

Systemic Candidiasis of a Wild Slaty-Backed Gull (*Larus schistisagus*) in Jeju, Korea

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Abstract : A young slaty-backed gull was found dead nearby Seongsan harbor, Seogwipo-si, Jeju. Grossly, focal ulceration and a protuberant nodule were observed in intermediated zone between proventriculus and gizzard. Numerous discrete or confluent white-yellowish nodules were scattered on the surface of liver. Caudal portion of left kidney was replaced by a white-yellowish nodule. Three raised masses were observed in the spleen. Histologically, there were severe ulceration with hemorrhage in the gizzard and multifocal granulomatous inflammations in liver, kidney, spleen, and lungs. Pink to dark-red, round to oval fungal spores and pseudohyphae in granulomatous lesions were confirmed by periodic acid-Schiff stain. *Candida albicans* were isolated from the lesions of liver, kidney, spleen and gizzard using fungal culture and confirmed by VITEK 2 system. Based on the gross, histopathological findings, and fungal examination, this case was diagnosed as systemic candidiasis of a wild slaty-backed gull. In our best knowledge, this is the first report for systemic candidiasis characterized by multifocal granulomatous lesions in internal organs of a wild gull in Korea.

Key words : *Candida albicans*, granuloma, gull, Jeju, systemic candidiasis.

Introduction

Candida (*C.*) species (spp.) are the normal microflora in the digestive system and genitourinary tracts of healthy humans, animals, and birds including gull (2,4). Candidiasis is an opportunistic endogenous mycosis caused by the infection of yeasts *C. genus*, principally *C. albicans*. Candidiasis is known to induce the ulceration of the digestive tracts including oral cavity, esophagus, crop and proventriculus during infection in birds such as chickens, turkeys, geese, pigeons, pheasants, and quail etc. (4). A case of candidiasis in layer chickens was previously reported in Korea (20). This study reports the systemic candidiasis of a wild slaty-backed gull (*Larus schistisagus*) caused by *C. albicans* infection in Jeju.

Case

In January 2014, a young slaty-backed gull found dead nearby Seongsan harbor, Seogwipo-si was requested to the Diagnostic Laboratory of Jeju Veterinary Research Institute. Necropsy was performed and collected tissues were fixed in 10% buffered formalin, embedded in paraffin, sectioned at 3 μ m and stained with hematoxylin & eosin (H&E) and periodic acid Schiff (PAS) stain. For bacterial and fungal cultures, aseptically collected samples from liver, kidney, spleen and gizzard were inoculated on blood agar plates (Hanil KOMED, Korea) and Sabouraud dextrose agar plates (BD

Difco, USA) aerobically and incubated for 48 hr at 37°C.

Grossly, focal ulceration and a protuberant nodule measuring 15 \times 20 \times 10 mm were observed in intermediated zone between proventriculus and gizzard (Fig 1A). Numerous discrete or confluent white-yellowish nodules ranged 1-20 mm in diameter were scattered on the surface of liver (Fig 1B). Caudal portion of left kidney was replaced by a white-yellowish nodule 30 \times 28 \times 10 mm in size (Fig 1C). Three raised masses with 1-3 mm in diameter were observed in the spleen (Fig 1D).

Histologically, severe ulceration with hemorrhage was observed in the keratinized stratified squamous epithelium of gizzard (Fig 2A). Multifocal to confluent granulomatous lesions were observed in gizzard (Fig 2A), liver (Fig 2B), kidney (Fig 2C), spleen (Fig 2D), and lungs. In granulomatous lesions of representative organs, central necrotic foci were surrounded by many inflammatory cells such as heterophils, lymphocytes, macrophages and multi-nucleated giant cells. Also, intra-lesional round to oval spores and pseudohyphae were found (Fig 2C). Pink to dark-red fungal spores and pseudohyphae in granulomatous lesions were confirmed by PAS stain (Fig 2A to D inserts). However, we could not find any histopathologic lesions in the brain and proventriculus.

In the fungal examination, whitish, creamy, high-convex colonies were observed on blood agar plates and Sabouraud dextrose agar plates. *C. albicans* was isolated from the lesions of liver, kidney, spleen and gizzard and confirmed by VITEK 2 system (Biomerieux., USA).

Based on the gross, histopathological findings, and fungal examination, this case was diagnosed as systemic candidiasis of a wild slaty-backed gull.

