Case Report

Ichthyosis in a Nigerian Dwarf Goat

Nigerian Dwarf 種のヤギにみられた魚鱗癬

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Abstract: A 4-year-old Nigerian Dwarf goat presented with a long history of nonpruritic, scaly skin noticed since it was acquired at 3 weeks of age. Dermatologic examination revealed widespread large, white, nonadherent scales covering the entire skin. Histopathologic findings were characterized by noninflammatory compact diffuse orthokeratotic hyperkeratosis. Oral vitamin A therapy resulted in an approximate 85% reduction of the scaling with no reports of adverse effects. This is the first reported case of ichthyosis in the goat. Oral vitamin A may be beneficial for the management of caprine ichthyosis.

Key words: goat, skin, ichthyosis, vitamin A

要 約: 4 歳, Nigerian Dwarf 種のヤギが生後 3 週より気づいたかゆみを伴わない落屑性皮疹を主訴に受診した。本症例では臨床的に, 大型白色で非固着性の鱗屑を略全身の皮膚に認めた。皮膚病理組織学的には非炎症性病変の所見を呈し, 稠密な正角化性の角化亢進が認められた。本症例ではビタミン A の経口投与により鱗屑が 85% 減弱し, 有害事象に関する報告は聴取されなかった。本症例はヤギに発症した魚鱗癬に関する初めての報告である。ビタミン A の経口投与はヤギに発症した魚鱗癬の管理に有効と考えられた。

キーワード: ヤギ, 皮膚, 魚鱗癬, ビタミン A

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Introduction

Ichthyosis (Greek: “fishy condition”; “fish scale disease”) consists of a heterogeneous group of hereditary and usually congenital disorders of keratinization (cornification) of the skin^{8, 14, 21}. Humans are affected by over 21 ichthyosiform dermatoses diagnosed on the basis of clinical, histopathological, ultrastructural, and genetic criteria⁸.

Ichthyoses have been uncommonly diagnosed in various breeds of dogs¹⁴ and cattle²¹, and rarely-to-extremely rarely diagnosed in alpacas²², cats⁵, llamas¹, and swine¹⁷. Although the vast majority of ichthyoses

in animals are assumed or proven to be of autosomal recessive inheritance^{2, 5–7, 9, 14, 21}, the precise genetic abnormality has only been determined in three dog breeds: Golden retrievers (insertion-deletion mutation in patatin-like phospholipase domain-containing protein)⁹, Norfolk terriers (donor splice-site mutation in keratin 10)⁶, and Parson (Jack) Russell terriers (insertion of a long interspersed nucleotide element in transglutaminase 1)⁷. To our knowledge, ichthyosis has not been previously reported in goats. Our purpose is to report a case of ichthyosis in a Nigerian dwarf goat.

Case Report

A 4-year-old, 40 kg male castrated Nigerian dwarf goat presented to the Equine and Farm Animal Hospital’s Internal Medicine Service with a long history

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Fig. 1. Skin over dorsolateral thorax. Numerous white scales on skin and throughout hair coat.

of nonpruritic, scaly skin noticed since it was acquired at 3 weeks of age. None of the other five goats in the herd were affected. The diet consisted of free choice hay and a salad consisting of cabbage, apples, and carrots along with access to a mineral and salt block. Additional supplementation included Capri-Min® (Caprine Supply, De Sota, Kansas, USA) (calcium 6-8% and phosphorus 12.0%/pound), Herbal Weekly Worm Formula and Tonic® (Molly's Herbs, Okemos, Michigan, USA) (garlic, cucurbita pepo, mugwort, fennel, hyssop, thyme, stevia), and a 400 mg vitamin E (d- α tocopherol acetate) tablet once daily. He had also received a Bo-Se® (Intervet/Merck Animal Health, Summit, New Jersey, USA; 50 mg vitamin E, 1 mg selenium/ml) injection (3 ml subcutaneously) three months prior to examination. Other previous therapy for the dermatosis included chlorhexidine shampoo, ivermectin, and permethrin powder with minimal improvement.

