



NOTE

Wildlife Science

Epicoccum nigrum-induced respiratory infection in a wild Eurasian scops owl (*Otus scops*)

Haerin RHIM^{1,2)}, Ji-Yeon PARK²⁾, Dong-Jin LEE²⁾ and Jae-Ik HAN^{1,2)*}¹⁾Laboratory of Wildlife Medicine, College of Veterinary Medicine, Chonbuk National University, Iksan 54596, Republic of Korea²⁾Jeonbuk Wildlife Center, Chonbuk National University, Iksan 54596, Republic of Korea

ABSTRACT. A wild adult Eurasian scops owl (*Otus scops*), which was unable to fly, was rescued. Physical examination revealed a sticky exudate around the glottis. Heterophilic leukocytosis was identified through complete blood count, and radiography revealed a marked elevated density of posterior air sacs and inner cavities in both sides of the humerus and femur. Fungal cultures of samples taken from the owl suggested a respiratory fungal infection. Through molecular typing, the fungus was identified as *Epicoccum nigrum*. The owl was treated with oral itraconazole and broad-spectrum antibiotics. After one month, the inner cavities of pneumatic bones were slightly distinguishable by radiography and the owl started to fly well. Two months later, the air sac and all pneumatic bones displayed normal appearance.

KEY WORDS: *Epicoccum nigrum*, pneumatic bone, respiratory infection, scops owl

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Respiratory fungal infections are one of the most common diseases among captive birds [6]. These infections also sometimes occur among free-living wild birds that have become debilitated through injury or inanition. The infection is established after the inhalation and settlement of spores in the respiratory system. If the spores migrate to the lower respiratory system, including the lungs and air sacs, the spores can migrate widely throughout the coelomic cavity, through the ramifying and interconnecting air sac system that reaches every part of the body, resulting in a systemic infection. This case report describes an unusual case of an *Epicoccum nigrum*-induced respiratory infection in a wild bird.

A wild adult scops owl (*Otus scops*) with the inability to fly was rescued in Iksan, Jeonbuk, Republic of Korea. Physical examination revealed a sticky greenish exudate around the glottis, but the bird was alert and responsive to stimuli. Neither a wound nor a fracture-suspected lesion was found. On manual complete blood count, heterophilic leukocytosis (2.2×10^4 cells/ μ l) was observed, while clinical chemistry profiles showed no remarkable findings (Avian Reptilian Profile Plus, VetScan VS2; Abaxis, Union City, CA, U.S.A.). Radiography revealed a marked elevated density of the posterior air sacs and inner cavities in both sides of the humerus and femur, which are pneumatic bones in scops owls (Fig. 1A). Under general anesthesia, tracheal swab and flushing of the intraosseous cavity of the left humerus were conducted aseptically. Incubation of the swab and washed fluids on a Sabouraud dextrose agar plate at 30°C for 10 days showed similar greenish-white fungal colonies surrounded by a white margin, suggesting a respiratory fungal infection (Fig. 2). The owl was immediately treated with oral itraconazole (10 mg/kg once per day) and broad-spectrum antibiotics, along with nebulization with 0.9% saline mixed with gentamicin and bromhexine. After one month of treatment, the inner cavity of the posterior air sacs and the pneumatic bones were slightly distinguishable on radiographs and the owl started to fly well (Fig. 1B). Three months later, the air sacs and all pneumatic bones displayed a normal appearance (Fig. 1C), and the owl's ability to fly had fully recovered. The bird was then returned to the wild.

Meanwhile, two colonies of the fungus isolated from the left humerus were identified using molecular methods. The genomic DNA encoding the ribosomal internal transcribed spacer (ITS) region, consisting of ITS1, 5.8S rRNA, and ITS2, was amplified using the primers ITS1 and ITS4, as previously described [3]. The amplicons were sequenced in a commercial laboratory (Solgent, Daejeon, Republic of Korea), and the identified sequences were further analyzed by comparison with sequences in the GenBank database. The isolated fungus was found to have 100% sequence identity to the *E. nigrum* sequence deposited by Cornell University, U.S.A. (GenBank accession number MK268066). Neighbor-joining phylogenetic analysis of the ITS region nucleotide sequence also confirmed the molecular identification results. Thus, the patient was finally diagnosed with an *E. nigrum*-induced respiratory infection.

At first presentation, the owl was otherwise healthy except for the inability to fly due to an unknown cause. At first, we

