

Diagnostic Exercise

From The Davis-Thompson Foundation*

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Answer Sheet

Title: Color dilution alopecia in a Yorkshire terrier.

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Clinical history:

A 1-year-old female Yorkshire terrier was presented to the clinic for a second opinion regarding its poor hair coat condition. According to the owner, the dog has been showing that appearance since the moment it was adopted, at 8 months of age. The owner also mentioned that the dog's father had a similar fur appearance. External deworming was regularly administered to this dog, and oral fluralaner (Bravecto™) was given at the time of its presentation. No other clinical signs were reported.

A complete physical examination was performed, with emphasis on skin and fur assessment. The main findings were the presence of extensive areas of hypotrichosis and alopecia, affecting only dark-haired regions, mainly in the dorsal region, neck and on the outer surface of both pinnae (Figures 1 and 2). The presence of seborrhea and small papules compatible with superficial folliculitis were also identified. No other abnormalities were detected during the remaining examination. The complete blood count and serum biochemistry, including total circulating thyroxine (tT4) were unremarkable. Deep skin scraping and dermatophyte culture were also performed, but both tests were negative for the presence of ectoparasites and fungi, respectively. Finally, the hair follicles from the lesion areas were pulled out and evaluated under a microscope using the trichogram technique (Figure 3).

Baths with an anti-seborrheic and anti-microbial shampoo were prescribed, but although seborrhea and folliculitis were quickly controlled with this topical treatment, the alopecic areas remained and no signs of hair regrowth was observed in the following dermatological reassessments.

Macroscopic images:



Figure 1 – Color dilution alopecia, Yorkshire terrier, dog. Extensive areas of hypotrichosis and alopecia, affecting only dark-haired regions, mainly in the dorsal region, neck, and on the outer surface of both pinnae (dorsal view).



Figure 2 – Color dilution alopecia, Yorkshire terrier, dog. Extensive areas of hypotrichosis and alopecia (arrows), affecting only dark-haired regions,

mainly in the dorsal region, neck and on the outer surface of both pinnae (lateral view).

Microscopic images:

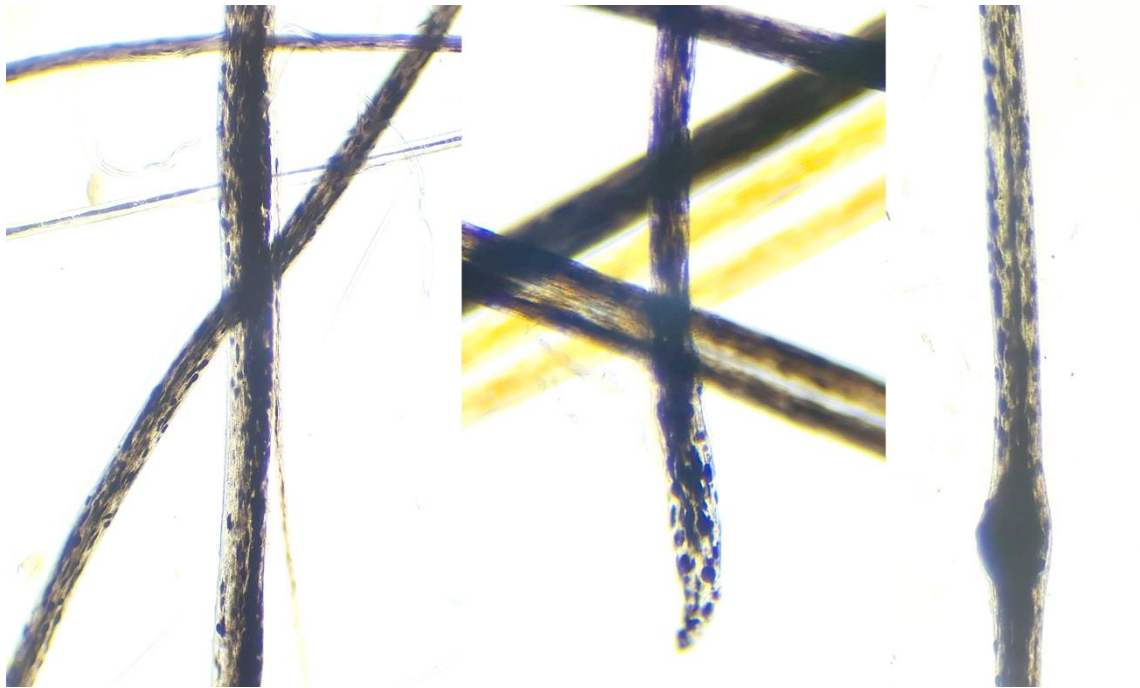


Figure 3 – Color dilution alopecia, Yorkshire terrier, dog. Trichogram of the dark hair follicles pulled from the affected areas. Presence of several large and irregular melanin clumps in the hair cortex and medulla (macromelanosomes).

Follow-up questions:

1- According only to the macroscopic images, without knowledge of the results of the complementary exams, what would be the main differential diagnoses for these extensive lesions of hypotrichosis and alopecia?

Answer: The main differential diagnoses based solely on clinical presentation were demodicosis, dermatophytosis, hypothyroidism, alopecia X, and color dilution alopecia.

2 - What changes do you observe in the microscopic images captured in the trichogram of this animal?

Answer: Through these microscopic images, it is possible to observe the presence of numerous melanin clumps that vary in terms of size, shape and location along the hair shaft. These anomalous accumulations of melanin even lead to the distortion of the hair shaft, which is broken in some points, particularly its tips. Pathogenic microorganisms such as mites (e.g., *Demodex canis*) or fungi (e.g., dermatophyte spores) are not identified.

