

PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on “Chronic Cough.” 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.

Chronic Cough

Developed by Mark McKinney and Dr. Melanie Lewis for PedsCases.com.
October 4, 2014.

You are listening to the PedsCases podcast series. This section deals with chronic cough in pediatrics. The objective is to review the most common causes of chronic cough, to offer clinical pearls, and to provide key points for you to use in managing it. The information will be presented to mirror the steps of clinical reasoning – I’m going to start off with a differential, then go through key parts to a history and physical without focusing in on any particular cause just yet. In the later half of the podcast, I’ll focus in on each of the more common causes, how to investigate further, and key points on management.

My name is Mark McKinney. I am a medical student at the University of Alberta. This podcast was developed in collaboration with Dr. Melanie Lewis, a pediatrician and faculty member at the University of Alberta.

You will find many differing definitions for what constitutes a chronic cough in children, but here I will use the common definition of a cough lasting 4 weeks or more. For a cough lasting less than 4 weeks, I encourage you to listen to the podcast on acute cough. Remember - as many as 6-8 viral infections can be expected in a child each year and symptoms may persist for up to 2 weeks after resolution of a fever. Parents might not be aware of this and attribute recurrent infections to a weak immune system or label a series of acute coughs as a chronic cough. It is important to be realistic in determining what might be a true chronic cough, as opposed to a prolonged or recurrent series of acute coughs.

Differential Diagnosis

The most common causes of chronic cough in children are gastroesophageal reflux disease, asthma, and infection. However the potential causes vary somewhat depending what age group you are dealing with. For instance congenital abnormalities will tend to show up early in infancy, whereas asthma is a greater concern in children and adolescents.

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Regardless of the age group, the most common cause of cough is infection – whether repeated infections or a prolonged infection with a particular bug. Viral infections of the upper respiratory tract are very common, and repeated infections can give the impression of a chronic cough. However there are some bugs that can cause a prolonged cough on their own. Some to look out for are pertussis and tuberculosis. I'll get into the specifics later on in the podcast.

Gastroesophageal reflux disease is among the most common causes of chronic cough in infants and children. Gastroesophageal reflux disease should be distinguished from the transient physiologic gastroesophageal reflux that occurs in 40-70% of infants that disappears as they get older. This will be discussed later in part 2 of the podcast. For now, keep in mind that gastroesophageal reflux disease is attributed as a major cause of chronic cough.

Congenital abnormalities will usually present themselves early in life. A tracheoesophageal fistula is a fairly common congenital defect where food can pass from the esophagus into the lower airways through a connection with the trachea. Like GERD, the cough occurs primarily with feedings.

A chronic cough caused by asthma is a fairly rare finding in infants. It tends to take a few years before presenting as a cough. However, in school aged children, asthma is a common cause. It can often be triggered by a viral pathogen, cold weather, or exacerbated by exercise. Even in children with medications for diagnosed asthma, consider that the asthma is not being well managed.

Allergic rhinitis is particularly common in children with a family history of atopy. Cough results from irritation of the oropharynx due to rhinorrhea. Upper airway cough syndrome (also called post-nasal drip) can similarly occur due to fluid dripping into the back of throat from rhinorrhea or otitis media with effusion. A cough may persist long after other symptoms have subsided while the remaining fluid continues to drain out.

Psychogenic cough is a fairly common possibility. This definition also includes habit coughs and tic coughs. Psychogenic coughs are often described as having a bizarre or honking sound, but may also be the quiet under-their-breath kind of cough.

Occasionally a chronic cough may represent a persistent aspirated foreign body which has gone unnoticed. This diagnosis requires a high index of suspicion.

Cystic fibrosis is a rare cause. Neonatal screening for CF is in place here in Alberta, but it is not 100% effective and not all children will have been screened.

So to review, the most common cause for chronic cough is infection. Most often, presentation with chronic cough is actually a series of acute infections mistaken for one prolonged one, but certain bugs can cause a prolonged cough all on their own. Upper airway cough syndrome may further prolong the symptoms of cough after an infection resolves. Aside from infection, GERD and asthma are very common, but keep an index

of suspicion for psychogenic cough or a missed foreign body aspiration as well. In infants, tracheoesophageal fistula should be high on your differential. Other congenital abnormalities are less common, but are worth considering. Cystic fibrosis is fairly rare, but definitely consider it in the context of failure to thrive.

The History and Physical Exam

The vast majority of information will come from the history and a few physical exam considerations. After these, the diagnosis is usually already made, but there are a few further investigations to confirm or sort out specific pathologies. To aid in organization, I have listed the approach to history and physical into 5 categories.

