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AMPATHCHAT

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Bordetella pertussis

Introduction

Pertussis, also known as whooping cough, is a highly infectious disease of the respiratory tract. *Bordetella pertussis* is classically regarded as the sole agent of pertussis. However, infection with other *Bordetella* species, such as *B. parapertussis* and *B. holmesii*, can cause a similar, though typically milder, clinical picture.

Transmission

B. pertussis is transmitted from person to person via respiratory droplets with a high secondary attack rate of up to 90% in susceptible contacts. The incubation period ranges from five to 21 days, but typically averages between seven and 10 days. The infected patient is most infectious during the early (cattarhal) phase of the illness but may transmit *B. pertussis* for up to three weeks following infection, if untreated.

Epidemiology

B. pertussis is considered endemic worldwide. Despite the availability of effective pertussis vaccines and high vaccine coverage rates, pertussis still occurs in epidemic cycles every two to five years. Superimposed on the cyclical pattern, a general increase in pertussis rates are being reported from developed and developing countries, including South Africa. During 2018, an increase in cases has been seen in specimens tested at Ampath (Figure 1) compared to 2016 and 2017. The highest morbidity and mortality rates occur in infants under six months of age. Increasing numbers of cases are diagnosed among adolescents and adults, as well as neonates and infants under six months of age (Figure 2).

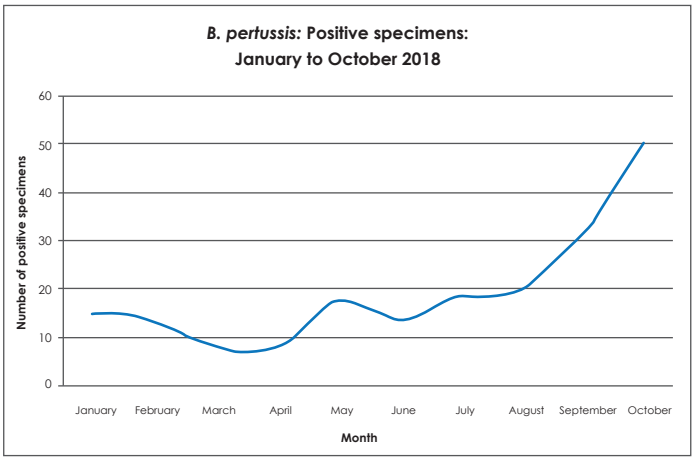


Figure 1

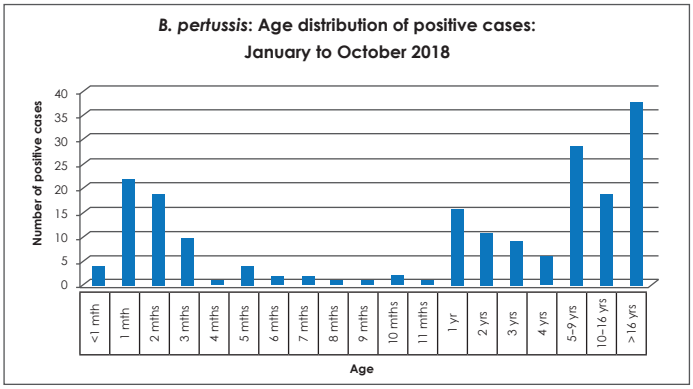


Figure 2

Clinical presentation

The classical presentation, most commonly seen during a primary infection in unvaccinated children, is characterised by three stages:

1. **Cattarhal stage:** Non-specific prodromal illness with cough and coryza. The patient is most infectious at this stage, which lasts between one and two weeks
2. **Paroxysmal stage:** Classical paroxysmal coughing spells followed by inspiratory whoops. Post-tussive vomiting may occur. Complications most commonly occur in this stage, which lasts between two and eight weeks
3. **Convalescent stage:** The cough gradually improves and the patient recovers. This stage lasts between one and two weeks

Atypical presentations may occur in patients with underlying immunity, neonates and infants. Neonates and young infants may present with apnoea alone or with complications such as encephalopathy, seizures and pneumonia. Patients with pre-existing immunity may present with milder disease or merely a history of prolonged cough. These atypical presentations may delay the diagnosis, leading to an increase in morbidity and mortality, as well as facilitating the transmission of pertussis.

Diagnosis

Diagnostic modalities include molecular-based methods (PCR), culture and serology (Table 1). PCR testing is the test of choice due to the relatively high sensitivity and short time to result. Ampath currently offers *B. pertussis* PCR testing as a standalone multiplex assay (multi-copy and single-copy gene targets) and as part of the BioFire multiplex respiratory panel (single-copy gene target). Both these PCR assays also detect *B. parapertussis*.

