PAPERS AND ORIGINALS

Severity of notified whooping cough

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Summary

An analysis was made of the severity of over 8000 cases of whooping cough notified from October 1974 to March 1975. Ten per cent of these patients were admitted to hospital and there were 10 deaths. Severity was directly related to age, the disease being most severe in children under 1 year, especially those under 6 months. There was some evidence that previous vaccination reduced the severity of the disease, but the vaccination programme does not cover very young children, and for them whooping cough is a dangerous disease.

Introduction

In view of the recent controversy over whooping-cough vaccine, we conducted a study into the severity of notified cases of whooping cough to assess the degree of hazard which the disease now presents.

Methods

In June 1974 the district community physicians and specialists in community medicine in 98 area health authorities (AHAs) were asked to send a copy of each whooping-cough notification they received to the Epidemiological Research Laboratory (ERL). The ERL then sent to each doctor who notified a case a form on which to record the severity and duration of the illness, admission to hospital, and any information on vaccination. For patients admitted to hospital a summary of the case or the original records were requested.

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Results

Ninety-four of the 98 AHAs approached took part. Between 1 October 1974 and 31 March 1975 10 145 cases of whooping cough were notified to the Registrar General from the 94 AHAs and the ERL received copies of 8263 (81%) of these. Another 970 notifications received by the ERL before 1 October were also included in the analysis. Forms were sent out requesting details of these 9233 cases, and 8229 (89%) were returned. In 137 cases the condition was found not to be whooping cough, and 8092 cases were left for analysis. The age distribution of the cases we surveyed followed closely the national pattern (table I).

A summary of the severity of illness according to age is shown in table II. Almost 10% of the patients were admitted to hospital, and this proportion was directly related to age: 60% of patients aged under 6 months were admitted compared with 3% of those aged over 3 years.

PATIENTS TREATED AT HOME

Severity—In the 7317 patients treated at home the severity of the illness was assessed by the general practitioner. The proportion considered severely ill was again directly related to age: 10% of those under 6 months had severe whooping cough compared with 2% of those over 3 years (table II). In contrast, the proportion of mild cases increased considerably in children over the age of 1.

Complications—In 77% of cases no associated symptoms or complications were reported. Bronchitis, which occurred in 20% of cases, was the most common. Complications were again related to age and were reported in 31% of children under 6 months compared with 17% of children over 5 years. Only four patients had convulsions. One child died (see table IV; case 10).

Length of illness—The average duration of illness was four and a half weeks. About 86% of children were ill for two to six weeks and nearly 8% were ill for over eight weeks. There was little difference in the various age groups.

HOSPITAL ADMISSIONS

In 806 of the cases notified to the ERL the patients were admitted to hospital and the records or a summary were received for all but 12 patients.

Diagnosis—Nineteen patients were subsequently considered by the consultant not to have whooping cough and they were excluded from the analysis. In a further 38 cases the diagnosis was considered doubtful but these cases were included. There was thus full agreement on

TABLE I—*Age distribution of all patients notified to Registrar General (from 98 AHAs) and those reported to ERL (from 94 AHAs)*

Age:	Months		Years					
	≤5	6-11	1	2-4	5-9	≥10	Not stated	Total
No (%) of total notifications ..	527 (5)	922 (9)	1071 (10)	3550 (34)	3474 (33)	846 (8)	102 (1)	10 492
No (%) of cases notified to ERL ..	531* (6)	696 (8)	858 (10)	2779 (34)	2689 (33)	626 (8)	84 (1)	8263

*A few hospital cases that had not been notified to the Registrar General were reported direct to the ERL.

TABLE II—*Number of patients admitted to hospital and degree of severity in home cases according to age. Results are numbers (percentages) of patients*

Age	Total No of cases	No (%) of hospital admissions	Home cases				
			No of cases	Severe	Moderate	Mild	Not stated
≤5 months	545	325 (60)	220	21 (10)	99 (45)	98 (45)	2 (1)
6-11 months	674	187 (28)	487	34 (7)	207 (43)	232 (48)	14 (3)
1-2 years	1645	153 (9)	1492	44 (3)	493 (33)	941 (63)	14 (1)
3-4 years	1920	55 (3)	1865	32 (2)	560 (30)	1242 (67)	31 (2)
≥5 years	3237	55 (2)	3182	71 (2)	980 (31)	2089 (66)	42 (1)
Not stated	71		71	3 (4)	16 (23)	51 (72)	1 (1)
Total	8092	775 (9·6)	7317	205 (3)	2355 (32)	4653 (64)	104 (1)

TABLE III—*Proportion of notified patients in each age group admitted to hospital*

Age:	<3 months	3-5	6-8	9-11	1 year	2	3-4	≥5
% Of patients admitted	75	54	33	19	12	6	3	2

the diagnosis between the hospital and the general practitioner in 737 of the 775 cases on which the hospital analysis was based. *Bordetella pertussis* was isolated from 31% of the 555 patients from whom a pernasal swab or a cough-plate was taken; lymphocytosis was present in 83% of the 532 patients in whom the result was recorded.

