

Clinical report of a Holstein's calf with ichthyosis

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Abstract

Congenital ichthyosis is a disease associated with hair loss and the presence of horny plates in the epidermis, covering the whole skin. The leading cause of the disease in humans and animals is genetic disorders, and they can be found in mild and severe forms. In June 2015, a newly born calf of the Holstein breed was referred to the Livestock Veterinary Hospital internal ward, Shabestar, Iran. The calf's clinical symptoms included maternal alopecia, thickening, and fissure over large areas of the body, tough skin with thick horny scales and deep crack, lack of flexibility in the body parts (gluteal, knee, and shoulder areas), ectropion, eclabium, and microtia. The blood samples were taken from the calf's jugular vein to measure the hematological and biochemical parameters. After euthanizing the calf, the skin of different body regions was sampled for histopathological examination of skin lesions. Based on the results, the amounts of plasma parameters such as urea, triglyceride, glucose, alanine transaminase, lactate dehydrogenase, phosphorus, and uric acid were increased. The leukocytosis and polycythemia were found in the hematology results, and histopathological analysis exhibited hypergranulosis and hyperkeratosis in the skin of affected areas. Ichthyosis is caused by the defect in the autosomal recessive gene and as an incurable disease; there is currently no cure for this deadly disease, and the livestock will be eliminated from the herd.

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Introduction

Congenital ichthyosis is a rare disease involving the hair loss and presence of horny plates in the epidermis, covering the entire surface of the skin. It includes keratinization disorders in the skin and changes in lipid metabolism. It is exhibited by skin fissures deeply penetrated the skin and creates deep ulcers. Seborrhea is also seen in the area, and the skin loses its flexibility. The leading cause of the disease is the genetic disorders affecting humans and animals.¹⁻⁴ The term ichthyosis is derived from the Greek word *ἰχθυός*, meaning the fish, referring to the scales as there is an increase in the keratinization of the epidermis.^{3,5} This disease has been reported in cattle, pigs, llamas, dogs, mice, poultry, and humans. It has mild and severe forms; where the hyper-keratosis and hypotrichosis occur in the mild form and in the severe form, alopecia, hyperkeratosis, thickening and cracking of the skin, ectropion (outward turning of the eyelid), eclabium (outward turning of the lip), microtia (unusually

small auricle), cataracts, and thyroid disorders may occur. The mild form is seen in Holstein and Jersey breeds, and the severe form is seen in the Friesian and Brown Swiss breeds. Hyperkeratosis is limited to certain areas such as the abdomen, groin, muzzle, and joints. In this disease, the animals are born dead or die a few hours to few days after the birth. It is also known as fish scale disease.^{3,5-7}

Case Description

In June 2015, a newly born calf of the Holstein breed (standard delivery) was referred to the Livestock Veterinary Hospital internal ward, Shabestar, Iran. The clinical symptoms of the calf included depression, 39.10 °C temperature, heart rate of 130 beats per min, respiratory rate of 38 breaths per min, maternal alopecia, seborrhea, thickening and fissure over large areas of the body, tough skin with thick horny scales and deep crack, lack of flexibility in the body parts (gluteal, knee and shoulder areas), ectropion, eclabium and microtia (Fig. 1).

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The blood samples were taken from the calf's jugular vein to measure the hematological and biochemical parameters (Table 1). The measurement of hematological and serological factors was done using the cell counter and auto-analyzer (BS-200; Mindray, Guangdong, China) devices, respectively. After euthanizing the calf, the skin of different regions of the body was sampled in the formalin fixative for histopathological examination of lesions and sent to the Histopathology Laboratory of Islamic Azad University, Shabestar Branch, Shabestar, Iran.



Fig. 1. A) Alopecia and **B)** skin thickening and crack in a newly born calf of the Holstein breed.

Table 1. Hematological and biochemical parameters.

