Resuscitation

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Question 1

A 6-year-old boy presents to the Emergency Department for an urticarial rash, wheezing, and vomiting after trading lunches with another child at school. The patient has a known allergy to peanuts. What is the most appropriate initial dose of epinephrine for this patient?

A. 1 mg/kg SC
B. 0.01 mg/kg IM
C. 0.1 mg/kg IM
D. 0.01 mg/kg IV
E. 1 mg/kg IV

Correct Answer: B

This patient is showing symptoms of an acute allergic reaction with multiple system involvement. When two or more systems are involved, the patient is in anaphylaxis. The most appropriate initial dose of epinephrine is 0.01 mg/kg IM of 1:1000 concentration. An intramuscular dose can be given prior to starting a peripheral IV line, as this will result in immediate medication delivery. The intramuscular epinephrine should be injected in the anterolateral thigh. In the event of shock, the perfusion to the subcutaneous tissue is not predictable; therefore, the subcutaneous route should not be used. One should suspect anaphylaxis if there is urticaria, wheezing, with a triggering exposure.

Take-Home Message
First-line treatment for anaphylaxis is 0.01 mg/kg of 1:1000 epinephrine administered intramuscularly.

ABP Content Specification
- Know the indications for and pharmacologic action of epinephrine in resuscitation.
- Know the routes of administration of drugs used in resuscitation.

Question 2

A 4-year-old girl arrives to the ED in acute respiratory distress. You determine that she requires endotracheal intubation and mechanical ventilation. What is the most appropriate cuffed endotracheal tube size for this patient?

A. 3.5 mm
B. 4.0 mm
C. 4.5 mm
D. 5.0 mm
E. 5.5 mm

Correct Answer: C

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M. Waseem et al. (eds.), *Prepare for the Pediatric Emergency Medicine Board Examination*,
https://doi.org/10.1007/978-3-030-28372-8_1

The generally accepted formula for estimating tube size is:

- Predicted size of uncuffed tube = (age/4) + 4
- Predicted size of cuffed tube = (age/4) + 3.5

In general, during preparation for intubation using the formulas, not only should the provider have the estimated tube size ready but also at least two endotracheal tubes 0.5 mm smaller and larger (one cuffed and one uncuffed) ready in case the estimate is either too large or too small.

Take-Home Message
Use the formula to estimate ET tube size and be prepared with tubes 0.5 mm size smaller and larger.

ABP Content Specification
- Know the use of advanced airway management techniques in patients with respiratory failure.

Question 3

A 4-year-old child presents to the Emergency Department after a seizure at home. He remains confused and combative. A bedside glucose evaluation reveals a blood glucose of 25 mg/dl. The patient weighs 20 kg. What is the most appropriate dose of glucose to administer to this patient?

A. 10 ml of D10
B. 250 ml of D5
C. 25 ml of D50
D. 40 ml of D25
E. 100 ml of D50

Correct Answer: D

Initial dose of IV dextrose: 0.5–1 g/kg
Using rule of 50:

- 5 ml/kg of D10%
- 2 ml/kg of D25%
- 1 ml/kg of D50%

Acute hypoglycemia can manifest with a number of symptoms ranging from dizziness or hunger to neurologic deficits and seizures. Hypoglycemia can be missed quite easily in the pediatric population; thus, a child with altered mental status and/or head trauma should have a point-of-care glucose check on arrival. The differential for hypoglycemia is broad, and a child with unexplained hypoglycemia should have an appropriate workup done in the ED. After the bolus, plasma glucose should be maintained by an infusion of dextrose at 6–9 mg/kg per minute, and blood glucose should be monitored every 30–60 minutes. If the patient has mild symptoms and can tolerate oral feeding, then an oral load of glucose can be given. In the event that immediate IV access cannot be obtained, intramuscular glucagon can be used to release stores of glucose from glycogen in the liver.

Take-Home Message
Know the rule of 50 to calculate the appropriate bolus of glucose.

ABP Content Specification
- Know the role of crystalloid infusion in the management of shock.

Question 4

A 4-year-old child has been transferred to your Emergency Department from a rural hospital for an epidural hematoma. He was intubated for airway protection and ventilated en route to your hospital. On arrival, his initial vitals are as follows: heart rate 110 beats/minute, respiratory rate 16 breaths/minute, blood pressure 110/60 mm Hg, and oxygen saturation 85% on 100% FiO_2. You notice the tube is quite deep in the patient's mouth. Approximately how many centimeters deep the ET tube should be?

