ventricular arrhythmias.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 11, Wide-Complex Tachycardia (Possible VT) With a Pulse and Poor Perfusion (Child; 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 (100%) oxygen
- Identifies wide-complex tachycardia with a pulse and poor perfusion
- Identifies the need for prompt synchronized cardioversion and is able to deliver it or help others do so
- Directs establishment of intravenous or intraosseous access provided it does not delay cardioversion
- Identifies the need and rationale for obtaining expert consultation to provide sedation before cardioversion attempt
- Directs safe delivery of attempted cardioversion at dose of 0.5-1 J/kg; if ineffective, increases dose to 2 J/kg
- States the reason it is important to search for and treat reversible causes of wide-complex tachycardias
- 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…
- What are the indications for synchronized cardioversion in a child with tachycardia and a pulse and poor perfusion? (Answer: Hypotension, acutely altered mental status, signs of shock)
- Although this patient had unstable wide-complex tachycardia, what interventions would be appropriate if this child demonstrated stable, narrow-complex tachycardia? (Answers: Vagal maneuvers, adenosine [first dose 0.1 mg/kg rapid bolus, maximum 6 mg; second dose 0.2 mg/kg rapid bolus])
- If this child had no central pulses, how would you treat the child? (Answer: As cardiac arrest with shockable rhythm)

Practice Case Scenario 12

# Pulseless Arrest, Pulseless Ventricular Tachycardia

(Infant; Arrest)

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### Scenario Lead-In

**Prehospital:** You are dispatched to a home where a 6 month old suddenly became gray and apneic. Babysitter called 911 and initiated CPR.

**ED:** An ambulance is en route with a 6-month-old infant who suddenly became limp and gray. CPR is in progress.

**General inpatient unit:** You are called as a member of the code team to see a 6 month old who suddenly became limp and gray. The infant was admitted for observation following a period of apnea. CPR is in progress.

**ICU:** You are called to see a 6 month old who suddenly became limp and gray. Patient was admitted following a period of apnea. 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** | 8 kg |
| **Age** | 6 months |

## Scenario overview and learning objectives

### Scenario Overview

This scenario focuses on the identification and management of 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 pulseless ventricular tachycardia [VT] persists) a second shock followed by CPR + epinephrine, and then (when pulseless VT 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 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 infant has pulseless VT
- 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 ventricular fibrillation (VF)/pulseless VT; the *2025 AHA Guidelines for CPR and ECC* noted that either amiodarone or lidocaine is equally acceptable. Avoid amiodarone in the context of long QT syndrome.
- Identifies reversible causes of persistent pulseless VT; 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 and 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 brachial pulse (none).
- Immediately begin high-quality CPR.

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

- Should verify airway, breathing, and circulation support
- Monitor reveals pulseless VT
- Weight 8 kg per color-coded length-based resuscitation tape

### Identify

- Cardiopulmonary arrest
- Pulseless VT 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 (pulseless VT, 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 pulse oximeter (per local protocol, may be deferred until ROSC).
- Manage airway (endotracheal intubation, supraglottic airway) without causing delays to CPR.

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

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

- **S**igns and symptoms: Infant suddenly became limp; no precursors
- **A**llergies: None known
- **M**edications: None
- **P**ast medical history: None
- **L**ast meal: 1 hour 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, a total of 3 shocks delivered, 1 dose of epinephrine, and 1 dose of antiarrhythmic (amiodarone or lidocaine): Sinus rhythm; heart rate 140/min; respiratory rate 30/min (bag-mask ventilation); $SpO_2$ 98%; blood pressure 84/50 mm Hg; temperature 36.4 °C (97.5 °F)

If no shock is delivered, pulseless VT continues.

