

Salmonella enterica Subspecies *diarizonae* Maxillary Sinusitis in a Snake Handler: First Report

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In this study, we report the first case of reptile-associated maxillary sinusitis due to *Salmonella enterica* subspecies *diarizonae* in a snake handler and the third case of salmonella-associated sinusitis worldwide. The case highlights the potential of respiratory transmission and atypical salmonellosis presentations.

Keywords. hygiene precautions; reptile-associated salmonellosis; salmonella; sinusitis; snake handler.

Reptile-associated salmonellosis (RAS) is an emerging zoonosis in humans who handle reptiles directly or indirectly, causing mainly enteric illness. In this study, we report the first case of reptile-associated maxillary sinusitis due to *Salmonella enterica* subspecies (subsp) *diarizonae* and the third case of salmonella-associated sinusitis in the literature. Our case suggests that healthcare providers should specifically ask about reptile exposure in persons with salmonellosis and should be aware of the possibility of salmonella infection presenting in atypical locations such as paranasal sinuses. To minimize zoonotic transmission, the hygiene practices recommended by the Centers for Disease Control and Prevention (CDC) should be followed [1].

CASE PRESENTATION

A 29-year-old man presented in February 2013 with intermittent fever and pain over the right maxillary and frontal sinus area with little nasal discharge, lasting 1–2 weeks and occurring approximately every 6 weeks for the past year. The patient improved only temporarily after treatment with amoxicillin (10 days) and amoxicillin-clavulanate (14 days). He also had

intermittent epigastric discomfort, diarrhea, and nausea. Upper gastrointestinal endoscopy showed normal findings. Due to chronic nasal breathing difficulties, nasal corticosteroids were given for 8 weeks. Because of persistent sinus pain and nasal discharge, a computed tomography (CT) image was obtained in November 2013 and showed polypoid mucosal thickening of the right maxillary sinus (Figure 1A). Septoplasty, conchotomy, infundibulotomy, and anterior ethmoidectomy were performed in December 2013. Histological examination of the removed tissue showed chronic sinusitis but no eosinophilia or malignancy. No culture was obtained. Nasal breathing improved, but intermittent fevers, sinus pain, and purulent rhinorrhea persisted. The patient improved only modestly after 2 courses of amoxicillin-clavulanate. A CT scan in April 2015 showed mucosal thickening in the right maxillary sinus and questionable contiguous cortical maxillary bone erosion (Figure 1B). Dental examination by a maxillofacial surgeon was unremarkable. Right subtotal medial maxillectomy with complete removal of maxillary sinus mucosa was performed. Histological examination of the removed tissue showed inflammation but no malignancy or fungal elements. *Salmonella enterica* subsp *diarizonae* serovar 47:kz35 grew in culture and were sensitive to ampicillin, ceftriaxone, trimethoprim/sulfamethoxazole, and ciprofloxacin. Treatment with ciprofloxacin 500 mg twice daily was given for 3 weeks followed by complete resolution of symptoms. At last follow-up (February 2016), the patient remains asymptomatic. On further questioning, he reported owning 5 pet snakes since 2010. He did not wash or disinfect his hands after handling them, feeding them, or cleaning their terrarium. Fecal culture in 3 snakes grew *S enterica* subsp *diarizonae*, with the same serovar 47:kz35 as the human isolate.

DISCUSSION

To our knowledge, ours is the first case of reptile-associated maxillary sinusitis (Table 1). In recent years, pet reptiles have gained in popularity and increasing numbers of RAS have been recorded [2]. More than 1 million cases of human salmonella infections occur each year in the United States [3], 74 000 of which are estimated to result from exposure to reptiles or amphibians [1]. This suggests that RAS is a significant public health issue, the importance of which is amplified by antimicrobial resistance of certain salmonella strains. Wild and pet reptiles can asymptotically carry and shed salmonella intermittently in their feces [2, 4, 5], thereby contaminating their own body surface and environment, which may promote human infection by direct or indirect contact [1]. Attempts at treating reptiles with antibiotics to eliminate salmonella carriage

