A search for subclinical infection during a small outbreak of whooping cough: implications for clinical diagnosis

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SUMMARY. The transmission of whooping cough in a general practice community was followed after the identification of the first case for nearly three years. Intensive case-finding was undertaken to detect contacts of known cases of whooping cough and to take pernasal swabs from those with any cough; 102 swabs were taken. In three months 39 cases of whooping cough were clinically diagnosed, 17 (44%) of which were confirmed bacteriologically. All had a prolonged paroxysmal cough, one-third reported a catarrhal phase, 18 (46%) vomited with paroxysms and nine (23%) whooped. No isolations of Bordetella pertussis *were obtained from the 84 contacts with non-paroxysmal coughs. There was no evidence that subclinical bordetella infection (showing none of the signs of whooping cough) is a common occurrence.*

It is probable that many recognizable cases of whooping cough are missed because it can be a milder illness than is often realized and commonly exhibits neither whooping, vomiting nor a catarrhal phase. Paroxysms may be infrequent. The diagnosis of whooping cough should be suspected from a prolonged paroxysmal cough alone.

Introduction

WHOOPING cough is typically described as an illness that starts with a seven- to 10-day catarrhal phase, merging into a one- to four-week paroxysmal phase followed by a convalescent phase.[1] It has been known from early studies, before there was effective immunization, that the spectrum of severity was wide and that about a quarter of the population appeared to acquire immunity without developing clinical whooping cough, presumably as a result of missed or atypical infection.[2] Asymptomatic infection is rare[3] but the occurrence of mild or abortive cases is recognized.[1,2] Over recent years the case fatality rate has decreased markedly and hospital admissions have declined with respect to notifications of the disease.[4] It has also been suggested that the disease is less severe than it was previously.[5,6]

It is possible that the clinical features of the disease have diminished at the same time as the severity so that the resultant illness would not be clinically distinguishable from other respiratory infections. We have called such putative cases 'subclinical whooping cough' because the signs and symptoms would indicate a different diagnosis. If subclinical infection were common this would alter one of the main assumptions made when balancing the risks and benefits of immunization, namely that most children are at risk of getting clinical whooping cough unless immunized. We were unaware of any previous systematic search for *Bordetella pertussis* infection in contacts of the disease with coughing illnesses showing none of the characteristics of whooping cough.

Method

The population studied is geographically discrete with 11 500 patients almost exclusively registered with one practice. Every case of whooping cough since 1977 has been studied and some of the data collected have already been reported.[7,8]

No whooping cough had been seen at the practice since October 1982. In July 1985 one child with the clinical signs of whooping cough was identified and this was subsequently confirmed bacteriologically. The source of his infection was unknown. Pernasal swabs were taken from family and social contacts of this and subsequent patients who had any cough.

Because of media publicity at the time (mid-1985) many parents knew of an impending epidemic of whooping cough. After it became known that there were confirmed cases in the village it was a relatively easy matter to pass the word around parents of contacts, teachers, playgroup leaders and the school nurse that children with a cough, who had been in contact with whooping cough cases could have a swab taken at the health centre to test for the disease. This process was monitored by one of us (J.D.P.) by making direct inquiries of parents of close classmates and playmates of known cases. We checked their medical records for recent consultations for coughs and examined class lists and seating positions.

Each patient found with a cough was seen by one of us and a pernasal swab taken which was immediately placed in transport medium; swabs were kept at room temperature and usually transported to the laboratory within 24 hours. None of the patients had a previous history of whooping cough. The progress of the patients was followed personally or by telephone until the outcome was clear. If whooping cough was suspected clinically the patient was examined by a doctor, a 10-day course of erythromycin prescribed and advice given to avoid contact outside the family for seven days. During the survey period children with respiratory problems requiring antibiotics who were not considered to need swabs taken were given amoxycillin if possible.

The immunization status of the children with whooping cough was confirmed from the records. It was not usually possible to establish the immunization status of the adults because of inadequate recording.

This intensive case-finding was continued for a period of three months.

Results

Over the period of three months swabs were taken from 102 patients (one was lost). The age distribution of patients and their immunization status is shown in Table 1. Seventeen swabs were positive for *Bordetella pertussis;* all patients found to be culture positive developed a paroxysmal cough that lasted at least three weeks. Of the 84 patients with negative swabs 16 had clinical signs of whooping cough. Half the swabs were taken within 10 days of the first symptoms appearing and two-thirds within 15 days; these proportions were the same in the whooping cough

Table 1. Age distribution and immunization status of the 101 patients with cough from whom pernasal swabs were taken. Number of patients with swabs positive for *Bordetella pertussis* is shown in parentheses. The age distribution of practice immunization rates is also shown.

