

Why Is Pertussis Disease So Severe?

WHOOPIING COUGH



Viral respiratory infections may also present in the same way with a chronic cough, so it is very difficult for the doctor to know what bug is causing the problem



NEWSLETTER

Compiled by: Christopher Arzur



WHOOPIING COUGH IS GENERALLY CATEGORIZED INTO THREE DISTINCT STAGES.

- The first stage is called the **prodromal or catarrhal stage** and lasts **1 to 2 weeks**.
- The presenting symptoms can be very subtle in onset and are very similar to that of many **viral respiratory tract infections**.
- Symptoms during this stage include **runny nose and eyes, sneezing and a dry, persistent cough**. Fevers are usually low-grade during this stage.

Did You Know?

The Chinese word for **pertussis** means the hundred day cough.

Then after 2 weeks the classic paroxysmal stage begins

- This stage lasts anywhere from **1 to 6 weeks**. The paroxysms, or fits of coughing, are intense and can be very distressing as the child coughs so violently that they may **vomit**. The coughing bouts may contain as many as **15 coughs** in a single breath, followed by a whooping sound as the child takes the next breath. The paroxysms tend to occur more frequently at night.
- Symptoms during this stage include **runny nose and eyes, sneezing, and a dry, persistent cough**. Fevers are usually low-grade during this stage.

After about 6 weeks

The patient enters the convalescent phase where the cough is less severe, but persists for weeks to months.

- Infants might not exhibit the typical cough; instead, they may experience apnoeic spells, during which they briefly stop breathing. (Partially vaccinated.)
- **Both children and adults** might not show the severe coughing phase; rather, they may only display a **persistent cough** that takes several weeks to improve.



DIAGNOSIS

Whooping cough is a highly contagious respiratory illness caused by the bacterium, **Bordetella pertussis**. The name of this disease originates from a Latin term that translates to **intense cough**. As a strict human pathogen, this bacterium only thrives within the human body and does not exist in the environment or in animals.



Cerba Lancet
Africa

References:

1. Babu MM, et al. Virulence factors of *Bordetella pertussis*. *Current Science* 2001; 80(12): 1512-1522.
2. Loeffelholz MJ, et al. Comparison of PCR, culture, and direct fluorescent-antibody testing for detection of *Bordetella pertussis*. *J Clin Microbiol* 1999; 37(9): 2872-2876.
3. Loeffelholz M. Towards improved accuracy of *Bordetella pertussis* nucleic acid amplification tests. *J Clin Microbiol* 2012; 50(7): 2186-2190.
4. World Health Organisation. Health topics: Pertussis. Available at: <http://www.who.int/topics/pertussis/en/>
5. Centers for Disease Control and Prevention. Pertussis (Whooping Cough). Available at: <http://www.cdc.gov/pertussis/index.html>
5. Madide A and Cotton M. Pertussis: An update for general practice. *SA Fam Pract* 2006; 48(4): 44-46.

www.cerbalancetafrica.com

WHY IS PERTUSSIS DISEASE SO SEVERE?

The severity of disease caused by any bacteria is in a large part due to its virulence factors. *Bordetella pertussis* causes disease by sticking to the cells of the respiratory tract (nose, throat, and lungs).

The bacterium is recognized as a **strict human pathogen**, meaning it exclusively survives within the human body and is not found in the environment or in animals. It has a limited lifespan in **respiratory secretions** and necessitates specific laboratory **media for culturing**.

As a result, this organism **presents greater challenges for growth** in clinical laboratories than many other bacteria that commonly cause diseases in humans.

Even in areas where there is **high vaccine coverage**, pertussis disease continues to cause severe illness and death among **very young children** who have not completed the primary vaccination series and therefore **aren't fully immune against infection**.

Despite a **massive drop** in the number of cases due to immunisation, there are still 50 million cases of **whooping cough** (pertussis disease) and 300 000 deaths reported worldwide every year, mostly amongst babies.



