UNIT NO. 4

PERTUSSIS

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ABSTRACT

Pertussis was a common childhood illness in the pre-vaccine era. With introduction of the vaccine in the national vaccination program, the incidence has fallen greatly. Worldwide there is a resurgence of pertussis in adults with transmission to infants. Pertussis booster is given in early childhood but not in adults because of the reactogenicity of the older pertussis vaccines. Newer vaccines have been developed with better tolerability profiles which can be considered for booster in adults.

EPIDEMIOLOGY AND ITS IMPACT ON STRATEGIES FOR PREVENTION

Pertussis immunization was introduced into Singapore's national vaccination program in 1959. In the pre-vaccine era, an average of 40 cases was reported in Singapore annually. With the introduction of pertussis vaccination, the number of cases reported annually has fallen to 1 case per year in the late 1990s. Many countries round the world are reporting a resurgence of pertussis despite immunization. Most of the cases are in infants and adults, with the adults being the source of the infection to the infants, as it is known that the protection against pertussis wanes with time. Transmission rates range from 25%-50% among unimmunized school contacts to as high as 70%-100% in household contacts. This has led to the consideration whether a booster should be given to adults to increase the herd immunity.

PATHOGENESIS

Pertussis is caused by the bacterium *Bordetella pertussis*. *Bordetella parapertussis* can cause a mild pertussis-like illness. Transmission is by inhalation of aerosol droplets produced by the patients during the catarrhal or paroxysmal phase. Patients who are past their third week of illness are generally noninfectious.

CLINICAL FEATURES AND DIAGNOSIS

The incubation period is about 7-14 days. The disease is divided into 3 stages: catarrhal, paroxysmal and convalescent.

The catarrhal phase which usually lasts for 1-2 weeks starts with symptoms of rhinorrhea, conjunctival injection, anorexia, listlessness and a hacking nocturnal cough that gradually becomes diurnal. The cough is initially not associated with fever and gradually increases in severity becoming paroxysmal.

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The paroxysmal phase persists for 1-4 weeks and is dominated by the severe, paroxysmal cough with the characteristic whoop at the end of the paroxysm. In young infants, vomiting,, choking spells and cyanosis can occur.

The convalescent phase usually starts 4-6 weeks after the onset of disease with a gradual decrease in the severity of the symptoms. A nonparoxysmal cough can persist for many months.

In adults, the disease is milder but is often long-lasting. Pertussis should be considered in an adult with paroxysmal cough or cough lasting longer than 7 days.

The complications are mostly respiratory in nature, such as asphyxia, bronchopneumonia, atelectasis, bronchiectasis and emphysema. Central nervous system complications can also occur resulting in encephalitis and convulsions.

There is a moderate leukocytosis of between 15,000 and 20,000/mm^3, usually with a lymphocytosis of 60%-80%. Cultures of nasopharyngeal specimens for *B. pertussis* are positive in 80%-90% during the catarrhal and early paroxysmal phases. The fluorescent antibody technique allows for rapid diagnosis but is not as sensitive or specific as cultures. No single serologic test has a high sensitivity and specificity. Multiple reports have indicated the polymerase chain reaction (PCR) assays are rapid, specific and sensitive methods for demonstrating *B. pertussis* from nasopharyngeal secretions.

Treatment is with macrolides given for 14 days. Alternatively, cotrimoxazole can be used. Treatment with Erythromycin during the catarrhal stage may ameliorate the clinical disease. Erythromycin is effective in eradicating the organism within 5 days. When given during the paroxysmal phase, it does not modify the course of the illness.

PREVENTION

Universal immunization of all young children is essential for the control of pertussis. The current National Immunization schedule for pertussis is at 3, 4, 5 months (primary series) and a booster at 18months. The pertussis vaccine can be given as the whole-cell or acellular vaccine and is usually given combined with diptheria and tetanus toxoid. However more combination vaccines are currently available.

Table 1. Clinical features of pertussis

History	Sensitivity	Specificity
Cough > 2 weeks	84% -100%	35% - 36%
Cough > 3 weeks	75% - 97%	51% - 59%
Whoop	37% - 90%	49% - 96%
Post-tussive vomiting	28% - 84%	45% - 84%
Paroxysms	68% - 94%	15% - 45%
Household exposure	20% - 50%	73% - 91%
Afebrile (Temp < 38°C)	62% - 96%	12% - 54%
Lymphocytosis	88%	

TYPES OF VACCINES AND ISSUES IN PERTUSSIS VACCINATION

There are two types of vaccines available.

Whole-cell vaccine

The first whole-cell vaccine came into use in the 1940s. All whole-cell pertussis vaccines are composed of a suspension of formalin-inactivated *B. pertussis* cells. They have a tendency to provoke transient local and systemic reactions. Local reactions include redness, swelling and pain at the injection site. Systemic reactions consist of fever and rarely more severe events such as seizures, hypotonic unresponsive episodes and encephalopathy. However, quantitative controlled studies published in the 1980s indicate there is no causative role of pertussis vaccine in SIDS, autism, infantile spasms or Reye's Syndrome.

Due to the reactogenicity of the whole-cell vaccine, local reactions occur more frequently with increasing doses. In some countries, no boosters were given after the primary series.

Acellular vaccine

Acellular vaccines contain purified and inactivated components of *B.* pertuss*is* cells and are less reactogenic. In a Swedish trial comparing whole-cell vaccine with three acellular vaccines containing 2,3 and 5 components, the whole-cell vaccine had the highest efficacy, whilst the 5 component vaccine was more protective against pertussis compared to the 2 and 3 component vaccines. These results suggest that the addition of fimbriae in the multicomponent vaccines have a significant role in protection against less severe infection. The optimal composition of acellular vaccines is still debated and it is not known which antigens are essential to ensure optimal efficacy.

Vaccine-induced protection lasts about 5-10 years. The recent resurgence in pertussis has been seen mainly in young infants, teenagers and adults. The proposed mechanism being infection in teenagers and adults due to waning of immunity with transmission of infection to infants who have not been immunized. With the development of acellular vaccines which are immunogenic but less reactogenic, booster may be considered for adolescents and adults. Currently, only France includes a booster dose for teenagers at 11-13 years in its official schedule.

There are only 2 absolute contraindications to receiving DPT:

- Anaphylaxis
- Encephalopathy that occurs within 7 days of receipt of dose of DPT, that is unexplained by another cause.

RECOMMENDED READING

Paediatric Respiratory Medicine by Taussiq and Landau.
Pediatric Drugs 2002;4(5): 299-313.

LEARNING POINTS

- **All children should be immunized against pertussis unless absolutely contraindicated.**
- **Whole-cell vaccines are more immunogenic compared to acellular vaccines.**
- **Acellular vaccines are less reactogenic and can be used for booster doses in teenagers and adults.**