**Identify**

- Cardiopulmonary arrest
- Pulseless wide-complex tachycardia, pulseless VT
- ROSC

**Intervene**

- Continue high-quality CPR; reassess rhythm every 2 minutes.
- If a shockable rhythm persists at second 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 third rhythm check, deliver shock, resume CPR, and prepare and administer antiarrhythmic drug for persistent VF/pulseless VT during chest compressions.
  - Administer 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 standard adult dose for that defibrillator).
- Consider placement of an advanced airway, especially if unable to provide adequate ventilation with bag-mask device and advanced care professional is available.

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

**Lab data (as appropriate)**

- Blood glucose 112 mg/dL (6.2 mmol/L) (after ROSC)
- Arterial/venous blood gas, electrolytes, calcium, magnesium

**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

## Practice Case Scenario 12, Pulseless Arrest, Pulseless VT (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) and monitors quality throughout resuscitation
- Directs placement of monitor leads/pads and activation of monitor
- Identifies pulseless VT 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 pulseless VT 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
- 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 infant'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 standard adult dose for that defibrillator)

## Practice Case Scenario 13

# 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-tracheal tube because of decreased mental status, and then he suddenly deteriorated and is being manually ventilated by another emergency responder. An intravenous catheter is in place.

**ED:** An 8-year-old boy is being transported by emergency responders. He has been intubated with an oral-tracheal tube for decreased level of consciousness (a Glasgow Coma Scale score of 4). He suddenly deteriorated and is being manually ventilated via the endotracheal tube. An intravenous catheter 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 oral-tracheal 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. An intravenous catheter 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 through the endotracheal tube. An intravenous catheter 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 (99.0 °F) |
| **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; asymmetric or 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.

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

- Airway: Orally intubated with a 6.0 cuffed endotracheal tube; 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 $CO_2$ still detectable
  - Obstruction: Normal breath sounds on left; if the endotracheal tube 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 (99.0 °F); 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 available).
- Rule out endotracheal tube displacement, obstruction and equipment failure.
- Perform needle decompression on right side (insert an over-the-needle catheter over the top of the child's third rib, second intercostal space in the midclavicular line; anticipate air will be expelled).
- 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: $SpO_2$ 85% and rising; blood pressure increases to 110/65 mm Hg; capillary refill 3 seconds
  - If needle decompression not performed: $SpO_2$ 85% 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 on the right improved, but breath sounds on the left still better than on the right
  - 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

## Practice Case Scenario 13, 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).
- 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)

## Practice Case Scenario 14

# Cardiogenic Shock

(Infant; Cardiomyopathy)

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### Scenario Lead-In

**Prehospital:** You have been dispatched to transport a 4-month-old female infant with a 48-hour history of respiratory distress.

**ED:** You are asked to assess and manage a 4-month-old female infant who has increased work of breathing with substernal and intercostal retractions, a breathless cry, and wheezing. She has a 3-day history of respiratory distress and increased lethargy. The infant was seen by her pediatrician 2 days ago for wheezing and respiratory distress and was given steroids and nebulizer treatments with no improvement.

**General inpatient unit:** You are called to assess a 4-month-old female infant who has been admitted to the ward with a 24-hour history of increased work of breathing and increased oxygen requirement.

**ICU:** You are called to the bedside of a 4-month-old female infant who has been admitted to the intensive care unit with a 24-hour history of increased respiratory distress. She has crackles and wheezing and an increased oxygen requirement. Her occasional cry sounds "breathless." The infant now appears mottled and lethargic. Her intravenous access is no longer functioning.

| Vital Signs | |
|---|---|
| **Heart rate** | 180/min |
| **Blood pressure** | 60/45 mm Hg |
| **Respiratory rate** | 60/min |
| **$SpO_2$** | 89% on room air |
| **Temperature** | 35.7 °C (96.2 °F) |
| **Weight** | 7 kg |
| **Age** | 4 months |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis should be on identification and rapid treatment of hypotensive cardiogenic shock. Priorities include immediate establishment of intravenous (IV) access and careful administration of a 5-10 mL/kg 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 recognize the development of signs of worsening heart failure during the administration of the fluid bolus and stop bolus fluid administration. The infant requires inotropic therapy to improve cardiac function and vasoactive drug therapy to improve blood pressure and systemic perfusion.

