

Streptococcus pneumoniae and *Mycoplasma pneumoniae* coinfection in community acquired pneumonia

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Abstract

The characteristics of nine children with community acquired pneumonia with evidence of *Streptococcus pneumoniae* and *Mycoplasma pneumoniae* coinfection are described.

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Mixed viral-bacterial infections as well as viral-viral infections are not uncommon in childhood pneumonia, and dual bacterial infections have also been described.¹ We describe the clinical characteristics and outcome of nine children with community acquired pneumonia with serological evidence of both *Streptococcus pneumoniae* and *Mycoplasma pneumoniae* infections.

Patients and methods

Between 1 January 1993 and 31 December 1995, the aetiology of community acquired pneumonia was studied in 254 hospitalised children at the Department of Paediatrics, Turku University Hospital.² The bacteria implicated were *S pneumoniae*, *M pneumoniae*, *Moraxella catarrhalis*, *Haemophilus influenzae*, *Streptococcus pyogenes*, and *Chlamydia pneumoniae*. The viruses implicated were respiratory syncytial virus, rhinovirus, parainfluenza virus types 1, 2, and 3, adenovirus, human herpesvirus 6, influenza A and B virus, and coronavirus. Informed consent was obtained from the parents or guardians of children serving as study subjects.

M pneumoniae infection was identified by studying IgM and IgG antibodies in acute and convalescent phase serum samples and/or positive nasopharyngeal aspirate culture.² In

some cases, the complement fixation (CF) test and/or cold haemagglutinin tests were carried out according to standard methods. For detection of *S pneumoniae* infection, pneumolysin IgG antibodies and pneumolysin immune complexes as well as C polysaccharide IgG antibodies and immune complexes were measured in acute phase and convalescent phase serum samples.² Blood cultures were obtained from two patients. The methods have been described previously.²

Results

Pneumonia caused by *M pneumoniae* was diagnosed in 17 patients, and pneumonia caused by *S pneumoniae* in 93 patients. Of these, evidence of coinfection of *M pneumoniae* and *S pneumoniae* was found in nine patients (table 1). Three of the nine children with coinfection also had evidence of viral infection (rhinovirus, influenza A virus, and human herpes virus 6). In addition, one child had evidence of *H influenzae* infection and one had evidence of *M catarrhalis* infection as a third possible causative agent. All nine patients were febrile before admission (>37.5°C). Seven patients had symptoms of respiratory tract infection. Five patients appeared ill. One patient had otitis media and one had maxillary sinusitis as well as tonsillitis. All patients had alveolar infiltrations in their chest radiographs: four solely and five with interstitial infiltrations. Five children had a C reactive protein concentration greater than 80 mg/l or a white blood cell count greater than $15 \times 10^9/l$. In the hospital, seven patients were initially treated with β lactam antibiotics (table 2), and two patients received macrolide treatment. Finally, five of the nine patients received macrolide treatment either before hospitalisation, in the hospital, or after discharge. The mean duration of fever (>37.5°C) after onset of antibiotic therapy was 24.4 (SD 14.5) hours, ranging from 10 to 48 hours in eight patients who were febrile in the hospital. Four of six patients not initially treated with a macrolide had respiratory symptoms or fever for up to seven days after discharge. In two of them, the symptoms disappeared after onset of macrolide treatment. At the follow up visit three to four weeks after discharge, all patients showed clinical recovery from pneumonia, but four (of the eight) patients still had minor infiltrations on chest radiograph. One patient treated with penicillin and cefadroxil developed otitis media during follow up.

