Necrotic Dermatitis in Waterfowl Associated With Consumption of Perennial Rye Grass (*Lolium perenne*)

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Abstract: Mute swans (Cygnus olor), whooper swans (Cygnus cygnus), and mixed-breed domestic geese (Anser anser domesticus) were presented for necrotic lesions on the feet, eyelids, and beak. Individuals from the same collection of birds had developed identical lesions during March–September of each of the previous 3 years. Vesicular and necrotic dermatitis involved only nonfeathered and nonpigmented areas of the integument. No abnormal clinical signs were seen on either carnivorous species or birds with pigmented skin from the same collection. The enclosure that housed the birds had been planted with perennial rye grass (Lolium perenne) 3 years previously. Based on the pathologic features and anatomic location of the lesions, the seasonal occurrence, the vegetation history of the enclosure, and the feeding behavior of the affected species, vesicular dermatitis resulting from photosensitization was the presumptive diagnosis. All affected birds recovered completely after the birds were removed from the enclosure, and no further clinical signs have been reported.

Key words: necrotic dermatitis, vesicular dermatitis, photosensitization, perennial rye grass, Lolium perenne, avian, waterfowl

Clinical Report

Several species of waterfowl from the Tehran Zoo (Iran), including 12 mute swans (Cygnus olor), 4 whooper swans (Cygnus cygnus), and 11 mixed-breed domestic geese (Anser anser domesticus), were referred to the Teaching Hospital, Faculty of Veterinary Medicine, University of Tehran, for evaluation of necrotic dermatologic lesions. The birds were part of a mixed collection that also included Muscovy ducks (Cairina moschata), common teals (Anas crecca), mallards (Anas platyrhynchos), pochards (Aythya ferina), great white pelicans (Pelecanus onocrotalus), purple gallinules (Porphyrio porphyrio), common coots (Fulica atra), and house sparrows (Passer domesticus); however, only the mute swans, whooper swans, and mixed-breed domestic geese were affected. No clinical problems were seen in either birds with pigmented skin or carnivorous birds.

All herbivorous birds were fed a diet of whole-grain wheat and fresh chopped lettuce throughout the year. The birds’ enclosure had been planted with perennial rye grass (Lolium perenne) 3 years previously, and the birds grazed on it daily. The same species of waterfowl had a history of developing nearly identical clinical lesions during March–September in each of the previous 3 years, which had resolved spontaneously by the early autumn. No mortality had been reported. According to the aviary manager’s reports, previous occurrence of dermatologic lesions had no effect on recurrence of the disease the following year at the same time.

Affected birds had necrotic lesions on the nonfeathered skin of the head and feet. The involved areas had initially developed erythema late in March, and vesicles began to form 4–6 weeks later, which coincided with growth of the enclosure’s grass. The lesions had subsequently coalesced before becoming necrotic and ultimately forming crusts. No unusual weather conditions were recorded before development of the lesions. All mute swans, whooper swans, and geese were affected by May; however, the type of lesions...
varied among species and individuals. Affected birds all exhibited some degree of skin necrosis, but the severity of vesicle formation and necrosis varied. In mute and whooper swans, rhinothecal necrosis and vesicle formation were restricted to nonpigmented areas (Fig 1). In 3 of the affected geese, severe full-thickness necrosis of the nonpigmented beak resulted in deformities and partial loss of the beak (Fig 2). The eyelids of the whooper swans and geese, but not the mute swans, had the same necrotic and vesicular lesions as other parts of the nonpigmented skin and beak. Moderate conjunctival hyperemia and blepharconjunctivitis were also observed in some birds (Fig 2). Some affected birds, particularly juveniles, developed necrotic and nonproliferative lesions on the skin of the foot web (Fig 3). No macroscopic lesions were found in feathered areas of the skin. In addition, keepers did not report observing pruritic behavior in any of the affected birds.

Foot and beak lesions of some affected birds were sampled and submitted for bacterial and fungal culture, which revealed growth of *Escherichia coli* and *Proteus* species. Gross examination of the feedstuff ingredients was unremarkable. Wheat grains were grossly intact and free of visible mold, and the lettuce was purchased daily and chopped on a clean surface with clean instruments immediately before feeding.

The enclosure had been planted with perennial rye grass (Fig 4) 3 years before presentation of the waterfowl in this report, and the birds grazed on it daily. Development of clinical signs occurred annually coincident with the growing season of the rye grass. Because perennial rye grass has been reported to induce photosensitization in other animals, photosensitization and subsequent vesicular and necrotizing dermatitis was the presumptive diagnosis.

