



# Invasive fungal otitis media with peripheral facial paralysis

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## ABSTRACT

Invasive fungal otitis media is clinically rare and diagnosis often delayed. We report a 65-year-old female with *Aspergillus fumigatus* otitis media complicated by mastoiditis and peripheral facial paralysis. Complete mastoidectomy and type II tympanoplasty, with oral administration of voriconazole for more than 3 months resulted in a successful outcome.

## 1. Introduction

Invasive fungal otitis media is rare in clinical practice and lacks typical symptoms in the early stages. It can be misdiagnosed as chronic suppurative otitis media or tuberculous otitis media, leading to progression of the disease and serious complications such as meningitis and intracranial granuloma formation. Diabetes, glucocorticoids, tuberculosis, methotrexate and other immunosuppressants are risk factors for the development of invasive fungal otitis media [1,2]. This article reports a case of invasive *Aspergillus fumigatus* otitis media complicated by mastoiditis and peripheral facial paralysis.

## 2. Case presentation

A 45-year-old female patient presented with otorrhea, tinnitus and hearing loss for more than 4 years (day 0). During this time, the patient had visited multiple hospital outpatient clinics and received multiple courses of levofloxacin ear drops and levofloxacin/dexamethasone ear drops which controlled the otorrhea at each time, but now the patient had continuous ear discharge for 1 month and levofloxacin dexamethasone ear drops (5 drops, tid, for 3 weeks) were ineffective. Endoscopic examination showed that the pars tensa of the left tympanic membrane was perforated with irregularly edges and the residual tympanic membrane was edematous and hypertrophic, with thick yellowish-green secretions and granulation tissue filling the left tympanic cavity, with

erosion of the skin of the external auditory canal (Fig. 1A). Computed tomography (CT) scan showed bone erosion and destruction of the external acoustic meatus, as well as soft tissue opacification in the mastoid, tympanic cavity, with obstruction of the eustachian tube (Fig. 1B–C).

Type II tympanoplasty was performed under general anesthesia on day 3. The necrotic tissue, the malleus and the incus were removed, and the tragus cartilage perichondrium was used to repair the tympanic membrane. The specimens of mastoid and tympanic tissue were taken for examination and the histopathology showed chronic inflammation of the mucosa and a large number of hyphae with morphological characteristics of *Aspergillus* spp. in the necrotic tissue (Fig. 2A). After the operation, secretions continued to leak out of the surgical cavity, and *Aspergillus fumigatus* was detected in ear canal secretion smears and microbial culture (Fig. 2B–C), and drug susceptibility testing showed that *Aspergillus fumigatus* was sensitive to voriconazole on day 50. Unfortunately, the cartilage perichondrium that repaired the tympanic membrane showed necrosis and perforation on day 54. Despite six months of outpatient dressing changes and intermittent oral administration of voriconazole which started on day 54 as following: the patient was treated with voriconazole (200 mg, q.12 h., po.) for 14 days, and stopped the medication for 20 days as the patient felt her symptoms improved. At next follow-up, the patient was continued to receive treatment with voriconazole (200 mg, q.12 h., po.) for 28 days. The drug was stopped again by the patient for 40 days, and then voriconazole