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Table 1 Tests positive for *Mycoplasma pneumoniae* and *Streptococcus pneumoniae* in children with coinfection

Case no.	Tests positive for <i>Mycoplasma pneumoniae</i>	Tests positive for <i>Streptococcus pneumoniae</i>
1	IgM (2, 27)*, CA (2)	Pneumolysin IC
2	IgM (33), IgG (rise†), culture (1), CA (1)	Pneumolysin IC
3	IgM (27), IgG (rise), culture (1)	Pneumolysin IC
4	IgM (1, 30), IgG (rise), CA (1)	Pneumolysin IC
5	IgM (1, 24), IgG (rise)	Pneumolysin IC, pneumolysin IgG, C polysaccharide IgG
6	IgM (1), IgG (1)	Pneumolysin IC
7	IgM (1, 29)	C polysaccharide IgG
8	IgM (1, 26)	Pneumolysin IgG
9	CF (rise)	Pneumolysin IC, pneumolysin IgG, C polysaccharide IgG

*Days at which positive tests for *M pneumoniae* were obtained after admission.

†Twofold or greater rise in antibody titres between paired samples.

IC, immune complexes; CA, cold haemagglutinins; CF, complement fixation test.

Table 2 Characteristics of children with *Streptococcus pneumoniae* and *Mycoplasma pneumoniae* coinfection

Case no.	Age (y)/sex	Duration of symptoms/fever before admission	Treatment in the hospital/after discharge	Symptoms after discharge
1	7.3/M	9 d/9 d*	Penicillin/cefadroxil	Cough for a week
2	10.5/M	3 d/3 d	Erythromycin/erythromycin	None
3	1.9/M	2 to 3 wk/<1 d	Penicillin/penicillin	Fever, cough, lethargy for 5 days
4	5.3/F	2 to 3 wk/<1 d	Penicillin/penicillin‡, azithromycin	Fever for 1 day
5	2.4/M	2 wk/2 wk	Penicillin/penicillin§, azithromycin	Fever and cough for a week
6	12.7/F	4 wk/4 wk†	Azithromycin/azithromycin	None
7	1.4/F	7 d/4 d	Penicillin/penicillin	Rhinitis and cough for a week
8	5.6/F	7 d/7 d	Cefuroxime/trimethoprim-sulpha	None
9	3.1/F	3 d/3 d	Penicillin/penicillin	None

*The patient had received a 5-day course of azithromycin before admission.

†The patient had received an 8-day course of cefadroxil before admission.

‡Was changed after one day because of fever.

§Oral penicillin treatment was changed to azithromycin after 1 week when a positive test result for *M pneumoniae* was available.

Discussion

S pneumoniae and *M pneumoniae* are the major bacterial causes of community acquired pneumonia in children, together accounting for up to 60% of cases.¹⁻³ In the present study, half of the hospitalised children with *M pneumoniae* pneumonia had evidence of *S pneumoniae* coinfection. On the other hand, 10% of the children with pneumococcal pneumonia had evidence of *M pneumoniae* infection. Earlier aetiological studies have reported evidence of *S pneumoniae* and *M pneumoniae* coinfection in 29 ambulatory or hospital treated children with pneumonia.³⁻⁷ In a recent study,³ patients with the coinfection accounted for 30% of cases of *M pneumoniae* infection and for 23% of cases of pneumococcal infection.

Pneumonia in children may often be caused by multiple microbial agents.¹ Intercurrent or preceding viral upper respiratory infections are believed to be risk factors for secondary bacterial disease. *M pneumoniae* infection can also precede viral or other bacterial infections by several days or weeks.⁸ Staugas and Martin⁹ reported five cases of *M pneumoniae* infection with probable secondary infection from *H influenzae*. Recently, Cimolai and coworkers⁸

reported four patients with severe bacterial or viral infections either following or coinciding with *M pneumoniae* respiratory infection. All these studies suggest that *M pneumoniae*, like respiratory viruses, may predispose to secondary bacterial infection.

In this study, seven patients (78%) had been ill for a week or longer before admission, supporting the view that *M pneumoniae* infection probably precedes *S pneumoniae* infection. In our earlier study, only 25% of 85 children with bacteraemic pneumococcal pneumonia had had symptoms for seven or more days at the time of diagnosis.¹⁰ Patients with *M pneumoniae* pneumonia are often treated as outpatients.⁷ It is possible that an additional pneumococcal infection, which cannot usually be confirmed by standard laboratory methods, increases symptoms leading to hospitalisation in a patient with *M pneumoniae* pneumonia.

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