A. 12 cm
B. 13 cm
C. 14 cm
D. 15 cm
E. 16 cm

Correct Answer: C

The ideal location for the endotracheal tube tip is at the midpoint between the thoracic inlet and the carina. Some tools that help with appropriate depth placement include placing the double line on the uncuffed ET tube at the glottis, using the length-based tape, estimating the tube depth at three times the inner diameter of the ETT, or 12+ [age (years)/2]. Use the formula 12 + [age (years)/2]. Beware that formulas are less accurate for children under 3 years of age.

The medications can be administered via ETT including atropine, naloxone, lidocaine, and epinephrine; schedule of medication can be remembered by the mnemonic LANE.

Take-Home Message

ET tube depth estimation can be done using the formula 12+ [age (years)/2].

ABP Content Specification

- Know the use of advanced airway management techniques in patients with respiratory failure.
- Recognize the presentations of patients with hypoxia.

Question 5

A 5-year-old child is brought to the Emergency Department by ambulance. The patient is pulseless, apneic, and unresponsive. All basic life support (BLS) maneuvers are being done. The patient is placed on the monitor, and the following rhythm is obtained.

What is the most appropriate next intervention?

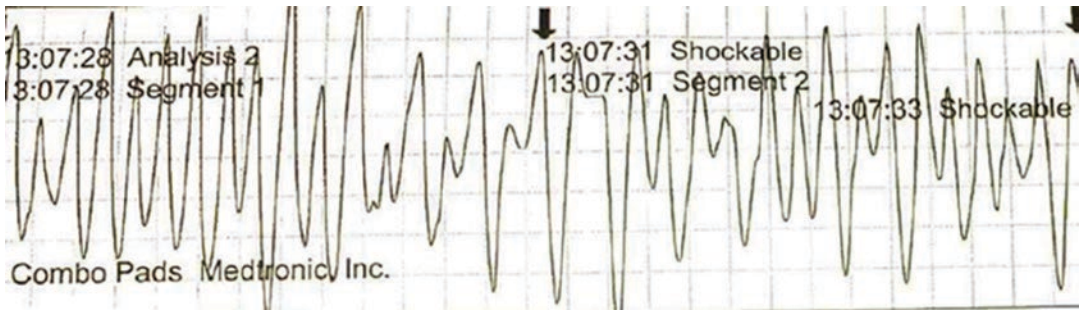
A. Defibrillation 4 J/kg
B. Intubate the patient
C. Give epinephrine 0.01 mg/kg IV/IO
D. Synchronized cardioversion
E. Defibrillation 2 J/kg

Correct Answer: E

This is an example of a patient with ventricular fibrillation (VF). Defibrillation is indicated for the treatment of VF; pulseless ventricular tachycardia, regardless of the waveform; and unstable, polymorphic (irregular) ventricular tachycardia with or without pulses. The recommendation is to defibrillate this patient at 2 J/kg after starting chest compressions and placing the patient on the monitor. CPR should be resumed immediately after the shock, and a rhythm check should occur 2 minutes later, at which point a 4 J/kg defibrillation dose can be given if the patient remained in VF.

In a patient without pulses, if a shockable rhythm is detected, then initiate CPR immediately and defibrillate. Once a shock has been delivered, chest compressions should be resumed immediately and continued for a period of 2 minutes. If no pulse is still detected, then an additional shock should be delivered while epinephrine is given every 3–5 minutes. Defibrillation should not be delayed for endotracheal intubation.

Synchronized cardioversion is used in the treatment of SVT and unstable monomorphic (regular) VT with pulses.



Take-Home Message
Defibrillation is the first step for the pulseless patient with a shockable rhythm such as VF and pulseless ventricular tachycardia.

ABP Content Specification
- Know the indications for and pharmacologic action of epinephrine in resuscitation.
- Know the indications for defibrillation in resuscitation.
- Recognize arrhythmias during cardiac arrest.
- Know techniques of pediatric advanced life support in cardiopulmonary arrest.

Question 6

A 10-year-old child has been struck by a vehicle at unknown speed. He is brought to the ED by paramedics. His initial vital signs are blood pressure 80/40 mm Hg, heart rate 130 beats/minute, respiratory rate 10 breaths/minute, and oxygen saturation 95% on non-rebreather face mask. His eyes open to painful stimuli, he cries to pain and making inappropriate sounds, and he withdraws to painful stimuli. What is his Glasgow coma scale score?