All affected species were transferred to a new enclosure on the opposite bank of the zoo’s lake,
which contained no perennial rye grass. The
birds’ diet and water source did not change, nor
were any other management factors altered. The
birds with severe dermal lesions were treated with
a single dose of dexamethasone (1 mg/kg IM). To
prevent secondary bacterial infections, the birds
with conjunctival hyperemia were treated with
chloramphenicol ophthalmic drops (q8h for
2 weeks).

During the previous 3 years, lesions were active
for nearly 6 months before their spontaneous
resolution in autumn. Once the birds were
removed from the enclosure that contained rye
grass, the lesions healed within 2–4 weeks,
although some severely affected areas remained
scarred (Fig 5). Subsequent to restricting the
birds’ access to perennial rye grass, no new lesions
have been reported.

Discussion

In this clinical report, we described primary
photosensitization in several species of waterfowl
resulting from consumption of perennial rye
grass. Primary photosensitization has rarely been
previously reported in birds, and, to the best of
the authors’ knowledge, this is the first report of
perennial rye grass–induced photosensitization in
waterfowl.

Vesicular and necrotic dermatitis involving
nonpigmented and nonfeathered regions was the
most significant clinical sign affecting the birds in
this report. Dermatitis characterized by vesicle
and crust formation on the feet, digits, and
occasionally unfeathered portions of the head
has been described in chickens, turkeys, ducks,
and geese. In some outbreaks, lesions have been
shown to result from photosensitization. Photosen-
sitivity refers to an enhanced susceptibility of
the skin to actinic radiation induced by the local
presence of a photodynamic agent, or chromo-
phore. Chromophores have chemical configura-
tions that enable them to absorb specific wave-
lengths of ultraviolet (UV) or visible light, known
Primary photosensitization is a cutaneous disorder that results from ingestion of phototoxic substances. Several plants synthesize fluorescent pigments, which are ingested by grazing animals and, when absorbed from intestine, enter the blood stream. These pigments localize in the skin where, in hairless, nonpigmented areas, they are exposed to sunlight. The action of UV light produces fluorescence, during which the transformation of absorbed radiation to that of a longer wave length releases energy capable of damaging capillaries and venules and results in endothelial degeneration, hyperemia, and edema. Photodynamic substances activated by light of the appropriate wavelength cause direct tissue damage by production of radical oxygen products and inflammatory mediators.

Gross lesions of photosensitization dermatitis consist of erythema and edema and can progress to cutaneous necrosis, vesicle formation, ulceration, exudation, and sloughing of necrotic tissues. Histology results reveal coagulative necrosis of the epidermis and sometimes superficial dermis and follicular epithelium with dermal vesicular degeneration that can result in edema, subepidermal vesicles, thrombosis, infarction, sloughing of necrotic tissues, and secondary bacterial infection.

Primary photosensitization is often the result of ingestion of preformed photodynamic substances contained in a variety of plants, including St. Johns’ Wort (Hypericum perforatum), buckwheat (Fagopyrum sagittatum), spring parsley (Cymopterus watsonii), Bishopsweed (Ammi majus), darnel or cockle (Lolium temulentum) contaminated by Cladosporium herbarum or other fungal-contaminated plants. Administration of phenothiazine, tetracycline, thiazides, or sulfonamides can also cause primary photosensitization. Abnormal porphyrin metabolism, a characteristic of diseases usually inherited as an enzyme deficiency and resulting in abnormal synthesis of photodynamic agents, including uroporphyrin and coproporphyrin, can result in photosensitization.

Hepatogenous (type III) photosensitization can occur secondary to inherited hepatic defects, biliary obstruction, or as a result of hepatic injury from a variety of sources.

Photosensitization is most frequently reported in sheep and cattle and is uncommon in dogs and cats. Perennial rye grass has previously been reported as a photosensitization-inducing plant in herbivores, and perloline has been implicated as the photodynamic agent involved in large animals. Diagnosis of photosensitization in herbivorous mammals is based on clinical signs, lesion distribution, and exposure to plants known to cause primary or hepatogenous photosensitization. In black and white animals, the tentative diagnosis is straightforward; the white-haired areas are involved, while the immediately adjacent black-haired skin is normal. No characteristic hematological or biochemical abnormalities have been reported in cases of primary photosensitization. Infestation of perennial rye grass with a fungal endophyte (Neophytodium...
[Acremonium lolii] has been reported to cause neurotoxic disease in ruminants and horses.\textsuperscript{14–16} Perennial rye grass staggers is particularly prevalent in many temperate regions of the world.\textsuperscript{16} Although all herbivorous species are at risk, sheep are most commonly affected by this neurologic condition.\textsuperscript{14} Rye grass staggers has not been reported in avian species.

