PedsCases Podcast Scripts

This is a text version of a podcast from Pedscases.com on "**Approach to a Child in Respiratory Distress.**" These podcasts are designed to give medical students an overview of key topics in pediatrics. The audio versions are accessible on iTunes or at www.pedcases.com/podcasts.

Approach to a Child in Respiratory Distress

This podcast was developed by Sarah Buttle and Dr. Tom Kovesi for PedsCases.com. November 27, 2016.

Introduction

Hello, my name is Sarah Buttle and I am a third year medical student at the University of Ottawa. This podcast was developed with Dr. Tom Kovesi, a pediatric respirologist and full professor of pediatrics at the Children's Hospital of Eastern Ontario in Ottawa, Canada.

This podcast will help you develop an approach to the child in respiratory distress. Respiratory distress results from the body's inability to match breathing with the metabolic demand for oxygen or ventilation, or in other words when the work of breathing is higher than the child is "used to". Respiratory distress in a child is an emergency and can quickly progress to life-threatening respiratory failure. Therefore, it is critical to develop a good understanding of how to quickly recognize, acutely manage, and proceed with investigating a child who presents in respiratory distress.

Objectives

The objectives for this podcast are as follows:

1. Recognize signs of respiratory distress in a child
2. Describe the acute immediate management of a child presenting in respiratory distress
3. List the differential diagnosis of a child presenting in respiratory distress
4. Order appropriate investigations in order to determine a specific diagnosis for a child presenting in respiratory distress

Case Presentation

To start, let's use a clinical case to help illustrate our approach to a child in respiratory distress. We will return to this case throughout the podcast.

You are a third year clerk working in the emergency department at a children's hospital. A very distressed parent has brought their three-year-old daughter in because she is "gasping for breath". The parent tells you that the child has been so short of breath that she is unable to speak, and seems to be turning blue! When you look at the child, she is clearly struggling to breathe with audible inspiratory wheeze, and is leaning forward in a tripod position while sitting in her parent's lap.

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Let's discuss in more detail the numerous signs of respiratory distress that a child could present with, which may vary with the age of the child.

Clinical Presentation

Signs of respiratory distress in a child's vitals include tachypnea, tachycardia and hypoxia. The WHO considers respiratory rate to be an essential marker for acute respiratory illness in infants and children. According to WHO approved standards, tachypnea is defined as over 60 breaths per minute in an infant under 2 months, over 50 in an infant 2-12 months, over 40 in a child aged 1-5, and over 30 in a child over 5 years of age. You may observe the child using accessory muscles to assist with breathing, or may see subcostal or intercostal in-drawing or sternal retractions. Other observable signs that suggest increased work of breathing include nasal flaring, a tracheal tug, or head bobbing. The child may adopt a tripoding position, leaning forward propped up by their arms, in an attempt to make breathing easier. The child's skin may appear dusky, and they may have central cyanosis – a bluish-grey discolouration secondary to low oxygen saturation. Fatigue related to increased work of breathing may limit a child's ability to speak or alter their level of consciousness, and is a marker of severe respiratory distress.

On physical exam, you may hear the child grunting or making other accessory sounds of breathing such as stridor or a wheeze. The child may have decreased air entry, or crackles on inspiration, depending on the underlying cause of respiratory distress. Assessing air entry is particularly important. The child in our scenario has tachypnea, tripoding, cyanosis, and inability to speak.

Acute Management

Now that you are familiar with how to recognize respiratory distress in a child, we will cover immediate management - that is, what you need to do to manage the child prior to making a specific diagnosis. For more details on acutely managing a newborn in respiratory distress, please refer to the PedsCases podcasts on "Neonatal Resuscitation".

The first step is to assess the child's ABCs. You need to determine the severity of the situation and if any emergency interventions are required. This should always be your initial approach to any child in an emergency scenario prior to conducting the history or physical exam. Conditions causing respiratory distress that require immediate life-saving interventions include complete or rapidly progressing partial upper airway obstruction, tension pneumothorax, cardiac tamponade, and severe cyanosis and/or respiratory failure. Now, let's go through each aspect of A, B and C.

