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Pertussis Infection in Adults

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Epidemiology

Pertussis, or *whooping cough*, is a highly contagious respiratory illness caused by *Bordetella pertussis*, a fastidious gram-negative coccobacillus that is a human pathogen without known animal or environmental reservoirs. There are 8 additional known *Bordetella* species, 3 of which can cause respiratory illness in humans: *B parapertussis* (which causes infection clinically indistinguishable from pertussis), *B bronchiseptica*, and *B holmesii*.

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Prior to introduction of the whole-cell pertussis vaccine in the US in the 1940s, pertussis was a leading cause of childhood mortality. Widespread vaccination in the US resulted in a decrease in annual reported cases from more than 250 000 to a nadir of 1010 in 1976.[1] Since the 1980s, cases of pertussis have increased in the US, likely related to increased clinician awareness and testing, improved diagnostic tests, and waning immunity from acellular pertussis vaccines. Provisional US surveillance data for 2024 reported more than 35 000 cases, including 10 deaths.

Currently, more than half of pertussis cases occur in adolescents and adults, who serve as a transmission reservoir to infants and children.[2] However, infants younger than 1 year have the highest incidence of infection (>23 cases per 100 000 in 2023) and are at greatest risk for complications (eg, apnea, pneumonia, seizures) and mortality, accounting for 89% of US pertussis-related deaths.[2]

Box. Pertussis in Adults

- The typical presentation is prolonged cough (>2 weeks) usually without classic whooping; paroxysms and posttussive vomiting occasionally occur.
- The sensitivity of culture is highest during the first 2 weeks of cough illness; polymerase chain reacting testing is sensitive up to 4 weeks after cough onset.
- First-line therapy is azithromycin (500 mg on day 1 followed by 250 mg on days 2 through 5) or clarithromycin (500 mg twice daily for 7 days). Trimethoprim-sulfamethoxazole (1 double-strength tablet twice daily for 14 days) may be used if intolerant to macrolide.
- Postexposure prophylaxis is recommended for household contacts, people at high risk for severe pertussis infection (eg, infants, adults with moderate/severe asthma or chronic obstructive pulmonary disease, those who are immunocompromised), and people who have contact with high-risk individuals (eg, pregnant persons in third trimester, infants).
- The tetanus, diphtheria, acellular pertussis (Tdap) booster is recommended at age 11 to 12 years but may be given at any time after 11 years of age if a patient has never received it. Tdap booster is recommended for pregnant people during each pregnancy.

Transmission, Clinical Presentation, and Risk Factors

Pertussis is spread by respiratory droplets. The incubation period is typically 7 to 10 days, which is longer than that of common viral upper respiratory infections (1-3 days).

Classically, pertussis infection has 3 clinical phases. The initial catarrhal phase lasts 1 to 2 weeks and is characterized by nonspecific symptoms such as malaise, rhinorrhea, and mild cough (**Box**). Population-based surveillance data show that fever occurs in only 12% of adults and 8.8% of older adults (≥65 years).[3] The characteristic symptom of paroxysmal cough, which involves repetitive, vigorous coughs during a single expiration, occurs during the paroxysmal phase, which lasts 2 to 3 months. Prolonged cough paroxysms may be followed by a forceful inspiration, which can cause the characteristic whooping sound. Severe coughing may cause urinary incontinence (reported in approximately one-third of females ≥50 years), syncope (2%), and rib fractures (2%).[4] Other complications in adults include pneumonia (5%-9% in individuals ≥30 years) and need for hospitalization (6% in those ≥50 years).[4] The frequency and severity of coughing gradually diminish and resolve during the convalescent phase.

