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A New Look at Infectious Diseases

Whooping Cough

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Whooping cough is a syndrome characterized by spasmodic coughing and often associated—at the end of a paroxysm—with a high-pitched inspiratory crowing sound or whoop. This infectious disease has long been recognized as a serious and potentially fatal illness of young children, particularly those below the age of 6 months, who may suffer temporary or permanent disability—and sometimes death—from apnoeic attacks, collapse of the lung, bronchopneumonia, or encephalopathy. Though the prevalence and fatality rate have declined considerably recently, whooping cough still remains a serious event in the life of a young child. Cases arise at any time of the year and outbreaks occur from time to time, often at intervals of two years and usually during the winter months. Whooping cough is a notifiable infectious disease.

Aetiology

Bordetella pertussis and the antigenically related *Bord. parapertussis* have generally been accepted as the causal organisms, though in recent years many authors have claimed that an identical clinical syndrome may arise after infection with certain viruses—particularly some adenoviruses, parainfluenza viruses, and respiratory syncytial virus. Probably whooping cough is a syndrome which may have a multiple aetiology; epidemics may be more related to infection with *Bordetella pertussis*, than to other causes and a variety of viruses may be able to produce sporadic cases. Progress with a scheme of immunization against the pertussis organism might be expected to reduce or abolish the component due to that organism and would thus clarify the part played by viruses in much the same way that glandular fever, in its anginose form, was more easily diagnosed in the absence of faucial diphtheria and virus croup was more easily recognized after the disappearance of laryngeal diphtheria.

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Clinical Features

The incubation period varies between seven and 14 days. The disease runs a protracted course, an initial catarrhal stage with vague respiratory symptomatology being followed by a better defined paroxysmal stage.

CATARRHAL STAGE

The illness begins like a persistent common cold with mild fever and a dry cough. As the days pass the cough increases in severity and starts to produce mucus. The coughs then become grouped together and may be followed by vomiting. These indefinite symptoms may continue for one or two weeks. The obvious difficulty in establishing a clinical diagnosis at this stage is unfortunate in that this is the most infectious period of the illness and measures which might help to prevent the spread of the disease are unlikely to be taken until it is too late for them to be effective.

SPASMODIC STAGE

The catarrhal phase merges gradually into the spasmodic stage and now the clinical picture is dominated by bouts of explosive, grouped coughs followed by the characteristic whoop. During a paroxysm of coughing the child becomes extremely distressed and frightened; the face is first red and then cyanosed, tears stream from the eyes, and mucus and saliva dribble from the mouth. After a variable number of coughs, often between 10 and 30, the glottis—which has been in spasm—relaxes and the sudden intake of air is accompanied by the high-pitched "whoop." There may be a whole succession of "coughs and whoop" before the child finally vomits or coughs up stringy mucus. Thereafter he settles for a time and often, quite exhausted, falls asleep.

The daily number of spasms is an index of the severity of the disease, up to 20 or more being not uncommon. Paroxysms may be initiated by many extraneous factors such as loud noises, emotional incidents, or even another child coughing. The typical paroxysms are often absent in young infants,

while the occurrence of complicating pneumonia may temporarily suppress the spasms, though they may return with recovery.

COURSE OF THE ILLNESS

The duration of illness is variable, but in severe cases the spasmodic stage may last up to four weeks or more. The first indication of recovery is a reduction in the number and in the severity of the spasms. The whoop disappears and vomiting subsides; coughs return to the grouped type before becoming single and finally disappearing altogether. Some children, however, seem to be able to produce coughing and even whooping at will long after the disease has settled—clearly a habit spasm produced so that they may receive extra attention. Most cases of whooping cough will have recovered by four to six weeks, and thereafter the improved appetite rapidly makes good any deficiencies in nutrition produced by the disease.

Complications

PRESSURE EFFECTS OF PAROXYSMS

The build-up of pressure during a paroxysm may induce certain complications, the most common of which are epistaxis, subconjunctival heamorrhage, umbilical herniation, and prolapse of the rectum. Rarely, subcutaneous emphysema, pneumothorax, and cerebral haemorrhage may occur.

