Pertussis: A disease re-emerges

The incidence of pertussis in the United States declined dramatically after the introduction of pertussis vaccine in the 1940s. Before that, an average of 160,000 cases of pertussis (150/100,000 population) occurred each year, resulting in 5000 deaths. Figure 1 shows how pertussis incidence declined steadily through 3 decades to reach a low of 1010 cases in 1976.

While other vaccine-preventable diseases such as polio, measles, rubella, diphtheria, and tetanus have been eradicated or have declined to only a few cases each year, pertussis has made a slight comeback. The number of cases began increasing in the 1980s and reached a level of 7000 to 8000 cases annually between 1996 and 2000 (see insert in Figure 1). There were 11,647 cases in 2003.

While these numbers are small compared with all cases that occurred in the prevaccine era, the increase is cause for public health concern.

**Why the increase in cases?**
Several possible causes could account for the increased incidence in reported pertussis. For one, the efficacy of the vaccine wanes with time after vaccination. Adolescents and young adults are left susceptible because, until recently, no vaccine has been available for persons after their 7th birthday. This, however, has been true for decades and does not explain recent increases.

The *Bordetella pertussis* bacteria may have genetically drifted to become less susceptible to vaccine-induced antibodies, or the apparent increase in cases could actually be just an increase in case detection.

It is also possible that the recent emphasis on avoiding unnecessary antibiotic use for respiratory infections has had the unanticipated consequence of decreasing previously fortuitous treatment of undiagnosed pertussis among older age groups.

**Unique features of this rebound**
The recent rise of pertussis displays several notable trends:
- Disease incidence now ebbs and flows in 3- to 4-year cycles
- The proportion of cases occurring among adolescents and young adults has increased. Table 1 shows the age breakdown of reported pertussis cases for 2001. Infants still account for the highest proportion of cases (29%) and the highest attack rates (55 cases per 100,000); but half of reported cases now appear in those age 10 years and older
- Nonimmunized or incompletely immunized infants are usually exposed to the disease by older household members, and not by same-age cohorts
- Since the disease presents as nonspecific cough in adolescents, it is often not diagnosed. The incidence is probably much higher than the reported number of cases would indicate.

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Revisit your approach to older patients

Clinical presentation of pertussis in an adolescent and adult is nonspecific. After an incubation period of 1 to 3 weeks, pertussis infection appears as a mild respiratory infection or the common cold.

After 1 to 2 weeks, the nonproductive cough can evolve into paroxysms of severe coughing (causing apnea), a posttussive inspiratory whoop, and vomiting. The inspiratory whoop and apnea are usually absent in previously immunized adults and adolescents. The cough gradually diminishes but can persist for up to 3 months.

**New tool in fight against pertussis now available**

Two products with tetanus toxoid—reduced diphtheria toxoid and acellular pertussis vaccines adsorbed (Tdap)—have been licensed for active booster immunization against tetanus, diphtheria, and pertussis as a single dose. BOOSTRIX (GlaxoSmithKline) is for persons aged 10 to 18 years, and ADACEL (Sanofi Pasteur) is for those aged 11 to 64 years.

The Advisory Committee on Immunization Practice of the Centers for Disease Control and Prevention (CDC) has recommended Tdap for universal use among adolescents aged 11 to 12 years, and may in the future recommend its use periodically for all adults.

**TABLE 1**

**Pertussis-related hospitalizations, complications, and deaths, by age group—United States, 1997–2000**

<table>
<thead>
<tr>
<th>AGE GROUP</th>
<th>NO. WITH PERTUSSIS</th>
<th>HOSPITALIZED NO. (%)</th>
<th>PNEUMONIA* NO. (%)</th>
<th>SEIZURES NO. (%)</th>
<th>ENCEPHALOPHY NO. (%)</th>
<th>DEATHS NO. (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&lt; 6 mo</td>
<td>7203</td>
<td>4543 (63.1)</td>
<td>847 (11.8)</td>
<td>103 (1.4)</td>
<td>15 (0.2)</td>
<td>56 (0.8)</td>
</tr>
<tr>
<td>6–11 mo</td>
<td>1073</td>
<td>301 (28.1)</td>
<td>92 (8.6)</td>
<td>7 (0.7)</td>
<td>1 (0.1)</td>
<td>1 (0.1)</td>
</tr>
<tr>
<td>1–4 years</td>
<td>3137</td>
<td>324 (10.3)</td>
<td>168 (5.4)</td>
<td>36 (1.2)</td>
<td>3 (0.1)</td>
<td>1 (&lt;0.1)</td>
</tr>
<tr>
<td>5–9 years</td>
<td>2756</td>
<td>86 (3.1)</td>
<td>68 (2.5)</td>
<td>13 (0.5)</td>
<td>0</td>
<td>2 (0.1)</td>
</tr>
<tr>
<td>10–19 years</td>
<td>8273</td>
<td>174 (2.1)</td>
<td>155 (1.9)</td>
<td>25 (0.3)</td>
<td>4 (0.1)</td>
<td>0</td>
</tr>
<tr>
<td>≥20 years</td>
<td>5745</td>
<td>202 (3.5)</td>
<td>147 (2.6)</td>
<td>32 (0.6)</td>
<td>3 (0.1)</td>
<td>2 (&lt;0.1)</td>
</tr>
<tr>
<td>Total</td>
<td>28,187†</td>
<td>5630 (20.0)</td>
<td>1477 (5.2)</td>
<td>216* (0.8)</td>
<td>26 (0.1)</td>
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</tr>
</tbody>
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*Radiographically confirmed.
†Excludes 92 (0.3%) persons of unknown age with pertussis.
‡Excludes one person of unknown age with seizures.