At presentation, the goat was alert and responsive with nonpruritic widespread scaly skin. A Dermatology Service consultation was obtained. Physical examination revealed widespread large, white nonadherent scales covering the entire skin, including both the convex and concave aspect of the pinnae (Figs. 1 and 2). A complete blood count, biochemistry profile, *Salmonella* culture, caprine arthritis enteritis virus ELISA, serum vitamin E, whole blood selenium, and serum zinc concentration were performed. Complete blood count and biochemistry profile were unremarkable with the exception of a mild mature neutrophilia (12.5 thou/ μ L; reference range 1.9-9.5 thou/L), attributed to the stress of being in the hospital. Serum zinc was markedly low (0.23 ppm; reference range 0.65-2.7 ppm). All other

Fig. 2. Skin over lateral thorax. Numerous white scales on skin and hair coat.

laboratory tests were unremarkable. Dermatologic testing included impression smears, trichography, and skin scrapings - all of which were unremarkable.

Differential diagnoses at this time included ichthyosis, nutritional deficiency, and a topical drug reaction. Three 6-mm-punch biopsies were obtained from the truncal skin. Histopathologic analysis revealed mild to moderate diffuse compact orthokeratosis of the epidermis and follicular infundibula (Figs. 3 and 4). These changes were consistent with ichthyosis.

Although the dermatosis was not typical of a zinc-responsive dermatitis, it was decided to firstly correct the low serum zinc concentration with zinc gluconate therapy (50 mg [1 mg/kg] orally once daily). After 6 weeks on this therapy, no improvement in the skin was noted. The zinc was then discontinued for four weeks with no change in the dermatosis. Additional impression smears, trichography, and skin scrapings were again unremarkable. Serum zinc concentration was again measured and was within normal limits (1.59 ppm; reference range 0.65-2.7 ppm). Vitamin A therapy (8000 IU [200 IU/kg] orally once daily) was prescribed for treatment of the previously diagnosed ichthyosis. After three months of vitamin A 8000 IU (200 IU/kg) therapy, an approximate 85% reduction in the widespread scaling was noted. The scaling previously noted along the concave and convex aspects of the pinnae was no longer present. Although scaling was persistent in all other regions, the severity was greatly decreased (Figs. 5 and 6).

Fig. 3. Skin biopsy specimen from lateral thorax. Compact orthokeratotic hyperkeratosis (black arrow) overlies a normal epidermis. The stratum corneum of normal goat skin is loose basket weave in appearance. The small number of perivascular lymphocytes are seen in normal goat skin. H&E stain 10X.

Fig. 4. Skin biopsy specimen from lateral thorax. Compact orthokeratotic hyperkeratosis of surface (red arrow) and hair follicle ostia (black arrow). H&E stain 20X.

Discussion

To the authors' knowledge, this is the first reported case of ichthyosis in a goat. In humans and other species^{2, 5-7, 9, 14, 21}, ichthyoses have been classified as inherited disorders – with the majority of clinical signs noted at or near birth¹⁴. In the goat reported herein, it is not known if the keratinization defect was present at birth (congenital). Neither were pedigree analysis or genetic testing performed to investigate the potential

Fig. 5. Skin over rump after 2 months of vitamin A therapy. No scales are seen.

Fig. 6. Skin over lateral thorax after 2 months of vitamin A therapy. Scaling of skin and hair coat is markedly reduced.

hereditary nature of the condition. However, no acquired cause for the keratinization abnormality was found. In all species in which ichthyosis has been reported, the unifying clinical sign is generalized scaling^{1, 14, 17, 21, 22}.

Diagnosis of ichthyosis is attained via history (early age of onset), physical examination (widespread keratinization disorder of variable severity), and histopathologic analysis. The relatively mild keratinization disorder in our goat is similar to that seen in Golden retrievers^{2, 14} and some cattle²¹. In dogs, cats,

cattle, and alpacas, noninflammatory diffuse (epidermis and hair follicles) orthokeratotic hyperkeratosis is the classic finding. Epidermal hyperplasia and hypo- or hypergranulosis are variable findings¹⁴⁾.

There are very few differential diagnoses for the total body keratinization abnormality of ichthyosis in the goat: (1) general nutritional deficiency, (2) prolonged total body applications of drying or irritating substances, (3) vitamin E/selenium-responsive dermatosis, and (4) zinc-responsive dermatosis. In the goat reported here, the diet was nutritionally complete, the goat was otherwise healthy, and no total body topicals had been used^{21, 24)}.