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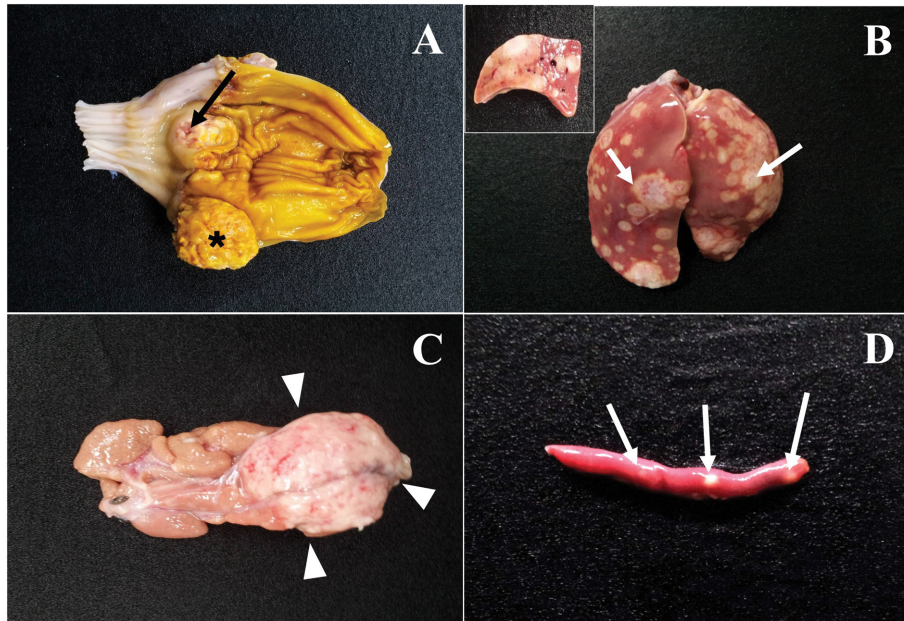


Fig 1. Gross findings. A: Focal ulceration (arrow) and a protuberant nodule (*) were observed in interdigestive zone between proventriculus and gizzard. B: Numerous discrete or confluent white-yellowish nodules (arrows) were scattered on the surface of the liver. The cut surface of the liver (Insert). C: Caudal portion of left kidney was replaced by a white-yellowish nodule (arrowheads). D: Three raised masses (arrows) were observed in the spleen.

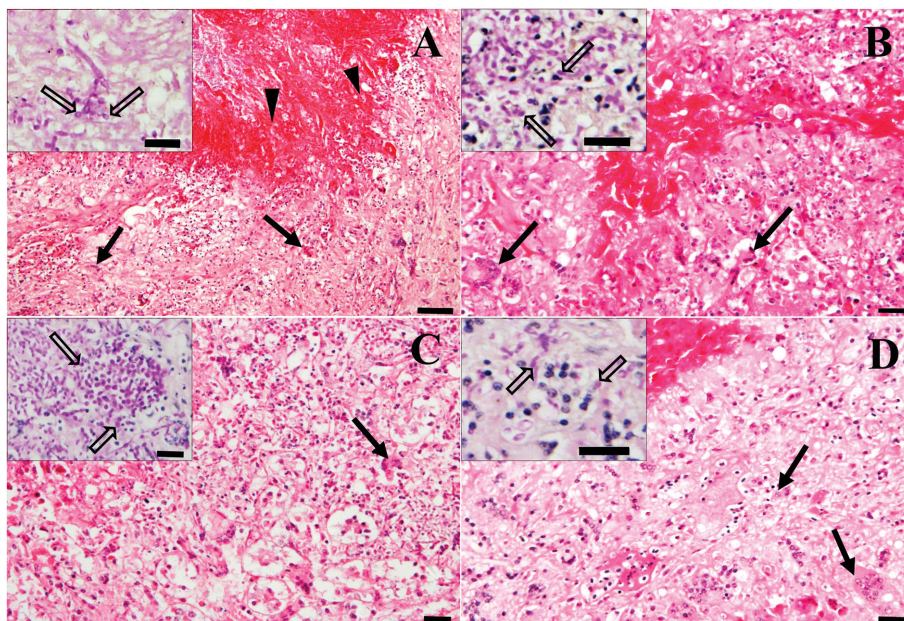


Fig 2. Histopathologic findings. A: Severe ulceration (arrowheads) was observed in the squamous epithelium of gizzard. Note the multi-nucleated giant cell (arrows). H&E (Bar = 50 μ m). Note the infiltration of heterophils, lymphocytes, macrophages and multi-nucleated giant cells (arrows) in liver (B), kidney (C) and spleen (D). H&E (Bar = 20 μ m). Insert A-D: Note round to oval pink colored spores and pseudohyphae (open arrows). PAS stain (Bar = 20 μ m).

Discussion

Avian candidiasis is sporadic, but severe outbreaks can cause great economic loss (4). In 1932, the first outbreak of candidiasis was reported in the mortality of up to 20% in young turkeys (5), and another report described the loss of 10,000 chicks (11). According to a recent report, *C. rugosa* infection caused 40% mortality in a flock of 6 week-old tur-

keys (18). *Candida* infection cause thrush in chickens, turkeys, geese, pigeons, guinea fowl, pheasants, ruffed grouse, quail, peacocks, lorries, lovebirds, finches, parrots, and parakeets (4). Among the various *C. spp.*, *C. albicans* is known to be the most virulent. After infection in tissues, pathogenic *C. albicans*, produce proteinase or phospholipase, which penetrates into tissues and damages lipid and protein cell membranes (6,10).

