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Bilateral Sensorineural Deafness Associated with *Mycoplasma pneumoniae* Infection : The First Case Report*)

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ABSTRACT

We report an 11-year-old girl, who suffered from *Mycoplasma pneumoniae* pneumonia, meningitis, and mild, bilateral, acute otitis media, with subsequent severe, mixed hearing loss. The patient presented extremely high *Mycoplasma pneumoniae* complement fixation and cold hemagglutinin titers, the unique chest x-rays indicating mycoplasma pneumonia, and cerebrospinal fluid suggestive of meningitis. A moderate grade of sensorineural hearing loss that was seen in the early clinical stage has not shown any improvement, although the other signs and symptoms have resolved. Possible causative relationships of *Mycoplasma pneumoniae* to otologic complications, especially those closely related to peripheral nerve impairments, were discussed.

INTRODUCTION

Mycoplasma pneumoniae (MP), long known as a causative organism of 11 to 40% of respiratory disease in man, especially primary atypical pneumonia, is receiving increasing attention recently because it also causes diverse complications involving various other organs and tissues such as the gastrointestinal, urogenital, nervous and cardiovascular systems, blood, skin, joints and muscles. Sometimes, clinical course is serious with poor prognosis. The complications affecting the central nervous system (CNS) are incresing and now accounting approximately 5 to 7% of all the MP infections[2,5,8,9]. This report describes a case of MP causing primary atypical pneumonia complicated first by meningitis and otopathy, and finally with bilateral, high-degree, sensorineural hearing loss.

CASE PRESENTATION

An 11-year-8-month-old female was in good health until five days prior to visiting a physician when she developed nonproductive cough and low-grade fever. She was admitted to a hospital because of suspected pneumonia by chest x-rays. On admission, C-reactive protein was three-positive, cold hemagglutinin (CHA) titer 1:128 and complement fixation (CF) titer 1:8 (Table 1, Fig. 1). Other routine laboratory data were noncontributory. Chest x-rays showed a soft, diffuse shadow in the left lower lung field, disappearance of the left diaphragm line, appearance of a rather broad hairline in the region corresponding to between the right middle and lower lobes, and rightward enlargement with rectilinearization of the mediastinum shadow.

A high fever of 38 to 39°C persisted after admission. On February 5, 1981, she developed otorrhea and complained of deafness the next

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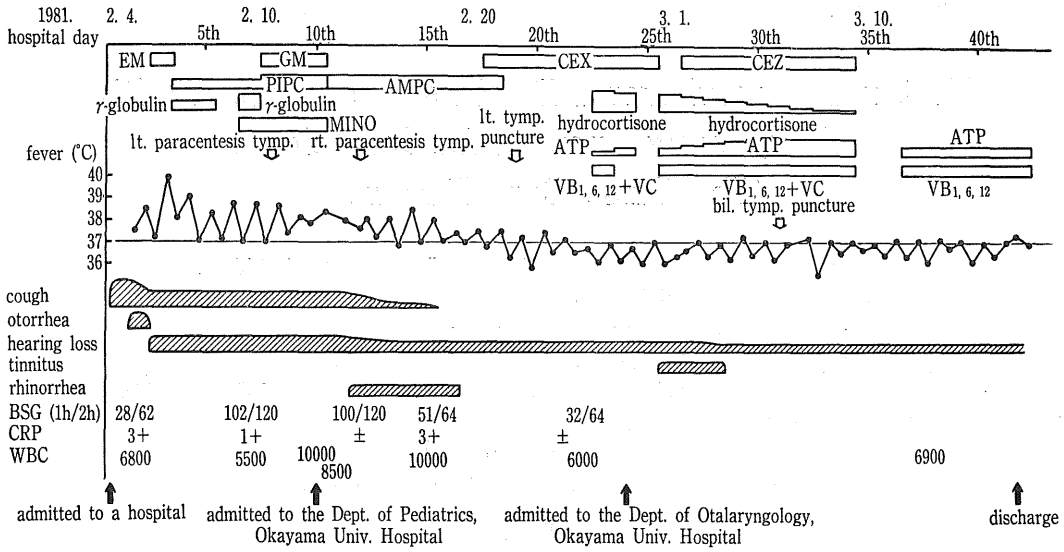

Fig. 1. Clinical course. EM: erythromycin; GM: gentamycin; PIPC: oxacillin; AMPC: amoxycillin; MINO: minocycline; CEX: cephalexin; CEX: cefazolin; and ATP: adenosine triphosphate.

