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# Solved Papers of

# Emergency Medicine

## for Postgraduate Students



Devendra Richhariya

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# Emergency Medicine Paper 16

*Shweta Ashok*

## Question 1

### 1. What is HAZMAT?

HAZMAT or "Hazardous materials" are substances in quantities or forms that may pose a reasonable risk to health, property, or the environment.

a. HAZMATs include such substances as toxic chemicals, fuels, nuclear waste products, and biological, chemical, and radiological agents.
b. HAZMATs may be released as liquids, solids, gases, or combination or form of all three, including dust, fumes, gas, vapor, mist, and smoke.

### 2. How will you recognize a HAZMAT event?

A HAZMAT (hazardous materials) event can occur in various ways, such as a spill, leak, explosion, or release of dangerous substances into the environment. Here are some common signs that may indicate a HAZMAT event:

a. *Unusual odors:* Hazardous materials often emit strong, unpleasant odors that can be easily detected in the surrounding area. These smells can range from a sweet or chemical-like scent to a foul, rotten odor.
b. *Visible haze, fog, or smoke:* A HAZMAT event can also produce a visible plume of smoke, haze, or fog in the air. This can be caused by a chemical reaction, a spill, or a release of gas or vapor.
c. *Unusual noise:* Some HAZMAT events, such as explosions or chemical reactions, can produce loud noises that are easily audible from a distance.
d. *Emergency vehicles:* In the event of an HAZMAT event, you may notice a significant presence of emergency vehicles, such as fire trucks, ambulances, and police cars. These vehicles may be responding to the incident or helping to evacuate the area.
e. *Evacuation orders:* If you receive an evacuation order from local authorities or emergency services, it is a clear indication that a HAZMAT event is occurring, and you should follow the evacuation procedures immediately.

If you suspect that there is a HAZMAT event occurring in your vicinity, take immediate action to protect yourself and those around you. You should follow any emergency instructions given by local authorities, avoid the affected area if possible, and seek medical attention if you experience any symptoms of exposure to hazardous materials.

### 3. What are the various control zones for decontamination in the field?

In the HAZMAT field, there are various control zones for decontamination. These zones are established to ensure the safety of personnel and the public during hazardous materials incidents. The following are the different control zones for decontamination:

*Hot zone:* This is the area where the hazardous materials are located, and it is the most dangerous zone. Only trained and equipped personnel should be allowed to enter this zone.

*Warm zone:* This is the area surrounding the hot zone where decontamination takes place. Personnel who have been in the hot zone must go through decontamination before entering the warm zone. This zone may also be used for equipment staging and other support activities.

*Cold zone:* This is the area furthest from the hot zone and is considered a safe zone. This area is where command and control functions take place and where decontaminated personnel and equipment are located.

*Support zone:* The support zone is typically located a safe distance away from the incident site, and is used as a staging area for personnel, equipment, and supplies. It may also serve as a decontamination area for those who have been exposed to the hazardous materials, and may include facilities for medical treatment or other support services.

The purpose of the support zone is to ensure the safety and well-being of emergency responders and other personnel, as well as to facilitate an effective response to the hazardous materials incident. Responders must be trained on the proper use and management of the support zone, in order to minimize the risk of injury or exposure to hazardous materials.

The boundaries of these zones can change depending on the specific incident and the type of hazardous material involved. The use of these zones helps to ensure that personnel and the public are protected during hazardous materials incidents.

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## Question 2

*A 7-month-old male child presented to the emergency department with episodes of crying spells and red colored stools. His mother noticed a mass in the right lower quadrant of abdomen.*

### 1. What are the possible diagnoses?

Based on the given information, there are several possible diagnoses that could explain the symptoms of the 7-month-old male child. Here are a few:

*Intussusception:* This is a medical emergency that occurs when a portion of the intestine telescopes into an adjacent part, causing obstruction, inflammation, and potentially leading to tissue damage. The classic triad of intussusception includes abdominal pain, vomiting, and bloody stool. Intussusception is most common in children between 6 months and 3 years of age.

*Meckel's diverticulum:* This is a congenital abnormality that results from incomplete closure of the omphalomesenteric duct during fetal development. Meckel's diverticulum can cause gastrointestinal bleeding, abdominal pain, and a palpable mass in the lower right quadrant of the abdomen. Meckel's diverticulum is most common in children <2 years of age.

*Infectious gastroenteritis:* This is a common condition in young children that is caused by a viral or bacterial infection of the digestive system. Symptoms may include abdominal pain, vomiting, diarrhea, and fever. In some cases, infectious gastroenteritis can cause blood in the stool.

*Cow's milk protein intolerance:* This is a condition in which the child's immune system reacts to the proteins in cow's milk, leading to gastrointestinal symptoms such as abdominal pain, diarrhea, and bloody stool.

*Allergic colitis:* This is a condition in which the child's immune system reacts to certain foods, leading to inflammation, and damage to the lining of the colon. Symptoms may include abdominal pain, diarrhea, and bloody stool.

These are just a few possible diagnoses based on the given information. However, a proper diagnosis can only be made by a qualified healthcare professional after a thorough physical examination and appropriate diagnostic tests.

