

# Acute Transient Sensorineural Hearing Loss Due to *Anaplasma phagocytophilum*

Princy Ghera, MD; Yusuf Kasirye, MD; Muhammad Waqas Choudhry, MD; Gene R. Shaw, MD; Victor S. Ejercito, MD

## ABSTRACT

We report the case of a patient who presented with a 3-month history of random epistaxis and recent onset of acute hearing loss associated with fever, chills, and myalgias. Pure tone audiometry revealed bilateral sensorineural hearing loss. Complete blood cell count showed an abnormal neutrophil count of 700/uL (normal >1900/uL) and platelet count of  $25 \times 10^3$ /uL (normal >175  $\times 10^3$ /uL). Giemsa-stained peripheral blood smear revealed neutrophilic intracytoplasmic inclusion consistent with anaplasma morulae. Polymerase chain reaction confirmed *Anaplasma phagocytophilum*. The patient was treated with oral doxycycline, and, after 14 days of treatment, the hearing loss had improved markedly. Therefore, we concluded that the patient's acute transient bilateral sensorineural hearing loss was associated with anaplasmosis.

## CLINICAL VIGNETTE

A 61-year-old woman with a past medical history significant for fibromyalgia presented with a 3-month history of random epistaxis and a 1-week history of acute onset hearing loss associated with fevers, chills, and generalized myalgias. She reported having a fever as high as 102° F at home. Her nose bleeds were nontraumatic, with no associated bleeding of the gums, hematuria, melana, or hematochezia. She described her sudden onset hearing loss as a sensation of ear “fullness” or “plugging” without any vestibular symptoms, otalgia, or ear discharge. Although her risk factor for a tickborne illness remained high, given that she was a resident of a rural area of Wisconsin with a home surrounded by woods and was involved in outdoor activities (ie, gardening, walking in woods, etc), she was uncertain as to whether she'd had any tick bites. She was taking cycloben-

• • •

**Authors Affiliations:** Department of Medicine-Pediatrics, Marshfield Clinic, Marshfield, Wis (Ghera); Department of Internal Medicine, Marshfield Clinic, Marshfield, Wis (Kasirye, Waqas Choudhry); Department of Lab-Pathology, Marshfield Clinic, Marshfield, Wis (Shaw); Department of Otolaryngology, Marshfield Clinic, Marshfield, Wis (Ejercito).

**Corresponding Author:** Princy Ghera, MD, Department of Medicine-Pediatrics, 1000 N Oak Ave, Marshfield Clinic, Marshfield, WI 54449; phone 715.387.5600; fax 715.389.5757; e-mail ghera.princy@marshfield-clinic.org.

zaprine for muscle pain as needed, but denied any recent medication intake that could be ototoxic. She did have some mild sensorineural hearing loss evident on a prior audiogram, but without any associated symptoms in the past (Figure 1a).

On physical examination, there were no signs of petechiae, ecchymoses, or skin rash. The ears were normal on otoscopic examination. The patient's presentation warranted basic blood work including complete blood count

(CBC), basic metabolic panel (MPB), erythrocyte sedimentation rate (ESR), C-reactive protein (CRP), prothrombin time/International Normalized Ratio (PT/INR), and activated partial thromboplastin time (APTT). This revealed an elevated inflammatory marker—CRP at 19 mg/dL (normal <1 mg/dL), but normal ESR at 14 mm/hr (normal <17 mm/hr). Her CBC showed an absolute neutrophil count of 700/uL (normal >1900/uL), platelets  $25 \times 10^3$ /uL (normal >175  $\times 10^3$ /uL), and a normal hemoglobin. Pure tone audiometry was performed and revealed bilateral sensorineural hearing loss with a speech recognition threshold (SRT) in the right ear at 45 decibels and in the left ear at 40 decibels. A speech discrimination score of 84% and 80%, respectively, also was noted (Figure 1b). At this point, given the history and the abnormal studies, our differential diagnosis included acute leukemia, viral illness, cyclobenzaprine-associated drug reaction, tickborne illness, or retrocochlear lesion.