- 1) First consider the child's age and overall wellness.
 - Do they appear unwell?
 - Do they have any ongoing conditions which may be causing, contributing to, or exacerbating the current cough?
 - Look at their growth parameters for evidence of failure to thrive. Failure to thrive may suggest an ongoing systemic pathology like congenital heart disease or cystic fibrosis. Congenital abnormalities or severe GERD may also contribute to poor feedings.
 - Next ask about a family history of atopy (eczema, asthma, or allergies), and examine their skin for eczema. This might suggest asthma or allergic rhinitis is the cause of the cough.
 - Also look at their fingers and toes for cyanosis or digital clubbing which might suggest a severe chronic process such as chronic hypoxia or underlying pulmonary, airway, or cardiac disease.

- 2) Consider likelihood of a current infection.
 - Remember that in children you can expect 6-8 infections per year, with a higher proportion in the winter months. A fever can be expected for about 3-4 days, and other symptoms including cough may persist for up to 3 weeks. Be realistic with the parents about what to expect with a child, but don't discount the possibility that they could be getting sick more or longer than the usual child. Prolonged infections, higher occurrence of infection, or abnormal bugs like *P. aeruginosa* may suggest abnormal lungs, airways, or immune compromise.
 - Ask about infectious contacts. Do they have siblings who are also sick? Do they go to school or daycare, and are children there sick? It can be common for children first starting school or daycare to get several viral infections back-to-back, particularly if they are an only child who has not built up a base of immunity yet.
 - Ask about vaccinations. But remember – vaccinations do not guarantee immunity, and are only available for specific pathogens. Children are routinely vaccinated against *Haemophilus influenzae* type B, pertussis, and either 7 or 13 serotypes of *Streptococcus pneumoniae* in the pneumococcal vaccine. Also ask about annual flu shots.

- Next, look for symptoms of a respiratory infection. Viral URTIs will commonly present along with some combination of fever, sore throat, runny nose, and acute otitis media.
 - Both viral and bacterial pneumonias will present with tachypnea and fever. Other findings of pneumonia may include wheezing, crackles, or increased work of breathing. Over areas of consolidation you can expect dullness to percussion and decreased breath sounds. Bronchiolitis, commonly caused by a respiratory syncytial virus infection, may be associated with wheezing.
 - Listen to breath sounds. Asymmetrically decreased air entry may suggest pneumonia (whether infectious or aspiration), or a foreign body.
- 3) Consider timing of the cough.
- Does anything bring about the cough? Bronchial hyperreactivity (aka asthma) causing cough is often brought on by exercise or cold air. Complete absence of exertional dyspnea or a cough that decreases with exertion may suggest a psychogenic cough.
 - Do they cough when eating? This may be due to GERD, or aspiration of food or fluid due to a congenital malformation such as a tracheoesophageal fistula.
 - Ask about night time coughing. A psychogenic cough will generally disappear at night, whereas in asthma or GERD it may be worsen.
- 4) Evaluate the character of the cough itself. Make sure you LISTEN to the cough - don't just rely on parent interpretations.
- Barking cough – croup
 - Bizarre or honking cough – psychogenic
 - Paroxysmal “whooping” cough - pertussis
 - Staccato cough – *Chlamydia pneumoniae* in infants
 - If they cough until vomiting - pertussis, asthma
- 5) Consider associated findings.
- Associated wheezing - intrathoracic or airway obstruction, such as asthma or Tracheomalacia
 - Associated crackles - any secretions or pulmonary disease
 - Hemoptysis - TB, foreign body
 - Recurrent pneumonia or colonization with odd bugs like *Staphylococcus aureus* or *Pseudomonas* may suggest immunodeficiency, congenital lung abnormalities, or CF

To review the history and physical exam: First consider the overall health of the child, ask about a family history of atopy, and examine for failure to thrive, digital clubbing, and cyanosis. Next consider likelihood of acute or recurrent infection, a long term infection, or immune compromise. Then consider timing of the cough, paying particular attention to coughing at night, with or after eating, and cough with exertion. Evaluate the character of the cough, being sure to listen to it yourself, and finally consider what other signs and symptoms are associated with the cough.

As I said before, the history and physical should give you most of the information you need to get a pretty good idea what's going on. Further investigation and management of a chronic cough is targeted at the specific conditions which may have been suggested from the history.

Presentation of Specific Conditions, Further Investigations and Management

Before I get into the individual common causes of acute cough, I want to make another special note: over the counter cough remedies are NOT effective in children and should NOT be used regardless of the cause of the cough. You should talk to the parents and discourage their use. This might take some explaining, but OTC cough remedies have been shown to be ineffective at dealing with coughs, and can occasionally cause harm.