It multiplies in this part of the body and then, as it is growing, it releases special **toxins** into the cells of the respiratory tract, which cause the **symptoms of whooping cough**, e.g. severe and protracted coughing. The bacteria grows with difficulty in the laboratory and dies quickly outside of the human body, therefore **sputum and aspirate samples** should be taken as quickly as possible to the laboratory to be plated out onto the special agar plates the organism grows on. Culturing the organism in the laboratory is the best way of determining if the **infection is definitely pertussis**. Unfortunately, it takes a long time to grow (**up to 7 days**) and might not grow properly on the agar plates, so the test **may be falsely negative**.

The first symptoms take a few days after infection to manifest. This is because the bacteria must multiply to a critical point.



HOW IS WHOOPING COUGH SPREAD?

Since the bacteria thrive in the **respiratory tract**, they are transmitted from one person to another through secretions from the lungs, throat, or nose. (For example, close contact with **respiratory droplets from coughing or sneezing**.) This **transmission** method is similar to that used by viruses, such as the Influenza virus, to spread among individuals.

During the first few weeks of infection, the patient is very infectious to those people around them, especially **babies and adults with poor immune systems**. For example, cancer patients. Vaccination is the best way to prevent this **potentially lethal disease**.



Key points about *Bordetella pertussis* include:

- It can survive for only a few hours in respiratory secretions.
- It requires specialized laboratory media for culture.
- These factors contribute to the challenges of cultivating this organism in clinical laboratories compared to many other bacteria that typically cause diseases in humans.
- The first symptoms take a few days after infection to manifest. This is because the bacteria must multiply to a critical point before they release enough toxins to cause disease.

HOW IS WHOOPING DIAGNOSED?

Diagnosis of whooping cough (pertussis disease) should always consist of a combination of suspicious clinical signs and symptoms along with laboratory tests e.g. **testing of blood and/or sputum**.

- The best specimen for PCR testing is a washout specimen from the back of your nasal cavity, called a **nasopharyngeal aspirate**.
- It is a slightly uncomfortable procedure to have, but swabs taken from the throat or nose may only contain small amounts of the bacteria, leading to a **false-negative PCR result**.
- **Blood samples can also be sent** to the laboratory to **measure levels of antibodies** produced to fight the bacteria. Unfortunately, early in the disease, the antibodies are still forming, and the test may be false-negative.
- The tests may also accidentally detect antibodies against bacteria that are similar but not identical to **pertussis bacteria**. This results in false-positive results, and as a result, the blood tests are not commonly recommended or performed. These tests also cannot distinguish between antibodies formed due to **infection** with the bacteria and those formed after **immunisation**.



Modern technology in the **form of PCR testing** is the new way to help diagnose pertussis disease. The best specimen for **PCR testing** is a **washout specimen** from the back of your nasal cavity, called a nasopharyngeal aspirate. It is a slightly uncomfortable procedure to have, but **swabs taken from the throat or nose may only contain small amounts of the bacteria, leading to a false-negative PCR result**.

- If a culture swab is taken later in the disease (e.g., during the convalescent phase) the culture may also be negative as the immune system has already started fighting the bacteria, resulting in fewer bacteria in the respiratory tract.

HOW IS WHOOPING COUGH PREVENTED?

There are two types of vaccines available against pertussis a whole cell vaccine that contains killed bacteria, and an acellular vaccine that only contains certain bacterial proteins. The acellular vaccine is used more often than the whole cell vaccine as it causes less redness, pain and swelling at the injection site. These are available in combination with tetanus and diphtheria vaccines and form part of the South African Expanded Programme for Immunisation (EPI).

- Children should receive the vaccine at 6, 10 and 14 weeks and 18 months of age, with a booster dose at 6 and 12 years of age. It is also recommended that pregnant women should receive a booster dose in the last trimester of each pregnancy, so that protective antibodies can be passed to the baby before birth.
- At least **90% of all people living in the community must be immunised against pertussis with at least 3 doses of the vaccine to prevent the spread** of this disease in the community, but the World Health Organisation (WHO) estimates that little more than 80% of people are adequately vaccinated worldwide, and even less so in developing countries like South Africa. The old saying **Prevention is better than cure** has never rung so true.

