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Pneumococcaemia complicated by meningitis

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SUMMARY Meningitis developed in 3 of 14 children with occult pneumococcaemia; in 2 of them it developed while they were being treated with low doses of intravenous penicillin, in the third child it developed at a time when he was not being treated. All children with occult pneumococcaemia should be treated with intravenous penicillin as are those with pneumococcal meningitis.

Unsuspected pneumococcal bacteraemia is not uncommon in febrile children who have no focus of infection.¹⁻⁴ Such children are generally aged between 6 and 24 months, have a temperature of $\geq 38.9^{\circ}\text{C}$, and leucocytosis $\geq 15 \times 10^9/\text{l}$. Some of them present with febrile seizures. Pneumococcaemia responds well to intravenous penicillin; spontaneous resolution has been described.¹⁻⁴ However there is the risk of developing meningitis.

We report 14 cases of occult pneumococcaemia in children. Meningitis developed in 2 of them despite the fact that they were being treated with intravenous penicillin, and it also developed in a third child who was not being given antibiotics.

Subjects and results

Fourteen children were admitted to Turku University Hospital or Aurora Hospital, Helsinki, during 1977-81 with a high temperature but no focus of infection. Two principal symptoms were febrile convulsions and abdominal pains. Pronounced leucocytosis was present in most of them. Twelve children remained in hospital and 2 returned home, one of whom was readmitted two days later.

Blood and spinal fluid were obtained for culture in all patients. This was done routinely at presentation in hospital. *Streptococcus pneumoniae* was identified using routine laboratory methods. All strains were sensitive to penicillin.

Three children developed meningitis. In each the first spinal fluid sample taken on admission contained fewer than $4.0 \times 10^6/\text{l}$ leucocytes and had no bacterial growth. One 4½-year-old girl (Case 1) was sent home, but she returned 3 days later with pneumococcal meningitis. She was treated with intravenous penicillin (450 000 U/kg a day) and sulphafurazole (150 mg/kg a day). Unilateral deafness was observed later. The 2 other children (Cases 2 and 3) were initially given intravenous penicillin (100 000 U/kg a day). This treatment was started one (Case 2) day and two (Case 3) days after the onset of symptoms. Despite this fever recurred and neck rigidity developed a day or two later. Case 2 had no bacterial growth in the repeat spinal fluid sample but a greatly increased number of leucocytes was recorded. He was treated with intravenous penicillin (1 000 000 U/kg a day) combined with sulphafurazole (150 mg/kg a day). Case 3 had pneumococcal growth in the second spinal fluid sample and the dose of penicillin was increased to 600 000 U/kg a day. Both children made good recoveries without any sequelae (Table).

Discussion

Twenty children have been reported in whom meningitis developed after detection of occult pneumococcaemia.²⁻⁴ In 5 of them, meningitis developed during oral or low-dose parenteral antibiotics. Our study confirms these observations.

Table Main characteristics of 14 children with occult pneumococcaemia

Case	Age (years)	Duration of symptoms (days)	Presenting symptoms			Total WBC ($\times 10^9/l$)	Spinal fluid	Treatment	Outcome
			Temperature ($^{\circ}C$)	Convulsions	Abdominal pains				
1	4.4	1	40.0	—	+	25.2	(1) Normal (2) 815 leucocytes culture positive	Penicillin + sulphafurazole	Unilateral deafness
2	1	<1	39.9	+	+	22.2	(1) Normal (2) 345 leucocytes no bacterial growth	Penicillin + sulphafurazole	Full recovery
3	0.8	<1	39.5	+	+	38.2	(1) Normal (2) 88 leucocytes culture positive	Penicillin	Full recovery
4	8.2	<1	39.6	—	+	39.1	Normal	Procaine penicillin*	Full recovery
5	2.2.9	<1	40.2	+	+	31.2	Normal	Penicillin†	Full recovery
6	3	<1	38.3	+	—	25.5	Normal	Procaine penicillin	Full recovery
7	0.8	<1	39.2	—	+	23.5	Normal	Penicillin	Full recovery
8	4	<1	40.0	—	+	32.9	Normal	Penicillin	Full recovery
9	1.1.9	<1	40.0	—	—	28.4	Normal	Penicillin	Full recovery
10	1.2	<1	37.8	—	+	31.3	Not done	Penicillin	Full recovery
11	2.4	<1	39.5	—	+	18.6	Normal	Procaine penicillin	Full recovery
12	0.7	3	38.9	—	—	30.9	Normal	Amoxycillin penicillin‡	Full recovery
13	2.7	3	38.5	—	+	29.1	Normal	Ampicillin penicillin	Full recovery
14	3.2	<1	40.0	—	—	13.3	Normal	No treatment	Full recovery

*30 000 U/kg a day, †200 000–500 000 U/kg a day, ‡40 mg/kg a day.
WBC = white blood count.

