

## PedsCases Podcast Scripts

This is a text version of a podcast from PedsCases.com on "Pertussis." 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.pedsCases.com/podcasts](http://www.pedsCases.com/podcasts).

### **Pertussis (Whooping Cough)**

Developed by Haran Yogasundaram and Dr. Sarah Forgie for PedsCases.com.  
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#### Learning Objectives

By the end of this podcast you should be able to:

- Describe the clinical presentation (including stages) of pertussis
- Diagnose pertussis
- Choose effective antimicrobial therapy for pertussis
- List the benefits of pertussis immunization

#### Podcast Script

Haran: Hello medical students and residents. Welcome to the PedsCases podcast on pertussis. I am Haran Yogasundaram, a medical student at the University of Alberta.

Dr. Forgie: I am Dr. Forgie, a pediatric infectious diseases specialist at the University of Alberta and Stollery Children's Hospital.

Haran: By the end of this podcast, you should be able to: describe the clinical presentation (including stages) of pertussis, diagnose pertussis, choose effective antimicrobial therapy for pertussis, and list the benefits of pertussis immunization. We'll have some sound clips of whooping cough as well. Let's get started. Dr. Forgie, what exactly is pertussis?

Dr. Forgie: Pertussis, also known as whooping cough or 100 day cough, refers to a contagious infection of the respiratory tract caused by the bacterium *Bordetella pertussis*. (Public Health Agency of Canada, Immunization & Vaccines - Vaccine Preventable Diseases - Pertussis, 2012)

Haran: How common are pertussis infections?

Dr. Forgie: Rates have been declining in recent years but are around 2 to 5 cases per 100,000 people in Canada. The incidence of pertussis is highest in infants and children. Around 10 to 30 cases per 100,000 toddlers one to four years of age that are observed

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in Canada. For infants under one year, the rates are about 35 to 100 cases per 100,000. (Public Health Agency of Canada, Immunization & Vaccines - Vaccine Preventable Diseases - Pertussis, 2012)

Pertussis is often missed and underreported due to the incidence being underestimated and the absence of classic features in older children. (Hamden, 2009)

Is pertussis found in all countries?

Haran: Is pertussis found in all countries?

Dr. Forgie: It is found year-round throughout the world. In developing countries, it is one of the leading causes of death among non-immunized children. (Public Health Agency of Canada, Immunization & Vaccines - Vaccine Preventable Diseases - Pertussis, 2012)

Haran: Wow! Just how serious is a pertussis infection?

Dr. Forgie: Children under one year of age are at risk for secondary bacterial infections, seizures, brain damage, and death. (Public Health Agency of Canada, Immunization & Vaccines - Vaccine Preventable Diseases - Pertussis, 2012)

In older children and adults, complications are rare. However, these patients can transmit pertussis to younger people. (Public Health Agency of Canada, Infectious Diseases - Pertussis (Whooping Cough) Fact Sheet, 2012)

Haran: How can infected patients transmit pertussis to others?

Dr. Forgie: It is important to note that these bacteria do not survive for long outside of a human host so fomite transmission is limited. (Forgie, *Bordetella pertussis*, 2012)

It is transmitted through respiratory droplets from an infected human. (Public Health Agency of Canada, Infectious Diseases - Pertussis (Whooping Cough) Fact Sheet, 2012)

It is highly contagious with as many as 80% of immunized household contacts of symptomatic cases infected.

Haran: Once a person comes into contact with respiratory droplets of an infected person, how do they develop an infection? How does pertussis evade our immune system?

Dr. Forgie: Well, *Bordetella pertussis* is a small, gram-negative bacillus that has many virulence factors. It possesses many adhesion factors: filamentous hemagglutinin, pili, and pertactin. These adhesion factors allow pertussis bacteria to adhere to the ciliated respiratory epithelium. Pertussis then replicates and causes inflammation of the respiratory tract. (Forgie, *Bordetella pertussis*, 2012)

Haran: Wait a second! I thought that our cilia move mucus and pathogens out of the respiratory tract. Why wouldn't that get rid of the pertussis bacteria?