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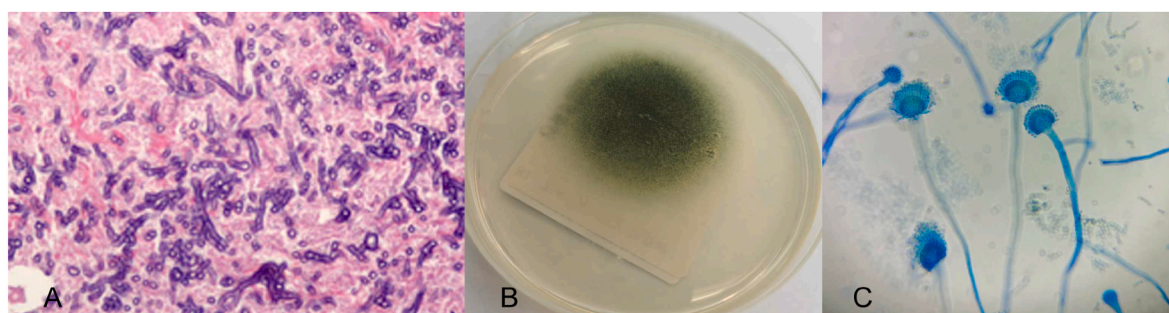
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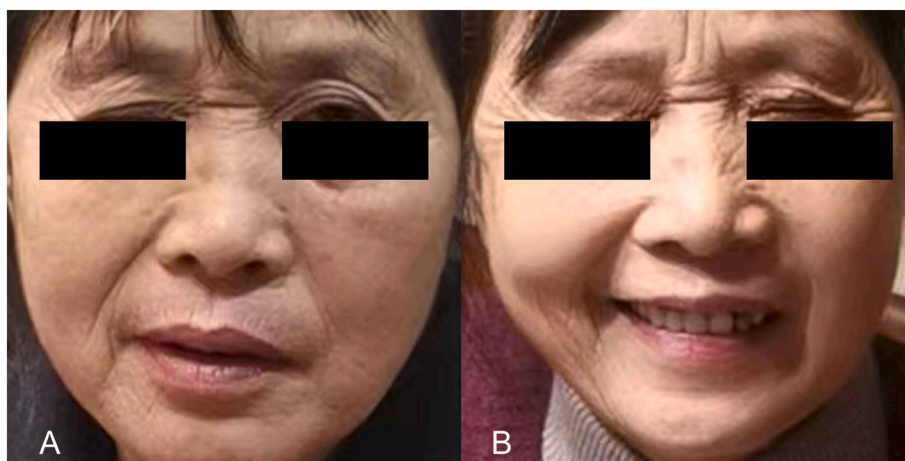
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**Fig. 1.** (A). Endoscope examination showed that the pars tensa of the left tympanic membrane was irregularly perforated and the residual tympanic membrane was edematous and hypertrophic, thick yellowish-green secretions and granulation tissue is seen in the left tympanic cavity. (B–C). Computed tomography (CT) scan showed bone erosion and destruction of external acoustic meatus, as well as soft tissue opacification in the mastoid and tympanic cavity with obstruction of the eustachian tube. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)



**Fig. 2.** (A) Histology of surgical specimen from middle ear showing branching septate fungal hyphae within necrotic tissue. (HE-stain,  $\times 400$ ). (B) Smear culture showed *Aspergillus fumigatus* colonies being dark green or smoky green, and fluffy or floc spread. (C) Lactophenol cotton blue staining showed that a typical morphology *Aspergillus fumigatus*. (For interpretation of the references to colour in this figure legend, the reader is referred to the Web version of this article.)



**Fig. 3.** (A) The patient developed 20 days after the 2nd surgery a left peripheral facial paralysis, graded House–Brackmann IV. (B) Facial nerve function recovered to House–Brackmann II after treatment with glucocorticoids and voriconazole.

(200 mg, q.12 h., po.) was continued for 14 days, after which the surgical cavity was still not dry and the tympanic membrane perforation remain unhealed.

A second open mastoidectomy and type II tympanoplasty were performed on day +197. During the operation, massive granulation tissue and thick secretions were seen in the tympanic cavity and mastoid cavity, and the implanted cartilage and perichondrium were necrotic. The temporalis fascia was used to repair the perforation and to cover the fresh incisal edge of the mastoid cavity. The cartilage of the concha cavity was removed to enlarge the entrance of the external auditory canal. Twenty days after the operation (day +217), a left peripheral facial paralysis graded House–Brackmann IV (Fig. 3A) was observed.

Simultaneously, there was a large amount of secretion exuding in the surgical cavity, and the repaired temporalis fascia was edematous and pale. The secretion was cultured and *Aspergillus fumigatus* was grown. Dexamethasone and vitamin B12 injection were given for 1 week, and the patient was started on voriconazole 200 mg orally every 12 hour for 5 months, the dosage was then reduced to 150mg orally every 12 hour for 1 month. Three months after the operation (day 287), the patient's facial nerve function slightly recovered, graded as House–Brackmann II (Fig. 3B), the perforation was healed, and the surgical cavity and external auditory canal were epithelialized and maintained dry (Fig. 4A). CT scan showed that the mastoid cavity was completely open and the fascia nicely closed off the small tympanic cavity (Fig. 4B–C).



