

Acute otitis media associated bilateral sudden hearing loss: case report and literature review

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Abstract

Background: Sudden sensorineural hearing loss is a rare otological condition with potential for dire outcomes including permanent hearing loss. Although the majority of cases are deemed idiopathic, bilateral sudden sensorineural hearing loss represents a rare subset typically related to systemic conditions, with higher morbidity and mortality. A controversial association with acute otitis media has been reported, with few bilateral cases published in the literature.

Case report: A very rare case of bilateral sudden sensorineural hearing loss associated with acute otitis media is described, with a review of the literature.

Conclusion: The limited evidence available suggests that acute otitis media with tinnitus and/or bacterial pathology may have an increased risk of sudden sensorineural hearing loss, which is consistent with the case described. Although there is no sufficiently powered published evidence to provide definitive treatment guidelines, the literature reviewed suggests that early myringotomy and antibiotics may greatly improve treatment outcomes.

Key words: Otitis Media; Acute Disease; Sensorineural Hearing Loss; Bilateral Deafness; Sudden Hearing Loss

Introduction

Sudden sensorineural hearing loss (SNHL) is a rare condition, affecting 5–20 per 100 000 population. It is defined as a loss of at least 30 dB over 3 contiguous frequencies or more, over a period of 3 days or less.¹ Although multiple aetiologies have been described, including autoimmune, vascular, viral and neurological diseases, direct causal links for these aetiologies have not been well established.² Sudden SNHL can be classified according to audiometric severity, audiometric configuration, onset timing and laterality.

Bilateral sudden SNHL represents a rare subset (affecting less than 5 per cent of reported sudden SNHL cases), which carries with it a higher association with systemic disease, increased morbidity and a mortality rate reported to be as high as 15.5 per cent.^{3,4} Bilateral sudden SNHL can be further classified by timing of bilateral symptoms as either simultaneous (second ear affected within 3 days), sequential (within 3–30 days) or progressive (more than 30 days).⁴ In contrast, acute otitis media is a very common otological condition with well understood pathology. Whilst conductive hearing loss in patients with acute otitis media is well recognised, an association with sudden SNHL is still considered controversial.⁵

Case report

A previously healthy 26-year-old female presented with complete bilateral hearing loss in the context of concurrent bilateral acute otitis media. The patient initially suffered from a non-productive cough, rhinorrhoea and malaise for one week, which was treated by her general practitioner with

roxithromycin. She went on to develop left-sided otalgia and re-presented to her general practitioner, who prescribed amoxicillin and clavulanate for an assumed acute otitis media. Over the next day, the patient gradually developed simultaneous complete bilateral hearing loss, with associated tinnitus, neck stiffness, subjective fevers and left-sided facial pain. After 3 days with these symptoms, the patient presented to the emergency department of the local hospital and was urgently referred to the otolaryngology department.

Examination revealed bilaterally erythematous tympanic membranes and bilateral cervical lymphadenopathy. The patient had normal neurological examination (excluding VIIIth cranial nerve) findings, with no signs of meningism beyond mild neck stiffness. She had no personal or family history of autoimmune conditions. Pure tone audiometry (Figure 1) revealed bilaterally equal moderate-to-severe SNHL, with an additional conductive component culminating in severe-to-profound hearing loss.

A clinical diagnosis of bilateral acute otitis media was made, and antibiotic treatment with amoxicillin and clavulanate was continued. Therapeutic myringotomy was refused by the patient, preventing drainage of the middle-ear cleft and potential identification of the causative pathogen. In view of the patient's SNHL, treatment was extended to include systemic corticosteroids and hyperbaric oxygen therapy (Appendix I).

Subsequent investigations revealed an elevated white cell count ($14.0 \times 10^9/l$) and C-reactive protein level (186 mg/l). Serology for toxoplasmosis, rubella, herpes simplex virus, human immunodeficiency virus, cytomegalovirus and Epstein–Barr virus were negative.