Table 1. Serologic data*

Date (1981)	Feb. 4	Feb. 18	Oct. 7
M. pneumoniae (CHA)	128	2560	80
M. pneumoniae (CF)	8	2048	32
Rubella (CF)		16	8
Mumps (HI)		<8	<8
Mumps (CF)		8	<4
Cytomegalovirus (CF)		16	8

* CHA: cold hemagglutinin; CF: complement fixation; and HI: hemagglutinin inhibition.

Table 2. Cerebrospinal fluid findings

Date (1981)	Feb. 16	Feb. 25	March 6
Cell count (/mm³)	172/3	108/3	26/3
Mononuclear cells (%)	99.5	100	100
Neutrophils (%)	0.5	0	0
Protein (mg/dl)	30	30	<20
Glucose (mg/dl)	56	90	58
Culture (micro-organisms)	(−)		

day. Based on the diagnosis of acute otitis media, she underwent paracentesis and was given 80 mg per day of minocycline for five days orally, together with several other antibiotics, steroid, adenosine triphosphate (ATP) preparation, vitamines B1, B6 and B12 and gamma-globulin. Because of the persistent high fever, she was transferred to Department of Pediatrics, Okayama University Hospital, on February 13. Examinations on the admission revealed a high degree of deafness, fever, mild inflammation of the nasopharynx, and lymphadenopathy bilaterally palpable at the neck, submandibula, axilla and inguinal. Chest x-ray findings were markedly improved with virtually no appreciable abnormalities. There was no impairment of the cranial nerves except for the eighth. Spinal tap showed cerebrospinal fluid (CSF) to be

clear and colorless with normal pressure. It contained 57/mm³ of leukocytes, 99.5% of which were mononuclear cells and 0.5% of neutrophils, protein of 30 mg/dl, and glucose of 56 mg/dl; cultures for micro-organisms were all negative (Table 2). CHA and CF titers were markedly elevated, *i. e.*, 1:2560 and 1:2048, respectively. Electroencephalogram (EEG), recorded on February 18, revealed irregular delta waves of moderate amplitude extending from the posterior temporal to occipital lobes. These slow waves decreased considerably in subsequent EEG, suggesting a cerebral disorder only in the acute stage.

She was examined also in Department of Otolaryngology, Okayama University Hospital, on February 13. She had rhinitis and mild inflammation of both tympanic membranes; bilateral paracenteses performed the next day produced mucous secretion. An audiogram (Fig. 2A) then showed bilateral, mixed hearing loss of high degree, and periodic examinations of the audiogram revealed no improvement especially in bone conducion. On February 27, she was transferred to Department of Otolaryngology. Audiologic examinations then revealed bilateral type I (Jerger) with Békésy audiometry, bilateral type B with tympanometry, and bilateral response of stapedial reflex with contralateral stimulation (110 dB at 500 Hz). At a stimulation rate of 13.3 clicks per second (115 SPL at 500 Hz), only waves I, III and V of the auditory brainstem response were recognized. Each wave had normal peak, interval and latency, except for the left wave I which had a prolonged latency of 2.7 msec. No nystagmus, vertigo and vomitting were observed throughout clinical course. A high-degree hearing loss, however, remained unchanged even after discharge, and audiogram taken on April 7 (Fig. 2B) showed bilateral sensorineural deafness.

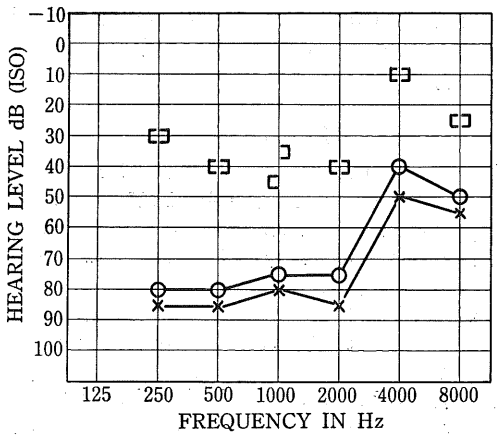

Fig. 2A. Pure tone audiogram showing bilateral mixed hearing loss (February 13, 1981).

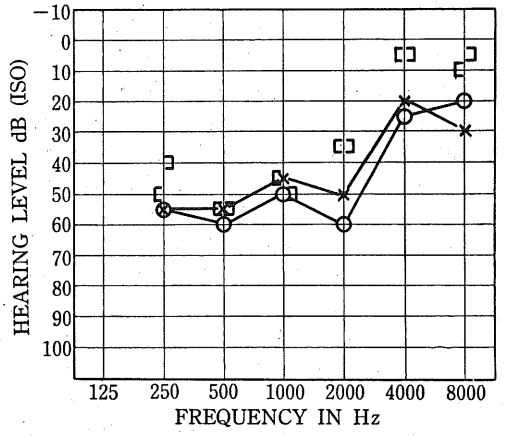

Fig. 2B. Pure tone audiogram showing bilateral sensorineural hearing loss (April 7, 1981).
Air conduction: ○ right and × left, and bone conduction; [right and] left; all with masking.