### 2. How do you investigate this child?

When a 7-month-old male child presents to the emergency department with episodes of crying spells, red-colored stools, and a mass in the right lower quadrant of the abdomen, the following investigations may be considered:

*Physical examination:* The child should be thoroughly examined, including the abdomen, to assess for the presence of a mass, tenderness, or distension. A digital rectal examination may also be performed to assess for the presence of blood.

*Laboratory tests:* Blood tests may be done to evaluate the child's complete blood count (CBC) to assess for signs of infection or anemia, electrolytes, and kidney function.

*Imaging tests:* Imaging tests may be used to visualize the mass in the abdomen and diagnose the underlying condition. These may include abdominal X-rays, ultrasound, computed tomography (CT) scan, or magnetic resonance imaging (MRI).

*Stool tests:* Stool tests may be done to evaluate for the presence of blood, bacteria, viruses, or parasites.

*Diagnostic procedures*: A diagnostic procedure, such as an endoscopy or colonoscopy, may be performed to directly visualize the gastrointestinal tract and assess for abnormalities.

The investigations will depend on the suspected diagnosis and the findings of the initial physical examination. It is important to note that any diagnostic procedure or imaging test should be done with caution in a young child and only after weighing the risks and benefits. A pediatrician or pediatric gastroenterologist should be consulted for further management and treatment.

### 3. How do you manage the child in emergency department?

The management of a 7-month-old male child who presents to the emergency department with episodes of crying spells, red-colored stools, and a mass in the right lower quadrant of the abdomen will depend on the underlying cause of the symptoms. Here are some general approaches to managing the common conditions that may be responsible for these symptoms:

*Intussusception:* A child suspected of having intussusception should be promptly treated with intravenous (IV) fluids and antibiotics through an IV line, and imaging tests will be done to confirm the diagnosis. Treatment may involve a procedure called an air or barium enema to correct the intussusception. In some cases, surgery may be necessary.

*Meckel's diverticulum:* The management of Meckel's diverticulum may involve surgery to remove the abnormality, especially if it is causing symptoms such as gastrointestinal bleeding or obstruction.

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*Infectious gastroenteritis:* Treatment of infectious gastroenteritis may involve supportive care, such as fluid and electrolyte replacement and symptomatic relief of diarrhea and vomiting. Antibiotics may be prescribed if there is a bacterial infection.

*Cow's milk protein intolerance and allergic colitis:* Management of these conditions may involve dietary changes, such as switching to a hypoallergenic formula or eliminating specific foods from the child's diet. In some cases, medications may be prescribed to manage symptoms such as inflammation and pain.

In all cases, it is important to closely monitor the child's symptoms and follow-up with a pediatrician or pediatric gastroenterologist for appropriate management and treatment. It is also important to provide adequate nutrition and hydration, and to prevent complications such as dehydration and electrolyte imbalances.

# Question 3

## 1. What are the key changes in recent 2018 Advanced Trauma Life Support (ATLS) guidelines compared to the previous ATLS guidelines?

Here are some of the key changes in the 2018 ATLS guidelines compared to the previous ATLS guidelines:

*Emphasis on the need for teamwork and communication:* The 2018 ATLS guidelines place a greater emphasis on the importance of communication and teamwork in trauma care. This includes the need for clear and concise communication between team members, as well as the importance of effective leadership and coordination of care.

*Updated approach to airway management:* The 2018 ATLS guidelines recommend a more aggressive approach to airway management in patients with trauma. This includes a focus on early recognition and intervention for airway obstruction and the use of advanced airway techniques such as video laryngoscopy and intubation.

*Focus on early identification of hemorrhage:* The 2018 ATLS guidelines emphasize the importance of early identification and control of hemorrhage in trauma patients. This includes the use of point-of-care ultrasound and other diagnostic tools to identify sources of bleeding, as well as the use of early resuscitation strategies such as tranexamic acid and early blood product administration.

*Greater emphasis on damage control surgery:* The 2018 ATLS guidelines recommend a greater emphasis on damage control surgery in the management of severely injured patients. This includes a focus on rapid control of hemorrhage and contamination, as well as the use of staged surgical interventions to minimize the risk of complications.

*Updated approach to spinal immobilization:* The 2018 ATLS guidelines recommends a more selective approach to spinal immobilization in trauma patients. This includes a focus on identifying patients who are at high risk for spinal injury and avoiding unnecessary immobilization in low-risk patients, as well as the use of alternative immobilization techniques such as cervical collars and vacuum mattresses.

## 2. Classify hemorrhagic shock as per 2018 ATLS guidelines.

The physiologic effects of hemorrhage are divided into four classes based on clinical signs, useful for estimating the acute blood loss. The following classification system is useful in emphasizing the early signs and pathophysiology of the shock state **(Table 1)**:

a. *Class I hemorrhage:* <15% blood volume loss (usually occurs in those donated 1 unit of blood).
b. *Class II hemorrhage:* 15–30% blood volume loss (uncomplicated mild hemorrhage for which crystalloid fluid resuscitation is required).
c. *Class III hemorrhage:* 31–40% blood volume loss (complicated moderate hemorrhagic state in which at least crystalloid infusion is required and also blood replacement).
d. *Class IV hemorrhage:* >40% blood volume loss (severe hemorrhage form in which patient will need aggressive resuscitative measures. Blood transfusion is required).