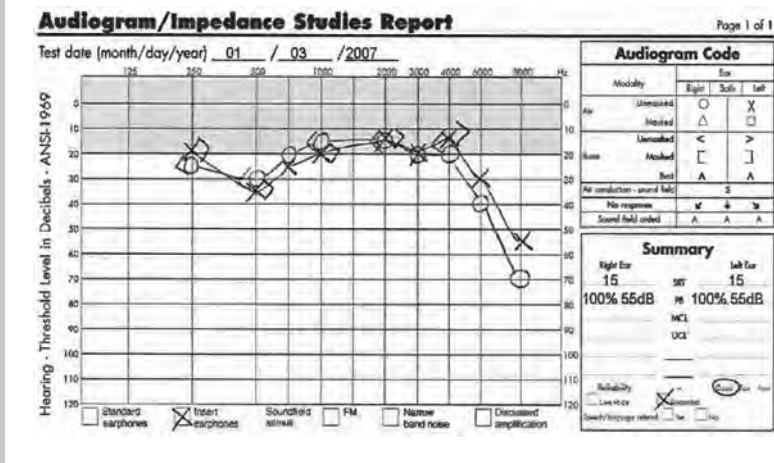
In the next tier of laboratory studies, a Giemsa-stained peripheral blood smear was performed and revealed neutrophilic intracytoplasmic inclusion consistent with an anaplasma morulae (Figure 2). Polymerase chain reaction (PCR) confirmed *Anaplasma phagocytophilum*. Further tests were negative for other tickborne infections. Given this positive finding, no further testing/imaging was pursued. The patient was started on oral doxycycline 100mg twice daily. Both laboratory values and the patient's symptoms began to improve within 2 to

4 days of the antibiotic therapy, and she was discharged to home to complete a 14-day course of doxycycline. Her epistaxis was thought to be related to low platelets. The CBC normalized after 11 days of treatment. The neutrophil count was normal at 2000/uL (normal >1900/uL), and platelets were normal at 337 x 10<sup>3</sup>/uL (normal >175 x 10<sup>3</sup>/uL). Follow-up audiometry studies after 14 days of treatment revealed marked improvement of the patient's hearing loss, with the SRT in the right ear at 15 decibels and in the left ear at 20 decibels. Speech discrimination score also improved to 96% in both ears, similar to her audiology findings prior to infection (Figures 1a and 1c). It is most likely that our patient's acute transient bilateral sensorineural hearing loss was due to anaplasmosis, a feature already described in other members of the *rickettsiae* species. The improvement in the hearing loss with the treatment of her anaplasmosis further supports this impression.