A. 6
B. 7
C. 8
D. 9
E. 10

Correct Answer: D

The Glasgow coma scale (GCS) is an objective method of following the patient's neurologic status. It assesses a patient's best eye, verbal, and motor response.

Eye Opening

Spontaneously	4
To verbal command	3
To pain	2
None	1

Best Verbal Stimuli

Oriented	5
Confused	4
Inappropriate words	3
Incomprehensible	2
No response	1

Motor Response

Obeys verbal commands	6
Localizes pain	5
Withdraw from the pain	4
Flexion to pain	3
Extension to pain	2
No response	1

- E2 V3 M4
- Eye opening (to painful stimuli) = 2
- Best verbal response (inappropriate words) = 3
- Best motor response (withdraws to pain) = 4

Take-Home Message
Glasgow coma scale is an objective way to assess the neurological condition of the patient and has implications for immediate intervention and prognosis. Therefore, it is important to document the score in all patients who present with head trauma or altered mental status.

ABP Content Specification
- Know the indications and procedures for transport to a higher-level facility.

Question 7

Which of the following is least likely to be present in a child with respiratory distress?

A. Use of accessory muscles and tripod position
B. Speaking in 1- to 2-word sentences
C. Muffled voice
D. Stridor
E. Speaking in full sentences

Correct Answer: E

Generally, the observations seen in a child who is in respiratory distress constitute the following: Mental status changes, (including somnolence or anxiety), changes in position to facilitate increased air movement ("sniffing position"), cyanosis, drooling, or dysphagia. Speaking in full sentences requires adequate respiration; thus, a child in respiratory distress would more often be able to use only one to two words at a time. A muffled voice or stridor would be evidence of upper airway obstruction, which could be associated with respiratory distress. Use of accessory muscles is common in cases of respiratory distress from many causes.

Take-Home Message
Inability to speak in full sentences in the setting of dyspnea or respiratory distress may indicate the onset or presence of respiratory failure and needs immediate intervention.

ABP Content Specification
- Understand the progression of respiratory failure to arrest.

Question 8

A 10-year-old boy with a history of asthma is brought to the Emergency Department for shortness of breath, cough, subjective fever, and rhinorrhea. His mother has been administering albuterol nebulizer treatments at home with little relief. His initial vital signs are as follows: heart rate 110 beats/minute, respiratory rate 15 breaths/minute, blood pressure 100/60 mm Hg, and oxygen saturation 93% on room air. On examination, the patient has intercostal and supra-costal retractions, poor inspiratory effort, and minimal wheezing in both lungs. He has a history of multiple hospitalizations for asthma exacerbation and has been intubated once for respiratory failure because of asthma exacerbation. What is the most appropriate intervention at this time?

A. Continue albuterol nebulizer treatments via nebulizer
B. Supplemental oxygen via nasal cannula
C. Noninvasive ventilation
D. Endotracheal intubation and mechanical ventilation
E. Discharge

Correct Answer: C

This is a case of severe respiratory distress in a patient with asthma exacerbation. Clinical signs for worsening respiratory distress include retractions, poor respiratory effort, and minimal wheezing, which could indicate fatigue and impending respiratory failure. Another sign of fatigue is his respiratory rate, which should normally be elevated in a child with respiratory distress. A normal respiratory rate in a patient with signs of respiratory distress indicates a patient with impending respiratory failure. Optimal treatment at this time would be initiation of noninvasive ventilation, while using albuterol and steroids to help treat the airway inflammation which has caused the impending respiratory failure. Indications for intubation in patients with acute severe asthma include hypoxemia despite high flow oxygen by noninvasive measures, increased work of breathing that does not improve with optimal medication delivery, altered mental status, and respiratory/cardiac arrest.

Take-Home Message
Use of noninvasive ventilation should be strongly considered initially for patients with severe distress, as it can at times prevent the need for endotracheal intubation. Ventilation of asthmatic patients through an endotracheal tube is associated with significant complications compared with other indications for respiratory failure and therefore should be used prudently.

ABP Content Specification

- Understand the progression of respiratory failure to arrest.
- Recognize the signs and symptoms of hypercarbia.
- Recognize the signs and symptoms of lower airway obstruction.

- Plan management priorities for patients in respiratory failure.
- Know the use of basic airway management techniques in patients with respiratory failure.
- Recognize the presentations of patients with hypoxia.