So I'll start the discussion with the biggest one – infection.

Infection

If infection is suspected from history and physical, there are three big questions you need to sort out. 1) Does this look like a picture of recurrent acute infections, or is this a prolonged infection? 2) Is this an infection of the URT or LRT? And 3) can I make a good guess as to what bug this is?

1) Acute vs. prolonged infection

Sorting out if you are dealing with a series of acute infections or a single prolonged infection can be tricky. A good pearl is that children who are first starting out at day care or school often face a series of repeated infections, leaving them coughing for months at a time. Though this is often worrisome and annoying for the parents, it's not worrisome for us because it's to be expected. It's important to teach parents around the incidence of childhood viral infections and to alert them to red flags which should bring them back in. This is things like increased work of breathing, lethargy, or poor tolerance of exertion. Aside from that, reinforce symptomatic management and reassure the parents.

2) Is this URT or LRT?

URT symptoms include fever, sore throat, runny nose, and acute otitis media. Viral infections are the most likely suspect for URTI. There are many viruses that could potentially be to blame, but some are more likely depending on the child's age. Bacterial infection of the upper respiratory tract causing cough is not common. LRT infections present as either bronchiolitis or pneumonia. Bronchiolitis present as tachypnea and fever, mainly in children less than 1 year of age. Pneumonia presents with tachypnea and fever as well, but with associated crackles, wheezing, decreased breath sounds, and dullness to percussion. Atypical pneumonias caused by Chlamydia or mycoplasma infections may present similarly, but tachypnea and fever are typically not as severe or may not be present at all.

Note that while a URTI will almost always be viral, both viral and bacterial infections can cause lower respiratory tract infections. Bacterial infections tend to show up as pneumonia, whereas viruses can cause bronchiolitis or pneumonia. There is a wide variety of bugs that could come up depending on the population that you are dealing with – if you are ever unsure on a course of action, consultation with a pediatric infectious disease specialist is recommended. Common viruses and bacteria are reviewed in the podcast on acute cough, so I'm not going to spend time rehashing it here. Instead I'll spend a bit of time on the ones that can bring about a chronic cough on their own.

3) What Bug is this?

I've already discussed about how to clinically tell the difference between a bacterial and viral infection, but if you're at all unclear you can get a sputum sample or nasopharyngeal aspirate and CBC with differential. A CBC-D can also suggest allergies instead of infection if they have eosinophilia.

If a bacterial cause is suspected and further investigation is warranted, get a CBC with a differential cell count, blood culture, and serology for mycoplasma. In a toxic-looking child, consider sepsis. Nasopharyngeal swabs may be done to look for pertussis or RSV. If pneumonia is suspected, get a CXR. Lobar pneumonia suggests a bacterial infection like *s.pneumo*, while patchy/perilobar pneumonia suggests a viral pneumonia.

Tuberculosis is a possibility in a child with the relevant risk factors presenting with fever or chills, excessive sweating, night time sweating, and potentially hemoptysis. To check for tuberculosis in a child with the relevant risk factors, you can do a Mantoux test, which is the tuberculin skin test, which will pick up any latent or active infection. If you get a negative reading, it either means they've never had TB or that this is their first time. Get an induced sputum culture or morning NG aspirate to test with PCR or culturing to look for active infection. If you're looking for TB, consider that the child might be immunocompromised, get a CBC and look at their WBC count, and consider HIV testing. The treatment of tuberculosis is complex and outside the scope of this podcast. Look up the most current information if you find yourself treating TB.

RSV usually associated with wheezing. Much more common in winter.

Chlamydia will present in the first few months of life as a staccato cough.

B.Pertussis is informally called "the hundred day cough". It will have has a distinctive whooping sound called a paroxysmal cough. *Pertussis* infections tend to be past their most treatable stages by the time of presentation and have a very prolonged course before the cough resolves. It has 3 stages: catarrhal, paroxysmal, and convalescent. The catarrhal stage is when they are most contagious, but the characteristic inspiratory whooping cough does not begin until the paroxysmal stage, when the child is no longer contagious. This can last for 10 weeks. The convalescent phase has gradual resolution

of symptoms, but the cough can return with later viral infections during this period. Sputum cultures can be taken to look for pertussis, though false negatives can be common. Pertussis can be treated with TMP/SMX for 10 days, or a macrolide (such as clarithromycin) for 5 days. This will not resolve the cough any faster, but will make the child significantly less contagious.

I guess that brings me to treatment.

