Published in final edited form as:

Otol Neurotol. 2017 April ; 38(4): e19–e20. doi:10.1097/MAO.0000000000001363.

Imaging Case of the Month Pneumatocele of the Tympanic Membrane

Shekhar K. Gadkaree, Taha A. Jan, and Alicia M. Quesnel

Department of Otolaryngology, Massachusetts Eye and Ear, Harvard Medical School, Boston, Massachusetts

A pneumatocele refers to a collection of trapped air enveloped by surrounding soft tissue that is usually the result of a traumatic or infectious insult to the tissue. Rarely, pneumatoceles of the mastoid portion of the temporal bone have been described that extend into the external auditory canal (EAC), causing compression or obstruction and thereby leading to hearing loss (1,2). To the best of our knowledge, pneumatoceles originating in the EAC at the level of the tympanic membrane have not been well described in the English language literature and may affect surgical planning (1,2). This case outlines the presentation, development, and surgical considerations of a tympanic membrane pneumatocele in a cochlear implant candidate.

A 69-year-old man presented with right greater than left asymmetric sensorineural hearing loss (SNHL) and a remote history of right chronic otitis media. His clinical history was also significant for intermittent bloody otorrhea from his right ear when using a home continuous positive airway pressure (CPAP) device without otalgia or vertigo. Otoscopic examination of the right ear was notable for a cystic mass filling the mid-portion of the EAC with no associated ulceration. The cystic mass could be laterally displaced by autoinsufflation. Audiometry revealed profound right SNHL with 6% word recognition score and 85 dB pure tone average (PTA), and left moderate SNHL with 68% word recognition score and 72 dB PTA. A magnetic resonance imaging showed no vestibular schwannoma or other retrocochlear lesions. Computed tomography of the temporal bone demonstrated an aerated middle ear, normal ossicles, normal cochlea, and a subtle outline of the cyst wall in the mid-EAC. These series of findings led to the diagnosis of a pneumatocele of the tympanic membrane.

The patient was followed over 1 year and his pneumatocele was intermittently present at office examinations. At some visits, the tympanic membrane appeared normal with no visible defect in the pars flaccida on otomicroscopy. Due to his profound right SNHL and progressive, fluctuating left SNHL, he opted for a staged tympanoplasty with canaloplasty and resection of pneumatocele followed by cochlear implantation. At surgery, the EAC was completely obstructed by the pneumatocele, which extended from a 2 mm hole in the anterior pars flaccida, tunneled under the EAC skin in the posterior/superior quadrant, and

Address correspondence and reprint requests to Alicia M. Quesnel, M.D., Massachusetts Eye and Ear, 243 Charles Street, Boston, MA 02114; Alicia_Quesnel@meei.harvard.edu.

The authors disclose no conflicts of interest.

extended medial to the superior half of the tympanic membrane (Fig. 1). The ossicular chain and chorda tympani were unaffected. When the EAC skin was removed off the cyst surface, a small vessel was visualized on the mucosalized surface of the air filled cyst, likely the source of intermittent bloody otorrhea experienced by the patient during CPAP use (Fig. 2). Given the anterior marginal location of the perforation in the pars flaccida and extension of the pneumatocele medial to the superior half of the tympanic membrane, a postauricular approach and total drum lateral graft technique was used intraoperatively. Pathology showed columnar epithelium with chronic inflammation.

The origin of the pneumatocele in this case appeared to be the lesion in the pars flaccida. Typically, pneumatoceles are formed due to infectious or traumatic insults to tissue. In traumatic insults, the compressive force of trauma is subsequently followed by rapid decompression, thereby creating a negative pressure that may lead to the formation of an air cavity. Infectious insults cause inflammation and fluid accumulation that can create a potential space between tissues. As fluid is resorbed with resolution of the infectious insult, an air cavity may persist. The tympanic membrane may be subjected to both infectious and traumatic insults, and identifying the causative etiology is difficult (1). While infectious insults may be common in patients with chronic otitis media, the bloody otorrhea noted with CPAP implies that the middle ear cavity was subjected to elevated pressures and provides a feasible mechanism for traumatic insult as well (3). CPAP creates a positive pressure force leading to expansion of potential spaces, which could eventually lead to the formation of a pneumatocele as seen in this case.

The images presented with this case study may aid in diagnosis of a rare EAC mass that presented with intermittent bloody otorrhea. This case highlights two interesting features of a tympanic membrane pneumatocele: 1) that the pneumatocele may be intermittently present within the EAC and 2) that the pneumatocele may be associated with a large cystic component within the middle ear space. This should be considered when planning the tympanoplasty approach for repair of a tympanic membrane pneumatocele, and factored into the surgical management plan for a two staged tympanoplasty and cochlear implantation for this patient. A tympanic membrane pneumatocele should be considered in the differential diagnosis of masses of the external auditory canal and abnormalities of the tympanic membrane, particularly in patients on CPAP.

REFERENCES

1. Lichtenberg R, Russell EJ. High-resolution CT of mastoid sinus pneumocele with external auditory canal stenosis. *AJNR Am J Neuroradiol* 1995;16:1703–6. [PubMed: 7502977]
2. Delabie G, Gordts F, Clement PAR. Mastoid pneumocele with secondary pneumatocele causing external auditory canal obstruction and the influence of forced nose blowing. *Ear Nose Throat J* 2010;89:E3–5. [PubMed: 20155688]
3. Lin FY, Gurgel RK, Popelka GR, Capasso R The effect of continuous positive airway pressure on middle ear pressure. *Laryngoscope* 2012;122:688–90. [PubMed: 22252535]

FIG. 1.
Initial view of pneumatocele obstructing EAC (*solid arrow*) on approach from the external auditory canal. Air filled cystic mass showing no associated ulceration. EAC indicates external auditory canal.

FIG. 2.

Secondary view of pneumatocele with EAC skin layer removed off cyst surface. Small vessel (*solid arrow*) on mucosalized pneumatocele surface. Two millimeter lesion in anterior pars flaccida (*dashed arrow*) also evident. *Solid line* indicates external boundary of cyst. *Dashed line* indicates area of cyst inside middle ear cavity.