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Approach to Foreign Bodies in Children

Developed by Mikaela Antaya and Dr. Matthew Carroll for PedsCases.com.
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Introduction:

Hello, my name is Mikaela Antaya, and I am a third-year medical student at the University of Alberta. This podcast was created with Dr. Matthew Carroll, a pediatric gastroenterologist at the Stollery Children's Hospital in Edmonton Alberta.

Today, we're diving into the different types of foreign bodies encountered in pediatrics, from those aspirated or ingested to those found in the ear and nose. This podcast aims to develop an approach to the diagnosis and management of foreign bodies in pediatrics.

Objectives:

In this podcast on pediatric foreign bodies, we will cover the following objectives:

1. Describe the clinical presentation of foreign bodies in the ear, nose, respiratory tract, and gastrointestinal tract in the pediatric population.
2. Identify the high-risk presentations of foreign bodies that require emergent management.
3. Discuss the approach to investigations and management for pediatric foreign bodies.

Clinical Presentation

Children are curious and often attempt to put objects in their mouths, ears, and nose. If they succeed, complications may arise. Ingestion, aspiration of a foreign body or objects placed in the nose and ears are common presentations to primary care and emergency medicine. The highest incidence occurs in younger children and toddlers aged 6 months to 3 years^{1,4}.

Foreign bodies can appear in many locations, and their presentation and management depend on the site and characteristics of the object. Today, we will discuss ingested foreign bodies, aspirated ones, and foreign bodies in the ear and nose.

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Case

Let's start with a case. You are on your emergency medicine elective when Sarah, a 4 year old female patient, is brought in to the emergency department by her mother. Sarah has exhibited symptoms of abdominal pain and repeated vomiting over the past 6 hours. Her mother reported that Sarah has been unusually fussy and refuses to eat or drink. There is no diarrhea, fever, or respiratory symptoms. Sarah's mother mentions that Sarah has been playing with various household items recently, including batteries.

Before we discuss the approach to management of Sarah's case, let's discuss some common types of foreign bodies and identify the objects that require emergent management and removal.

Objects commonly placed in the mouth, nose, and ears that are less likely to present emergently and require prompt removal include beads, coins, buttons, small toys or toy parts, seeds, and rocks⁸. However, these smaller objects can still pose an aspiration risk, especially in younger children, due to their narrower aerodigestive tracts compared to older children.

High-risk objects that require emergent management include button batteries, which have corrosive potential, large objects, which can obstruct the airway or digestive tract, sharp objects, toxic matter, and multiple magnets. In the ear and nose, vegetable matter may be an object of greater risk due to its ability to expand with moisture. History, physical examination, and investigations are used to determine if high-risk objects are the cause of obstruction.

Now we will cover the common presentations of foreign bodies, differentiated by where the foreign body is located. It is important to note that children who have a foreign body can often be asymptomatic and are frequently brought in due to the concern of a caregiver who witnessed the ingestion, aspiration, or placement into the ear or nose.

Aspirated Foreign Bodies

Let's start with aspirated foreign bodies, or foreign bodies in the respiratory tract, which can lead to potentially life-threatening situations. Because children have smaller diameter airways than adults, even small objects can lead to airway obstruction and respiratory compromise.

Children who have aspirated foreign bodies into the respiratory tract often present with sudden onset coughing, difficulty breathing, and wheezing³. In severe cases with airway obstruction, the presentation may include stridor, choking and cyanosis³.

In acute management of a suspected aspirated foreign body, stabilization of the patient's airway, breathing, and circulation (ABC's) are of paramount importance. Vital signs must be taken. If a child presents with severe or complete upper airway obstruction with severe respiratory distress, emergency airway management is indicated with assistance by ENT and/or anesthesia.

The differential for upper airway obstruction with acute respiratory distress in children should be considered, which includes foreign body aspiration, anaphylaxis, infection (such as epiglottitis, croup or peritonsillar abscesses), smoke inhalation and laryngeotracheal injury. Once ensuring the child is stable and the airway is patent, a thorough history and physical exam are crucial to determining the cause of upper airway obstruction. The caregiver or guardian who has brought the child in for care should be asked about the child's history of the presenting illness. Important points to ensure are not missed on history are the timing of the event and type of object aspirated (if the event was witnessed), recent history of choking, food consumption history, history of fever, trauma, change in voice, and history of respiratory infection⁵.