Test	Result
White blood cell ($\times 10^3 \mu\text{L}^{-1}$)	75.50
Red blood cell ($\times 10^6 \mu\text{L}^{-1}$)	10.30
Hemoglobin (g dL ⁻¹)	11.80
Packed cell volume (%)	39.80
Mean corpuscular volume (fL)	38.40
Mean corpuscular hemoglobin (pg)	11.40
Mean corpuscular hemoglobin concentration (g dL ⁻¹)	29.60
Platelet count ($\times 10^3 \mu\text{L}^{-1}$)	277.00
Urea (mmol L ⁻¹)	101.00
Triglycerides (mg dL ⁻¹)	34.00
Cholesterol (mg dL ⁻¹)	51.00
Aspartate aminotransferase (U L ⁻¹)	3.00
Alanine aminotransferase (U L ⁻¹)	123.00
Alkaline phosphatase (U L ⁻¹)	81.00
Conjugated bilirubin ($\mu\text{mol L}^{-1}$)	0.60
Calcium (mmol L ⁻¹)	0.30
Phosphorus (mmol L ⁻¹)	12.00
Iron ($\mu\text{mol L}^{-1}$)	1284
Low-density lipoprotein (mg dL ⁻¹)	87.00
High-density lipoprotein (mg dL ⁻¹)	0.00
Lactate dehydrogenase (mg dL ⁻¹)	2046
Magnesium (mg dL ⁻¹)	0.90
Albumin (g dL ⁻¹)	6.00
Creatinine (mg dL ⁻¹)	0.00
Urate (mg dL ⁻¹)	2.90
Glucose (mg dL ⁻¹)	85.00
Total protein (g dL ⁻¹)	6.10

Results

Based on achieved results, the amounts of plasma parameters such as urea, triglyceride, glucose, alanine transaminase, lactate dehydrogenase, phosphorus, iron, and uric acid were increased, and the amounts of calcium, magnesium and, aspartate transaminase were decreased.

The leukocytosis ($75.50 \times 10^3 \mu\text{L}^{-1}$; normal range: $4.90 - 12.00 \times 10^3 \mu\text{L}^{-1}$), normocytic-hypochromic anemia, and polycythemia ($10.00 \times 10^6 \mu\text{L}^{-1}$; normal range: $5.10 - 7.60 \times 10^6 \mu\text{L}^{-1}$) were found in the hematology results, and histopathological examination revealed hypergranulosis and hyperkeratosis in the skin of affected areas. The histopathological investigation also showed dermal collagen dysplasia, mild perivasculitis, edema, and hyperemia, along with mild epidermal hyperplasia (mainly parakeratosis). Disruption, hyperemia, and hemorrhage were evident in the subcutaneous muscles (Fig. 2). Shortly after birth, the calf was more depressed and euthanized due to the severity of the lesions, poor prognosis, and welfare reasons.

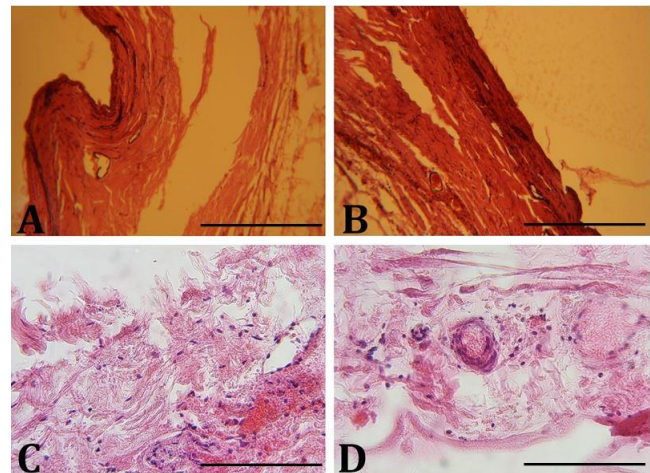


Fig. 2. A) Presence of horny epidermis and **B)** hyperkeratosis; **C)** collagen dysplasia (H & E, Scale bars = 200 μm); **D)** mild perivasculitis (H & E, Scale bar = 100 μm).