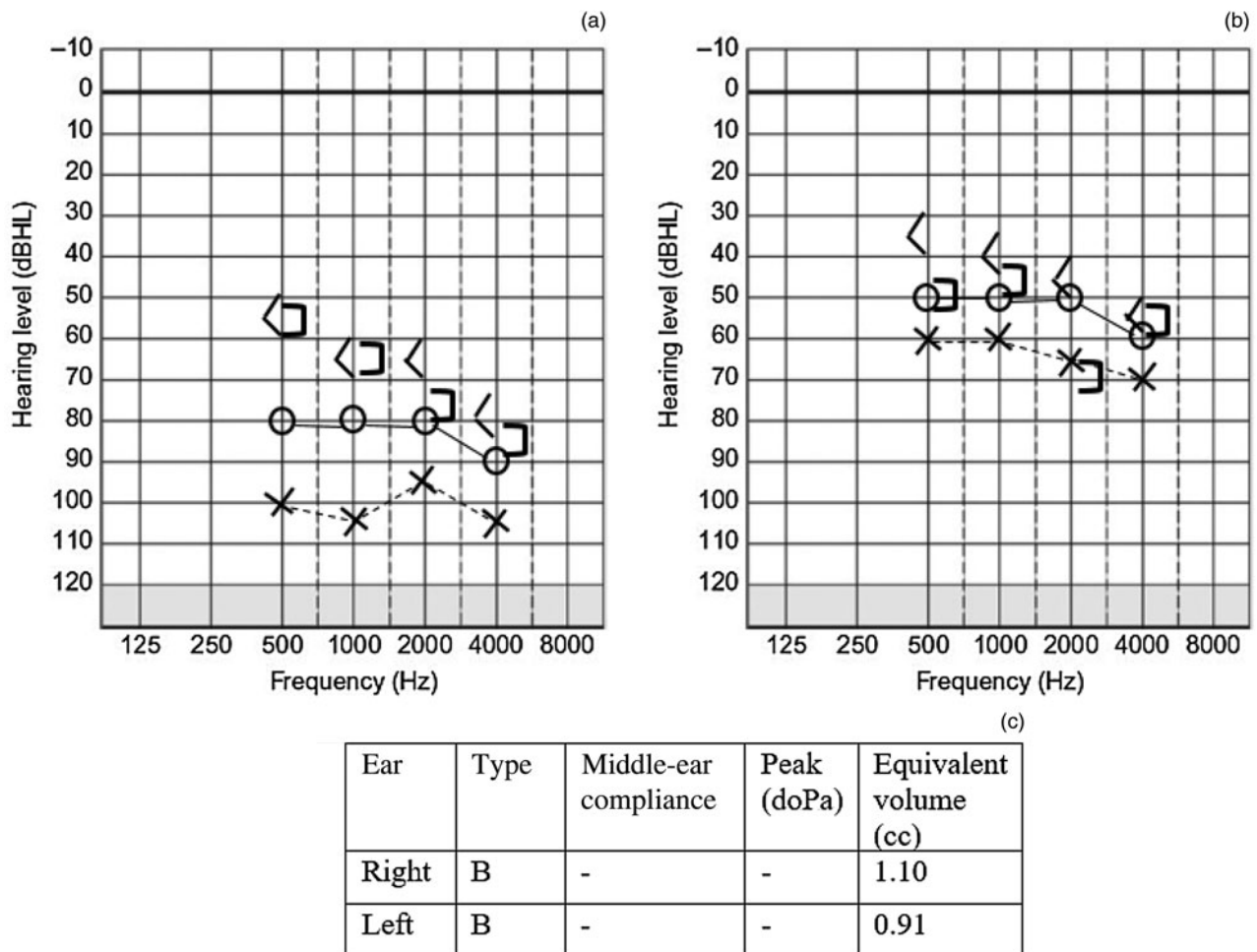


FIG. 1

(a) Pre- and (b) post-treatment pure tone audiometry, and (c) tympanometry findings. < = bone conduction right ear;] = bone conduction left ear; O = air conduction right ear; X = air conduction left ear

Urgent magnetic resonance imaging of the internal auditory meati (Figure 2) and brain was performed. This showed bilateral suppurative otitis media, with no evidence of retrocochlear or intracranial pathology. There was also no evidence of labyrinthine ossification, although this scan was performed early in the clinical course.

Whilst subjective neck stiffness and bilateral cervical lymphadenopathy were concerning presenting features, further history, examination and investigation revealed no frank meningism or systemic pathology. The cervical lymphadenopathy was deemed likely from the preceding upper respiratory tract infection. Given the lack of further findings and the patient's therapeutic response, acute otitis media was considered the likely aetiology of her bilateral sudden SNHL.