On physical exam, inspection of the child may reveal signs of respiratory distress and increased work of breathing such as drooling, nasal flaring, tracheal tug, tri-podding, supraclavicular, subcostal, and intercostal indrawing and other increased respiratory muscle use⁵. If the child is hypoxic, central cyanosis may be present. Abnormal respiratory sounds may be heard with or without using a stethoscope depending on the location of the FB. An aspirated foreign body commonly leads to wheezing, stridor, and asymmetric or decreased breath sounds on auscultation.

Management of aspirated foreign bodies depends on patient stability, the location of obstruction, and the presence or absence of airway obstruction. In cases of total or near-total obstruction, more urgent resuscitation measures must be taken. If a foreign body aspiration is suspected and the patient is responsive, back blows, chest blows, and the Heimlich maneuver can be used in an attempt to dislodge the obstruction so the foreign body can be manually removed³. If the patient is unresponsive, CPR may be required alongside attempting to remove the foreign body with Magill forceps and laryngoscopy³. In these cases, urgent consultation to your otolaryngology and anesthesia colleagues are indicated for airway management and removal. If the foreign body is not definitively removed in these cases, the patient is taken to the OR for removal via bronchoscopy.

In cases of suspected foreign body aspiration where the patient is stable and has no airway compromise, chest X-rays with inspiratory and expiratory films are indicated. The majority of aspirated foreign bodies are radiolucent which means the object is not often seen on X-rays⁵. However, x-rays can detect complications due to foreign body aspiration, such as atelectasis, hyperinflation, pneumonia, and mediastinal shift. Once the diagnosis of foreign body aspiration is confirmed, rigid bronchoscopy is the preferred intervention used for the removal of the foreign body⁵.

Ingested Foreign Bodies

Moving on to ingested foreign bodies, which can cause significant morbidity if not managed promptly. Young children and toddlers often explore their environment through oral exploration, leading to accidental ingestion of various objects.

A child who has swallowed or ingested a foreign body in the gastrointestinal tract can present with food refusal, drooling, coughing, vomiting, difficulty swallowing (AKA dysphagia), throat pain with swallowing (AKA odynophagia), abdominal pain, and black, tarry stool (AKA melena)⁹.

Children who have ingested foreign bodies may be at risk of airway compromise depending on the size and location of the object. As such, initial management should emphasize stabilization of the airway, breathing, and circulation, and in expert hands, (anesthesia, otolaryngology) include direct visualization of the oropharynx to rule out airway obstruction⁶.

When taking a history, ask about type and timing of object ingestion (if witnessed), history of presenting illness, choking history, past medical history, birth, immunization, nutrition, and developmental history. In the past medical history, ask about certain conditions that can increase risk for foreign body ingestion, including gastrointestinal tract abnormalities or congenital abnormalities such as strictures and fistulas, neuromuscular disease, eosinophilic esophagitis and related history of atopy such as asthma, allergic rhinitis, and atopic dermatitis (AKA eczema)¹.

On physical examination, the patient should be examined for signs of respiratory distress. The oral cavity of a child who has ingested a foreign body may reveal excessive drooling, as well as lesions such as lacerations. An abdominal examination should be performed, which may reveal tenderness, distension, and signs of peritonitis or obstruction⁶.

In terms of imaging, all patients who do not exhibit airway compromise with a suspected ingested foreign body should undergo neck, chest, and abdominal X-rays with anteroposterior (AP) and lateral views⁹. Results from imaging are highly useful in determining the type of object ingested and its location if the foreign body is radioopaque.

Management of ingested foreign bodies depends on the type of object, its location, and the presence or absence of symptoms. Foreign bodies lodged in the esophagus are referred for urgent endoscopic removal by gastroenterology. Objects in the stomach or further along the GI tract are often managed with clinical observation, with repeat imaging to ensure passage of the object. Symptomatic patients who have

swallowed sharp objects or multiple magnets may require removal by endoscopy or surgical intervention².