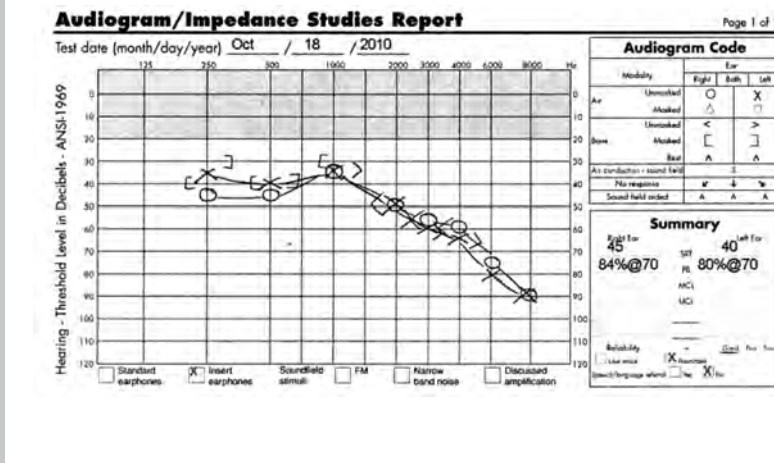
## DISCUSSION

Human granulocytic anaplasmosis (HGA) was first described in 1994 as a tickborne disease caused by an obligate, intracytoplasmic, gram-negative bacteria called *Anaplasma phagocytophilum*.<sup>1,2</sup> It belongs to the order *rickettsiales*, family *anaplasmataceae*, and genus *Anaplasma*. This family also includes genus *Ehrlichia*, an organism with similar infectious characteristics.<sup>3</sup> As is common for organisms in the *rickettsiale* order, transmission is predominantly via tick bites; hence it is considered a tickborne bacterial infection. Ticks of the *Ixodes* species are the vectors for *Anaplasma phagocytophilum*, with other mammals acting as the reservoir.<sup>1-3</sup> Rickettsial diseases are zoonotic illnesses caused strictly by intracellular agents.<sup>3</sup>

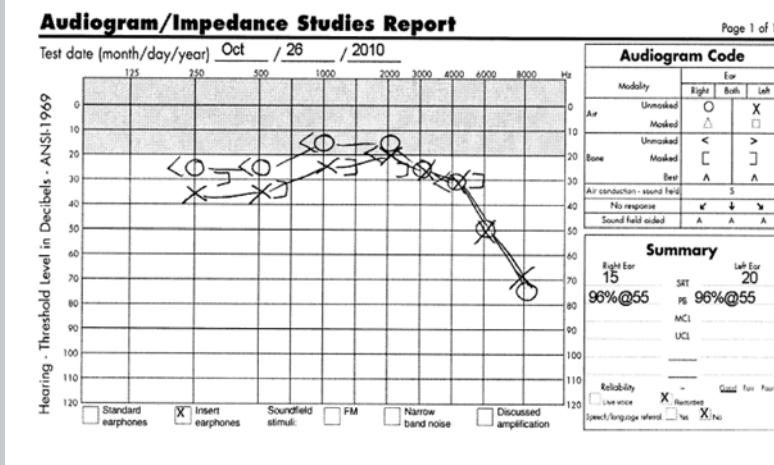
HGA can present as either a self-limited febrile illness or a fulminant multisystemic disease. Disease severity correlates with extremes of age and comorbidities. The incubation period is about 7 to 21



a.

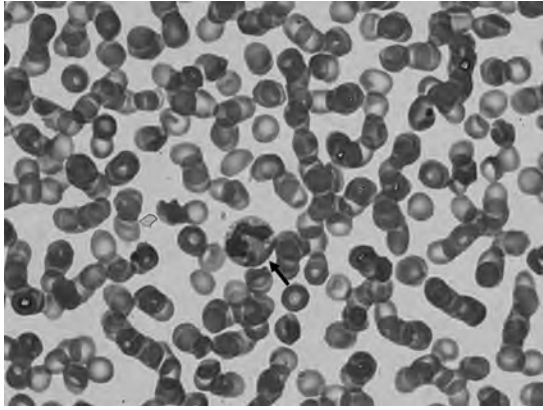


b.



c.

**Figure 1.** Patient's audiogram (a) 3 years prior to the infection; (b) showing sensorineural hearing loss in bilateral ears with speech recognition; (c) showing improved hearing loss after treatment with doxycycline.



**Figure 2.** *Anaplasma morulae* seen as an intracytoplasmic inclusion in a neutrophil.

days, after which a patient develops fevers, chills, myalgia, and headache. Rare and unusual presentation features include acute sensorineural hearing loss (as was present in our patient), meningoencephalitis, or opportunistic infections due to severe neutropenia.<sup>1,2</sup> Severe headache is the most common neurological symptom. Neurological manifestations can occur in both the acute and subacute convalescent phases. Appearance of a rash strongly suggests the diagnosis of HGA.<sup>3</sup> Laboratory features include neutropenia, lymphopenia, thrombocytopenia, and elevated inflammatory markers (erythrocyte sedimentation rate and C-reactive protein).