The infant may need additional support with continuous positive airway pressure (CPAP), noninvasive bilevel positive-pressure ventilation, or other positive-pressure ventilation support to improve oxygenation. 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 (labored breathing, fine crackles, and hepatomegaly) and evidence of decreased perfusion (mottling, cyanosis, lethargy) 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 bolus fluid administration for cardiogenic shock and describes possible negative effects of excessive bolus fluid administration; in this scenario, signs of intolerance of bolus fluid administration include worsening of signs of heart failure with no improvement in shock signs

### Evaluate—initial assessment (Pediatric Assessment Triangle)

**Appearance**

- Lethargic; minimal reaction to noises in room

**Breathing**

- Labored breathing with moderate to severe intercostal and subcostal retractions

**Circulation**

- Pale; significant mottling with peripheral cyanosis noted

### 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.

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

- Airway: Patent
- Breathing: Respiratory rate about 60/min; mild intercostal retractions; nasal flaring and intermittent grunting; $SpO_2$ 89% on room air, 100% with 100% oxygen
- Circulation: Heart rate 180/min; central pulses present (not strong) and peripheral pulses weak and thready; capillary refill about 4 seconds; cool, mottled hands and feet; blood pressure 60/45 mm Hg
- Disability: Lethargic; responds to painful stimuli
- Exposure: Temperature 35.7 °C (96.2 °F); weight 7 kg

**Identify**

- Respiratory distress
- Hypotensive shock, probably cardiogenic
- Sinus tachycardia

**Intervene**

- Apply blood pressure cuff.
- Obtain vascular (IV/intraosseous [IO]) access.
- Administer a fluid bolus of 5-10 mL/kg of isotonic crystalloid IV/IO over 10-20 minutes.
- Perform careful and frequent reassessment during and after fluid bolus. Stop fluid bolus if respiratory distress worsens or rales or hepatomegaly develop/worsen or if vital signs 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 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): 24 hours of increased respiratory distress and difficulty breathing, no improvement with steroids or nebulizer treatments

**Physical examination**

- Repeat vital signs after oxygen and first fluid bolus: Heart rate 180/min; respiratory rate 75/min; $SpO_2$ 89% while receiving 100% oxygen by nonrebreather face mask; blood pressure 56/30 mm Hg
- Head, eyes, ears, nose, and throat/neck: Mucous membranes slightly dry
- Heart and lungs: Rapid rate; S3 gallop now detected; crackles and retractions worsening
- Abdomen: Liver edge palpable at 3 cm below costal margin; nondistended abdomen; hypoactive bowel sounds
- Extremities: Cold upper and lower extremities; mottled; weak peripheral pulses
- Back: Normal
- Neurologic: Lethargic; pupils 4 mm, equal, reactive

**Identify**

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

**Intervene**

- Apply blood pressure cuff.
- Stop bolus fluid administration (signs of heart failure worsening).
- Begin vasoconstrictive inotropes if hypotension and assess response.
- Assess response to oxygen administration.
- Identify persistent hypoxemia despite oxygen administration.
  - Administer CPAP or noninvasive bilevel positive-pressure ventilation or other support if hypoxemia and respiratory distress continue.
- Obtain 12-lead electrocardiogram.
- Obtain a pediatric cardiology consultation and an echocardiogram, if available.
- Arrange for transfer to the intensive care unit for closer monitoring, if infant is not already in intensive care.