Question 9

Which of the following agents would be the best induction agent when intubating an asthmatic in severe respiratory distress?

A. Etomidate
B. Thiopental
C. Ketamine
D. Fentanyl and versed
E. Propofol

Correct Answer: C

Both ketamine and propofol have been found to have bronchodilatory properties and thus are suitable induction agents for the severe asthmatic. Ketamine is preferred over propofol due to the direct and indirect mechanisms for bronchodilation, as well as its vasoactive component. The downside of propofol is the potential to induce hypotension in the peri-intubation setting. Thiopental and other barbiturates are not preferred, as they can induce bronchospasm via histamine release. Fentanyl and *m*idazolam (versed) are not ideal agents for rapid sequence intubation. Indeed, if fentanyl is delivered inappropriately, then the patient's respiratory status may worsen significantly, and it may cause acute respiratory failure in an otherwise well patient. The dosage for ketamine in RSI is 1–2 mg/kg.

Take-Home Message
Ketamine is the preferred sedative in asthma patients that require rapid sequence intubation due to its ability to aid bronchodilation and maintain blood pressure.

ABP Content Specification
- Recognize the complications associated with rapid sequence induction for intubation.

Question 10

Which of the following agents is the best choice for induction when intubating a child in septic shock?

A. Etomidate
B. Thiopental
C. Ketamine
D. Fentanyl and midazolam
E. Propofol

Correct Answer: C

Ketamine is a good choice for intubation in septic shock as it maintains cardiovascular stability during intubation. The dose of ketamine in RSI is 1–2 mg/kg.

Propofol is a potent sedative agent that can cause respiratory depression and hypotension and therefore is not a good choice for the patient in shock. Fentanyl and Midazolam (versed) are good choices for conscious sedation, as together they provide pain control and sedation; they are not, however, good choices for intubation.

Etomidate is hemodynamically neutral agent. It is preferred in head-injured patients who have shock transient adrenocortical suppression following a single dose of etomidate has been demonstrated in adults in numerous small randomized trials. The 2015 PALS guidelines recommend that etomidate be avoided in patients with septic shock. Ketamine is the preferred rapid sequence intubation (RSI) induction agent for pediatric patients in septic shock (see the below references). Etomidate has a quick onset of action approximately 30 seconds and a short half-life resulting in an awake and alert patient within 5–15 minutes of drug discontinuation. The main side effects are myoclonus, nausea, vomiting, respiratory depression, and adrenocortical suppression. If etomidate must be

used in the setting of septic shock refractory to fluids and vasopressors, a stress dose of dexamethasone (0.1 mg/kg) should be administered.

In isolated head-injured children, propofol, etomidate, or thiopental can be used.

ABP Content Specification

- Know the use of advanced airway management techniques in patients with sepsis.
- Plan the key steps and know the potential pitfalls in performing rapid sequence induction for intubation.
- Recognize the complications associated with rapid sequence induction for intubation.

Take-Home Message

Ketamine may be preferred to etomidate due to less likely adrenal suppression. Ketamine's catecholamine effect might worsen hypotension in the peri-intubation period.

Question 11

When compared to the adult airway anatomy, the pediatric airway is as follows:

A. More anterior and superior
B. More posterior and superior
C. More posterior and inferior
D. More anterior and inferior
E. The same

Correct Answer: A

In adults, the vocal cords (or glottis) is the narrowest portion of the airway. The cricoid ring (below the vocal cord) is the narrowest portion of the pediatric airway. Therefore, once the endotracheal tube passes through the vocal cords, it is lodged at the level of the cricoid cartilage.

Also, pediatric airway is funnel shaped in children under 8 years of age and cylinder shaped in adults. The larynx is more anterior and superior, and trachea is short. The epiglottis in children is longer, narrower, and omega shaped than the adult epiglottis. Because the angle between the base of the tongue and the glottis opening is more acute, this may make direct laryngoscopy difficult in children.

These anatomical differences have practical implications with respect to ET tube placement and must be kept in mind during intubation. In addition to these anatomic factors, it is important to take into account the relatively large size of the tongue in children, as this can make pediatric intubation more difficult.

Take-Home Message

The anatomy of the pediatric airway differs from the adult, and awareness of these differences can improve chances of successful endotracheal intubation. The pediatric airway is funnel shaped (<8 years), larynx is located more anteriorly, and the cricoid ring is the narrowest portion of the pediatric airway.