Reason for admission—Eighty-seven per cent of the 775 patients were admitted to hospital because of the severity of the illness. In 7% there were additional medical factors such as congenital heart disease, prematurity, and asthma. In 4% admission was partly for social reasons; this was most common in children over 5 years (9%) and least common in infants under 6 months (3%). In 1% the admission was for both additional medical and social reasons. The most common reason for admission was the increasing severity and frequency of the paroxysms of coughing, particularly when accompanied by vomiting, cyanosis, or apnoea.

Age—Table III shows the proportion of notified cases in each age group admitted to hospital. The proportion was greatest in children under 3 months (75%) and in children of 3 to 5 months (54%); it was halved between the ages of 6 and 11 months and decreased considerably over the age of 1 year. The oldest patient admitted was a man of 76 who developed a paroxysmal cough, presumed to be whooping cough caught from his grandchildren.

Deaths—Nine patients died, six during the acute phase of the illness, two within three weeks of apparent recovery, and one nine months after the initial attack. The six children under the age of 6 months who died in hospital were recorded as having a family contact with whooping cough. None of the children who died had been vaccinated (table IV).

Assessment of severity—The severity of the disease was assessed at the ERL from the symptoms recorded on admission and the subsequent course of the illness. Forty-five patients (6%) were considered to be critically ill; these included 27 children who needed intensive care. Others in this category suffered from respiratory arrest, cardiac failure, dehydration, repeated apnoeic attacks, inability to feed, and inhalation of vomit. Thirty-nine of these children eventually recovered. All but three of those critically ill were less than 6 months old, and all but one—an 8-year-old—were unvaccinated. Severe illness was assessed from the description of the frequency and severity of the paroxysmal cough associated with vomiting and the presence of cyanosis or apnoea, or both. We judged 341 children (44%) to be severely ill. This percentage did not vary much with age (48% of those under 6 months compared with 40% of those over 5 years).

Complications—At least one associated symptom or complication occurred in 78% of patients admitted. Complications included vomiting in 41% of cases, cyanosis in 32%, bronchitis in 19%, pneumonia in 18%, apnoea in 5%, convulsions in 4%, and dehydration in 1%. There were also a few cases of hernia, sub-conjunctival haemorrhage, and gastroenteritis. Three children became temporarily unconscious. A further two developed encephalitis; one was a critically ill 8-week-old baby and the other was a 1-year-old child who had recovered from whooping cough at home five weeks earlier. The cause of this second case remained in some doubt. Both children, who were unvaccinated, recovered—apparently without sequelae. Cyanosis and apnoea occurred more often in young infants: 42% of children under 6 months were cyanosed and 6% had apnoea. Bronchopneumoni caused six of the 10 deaths, but the incidence of pneumonia among all hospital cases was only 19%. The severity of the illness was due more often to the actual symptoms of pertussis: the paroxysmal cough with associated vomiting and cyanosis.

Treatment—The variety of drugs used suggested that no drug had a specific effect on whooping cough, although frequent suction, oxygen, and nursing in a damp atmosphere alleviated symptoms. In several cases the severity and frequency of the vomiting made intravenous or tube feeding necessary. In contrast, patients who developed or were suspected of having pneumonia usually responded rapidly to antibiotics and the only prolonged cases were those in which one or more lobes collapsed.

Period in hospital—Patients' stays in hospital ranged from one week (24%) to over four weeks (11%); 7% were readmitted shortly after discharge. The mean period in hospital was 15·2 days, varying from 17·8 in children under 6 months to 13·8 days in children over 5 years.

VACCINATION

Details of vaccination are given in table V. The likelihood of any child under 1 year being fully vaccinated under the current recommended schedule is small, and among the 674 children aged 6-11 months who should have been vaccinated 64% were unvaccinated. Using admission to hospital as the criterion of severity, the percentage of fully vaccinated children was much lower, in all age groups, among those admitted to hospital than among those treated at home. The overall difference was statistically significant well beyond the 0·01% level (using Cochran's method for combining the results of the 2 × 2 contingency tables at each age). This comparison indicated that previous vaccination reduced the likelihood of a severe attack. As vaccination is now rarely completed until after the age of 1 year, its effects on the severity of whooping cough should have been most evident in 1 to 2-year-old children. These children were born after the last epidemic in 1971 and such protection they do possess might reasonably be attributed to vaccination. In this age group the numbers admitted to hospital and those severely ill at home were again less among the fully vaccinated than among the unvaccinated children (table VI).