**TABLE 1:** Signs and symptoms of hemorrhage by class based on ATLS 2018 guidelines.

| *Parameter* | *Class 1* | *Class II (Mild)* | *Class III (Moderate)* | *Class IV (Severe)* |
|---|---|---|---|---|
| Approximate blood loss | <15% | 15–30% | 31–40% | >40% |
| Heart rate | ↔ | ↔/↑ | ↑ | ↑/↓↓ |
| Blood pressure | ↔ | ↔ | ↔/↓ | ↓ |
| Pulse pressure | ↔ | ↓ | ↓ | ↓ |
| Respiratory rate | ↔ | ↔ | ↔/↑ | ↑ |
| Urine output | ↔ | ↔ | ↓ | ↓↓ |
| Glasgow Coma Scale score | ↔ | ↔ | ↓ | ↓ |
| Base deficit | 0 to –2 mEq/L | –2 to –6 mEq/L | –6 to –10 mEq/L | –10 mEq/L or less |
| Need for blood products | Monitor | Possible | Yes | Massive transfusion protocol |

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# Question 4

## 1. What is BLUE protocol for ultrasound (USG) in emergency department?

Bedside lung ultrasound in emergency (BLUE) is a basic point-of-care ultrasound (POCUS) examination performed for identifying undifferentiated respiratory failure at the bedside, immediately after the physical examination, and before any radiography.

a. The protocol is simple and takes only a few minutes to perform.
b. It analyzes three standardized points on each hemithorax in patients with acute respiratory failure, by establishing the presence or absence of:
   i. Lung sliding
   ii. Anterior lung rockets
   iii. Posterior and/or lateral alveolar and/or pleural syndrome (PLAPS)
   iv. A noncompressible deep vein.
c. Lung ultrasonography is becoming a standard tool in critical care, due to its very high sensitivity and specificity to diagnose common chest pathologies.

## 2. Describe different profiles in lung USG.

**Ultrasound profile (Fig. 1)**

a. *Left panel:* The A profile is defined as predominant A lines plus lung sliding at the anterior surface in supine or half-sitting patients (stage 1/1).
   i. This profile suggests chronic obstructive pulmonary disease (COPD), embolism, and some posterior pneumonia. Pulmonary edema is nearly ruled out.
b. *Middle:* The B profile is defined as predominant B lines in stage 1.
   i. This profile suggests cardiogenic pulmonary edema, and nearly rules out COPD, pulmonary embolism, and pneumothorax.
c. *Right panel*: An AB profile, massive B lines at the left lung, A lines at the right lung.
   i. This profile is usually associated with pneumonia.

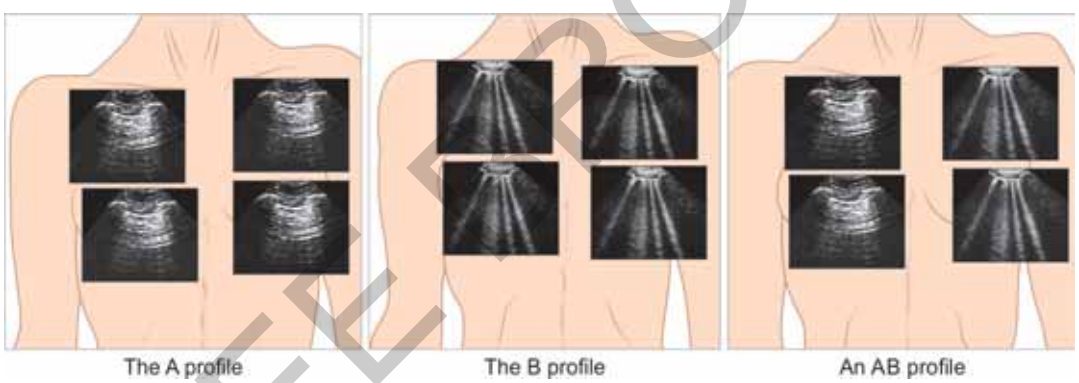


**Fig. 1:** Ultrasound profiles.

## 3. Explain the role of USG in diagnosis of lung parenchymal diseases.

Lung parenchymal diseases refer to conditions that affect the tissue and structures within the lungs themselves. While USG is not typically the first choice of imaging modality for evaluating lung parenchymal diseases, instead, other imaging modalities like chest X-ray, CT, and MRI are preferred. However, in certain situations, such as when a patient is critically ill and cannot be moved, or when a patient cannot tolerate a CT scan due to radiation exposure, an ultrasound may be used as an alternative imaging modality.

Parenchymal disease can be detected by ultrasonography as long as there is no air between the probe and the lesion and the beam reaches the pleura. Some lung parenchymal diseases that may be detected on ultrasound include:

a. *Pleural effusion:* This occurs when fluid accumulates in the pleural space, the area between the lung and the chest wall. On ultrasound, pleural effusion appears as a black area between the lung and the chest wall.
b. *Pneumothorax:* This occurs when air enters the pleural space, causing the lung to collapse. On ultrasound a pneumothorax can be used to diagnose a collapsed lung (pneumothorax) by detecting the absence of lung sliding or the presence of lung point on the ultrasound image.
c. *Interstitial lung diseases:* Ultrasound may be used to evaluate for interstitial lung diseases, which are a group of conditions that affect the lung tissue, including pulmonary fibrosis. On ultrasound, interstitial lung diseases may appear as areas of increased or decreased lung density.
d. *Lung consolidation:* This is a condition where the lung tissue becomes filled with fluid, pus, or other substances,

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making it denser and less elastic. Ultrasound can help detect areas of consolidation in the lungs, which may be indicative of pneumonia or other lung infections.

e. *Lung abscess:* This refers to a collection of pus within the lung tissue. On USG, a lung abscess may appear as a hypoechoic (dark) area within the lung.

f. *Lung cancer:* While USG is not typically used to diagnose lung cancer, it may be used to guide the placement of a needle during a biopsy to obtain a tissue sample for diagnosis.