Airway: The first step to managing a child in any emergency scenario is to determine their airway status. Care must be taken not to agitate the child due to the risk of increasing distress and losing the airway. Do not have the child lay down, as this may completely obstruct the airway. Use a calm demeanor and keep the child with their parent whenever possible. Assess whether the patient can speak or cry and look for signs of airway obstruction like choking and cyanosis. If the patient is at risk for losing their airway, consider the need to establish an alternative airway. STAT consultation with anesthesiology or an otolaryngologist for acute airway management may be necessary. As a student, do not be afraid to call for help!

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Breathing: To assess breathing, count the respiratory rate, look for symmetry of chest rise, use of accessory muscles, and listen for airway movement and quality of breath sounds bilaterally. Make note of any adventitious breath sounds such as wheezing or stridor, which are clues to the underlying diagnosis. Again, decreased air entry and/or fatigue due to increased work of breathing are ominous signs.

Circulation: Examine the child's skin colour - do they appear they pale or ashen? Check the peripheral capillary refill time by pressing on the nail beds of fingers or toes. Assess multiple peripheral pulses such as radial and femoral for quality, strength, and rate. Based on your findings, you may need to establish IV access to supply fluids and/or medications after the airway has been secured.

Once you have confirmed that your patient is stable through assessing and addressing their ABCs, you can move on to conducting a more specific history and physical exam. It is helpful to consider the differential diagnosis of a child presenting in respiratory distress first, to help focus your encounter.

Differential Diagnosis

The differential diagnosis of a child in respiratory distress is broad. We feel it is useful to use a structural approach when considering this presentation.

Pulmonary causes are the most frequent underlying etiologies of respiratory distress. Common and/or important upper airway pathologies include a laryngeal foreign body, croup, epiglottitis, and retropharyngeal abscesses. Lower airway pathologies that can cause respiratory distress include acute asthma exacerbations, acute respiratory distress syndrome, infection such as pneumonia or tuberculosis, bronchiolitis, and a lower airway foreign body. Pleural pathologies, including pneumothorax, hemothorax and pleural effusion can also present as respiratory distress.

Of the non-pulmonary causes, cardiac causes of respiratory distress are among the most important to consider. A child in respiratory distress may be experiencing congestive heart failure or pulmonary edema. Other important diagnoses to consider include central nervous system disturbances, meningitis, metabolic acidosis, and anaphylactic reactions.

Now, let's move on to conducting a specific history and physical exam for the child in respiratory distress in order to help narrow your differential.

History

In the history, inquire about the onset, course and duration of the episode, as well as if the child has experienced any similar events in the past. Illustrative examples to help elicit shortness of breath on history include an infant not able to feed, or an older child unable to speak in full sentences. Ask about associated symptoms. If the child has a cough, this can indicate an infection like bronchiolitis, pneumonia, or tuberculosis. The presence of fever also often suggests infection. A change in the child's voice plus fever can indicate an upper airway abnormality like a retropharyngeal abscess. If the child is afebrile and has no other symptoms of an upper respiratory tract infection like sore throat, a diagnosis of metabolic acidosis may be more likely. Vomiting and abdominal pain can point towards an underlying

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metabolic abnormality. Choking, gurgling, drooling and dysphagia all suggest an obstructive cause for respiratory distress such as foreign body aspiration or epiglottitis. Any time a foreign body inhalation has been possibly witnessed, this diagnosis must be excluded. Chest pain and hemoptysis can be present in cases of trauma and could indicate lung injury such as pneumo- or hemo-thorax.

Relevant risk factors that you should ask about include any infectious or sick contacts, particularly pertussis or tuberculosis. Ask about recent travel outside the country. Check if their immunizations are up-to-date, and don't forget to ask about the flu shot. Take a focused past medical history, including asking about immunocompromised status and previous respiratory diseases, such as a previous diagnosis of asthma. Ask about trauma which may suggest a pneumothorax; although these patients will be quite sick at presentation. Ask about exposure to allergens or toxins, which could precipitate an asthma or anaphylactic attack.