Ingestion of button batteries is a scenario with rapid and lethal consequences if not promptly detected and managed. When the button battery interacts with saliva, alkaline tissue necrosis occurs, known as liquefactive necrosis, which leads to complications. These complications include tracheoesophageal fistula, esophageal perforation or strictures, vocal cord paralysis from recurrent laryngeal nerve injury, and hemorrhage, from vascular-esophageal fistula development⁹. These complications can occur before or following button battery removal. Radiologic signs of button batteries include the halo sign and step-off sign, in which the separation of the anode and cathode of the button battery is visualized⁹. According to the North American Society of Pediatric Gastroenterology, Hepatology, and Nutrition, all children with button batteries located in the esophagus should immediately be sent for removal by endoscopy by gastroenterology². After presentation and before endoscopic therapy, honey or sucralfate should be used to neutralize the button battery's corrosive effects⁹. When employing honey, 10ml honey given orally every 10 minutes if the ingestion took place 12 or less hours prior. Alternatively, 1 gram sucralfate every 10 minutes (up to 3 doses) can be used, but sucralfate may limit operative visualization due to its whitening effect. Aside from the honey/sucralfate protocol, patients should be NPO. IV access should be obtained with 1 large bore IV. If button batteries are found in the stomach or further along the GI tract, the decision for removal by endoscopy depends on the age and size of the battery, for example, if the battery is less than 20mm in diameter or the child is greater than 5 years old, observation with repeat imaging may be considered².

Ear and Nose Foreign Bodies

The last category of foreign bodies we will cover today is foreign bodies of the ear and nose. In contrast to foreign bodies of the gastrointestinal and respiratory systems, foreign bodies in the ear and nose most often present asymptotically, but always require removal. While frequently seen as minor incidents, ear and nose foreign bodies can lead to complications if not managed properly. Foreign bodies in the ear can cause pain, hearing loss, foul smell and even damage to the eardrum. In the nose, foreign bodies can result in nasal obstruction, infections/purulent drainage and respiratory issues.

When presenting asymptotically, the presentation of ear and nose foreign bodies is due to observation of a child inserting the object into their nose or ear by a caregiver, the caregiver noticing an object in a child's ear or nose, or an incidental finding on otoscopy⁴.

When a patient presents with a suspected ear or nose foreign body, a systematic approach to assessment is key. Begin by taking a detailed history, including possible

witnessing of the incident and any associated symptoms. With ear foreign bodies, common symptoms include hearing loss, ear pain, and occasionally infection with purulent or bloody drainage. With nose foreign bodies, foul-smelling discharge from one side of the nose is common, as well as a blocked or stuffy nose, pain or discomfort, and occasionally chronic sinusitis or epistaxis⁸.

A thorough physical examination, including otoscopy for the ear and rhinoscopy for the nose, helps identify the location and nature of the foreign body.

Now, let's discuss the various techniques for removing ear and nose foreign bodies. In the ear, gentle irrigation with warm water or saline is often effective for dislodging small objects like insects or debris. It is important to note that irrigation should not be used for button batteries, vegetable matter, or patients with a ruptured tympanic membrane or tympanostomy tubes⁸. For larger or more challenging foreign bodies of the ear, specialized instruments such as wax loops, alligator forceps, or right-angle hooks may be necessary. In the nose, techniques range from positive pressure techniques and simple extraction with the tools mentioned before to more complex procedures like balloon-tip catheter assisted extraction^{7,8}. The method used for management depends on factors such as the type and location of the foreign body, as well as the patient's age and cooperation.

Primary care providers can remove most foreign bodies of the nose and ear. However, there are certain situations which require referral to otolaryngology for management. These situations include button batteries, multiple magnets, and objects close to the tympanic membrane⁷.

Unfortunately, sometimes complications can arise during or after the removal of ear and nose foreign bodies. These may include trauma to surrounding tissues, perforation of the eardrum, or infection⁴. Patient and caregiver education on signs of complications and clear instructions for follow-up care is essential. Close monitoring in the days following removal helps ensure timely intervention if any issues arise.

Back to the case

Now that we've learned about the approach to foreign bodies, let's get back to Sarah's case. Sarah is presenting with abdominal pain, vomiting, irritability, and food refusal, and a history of playing with household objects including batteries. Following completion of your history from Sarah and her mother, performing a thorough physical exam, taking vitals, ensuring Sarah's airway is patent, and determining that Sarah is hemodynamically stable, you are able to identify that Sarah has ingested a foreign body, with a high index of suspicion of a button battery, which is a surgical emergency. Sarah is immediately given 10ml honey every 10 minutes in order to neutralize the corrosive effects of a possible button battery, and IV access is established with 1 large bore IV.