## Question 5

### 1. What is sudden infant death syndrome (SIDS)?

Sudden infant death syndrome is the sudden and unexplained death of an apparently healthy infant <1 year of age, usually during sleep. SIDS is sometimes called "crib death" because the infants often die in their cribs.

The cause of SIDS is not known, but it is believed to be related to abnormalities in the part of an infant's brain that controls breathing and arousal from sleep.

There are several risk factors associated with SIDS, including placing an infant to sleep on their stomach or side, soft bedding in the crib, overheating, exposure to secondhand smoke, premature birth or low birth weight, and maternal smoking during pregnancy.

### 2. Enumerate various causes for SIDS.

The cause of SIDS is not known, but it is believed to be related to abnormalities in the part of an infant's brain that controls breathing and arousal from sleep.

A combination of genetic, environmental, and lifestyle factors which can increase the risk of sudden and unexplained death in apparently healthy infants. Some of the potential causes of SIDS include:

*Abnormalities in the brainstem:* The brainstem controls vital functions such as breathing, heart rate, and blood pressure, and some research suggest that abnormalities in this area may contribute to SIDS.

*Respiratory issues:* Some infants who die from SIDS may have problems with their breathing, including episodes of apnea (a pause in breathing) or hypopnea (shallow breathing).

*Cardiac abnormalities:* Certain heart conditions may increase the risk of SIDS, such as long QT syndrome, a condition that affects the heart's electrical activity.

*Environmental factors:* Exposures to environmental toxins, such as cigarette smoke, may increase the risk of SIDS.

*Sleeping position:* Placing infants on their stomachs or sides to sleep has been associated with an increased risk of SIDS.

*Overheating:* Infants who become overheated during sleep may be at higher risk for SIDS.

*Maternal factors*: Some maternal factors, such as young maternal age, smoking, substance use, and inadequate prenatal care, may increase the risk of SIDS.

It is important to note that while these factors may increase the risk of SIDS, the exact cause of SIDS remains unknown in most cases.

### 3. What are the risk factors for SIDS?

There are several risk factors associated with SIDS, including placing infants to sleep on their stomach or side, soft bedding in the crib, overheating, exposure to secondhand smoke, premature birth or low birth weight, and maternal smoking during pregnancy. Following are some risk factors that may increase the likelihood of SIDS occurring:

*Age:* SIDS most commonly occurs in infants between 1 and 4 months of age.

*Sleeping position:* Infants who are placed on their stomachs or sides to sleep have a higher risk of SIDS than those who are placed on their backs.

*Soft bedding:* The use of soft bedding, such as blankets, pillows, or stuffed animals, in the infant's sleep area has been linked to an increased risk of SIDS.

*Prematurity and low-birth weight:* Infants who are born prematurely or have a low-birth weight have a higher risk of SIDS.

*Maternal factors:* Maternal smoking during pregnancy, as well as exposure to secondhand smoke after birth has been linked to an increased risk of SIDS. Other maternal factors, such as young maternal age, poor prenatal care, and substance abuse, may also increase the risk.

*Family history:* Infants with siblings or other family members who have had SIDS have a higher risk of SIDS.

*Overheating:* Infants who become too warm during sleep may be at higher risk for SIDS.

*Male sex:* Male infants have a slightly higher risk of SIDS than female infants.

It is important to note that most infants who have one or more of these risk factors do not develop SIDS, and infants who do not have any of these risk factors can still develop SIDS. However, taking steps to reduce these risk factors can help to lower the risk of SIDS.

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### 4. How will you prevent SIDS?

While the exact cause of SIDS is not fully understood, there are several steps that parents and caregivers can take to help reduce the risk of SIDS. These include:

a. Always placing infants on their backs to sleep, both for naps and at night. Infants who sleep on their stomachs or sides are at a higher risk of SIDS.
b. Using a firm and flat sleep surface, such as a crib or bassinet, with a tight-fitting sheet. Soft surfaces, such as couches or adult beds, are not safe for infants to sleep on.
c. Keeping soft objects, loose bedding, and other hazards out of the sleep area. This includes pillows, blankets, stuffed animals, and crib bumpers.
d. Avoiding overheating by dressing infants in lightweight clothing and keeping the room at a comfortable temperature. Infants who become too warm during sleep are at a higher risk of SIDS.
e. Offering a pacifier at naptime and bedtime. This has been shown to reduce the risk of SIDS, although it is not clear why.
f. Avoiding exposure to smoke, both during pregnancy and after birth. Infants who are exposed to cigarette smoke are at a higher risk of SIDS.
g. Providing a safe sleep environment for infants when they are away from home. This includes using a safe sleep surface, such as a portable crib or play yard.
h. *Breastfeeding infants:* Breastfeeding has been associated with a lower risk of SIDS.

It is important to note that while these steps can help to reduce the risk of SIDS, there is no way to completely prevent SIDS.