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

**Lab data**

- Arterial blood gas (after initiation of CPAP or positive-pressure ventilation): pH 7.25; $PCO_2$ 20 mm Hg; $PO_2$ 170 mm Hg; lactate 4.9 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 infants and children. Hypoglycemia should be treated immediately.
- Arterial blood gas confirms metabolic acidosis associated with inadequate 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

## Practice Case Scenario 14, Cardiogenic Shock (Infant; Cardiomyopathy)

### 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/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 inotropic/ vasoactive support; titrates to improve cardiac output and systemic perfusion
- Obtains expert consultation from a pediatric cardiologist and obtains an echocardiogram or other diagnostic studies as recommended by cardiologist

### 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)

Practice Case Scenario 15

# Disordered Control of Breathing Disease

(Infant)

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**Scenario Lead-In**

**Prehospital:** You respond to a 911 call for a 6 month old having a seizure.

**ED:** Emergency responders arrive with a 6-month-old boy brought from his home after mother called 911 because her child had a seizure.

**General inpatient unit:** You are called to the room of a 6-month-old boy who is being admitted after having a seizure.

| Vital Signs | |
|---|---|
| **Heart rate** | 146/min |
| **Blood pressure** | 88/56 mm Hg |
| **Respiratory rate** | 12/min |
| **$SpO_2$** | 80% on room air |
| **Temperature** | 39.7 °C (103.5 °F) |
| **Weight** | 7 kg |
| **Age** | 6 months |

## Scenario overview and learning objectives

### Scenario Overview

Emphasis of this scenario is on recognition and immediate management of an infant with respiratory failure and disordered control of breathing (inadequate respiratory rate and effort and decreased level of consciousness after a seizure that likely complicates an episode of meningitis). This infant requires immediate opening of the airway and bag-mask ventilation with 100% oxygen. During debriefing, discuss 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 infant demonstrated inadequate spontaneous respiratory effort with very slow and shallow breaths, although they were regular
- Recalls causes of disordered control of breathing; cues to the instructor: 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 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

**Circulation**

- Pink skin

## Identify

- Immediate intervention needed

## Intervene

- Apply blood pressure cuff.
- Activate the emergency response system. Emergency medical services requests additional assistance if needed.
- Position the infant to open 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 support airway, oxygenation, ventilation, and perfusion)

- Airway: Paradoxical movement of chest and abdomen when breathing, relieved when airway opened
- Breathing: Spontaneous respiratory rate 12/min; effort shallow and regular; lungs clear to auscultation bilaterally; $SpO_2$ 80% on room air and 99% with bag-mask ventilation with 100% oxygen at a rate of 30/min
- Circulation: Heart rate 146/min; dusky (before bag-mask ventilation with 100% oxygen); strong central and peripheral pulses; capillary refill 2 seconds; blood pressure 88/56 mm Hg
- Disability: Lethargic; responsive to painful stimuli
- Exposure: Temperature 39.7 °C (103.5 °F); weight 7 kg

**Identify**

- Respiratory failure (inadequate respiratory rate and effort)

**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 infant's spontaneous respiratory effort.
- Consider insertion of oropharyngeal airway if infant is unresponsive with no cough or gag reflex.
- 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, irritable 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; tense anterior fontanelle
- Heart and lungs: Clear breath sounds; good chest rise with assisted ventilation; rate and depth of spontaneous breaths increasing
- Abdomen: Normal
- Extremities: No edema; no rash
- Back: Normal
- Neurologic: Level of consciousness unchanged; moves all 4 extremities with painful stimulus but in nonpurposeful fashion; pupils 3 mm bilateral and reactive

**Identify**

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

**Intervene**

- Closely monitor infant's level of consciousness, spontaneous respiratory effort, and airway protective mechanisms (ability to cough to protect airway). Remove oral airway if responsiveness improves or cough or gag reflex returns.
- If infant's spontaneous respiratory effort improves, provide bag-mask ventilation that assists the infant's respiratory effort.
- As patient will continue to be bradypneic with a reduced level of consciousness, continue 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 to 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 infant had a seizure and still has decreased level of consciousness, so it will be important to check the glucose.
- It is not always possible to obtain an arterial blood gas.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 15, Disordered Control of Breathing Disease (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**
- 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 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 were the indications for endotracheal intubation in an infant with disordered control of breathing? (Answers: Inadequate spontaneous respiratory effort and/or failure to maintain a patent airway, signs of possible increased intracranial pressure/ insufficient ventilation with oropharyngeal airway or bag-mask ventilation)
- If the infant requires intubation, how would you estimate the size of endotracheal tube to use?