Treatment should be targeted at the most likely bug involved. Viral infections do not respond to antibiotics, but are mostly self-limiting so can be effectively dealt with through fluids, rest, and symptomatic management, without the need for further investigations. The only virus that can directly be treated is influenza, and only if treatment is started within the first 2 days of infection. Antiviral treatment with oseltamivir (Tamiflu) will reduce period of symptoms by 1 or 2 days, and lower chances of more severe infections or pneumonia. However this is only necessary in children at greater than normal risk. The average child will do just fine without antiviral medication. Annual flu shots should be encouraged instead. If you suspect a viral infection, be confident in your diagnosis and do not prescribe antibiotics. Over-prescription of antibiotics is a major driver of antibiotic resistance in bacteria.

If it is a bacterial infection, treat with appropriate narrow-spectrum antibiotics for the most likely cause. I'm not going to go over every possible bug and drug combination because you could dedicate a whole podcast to that.

Asthma

Suspect asthma in a child whose cough is brought about by exercise or triggers like cold air and irritants, where the cough is associated with wheezing, and if there is a family history of atopy. They may also cough to the point where they start gagging or vomit.

A very practical test for asthma is to empirically put them on a bronchodilator. If the cough goes away or is significantly reduced, they likely have asthma. Spirometry and PFTs are not done in children under about 6 years old because they won't cooperate well enough. However in older children, spirometry may be a useful investigation. Decreased ratio of FEV1/FVC is expected, with near full reversal post-bronchodilator. If there is partial, but not full reversal, consider that there may be chronic changes or underlying airway damage in addition to the asthma. A chest Xray may be taken to look for additional pathology. Asthma alone may show hyperinflation, but the Xray might also be normal, so it is not definitive for diagnosing asthma.

While expiratory wheezes are an important finding in asthma, as many as 50% of children will wheeze at some point, but the majority won't go on to develop asthma. Children have narrower airways than adults, which predisposes them to wheeze with even small reductions in diameter. As they get older and their airways grow with them, many of these adventitious sounds will go away. However, in children who do have

asthma, this does not mean that they have outgrown the asthma, merely that they have become less symptomatic.

Asthma is typically managed in children with an inhaled short-acting beta agonist as needed, and an inhaled corticosteroid twice daily for management. Do not forget the importance of patient and parent education, particularly with respect to avoidance of triggers. Common triggers can include smoking in the household, allergens and irritants like pollen or dust, or a household pet. The family may need to strongly consider removing a pet from the household if it is a trigger. The constant presence of a trigger like a pet may promote chronic inflammation and airway changes which will permanently worsen the asthma. A written action plan and good follow up early on is essential to good management of asthma.

Allergies

Consider allergic rhinitis strongly in a child who is generally well, and has a family history of atopy. The single best investigation is a good family history for atopy. Look for eczema, hives, rashes, and ask the parents about asthma and allergies in the family. If history is unclear, you can proceed to allergy testing. If you are trying to differentiate specifically between an infectious versus an allergic cause, a CBC with differential would show increased WBC count in both, but allergies are associated with eosinophilia.

Seasonal allergies can be quite common, especially in northern climates where the melting of snow uncovers a ton of allergens all at once, followed by hay fever due to pollen season in the spring. Consider a trial of allergen avoidance, anti-histamines, and intranasal corticosteroids. Like asthma, avoidance of triggers is key to management of allergic rhinitis.

GERD

Gastroesophageal reflux disease is a common cause of cough with feeding in infants and very young children. Cough in GERD results from irritation of the esophagus as stomach contents are brought back into the esophagus, and will increase in severity with or immediately after feeding, particularly if the children are very active or laid supine immediately after feeding. Between 40 and 70% of infants with have some degree of physiologic gastroesophageal reflux that goes away as they age. This is normal, but if reflux persists into childhood and is associated with pain from esophagitis, aspirating, or failure to thrive, start considering GERD. The best way to make a diagnosis of GERD is by taking a clear history that shows a symptoms pattern with feeding, or soon afterwards – an excluding other possible explanations.

GERD can be associated with wheezing, vomiting, and tachypnea. Although it is common for infants to have some degree of reflux, buzzers should go off in your head when you hear these symptoms because they can be associated with more severe congenital malformations. An Xray is a good idea to rule out a tracheoesophageal fistula or other congenital abnormality.

A definitive treatment for GERD in children has not been established. A trial of proton pump inhibitors might be justified, and keeping the child upright after feeding can also be helpful.

Congenital abnormalities

There are a wide variety of problems that can develop as a result of abnormal development of the lungs, airways, or esophagus. The majority of these will present during the neonatal period, but there are a few which may go unnoticed until a bit later in infancy. I'll focus on one of the more common ones - tracheoesophageal fistula.

