UNIT NO. 3

PERTUSSIS

Dr Brenda Ang

ABSTRACT

Pertussis is mainly thought to be a disease affecting young children, but it can also affect adults and the elderly. While vaccination has largely reduced the incidence of pertussis compared to the pre-vaccine era, there has been an upswing in the incidence, and outbreaks continue to occur.

Keywords: pertussis, vaccination

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INTRODUCTION

Pertussis, otherwise known as 'whooping cough' is a highly contagious disease caused by the bacterium *Bordetella pertussis*. Humans are the only reservoir for *B. pertussis*.

Clinical presentation and outcome

Pertussis is a prolonged coughing illness with clinical manifestations that may vary by age. The initial stage may be insidious with the onset of runny nose, sneezing, mild occasional cough. Fever may be low grade or absent. The cough gradually becomes paroxysmal (after one-two weeks) and may end in vomiting, cyanosis, and/or characteristic high-pitched inspiratory 'whoop'. Infants are less likely to have the 'whoop' and may have more catarrhal stage, and are more likely to present with gagging, gasping, cyanosis, apnoea or non-specific signs such as poor feeding or seizures.

In adults or children partially protected by vaccination, illness may just be a mild cough, and may occur without the "whoop" sound. In adults post-tussive vomiting, is strongly suggestive of pertussis.[1]

Transmission

Pertussis is mainly transmitted by large droplet infection or direct contact with discharges from infected persons while indirect spread via fomites may occur. The incubation period ranges from 4-21 days, usually 7-10 days.

BRENDA ANG
Senior Consultant
Department of Infectious Diseases
Chairman, Infection Control Committee
Adj Assoc Prof LKC School of Medicine

Infectivity

Patients are infectious from the onset of catarrhal symptoms but infectiousness decreases as the disease progresses, and is negligible three weeks after onset of cough. Patients are thus generally considered non-infectious:

- 21 days after onset of any cough
- Four days after onset of paroxysmal cough (if known)
- After completing a five-day course of appropriate antibiotics

Complications

Complications can be related to the infection e.g. pneumonia, otitis media, neurologic complications[1] e.g. seizures, encephalopathy (more common among infants), anorexia, dehydration or mechanical sequelae of severe or prolonged coughing such as pneumothorax, epistaxis, subdural hematomas, hernias, rectal prolapse, rib fractures, urinary incontinence. Rarely, in older adults, vigorous coughing may cause intracranial haemorrhage or stroke.[1-2]

Diagnosis

Diagnosis can be done by obtaining a nasopharyngeal swab or aspirate and sending that for culture or Polymerase chain reaction (PCR) testing. Bacterial culture is the gold standard, but sensitivity may range from 20-80 percent though it is very specific (100 percent). PCR is more sensitive than cultures and is not affected by previous antibiotic use.

Treatment

Supportive care is the mainstay of management of patients with *Bordetella pertussis* infection. Attention should be given to hydration and nutrition and this may have to be done via nasogastric tube feeding or intravenous lines.

Patients should be hospitalised if they are very young <four months, if there is respiratory distress, or evidence of pneumonia, cyanosis or apnoea, or seizures.

Macrolides are highly effective at eradicating B. pertussis from nasopharynx, with azithromycin and clarithromycin as preferred choices.

Prevention

Pertussis vaccines prepared from whole *Bordetella pertussis* organisms were available from the 1940s through the 1990s, protecting infants who were two months of age or older.[3] Pertussis vaccination resulted in a marked decrease in the incidence of disease with diagnosed cases of pertussis reaching a nadir in 1976.

Whole-cell pertussis vaccines, when administered as part of a combined diphtheria, tetanus toxoids, and pertussis vaccine, were effective, but they were associated with adverse effects.[4] This led to the development of the diphtheria–tetanus–acellular pertussis (DTaP) vaccine.[5]

Beginning in the early 1990s, the United States started to make the transition from whole-cell pertussis vaccines to DTaP, and by the late 1990s, DTaP was being used for all five recommended doses. However, since the 1980s, despite high levels of vaccine coverage in children, outbreaks of *B. pertussis* have occurred every 3 to 5 years, with an increase in the peak incidence with each successive outbreak.[6]

Numerous studies have documented waning immunity following acellular pertussis vaccination.[7]

This waning immunity is likely a major contributor to the resurgence in disease and explains the large proportion of US pertussis cases occurring among fully vaccinated individuals.