The important finding in our patients is that meningitis developed despite treatment with intravenous penicillin (100 000 U/kg a day). The mechanisms underlying this phenomenon are unknown. It has been suggested that lumbar puncture might be a contributing factor in the pathogenesis of meningitis in bacteraemia.^{1 4 5} The fact that virtually no penicillin enters the cerebrospinal fluid when the meninges are normal may be relevant.⁶ In a recent retrospective study Eng and Seligman⁷ suggested that if lumbar puncture-induced meningitis occurs, it is sufficiently rare to be clinically insignificant. No ethical prospective study can be designed to resolve this issue.⁵

Pneumococcal bacteraemia is a serious illness. Although the lesion in some children may heal spontaneously (for example, Case 14) prompt treatment should be given. Teele *et al.*³ recommended initial ampicillin or amoxycillin for children at risk of bacteraemia, since they found that occult bacteraemia was caused by *Haemophilus influenzae*. Feder⁴ suggested that children with symptoms and signs compatible with pneumococcaemia should be carefully followed up, and penicillin 200 000 U/kg a day given intravenously if the blood culture gives a positive result. It has been suggested that if the child is afebrile and appears well during the second visit no treatment is necessary even in the presence of bacteraemia.^{3 4 8} However our findings, and those of others, show that all children with pneumococcaemia should be treated. The treatment should cover

meningitis—namely penicillin 400 000 U/kg a day intravenously. This view is confirmed by Myers *et al.*¹ Any child in whom symptoms are mild should be followed closely after the diagnostic tests because it is not known why some children develop meningitis and others do not.² If lumbar puncture is considered essential the initiation of high-dose antibiotic regimen is advisable because of the risk connected with this procedure.

Addendum

Since this paper was submitted Teele *et al.*⁹ have reported a retrospective study which showed a significant association between a lumbar puncture performed during bacteraemia and the later development of meningitis. If lumbar puncture is performed in a child with symptoms and signs compatible with pneumococcaemia they too recommend treatment for bacteraemia and meningitis.

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Response of bedwetting to the enuresis alarm

Influence of psychiatric disturbance and maximum functional bladder capacity

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SUMMARY Fifty-four children with nocturnal enuresis were managed with the pad and bell system. Their maximum functional bladder capacity was estimated before they began treatment, and a Rutter A questionnaire was completed by the mothers. If an average of less than one wet night a week is taken as a criterion of success, then 63% of them responded in the last month of treatment; neither the Rutter score nor the maximum functional bladder capacity predicted outcome. However 26% failed to persist with treatment to the end of the project and were considered to have dropped out. If they are excluded, the initial response rate is 73%. In these cases a Rutter total score of at least 18 was found to be associated with failure to respond, but the maximum bladder capacity was not related to outcome.

The pad and bell system is effective in the management of bedwetting¹ but it has the disadvantage of requiring a good deal of effort for several weeks in order to give it a reasonable chance of success. If a patient who is likely to fail to respond can be identified in advance, his family will be saved much fruitless effort, and other procedures may have a greater chance of success.

There is a relationship between childhood psychiatric disturbance and enuresis.² There is also a well-documented association between bedwetting and a small maximum functional bladder capacity (MBC).³

The Rutter A (parent) scale⁴ provides a convenient measure of emotional disturbance in a child; it is

completed by the mother and can easily be administered in a busy paediatric clinic. The method of estimating the MBC described by Starfield⁵ is convenient to use in a hospital outpatient department. These two tests were used in an attempt to predict response to the enuresis alarm.

Methods

Selection of cases. Out of a group of 63 children referred with enuresis as the chief complaint, it was decided to manage 54 of them with the pad and bell. The remaining 9 were not treated in this way because they had previously failed to respond to an enuresis alarm, had parents who seemed incapable of co-operating, or had associated problems that required attention. No child with an active urinary infection was included.

Method. On the first outpatient clinic attendance each mother completed the Rutter A scale and the child had the MBC estimated. The child also had a physical examination and was asked to produce a midstream specimen of urine to send for culture. The mother was asked to complete a chart on the number of wet nights the child had during the next 4 weeks before the second outpatient visit. On the second attendance at the hospital the MBC was again estimated. Further charts were supplied so that the mother could again record the number of wet nights. The enuresis alarm was carefully demonstrated and supplied on loan. The mother was encouraged to assist as much as possible in its use. She returned once a month to report progress. The