Obtaining a relevant past medical history can help guide your differential diagnosis. Relevant conditions to specifically ask about include asthma, atopy - in particular eczema and allergies - and any previous episodes consistent with the current presentation, including treatments that were used and whether they worked. Also ask about any underlying medical issues, such as congenital heart disease, neuromuscular disorders, or hematological conditions like Sickle Cell Disease. Complete a brief screen for relevant family history of asthma, atopy and cardiac disease.

Finally, do not forget to confirm current medications and any allergies the child may have.

Clinical Presentation

Now that we've reviewed important elements to consider in the history of a child presenting in respiratory distress, let's return to our case for a moment.

Once you assess the girl's ABCs and are satisfied that she is stable and has a patent airway, you ask her parent some further questions. You learn that the girl has recently been prescribed a puffer by her family doctor for asthma. She was playing with some small toys when her parent noticed that she seemed to be choking and struggling for air. The child does not have a cough, and has not been exposed to any sick contacts recently. She doesn't have a recent history of any trauma, and there is no family history of asthma or heart conditions.

Based on this history, you are starting to suspect either an acute asthma exacerbation or foreign body obstruction as a cause for this child's respiratory distress. In order to not miss other important causes, you move on to completing a physical examination while she is in her parent's lap.

Physical Exam

Always start with vital signs. Assess the patient's heart rate, respiratory rate, oxygen saturation, blood pressure, and temperature. Don't estimate the respiratory rate. Ideally – count the respiratory rate for 30 seconds using a watch or clock, and then multiply by 2. For more details of normal ranges for pediatric vital signs by age group, please refer to the

“Pediatrics Vitals Sign Reference Chart” available at www.pedscases.com. When assessing respiratory rate, look for tachypnea and assess respiratory pattern. Rapid shallow breathing with prolonged exhalation is characteristic of air trapping such as in asthma, whereas Kussmaul respirations which are deep regular sighing breaths are indicative of underlying metabolic acidosis or a brainstem disorder. Observe the child for signs of paradoxical breathing or abnormalities like flail chest or asymmetrical expansion.

Determine oxygen saturation accurately through pulse oximetry monitoring. Saturations taken while the child is crying, coughing, or vomiting will not be accurate. Although no normal values for oxygen saturation have been established in the pediatric population, a level less than 92% is concerning. If the oxygen saturation is low, provide supplemental oxygen as needed, using either a nasal cannula or face mask to ensure oxygen saturation is above 94%. If oxygen saturation is severely reduced, the administration of 100% oxygen may be required.

Determine heart rate, rhythm, and character. Tachycardia is common in children presenting with respiratory distress. When assessing blood pressure, look for pulsus paradoxus: a decrease greater than 10mmHg in systolic BP during inspiration. This finding can be present in a variety of pathologic states that can cause respiratory distress including heart failure, asthma, anaphylactic or cardiac shock, and tension pneumothorax. Observe the child’s level of consciousness. Do they appear anxious, irritable, or lethargic?

Next, move on to a head-to-toe examination of relevant systems – primarily HEENT, resp, and cardio. Inspect the oropharyngeal cavity for any foreign bodies, and observe whether the child is drooling or having trouble swallowing. If they are drooling, defer the exam!

Listen for abnormal respiratory sounds like gurgling, stridor, cough, wheezing or grunting. You may even be able to appreciate some of these noises without auscultation. Stridor is a mild-pitched snoring sound suggestive of nasopharyngeal obstruction that may be transmitted throughout airways but can be heard loudest with your stethoscope near the patient’s nose and mouth. Stridor is a musical, high-pitched breath sound that is typically inspiratory if obstruction is above the vocal cords, and biphasic if located at glottis or subglottis. Wheezing is a high-pitched whistling sound that is expiratory and suggests lower airway obstruction. Grunting is a low or mild-pitched expiratory sound caused by sudden closure of the glottis during expiration, and may be heard if the child is compensating for poor lung compliance.

