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Clinical Records

Labyrinthine involvement and multiple perforations of the tympanic membrane in acute otitis media due to group A streptococci

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Abstract
We present here three cases of acute otitis media caused by a virulent group A streptococcal infection that rapidly led to deterioration in hearing. Two of the three cases presented with severe sensorineural and mixed hearing loss with multiple tympanic membrane perforations, and the third presented with severe bilateral sensorineural hearing loss following acute otitis media involving group A streptococci. All patients were treated with systemic (piperacillin) and topical antibiotics (ofloxacin ear drops): one patient also received a systemic steroid (betamethasone). Deafness persisted in one patient but in the other two, hearing gradually recovered. Severe cytotoxicity was considered to have occurred in all patients, resulting in multiple perforations of the tympanic membrane and necrosis in the middle ear.

Key words: Streptococcal infections; Labyrinth; Otitis media; Hearing loss, sensorineural

Introduction

Despite the availability of effective antibiotics, treatment of labyrinthine involvement in acute otitis media remains a clinical challenge. Infections by pathogens such as influenza virus,[1] mycoplasma,[2] *Haemophilus influenzae*,[3] *Streptococcus pneumoniae*[4] and *Pseudomonas aeruginosa*[5] have all been linked to such involvement of the labyrinth. However, cases involving *Streptococcus pyogenes*, which are group A streptococci, are rare.[6] We report here three Japanese patients who presented with sensorineural hearing loss (SNHL) following acute otitis media caused by group A streptococci. Two of the patients exhibited multiple perforations of the tympanic membrane.

Case report

A 46-year-old man (*Case 1*) and a 63-year-old man (*Case 2*), presented with unilateral otalgia, profuse purulent otorrhoea, with necrotic tissue in the middle ear and multiple perforations of the tympanic membrane (Figure 1). A 39-year-old man (*Case 3*) complained of bilateral otalgia with purulent otorrhoea after bilateral myringotomy. Both *Cases 1* and *2* were diagnosed as having well-controlled diabetes mellitus, and had no other significant clinical findings. *Case 3* showed no medical problems other than otitis media. Pure-tone audiometry of the affected ears revealed no measurable hearing in *Case 1* (Figure 2A), severe mixed hearing loss of 70 to 100 dB in *Case 2* (Figure 2B) and bilateral severe sensorineural hearing loss of 70 to 100 dB (Figure 2C) in *Case 3*. High-resolution computed tomography of the temporal bone showed a soft tissue density in the middle ear without any labyrinthine fistula in all the patients. Electronystagmography revealed spontaneous nystagmus toward the unaffected ears and unilateral canal paresis in *Cases 1* and *2*. Group A streptococci were isolated from the otorrhoeic discharge in *Cases 1* and *3*. Although no significant pathogen was isolated from *Case 2*, both the titres of anti-streptolysin O (ASO) (295 Todd units, normal value; < 240) and those of anti-DNase-B (× 603 normal value; < 360) were elevated. Systemic (piperacillin 2 g/day) and topical antibiotics

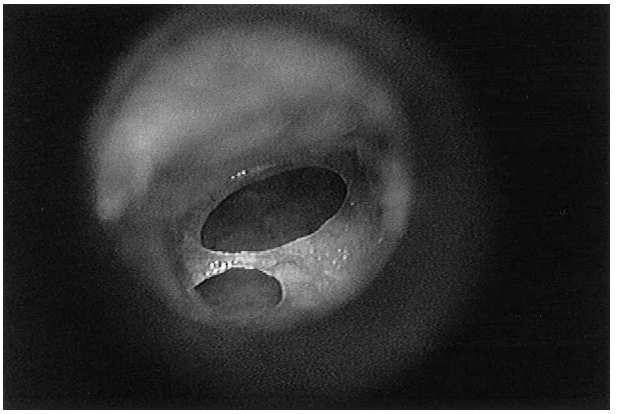

Fig. 1
Otoscopic examination (*Case 1*). *Cases 1* and *2* exhibited multiple perforations of the tympanic membrane.