Table 1: Laboratory diagnosis of pertussis

Test	Sensitivity	Specificity	Specimen	Comments
Molecular testing: ***B. pertussis* PCR** • **Single-copy gene target OR** • **Multi-copy gene targets**	70–99%	86–100%	Nasopharyngeal swab or aspirate or sputum	Optimal sensitivity in cattarhal and early paroxysmal stage prior to antibiotic therapy. A PCR using a single-copy gene target is known to have lower sensitivity, but may be more specific compared to a PCR using multi-copy gene targets.
Serology: **Anti-pertussis toxin IgG**	50–99%	>90%	Blood	Ideally needs paired serum samples: acute phase and convalescent. Influenced by previous vaccination (within one year) and presence of maternal antibodies in neonates and infants.
Culture: **Not routinely performed**	12–60%	100%	Nasopharyngeal swab or aspirate or sputum	Optimal sensitivity in early cattarhal stage prior to antibiotic therapy. Needs specialised transport media to retain viability of *B. pertussis*.

Factors that influence the sensitivity of *B. pertussis* PCR testing include:
- Genetic target of the PCR test: single vs multi-copy targets
- Patients presenting late in the course of disease
- Poor specimen quality
- Other Bordetella species, such as *B. parapertussis,* causing the clinical presentation

In a patient in whom the index of suspicion for pertussis remains high in spite of a negative *B. pertussis* PCR, the result needs to be discussed with a microbiologist.

Culture is not routinely performed due to the relative difficulty in culturing *B. pertussis*. The clinical impact of serological testing for pertussis is limited, but it may be helpful in patients presenting late in the course of disease where both culture and PCR testing is negative.

In addition, other non-specific laboratory findings include a leucocytosis secondary to lymphocytosis, which may be marked in severe disease.

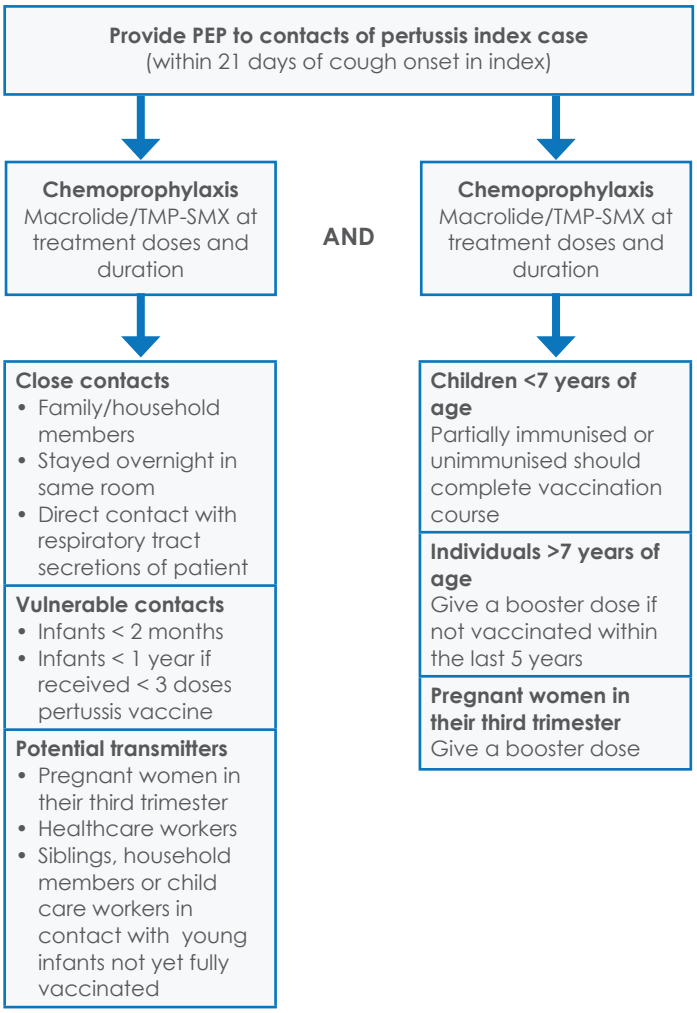
Treatment

The management of pertussis is mainly supportive. Antibiotic therapy plays a secondary role in terms of eradicating carriage of *B. pertussis* and limiting transmission. Macrolides, for example erythromycin, azithromycin and clarithromycin, form the mainstay of antibiotic therapy and are most effective at modulating the clinical course of disease if administered early in the disease process (within first two weeks). Trimethoprim-sulfamethoxazole is an alternative if macrolides are contra-indicated.

Prevention

Primary prevention of pertussis occurs through vaccination with the acellular pertussis vaccine as part of the South-African EPI (public and private schedule). Immunity following vaccination with acellular pertussis (aP) vaccines begins to wane after approximately five years. A booster dose of an aP-containing vaccine is thus indicated every four to six years. Additional groups that need to be targeted by vaccination include healthcare workers, pregnant women (at 27 to 36 weeks gestation during each pregnancy, regardless of interval since previous pertussis vaccine) and ideally household contacts of neonates and infants.

In the event of exposure to a confirmed or suspected pertussis case, post-exposure prophylaxis (PEP) should be provided to close and vulnerable contacts, as well as potential transmitters of pertussis, regardless of immunisation status. Contacts need to be monitored for symptoms and signs of pertussis for 21 days.



For detailed guidelines on the diagnosis, management and public health response to pertussis, please refer to the NICD website.

References available on request.