RESPIRATORY SYSTEM

Bronchopneumonia is usually the result of secondary infection with *Haemophilus influenzae* and pneumococcus, and less frequently with streptococcus and staphylococcus. It is the most serious respiratory complication, but with appropriate antibiotic therapy, the outlook is now much better. Lobar or segmental atelectasis is common and mainly affects the lower lobes, the right middle lobe, and the lingular segment of the left upper lobe. It is due to blockage of the bronchioles with mucopus, and is not usually detected clinically but may be found frequently on routine radiographical examination. The atelectasis may be fleeting but sometimes persists for many weeks or even months; most cases eventually recover, apparently completely, and it is doubtful whether whooping cough is a precipitating factor in bronchiectasis in later life.

CENTRAL NERVOUS SYSTEM

The neurological changes which arise in whooping cough most probably result from cerebral anoxia. The most common clinical manifestation is the occurrence of convulsions; these are usually generalized and may be transient and without sequelae, or may be repeated producing a condition resembling status epilepticus. These repeated convulsions always have a serious prognosis and may end fatally; occasionally, recovery may take place but at the expense of permanent neurological sequelae.

OTHERS

Otitis media, which was once a common complication, seems nowadays to occur less frequently. Gastroenteritis was also common, probably as a reflection of the susceptibility of a debilitated child to infection, but now occurs only rarely.

Diagnosis

The diagnosis of whooping cough is usually made on clinical grounds, but this may prove difficult in the catarrhal stage of the illness. *Bord. pertussis* may be isolated either from a pernasal swab or on a cough plate, the former being the method more commonly used. The swab should be taken immediately after a paroxysm. Rates of isolation are very variable from centre to centre, and unless the bacteriologist has a special interest in the subject, bacteriological confirmation of a clinical diagnosis may not readily be forthcoming.

The result of the white blood cell count may be helpful from the second week onwards, for it is often appreciably raised, counts of between 20,000 and 60,000 cells/mm^3 being not uncommon; there is also an absolute and a relative lymphocytosis. More rarely, leukaemoid reactions, with cell counts up to 150,000/mm^3 are encountered. The erythrocyte sedimentation rate is normal in uncomplicated whooping cough but is increased in complications due to secondary infecting organisms. Complement-fixing antibodies are present from the third week of illness but are of value only as a retrospective method of confirmatory diagnosis.

Management

CURATIVE TREATMENT

The multiplicity of remedies that have been used in whooping cough, many of them in the folk-lore category, are adequate testimony to the ineffectiveness of most. In an uncomplicated attack the nursing of the affected child is the most important consideration and usually this will be best carried out by the mother in the patient's own home. The disease is a frightening one, however, for mother as well as child, and admission to hospital may be sought solely for this reason.

NURSING MEASURES

The young child requires close supervision by day and night. In the home the mother should sleep in the same room as the child, and in hospital a microphone system should be part of the equipment in a cubicle used for whooping cough. Whenever a spasm develops, the nurse or mother should immediately lift the child from the cot and should hold him or her in the head-down position, patting the back until the spasm is over. Otherwise there is a danger of suffocation from the inhalation of secretions and vomit. Older children usually manage to cope and, especially in the later stages of the illness, may be allowed up and even out of doors.

Feeding often presents a real problem and the rule should be to give small feeds frequently and preferably after a spasm. Crummy food such as biscuits should be avoided, and milk forms an important part of the diet. In severe cases, nursing in an oxygen tent may reduce the frequency of the spasms.

DRUGS

The course of whooping cough is unlikely to be influenced by drug therapy. In particular, antispasmodic agents are quite ineffective since spasm of smooth muscle is not a feature of the disease. A small dose of a sedative such as phenobarbitone seems rational, but it is difficult to achieve a dose that combines effectiveness with maintenance of the cough reflex, which obviously should not be depressed over-much.

Antibiotics play little part in the treatment of uncomplicated whooping cough; if they are to have any effect at all they must be prescribed early in the illness and this, of course, is just the time when diagnosis is most difficult. *Bord. pertussis* is sensitive in vitro to tetracycline, ampicillin, and chloramphenicol, and of these ampicillin is the antibiotic of choice in the young child.