TABLE IV—*Details of patients who died*

Case No	Age (months)	Illness	Date of death	Necropsy report
1	1	10 Day's cough, 4 days' hospital, family contact	31 Oct 1974	Bronchopneumonia
2	1	11 Days' cough, 3 days' hospital, family contact, premature baby	16 Feb 1975	Whooping cough
3	1	21 Days' cough, 2 days' hospital, family contact, post-mature baby	21 March 1975	Whooping cough, bronchopneumonia
4	2	10 Days' cough, 2 days' hospital, family contact	26 Oct 1974	Bronchopneumonia
5	3	Bronchitis 3 weeks earlier, 2 days' hospital, family contact, premature baby	3 Nov 1974	Bronchopneumonia
6	5	7 Days' cough, 5 days' hospital, family contact, premature baby	30 Sept 1974	Bronchopneumonia
7	13	Whooping cough Feb 1974, cough and vomiting persisted, admitted to hospital Nov 1974	8 Nov 1974	Collapsed mid-lobe, laryngotracheitis
8	2	Hospital for 3 weeks with whooping cough, died at home 2½ weeks after discharge	1 Jan 1975	Bronchopneumonia
9	6	Clinical whooping cough before admission, nearly recovered, admitted to hospital for diarrhoea, died at home 5 days after discharge	15 Dec 1974	Gastroenteritis
10	10	Colds and coughs since birth, whooping cough early March 1975, recovering when seen on 14 March 1975 by GP; found dead in cot 3 weeks later (never admitted to hospital)	6 April 1975	(1) Sudden death in infancy, (2) pneumonitis

TABLE V—*Degree of vaccination in patients admitted to hospital and those looked after at home. Results are numbers (percentages) of patients*

Age	Hospital admissions					Home cases				
	No of cases	Fully vaccinated	Partially vaccinated	Not vaccinated	Not known	No of cases	Fully vaccinated	Partially vaccinated	Not vaccinated	Not known
≤5 months	325	0	4 (1)	319 (98)	2 (1)	220	9 (4)	12 (5)	184 (84)	15 (7)
6-11 months	187	1 (1)	15 (8)	154 (82)	17 (9)	487	38 (8)	79 (16)	279 (57)	91 (19)
1-2 years	153	10 (7)	19 (12)	94 (61)	30 (20)	1492	452 (30)	159 (11)	485 (33)	396 (27)
3-4 years	55	14 (25)	1 (2)	24 (44)	16 (29)	1865	852 (46)	114 (6)	348 (19)	551 (30)
≥5 years	55	14 (25)	2 (4)	25 (45)	14 (25)	3182	1520 (48)	220 (7)	505 (16)	937 (29)
Not stated	—					71	30 (42)	6 (8)	7 (10)	28 (39)
Total	775	39 (5)	41 (5)	616 (80)	79 (10)	7317	2901 (40)	590 (8)	1808 (25)	2018 (28)

TABLE VI—*Severity of illness in 1 to 2-year-olds according to vaccination state*

	No of cases	No (%) admitted to hospital	No (%) treated at home*		
			Severe	Moderate	Mild
Fully vaccinated	459	10 (2)	4 (0·9)	111 (24)	334 (73)
Unvaccinated	575	94 (16)	28 (5)	214 (37)	239 (42)

*Excluding those in whom the degree of severity was not known.

Discussion

This survey has shown that in young infants whooping cough is still dangerous. No less than 60% of patients aged under 6 months were admitted to hospital and the proportion was even greater in those under 3 months. Half these children were severely ill. The crucial factor was seldom the development of pneumonia, which usually responded rapidly to antibiotics, but the paroxysmal cough and vomiting associated with the primary condition, for which no specific cure is available and which often required intensive care and constant nursing surveillance. Among children under 1 year there were nine deaths. Clearly the urgent problem remains the prevention of whooping cough in very young infants who are not directly protected by the current vaccination regimen. Over the age of 3, although it might be troublesome and sometimes last for several weeks, whooping cough was rarely severe. Apart from age, the other important influence was vaccination. Although the survey was not designed to assess the protection from vaccine, clearly at all ages previous vaccination reduced the severity of the disease.

The mortality of notified whooping cough—1 per 1000 notifications—has not changed over 20 years, but notifications have progressively decreased. Nevertheless, in a short period of six months during the smallest outbreak ever recorded over 800 of the patients notified were admitted to hospital and many of them required highly skilled care. If there were larger outbreaks of whooping cough the numbers of children needing hospital treatment would inevitably constitute a serious problem.

The survey was limited both by its dependence on notified cases and by the fact that only the immediate effects of the attack could be recorded; an attempt will be made to follow up the serious cases. Although the coverage of notified cases was reasonably comprehensive (the AHAs sent copies of 81% of their notifications and 89% of doctors completed inquiry forms), nothing is known about the severity of those cases that escaped notification. Even if all such cases were mild, however, although the proportions severely ill would be different, the actual numbers admitted to hospital would not decrease. The conclusion is inescapable that whooping cough remains a serious disease in young infants.

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