Dr. Forgie: Good question! Pertussis also has several toxins that cause harm. One of those toxins is called tracheal cytotoxin. This toxin paralyzes the cells of our mucociliary escalator, preventing clearance of the mucus. The other toxins include pertussis toxin, adenylate cyclase toxin, dermonecrotic toxin, and hemolysin. (Forgie, *Bordetella pertussis*, 2012)

Haran: That sounds like a nasty little bacterium. Moving on to the macroscopic scale, what is the clinical presentation of pertussis?

Dr. Forgie: Well, a patient with a pertussis infection may present in different stages. The infection has an initial incubation period of 1 to 3 weeks, followed by the catarrhal stage. At the cellular level, this stage is when the pertussis bacteria are adhering to ciliated respiratory epithelial cells. Clinically, an infected person may have runny nose, low grade fever, and intermittent cough. It is very important to remember that during the catarrhal stage, the person is very contagious. Unfortunately, because the symptoms are non specific, many people do not know that they have pertussis and often infect others. (Forgie, *Bordetella pertussis*, 2012)

The next stage, after the catarrhal, is the paroxysmal stage. At the cellular level, the various toxins I mentioned earlier that *Bordetella pertussis* produces are being released. The tracheal cytotoxin paralyzes the mucociliary escalator, which leads to coughing. The cough is an attempt to clear the mucous. Other toxins damage the trachea and cause swelling. After coughing fits, small children often make a whooping sound on inspiration because of this swelling. Adolescents and adults do not have the whoop due to their larger tracheal diameters (so there is less effect from the swelling) and perhaps some partial protection from the vaccine if they are vaccinated. (Forgie, *Bordetella pertussis*, 2012)

We have some audio clips of pertussis, with permission of Dr. Doug Jenkinson of [whoopingcough.net](http://whoopingcough.net). This first clip is of a child with pertussis who does not have a whoop.

[sound clip: *cough\_without\_whoop.wav*] (Jenkinson, 2012)

The next clip here is a child who has a slight whoop.

[sound clip: *cough\_slight\_whoop.wav*] (Jenkinson, 2012)

Finally, we have a child here with a classical whoop.

[sound clip: *cough\_heavy\_whoop.wav*] (Jenkinson, 2012)

The paroxysmal stage can last 1-2 months. After the paroxysmal stage, the final stage of a pertussis infection is called the convalescent stage. During this stage, the patient recovers but may still have intermittent episodes of coughing. (Forgie, Bordetella pertussis, 2012)

The convalescent stage can last several weeks but the intermittent episodes of coughing may be brought on even months later with another viral infection. (Forgie, Bug Bios: Bordetella Pertussis, 2012)

Haran: So just to summarize, following the incubation period there are three stages: the catarrhal stage, the paroxysmal stage, and the convalescent stage. The catarrhal stage is when the patient is most highly infectious and is characterized by runny nose, low grade fever, and intermittent cough. The paroxysmal stage lasts 1-2 months and is characterized by coughing fits to get rid of pooling mucous. Younger children may have classical whoop sounds on inspiration following fits. The convalescent stage can last weeks and is when the patient recovers but may still have intermittent coughing fits.

Dr. Forgie: Correct! It is also important to note that when the mucociliary escalator is paralyzed, the patient is at high risk for secondary bacterial infections. So it is important to monitor children for bacterial pneumonia. (Forgie, Bordetella pertussis, 2012)

Haran: Ok, so when a child is diagnosed with pertussis we should be on the lookout for bacterial infections. Speaking of diagnosis, besides the history of a cough longer than two weeks, what can we use to diagnose pertussis?

Dr. Forgie: You've raised a good point. While the history of having cough longer than two weeks is very important, we can use a more specific test to diagnose a pertussis infection. We collect a nasopharyngeal aspirate, or an NPA. We send the NPA for analysis and we have to indicate on the requisition that we are concerned about pertussis – otherwise the lab will only look for viruses. When they look for pertussis, they will do polymerase chain reaction (PCR), and some labs will do culture for pertussis, and/or direct fluorescent antibody (DFA) test. The culture takes several days, and while the DFA is fast, the sensitivity of the test is low – a positive result rules in pertussis but a negative result does not rule pertussis out. (Forgie, Bordetella pertussis, 2012)

Haran: Excellent. So now that we can diagnose pertussis in children, what can we do about it? How is treated?