Why then do we still recommend vaccination?

B. pertussis is highly contagious, and with significant morbidity, and even mortality in extreme of age groups.

Vaccination though does not completely eradicating pertussis, it does reduce the incidence of disease. Immunisation has also been shown to reduce the severity of symptoms and complications. This was previously shown with the whole cell vaccine, and a more recent study has also shown this to be true with acellular vaccine.[8]

Despite infant vaccination programmes with high coverage rates in developed countries, many of them have continued to experience pertussis outbreaks. This is partially due to decreases in natural immunity as well as waning immunity in the population following vaccination, as discussed above.

The overwhelming majority of morbidity and mortality of pertussis occurs in children who are three months or younger. Pertussis can be very severe in the very young child, who is at greatest risk of developing serious complications such as pneumonia, seizures or brain damage, any of which could ultimately be fatal.

Thus, it is imperative to try and prevent disease in all, especially infants. However, immune systems in newborns cannot create antibodies until they are two months old so immunisation of children starts at either second or third month.

Protecting infants

Adults (either parents or caregivers) can be a source of infection to children and infants. Thus, two vaccine strategies have been proposed to protect infants.

In 2006, the Advisory Committee on Immunization Practices (ACIP) recommended that all adolescents and adults be vaccinated with a single dose of Tdap, emphasizing the importance of vaccinating adults in close contact with young infants.

This first strategy (cocooning) targets mothers, fathers, and other infant caregivers for vaccination to create a protective "cocoon" around vulnerable infants, with the goal of interrupting pertussis transmission from infected adults.

The second involves vaccinating pregnant women, which directly protects through the passive transfer of pertussis antibodies. This approach, started in 2011 when ACIP recommended giving Tdap for pregnant women who had not been previously immunised.[9]

In 2013, it was updated with the recommendation for vaccination for each pregnancy, preferably between 27-36 weeks of gestation. This approach has been supported by the American College of Obstetricians and Gynaecologists,[10] Centres for Disease Control, and adopted by Ministry of Health (MOH) in 2017.

Protecting the Elderly

Because pertussis is mostly thought of as a disease of children, the diagnosis is often not suspected, and relevant tests not ordered. There is thus a considerable underestimation of the pertussis burden amongst older adults and a very limited number of epidemiological studies in these age groups. Seroprevalence studies consistently demonstrate that the reported incidence may be much lower than the actual incidence.

Although generally not severe in adults as compared to children, pertussis can be associated with complications in patients with chronic conditions such as asthma, chronic obstructive pulmonary disease, high BMI, or extreme of age. Adults older than 65 with pertussis are also more likely to be hospitalised than those in 45-64 age group.[11]

The elderly is vulnerable to severe infections and even death. There has also been mortality reported, and with some cases dying of intracranial haemorrhage from prolonged coughing.[12] As the global population ages, the health and economic burden of the disease is expected to rise. There are considerations for recommending extending vaccination to adults, especially the elderly and those with risk factors for severe disease. In addition, some thought should be given to decreasing childhood pertussis infection through vaccination of the elderly especially if they are caregivers for young children.

Immunization of Health Care Workers

Health care workers are a priority group for vaccination because of their increased risk of acquiring infection and the potential to transmit pertussis to high-risk patients, such as children and infants, as well as to the elderly. Recognising this, in September 2018, MOH has updated recommendations for DTP to all HCWs, and not only for those managing children.

Summary

Pertussis is a contagious respiratory infection, with severe consequences especially in the extreme ends of the age spectrum.

Pertussis should therefore be considered in the differential diagnosis of cough illnesses lasting more than one - two weeks especially in patients who may not have had updated immunisations.

Vaccination with acellular vaccines has reduced adverse outcomes, but neither natural infection nor vaccination provides lifelong protection against pertussis.

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LEARNING POINTS

- **Pertussis is a highly infectious bacterial disease spread by respiratory droplets.**
- **It can cause severe disease and death at both ends of the age spectrum.**
- **Immunity (either through natural infection or immunisation) is not long-lasting.**