Transient acute sensorineural hearing loss due to *rickettsiae* order is very rare.<sup>4</sup> A thorough search of the literature revealed only a few case reports of sensorineural hearing loss caused by the *rickettsiae* order.<sup>3</sup> Ehrlichiosis has been emerging more recently as the cause of neuromeningeal complications.<sup>5</sup> The exact mechanism remains unknown, although the propensity of these organisms to invade the central nervous system has raised the hypothesis that this presentation might be a result of eighth cranial nerve neuropathy. Another theory assumes that *Rickettsia* induce vasculitis with subsequent infarction of neural tissue by direct invasion of the endothelium involving the cochlear vasa vasorum or vasa nervosum of the cochlear nerve,<sup>3,6</sup> leading to sensorineural injury. This usually resolves after treatment of the primary disease.

Peripheral blood smear in infected patients usually shows an intracytoplasmic inclusion body. Confirmation of the diagnosis can be done by indirect fluorescent antibody test (IFA), PCR,

or tissue immunochemical staining. Although IFA is the most sensitive test, antibodies only appear 2 to 3 weeks after onset of the disease. Although not readily available in all institutions, PCR is faster and more useful in confirming the diagnosis. However, beginning treatment based only on suspicion of the disease is recommended<sup>1</sup> because delay in treatment can result in permanent neurological sequelae and even death.<sup>7</sup> This also can be dependent on comorbid conditions such as age and chronic disease status.<sup>6,7</sup>

Tetracyclines are the first line of treatment. In patients where tetracyclines are contraindicated (allergic, pediatric, or pregnant), rifampin can be used. The latter can be combined with a cephalosporin if there is co-infection with other tickborne illnesses.<sup>2</sup>

Prior diagnosis of rickettsial-induced hearing loss has been made on the basis of IgM antibodies in the serum and reversal of hearing loss with tetracycline treatment.<sup>3</sup> In our patient, the lab work was consistent with anaplasmosis, the hearing loss improved with no other specific treatment, and there was no other possible explanation for the former. Therefore, we concluded that the patient's acute transient bilateral sensorineural hearing loss was associated with anaplasmosis.

**Acknowledgments:** The authors thank the Marshfield Clinic Research Foundation's Office of Scientific Writing and Publication for editorial assistance in the preparation and submission of this manuscript.

**Financial Disclosures:** None declared.

**Funding/Support:** None declared.

## REFERENCES

1. Chen SM, Dumler JS, Bakken JS, Walker DH. Identification of a granulocytotropic Ehrlichia species as the etiologic agent of human disease. *J Clin Microbiol*. 1994;32(3):589-595.
2. Wormser GP, Dattwyler RJ, Shapiro ED, et al. The clinical assessment, treatment, and prevention of Lyme disease, human granulocytic anaplasmosis, and babesiosis: clinical practice guidelines by the Infectious Diseases Society of America. *Clin Infect Dis*. 2006;43(9):1089-1134.
3. Tsiachris D, Deutsch M, Vassilopoulos D, Zafiropoulou R, Archimandritis AJ. Sensorineural hearing loss complicating severe rickettsial diseases: report of two cases. *J Infect*. 2008;56(1):74-76.
4. Raoult D, Roux V. Rickettsioses as paradigms of new or emerging infectious diseases. *Clin Microbiol Rev*. 1997;10(4):694-719.
5. Christmann D, Hansmann Y, Remy V, Lesens O. [Tick-borne neurological diseases.] [Article in French] *Rev Neurol (Paris)*. 2002;158(10Pt1):993-997.
6. Marrie TJ, Raoult D. Rickettsial infections of the central nervous system. *Semin Neurol*. 1992;12(3):213-224.
7. Glaser C, Christie L, Bloch KC. Rickettsial and ehrlichial infections. *Handb Clin Neurol*. 2010;96:143-158.

advancing the art & science of medicine in the midwest

**WMJ**

*WMJ* (ISSN 1098-1861) is published through a collaboration between The Medical College of Wisconsin and The University of Wisconsin School of Medicine and Public Health. The mission of *WMJ* is to provide an opportunity to publish original research, case reports, review articles, and essays about current medical and public health issues.

© 2011 Board of Regents of the University of Wisconsin System and The Medical College of Wisconsin, Inc.

**Visit [www.wmjonline.org](http://www.wmjonline.org) to learn more.**