## Practice Case Scenario 16

# Bradycardia

(Child; Seizure)

American Heart Association. | American Academy of Pediatrics
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### Scenario Lead-In

**Prehospital:** You are dispatched to the home of an 8-year-old child who was having a generalized seizure and received rectal diazepam; he now has decreased respiratory effort.

**ED:** Paramedics arrive with an 8-year-old child who was having a generalized seizure and received rectal diazepam; he now has decreased respiratory effort.

**General inpatient unit:** You are a member of the rapid response team called to evaluate an 8 year old who had a generalized seizure on the floor and received intravenous lorazepam; he now has decreased respiratory effort.

**ICU:** You are asked to evaluate an 8 year old who just had a seizure and received intravenous lorazepam; he now has decreased respiratory effort.

| Vital Signs | |
|---|---|
| **Heart rate** | 45/min |
| **Blood pressure** | 85/54 mm Hg |
| **Respiratory rate** | 6/min |
| **$SpO_2$** | 62% before bag-mask ventilation with oxygen |
| **Temperature** | 39.3 °C (102.7 °F) |
| **Weight** | 27 kg |
| **Age** | 8 years |

## Scenario overview and learning objectives

### Scenario Overview

- Emphasis should be placed on identification and treatment of hypoxic bradycardia associated with disordered control of breathing/respiratory depression and upper airway obstruction. Priorities include immediate establishment of a patent airway and effective bag-mask ventilation with 100% oxygen. Provider may need to reopen airway and reattempt bag-mask ventilation before it produces effective chest rise. Chest compressions are not required because the heart rate, oxygenation, and perfusion rise quickly once effective bag-mask ventilation is provided. If the patient cannot maintain a patent airway and does not recover adequate spontaneous ventilation, providers should prepare for advanced airway insertion. The student should describe how to estimate the child's endotracheal tube size. Discussion of flumazenil as a receptor antagonist is beyond the scope of the scenario, and the drug is contraindicated for this patient (it can lower seizure threshold).

### Scenario-Specific Objectives

- Demonstrates support of oxygenation and ventilation in a patient with hypoxic bradycardia
- Recognizes indications for CPR in bradycardic patient; in this scenario, compressions are not needed because the child's heart rate and oxygenation quickly improve once effective bag-mask ventilation with oxygen is provided
- 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 noise

**Breathing**

- Very slow respiratory rate

**Circulation**

- Pale; lips slightly dusky Identify

### 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 carotid pulse (slow pulse detected).
- Begin bag-mask ventilation with 100% oxygen.
- Apply cardiac monitor.
- Apply pulse oximeter.

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

- Airway: Snoring respirations
- Breathing: Spontaneous respiratory rate 6/min; $SpO_2$ 62% on room air; initially bag-mask ventilation with 100% oxygen produces no chest rise and poor air entry bilaterally; if health care professional reopens airway and reattempts bag-mask ventilation, significant improvement in ease of ventilation and chest rise is apparent, and $SpO_2$ rises rapidly
- Circulation: Initial heart rate 45/min (sinus bradycardia); weak peripheral pulses; 2+ central pulses; capillary refill 3-4 seconds; blood pressure 85/54 mm Hg; heart rate increases to 95/min with effective bag-mask ventilation with 100% oxygen
- Disability: Unresponsive
- Exposure: Temperature 39.3 °C (102.7 °F); weight 27 kg; no rashes

**Identify**

- Respiratory failure due to upper airway obstruction and disordered control of breathing
- Sinus bradycardia (rate 45/min increases to 95/min with bag-mask ventilation)
- Decreased level of consciousness

**Intervene**

- Insert oral airway.
- Reopen airway, reposition face mask, ensure adequate seal to face, provide bag-mask ventilation that produces chest rise, and suction as needed.
- Assess heart rate response to ventilation and oxygen administration to determine the need for additional intervention.
- Obtain vascular access (intravenous/intraosseous).