3 - Based on the anamnesis, the clinical presentation and the complementary exams (particularly the trichogram), what is your clinical diagnosis?

Answer: Color dilution alopecia.

4 - What clinical evolution do you expect for this animal concerning these hair coat abnormalities and what more diagnostic tests could be performed?

Answer: Since it is an irreversible genetic disorder associated with a weak or null capacity for hair regrowth, the expected clinical evolution is that the animal becomes completely alopecic in the dilute areas of the hair coat.

With regard to more diagnostic tests, it would also be possible to carry out histopathological analysis, through tissue biopsy from the lesion areas, and even genetic tests from a blood sample. Histopathology was not performed in this case because it is considered a more invasive test that would only confirm the diagnosis previously established. Regarding genetic tests, it would be interesting to perform a molecular technique to find the MLPH mutation, given that her father had a similar hair coat, which raises the suspicion of a hereditary transmission.

Discussion

Color dilution alopecia (CDA) is an uncommon genetic condition characterized by follicular dysplasia due to an abnormal distribution of melanin [1]. Mutation in the melanophilin (MLPH) gene has been considered as a potential cause for this condition [2]. CDA has been reported in Yorkshire Terriers, but also in Doberman pinschers and Dachshunds [2-4]. Affected dogs develop hypotrichosis restricted to dark-haired regions associated with brittle and easily shed hair leading to alopecia [5-7]. This fragility of the hair is due to the abnormal accumulation of melanin clumps (macromelanosomes) in the shaft of dark hair follicles, which leads to their distortion and breakage [1]. In association with the lack of hair, these animals are prone to the development of scaling, comedones, folliculitis, and even, in some cases, superficial pyoderma [8]. Moreover, these animals may be more predisposed to the development of skin tumors due to the greater exposure of the skin secondary to the lack of fur, as previously suggested [7, 9].

Trichogram is a simple way to establish the diagnosis, allowing the detection of these large and irregular melanin clumps in the hair cortex and medulla, particularly in the telogen phase [1, 3, 5]. Histopathology can also be performed, through tissue biopsy from the lesion areas, which usually shows abnormal melanin clumping in epidermal, hair matrix, and follicular basal cells, and also follicular hyperkeratosis [3, 5-7]. A PCR-restriction-fragment length polymorphism (PCR-RFLP) technique was recently described for the identification of the MLPH mutation through a blood sample [2]. This type of genetic molecular tests allows not only to confirm the clinical diagnosis, but also to identify other color dilution gene carriers that may not have a clinical manifestation, but that must be kept away from breeding to avoid the transmission of CDA to subsequent generations. Probably if this animal's parents had been tested, they would not have been used as breeders and their offspring would not have manifested this disorder.

As this is an irreversible condition, there is no treatment that will cure the condition. Melatonin treatment has been described but not found to be effective [5]. Even so, the use of retinoids and essential fatty acids have been reported to improve skin and coat quality and systemic antibiotic therapy may be used in cases of superficial pyoderma [8].

This clinical case shows the importance of considering CDA as a differential diagnosis in color-dilute dogs that show areas of hypotrichosis and alopecia, especially when parasitic and endocrine diseases are ruled out. We also showed that a simple, accessible and inexpensive technique, such as the trichogram, allows to establish the diagnosis of this disease.

References

1. Miller W, Griffin C Campbell K. Congenital and Hereditary Defects. Muller and Kirk's Small Animal Dermatology. 7th ed. St. Louis: Elsevier; 2013. p. 573-617.
2. Caramalac SM, Caramalac SM, Babo-Terra VJ, Ramos CAN, Palumbo MIP PCR-RFLP molecular confirmation of color dilution alopecia in dogs in Brazil. *J Vet Diagn Invest* 2021;33(5):984-986.
3. Roberto F, Cerundolo R, Restucci B, Vincensi MR, Caprariis Dd, Vico Gd Maiolino P Colour Dilution Alopecia (CDA) in Ten yorkshire Terriers. *Vet Dermatol* 1995;6(4):171-178.
4. Beco L, Fontaine J, Gross TL, Charlier G () Colour dilution alopecia in seven Dachshunds. A clinical study and the hereditary, microscopical and ultrastructural aspect of the disease. *Vet Dermatol* 1996;7(2):91-97.
5. Perego R, Proverbio D, Roccabianca P, Spada E. Color dilution alopecia in a blue Doberman pinscher crossbreed. *Can Vet J* 2009;50(5):511-514.
6. Lopes NL, Peixoto AdP, Costa TdS, Pisani RBF, Medeiros CMBT, Ramadinha RHR, Mascarenhas MB, Fernandes JI. Color dilution alopecia: case report. *Braz J Vet Med* 2017;39:198-202.
7. Antunes MIPP, Fabris VE, Machado LHA. Carcinoma de células escamosas em um cão com alopecia por diluição de cor. *Vet Zootec* 2012;19(4):507-512.
8. Paradis M, Cerundolo R. An approach to symmetrical alopecia in the dog. In: Foster AP, Foil CS, editors. BSAVA Manual of Canine and Feline Dermatology. 2nd ed. Gloucester: British Small Animal Veterinary Association; 2003. p. 83-93.
9. Madewell BR, Ihrke PJ, Griffey SM. Multiple skin tumours in a Doberman Pinscher with colour dilution alopecia. *Vet Dermatol* 1997;8(1):59-61.

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