

Whooping Cough: Threat to Healthcare Workers

Description/Etiology

Whooping cough (also known as pertussis) is a respiratory infection caused by the gram-negative bacillus *Bordetella pertussis*. The spread of *B. pertussis* occurs primarily through respiratory droplets. *B. pertussis* produces toxins that paralyze respiratory cilia and cause inflammation of the respiratory tract that interferes with clearance of respiratory secretions, particularly in the respiratory system. A staccato-type (i.e., a short, abrupt) cough is a common manifestation of *B. pertussis* infection. Affected individuals are most contagious 2 weeks prior to the onset of coughing and during the first 2 weeks of coughing. Infection lasts 30–90 days and is usually self-limiting, but can be life-threatening in individuals with a compromised immune system. Potential complications in vulnerable patients include pneumonia and apnea. Hypoxia caused by the effect of pertussis toxin can contribute to neurologic complications (e.g., seizures, encephalopathy).

Whooping cough is highly contagious; infection occurs in 80–90% of susceptible contacts. For every symptomatic person there are several asymptomatic persons who are capable of spreading infection. Numerous outbreaks of whooping cough have occurred in healthcare settings, posing a serious threat to healthcare workers (HCWs), patients, and their families. Factors that contribute to the rapid spread of infection include failure to identify and isolate infected patients; failure to recognize, treat, and enforce sick leave for infected staff members; inefficiency in instituting infection control protocols; waning immunity in adolescents and adults; and nonadherence to recommendations for childhood immunization.

Diagnosis is made based on medical history, clinical presentation, and results of laboratory studies. Culture of nasal secretions is the gold standard for laboratory diagnosis. A thorough review of the patient's immunization record is important because vaccine-induced immunity wanes after 5–10 years and immunity developed from previous infection does not provide lifelong protection against reinfection. Prompt diagnosis in the healthcare setting is important to prevent a facility-wide epidemic.

Guidelines for managing whooping cough in the healthcare setting include vaccination of HCWs, screening of all HCWs who have had known contact with infected individuals, postexposure prophylaxis for HCWs in contact with patients at risk for severe disease (e.g., newborns, patients with chronic respiratory conditions), prompt treatment and enforcement of sick leave for symptomatic workers, and strict adherence to infection control protocols for droplet precaution to prevent further spread of the infection.

Facts and Figures

Approximately, 49 million cases of whooping cough and 195,000 associated deaths occur each year worldwide. In 2015, 20,762 cases of whooping cough and six whooping cough-related deaths occurred in the United States. Under-immunization of HCWs against whooping cough is a common problem in the U.S. and other countries. Srivastav et al. (2017) reported that whooping cough vaccine coverage among HCWs in the U.S. was 34.8% in 2012, 40.2% in 2013, and 42.4% in 2014.

Risk Factors

The risk of spreading whooping cough in the healthcare setting increases with unprotected exposures (e.g., delayed diagnosis) to infected patients and HCWs, lack of staff immunity or

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waning immunity, and failure to adhere to established infection control protocols, especially droplet precautions, once in place.

Signs and Symptoms/Clinical Presentation

Whooping cough is classically divided into three stages, although many infected individuals do not appear to experience distinct stages:

- › The catarrhal stage lasts 1–2 weeks and is characterized by cold-like signs and symptoms, including runny nose and congestion
- › The paroxysmal stage lasts 2–6 weeks and is characterized by episodes of uninterrupted coughing followed by exhaustion and, in some cases, posttussive emesis. In infants, the paroxysmal stage can manifest as frequent episodes of choking and cyanosis
- › The convalescent stage lasts 2 weeks or longer, during which signs and symptoms gradually resolve but cough can persist for several weeks

Some infected individuals report having intermittent episodes of uncontrollable cough accompanied by a feeling of strangulation, intense headache, and diminished awareness. The cough can become severe enough to break ribs, rupture vertebral arteries, or cause subconjunctival hemorrhage. Some patients report feeling fine between coughing episodes.

Assessment

› Patient History

- Inquire about onset, duration, and severity of symptoms
- Review immunization record with attention to the most recent pertussis vaccination/booster

› Laboratory Tests

- Nasopharyngeal secretions obtained during the catarrhal or early paroxysmal stage of disease are positive for *B. pertussis* in patients with whooping cough; specimens are obtained by inserting a small flexible Dacron or calcium alginate swab through the nose to the posterior nasopharynx and placed in a *Bordetella*-specific transport media
 - Culture is the gold standard; specimens are plated on Regan-Lowe charcoal agar or Stainer-Scholte agar in the laboratory
 - Polymerase chain reaction (PCR) testing is highly sensitive for infection and will identify *B. pertussis* in persons with whooping cough. PCR is used in conjunction with culture for diagnosing whooping cough
 - Direct fluorescent assay (DFA) or a culture of sputum can identify *B. pertussis*; DFA has a low sensitivity and variable specificity, and is used as an adjunct to culture or PCR testing
- Serologic testing can identify antibodies to *B. pertussis* antigens; serologic testing is the most useful test in previously immunized individuals. State-run laboratories usually perform serologic testing
- CBC can reveal lymphocytosis during the catarrhal and paroxysmal stages of disease of unimmunized infected children

› Other Diagnostic Tests/Studies

- Chest X-ray can identify focal atelectasis, infiltrates, and consolidation

Treatment Goals

› Promote Symptomatic Relief and Reduce Risk of Complications

- Monitor vital signs, assess all physiologic systems, and review laboratory/diagnostic study results for all persons who are potentially identified or confirmed to have whooping cough; immediately report abnormalities and treat, as ordered
- Administer oxygen and intravenous fluids, as ordered
- Administer prescribed antibiotics (e.g., macrolides [e.g., azithromycin, clarithromycin, telithromycin] or fluoroquinolones) at the catarrhal stage or early paroxysmal stage to reduce infectivity, risk for complications, and duration of manifestations
 - Monitor treatment efficacy and for adverse effects of prescribed medication