Since treatment, the patient's acute otitis media and conductive hearing loss has resolved, and her sensorineural deficit has improved by an average of 22.5 dB in the right ear and 15 dB in the left. Although this is not back to pre-morbid baseline levels, the improvement has allowed her to have functional hearing with the assistance of hearing aids.

Discussion

Bilateral sudden SNHL may be considered a medical emergency, requiring urgent investigation and treatment because

of its heightened morbidity and mortality. Despite rarely being identified as idiopathic in comparison to unilateral disease, bilateral sudden SNHL remains a diagnostic and therapeutic dilemma given its rare incidence, varied aetiology and ambiguous presentation.

Sensorineural hearing loss has become an increasingly recognised possible sequelae of chronic serous otitis media.^{6,7} The pathogenesis of this loss has been well studied, with the leading theory proposing inflammation-induced permeability of the round window membrane, allowing passage of endotoxins and ionic disequilibrium within the cochlea.⁸ Numerous inflammatory mediators and bacterial by-products associated with otitis media, including by-products of *Streptococcus pneumoniae*, have been demonstrated to cause increased round window membrane permeability and cochlear damage.⁸⁻¹⁰ The above is supported further by the fact that the typical resulting hearing loss predominantly affects high frequencies, which are detected by hair cells in the cochlear basal turn adjacent to the round window membrane.¹¹ Although it has been hypothesised that acute otitis media has inherently greater potential to cause increased round window membrane permeability, a link with sudden SNHL is still considered controversial.¹²

A review of the available English-language literature within PubMed and Medline databases was performed,

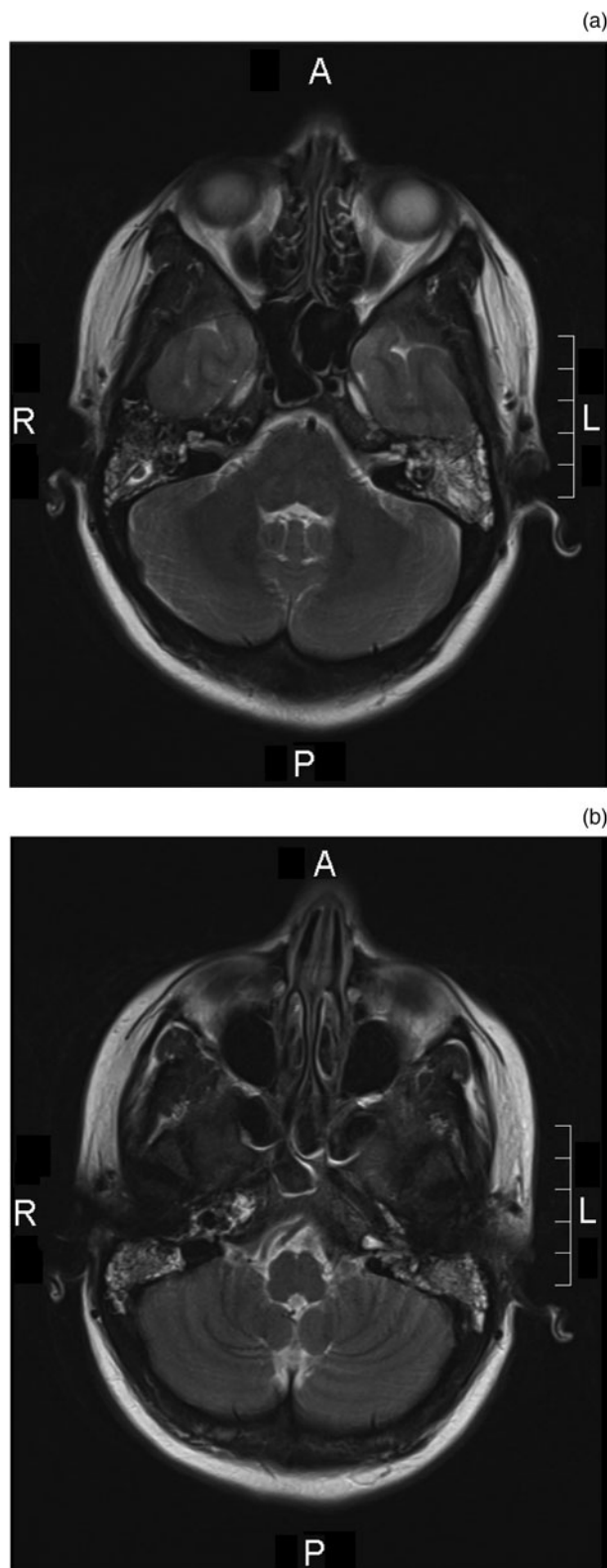


FIG. 2

(a) & (b) Axial magnetic resonance imaging scans of the internal auditory meati. A = anterior; R = right; L = left; P = posterior

using the Medical Subject Heading terms 'acute disease', 'otitis media' and 'hearing loss, sensorineural', with the additional key words 'bilateral' or 'sudden'. Additional manual searching was performed through open access journals.

