

## Aural Abscess in a River Cooter (*Pseudemys concinna*)

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**Abstract :** A 3-year-old, captive female river cooter was presented with a 4-day history of progressive unilateral swelling of the right side of the head, lethargy, and anorexia. History, physical examination, and radiographic examination revealed an aural abscess. After administration of antibiotics and supportive care, surgical intervention was performed. Swab samples were collected from the tympanic cavity during surgery for cytology and antimicrobial susceptibility testing. Molecular analyses of 16S ribosomal RNA gene sequences identified *Citrobacter* spp. and *Morganella morganii*. The patient was treated with ciprofloxacin and meloxicam and recovered after 2 months. This report describes the successful correction of a unilateral aural abscess that responded well to surgical intervention and a properly selected antibiotic.

**Key words :** chelonian, aural abscesses, ear infection, middle ear, tympanic cavity.

### Introduction

Aural abscess, presenting as a unilateral or bilateral swelling of the tympanic cavity or middle ear, is a common clinical disease in chelonians (1). Although the exact cause of aural abscess in turtles is unclear, most appear to be the result of several predisposing factors including improper husbandry, chronic suboptimal habitat temperature, and inadequate nutrition resulting in vitamin A deficiency (2). As a result, the reptile tends to be immunosuppressed, leading to the development of secondary opportunistic infections (1,3). The cell-mediated immunologic response to the pathogens manifests as an accumulation of granulocytes and histiocytes (1,2). Since reptiles lack lytic enzymes within their granulocytic leukocytes, the inflammatory exudate tends to be caseous rather than liquid (1,2).

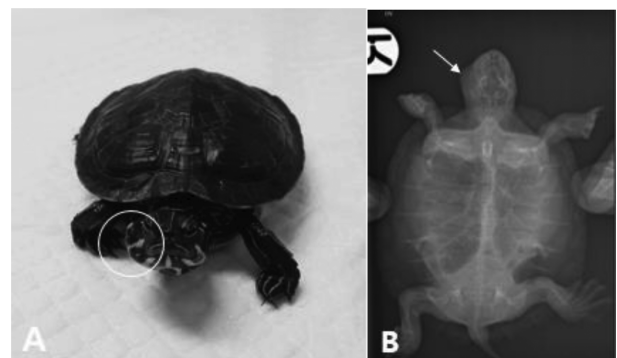
Most aural abscesses heal completely after surgical removal (3). For chelonians with long-standing abscesses, delay of surgical intervention and initiation of systemic antibiotics, fluids, and appropriate supportive care for 3 to 4 days are beneficial, improving the overall outcome of treatment (1,3). Appropriate anesthesia should be administered to facilitate adequate debridement of the tympanic cavity and alleviate the pain associated with the disease process (1). After surgery, suitable analgesics and antibiotics should be administered as long as is needed (3).

The present report describes a case of unilateral aural inflammation that responded well to surgical manipulation and a properly selected antibiotic. To the authors' knowledge, this study provides the first clinical description of a facultative anaerobic bacterial infection from the tympanic cavity of a river cooter in Korea.

### Case Report

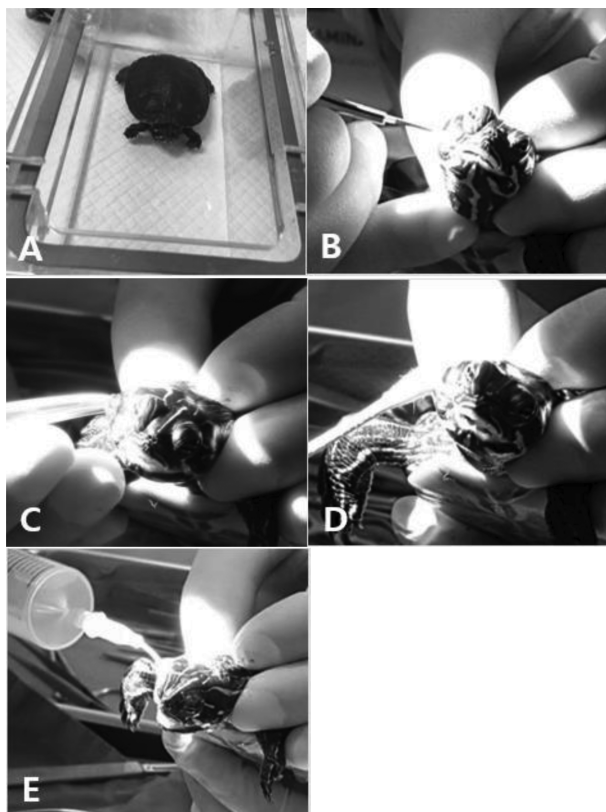
A 3-year-old, captive female river cooter weighing 0.13 kg was presented for consultation with a 4-day history of progressive swelling on the right side of her head, lethargy, and anorexia (Fig 1A). Physical examination showed depression with significant unilateral aural swelling. A dorsoventral radiograph demonstrated soft tissue swelling of the right side of the head (Fig 1B). According to the owner, the turtle's diet consisted of vegetables and commercial turtle chow without vitamin supplements. Moreover, the turtle was housed in a vivarium that was disinfected twice a week.

