INFORMATION PAPER

Military Vaccine Agency
21 December 2010

SUBJECT: Pertussis Infection and Pertussis Vaccines

1. Purpose. To describe pertussis and the vaccines to prevent it.

2. Facts.

a. Microbiology. *Bordetella pertussis* is a fastidious, gram-negative bacterium that is responsible for producing multiple antigenic and biologically active products, including the pertussis toxin (PT). These products are responsible for the clinical features of pertussis disease. The immune response following a pertussis infection produces only short term immunity and cannot be relied upon for permanent protection.

b. Disease. Pertussis, better known as whooping cough, is an acute, infectious, respiratory disease that causes fits of violent coughing, frequently followed by an inspiratory whoop and vomiting. The bacterium attaches to the cilia of the respiratory tract releasing the toxin which causes inflammation, resulting in difficulty with the clearance of the pulmonary secretions. The average incubation period is 7-10 days and the clinical course is seen in three stages.

(1) The catarrhal stage is characterized by the insidious onset of a runny nose, sneezing, low-grade fever, and a mild, occasional cough, similar to the common cold. The cough gradually becomes more severe, and after 1–2 weeks, the second stage begins. Fever is generally minimal throughout the course of the illness.

(2) During the paroxysmal stage the diagnosis of pertussis is usually suspected. The patient has bursts (paroxysms) of numerous, rapid coughs, due to difficulty expelling thick mucus from the tracheobronchial tree. At the end of the paroxysm, a long inspiratory effort is usually accompanied by a characteristic high-pitched whoop. During such an attack, the patient may become cyanotic (turn blue). Children and young infants, especially, appear very ill and distressed. Vomiting and exhaustion commonly follow the episode. Paroxysmal attacks occur more frequently at night, with increase in frequency and severity, during the first 1-2 weeks. The paroxysmal stage usually lasts 1 to 6 weeks or longer.

(3) In the convalescent stage, recovery is gradual. The cough becomes less paroxysmal and disappears in 2 to 3 weeks. However, paroxysms often recur with subsequent respiratory infections for many months after the onset of pertussis.

The most common complication, and the cause of most pertussis-related deaths, is secondary bacterial pneumonia. Seizures and encephalopathy may occur as a result of hypoxia. Young infants are at highest risk of developing complications and death.

c. Epidemiology. Pertussis occurs worldwide and is one of the most contagious diseases among human beings. Person to person transmission commonly occurs by the respiratory route through contact with respiratory droplets, or by contact with airborne droplets of respiratory secretions. Adolescents and adults are an important reservoir for B. pertussis and are often the source of infection for infants. Pertussis is highly communicable, as evidenced by secondary attack rates of 80% among susceptible household contacts. Persons with pertussis are most infectious during the catarrhal period and the first 2 weeks after cough onset (i.e., approximately 21 days).

d. Vaccine. Primary immunization against pertussis is provided in combination with diphtheria and tetanus toxoids (DTaP) administered in childhood. Vaccine efficacy ranges from 80% to 85% for vaccines currently licensed in the United States. When studied, the current acellular pertussis vaccines (aP) were significantly more effective and were associated with fewer side effects than the original whole-cell pertussus vaccine. Increases in pertussis infections in adolescents and adults (probably due to waning immunity following primary immunization) resulted in recent licensing of Tdap (tetanus toxoid, reduced dose diphtheria and acellular pertussis vaccine) for immunizing adolescents and adults after completion of primary immunization with DTP/DTaP.

e. Cautions. The following people should not receive pertussis vaccine: people who had serious allergic reactions to previous pertussis immunization, people with severe allergy to any vaccine component; and people who developed encephalopathy within 7 days of pertussis vaccination not due to another identifiable cause.

f. Immunization.

(1) Children. The primary series of DTaP vaccine consists of four doses, the first three doses given at 4- to 8-week intervals (minimum of 4 weeks), beginning at 6 weeks to 2 months of age. The fourth dose is given 6–12 months after the third to maintain adequate immunity for the ensuing preschool years. The fourth dose of all brands of DTaP is licensed, and recommended by ACIP, to be administered at 15–18 months of age (17–20 months for Daptacel). Children who received all four primary doses before the fourth birthday should receive a booster dose of DTaP before entering school. For additional dosing schedules refer to the most recent ACIP recommendation for DTaP use.

(2) Adolescents. Administer a single dose of Tdap to children 11–12 years of age. Adolescents 13–18 years who have not received Tdap should receive a single dose of Tdap as their catch-up booster instead of Td if they have completed the recommended childhood DTaP/DTP vaccination series, and have not yet received a Td booster. An interval of 5 years between Td and Tdap is recommended to reduce the risk for local and systemic reactions after Tdap.

(3) Adults. Administer a single dose of Tdap to replace a single dose of Td for adults 19 through 64 years of age as a booster against tetanus, diphtheria and pertussis. Tdap may be given at an interval less than 10 years since receipt of the last tetanus toxoid-containing vaccine to protect against pertussis. Special emphasis should be placed on Tdap vaccination of adults who have close contact with infants, such as childcare and healthcare personnel, and new parents and siblings.

(4) Pregnant women.

(a) Any women who might become pregnant is encouraged to receive a single dose of Tdap if she has not already received a dose.

(b) Women who have not received Tdap (including those breastfeeding) should receive a dose in the immediate postpartum period, before discharge from the hospital, if two or more years have elapsed since the last Td.

g. Adverse Events. Local reactions (e.g., erythema, tenderness) are common after the administration of vaccines containing diphtheria, tetanus, or pertussis antigens. Mild systemic reactions may include generalized body aches, headaches and fatigue. Moderate-to-severe systemic events, although rare, may include high fever (i.e., > 105^{o}F) and associated temporary febrile seizures in children.

h. DoD Policy. DoD immunization requirements for pertussis follow ACIP recommendations using FDA –licensed pertussis vaccines for adolescents and adults.

3. References.

a. Centers for Disease Control and Prevention. Preventing Tetanus, Diphtheria, and Pertussis Among Adults: Use of Tetanus Toxoid, Reduced Diphtheria toxoid, and Acellular Pertussis vaccine — Recommendations of the Advisory Committee on Immunization Practices (ACIP). MMWR 2006;55 (No. RR-17):1-44

b. Multiple resources (e.g., Package inserts and Vaccine Information Statements) assembled by Military Vaccine Agency: www.vaccines.mil/pertussis

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