Age (years)	Number of patients: Immunized	Immune status unknown	Not immunized	Practice immunization rate (%)
<1	0	–	5 (2)	–
1	2	–	3	*91*
2	6	–	2 (1)	*89*
3	13	–	0	*86*
4	1	–	5	*83*
5	5 (1)	–	2 (1)	*81*
6	9 (2)	–	5 (2)	*60*
7	6	–	2	*60*
8	5 (1)	–	9 (2)	*40*
9	1	–	2 (1)	*31*
10	0	–	1 (1)	*55*
12	–	1	1	*75*
15	–	–	1	*95*
Over 20	1	13 (3)	–	–
Total	49 (4)	14 (3)	38 (10)	–

and non-whooping cough groups. In addition, there were a further six patients who had clinical disease but had no swab taken, making a total of 39 patients in the practice with clinical whooping cough.

Of the 39 patients with whooping cough, nine (23%) whooped, 18 (46%) vomited after paroxysms and about one-third reported a catarrhal phase. Those without a catarrhal phase started with the paroxysmal phase and this became virtually fully developed within three or four days. Of the 17 patients with positive swabs, five (29%) whooped and 10 (59%) vomited. Many children were not considered by their parents to be ill enough to require medical advice, but they were brought to the surgery because other people suggested they should be checked. Most parents never suspected their child could have whooping cough even when the disease was at its height.

In the course of the study six swabs were taken from asymptomatic contacts. The swabs were all negative for bordetella, none of the patients developed any symptoms and these figures have not been included in the main results.

Discussion

A clinical diagnosis of whooping cough was easy to make, even though it was usually retrospective. There was a clear dividing line between those patients considered to have whooping cough, who had a paroxysmal cough for three to six weeks and the remainder, who had no paroxysmal cough at all. The doctor did not usually hear the children coughing but the parents' description was sometimes almost pathognomonic: for example, 'Waking in the night coughing until he seemed to lose his breath'. A little known feature we have found useful when making a clinical diagnosis is that when the paroxysmal phase is established coughing is almost always exclusively paroxysmal.

The validity of the clinical diagnosis was reaffirmed by the fact that the frequencies of whooping and vomiting were similar in the groups with positive and with negative swabs. In addition, the source of infection was identified in almost all cases from contact with a known case.

Bordetella pertussis is a difficult organism to isolate. Williams' recent large series succeeded in isolating it in 905 out of 2295 (39%) cases of whooping cough in South Wales.[9] In the present study the organism was isolated in 17 out of 39 cases (44%), although 52% of the swabs taken were positive. This was because in six cases no swab was taken, and whooping cough was diagnosed only when the patient was almost recovered, the case having been brought to light when a sibling or other contact was diagnosed or after a holiday. It might be that bordetella is more likely to be isolated in severe infection and would not be detected in the presence of minor symptoms if the organism were only present in small numbers or for a short time. If so, such patients are probably an unimportant factor in transmission of the infection in the community. Bordetella is more likely to be isolated in the early stages of the illness, but there was no difference in timing between swabs taken from whooping cough patients and from the others.

The age distribution of the cases of whooping cough is atypical since the immunization pattern in the practice (Table 1) resulted in the highest numbers of susceptible individuals being in the six- to 10-year-old group. Older children can be expected to have milder disease and the symptoms have to be interpreted with this in mind. Nevertheless, the fact that only nine patients (23%) whooped and that two-thirds apparently had no catarrhal phase suggests that the classic textbook picture of whooping cough is misleading and may inhibit clinical detection of the disease. This might place contacts at greater risk since there is no opportunity to limit the spread of infection by quarantine or antibiotics, even though the value of these measures is speculative.

The fact that, in the parents' eyes, many of our cases were not serious enough to be brought to the doctor seemed to be a result of publicity emphasizing the severity of the disease. Many of the patients had only three or four paroxysms in 24 hours. The existence of a broad spectrum of severity of whooping cough needs to be better known by lay persons and professionals.

We believe that if it were more widely known that the paroxysmal cough, predominantly at night and lasting at least three weeks, may be the only constant feature of *Bordetella pertussis* infection, it could be identified clinically more often. It is probable that many recognizable cases of whooping cough are being missed.

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