There is limited evidence of acute otitis media associated sudden SNHL within the literature,^{5,13–19} with only three case series reporting patients suffering bilateral sudden SNHL (Table I).^{13–15} Two of the case series feature considerable confounding factors, whilst the third focuses on the microbiological features of the cases. Five case series and one case study report unilateral SNHL associated with acute otitis media, with a total of 46 patients described (Table II).^{5,14–18} Common findings of note within the literature include a high prevalence of bacterial pathology and tinnitus, and favourable treatment outcomes with early myringotomy (with or without ventilation tubes) and antibiotics.

Pathogenic organisms

Nishioka *et al.* reports three cases of bilateral sudden SNHL in patients suffering bilateral acute otitis media and confirmed *Mycoplasma pneumoniae*.¹³ *M pneumoniae* is a known risk factor for sudden SNHL, thus the presence of pneumonia is a significant confounder.²⁰ Kanazawa *et al.* describe a case of bilateral sudden SNHL secondary to acute otitis media caused by group A streptococci, and complicated by multiple tympanic perforations and necrosis of the middle-ear cavity.¹⁴ Other factors likely contributed to this patient's hearing loss, beyond acute otitis media.

In a retrospective case series investigating the complications of acute otitis media, with a focus on bacteriology and virology, Hyden *et al.* reports two patients with bilateral sudden SNHL.¹⁵ These two patients were confirmed to have a bacterial acute otitis media and had complete resolution of symptoms once treated, with myringotomy and antibiotics being the only common treatment modalities.

Presenting symptoms

Park *et al.* report tinnitus, a symptom not typically suffered in uncomplicated acute otitis media, as the most common complaint of the patients included in their series.¹⁶ Akdag *et al.* report the incidence of tinnitus in their series to be as high as 42.8 per cent.⁵ This association is significant as tinnitus has been previously identified as a negative prognostic indicator in SNHL, and it may act as a red flag symptom for patients with acute otitis media, signifying a higher risk of sudden SNHL.²¹

Treatment options

Song *et al.* differentiate patients with acute otitis media associated sudden SNHL, labelling the clinical entity as 'pseudo-sudden deafness'.¹⁷ The authors proposed that this differentiation is necessary, given the specific underlying aetiology, and the belief that treatment with early myringotomy (with or without ventilation tubes) and antibiotics significantly improves prognosis. Amongst the 46 reported patients with unilateral disease, 76.1 per cent were found to have audiometric improvement, with the most common treatment offered being myringotomy and antibiotics. Amongst the patients with non-binary treatment outcomes, 52.2 per cent had a complete recovery.

Although these studies were limited by a small sample size, and heterogeneous treatment regimens and outcomes, they do suggest that patients with acute otitis media related sudden SNHL will have improved treatment outcomes with early myringotomy and antibiotics.

TABLE I
LITERATURE REVIEW SUMMARY: BILATERAL SUDDEN SNHL CASES ASSOCIATED WITH AOM

Authors	Study type	Cases (<i>n</i>)	Predominant symptoms	Treatments utilised	Outcomes (<i>n</i> (% total))*
Nishioka <i>et al.</i> ¹³	Case series	3	Cough, fever hearing loss	Antibiotics, ATP, systemic steroids	PR = 1 (33.3) NR = 2 (66.7)
Kanazawa <i>et al.</i> ¹⁴	Case series	1	Otalgia, otorrhoea	Myringotomy [†] , antibiotics	CR/PR [‡] = 1 (100)
Hyden <i>et al.</i> ¹⁵	Case series	2	Hearing loss, facial palsy, vertigo	Myringotomy [†] , antibiotics	CR = 2 (100)

*Treatment outcome assessed through Furuhashi classification or, if not available, author description.¹⁹ [†]With or without ventilation tubes.
[‡]Successful treatment outcome was not qualified or quantified. SNHL = sensorineural hearing loss; AOM = acute otitis media; ATP = adenosine triphosphate; PR = partial response; NR = no response; CR = complete response