On the basis of the patient history and clinical examination, the turtle was diagnosed as having a unilateral aural abscess. Before surgical removal of the infected tissue, gentamicin (3 mg/kg intramuscular, Gentamicin Sulfate Injection Sinil<sup>®</sup>, Sinilpharm, Seoul, Korea), ciprofloxacin (10 mg/



**Fig 1.** Unilateral swelling of the right side of the head (circle) indicating abscess formation in the tympanic cavity (A) and soft tissue opacity of the swollen area of the right side of the head (arrow) indicating no involvement of the surrounding osseous structures of the ear (B).

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**Fig 2.** Surgical procedures for the aural abscess. After the general anesthesia (A), the bulla is incised horizontally (B). Inflammatory debris is gently removed (C), and a swab is used to obtain samples from the inside of the tympanic cavity (D). Finally, the tympanic cavity is flushed with warm saline (E).

kg by mouth [PO] q48h, Prodin<sup>®</sup>, Sinilpharm, Seoul, Korea), and meloxicam (0.4 mg/kg PO q24h, Metacam<sup>®</sup>; Boehringer Ingelheim, Ingelheim, Germany) were administered as a preoperative treatment following supportive care (critical care diet, Oxbow Pet Products, Omaha, NE, USA).

On the day of surgery, isoflurane (Ifran<sup>®</sup>; Hana Pharm, Seoul, Korea) was administered at a constant rate for 30 min to induce anesthesia (Fig 2). A horizontal incision was made through the tympanum and continued in an inverted arch from both sides. Yellowish firm material was entirely removed with the aid of a retractor. A dry sterile swab was placed in the tympanic cavity and rolled over the caseous material and aural epithelium several times. Afterward, the tympanic cavity was flushed with warm saline and the surrounding tissues

were disinfected with betadine. The surgical wound was allowed to heal by secondary intention. Postoperatively, ciprofloxacin (10 mg/kg PO q48h, Prodin<sup>®</sup>) and meloxicam (0.4 mg/kg PO q24h, Metacam<sup>®</sup>) were prescribed.

Cytology revealed heterophilic inflammation with bacterial infection. Swabs received for antimicrobial susceptibility testing were immediately plated on trypticase soy agar with 5% sheep blood and incubated for 24 h at 37°C. The isolated bacteria were identified molecularly based on the sequence of 16S ribosomal RNA gene and were identified as *Citrobacter* spp. and *Morganella morganii* (4). Kirby-Bauer antimicrobial susceptibility testing revealed that the isolates were susceptible to 8 agents (amikacin, gentamycin, enrofloxacin, ciprofloxacin, cefotaxime, cefepime, ampicillin/sulbactam, and chloramphenicol) (5).

Follow-up examination was conducted every third or fourth day, and the patient was prescribed ciprofloxacin (10 mg/kg PO q48h, Prodin<sup>®</sup>), meloxicam (0.4 mg/kg PO q24h, Metacam<sup>®</sup>), and daily lavage (Fig 3). On postoperative day 1, the patient resumed a normal appetite. On postoperative day 3, the surgical wound seemed to be closed and no difference was noted in size. To maintain drainage of the abscess site, a surgical window was re-created with a syringe needle. At the 1-week follow-up evaluation, the amount of purulent discharge and the size of the edema were markedly decreased. On postoperative day 10, there was no significant change in size of the abscess. On postoperative day 14, the turtle was no longer depressed and skin necrosis on the incision site occurred and peeled off. On postoperative day 31, granulation tissue formation and epithelialization of wound were seen. On postoperative day 59, the wound had fully healed.

## Discussion

Since most aural abscesses result from the extension of oropharyngeal bacterial colonization, organisms associated with the disease tend to reflect the normal or commensal flora of the oral cavity (3). A variety of pathogens have been isolated from reptilian aural abscesses (3). One study reported the most prevalent bacterial pathogens and their antimicrobial sensitivity patterns in chelonian aural abscesses (6). Most tended to be aerobic; Gram-negative bacteria were identified from an aural abscess in 23 eastern box turtles (*Terrapene carolina carolina*), including *Citrobacter* spp. and *Morganella morganii* (1,6,7). Of the bacteria isolated, most showed resistance to aminopenicillins and cephalosporins, with a variety of resistance to several antimicrobial drugs. There-



**Fig 3.** Follow-up examination of the wound after surgery. (A) Unilateral abscess of the right side of the head. (B) Patient appearance right after surgery. (C) Patient appearance 17 days after surgery. Note that epithelialization of the surgical wound has begun. (D) Patient appearance 59 days after surgery. The wound has healed.

fore, broad-spectrum antibiotics against Gram-negative bacteria can be a first choice treatment for aural infection. If there is multiple drug resistance, viable options may be limited, resulting in prolonged presence of exudates. Even though the most consistently isolated bacterial agents were opportunistic, they should not be ruled out as potential pathogens (6). Further studies are needed to examine the normal bacteria flora associated with the tympanic cavity of healthy captive turtles.