**Fig. 4.** (A) The surgical cavity and external auditory canal were epithelialized and maintained dry. (B–C) CT scan showed that the mastoid air cell was completely open and the fascia closed the tympanic cavity to form a small tympanic cavity.

### 3. Discussion

Otomycosis is usually a fungal infection of the external auditory canal, and rarely involves the middle ear [3]. Otomycosis is an opportunistic infection most commonly seen in patients with poor immunity, poor nutritional status, abuse of antibiotics, unhygienic ear cleaning habits, and is characterized by exudation and scabbing in the external auditory canal and middle ear [4]. Fungi rarely cause inflammation of the middle ear mucosa, even in the presence of tympanic membrane perforation. Vennewald et al. conducted mycological examination of 115 patients suffering from chronic otitis media and persistent otorrhea with suspicion of otomycosis, but fungi were identified in only 5 middle ear specimens, and no invasive fungal growth into the subepithelial connective tissue was observed [5].

*Aspergillus* is the most common fungal ear infection in adults, followed by *Candida albicans*, but the common strains of *Aspergillus* vary in different regions [6–9]. Zhang et al. reported that the most common strain of ear fungal ear infection in western China is *Aspergillus tubular* [7]. Hagiwara et al. found that the strains of ear fungi in Tochigi Prefecture of Japan were *Aspergillus niger*, *Aspergillus tubular*, and *Aspergillus fumigatus* in turn [10]. Chavan et al. reported that the most common ear fungal infection in Mumbai is *Aspergillus niger* [11]. Abdelazeem et al. reported that the most common fungus in Gharbia Province of Egypt is *Aspergillus niger* [12]. Commonly used antifungal drugs are imidazoles and triazoles, which are typically applied. Imidazoles include clotrimazole, miconazole, econazole, and ketoconazole; triazoles include fluconazole, itraconazole, voriconazole.

Invasive fungal otitis media is rare in clinic. Low immunity and diabetes are risk factors of invasive fungal otitis media. *Aspergillus* spp., especially *Aspergillus fumigatus*, are the main causes of invasive fungal otitis media. Ear pain and ear leakage are the most common symptoms of middle ear fungal infection, followed by hearing loss and ear distension [3,11]. Fungal otitis media has atypical clinical features in early stage, so it is difficult to distinguish from bacterial otitis media, and serious adverse results can be caused by misdiagnosis and mistreatment [2]. Some studies reported that severe vertigo caused by labyrinthitis are also clinical manifestations of invasive otitis media. We found that invasive fungal otitis media can cause skin necrosis and bone exposure of external auditory canal, irregular perforation of tympanic membrane, continuous overflow of thick secretions, granulation of middle ear mucosa, erosion and absorption of auditory ossicles, but dead bone formation is rare. Voriconazole is considered to be the most effective drug for the treatment of invasive middle ear mastoid aspergillosis [13].

We suggest that the key to the treatment of invasive fungal middle ear mastoid infection is complete mastoidectomy and type II tympanoplasty, combined with oral administration of sensitive antifungal drugs for more than 3 months before and after operation [14]. Specifically, it is necessary to grind the posterior wall of the external auditory canal down to the level of the facial nerve, thoroughly clean the necrotic tissue and

new granulation tissue in the mastoid and tympanum, remove the cartilage of the concha cavity to enlarge the orifice of the external auditory canal, and use a large piece of temporal muscle fascia to repair the perforation and cover the fresh incised edge to speed up the epithelialization and dryness of the mastoid. For this case, the patient was given oral voriconazole according to the drug sensitivity test for 6 months before and after the second operation. Finally, the surgical cavity and the external ear canal are epithelialized and kept dry.

In conclusions, invasive fungal otitis media is a rare occurrence in the clinic. *Aspergillus*, especially *Aspergillus fumigatus*, is the main pathogen of invasive otitis media. Fungal otitis media has atypical clinical features in early stage and serious adverse results can be caused by misdiagnosis and mistreatment, the occurrence of peripheral facial paralysis during anti-inflammation is a dangerous signal of invasive middle ear fungal infection. It is recommend that invasive fungal otitis media must be treated with surgery to completely remove the lesion until fresh wounds are exposed, and a long course of antifungal drugs according to drug sensitivity test should be administered at the same time.