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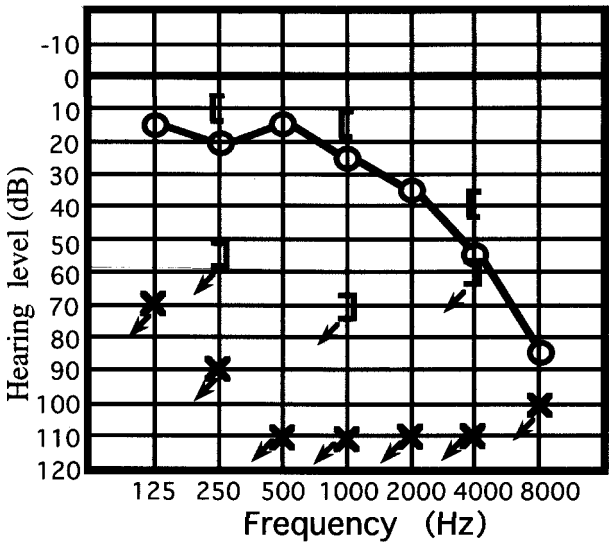
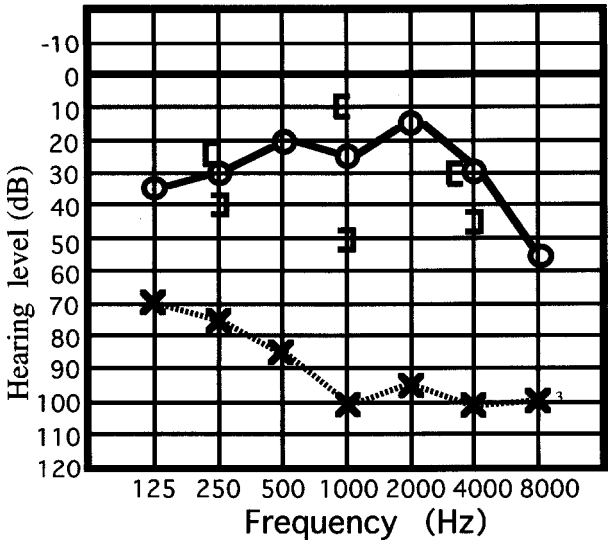
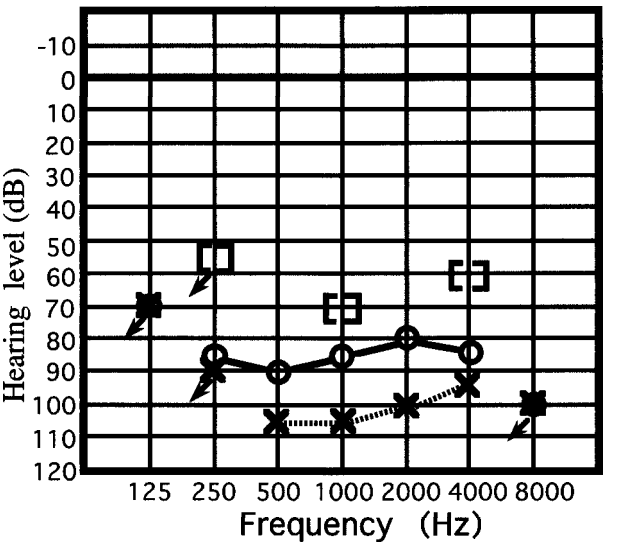


(A)



(B)



(C)

FIG. 2

On initial examination, pure-tone audiometry revealed no measurable hearing in the affected ear in *Case 1* (A), severe mixed hearing loss in *Case 2* (B) and severe sensorineural hearing loss in *Case 3* (C).

(ofloxacin ear drops) were administered to all the patients. A systemic steroid (betamethasone/total 60 mg) was additionally administered to *Case 3*. Hearing loss gradually recovered in *Cases 2* and *3* but no improvement was noted in *Case 1*.

Discussion

All three patients exhibited moderate to severe acute otitis media and a moderate to severe degree of sensorineural hearing loss in the affected ear at a comparatively early stage in the disease. Labyrinthine involvement in acute otitis media has been reported as being an effect of bacterial toxins and infiltration of infectious products, with increase in permeability of the round window membrane,[7,8] as noted in the present cases. Group A streptococci were isolated from the otorrhoeic discharge in *Cases 1* and *3*. Although no significant pathogen was isolated from *Case 2*, both the titres of ASO and those of anti-DNase-B were elevated. In the late 1980s, the emergence of severe group A streptococcal infection was linked to serious diseases, such as streptococcal bacteraemia, myositis, and necrotizing fasciitis, with a 30 per cent death rate.[9] The group A streptococci isolated from patients with these invasive diseases are predominantly strain M, types 1 and 3, which produce pyogenic exotoxin A or B or both.[10] The M protein contributes to the invasiveness of the organisms through its ability to inhibit the phagocytosis of streptococci by human polymorphonuclear leukocytes.[11] Streptococcal pyogenic exotoxin A or B induces human mononuclear cells to synthesize tumour necrosis factor-α (TNF-α) which could cause severe tissue injury,[12] such as the multiple perforations in the tympanic membrane observed in the presented cases here. Moreover, it has been reported that the peptidoglycan-polysaccharide complex from the cell wall of group A streptococci could induce arthritis, hepatitis and severe otitis media.[13] Although it has remained unclear whether the underlying diabetes mellitus predisposed to the severe otitis media and labyrinthine involvement in *Cases 1* and *2*, well-known risk factors for severe group A streptococcal infection include acquired immunodeficiency syndrome (AIDS), cancer, diabetes mellitus, alcohol abuse and chickenpox.[14] Based on these findings, group A streptococci were regarded as the pathogens which caused acute otitis media with multiple tympanic membrane perforations and labyrinthine involvement in the cases presented here, even though the specific strains of the group A streptococci isolated could not be determined. To our knowledge, no case of sensorineural hearing loss asso-

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ciated with otitis media caused by group A streptococci has been reported so far, except for a single reported case of β-haemolytic streptococcal infection.[6]

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