ABP Content Specification

- Understand the anatomy of the respiratory system.

Question 12

A 7-year-old boy comes to the Emergency Department with a 1-week history of diffuse abdominal pain, weight loss, nausea, and vomiting. He also admits to polyuria and polydipsia, worsening over the past few days. His vital signs are as follows: heart rate 150 beats/minute, respiratory rate 30 breaths/minute, blood pressure 90/50 mm Hg, and oxygen saturation 99% on room air. A bedside glucose is 520 mg/dl. He appears lethargic and has dry mucous membranes. Which of the following is the most appropriate initial management after IV access has been obtained?

A. Insulin bolus 0.2 unit/kg
B. Insulin drip 0.1 unit/kg/hour
C. Normal saline bolus 20 ml/kg
D. IV antibiotics
E. D5NS at 150 ml/hour

Correct Answer: C

This is a case of diabetic ketoacidosis (DKA). DKA is a state of hyperosmolar hypovolemia. The patient becomes volume depleted through osmotic diuresis and gastrointestinal losses via vomiting, sometimes with diarrhea as well. Studies have shown that patients in moderate–severe DKA generally have about 30–100 ml/kg total body water loss and total body electrolyte disturbances (see below reference). An initial volume expansion should start with a normal saline bolus of 20 ml/kg administered over 60 minutes, with repeat boluses if the patient remains hemodynamically unstable. If the patient is stable after the initial bolus, maintenance fluids can be started with a goal of replacing fluid losses over the next 24–72 hours.

Take-Home Message

DKA is characterized by significant fluid deficit causing depleted circulatory volume, and thus the initial management strategy is fluid resuscitation to maintain tissue perfusion. This should be immediately followed by correction of hyperglycemia and electrolyte imbalance with insulin infusion and appropriate replacement electrolytes.

ABP Content Specification

- Plan the management of acute diabetic ketoacidosis.
- Understand the pathophysiology of hypovolemic shock.
- Recognize signs and symptoms of uncompensated shock.
- Know the role of crystalloid infusion in the management of shock.

Question 13

The incidence of septic shock in children in the United States is greatest in:

A. Infants
B. School-aged children
C. Pre-teens
D. Teenagers
E. Fetuses

Correct Answer: A

There are almost 47,000 cases of pediatric sepsis each year. Approximately, 10 times as many infants develop sepsis when compared with older children. Infants are at highest risk, with low and very low birth weight infants comprising more than 25% of cases. Therefore, early recognition and immediate treatment are essential in this age group.

Take-Home Message

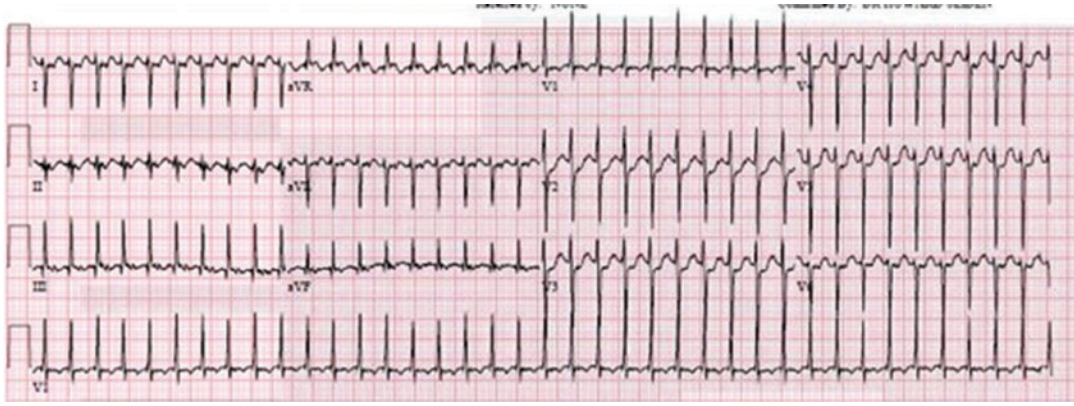
Infants are at higher risk for sepsis relative to other pediatric age groups, and majority occur in very low birth weight infants.

ABP Content Specification

- Differentiate the major causes of shock by age.
- Know major etiologies of circulatory failure/shock.