### Conflict of interest

There are none.

### Ethical statement

The authors confirm that the ethical policies of the journal, as noted on the journal's author guidelines page, have been adhered to. No ethical approval was required. The relatives of the deceased patient consented to publish anonymous information on his case.

### CRediT authorship contribution statement

**Wenjie Kang:** Writing – original draft, Data curation. **Jie Zhang:** Writing – original draft, Data curation. **Hanbing Gao:** Writing – review & editing, Data curation. **Ming Guan:** Writing – review & editing, Writing – original draft, Funding acquisition, Data curation, Conceptualization.

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## References

- [1] F. Rob, L. Školoudík, V. Chrobok, J. Dědková, P. Kašparová, L. Podrazilová, Invasive *Aspergillus* infection of middle ear in a patient treated with secukinumab, methotrexate, and corticosteroids for psoriasis and psoriatic arthritis, *J. Dermatol. Treat.* 33 (7) (2022) 3063–3065.
- [2] Y. Liu, L. Han, J. Cao, Invasive fungal otitis media in diabetic patients: a case-based review, *The journal of international advanced otology* 19 (1) (2023) 55–60.
- [3] M. Gharaghani, Z. Seifi, A. Zarei Mahmoudabadi, Otomycosis in Iran: a review, *Mycopathologia* 179 (5–6) (2015) 415–424.
- [4] E. Geraymovych, J.H. Conduff, P.S. Braich, C.T. Leffler, V.S. Brar, Prevalence and factors predictive of intraocular fungal infection in patients with fungemia at an academic urban tertiary care center, *Clin. Ophthalmol.* 9 (2015) 1853–1858.
- [5] I. Vennewald, J. Schönlebe, E. Klemm, Mycological and histological investigations in humans with middle ear infections, *Mycoses* 46 (1–2) (2003) 12–18.
- [6] T.J. Martin, J.E. Kerschner, V.A. Flanary, Fungal causes of otitis externa and tympanostomy tube otorrhea, *Int. J. Pediatr. Otorhinolaryngol.* 69 (11) (2005) 1503–1508.
- [7] L. Zhang, X. Wang, J. Houbraken, H. Mei, W. Liao, H. Hasimu, et al., Molecular identification and in vitro antifungal susceptibility of *Aspergillus* isolates recovered from otomycosis patients in western China, *Mycopathologia* 185 (3) (2020) 527–535.
- [8] Y. Li, L. He, Diagnosis and treatment of otomycosis in southern China, *Mycoses* 62 (11) (2019) 1064–1068.
- [9] S. Khan, H. Bilal, M. Shafiq, D. Zhang, M. Awais, C. Chen, et al., Distribution of *Aspergillus* species and risk factors for aspergillosis in mainland China: a systematic review, *Therapeutic advances in infectious disease* 11 (2024) 20499361241252537.
- [10] S. Hagiwara, T. Tamura, K. Satoh, H. Kamewada, M. Nakano, S. Shinden, et al., The molecular identification and antifungal susceptibilities of *Aspergillus* species causing otomycosis in Tochigi, Japan, *Mycopathologia* 184 (1) (2019) 13–21.
- [11] R.P. Chavan, S.M. Ingole, G.S. Kanchewad Resident, Single topical application of 1% clotrimazole cream in otomycosis, *Indian J. Otolaryngol.* 75 (Suppl 1) (official publication of the Association of Otolaryngologists of India. 2023) 147–154.
- [12] M. Abdelazeem, A. Gamea, H. Mubarak, N. Elzawawy, Epidemiology, causative agents, and risk factors affecting human otomycosis infections, *Turk. J. Med. Sci.* 45 (4) (2015) 820–826.
- [13] P.L. Shao, L.M. Huang, P.R. Hsueh, Recent advances and challenges in the treatment of invasive fungal infections, *Int. J. Antimicrob. Agents* 30 (6) (2007) 487–495.
- [14] M. Youssef, M. Bassim, N. Shabb, S.S. Kanj, *Aspergillus* mastoiditis in an immunocompetent patient: a case report and review of the literature, *Scand. J. Infect. Dis.* 46 (4) (2014) 325–330.