Also auscultate for murmurs or abnormal heart sounds. Feel the abdomen for hepatomegaly, which could suggest heart failure or liver dysfunction. Examine the child’s skin for signs of anaphylactic reactions such as urticaria or swelling.

Investigations

Once your patient is stable and you have completed a thorough history and physical examination, you may need to order laboratory and imaging investigations to help you narrow down a specific cause for the child’s respiratory distress. The extent of investigations depends on your ability to rule in or out specific causes through your history

and physical exam. For example, an acute asthma exacerbation would not require any further investigation before commencing specific management.

Firstly, if the patient is stable enough, consider a chest X-ray, ideally with two views; AP and lateral. You may need additional views if clinically indicated, for example a neck radiograph for children with findings suggestive of epiglottitis, retropharyngeal abscess or foreign body aspiration. Inspiratory/expiratory views may help diagnose a foreign body. If you suspect epiglottitis, do not waste time getting a lateral x-ray until you have the airway secured – you will likely disturb the child, which can risk loss of airway patency. If there's significant doubt, the lateral neck X-ray should be obtained in the resuscitation room.

Depending on the clinical scenario, a number of lab investigations may be useful. An arterial blood gas may help to distinguish a metabolic cause for respiratory distress from a respiratory cause. In many pediatric hospitals, a capillary blood gas can be done instead, and, in conjunction with oxygen saturation by pulse oximetry, offers fairly similar information and is less traumatic for the child. Venous blood gases do not provide an accurate PCO2 or PO2, and are not recommended. An electrolyte panel can provide additional relevant information if a metabolic cause is suspected. A complete blood count with differential and blood cultures may be necessary if you are concerned about a more severe infection or sepsis.

If there is a history of trauma, ultrasound can be used to diagnose pneumothorax or cardiac tamponade. Ultrasounds can also demonstrate pleural or pericardial effusions in cases consistent with cardiac dysfunction. If you are concerned about a cardiac cause for the respiratory distress, an echocardiogram and electrocardiogram are also useful tools.

Case Resolution

When faced with a child in respiratory distress, a good strategy it to use your history and physical to help prioritize your differential diagnosis, then order targeted investigations if necessary to rule key diagnoses in or out. Let's check in with our clinical case for an example.

After conducting a physical exam and coupled with information you obtained from the parent on history, you have ruled out cardiac, infectious, anaphylactic, and traumatic causes for the girl's respiratory distress. On auscultation, she has decreased air entry bilaterally and a fixed high-pitched wheeze. Her SpO2 is at 91%, so you provide supplemental oxygen with a face mask and her SpO2 increases to 98%. When examining her mouth and throat you are unable to visualize any object in the oropharynx, but feel imaging is necessary to rule out a foreign body in her airway. You order a chest x-ray with AP and lateral views that show a small object lodged in the right mainstem bronchus. You consult a pediatric otolaryngologist to remove the object with rigid bronchoscopy.

This brings us to the end of our podcast on the approach to a child in respiratory distress. To conclude, let's summarize the most important take home points:

1. Acute management of a child in respiratory distress focuses on the ABCs. Always ensure your patient is stable before moving on to other investigations. It is important

to monitor the ABCs and the child's vitals regularly throughout your assessment as a child presenting in respiratory distress represents a pediatric emergency and their status could change quickly. Take care not to distress the child throughout your encounter, and consider having means to secure an alternate airway on hand if the child's airway becomes obstructed.

2. The presentation of a child in respiratory distress can vary by age. Common signs of a child in respiratory distress include those of increased work of breathing, such as accessory muscle use, retractions, and tachypnea.
3. The differential for a child presenting in respiratory distress is very broad. Consider organizing your thoughts by system, starting with pulmonary causes, then cardiac, followed by systemic and other causes. Use your history and physical exam to guide further investigations and management for your patient beyond acute stabilization.

We hope that this podcast has been helpful. Thanks for listening!

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