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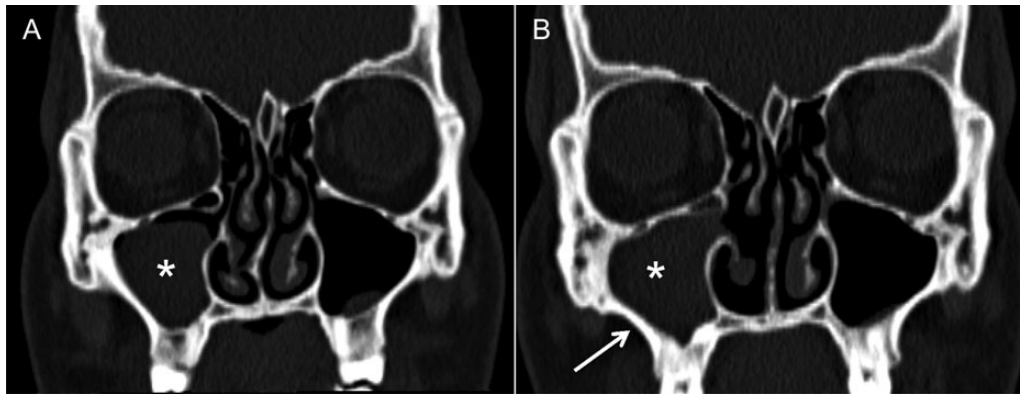


Figure 1. Computed tomography imaging of the paranasal sinuses in the coronal plane. (A) Image performed in 2013 shows subtotal shadowing of the right maxillary sinus by polypoid mucosal thickening (asterisk). (B) Image performed in 2015, postendoscopic infundibulotomy, demonstrates progressive parietal mucosal thickening (asterisk). The lateral wall of the sinus has noticeably thickened (arrow) compared with (A), indicating a chronic sinusitis with consecutive osseous reaction.

Table 1. Salmonella-Associated Sinusitis Reported in the Literature

Author	Clinical Feature	Microbe	Treatment	Outcome
Hartmann [9]	Enteritis, unilateral purulent rhinorrhea	<i>S typhimurium</i>	Caldwell-Luc operation, antibiotic	Cure
Räisänen and Asikainen [10]	Unilateral purulent rhinorrhea	<i>S typhimurium</i>	Clindamycin, Rivampicillin, irrigation	Cure
Horvath, 2016	Intermittent fever, pain over the right maxillary and frontal sinus area	<i>S enterica</i> subsp <i>diarizonae</i>	Limited symptomatic response to extensive surgery; asymptomatic after ciprofloxacin treatment	Cure

Abbreviations: *S*, *Salmonella*; subsp, subspecies.

have been unsuccessful [6]. To minimize the zoonotic spread of salmonella, the CDC emphasizes the need for strict hygiene precautions when handling reptiles [1].

Salmonella enterica subsp *diarizonae* and *arizonae* are major reptile-associated pathogen in humans [4] and are highly prevalent in free-living and captive reptiles, particularly in snakes [2, 6]. In humans, RAS presents mainly as enteritis [6]. *Salmonella* may reach the upper respiratory tract hematogenously after oral inoculation [7] or perhaps via inhalation [8]. Whether sinusitis occurred via inhalation or orally or hematogenously in our patient remains unclear.

CONCLUSIONS

Two human cases of *Salmonella enterica* subsp *typhimurium* maxillary sinusitis have been described in the literature [9, 10]; the presumed mode of spread to the sinuses was hematogenous. Neither case was associated with reptiles. Our previously healthy patient developed chronic salmonella sinusitis approximately 2 years after purchasing pet snakes. A causal relationship is suggested by culturing identical salmonella isolates from the patient and the snakes. Insufficient hygiene precautions during handling of the snakes likely led to our patient's infection. A local immunosuppressive effect of nasal corticosteroids and the effects of prior antimicrobial therapy on local colonization resistance may have facilitated sinus infection with RAS in our patient. Purulent nasal discharge and sinus pain did not respond to decongestants,

nasal corticosteroids, and surgical drainage, but resolved after appropriate antibiotic treatment, suggesting that the symptoms were due to salmonella-associated sinus infection.

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