Question 14

An 11-month-old girl is brought to the Emergency Department for evaluation of fussiness and fever. She was taken to her primary care physician who diagnosed her with acute otitis media and started her on oral antibiotics. The patient has not been taking much in the way of oral fluids and has not eaten for the past day. She has had decreased wet diapers over the past 24 hours. Initial vital signs are as follows: temperature 102 °F, heart rate 240 beats/minute, respiratory rate 45 breaths/minute, blood pressure 90/50 mm Hg, and oxygen saturation 99% on room air. You administer a 20 ml/kg bolus and acetaminophen, but the heart rate remains at 240 beats/minute. A 12-lead electrocardiogram is obtained.



What is the most appropriate next intervention?

A. Cardioversion 1 J/kg
B. Amiodarone 5 mg/kg
C. Adenosine 0.1 mg/kg
D. Procainamide 15 mg/kg
E. Cardioversion 2 J/kg

Correct Answer: C

This is a case of supraventricular tachycardia (SVT). The initial hemodynamic assessment was normal – the patient is normotensive, and has no signs of acute heart failure, shock, or altered mental status. If the patient is deemed unstable, then he/she should be treated with synchronized cardioversion at 0.5–2.0 J/kg. EKG findings of SVT include absent P waves, tachycardia not consistent with sinus tachycardia, no variation of heart rate with activity, and heart rate >220 in infants or >180 in children. Vagal maneuvers are an appropriate initial intervention, or adenosine 0.1 mg/kg can be administered. Adenosine is the medical intervention of choice for SVT. Adenosine must be given as a rapid IV push over 1–2 seconds followed by a 5-ml normal saline flush. This measure is done because of its very short half-life. If no response is seen, then the dose can be increased to 0.2 mg/kg.

Take-Home Message
SVT is best treated first with vagal maneuvers and then adenosine in the hemodynamically stable patient. The first dose of adenosine is 0.1 mg/kg. A second dose of 0.2 mg/kg may be given if the first is unsuccessful.

ABP Content Specification
- Know the indications for and pharmacologic action of amiodarone.
- Know the indications for and pharmacologic action of adenosine.
- Know the indications for and pharmacologic action of procainamide.
- Know the indications for cardioversion in resuscitation.
- Know treatment of stable dysrhythmias.

Question 15

A 15-year-old boy is brought to the Emergency Department after sustaining a head injury while riding his bicycle. He was un-helmeted and sustained a loss of consciousness after his fall. EMS transported him after they placed a cervical collar on him and placed him on a backboard. His initial vital signs are as follows: heart rate 45 beats/minute, respiratory rate 11 breaths/minute, blood pressure 80/50 mm Hg, and oxygen saturation 97% on room air. The airway is patent, the patient is breathing well, but has diminished pulses in all 4 extremities. The patient is unable to move any of his extremities during the examination. Packed red blood cells are ordered, and 1 liter of 0.9% normal saline is given without improvement in the blood pressure. The most appropriate vasopressor for this condition is:

A. Epinephrine
B. Dopamine
C. Dobutamine
D. Milrinone
E. 2 units of packed red blood cells

Correct Answer: A

This is a case of spinal shock. Hypotension, which may be mild in these patients, results from the loss of peripheral vascular resistance, but tachycardia may not be present due to loss of sympathetic tone. Initial management should focus on increasing intravascular volume while closely monitoring for signs of hemorrhagic shock due to trauma. Neurogenic shock is generally seen with acute spinal cord injury above the level of T6. Epinephrine is the vasopressor of choice among those listed here. Vasopressors with alpha and beta activity should be initiated to counter the loss of sympathetic tone and provide chronotropic cardiac support.

Take-Home Message
For patients presenting with traumatic shock, spinal cord injury should always be in the differential diagnosis. Spinal shock is characterized by hypotension, bradycardia, and abnormal neurologic examination (mental status or motor dysfunction), often with some localization. Epinephrine infusions are necessary for their vasopressor effect to maintain blood pressure and tissue perfusion.

ABP Content Specification
- Understand the pathophysiology of neurogenic shock.
- Know the role of pharmacologic therapy for circulatory failure/shock.

Question 16

A 3-year-old boy is undergoing a CT scan with sedation due to agitation. What is the most sensitive method for detecting hypoventilation during the sedation?

