

1 **Cerebellar abscess caused by extension of an otogenic infection through the**  
2 **labyrinth and internal auditory canal**

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4 Brain abscesses are the second most common intracranial complication of chronic otitis  
5 media and cholesteatoma<sup>1</sup>. Otogenic brain abscesses are relatively rare in the Western  
6 world due to early diagnosis and appropriate treatment of middle ear disease,  
7 nevertheless a high mortality rate of 40% has been reported even in patients treated  
8 with antibiotics. Current literature presents three common pathways of intracranial  
9 extension of otogenic infections: direct spread via an eroded dural plate of the middle or  
10 posterior fossa; meningogenic extension through the labyrinth and the vestibular or  
11 cochlear aqueduct; and hematogenous dissemination along venous routes or  
12 secondary to sigmoid sinus thrombosis<sup>2,3</sup>. We present a case of cerebellar abscess  
13 formation associated with extension of chronic middle ear disease through the labyrinth  
14 and the internal auditory canal (IAC) to the cerebellar peduncle; a pathway not well  
15 documented in the literature.

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17 *Case presentation*

18 A 44-year old man with a history of recurrent otitis media during childhood and a  
19 previous diagnosis of sudden deafness on the right side with incomplete remission  
20 twelve years prior to the current episode, now presented with hearing loss and otalgia  
21 on the right side that had been progressive over months, an acute onset ipsilateral facial  
22 paresis that had been troubling the patient for some weeks, and dysarthria and gait  
23 disturbance with a tendency to fall that had become apparent since a few days.  
24 Otoscopy showed purulent otorrhea, loss of tympanic membrane landmarks, and  
25 abundant granulation tissue. Neurologic examination demonstrated a facial hemiparesis  
26 on the right (House-Brackmann grade 3), a grade 2 nystagmus to the right, diplopia,  
27 hypoesthesia of the right face, ataxia, dysarthria, gait abnormality, and an apparent  
28 tendency to fall towards the right side; suggesting involvement of cranial nerves V, VI,  
29 VII and VIII and cerebellar dysfunction. Computed tomography (CT) showed  
30 opacification of the right middle ear and mastoid, with erosion of the ossicles, the  
31 cochlea and cochlear aperture, and possibly the oval window (figure 1A). Contrast

32 enhanced T1 weighted magnetic resonance imaging (MRI) revealed enhancement in  
33 the middle ear, cochlea, IAC, CPA, and a hypointense mass with rim enhancement of  
34 the right cerebellum (figure 1B). This mass mimicked a cystic cerebellopontine angle  
35 tumor because of its location and appearance on contrast enhanced T1 weighted MR  
36 imaging. Diffusion-weighted imaging (DWI) demonstrated restricted diffusion in the right  
37 middle ear and mastoid, suggestive of cholesteatoma.

38 A subtotal petrosectomy with a trans-otic approach to the CPA was performed, during  
39 which a mastoid and middle ear cholesteatoma was removed, the cochlea was  
40 exenterated, the IAC and CPA were opened, and the cerebellar abscess was drained  
41 through the translabyrinthine route. Remarkably, the erosion of the labyrinth was not  
42 caused by the cholesteatoma, which was confined to the mastoid and middle ear. The  
43 eroded cochlea, like the semicircular canals and the IAC, contained granulous tissue  
44 and pus. Cultures revealed *E. coli* strains and intravenous flucloxacillin, ceftazidime and  
45 metronidazole were continued for several weeks. As expected, the hearing and  
46 vestibular function on the right side did not recover, but the patient demonstrated  
47 improved balance and a full recovery of the function of cranial nerves V, VI and VII.  
48 Follow-up MR imaging demonstrated complete remission of the abscess after 3 months.

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## 50 *Discussion*

51 The preoperative CT and MR imaging illustrates a spread of infection from the middle  
52 ear, through the eroded cochlea and cochlear aperture, to the internal auditory canal  
53 and further onwards to the cerebellum. This route is supported by the pattern of  
54 symptom progression; starting with vestibulocochlear and facial nerve dysfunction and  
55 followed by dysarthria, ataxia and gait disturbances indicating cerebellar involvement. It  
56 represents an alternative, fourth pathway of spread of otogenic infections that has been  
57 suggested only once before by Politzer in 1916<sup>4</sup>.

58 Currently, it is not well understood why bacterial labyrinthitis sometimes results in  
59 obliteration of the labyrinth by fibrous or osseous tissue, and sometimes in erosion of  
60 the labyrinth, as in this case. The type of cochlear involvement is most probably  
61 determined by the properties of the specific causative bacterium, its toxins, or the

62 inflammatory response. Interestingly, *E.coli* strains (as found in the current case) have  
63 been associated with osteolysis through osteoclastogenesis<sup>5</sup>.  
64 Contrast enhanced CT or MR imaging is essential in the preoperative diagnosis of this  
65 type of intracranial complication of chronic otitis, showing enhancement of the IAC and  
66 intracerebral or intracerebellar lesions with rim enhancement.

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#### 88 *Figure legends*

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90 Figure 1. Preoperative CT imaging.

91 A. Axial CT image showing opacification of the right mastoid process (M) and middle  
92 ear (ME), extensive boney erosion of the ossicular chain, Fallopian canal (F), cochlea

93 (C) and cochlear aperture (CA), with an apparent connection between the middle ear,  
94 the vestibule and the internal auditory canal (IAC), but no erosion of the dural plate.

95 B. Coronal CT image showing opacification of the right middle ear (ME), extensive  
96 boney erosion of the ossicular chain and cochlea (C), but no erosion of the dural plate.  
97 The Fallopian canal is intact in this image (F).

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100 Figure 2. Preoperative MR imaging.

101 A. T1-weighted Gadolinium-enhanced axial MR image showing contrast enhancement  
102 of the right middle ear, cochlea (C), internal auditory canal (IAC) and cerebellopontine  
103 angle (CPA), and a hypointense lesion with rim enhancement in the cerebellar  
104 peduncle, suggesting an infection spreading from the middle ear through the labyrinth  
105 and IAC to form an intracerebellar abscess (A). The sigmoid sinus (SS) is patent.

106 B. Preoperative T2-weighted axial MR image showing a hyperintense signal in the right  
107 mastoid and middle ear, and an intermediate signal in a distorted cochlea (C), indicative  
108 of cochlear erosion and diminished patency. A diffuse intermediate intensity signal is  
109 visible in the cerebellum and brain stem, indicative of abscess formation and edema.

110 C. Preoperative non-epi diffusion-weighted MR image showing diffusion restriction in  
111 the right middle ear (ME), indicating a cholesteatoma, and to a lesser extent also in the  
112 cerebellum at the location of the abscess (A).

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