Primary photosensitization in birds has been infrequently reported in the literature.\textsuperscript{3,17–23} The same criteria are used to diagnose photosensitization in avian species and mammals.\textsuperscript{10–12,17} Egyed et al\textsuperscript{19} described chronic lesions of the beak, foot web, and eyes in geese photosensitized by the consumption of bishopsweed. Ocular involvement, including chemosis, blepharoconjunctivitis, keratitis, symblepharon, ankyloblepharon, cicatricial ectropion, and mydriasis, was reported in 89% of the affected birds.\textsuperscript{18} In the birds affected at the Tehran Zoo, blepharoconjunctivitis was the only ocular lesion appreciated. Shlosberg and Egyed\textsuperscript{22} reported similar lesions in ducklings that resulted from ingestion of spring parasleys (Cymopterus longipes and C. watsonii). Although the general health of waterfowl was reported to be minimally affected,\textsuperscript{22,23} ingestion of $C$ longipes can cause high mortality in turkey poults.\textsuperscript{24} Photosensitization resulting from consumption of St. John’s Wort has also been reported in waterfowl.\textsuperscript{25} Although photosensitivity induced by perennial rye grass was previously reported in other species, the authors are unaware of any report that involves waterfowl.

Bacterial dermatitis, pox, and frostbite are other diseases that can produce vesicular and necrotic skin lesions in waterfowl.\textsuperscript{17} Bacterial dermatitis most commonly occurs as pododermatitis in larger ducks and swans.\textsuperscript{17} Neither $E$ coli nor Proteus species, which were isolated from the skin lesions of some of the affected birds at the Tehran Zoo, are considered to be primary or contagious pathogens in waterfowl. In this report, the lesions were almost entirely restricted to nonfeathered areas of the integument, and no signs of folliculitis or exudative dermatitis that suggested a bacterial etiology or contribution were seen in the affected birds. Poxvirus infections are rarely seen in waterfowl,\textsuperscript{17} and dermatologic lesions in such cases are typically proliferative and not restricted to nonpigmented areas of the skin. The seasonal occurrence (March–September) of the cases in this report ruled out frostbite.

Histopathology was not performed on the affected birds, because it was considered difficult to biopsy the sites involved (eg, the beak and eyelids), and it was not practical for the zoo to hospitalize the birds after surgery. Although histopathology can be used to support the diagnosis of photosensitization-induced dermatitis and to rule out other possible causes of dermatopathologies, to the authors’ best knowledge, histopathologic evaluation has had no particular diagnostic value in the cases of photosensitization previously reported in mammals or birds. The clinical history and pathologic features of the affected birds in this case were similar to those reported in other cases of photosensitization-induced dermatitis in avian species. Although photosensitization was most likely the result of ingestion of perennial rye grass, the grass was not examined for the presence of fungal contaminations, so this could not be ruled out as a contributing factor. Hepatogenous (type III) photosensitization was considered unlikely, because no other clinical signs of liver disease were noted. The strongest pieces of evidence that photosensitization dermatitis was the result of perennial rye grass ingestion in this case were that no clinical signs of vesicular dermatitis had occurred in this group of birds before planting perennial rye grass in the aviary, removal of rye grass from the birds’ environment resulted in resolution of active lesions, and no further lesions have been reported subsequent to changing the enclosure’s vegetation.

Removal of animals from direct sunlight and prevention of ingestion of further toxic materials have been reported to be effective management tools in cases of primary photosensitization.\textsuperscript{11,17} Anti-inflammatory doses of corticosteroids have been reported to be effective in early cases of solar dermatitis in dogs and cats.\textsuperscript{9} Parenteral administration of nonsteroidal anti-inflammatory drugs, corticosteroids, and antihistamines have also been reported to be therapeutically effective in horses and farm animals.\textsuperscript{11} Prophylactic antibiotic administration has been recommended in cases in which secondary bacterial infections are a concern.\textsuperscript{10,11} Although the use of dexamethasone in birds has been reported to have potentially harmful immunosuppressive effects,\textsuperscript{26,27} the birds treated in this report have experienced no apparent superimposition of infections, such as aspergillosis, for at least 1 year subsequent to treatment. However, the lack of a controlled study on the use of anti-inflammatory or antibiotic medications does not allow the authors to conclude whether or not this treatment regimen had therapeutic effects.
Photosensitization induced by consumption of perennial rye grass by the waterfowl in this report resulted in beak deformity and partial rhaphothecal loss in severe cases, even after removal of the birds from the enclosure. The occurrence of photosensitization in waterfowl in this report underscores the importance of critically assessing the flora to be used in areas housing captive waterfowl.

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