Dr. Forgie: So remember, *Bordetella pertussis* is a gram-negative aerobic bacterium that can be treated with appropriate antimicrobials. Typically macrolides (such as erythromycin, azithromycin, or clarithromycin) may be used, or if there are allergies trimethoprim-sulfamethoxazole (TMP-SMX) are used to reduce duration of symptoms and decrease patient infectivity. Patients are treated for 14 days with erythromycin, for shorter courses with the other macrolides, and they are no longer infectious after 5 days of treatment (Forgie, Bug Bios: Bordetella Pertussis, 2012).

Haran: So to summarize diagnosis and treatment... given a history of a cough lasting longer than 2 weeks we would then take a nasopharyngeal aspirate and send it off to the lab, making sure to specify that we would like them to look for pertussis. Given a positive result, we would treat the pertussis infection with antimicrobials. Macrolides or TMP-SMX are administered for 14 days. After 5 days, patients are no longer infectious.

Dr. Forgie: That is correct! And remember, depending on the type of macrolide, some of them are used for slightly shorter courses. Make sure to look it up in your reference for the duration of therapy.

Haran: Alright. Earlier you mentioned immunization a couple of times. What can you tell me about the pertussis vaccine?

Dr. Forgie: As of 1997, purified acellular-component pertussis vaccines replaced previously used whole-cell pertussis vaccines. The newer generation of vaccines contain immunogens derived from pertussis, such as inactivated pertussis toxin, filamentous hemagglutinin, and pertactin. The vaccine is administered intramuscularly. (American Academic of Pediatrics, 2012)

The primary series of pertussis immunization is recommended at 2, 4, and 6 months of age. Boosters are given at 18 months, 4 to 6 years, and 14 to 16 years of age. Adults can now receive boosters if they did not receive one as teenagers. (Public Health Agency of Canada, Immunization & Vaccines - Vaccine Preventable Diseases - Pertussis, 2012)

The pertussis vaccine is almost always combined with diphtheria and tetanus toxoids. During the primary series, it may also be combined with polio, *Haemophilus influenza* type b, and hepatitis B vaccinations. The pertussis, diphtheria, and tetanus vaccine is known as DTaP (that's big D, big T, little a, big P) for the primary series and then Tdap (which is big T, little d, little a, little p) for boosters. (Public Health Agency of Canada, Immunizations & Vaccines - Canadian Immunization Guide - Pertussis Vaccine, 2012)

Haran: How effective is the vaccine?

Dr. Forgie: Acellular pertussis vaccines have an estimated efficacy of 80%-85% following completion of the primary series. (Public Health Agency of Canada, Immunizations & Vaccines - Canadian Immunization Guide - Pertussis Vaccine, 2012)

Haran: Are there any contraindications to immunization?

Dr. Forgie: The only contraindication for the pertussis vaccine, which is applicable to all vaccines, is a history of severe allergic reaction. (American Academic of Pediatrics, 2012)

Haran: Alright! So the take home points would be as follows:

- 1) *Bordetella pertussis* has many virulence factors and can be a very serious infection for young children.
- 2) A pertussis infection can last a few months and presents in several stages: a highly-infectious catarrhal stage, a paroxysmal stage including cough fits and potentially a classical whoop sound, and finally a convalescent recovery stage.
- 3) After a two-week history of cough, a nasopharyngeal aspirate should be taken and sent to the lab with instructions to look for pertussis.
- 4) A positive test rules in pertussis and the patient should be treated with a macrolide or TMP-SMX for 14 days. Make sure to review your reference for the duration of macrolide treatment. After 5 days they are no longer infectious.
- 5) The acellular pertussis vaccine is part of the regular immunization schedule in Canada and plays an important role in reducing the incidence of pertussis infections.

Dr. Forgie: That's correct! For more information on pertussis, you can consult the Public Health Agency of Canada, the Red Book from the American Academy of Pediatrics, or the Canadian Pediatric Society website.

Haran: Thank you very much for your time and expertise, Dr. Forgie! This concludes this Pedcases podcast on pertussis.

Dr. Forgie: Thank you!

## References

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