TABLE II
LITERATURE REVIEW SUMMARY: UNILATERAL SNHL CASES ASSOCIATED WITH AOM

Authors	Study type	Cases (<i>n</i>)	Predominant symptoms	Treatments utilised	Outcomes (<i>n</i> (% total))*
Kanazawa <i>et al.</i> ¹⁴	Case series	2	Otalgia, otorrhoea	Antibiotics	CR/PR [‡] = 1 (50) NR = 1 (50)
Hyden <i>et al.</i> ¹⁵	Case series	13	Hearing loss, vertigo	Myringotomy [†] , antibiotics	CR = 4 (30.8) PR = 7 (53.8) NR = 2 (15.4)
Park <i>et al.</i> ¹⁶	Case series	8	Tinnitus, otalgia, hearing loss	Myringotomy [†] , systemic steroids, antibiotics	CR = 5 (62.5) PR = 2 (25) NR = 1 (12.5)
Akdag <i>et al.</i> ⁵	Case series	14	Tinnitus, hearing loss, vertigo	Myringotomy [†] , systemic steroids, topical steroids, antibiotics	CR/PR [‡] = 11 (78.6) NR = 3 (21.4)
Song <i>et al.</i> ¹⁷	Case series	8	Otalgia, tinnitus, otorrhoea, hearing loss	Myringotomy [†] , systemic steroids, antibiotics	CR = 2 (25) PR = 2 (25) NR = 4 (50)
Jang <i>et al.</i> ¹⁸	Case study	1	Hearing loss, tinnitus, vertigo	Antibiotics, systemic steroids	CR = 1 (100)

*Treatment outcome assessed through Furuhashi classification or, if not available, author description.¹⁹ [†]With or without ventilation tubes.
[‡]Successful treatment outcome was not qualified or quantified. SNHL = sensorineural hearing loss; AOM = acute otitis media; CR = complete response; PR = partial response; NR = no response

- Sudden sensorineural hearing loss (SNHL) is rare, with potential dire outcomes including permanent hearing loss
- Bilateral sudden SNHL represents a rare subset, and has a higher association with systemic disease and poorer outcomes
- Acute otitis media is a controversial possible aetiology for sudden SNHL, with evidence limited to case series
- This paper describes a very rare case of bilateral sudden SNHL associated with acute otitis media
- The limited evidence suggests that acute otitis media with tinnitus and/or bacterial pathology may have increased the sudden SNHL risk
- Early myringotomy and antibiotics may improve treatment outcomes for patients with acute otitis media associated sudden SNHL

Current American Academy of Otolaryngology guidelines for sudden SNHL recommend treatment options of systemic corticosteroids and/or hyperbaric oxygen therapy if within three months of diagnosis, with intratympanic steroids suggested as a possible salvage therapy. The caveat to this

treatment guideline is that any underlying aetiology should be addressed if identified. The patient discussed in this case report received early antibiotics, but declined myringotomy and ventilation tube insertion. This and the patient's middle-ear infection precluded the use of intratympanic steroids. Whilst the patient's conductive hearing loss completely resolved, and her sensorineural loss improved to a level which provided functional hearing with the assistance of hearing aids, the literature suggests that the patient would have had a greater chance of complete recovery if early myringotomy and ventilation tubes were utilised.

Conclusion

Sudden SNHL is a rare but profound possible complication of acute otitis media. In adults with acute otitis media, evaluation for hearing loss should be performed and the risk of sudden SNHL considered. This may be especially pertinent if the patient presents with tinnitus or if bacterial infection is suspected. Conversely, patients with sudden SNHL should be screened rigorously for acute otitis media through history, examination and audiology. If acute otitis media is present, early and aggressive treatment with myringotomy (with or without ventilation tubes) and antibiotics should be offered, in addition to the recommended modalities of systemic corticosteroids and hyperbaric oxygen therapy.

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Appendix I. TREATMENT REGIMEN

Systemic corticosteroids
50 mg oral prednisone once daily for 7 days with subsequent incremental weaning
Hyperbaric oxygen therapy
20 dives performed at 1 dive/day
Dives to 14 m (140 kPa), with 20 minutes decompression time & 75 minutes total time at pressure

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Dr A Smith takes responsibility for the integrity of the content of the paper

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