TREATMENT OF COMPLICATIONS

Bronchopneumonia is a clear indication for antibiotic therapy. Ampicillin would cover most of the common secondary infecting orgaisms with the single exception of a penicillin-

resistant staphylococcus, which would require treatment with cloxacillin. The child should be nursed in an oxygen tent. Atelectasis calls for physiotherapy, including postural drainage, and radiological surveillance. Apnoeic attacks in a young infant are an alarming feature but seldom call for any heroic methods of treatment; the baby should be held upside down and any mucus that has collected in the pharynx must be removed. Convulsions are treated with heavy sedation and paraldehyde, phenobarbitone, or diazepam may be used; once again, the child should be nursed in an oxygen tent.

Prevention

Specific prophylaxis with pertussis vaccines had come to be accepted as an effective procedure, and the decline in the prevalence of the disease in the decade before 1957 was generally attributed to their use. Nevertheless, by 1963 the number of notified cases had increased again, though only to about one-fifth of the previous figures. At this time it was shown that previous infecting strains of the organism had been largely replaced by the serotype 1, 3—against which the vaccines then in use gave little protection. Since 1964 this situation has been corrected and all British vaccines now include strains of type 1, 3. Nevertheless, other allegations have been made against the use of pertussis vaccines, particularly that they may give rise to serious reactions especially in the brain. Convulsions, various forms of paralysis, coma, collapse, and death have all been reported. Clearly, as has recently happened with smallpox, one has to set the benefits from pertussis vaccination against the incidence of reactions from the vaccine. At present in Britain there is probably a continuing indication for recommending the use of the vaccine, though the position will obviously need to be kept under review.

Whooping cough vaccine should be given in the form of triple diphtheria/tetanus/pertussis vaccine in a course of three doses. The first dose is given after the age of 3 months and preferably at 6 months; the second dose is given six to eight weeks later, and the third dose four to six months later. No further booster dose is necessary. The hazards of whooping cough in infancy have encouraged a view that pertussis vaccination should be completed during the first three months of life. This is not the ideal time for obtaining the best immunological response and it is therefore not advised. Vaccination of the child population at the later ages recommended might be expected to reduce the attack rate on unvaccinated younger infants.

In view of the reactions that occasionally follow pertussis vaccination, the doctor should not give the vaccine if there is a previous history of convulsions. Further, if a convulsion or any other severe local or general reaction has followed the first dose of vaccine, no more should be given.

If triple antigen has been used the course may be completed using combined diptheria/tetanus toxoid. A history of allergy in the child or in the family is not a contraindication to pertussis vaccination.

Recommended Further Reading

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European Counterparts

Two Radiologists — Holland and Britain

FROM A SPECIAL CORRESPONDENT

British Medical Journal, 1973, **1**, 225–226

"Normally I wouldn't ask you to use pseudonyms in your article", said Dr. van Tromp, a radiologist in a Dutch university city, "but at the moment I am engaged in a political row with our pharmacists over who should run the nuclear medicine departments and I don't want to mention names." Though he regards such negotiations as an irritant, medical politics are a constant minor feature of Dr. van Tromp's life as head of a busy service and research department. Besides day-to-day problems, such as his present fight to get a 24-hour diagnostic isotope service under the wing of his own department, every year he has to stake out a claim for his department's share of the funds allocated to the hospital and the university and consider whether he should apply to the central research fund, a scheme run by the Netherlands Government which helps special research projects. But otherwise he is mercifully free from committee work, as is his British counterpart, Dr. Rushton-Wilson, who was emphatic that the thought of exchanging his present mix of service, teaching, and research work for the infighting associated with becoming a departmental head had always deterred him from applying for such a post.

Training

Both Dr. van Tromp and Dr. Rushton-Wilson went into radiology with roughly the same experience—several years in general medicine (which in Dr. Rushton-Wilson's case resulted in an M.R.C.P.) followed by training in a university radiological department, and both men had spent part of this time abroad—Dr. van Tromp in Germany and Dr. Rushton-Wilson in the U.S.A. Dr. Rushton-Wilson's training had lasted six years, including time spent taking the diploma in medical radiodiagnosis and the Fellowship of the Faculty of Radiologists. Dr. van Tromp's formal training had lasted four years,