*Correspondence to: Han, J.-I.: jihan@jbnu.ac.kr

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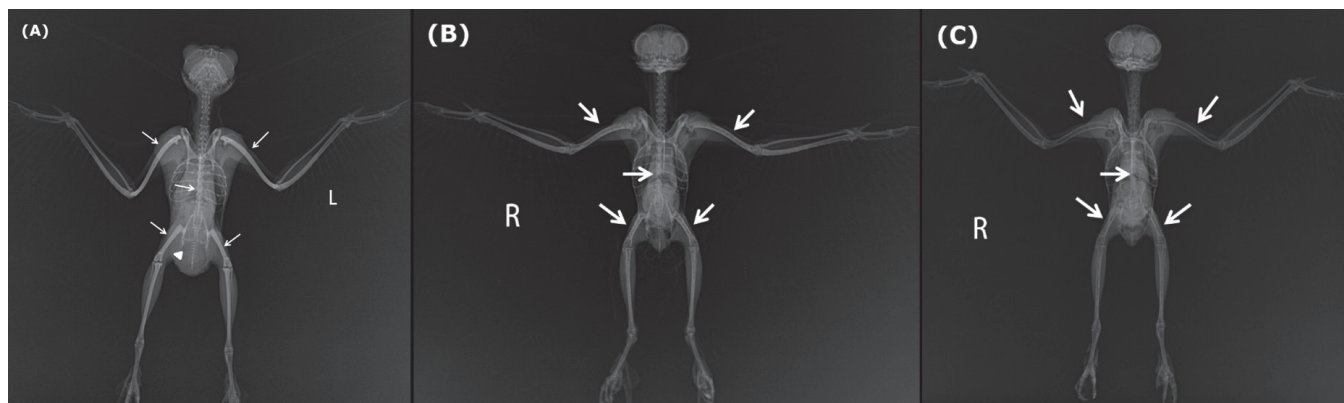


Fig. 1. Ventrodorsal view on days 1 (A), 60 (B), and 90 (C). Note that the inner cavity of every pneumatic bone (arrows), including the humerus, vertebra, and femur, as well as the caudal air sac (arrowhead) showed increased density on day 1. The inner cavity densities of all pneumatic bones (arrows) decreased and appeared normal on day 90 (C).

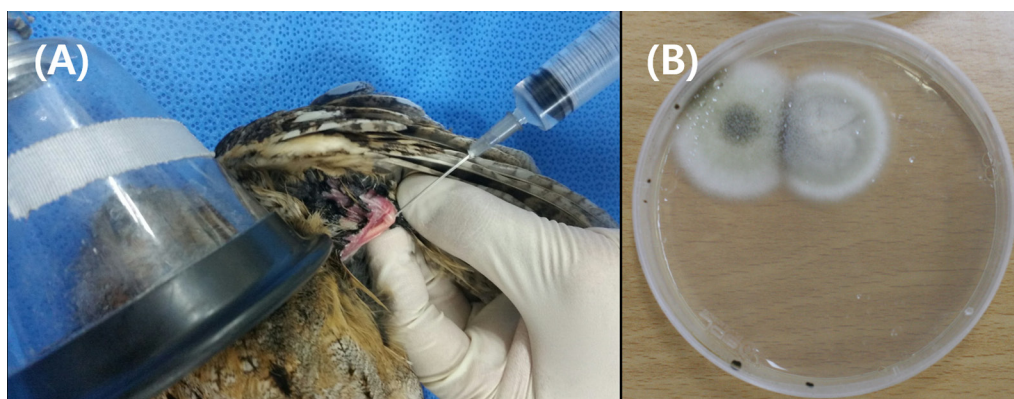


Fig. 2. After the flushing of the intraosseous cavity of the left humerus under general anesthesia (A), culture of the flushed fluid on Sabouraud dextrose agar plate showed a greenish-white colony surrounded by a white margin (B).

suspected a wound or fracture; however, radiography showed severely radiopaque cavities in the humerus and femur on both sides, suggesting an infection, or bone marrow problems. Based on the physical examination, indicating a sticky greenish exudate around the glottis, the cause of this seems to be an infection. Subsequent fungal cultures derived from a tracheal swab and intraosseous flushing confirmed that this fungal infection was the reason for the radiographic abnormalities of the pneumatic bones. Because of the low pathogenicity of *E. nigrum*, along with no prior information concerning *E. nigrum*-induced respiratory infections in birds, we investigated other reasons for flightlessness, but were unsuccessful. Within two months of therapy, the ability to fly was gradually recovered, parallel to the improvement of radiographic signs, suggesting that the *E. nigrum*-induced respiratory infection was the root cause of the flightlessness.

E. nigrum is a saprophytic fungus found in soil and decaying vegetation matter [4]. The fungus is known to produce toxins that act like the antibiotics flavipin, epicorazine A and B, and indole-3-acetonitrile [2]. This ubiquitous fungus has rarely been known to cause an opportunistic infection in immunocompromised human patients [1, 5]. In both human cases, voriconazole combined with amphotericin B was effective in treating *E. nigrum*-induced pyelonephritis or intramuscular abscess. In this report, the owl responded well to empirical treatment with oral itraconazole, suggesting the low pathogenicity of the fungus in birds. Thus, antifungal susceptibility testing was not performed. However, the cause of the infection was not clear, but may be related to the migration of the owl from Korea to South Asia.

Characteristically, radiography revealed that the infection was particularly severe in both sides of the pneumatic bones, rather than in the air sacs in this owl. Considering the general pathogenesis of respiratory fungal infections in birds, it seems that this fungus prefers to settle in bone cavities rather than in the lung tissues or air sacs, which differs from the pathogenesis of aspergillosis, a common avian respiratory disease [6]. This feature seems to result in the bird displaying normal respiration and activities, except the inability to fly. This hypothesis is supported by the fact that flight was fully recovered in parallel to the recovery of radiographic abnormality in pneumatic bones.

In conclusion, to the best of our knowledge, this is the first report of an *E. nigrum* infection in an animal. Wildlife clinicians

should pay careful attention to the differentiation of respiratory fungal infections, even if the density of pneumatic bones is elevated on a radiograph.

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