Spontaneous Otogenic Pneumocephalus: Reporting a Unique Site of Dehiscence

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spontaneous otogenic pneumocephalus, petrous apex, altitude changes, temporal bone

Pneumocephalus is the presence of air in the intracranial space and is usually caused by trauma, tumor, or infection.¹ Spontaneous occurrences of pneumocephalus, however, are very rare and generally result from a skull base defect.² In this report, we present a case of spontaneous otogenic pneumocephalus that developed during an airplane flight. We believe that this is the first report of spontaneous pneumocephalus involving the petrous apex. A combined right transmastoid and middle fossa surgical approach was performed to repair the defect, followed by no recurrence of symptoms.

Case Report
This report was exempted from review by the Thomas Jefferson University Institutional Review Board.

Presentation
A 67-year-old woman reported the onset of severe vertigo, nausea, vomiting, headache, and acute ear pain while flying in an airplane for several hours. The patient had no history of otologic surgery or disease and had baseline high-frequency symmetric sensorineural hearing loss. Immediately after landing, the patient was transferred to the emergency department with bloody drainage from her right ear.

A noncontrast head computed tomography scan, performed at an outside institution, showed pneumocephalus in the right middle fossa adjacent to the temporal bone (Figure 1). The patient later underwent a neck and skull base computed tomography scan, with and without contrast, which indicated thinning and possible dehiscence of the right tegmen tympani (Figure 2). Magnetic resonance imaging of the internal auditory canal with and without contrast did not indicate any evidence of encephalocele. Notably, no defect was identified in the petrous apex on preoperative imaging studies.

The patient was referred to our institution for treatment. Physical examination demonstrated both tympanic membranes to be normal, suggesting that the bloody drainage observed at the time of symptom onset was secondary to a perforation that had since healed. Conservative treatment was discussed; however, the patient wished to move forward with surgical repair to allow flying without recurrence of symptoms.

Procedure
The patient was brought to the operating room for a combined transtemporal and middle fossa approach to repair the anticipated bone defect. A complete mastoidectomy was performed, which surprisingly showed no evidence of dehiscence involving the tegmen tympani or tegmen mastoid, no encephalocele, and no cerebrospinal fluid leakage. A middle fossa craniotomy was performed, which confirmed the absence of a defect over the tegmen. However, medial and anterior to the tegmen, a bony defect was identified involving a pneumatized petrous apex, with a small associated encephalocele and dural defect. The middle fossa floor was resurfaced with temporalis fascia to cover the dural defect, and mastoid cortical bone combined with bone cement was used to cover the defective petrous apex. Dural sealant was used for reinforcement.

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Postoperative Course

Postoperatively, the patient recovered and experienced no complications. Postoperative magnetic resonance imaging performed 3 months after surgery showed postsurgical changes and no evidence of intracranial air. As of 3 years from the time of surgery, the patient has resumed flying and has experienced no recurrence of symptoms.

Discussion

Cases of spontaneous pneumocephalus are exceedingly rare. We believe that our patient is the second reported case of subdural spontaneous pneumocephalus with an otogenic origin occurring on an airplane or due to altitude changes. The only other case with an otogenic origin also occurred with an altitude change and was described by Hage et al in 2015.3 Thus, altitude changes as triggering events for spontaneous pneumocephalus are rare but should be considered.

Surgery is the recommended course of action for correction, aiming to release the intracranial pressure as well as repair any fistula found at the temporal bone roof and dura. The techniques for correcting the spontaneous pneumocephalus essentially mirror those for otogenic cerebrospinal fluid leak repair. Typically, closing the communication between the mastoid and cranial cavity is the goal and is done with multilayer closure. For patients with intact hearing, surgeons should seal the middle ear from the mastoid cavity and/or obliterate the mastoid with fat or muscle. Following a review of 35 cases, there have been no reports of recurrent spontaneous pneumocephalus once the communication had been sealed.

The petrous apex is a unique and previously never-reported site of dehiscence. In most cases, spontaneous pneumocephalus is identified in the tegmen or posterior fossa. When no defect is found, the petrous apex should be evaluated. This diagnosis should be considered for patients who report acute nonspecific neurologic symptoms and are found to have intracranial air on imaging studies.

Author Contributions

Matthew Stewart, conception, drafting, revising, final approval; Christopher Farrell, acquisition and analysis of data (intraoperative), revising, final approval; Stanley Pelosi, conception, acquisition and analysis of data (intraoperative), revising, final approval.

Disclosures

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