A. End-tidal CO_2 monitoring
B. Continuous video EEG
C. Continuous pulse oximeter
D. Telemetry cardiac monitoring
E. Respiratory rate monitor

Correct Answer: A

$ETCO_2$ is more sensitive for detecting hypoventilation and apnea than clinical assessment and continuous pulse oximetry. There is no role for continuous vEEG in procedural sedation. Telemetry cardiac monitoring provides only late indicators for apnea. Studies have shown that $ETCO_2$ is an earlier indicator for apnea versus respiratory rate monitoring as well.

Take-Home Message
End tidal CO_2 is a valuable noninvasive tool that gives a very early indication of inadequate ventilation and is very useful to monitor sedation and can help identify respiratory failure.

ABP Content Specification
- Recognize and interpret relevant monitoring studies for respiratory failure.

Question 17

A 38-week newborn is delivered via spontaneous vaginal delivery in the emergency department. The amniotic fluid is dark and cloudy. You evaluate the infant under the warmer and note gasping, pale color, and a heart rate of 75 beats/minute. The best initial step is:

A. Immediate endotracheal intubation and suctioning of meconium
B. Bag-mask ventilation
C. Initiate chest compressions
D. Obtain vascular access and administer epinephrine
E. Vigorous drying and stimulation

Correct Answer: B

Positive pressure ventilation (PPV) should be provided to depressed infants born through meconium with a heart rate less than 100 breaths/minute. There is insufficient evidence to support intubation with tracheal suctioning, which inherently delays the initiation of oxygenation and ventilation. Neonatal guidelines for chest compressions specify chest compressions for a heart rate less than 60 beats/minute. Airway and breathing are the priority in this scenario, so vascular access and epinephrine administration should be after addressing airway and ventilation during resuscitation.

Take-Home Message
PPV via bag mask is the initial treatment to resuscitate unresponsive infants born to meconium stained amniotic fluid mothers. There is inadequate evidence for better outcomes with tracheal suctioning.

ABP Content Specification
- Recognize signs and symptoms of neonatal distress.
- Plan step-wise intervention in the treatment of neonatal distress.
- Plan management of meconium aspiration.

Question 18

A 2-year-old child presents with high fever, drooling, and mild respiratory distress. He is ill-appearing. The mother states they do not believe in immunizations. The child's neck radiograph is most likely to reveal:

A. Steeple sign
B. Thumbprint sign
C. Unilateral air trapping/hyperinflation of lung fields on expiratory chest X-ray
D. Widening of the retropharyngeal space
E. Radiopaque foreign body

Correct Answer: B

This is a typical presentation of acute epiglottitis. The incidence of epiglottitis has decreased due to widespread immunization against influenza type b (Hib). The thumbprint sign is indicative of an edematous epiglottis. HiB was associated with 90% of cases of epiglottitis prior to the advent of the HiB vaccination. The primary objective in the management of these cases is to secure the airway. These patients have a tendency to deteriorate quickly. Never place these patients in the supine position as it can cause upper airway obstruction due to the large epiglottis and subsequent respiratory arrest. ENT and/or anesthesia should be notified anticipating a difficult airway intervention in a controlled setting such as operating room.

Take-Home Message
Thumbprint sign in a child presenting with stridor and drooling is strongly suggestive of acute epiglottitis. Airway manipulation should be minimized to prevent rapid deterioration and progression to respiratory failure**.**

ABP Content Specification
- Recognize signs and symptoms of upper airway obstruction.
- Recognize and interpret relevant radiographic studies for respiratory failure.
- Know etiology of respiratory failure.

Question 19

An 11-year-old patient who was in a severe motor vehicle collision and sustained multiple fractures and a potential traumatic brain injury (TBI) presents to the ED. The GCS is 5. Multiple direct and video laryngoscopy intubation attempts with in-line cervical spine stabilization have been unsuccessful. What is the most appropriate next step for this patient?

A. Surgical cricothyrotomy
B. Needle cricothyrotomy
C. Insertion of LMA
D. Continue to use bag-valve mask
E. Chin lift to improve visibility

Correct Answer: C

The laryngeal mask airway (LMA) is a temporizing measure to ventilate in the setting of the difficult airway. After two to three attempts of endotracheal intubation, an LMA can be placed to continue ventilating and oxygenating the patient while an alternative plan for intubation is determined. The LMA is inserted into the mouth and blindly passed along the palate into the posterior pharynx until resistance is met. The cuff is then inflated, and the mask forms a partial seal around the larynx. The airway is not secured, and the patient remains at risk for aspiration if they vomit. The LMA can be used as a conduit for a fiberoptic bronchoscope or bougie.