DISCUSSION

Of more than 10 strains of mycoplasma so far isolated from man, those with pathogenicity are limited to *Mycoplasma pneumoniae, urealyticum* and *hominis*. Yesnick[12] reviewed 38 cases of CNS complications by MP including his own-experienced one case. Since then, more than 20 cases have been reported in Japan. There have been only few reported cases of otolaryngologic MP infection, partly because the infection may go unnoticed for a lack of subjective symptoms especially in children. Chanock et al.[1], Foy et al.[3] and Rifkind et al.[7] reported otitis media by MP infection, and described myringitis as one of the characteristic complications. Cranial nerve impairments were reported in two cases and one case of sudden deafness by van Dishoeck[11] and Shanon et al.[8], respectively, one case of visual-perceptive problems by Lerer and Kalavsky[5], and one case of the left facial nerve paralysis by Nishida et al.[6]. To our knowledge, there have been no case reports of bilateral sensorineural deafness.

The eighth cranial nerve impairment in this case could be due to: (i) the spread of otitis

media into the inner ear through the fenestra vestibuli and fenestra cochleae; (ii) extension of meningitis into the inner ear through the internal auditory canal or aquaeductus vestibuli or canaliculus cochleae; (iii) a subsequence of generalized involvement of the cranial nerves; and (iv) hematogenous spread. Unfortunately, no cultures of the middle ear secretion were made to identify bacteria, viruses or mycoplasmas. Profuse otorrhea, typical of suppurative otitis media, was never seen; there was no vertigo or other vestibular manifestations associated with severe otitis interna; nonetheless, sensorineural deafness developed rather early and concurrently with secretory otitis media, and never improved. These facts suggest that (ii) and/or (iii) were the most probable. The speach audiometry was attempted several times; unfortunately, however, none of these turned out to be satisfactory because of a lack of patient's cooperation.

The mechanism of cranial nerve impairments has not been fully elucidated, although the direct invasion of mycoplasma or neurotoxin produced by mycoplasma or immunologic reaction to mycoplasma has been suggested[4]. Histologic examination of the brain has offered little information, and there have been no reports on the successful isolation of MP from brain tissues. EEG of this case suggested that a brain impairment occurred in the early stage of the disease, although computed tomography gave no evidence of intracranial lesions. The definite cranial nerve impairments due to MP infection require MP isolated directly from CSF or brain tissues. In most cases, however, such an evidence is unavailable so that alternatively, isolation of MP from the pharynx and/or sputum or comparison of CF titers of MP between the acute and convalescent stages aids the diagnosis; more than 1:4 in the acute and more than 1:64 in the convalescent stage are suggestive of MP infection. CF titers of MP in this case were 1:8 and 1:2048 in the early and convalescent stages, respectively, and CHA titers were 1:2560 in the latter stage, while all the virus CF titers examined were low (Table 1). This patient was therefore diagnosed first as MP pneumonia, and later complicated meningitis and impaired eighth cranial nerve due to MP.

Penicillin and cephalosporin are ineffective against mycoplasmas which have no cell wall. On the other hand, macrolide and tetracycline, inhibitors of protein synthesis necessary for micro-organism multiplication, are often effective[3], although other investigators reported that tetracycline was not effective in cases with CNS complications[10]. Minocycline, a tetracycline derivative, was effective to this case so far as MP pneumonia was concerned, but steroid, ATP, vitamines B1, B6 and B12 and gamma-globulin did not improve sensorineural deafness; this posed a therapeutic problem.

The prognosis of nerve impairments is usually favorable. Lerer and Kalavsky[5], however, reported that children under the age of 14 years were more severely affected neurologically than older patients, and that patients with a significant increase in CSF protein and leukocyte count were more likely to develop neurologic symptoms than patients with similar anatomic involvement but lower CSF protein and cell count. Increased CSF protein and cell count in this case, particularly during the convalescent stage, may account for severe and permanent neurologic disorders.

Neurologic complications by MP infection as reported here undoubtedly call attention to not only immunology of the complications but also pathogenesis of their mechanisms. Possible causative relationships of MP to otologic complications, especially those closely related to peripheral nerve impairments, should be kept in mind in clinical practice.

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