Vitamin E/selenium-responsive dermatosis is characterized by a dry, thin hair coat; waxy, adherent scales; and periorbital alopecia^{21, 24)}. The dermatosis responds completely and rapidly to the administration of vitamin E and selenium (3 mg selenium and 150 mg vitamin E per 50 kg, subcutaneously)²⁴⁾. The goat reported here had neither a thin, dry hair coat, waxy scales, nor periorbital alopecia, and did not respond to an injection of selenium and vitamin E nor oral administration of vitamin E.

Zinc-responsive dermatosis may exhibit widespread scaling and a greasy, matted hair coat, but is characterized by erythema, hyperkeratosis, and thick crusts on the face, pinnae, and distal limbs^{21, 24)}. Although the histological keratinization defect of zinc-responsive dermatosis in swine^{16, 21)}, cattle^{21, 23)}, and dogs is parakeratotic, that seen in goats and sheep^{18, 25)} is orthokeratotic, parakeratotic, or both. The keratinization defect in alpacas²²⁾ is primarily orthokeratotic. The measurement of serum or blood concentrations of zinc cannot reliably separate affected animals from normals^{3, 4, 14, 24)}. The dermatosis responds completely and rapidly to zinc (eg. 1 gram of zinc sulfate per day, by mouth)²⁴⁾. The goat reported here did not have erythema, hyperkeratosis, and crusting. Although pretreatment serum zinc concentration was low and returned to normal with zinc supplementation, the dermatosis did not improve.

Because the ichthyoses are genetic disorders, they are incurable^{8, 14, 21)}. Therapeutic approaches to ichthyoses in animals vary according to the severity of the dermatosis, the interest and abilities of the owner, and economic considerations¹⁴⁾. Mild cases may require no treatment. More severe cases could be managed by the routine topical applications of moisturizing

and keratomodulatory shampoos and rinses. Very severe cases may respond to the oral retinoids or to nothing at all. Some animals are euthanized for various reasons: interest of owner, economics, and inadequate response to treatment. The term “retinoids” refers to all chemicals – natural or synthetic – that have vitamin A activity^{8, 12, 14, 19)}. Synthetic retinoids are primarily retinol, retinoic acid, or retinal derivatives or analogs. Vitamin A and the retinoids are regulators of epithelial proliferation, growth, and differentiation^{8, 12, 14, 19)}. They are antiproliferative, anti-inflammatory, and immunomodulatory agents^{8, 12, 14, 19)}. Although retinoids have been advocated for the treatment of canine ichthyoses, most information is anecdotal^{12, 14, 19)}. In three case reports, isotretinoin (1 mg/kg q 12 to 24 hours by mouth) was effective in an American pitbull²⁰⁾ and ineffective in a soft-coated Wheaten terrier¹⁰⁾, and etretinate (2.5 mg/kg/day by mouth) was effective in a Parson (Jack) Russell terrier¹³⁾.

There are two major deterrents to the use of synthetic retinoids in animals in the United States: (1) expense, and (2) ability to obtain the drugs owing to the regulation and monitoring required for human use¹⁴⁾. Because of these deterrents, veterinarians are evaluating the therapeutic properties of natural vitamin A (retinol) in selected canine dermatoses (e.g., ichthyosis, primary seborrhea, sebaceous adenitis)¹⁴⁾. Retinol appears to be safe in dogs as long as the daily oral dose does not exceed 1200 IU/kg¹⁴⁾. Retinol (800 IU/kg/day by mouth) was ineffective in one Parson (Jack) Russell terrier¹³⁾ and an unspecified number of Golden retrievers (dose and duration of treatment not stated)²⁾ with ichthyosis. In our patient, three months of vitamin A (200 IU/kg) therapy resulted in an approximate 85% reduction of the scaling previously noted with no reports of adverse effects.

In conclusion, this case represents, to the best of the authors' knowledge, the first documented case of presumed congenital and hereditary caprine ichthyosis which should be included in the differential diagnoses of widespread scaling that is first noticed as a young kid. In addition, oral vitamin A may be beneficial for the management of caprine ichthyosis.

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