In recent years, there have been several reports indicating the possibility of hypovitaminosis A as a predisposing factor of aural abscesses. Vitamin A contributes to maintenance of the epithelium in a normal differentiated state; when this cofactor is lacking, mucin-secreting epithelium undergoes squamous metaplasia and a change in phenotype from simple or pseudostratified columnar to stratified squamous cells (11,12). Hypovitaminosis A-induced changes, such as squamous metaplasia, hyperplasia, and hyperkeratinization of mucin-secreting epithelium, result in clinically noticeable signs. In captive turtles, squamous metaplasia occurs in the middle ear and eustachian tube, where it manifests as sloughed epithelium. The sloughed epithelium accumulates, forming a caseous plug with secondary bacterial infection (1,12). One study has suggested that the presence of aural abscesses in box turtles is a result of a possible vitamin A deficiency induced by chronic exposure to organochlorines (2). This study showed reduced serum and hepatic vitamin A levels in turtles with aural abscesses compared with clinically normal turtles (2,4). A definitive diagnosis of hypovitaminosis A requires a large volume of blood or an antemortem vitamin A assay of the liver (8,9). Given the size of the patient in the current study, investigations into hypovitaminosis A were limited. As the inflammatory exudate in reptiles tends to be caseous rather than liquid, as seen in mammals, a large enough surgical incision should be made to prevent premature closure of the wound and abscess reformation.

### Acknowledgement

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### References

1. Murray MJ. Aural abscesses. Mader DR. In: Reptile Medicine and Surgery. 1st ed. Philadelphia, Pennsylvania, USA: WB Saunders 1996; 349-352.
2. Holladay SD, Wolf JC, Smith SA, Jones DE, Robertson JL. Aural abscesses in wild-caught box turtles (*Terapene carolina*): possible role of organochlorine-induced hypovitaminosis A. *Ecotoxicol Environ Saf* 2001; 48: 99-106.
3. Mader DR. Reptile Medicine and Surgery, 2nd ed. Philadelphia, Pennsylvania, USA: Elsevier Health Sciences 2005; 742-746.
4. Petti CA, Bosshard PP, Brandt ME, Clarridge JE, Feldblyum TV, Foxall P, Furtado MR, Pace N, Procop G. Interpretive criteria for identification of bacteria and fungi by DNA target sequencing: Approved guideline MM18-A. Wayne, Pennsylvania, USA: Clinical and Laboratory Standards Institute 2008; 28: 25.
5. Patel JB, Cockerill FR, Alder J, Bradford PA, Eliopoulos GM, Hardy DJ, Hindler JA, Jenkins SG, Lewis JS, Miller LA, Swenson JM, Traczewski MM, Tumidge JD, Weinstein MP, Zimmer BL. Performance standards for antimicrobial susceptibility testing: 24th informational supplement M100-S24. Wayne, Pennsylvania, USA: Clinical and Laboratory Standards Institute 2014; 34: 51-55.
6. Willer CJ. Aural abscesses in wild eastern box turtles, *Terrapene carolina carolina*, from North Carolina: aerobic bacterial isolates and distribution of lesions. *J Herpetol Med and Surg* 2003; 13: 4-9.
7. Stewart JS. Anaerobic bacterial infections in reptiles. *J Zoo Wild Med* 1990; 21: 180-184.
8. Evans RH. Chronic bacterial pneumonia in free-ranging eastern box turtle (*Terrapene carolina carolina*). *J Zoo Wild Med* 1983; 19: 349-352.
9. Lawton MPC. Ophthalmology of Exotic Species. In Petersen J, Crispin SM: Manual of Small Animal Ophthalmology. Gloucester, Gloucestershire, UK: BSAVA 1993; 93-96.
10. Cooper JE, Sainsbury AW. Self-Assessment picture test in veterinary medicine: Exotic species. Philadelphia, Pennsylvania, USA: Mosby-wolfe 1995; 650.
11. Kim YS, Hwang SM, Lee SJ, Jung JS. Differential expression of a WD protein during squamous differentiation of tracheal epithelial cells. *J Cell Biochem* 2002; 86: 194-201.
12. Brown JD, Richards JM, Robertson J, Holladay SD, Sleeman JM. Pathology of aural abscesses in free-living eastern box turtles (*Terrapene carolina carolina*) Wildlife Disease Association. *J Wildlife Dis* 2004; 40: 704-712.