## Question 6

### 1. What are the revised diagnostic criteria for sepsis and septic shock?

The new definitions emphasize the importance of organ dysfunction as the primary indicator of sepsis and septic shock, rather than relying solely on systemic inflammatory response syndrome (SIRS) criteria.

Here are the diagnostic criteria for sepsis and septic shock according to Sepsis-3:

*Sepsis:* Suspected or confirmed infection.

An acute change in sequential (sepsis-related) Organ Failure Assessment (SOFA) score of 2 or more points, which is a measure of organ dysfunction.

The SOFA score ranges from 0 to 24 and includes assessments of six organ systems–respiratory, cardiovascular, renal, hepatic, coagulation, and neurological.

*Septic shock:* Sepsis as defined above.

Vasopressor therapy required to maintain a mean arterial pressure (MAP) of 65 mm Hg or greater serum lactate level >2 mmol/L (18 mg/dL) despite adequate fluid resuscitation.

The revised diagnostic criteria focus on early recognition and management of sepsis and septic shock by identifying patients with organ dysfunction, rather than relying solely on inflammatory markers. This shift in emphasis allows for earlier intervention and potentially better outcomes for patients with sepsis and septic shock.

### 2. Explain Quick Sequential Organ Failure Assessment (qSOFA) scoring of sepsis.

*Quick Sequential Organ Failure Assessment (qSOFA)* is a simplified version of the SOFA score that can be used at the bedside to quickly identify patients with suspected infection who are at higher risk for poor outcomes. It consists of three criteria, with one point assigned for each of the following:

1. Respiratory rate of 22 breaths per minute or higher
2. Altered mentation (e.g., confusion or decreased level of consciousness)
3. Systolic blood pressure of 100 mm Hg or lower

Patients with a qSOFA score of 2 or higher are considered at increased risk of poor outcomes and should prompt clinicians to investigate for the presence of organ dysfunction, initiate appropriate therapy, and consider referral to critical care if necessary.

Quick Sequential Organ Failure Assessment is not a substitute for clinical judgment, and it should be used in conjunction with other clinical information to guide decision-making. It is also important to recognize that qSOFA is not a diagnostic tool for sepsis, but rather a screening tool to identify patients at increased risk of poor outcomes who may require further evaluation and management.

### 3. What are the recent surviving sepsis bundles guidelines?

The most recent version of the Surviving Sepsis Campaign (SSC) guidelines is the 2021 update. The 2021 SSC guidelines continue to emphasize the importance of early recognition and management of sepsis, with a focus on the use of protocols and bundles to improve outcomes. Some key recommendations from the guidelines include:

a. *Use of the quick qSOFA* score to identify patients at high risk of poor outcomes from sepsis.
b. *Administration of broad-spectrum antibiotics within 1 hour* of sepsis recognition.
c. *Aggressive fluid resuscitation* in patients with sepsis-induced hypotension or elevated serum lactate levels.

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d. *Use of vasopressors* in patients with persistent hypotension despite adequate fluid resuscitation.
e. *Early initiation of source control measures,* such as drainage of abscesses or removal of infected tissue.
f. Use of *lung-protective ventilation strategies* in patients with sepsis-induced respiratory failure.
g. Use of *renal replacement therapy* in patients with sepsis-induced acute kidney injury.

# Question 7

## 1. What are the causes of abdomen pain in neonates and young infants?

Young infants typically tend to eat every second hourly. So incessant cries and fatigue with poor feeding are the signs of serious illness. Intermittent, colicky pain is often associated with intussusception, colic, and gastroenteritis. Necrotizing enterocolitis and volvulus are more typically associated with continuous pain. Pain after feeds may be caused by gastroesophageal reflux. Pyloric stenosis causes progressive painless projectile vomiting followed by renewed interest in feeding.

There are many possible causes of abdominal pain in neonates and young infants.

Some of the most common causes include:

*Colic:* This is a common condition that causes excessive crying and fussiness in babies. It is not clear what causes colic, but it usually resolves on its own within a few months.

*Gastroesophageal reflux (GERD):* GERD occurs when stomach acid flows back into the esophagus. The symptoms include spitting up, vomiting, and irritability.

*Constipation:* Infants may experience abdominal pain and discomfort if they are constipated. The signs of constipation include infrequent bowel movements, hard stools, and straining during bowel movements.

*Intussusception:* This is a condition in which a portion of the intestine folds into itself, causing a blockage. The symptoms include abdominal pain, vomiting, and bloody stools.

*Gastrointestinal infections:* Infants may experience abdominal pain and diarrhea as a result of a viral or bacterial infection.

*Milk protein intolerance:* Some babies are intolerant to cow's milk protein, which can cause abdominal pain, vomiting, and diarrhea.

*Hernia:* A hernia occurs when an organ or tissue protrudes through a weak spot in the surrounding muscle or connective tissue. In infants, a hernia may be visible as a bulge in the abdomen.

*Meconium ileus:* This is a blockage in the intestine caused by thick, sticky meconium. It is more common in babies with cystic fibrosis.

*Urinary tract infection:* Infants with a urinary tract infection may experience abdominal pain, fever, and frequent urination.