TEF is where there is an abnormal connection between the esophagus and trachea through which food can pass into the airways. Not surprisingly, symptoms appear with feedings primarily, or shortly after. Coughing, gagging, vomiting, wheezing, and increased oral secretions are common. Cyanosis may also occur. They may frequently develop aspiration pneumonias and are more prone to LRT infections as well.

This presentation is very similar to severe GERD, so further investigation is needed to differentiate the two. Almost all tracheal or esophageal abnormalities will be picked up by a barium swallow test, including TEF. For large malformations, an ultrasound may be sufficient. A bronchoscopy is a more invasive test if the barium swallow is unclear.

Foreign body?

Carefully look at down their throat to visualize the oropharynx. If the object is not visible, try chest xray on inspiration, expiration, and lateral decubitus. Bronchoscopy if unclear but strong suspicion.

Bronchoscopy will be required for removal of foreign bodies. Majority of foreign bodies end up in the right main stem bronchus due to its wider shape which is also more in line with the trachea than the left side.

Although most foreign body aspirations will present acutely, it is possible for an aspirated foreign body to go unnoticed for a prolonged period. For instance, a child may have recently had a string of uncomplicated infections which the parent attributed the cough to. Not all foreign body aspirations present with hemoptysis. In addition, non-metallic foreign bodies often don't show up on Xray. Because foreign body aspiration is a possibility with a relatively quick fix solution, keep it on your differential, but realize that it is fairly uncommon in the case of a chronic cough.

Management of foreign body aspiration is dealt with in the podcast on acute cough.

Cystic Fibrosis

This is actually a fairly rare condition. It's a congenital problem, but in the absence of screening programs can go unnoticed for months to years. Neonatal screening for CF is in place here in Alberta, but it is not 100% effective and not all children will have been screened. At birth, meconium ileus is a classic presentation, but this is unlikely to have

gone unnoticed, and in less severe forms like the ones that might show up in your office years later, it is often not present at all.

Consider CF on your differential in children showing failure to thrive, recurrent lower respiratory tract infections, or infections at greater than the normal frequency and duration. Weird infections like *P. aeruginosa*, or colonization with *S. aureus* or pseudomonas should also be a red flag to you. A sputum sample is a good idea for children presenting primarily with pneumonia or a very productive cough. If you are thinking this might be CF, a sweat chloride test is a quick and easy way to pick it up, and is nearly 100% sensitive. Pancreatic exocrine insufficiency is almost always present in CF as well. Genetic testing is not always necessary, but consider offering it to the family.

Treatment for CF is complex and involved. The key basics are chest physiotherapy to deal with secretions, prophylactic antibiotics to prevent colonization with nasty bugs that are almost impossible to get out once they are there, and infection control. When kids with CF get sick, it lasts a long time, and greatly increases their risk of developing bronchiectasis.

Bronchiectasis

Bronchiectasis is an abnormal dilation and weakening of the conducting airways due to damage to the muscular and elastic components of the bronchial walls. It is typically the result of long standing airway inflammation, but it may also be congenital from developmental arrest of the bronchial tree. Acquired bronchiectasis can occur in many conditions of long-lasting pathology or recurrent infections. For instance, cystic fibrosis inevitably leads to some degree of bronchiectasis from the chronic inability to effectively clear secretions.

Bronchiectasis will present as a chronic cough with occasional hemoptysis, sputum production, and non-specific lung findings like crackles and wheezes. Digital clubbing is an occasional finding in severe cases. A chest xray or CT is used for diagnosis.

Psychogenic cough

Psychogenic coughs include both habit coughs and tic coughs, both without organic origin. This may present as a bizarre or honking cough, or may be an under-their-breath kind of cough. Key findings include reduced coughing when distracted, and reduced or absent cough at night - unlike infections, GERD, or asthma which tend to be worse at night. Keep a high index of suspicion for psychogenic cough, and consider it whenever the cough does not fit the other pictures of chronic cough.

Habit cough may begin post-viral infection as a cough that never went away. Emotional stress may precipitate the cough.

May need counselling to address underlying anxiety, or other psychological basis of the cough.

That's it for the management of the most common causes of chronic cough. I'll do a quick recap of the topics covered in this podcast.

Conclusion

Remember to start broadly by forming a differential.

Finally, target any further investigations or management at the specific conditions suggested by the history and physical exam, but discourage the use of OTC cough remedies because they don't work.

This concludes this PedsCase podcast on chronic cough. Again, my name is Mark McKinney and this podcast has been produced in collaboration with Dr. Melanie Lewis. I hope this has been an informative look at a very broad and very common topic. I wish you and your future patients all the best.

References

References available upon request.