C. albicans can cause two major types of infections in humans: superficial infections, such as oral or vaginal candidiasis, and life-threatening systemic infections (3). *C. albicans* is a common environmental fungus that can infect the digestive tracts of birds and cause a crop infection, especially in young birds. *C. albicans* infection in the crop and proventriculus of 23 weeks old layer chickens was reported in Korea (20). Systemic infection of *C. albicans* characterized by diffuse pyelonephritis, granulomatous myocarditis, multifocal necrotizing encephalitis and aortitis were observed in two young dogs (12). Severe ulcerative lesions in proventriculus and gizzard and granulomatous inflammations of liver, kidney, spleen, and lungs were major two lesions in this case. Therefore, an imbalance or disruption of normal bacterial populations with unknown cause in the digestive tract of gull may lead to the overgrowth of *Candida*. And invade *C. albicans* in proventriculus and gizzard may scattered to internal organs through hematogenous routs.

The prevalence of *Candida* infection is higher in pregnant, diabetic, elderly or immunocompromised individuals, or in those who with long-term antibiotic or corticosteroid treatment (14,17). With the increase of environmental pollution, radiotherapy, chemotherapy, and the use of wide-spectrum antibiotics, hormones, and immunosuppressant in recent years, candidiasis rates have increased in both humans and animals (13). Young birds receiving long term antibiotics and adult birds that are on long term antibiotics or are suffering from an illness or malnutrition may develop secondary candidiasis. The precise cause of *C. albicans* infection is unknown in this case, but young age with low immune status of gull might be closely associated with the occurrence of systemic candidiasis.

Sung *et al.* (20) reported about candidiasis in 23 weeks old layer chickens in Korea. Grossly, the whitish pseudomembrane was found in the crop and the mucosa of proventriculus was covered with hemorrhagic exudate. The histological findings of the affected crop were epithelial hyperplasia, hydropic degeneration, and mycelia formation. *C. albicans* was isolated from necrotic mucosal surfaces of the crop. However, this case showed granulomatous lesions in the gizzard, liver, spleen, and kidney as well as severe hemorrhagic ulceration.

According to another domestic report, two dogs (a poodle dog and a Maltese), 18 and 2 months old were diagnosed as systemic candidiasis (12). Histopathologically, multiple spore and pseudohyphae of mycelia were observed in the lesions of kidney, heart, brain and aorta. And *C. albicans* was identified in pure culture from the kidney and heart. Diffuse pyelonephritis, granulomatous myocarditis, multifocal necrotizing encephalitis and aortitis were observed in poodle dog and granulomatous myocarditis in maltese dog.

Renal candidiasis can have two main causes (9): Urinary tract infections can be transmitted through vascular pathways caused by systemic infections and through genital infections. In this case, there were observed both ulcer lesions and a granulomatous nodule with hyphae in intermediated zone between proventriculus and gizzard. As a result, *C. albicans*, which had been infected in the digestive system, were believed to have formed granulomatous lesions on liver,

spleen and kidney. Accordingly, this case seems to be similar to systemic candidiasis in two dogs of Kim *et al.* (12).

The pathogen that can induce granulomatous lesions is varied in poultry. Granulomas are the result of chronic stimulation of the immune system and they have been attributed to a number of the causative agent in chickens (21). These causes include *Mycobacterium avium* (7), mucoid *Escherichia coli* (19), *Aspergillus fumigatus* (1), *Histomonas meleagridis* (16), and *C. albicans* (15). Based on the special staining and fungal culture, *C. albicans* was nicely demonstrated and isolated in the typical granulomatous lesions in gizzard, liver, kidney, and spleen in this case of wild gull. In our best knowledge, this is the first report for systemic candidiasis characterized by multifocal granulomatous lesions in internal organs of a wild gull in Korea.

According to recent literature, avian bornaviruses have been detected in North American gulls in which they cause lethal neurologic disease (8). In addition, avian bornaviruses cause encephalitis characterized by perivascular cuffing and focal gliosis and proventricular dilatation disease (PDD) in several species of birds, especially parrots, waterfowl and finches (22). Also, secondary fungal infections of the non-motile proventriculus can result in death by sepsis. In this case, *C. albicans* was successfully isolated from the lesions of internal organs including gizzard, the near organ of proventriculus. However, encephalitis and proventricular dilatation with neuronal damage and lymphoplasmacytic infiltration were not observed in this slaty-backed gull case. But, further in depth study for avian bornaviruses would be necessary in wild birds in Jeju.

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