Because prior pertussis infection or immunization may attenuate illness severity, cough persisting more than 2 weeks may be the only symptom. Among adults presenting with prolonged cough, the estimated prevalence of pertussis is 12% to 32%.[5] Compared with adults without airway disease, those with asthma and chronic obstructive pulmonary disease are at increased risk of acquiring pertussis and more severe disease.[6] Obesity is also a risk factor for acquiring pertussis, and those who are immunocompromised or smoke cigarettes are at higher risk for severe disease.[6]

Diagnosis

In adolescents and adults with a cough illness, a systematic review of 3 prospective cohort studies (486 patients) reported that the likelihood of pertussis increased with presence of inspiratory whoop (summary likelihood ratio [LR], 1.9 [95% CI, 1.4-2.6]) and posttussive emesis (summary LR, 1.8 [95% CI, 1.4-2.2]) and decreased with the absence of paroxysmal cough (summary LR, 0.52 [95% CI, 0.27-1.0]) and absence of posttussive emesis (summary LR, 0.58 [95% CI, 0.44-0.77]).[5] Clinicians should suspect pertussis in adults with cough of any duration with paroxysms, inspiratory whoop, or posttussive emesis.

Three laboratory tests are available to diagnose pertussis infection. Nasopharyngeal culture, the criterion standard, is 100% specific, but sensitivity declines after 2 weeks of cough illness and results may take up to 7 days to be available. Polymerase chain reaction testing of a nasopharyngeal specimen may be useful up to 4 weeks after cough onset, with sensitivity and specificity up to 97% and 93%, respectively.[7] A serologic assay developed by the US Centers for Disease Control and Prevention is mostly used for research and surveillance; commercial assays have not been standardized and may not be available.

Treatment

Initiation of treatment before test results are available is appropriate if the clinical index of suspicion for pertussis is high and, especially, for individuals who have contact with others at risk for severe disease (eg, infants, young children). Recommended treatment for pertussis infection in adults is azithromycin (preferred for pregnant patients) or clarithromycin and, for those unable to take macrolides, trimethoprim-sulfamethoxazole (Box).

Although there are no published trials of pertussis treatment in adults, a multicenter, randomized trial comparing azithromycin to erythromycin in children aged 6 months to 16 years reported bacterial eradication in all patients with positive culture results who had repeat culture testing at the end of antibiotic therapy (n = 53 for both groups).[8] However, antibiotic treatment may not alter the course of illness, particularly if started after the catarrhal phase. Nevertheless, all patients diagnosed with pertussis within 3 weeks of cough onset should receive antibiotic therapy, primarily to reduce transmission risk. Antibiotic treatment 3 weeks after cough onset is generally not recommended because the cough is caused by toxins produced by *B pertussis* that damage the ciliated respiratory epithelium and impair clearance of secretions, not by ongoing infection. To prevent transmission to neonates, pregnant individuals with pertussis who are near full term should receive antibiotics up to 6 weeks after cough onset.

Prevention

Vaccination

The tetanus, diphtheria, acellular pertussis (Tdap) vaccine is safe and 92% (95% CI, 32%-99%) effective at preventing pertussis infection.[9] However, a case-control study of adolescents conducted during an epidemic reported Tdap vaccine efficacy was 73% (95% CI, 60%-82%) within 1 year of vaccination but declined to 34% (95% CI, −0.03% to 58%) after 2 to 4 years.[10] For unvaccinated adults, the preferred primary vaccination schedule is the Tdap vaccine followed by either the Td or Tdap vaccine at least 4 weeks later and subsequently by either the Td or Tdap vaccine in 6 to 12 months. Because immunity wanes both after childhood vaccination and infection, 1-time Tdap booster vaccination is recommended for all people at any time after age 11 years. To protect infants, the Tdap vaccine is also recommended during each pregnancy and for persons with close infant contact.

Postexposure Prophylaxis

All household contacts of a person with pertussis should receive postexposure antibiotic prophylaxis (with the aforementioned treatment regimen), regardless of their vaccination history. Postexposure prophylaxis is also recommended for people at high risk of developing severe infection and those who have contact with individuals at high risk (Box). Patients with *B pertussis* infection should avoid contact with persons at high risk for severe illness until they have completed at least 5 days of antibiotics or after 21 days have elapsed since cough onset.

Conclusions

Pertussis is a common cause of severe and prolonged cough in adults in the US. It is highly contagious and, if transmitted to infants or high-risk adults, may cause serious complications and, rarely, death. Vaccination is highly effective at preventing pertussis infection.

ARTICLE INFORMATION

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