## 2. What are the major life-threatening causes of abdominal pain in neonates and young infants?

Abdominal pain in neonates and young infants can be a sign of a serious medical condition. Some of the major life-threatening causes of abdominal pain in this population include:

*Intestinal obstruction:* This is a blockage that prevents food or fluids from passing through the small or large intestine. It can be caused by a variety of factors such as meconium ileus, volvulus, and intussusception.

*Necrotizing enterocolitis:* This is a serious condition that occurs when the lining of the intestinal wall becomes inflamed and dies. It is most common in premature infants and can lead to perforation of the bowel.

*Malrotation with midgut volvulus:* This is a condition in which the intestine twists around its mesentery, leading to obstruction and ischemia.

*Gastrointestinal perforation:* This is a hole in the stomach or intestine that can be caused by a variety of factors such as trauma, infection, or inflammation. It can lead to peritonitis and sepsis.

*Acute appendicitis:* This is an inflammation of the appendix that can lead to perforation and peritonitis.

*Hernias:* These are protrusions of abdominal contents through a weakness in the abdominal wall. In infants, inguinal hernias are the most common.

*Mesenteric adenitis:* This is an inflammation of the lymph nodes in the mesentery that can mimic the symptoms of appendicitis.

*Urinary tract infections:* These can cause abdominal pain in infants, particularly if there is associated fever.

# Question 8

*A 2-year-old child presented with fever, drooling of saliva, and stridor.*

## 1. Enumerate the causes of stridor in infants and children.

Stridor in infants and children can have several different causes, including:

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*Croup:* This is a viral infection that causes inflammation of the upper airway, which can result in a barking cough, hoarseness, and stridor.

*Epiglottitis:* This is a bacterial infection that causes inflammation and swelling of the epiglottis, which can lead to difficulty breathing and stridor.

*Foreign body aspiration:* This occurs when a child inhales a foreign object, such as a toy or food, which can cause obstruction of the airway and stridor.

*Anaphylaxis:* This is a severe allergic reaction that can cause swelling of the throat and airway, leading to difficulty breathing and stridor.

*Trauma to the neck or airway:* This can occur as a result of a fall, car accident, or other injury, and can lead to obstruction of the airway and stridor.

*Vocal cord dysfunction:* This occurs when the vocal cords do not function properly, causing difficulty breathing and stridor.

*Tonsillitis:* Inflammation of the tonsils can cause difficulty breathing and stridor.

*Congenital abnormalities:* Infants may be born with structural abnormalities in the airway that can cause stridor, such as laryngomalacia or tracheomalacia.

## 2. What is croup?

*Croup* (*viral laryngotracheobronchitis*) is the most common cause of stridor outside the neonatal period, commonly affecting children 6 months–3 years old. It is caused by a viral infection that inflames the upper airways, including the larynx, trachea, and bronchi. The most common causes are: Parainfluenza virus rhinovirus.

*Other causes are:* Influenza respiratory syncytial virus (RSV) metapneumovirus enterovirus coronavirus.

## 3. Discuss the clinical presentation of croup.

The clinical features of croup may vary in severity from mild to severe, and typically develop over a period of several days. The common signs and symptoms of croup include:

a. A barking cough that may sound like a seal or dog barking.
b. Hoarse voice or changes in voice quality.
c. Difficulty breathing, which may cause a high-pitched or wheezing sound when inhaling.
d. Rapid, shallow breathing.
e. Stridor, a harsh, high-pitched sound that occurs when breathing in.
f. Mild-to-moderate fever.
g. Runny or stuffy nose.
h. Irritability or restlessness.

*In some cases, croup may also cause other symptoms such as:*

a. Bluish or grayish skin around the nose, mouth, or fingernails due to a lack of oxygen.
b. Dehydration, especially if the child is having difficulty drinking fluids.
c. Fatigue or lethargy.

Most cases of croup are mild and can be treated at home conservatively with rest and fluids. Though the symptoms usually last for about 3–7 days, the cough can linger for up to 2 weeks. Most children recover fully without any lasting complications.

## 4. What is the diagnosis of croup?

Diagnosis is clinical based on the history as given by parents and the signs on examination.

X-ray radiograph of neck demonstrates subglottic narrowing, referred to as "steeple sign" **(Fig. 2)**.

*Severity:* Croup is classified as mild, moderate, and severe depending on the degree of airway obstruction.

*Modified Westley croup score* is one of the commonly used scoring guidelines in clinical practice. It is the sum of points assigned for five factors—level of consciousness, cyanosis, stridor, air entry, and retractions. The points given for each factor is listed in **Table 2**, and the final score ranges from 0–17.

*A total score of <4 points indicates mild croup:* The characteristic barking cough and hoarseness may be present, but no stridor at rest. *A score of 3–5 points indicates moderate croup.* It presents with easily heard stridor, and few other signs. *A total score of 6–11 points indicates severe croup.* It presents with obvious stridor along with marked chest wall indrawing. *A score of >12 points indicates impending respiratory failur*e. The barking cough and stridor may not be prominent at this stage. Severe croup is rare and seen among <1% of children presenting to the emergency department.