› Prevent Further Transmission in the Healthcare Setting and Educate

- Administer prescribed antimicrobial prophylaxis to HCWs and patients who have been exposed to *B. pertussis* and encourage HCWs who have had unprotected contact with infected patients to seek immediate medical attention
- Provide facility-wide education to HCWs, including on signs and symptoms of whooping cough, vaccination requirements, and booster requirements for prolonged immunity
 - Educate that Tdap (tetanus, diphtheria, acellular pertussis) vaccine is recommended as a booster dose for HCWs
 - Educate that a single dose of Tdap vaccine can be administered to adults regardless of the time since their last tetanus shot
- Follow facility protocols for strict infection control
 - For personnel who develop signs and symptoms after exposure, enforce sick leave until 5 days after initiation of antimicrobial treatment

- Implement droplet precautions for infectious patients until they have received antimicrobial treatment for 5 days
- Follow facility protocols for mandated reporting of infectious disease

Food for Thought

- › Implementation of a quality improvement initiative, which included a general education campaign and improved access to the Tdap vaccine, at a children’s hospital in Memphis, Tennessee increased HCW vaccination coverage from 58% to 90% over a 15-month period (Jiang et al., 2018)
- › “Cocooning” (i.e., immunizing, including booster shots, those living with or caring for infants) can reduce risk of whooping cough in the newborn. In a questionnaire-based study conducted in the Netherlands, 67.3% of maternity assistants, 53.1% of midwives, and 44.5% of pediatric nurses reported that they intended to accept a whooping cough cocooning vaccination (Visser et al., 2018)

Red Flags

- › Genetic changes in circulating strains of *B. pertussis* can cause vaccines to fail
- › HCWs in pediatric units and emergency departments should be aware that whooping cough mortality is highest in very young infants
 - Infection control precautions should be strictly enforced
 - HCWs should consider receiving booster vaccination to prevent the spread of whooping cough to populations who are at high risk of whooping cough, including infants who are < 6 months of age and immunocompromised individuals

What Do I Need to Tell the Patient/Patient’s Family?

- › Educate regarding the importance of prophylactic antibiotic therapy for all household contacts, if applicable
- › Reassure patient and/or family during episodes of coughing because these episodes are severe and can be frightening
- › Teach patient and/or family the signs of respiratory distress, and emphasize the importance of seeking immediate medical attention if signs and symptoms of respiratory distress develop
- › Educate HCWs about the importance of receiving a booster vaccination because immunity to *B. pertussis* wanes over time; Tdap can be administered every 10 years, when a booster for Td is recommended
- › Educate about frequently performing hand hygiene and cough etiquette (e.g., coughing into sleeve of arm or tissue, discarding tissue in waste receptacle, performing hand hygiene), avoid touching eyes, nose and mouth, keeping a distance of 6 feet from someone who is sneezing or coughing, avoiding tobacco smoke, which can increase the risk of developing infection and complications associated with respiratory infection

References

1. Bocka, J. J., McNeil, B. K., & Aronoff, S. C. (2018, November 14). Pertussis. *Medscape*. Retrieved December 10, 2018, from <http://emedicine.medscape.com/article/967268-overview> (RV)
2. Adams, D. A., Thomas, K. R., Jajosky, R. A., Foster, L., Baroi, G., Sharp, P., & Nationally Notifiable Infectious Conditions Group. (2017). Summary of notifiable infectious diseases and conditions – United States, 2015. *MMWR. Morbidity and Mortality Weekly Report*, 66(31), 1-143. doi:10.15585/mmwr.mm6453a1 (PGR)
3. Jiang, C., Whitmore-Sisco, L., Gaur, A. H., Adderson, E. E., & Tdap Working Group. (2018). A quality improvement initiative to increase Tdap (tetanus, diphtheria, and acellular pertussis) vaccination coverage among direct health care providers at a children’s hospital. *Vaccine*, 36(2), 214-219. doi:10.1016/j.vaccine.2017.11.071 (R)
4. Liang, J. L., Tiwari, T., Moro, P., Messonnier, N. E., Reingold, A., Sawyer, M., & Clark, T. A. (2018). Prevention of pertussis, tetanus, and diphtheria with vaccines in the United States: Recommendations of the Advisory Committee on Immunization Practices (ACIP). *Morbidity and Mortality Weekly Report*, 67(2), 1-44. doi:10.15585/mmwr.rr6702a1 (G)
5. Schwartz, B. S. (2018). Bacterial & chlamydial infections. In M. A. Papadakis & S. J. McPhee (Eds.), *2018 current medical diagnosis & treatment* (57th ed., pp. 1476-1477). New York, NY: McGraw-Hill Education. (GI)
6. Srivastav, A., Black, C. L., Lu, P.-J., Zhang, J., Liang, J. L., & Greby, S. M. (2017). Tdap vaccination among healthcare personnel, Internet Panel Survey, 2012–2014. *American Journal of Preventive Medicine*, 53(4), 537-546. doi:10.1016/j.amepre.2017.04.002 (R)
7. Visser, O., Hulscher, M. E. J. L., Antonise-Kamp, L., Akkermans, R., van der Velden, K., Rüter, R. A. C., & Hautvast, J. L. A. (2018). Assessing determinants of the intention to accept a pertussis cocooning vaccination: A survey among healthcare workers in maternity and paediatric care. *Vaccine*, 36(5), 736-743. doi:10.1016/j.vaccine.2017.12.021 (R)