Discussion

The history of skin keratinization disorders noted since birth and the gross and histopathological findings were consistent with congenital ichthyosis's clinical diagnosis. Eclabium, ectropion, microtia, and the inability to stand exacerbated the prognosis and the combination of these symptoms was the reason for euthanasia. Hematological findings revealed leukocytosis. These changes are consistent with the clinical signs of secondary bacterial infections of the wounds, and possible bacteremia and histopathological findings of perivascular dermatitis with hyperkeratosis can also justify this severe leukocytosis.⁸ The situation is distinguished histopathologically by outstanding laminated hyperkeratosis of the epidermis. Hyperkeratosis is limited to certain areas such as the abdomen, groin, muzzle, and joints. The biopsy helps most cases of skin diseases if clinical symptoms are insufficient for definitive diagnosis.

The main histopathological characteristics, in this case, were hypergranulosis and hyperkeratosis, along with dermal collagen dysplasia. Other former reports

have shown orthokeratotic hyperkeratosis, follicular keratosis, diffuse dermal mucinous degeneration, thickening and cracking of the skin, ectropion, eclabium, microtia, cataracts, and thyroid disorders.^{1-3,9,10} In the presented case, hypergranulosis and hyperkeratosis were observed along with dermal collagen dysplasia, mild perivasculitis, edema, and hyperemia, as well as mild epidermal hyperplasia. Hereditary collagen dysplasia was observed in this case, and there have been no reports in this regard; this is also referred to as dermatosparaxis, meaning torn skin being clinically visible in Figure 1 (gluteal area) this skin disorder. This is the first case of ichthyosis in which hereditary collagen dysplasia is reported.⁸

Ichthyosis is caused by the defect in the autosomal recessive gene. The severe form is a deadly disease-causing abortion, or in the case of animal survival, it will be wasted in a few days. It is an incurable disease, and there is currently no cure for this fatal disease. The livestock is eliminated from the herd because of the lack of beauty. The existence of a suitable breeding program is the only option to minimize the incidence of ichthyosis.^{1,4,9}

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Conflict of interest

The authors declare no conflict of interest.

References

1. Raoofi A, Mardjanmehr SH, Nekoei S. Ichthyosis congenita in a calf in Iran. *Vet Rec* 2001; 149(18): 563. doi: 10.1136/vr.149.18.563.
2. Molteni L, Dardano S, Parma P, et al. Ichthyosis in Chianina cattle. *Vet Rec* 2006; 158(12): 412-414.
3. Cornillie P, Cools S, Vandaele L, et al. Ichthyosis in the Belgian White and Red cattle breed. *Vlaams Diergeneeskd Tijdschr* 2007; 76: 345-351.
4. Constable P, Hinchcliff KW, Done S, et al. *Veterinary medicine: a textbook of the diseases of cattle, horses, sheep, pigs and goats*. 11th ed. Philadelphia, USA: Elsevier Health Sciences 2017; 1646.
5. Scott DW. *Color atlas of farm animal dermatology*. 2nd ed. New Jersey, USA: John Wiley & Sons 2018; 79-80.
6. Divers TJ, Peek SF. *Rebhun's diseases of dairy cattle*. 2nd ed. Philadelphia, USA: Saunders 2008; 315.
7. Andrews AH, Blowey RW, Boyd H, et al. *Bovine medicine: Diseases and husbandry of cattle*. 2nd ed. New Jersey, USA: John Wiley & Sons 2004; 182 and 888.
8. Maxie G. Jubb, Kennedy & Palmer's pathology of domestic animals. 6th ed. Philadelphia, USA: Saunders 2016; 530-546.
9. Câmara ACL, Borges PAC, Paiva SA, et al. Ichthyosis fetalis in a cross-bred lamb. *Vet Dermatol* 2017; 28(5): 516-e125. doi: 10.1111/vde.12459.
10. Azimpour S, Sasani F, Mottaghian P, et al. Ichthyosis congenita in a calf: case report. *Thai J Vet Med* 2016; 46(3): 517-521.