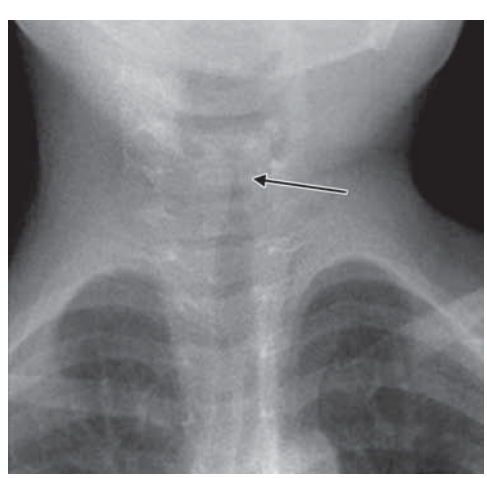

**Fig. 2:** The steeple sign as seen on an anteroposterior (AP) neck X-ray of a child with croup.

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**TABLE 2:** Modified Westley croup score.

| *Clinical features* | *Assigned score* |
|---|---|
| Inspiratory stridor | • None = 0 point<br>• With agitation only = 1 point<br>• At rest = 2 points |
| Intercostal retractions | • Mild = 1 point<br>• Moderate = 2 points<br>• Severe = 3 points |
| Air entry | • Normal = 0 point<br>• Slightly decreased = 1 point<br>• Severely decreased = 2 points |
| Cyanosis | • None = 0 point<br>• With agitation only = 4 points<br>• At rest = 5 points |
| Level of consciousness | • Normal = 0 point<br>• Altered = 5 points |

### 5. Discuss the treatment of croup.

The treatment of croup depends on the severity of the symptoms. In most cases, croup is a self-limited illness that improves on its own within a few days. The following treatments may be recommended to help alleviate symptoms and improve the child's comfort:

*Humidifier:* Using a cool-mist humidifier in the child's bedroom can help to relieve cough and ease breathing. Alternatively, taking the child into a steamy bathroom for a few minutes can also be effective.

*Rest:* Encouraging the child to rest and limiting physical activity can help to reduce the strain on the respiratory system and promote healing.

*Fluids:* Making sure the child drinks plenty of fluids can help to prevent dehydration, thin out mucus secretions, and make coughing more productive.

*Medications:* Over-the-counter pain relievers, such as acetaminophen or ibuprofen, can be given to help reduce fever and relieve pain. Oral steroids may be prescribed to help reduce inflammation in the airways and improve breathing, hence, reducing the duration of the disease. Recommended is dexamethasone single dose of 0.6 mg/kg per oral.

*Emergency care:* In rare cases of severe croup, where the child is struggling to breathe, hospitalization may be necessary. In the hospital, the child may receive supplemental oxygen, nebulized medications, and other treatments to help alleviate symptoms and improve breathing.

For severe croup with persistent respiratory failure despite medical therapy, endotracheal intubation may be necessary. There is insufficient evidence to determine whether nebulized beta agonists are beneficial with croup, as it causes vasodilation, which may worsen upper airway edema. Hence, beta-agonists are not recommended in croup.

## Question 9

*A 12-year-old child presented to your emergency department with fever and severe headache. The attending physician suspected him to be suffering from Nipah virus infection. Discuss the following with regard to Nipah virus infection:*

### 1. History and epidemiology.

Nipah virus is classified as a zoonotic virus, meaning that it is transmitted from animals to humans. The primary reservoir of the virus is fruit bats of the *Pteropodidae* family, and transmission to humans can occur through direct contact with infected animals or consumption of contaminated food or water.

Nipah virus was first discovered in 1999 following an outbreak of disease in pigs and people in Malaysia and Singapore. The first Nipah virus outbreak occurred in India in the year 2001 at Siliguri. The second outbreak happened at Nadia in 2007. Nipah virus exhibits neurological and pneumonic tropism with the predominant clinical presentation being encephalitis in humans. The epidemiology of Nipah virus outbreaks is complex, as it involves multiple factors, including the ecology of the virus, the behavior of the reservoir host (fruit bats), and the interactions between humans, animals, and the environment. Outbreaks of Nipah virus are often linked to agricultural practices that bring humans and domestic animals into close contact with bats, as well as the consumption of contaminated food or water.

### 2. Transmission of infection.

Nipah virus is primarily transmitted to humans from animals, specifically fruit bats of the *Pteropodidae* family. The virus can be transmitted to humans through direct contact with infected bats, their urine or saliva, or through consumption of food or water contaminated with bat excretions.

Transmission of Nipah virus can also occur through contact with infected animals, such as pigs, which can act as intermediate hosts for the virus. Humans can contract the virus through direct contact with infected pigs, or by consuming contaminated pork products.

Human-to-human transmission of Nipah virus has also been reported, particularly in healthcare settings where there is close contact between infected individuals and healthcare workers. The virus can be transmitted through respiratory secretions, such as droplets, or through contact with contaminated surfaces. Preventing transmission of

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Nipah virus requires strict biosecurity measures, particularly in regions where the virus is known to be present. This includes avoiding direct contact with infected animals, wearing protective clothing and equipment, implementing proper hand hygiene, and implementing proper food safety practices. In summary, Nipah virus is primarily transmitted to humans through contact with infected animals, particularly fruit bats and pigs. Human-to-human transmission can also occur through close contact with infected individuals. Preventing transmission requires strict biosecurity measures and proper hygiene practices.

### 3. Clinical features of Nipah virus.

The clinical features of Nipah virus infection can vary widely, ranging from asymptomatic or mild respiratory illness to severe encephalitis with a high case fatality rate.