**FIGURE 1**

Number of reported pertussis cases, by age—1922–2000

Suspect pertussis in anyone who has had a cough for 2 weeks or longer, even without paroxysms and posttussive symptoms.

Infants exhibit more severe symptoms and suffer higher rates of complications, including severe apnea, hospitalization, seizures, secondary pneumonia, and death (TABLE 1).

Required laboratory confirmation

For any patient with suspected pertussis, obtain an aspirate of the posterior nasopharyngeal region or swab it for culture. The specimen can be collected by inserting a Dacron nasopharyngeal swab into the nostril to reach the posterior nares and leaving it in place for 10 seconds (FIGURE 2). If the specimen cannot be streaked onto a special enriched culture medium, place it in a special transport medium and refrigerate it until sent to the laboratory. Local or state health departments can often assist with obtaining the transport medium.

Polymerase chain reaction can be used to make a presumptive diagnosis but should be followed by culture confirmation. Direct fluorescent antibody testing of nasopharyngeal specimens and serologic testing for antibodies are not currently recommended as diagnostic tests by the CDC.

Four antibiotics available for treatment of pertussis

The CDC’s recommended medications, doses, and duration of treatment are listed in TABLE 2.

Treatment, if started within the first 2 to 3 weeks, can reduce symptoms and clear B pertussis from the nasopharynx, thus reducing transmission to others. The CDC recommends initiating treatment as soon as pertussis is suspected.

Erythromycin is the agent with the longest history of use and most evidence for effectiveness. Due to its duration of therapy, however, and to the incidence of gastrointestinal side effects, it is less attractive to patients and physicians than other options.

New outcome studies of other macrolides are promising. Most authorities believe azithromycin and clarithromycin...
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**FAST TRACK**

If started within the first 2 to 3 weeks, treatment can reduce symptoms and help prevent transmission to others.

**TABLE 2**

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<tr>
<th>AGE</th>
<th>AZITHROMYCIN (5-DAY COURSE)</th>
<th>ERYTHROMYCIN (14-DAY COURSE)</th>
<th>CLARITHROMYCIN (7-DAY COURSE)</th>
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<td>&lt;1 month</td>
<td>Recommended in this age group. 10 mg/kg/d in a single dose for 5 days</td>
<td>Not preferred due to association with pyloric stenosis. If used dose is 40–50 mg/kg/d divided in 4 doses for 14 days</td>
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<td>1–5 months</td>
<td>10 mg/kg/d in a single dose for 5 days</td>
<td>40–50 mg/kg/day divided in 4 doses for 14 days</td>
<td>15 mg/kg/d in 2 divided doses (maximum 500 mg/dose for 7 days)</td>
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<td>≥6 months</td>
<td>10 mg/kg/d in a single dose on day 1 then 5 mg/kg/d on days 2–5</td>
<td>40–50 mg/kg/day divided in 4 doses for 14 days</td>
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<td>Adults</td>
<td>500 mg single dose on day 1 then 250 mg on days 2–5</td>
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are acceptable alternatives and should achieve the same results as erythromycin.

Trimethoprim-sulfamethoxazole can be used for those older than 2 months, for those allergic to, or intolerant of, macrolides. The dose for children is 8 mg/40 mg per day in 2 divided doses for 14 days; for adults it is 320 mg/1200 mg per day in 2 divided doses for 14 days.

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**Preventing infection in family members and close contacts**

Those with pertussis are most infectious in the first 3 weeks of symptoms. The CDC recommends initiating chemoprophylaxis for all household and close contacts of those in whom pertussis is highly suspected or confirmed, regardless of the contacts’ age and vaccination status.

Close contacts are those with direct face-to-face contact with a symptomatic patient, or those who share a confined space for a prolonged period with the patient. Chemoprophylaxis is especially important for high-risk contacts: those under 1 year of age and those with chronic conditions that make them susceptible to complications from pertussis (eg, immune deficiencies, chronic lung disease, or cystic fibrosis).

Chemoprophylaxis has limited benefit if started beyond 3 weeks after exposure. The same antibiotics, doses, and treatment durations are recommended for chemoprophylaxis as for treatment.

Completion of a 4-dose series of pertussis-containing vaccine is also recommended for close contacts. This recommendation has historically pertained only to those before their seventh birthday. With the licensure of Tdap for adolescents and adults, this recommendation may soon include contacts through age 18 and could be expanded to include adults through age 64 in the near future.

**Preventing the spread of pertussis in your community**

Schools, day care centers, and health care facilities are all potential foci of spread of infection. During outbreaks the local public health department may implement guidelines at schools and day care centers that refer symptomatic staff and students to a physician for evaluation.

If you examine such a patient, perform a nasopharyngeal culture and initiate
Report any suspected cases to the local public health department; begin prophylaxis for family members and all close contacts.