Needle cricothyrotomy involves the insertion of a large needle through the cricothyroid membrane into the airway for transtracheal ventilation (TTV). This option is for "cannot intubate–cannot ventilate" situation when oral or nasal intubation is impossible or fails. This is a temporary measure to reestablish oxygenation until a definitive surgical airway such as tracheostomy can be established. The cricothyroid membrane can be identified as an indentation between the thyroid and cricoid cartilage.

Take-Home Message

The LMA is a good alternative to enable ventilation in the setting of a difficult airway and can be used as a conduit to access a more secure airway.

ABP Content Specification

- Know the use of advanced airway management techniques in patients with respiratory failure.
- Know the use of surgical airway management procedures.
- Learning point – after multiple failed endotracheal intubation attempts, the next step is always LMA before a surgical airway.

Question 20

A 4-year-old boy is brought to the ED by EMS after he was found altered, minimally responsive with cool and clammy extremities. His heart rate is 45 beats/minute, and blood pressure is 50/20 mmHg. He is awake and has a pulse on your examination. The paramedics placed an IV and administered 0.01 mg/kg epinephrine without response. The strip from EMS is shown below.

What is the next treatment of choice?

A. Atropine 0.02 mg/kg intravenous
B. Atropine 0.1 mg/kg intravenous
C. Atropine 1 mg intravenous
D. Transvenous pacing
E. Amiodarone 5 mg/kg intravenous

Correct Answer: A

This patient has a second-degree (type 2) AV block. In this situation, chest compression should be initiated if the heart rate is less than 60 beats/minute and epinephrine 0.0.1 mg/kg is administered. If the bradycardia persists despite these efforts and the patient shows evidence of AV block, then atropine 0.02 mg/kg should be administered and can be repeated.

Take-Home Message

Severe bradycardia with second-degree heart block should be treated with IV epinephrine, and if not responsive, then atropine can be added.

ABP Content Specification

- Know the indications for and pharmacologic action of atropine in resuscitation.
- Know the indications for and pharmacologic action of epinephrine in resuscitation.
- Recognize unstable arrhythmias leading to cardiac arrest.

Question 21

You have just intubated a 5-year-old girl for acute respiratory failure due to multifocal pneumonia. The chest radiograph confirmed placement of the endotracheal tube. About 15 minutes later, you hear alarm bells and notice the blood pressure is 50/20 mm Hg, and the pulse oximeter shows 85% on FiO2 100%. Which of the following is a possible cause of the patient's current condition?

A. Dislodged or displaced endotracheal tube
B. Mucus plug
C. Pneumothorax
D. Ventilator malfunction
E. Any of the above

Correct Answer: E

This patient is showing signs of decompensation after being placed on mechanical ventilation post-intubation. The DOPE mnemonic is an easy way to remember the most likely causes of post-intubation deterioration.

- D- Dislodged/displaced endotracheal tube (main stem, esophageal, supraglottic)
- O- Obstructed endotracheal tube – kink, mucus plug
- P- Pneumothorax
- E- Equipment failure, including ventilator malfunction or no oxygen connection

Take-Home Message

Consider DOPE mnemonic to manage patients that are difficult to ventilate after successful endotracheal intubation.

ABP Content Specification

- Plan mechanical interventions during the postarrest period, including hypothermia.
- Know etiology of respiratory failure.

Suggested Reading

Question 1

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Question 12

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Question 13

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Question 14

Paul T, Bertram H, Bökenkamp R, Hausdorf G. Supraventricular tachycardia in infants, children and adolescents: diagnosis, and pharmacological and interventional therapy. Paediatr Drugs. 2000;2(3):171–81.

Question 15

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Question 16

American Academy of Pediatrics; American Academy of Pediatric Dentistry, Coté CJ, Wilson S; Work Group on Sedation. Guidelines for monitoring and management of pediatric patients during and after sedation for diagnostic and therapeutic procedures: an update. Paediatr Anaesth. 2008;18(1):9–10.

Question 17

https://eccguidelines.heart.org/index.php/circulation/cpr-ecc-guidelines-2/part-13-neonatal-resuscitation/.

Question 18

Lee DR, Lee CH, Won YK, Suh DI, Roh EJ, Lee MH, et al. Clinical characteristics of children and adolescents with croup and epiglottitis who visited 146 Emergency Departments in Korea. Korean J Pediatr. 2015;58(10):380–5.

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Question 21

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