The incubation period of Nipah virus infection is typically between 5 and 14 days. The initial symptoms of the infection are often nonspecific and can include fever, headache, myalgia (muscle pain), vomiting, and sore throat. In some cases, patients may also experience cough, abdominal pain, and diarrhea.

As the infection progresses, patients may develop neurological symptoms, including seizures, disorientation, and altered consciousness. In severe cases, patients may develop encephalitis, which can lead to coma and death.

The case fatality rate of Nipah virus infection varies between outbreaks, with reported rates ranging from 40–90%. Factors that may affect the severity of the disease include the virulence of the virus strain, the age and immune status of the patient, and the time to initiation of appropriate medical treatment.

### 4. Management of Nipah virus.

Currently, there is no specific treatment or vaccine for Nipah virus infection, and supportive care is the primary form of management. The management of Nipah virus infection involves a multidisciplinary approach, including clinical management, infection control, and public health measures.

Clinical management of Nipah virus infection involves supportive care, such as respiratory support, fluid and electrolyte management, and treatment of complications such as seizures. Patients with severe neurological symptoms may require intensive care and mechanical ventilation.

Infection control measures are critical for preventing the spread of Nipah virus. Strict isolation precautions, including contact and droplet precautions should be implemented for suspected or confirmed cases of Nipah virus infection. Healthcare workers should wear personal protective equipment, including gloves, gowns, masks, and eye protection, when caring for patients with suspected or confirmed Nipah virus infection. Public health measures, including active surveillance, contact tracing, and outbreak investigation, are critical for controlling Nipah virus outbreaks. Public health authorities should implement strict biosecurity measures in areas where the virus is known to be present, and should provide public education about the risks of Nipah virus infection and how to prevent transmission.

## Question 10

### 1. Discuss the odds ratio giving an example.

The odds ratio is a statistical measure used to quantify the association between two binary variables. It is the ratio of the odds of an event occurring in one group to the odds of the same event occurring in another group. In other words, it tells us how much more or less likely it is for an outcome to occur in one group compared to another group. Here is an example to illustrate how odds ratio works:

Suppose a study is conducted to investigate the association between smoking and lung cancer. The researchers divide the participants into two groups—smokers and nonsmokers. They find that out of 100 smokers, 30 develop lung cancer, while out of 100 nonsmokers, only 5 develop lung cancer.

The odds of developing lung cancer in the smoker group are calculated as the ratio of the number of smokers who developed lung cancer (30) to the number of smokers who did not develop lung cancer (70). This gives an odd of 0.43 (30/70).

Similarly, the odds of developing lung cancer in the nonsmoker group are calculated as the ratio of the number of non-smokers who developed lung cancer (5) to the number of non-smokers who did not develop lung cancer (95). This gives an odd of 0.05 (5/95).

The odds ratio is then calculated as the ratio of the odds of developing lung cancer in the smoker group to the odds of developing lung cancer in the nonsmoker group. This gives an odds ratio of 8.6 (0.43/0.05).

This means that smokers are 8.6 times more likely to develop lung cancer compared to nonsmokers. In other words, the odds of developing lung cancer are 8.6 times higher in smokers than non-smokers.

The odds ratio is a useful measure because it allows us to compare the strength of association between two groups even if the baseline risk of the outcome is different in the two groups. In the above example, the baseline risk of developing lung cancer is much higher in the smoker group than in the non-smoker group. However, the odds ratio takes this

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into account and provides a meaningful comparison of the strength of association between smoking and lung cancer in the two groups.

### 2. Discuss the likelihood ratio giving an example.

In statistics, the likelihood ratio is a measure of the strength of evidence provided by the data in favor of one statistical hypothesis over another. It is defined as the ratio of the likelihoods of two different hypotheses, given the same observed data. The likelihood ratio is often used in hypothesis testing, model selection, and parameter estimation. Here is an example to illustrate the concept of likelihood ratio: Suppose we have a medical test for a rare disease, which affects only 1% of the population. The test has a sensitivity of 90% (i.e., it correctly identifies 90% of the people who have the disease) and a specificity of 95% (i.e., it correctly identifies 95% of the people who do not have the disease). We want to know how strong the evidence is in favor of a positive test result indicating the presence of the disease, compared to a negative test result indicating the absence of the disease.

Let H0 be the null hypothesis that the person does not have the disease, and let H1 be the alternative hypothesis that the person does have the disease. The likelihood of observing a positive test result, given H0, is 0.010.05 + 0.990.05 = 0.0595. The likelihood of observing a positive test result, given H1, is 0.010.9 + 0.990.1 = 0.108. The likelihood ratio in favor of H1 over H0 is therefore:

$$\text{Likelihood ratio} = \text{Likelihood (H1)}/\text{Likelihood (H0)} = 0.108/0.0595 = 1.82.$$

This means that observing a positive test result is 1.82 times more likely if the person has the disease (H1) than if the person does not have the disease (H0). We can use this likelihood ratio to calculate the odds ratio, which is a commonly used measure of the strength of association between a risk factor and a disease:

$$\text{Odds ratio} = \text{Likelihood ratio}/(1 - \text{prior odds})$$

where the prior odds are the odds of having the disease before the test result is known. For example, if the prior odds are 1:100 (i.e., the person has a 1% chance of having the disease before the test), then the odds ratio is:

$$\text{Odds ratio} = 1.82/(1/100) = 182$$

## SUGGESTED READING


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