Recognizing the severity of the situation, pediatric gastroenterology and ENT are consulted, and immediate radiographs are ordered. Sarah's Chest X-rays reveal a

circular radiopaque object in the mid-esophagus, measuring 20 mm in diameter. The X-rays show a halo sign on the PA view and a step-off sign on the lateral view, confirming the presence of a button battery. Sarah is taken to the operating room, where endoscopic retrieval of the button battery is performed under general anesthesia. The battery was successfully removed from the esophagus without complications. During the procedure, minor mucosal injury in the form of superficial blistering is noted, but there is no evidence of perforation or extensive damage. Following the procedure, Sarah is admitted and placed on an NPO diet until follow-up imaging confirms normal results. This includes an MRI of the neck and chest and an esophagram with water-soluble contrast, which are scheduled within 24-48 hours of the battery removal.

Review

This podcast aims to delve into the complex and critical topic of foreign bodies in pediatrics. The podcast covers various aspects of this subject, offering an approach to the diagnosis and management of foreign bodies in children. Here's a detailed review of the key points we discussed today:

Clinical Presentation of Foreign Bodies

The podcast began by highlighting the common presentations of foreign bodies in children, emphasizing the importance of a thorough history and physical examination. Children, especially those aged 6 months to 3 years, often explore their environment by putting objects in their mouths, ears, and noses. This curiosity can lead to the ingestion, aspiration, or placement of foreign bodies in the nose or ears, necessitating medical attention. Furthermore, younger children face a higher risk of luminal obstruction from foreign bodies because of the smaller size of their aerodigestive tract.

High-Risk Presentations

High-risk foreign bodies that require emergent management were identified, including:

- **Button Batteries**, due to their corrosive potential.
- **Large Objects**, which can obstruct the airway or digestive tract.
- **Sharp Objects and Toxic Matter** pose risks of mechanical and chemical tissue injury and poisoning.
- **Multiple Magnets**, which can cause significant internal damage.
- **Vegetable Matter in the Ear or Nose**, due to its ability to expand with moisture.

Aspirated Foreign Bodies

Aspirated foreign bodies can lead to life-threatening situations.

- **Symptoms** include sudden onset coughing, dyspnea, wheezing, stridor, choking, and cyanosis.

- **Management** highlights stabilizing the airway, breathing, and circulation. Techniques such as back blows, chest thrusts, and the Heimlich maneuver are essential. In severe cases, bronchoscopy may be required for removal.

Ingested Foreign Bodies

Foreign bodies in the gastrointestinal tract can have significant morbidity.

- **Symptoms** include food refusal, drooling, coughing, vomiting, dysphagia, odynophagia, abdominal pain, and melena.
- **Management** emphasizes airway stabilization, history taking, and physical examination. Imaging plays a crucial role in locating the foreign body. Urgent endoscopic removal is necessary for objects lodged in the esophagus, while observation may suffice for objects in the stomach or further along the GI tract.

Ear and Nose Foreign Bodies

Foreign bodies in the ear and nose, though often asymptomatic, can lead to complications if not managed properly.

- **Symptoms** include ear pain, hearing loss, nasal obstruction, infections, and respiratory issues.
- **Management** of ear and nose foreign bodies utilizes techniques such as irrigation, positive pressure, and specialized instruments. Referral to otolaryngology is recommended for complex cases, such as those involving button batteries or multiple magnets.

Key Learning Points

This brings us to the conclusion of our podcast on the approach to foreign bodies in pediatrics. Let's summarize the episode with a review of key learning points:

1. **Thorough Assessment:** Accurate history taking and physical examination are crucial in identifying and managing foreign bodies in children. A primary survey of ABCs is paramount to guide safe steps in management and avoid further airway compromise.
2. **High-Risk Foreign Bodies:** Recognizing and promptly managing high-risk objects such as button batteries, multiple magnets, and sharp objects can prevent, or minimize, severe complications.
3. **Management Techniques:** Knowing the appropriate intervention techniques for aspirated, ingested, and ear/nose foreign bodies is essential for effective treatment.
4. **Imaging:** The use of X-rays and other imaging modalities is important for locating and identifying foreign bodies.

5. **Referral and Follow-Up:** Understanding when to refer cases to specialists and educating caregivers on post-removal care and signs of complications are vital for optimal patient outcomes.

Thank you for listening to this PedsCase podcast on Approach to Foreign Bodies

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