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

**SAMPLE history**

- **S**igns and symptoms: Had generalized tonic-clonic seizure and received benzodiazepine as noted
- **A**llergies: None
- **M**edications: Levetiracetam
- **P**ast medical history: Known seizure disorder; last seizure was 6 months ago
- **L**ast meal: Ate normally 2 hours ago
- **E**vents (onset): Upper respiratory infection symptoms for 2 days; generalized tonic-clonic seizure lasting 12 minutes; seizure activity stopped 5 minutes before team's arrival

**Physical examination**

- Repeat vital signs after effective bag-mask ventilation: Heart rate increases to 95/min; $SpO_2$ 95% with bag-mask ventilation at a rate of 16-20/min with 100% oxygen; blood pressure 95/54 mm Hg
- Head, eyes, ears, nose, and throat/neck: Continues to be ventilated with bag-mask device with oropharyngeal airway in place
- Heart and lungs: No murmur; good air entry with positive-pressure ventilation; 2+ central and peripheral pulses; capillary refill 3 seconds
- Abdomen: Soft; no organomegaly
- Extremities: Unremarkable
- Back: Unremarkable
- Neurologic: Remains unresponsive to painful stimulation; pupils 3 mm, equal, and reactive to light
- Point-of-care (POC) glucose (see the Evaluate and Identify/intervene boxes that follow)

**Identify**

- Altered level of consciousness
- Sinus rhythm with correction of bradycardia
- Respiratory failure due to upper airway obstruction and disordered control of breathing

**Intervene**

- Continue bag-mask ventilation as needed. If $SpO_2$ is greater than 94% and perfusion is improving with bag-mask ventilation, do the following:
  - Wean supplemental oxygen as tolerated.
  - Evaluate spontaneous respiratory effort and provide assisted ventilation to support spontaneous respiratory efforts.
  - Remove oral airway if child begins to respond at all or develops cough or gag reflex.
  - Stop bag-mask ventilation if child's spontaneous ventilation effort becomes adequate.
- If child does not recover effective spontaneous ventilation and airway protective mechanisms, consider placement of advanced airway. Obtain expert consultation.
- Check POC glucose concentration.

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

**Lab data**

- Blood glucose 107 mg/dL (5.9 mmol/L)
- A blood gas (arterial, venous, or capillary) not indicated in the immediate management of this child

**Imaging**

- Once patient is stabilized for transport: head computed tomography if there is a history or physical findings to suggest trauma

**Identify/intervene**

- A blood glucose concentration should be checked as soon as reasonably possible in all critically ill infants and children. Hypoglycemia should be promptly treated.
- Laboratory studies (other than POC glucose testing) are deferred until effective airway, oxygenation, ventilation, and heart rate/perfusion are established.

**Re–evaluate-identify-intervene after each intervention.**

# Debriefing Tool

## Practice Case Scenario 16, Bradycardia (Child; Seizure)

### 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 hypoxia that is caused by upper airway obstruction and disordered control of breathing (ie, hypoventilation)
- Directs insertion of oral airway and 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
- Determines that chest compressions and epinephrine administration are not needed because heart rate increases adequately with establishment of patent airway, adequate oxygenation, and ventilation
- Directs establishment of intravenous or intraosseous access
- Checks glucose with POC testing in this unresponsive patient
- 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*].
- 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 child in this scenario did not require chest compressions. What would have been the indications for the addition of chest compressions to ventilation (CPR)? (Answer: Heart rate is less than 60/min with signs of poor perfusion despite adequate oxygenation and ventilation.)
- The child in this scenario did not require epinephrine administration. If it had been necessary, what dose would be appropriate? (Answer: 0.01 mg/kg [0.1 mg/mL concentration; maximum dose 1 mg])
- In addition to hypoxia, what are 3 other causes of bradycardia in infants and children?