Opis przypadku *Case report*

Cutaneous candidiasis in a dog with demodicosis – case report

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Summary

This report describes the clinical findings and treatment of cutaneous candidiasis caused by Candida albicans in a fourteen-month-old dog. Skin lesions were located on the neck and back, and included hair loss, erythema, papules, and pustules. Swab cultures obtained from intact pustules grew C. albicans but no bacteria. The examination of susceptibility to antifungals, carried out with ATB FUNGUS (bioMérieux), revealed that the isolated strain was susceptible to flucytosine, amphotericin B, and nystatin, but only moderately susceptible to fluconazole, econazole, and ketokonazole. The treatment consisted of the application of amitraz (an antiparasitic drug) and ketokonazole (orally, 15 mg/kg twice a day for 14 days), followed by miconazole cream. A complete recovery was obtained within 8 weeks. An infection with Demodex canis and, probably, previous antibiotic therapy were recognized as predisposing factors in this case. The repeated isolation of Candida albicans from intact pustules and a positive response of the patient to antifungal treatment proved the role of this yeast in the infection described here.

Keywords: dog, Candida albicans, skin infection, Demodex canis

Skin infections caused by yeasts are relatively uncommon conditions in dogs. Among these fungi, *Malassezia pachydermatis* plays the most important role (4, 13). Although members of the genus *Candida* occur as normal microbiota of the canine gastrointestinal and upper respiratory tracts, they have only rarely been isolated from clinical cases (18). There are only a few reports concerning *Candida* infections of skin in dogs; these infections were caused by *C. albicans* (7, 11), *C. tropicalis* (10), *C. guilliermondii* (12) and *C. parapsilosis* (1).

Yeasts of *Candida* spp. show a distinct predilection for mucous membranes and mucocutaneus junctions (11, 17). Under favourable conditions, these microorganisms may transform into pathogens causing different infections of mucosae and/or skin, as well as generalized diseases (5, 6, 8, 9, 12, 14). Predisposing factors that may lead to yeast infections include immunological defects (T-cell dysfunction, impairment of phagocytosis), physiological conditions (age, pregnancy), pathological factors (endocrine disorders, diabetes mellitus, viral and parasitic infections), and iatrogenic agents (long-term administration of antibiotics, corticosteroids, or cytostatic drugs). Cutaneous candidiasis is also promoted by a high level of skin moisture over a long period of time and subsequent epidermal maceration (18). Therefore, skin lesions associated with *Candida* infections are found more frequently in regions of the oral cavity, groin, genital organs, and anus.

Canine demodicosis is a common parasitic skin disease (17). *Demodex canis*, the causative agent, colonizes hair follicles in the majority of healthy dogs. Clinical signs of demodicosis result from an enormous multiplication of *D. canis*, which, in turn, is due to some defects of the immune system. It is thought that generalized demodicosis has been caused by a hereditary, *D. canis*-specific, T-cell defect that enables the proliferation of the parasite. The mites (and probably microorganisms) induce a humoral factor that suppresses the immune response to *D. canis* (17). Dysfunctions of some immune system elements during demodicosis, as well as the inflammation of skin and hair follicles, not infrequently cause secondary infections by various microorganisms. Complicating agents usually include bacteria: most often *Staphylococcus intermedius* and, less frequently, Gram-negative rods *Proteus* sp. and *Pseudomonas* sp. (17).

Despite the fact that demodicosis is strictly associated with a state of immunosuppression and is, of itself,

a disease predisposing to secondary infections, cases of concurrent infection with *Demodex canis* and *Candida* sp. have not yet been described in the literature.

Case history

A fourteen-month-old male American Staffordshire terrier was presented for microbiological examination. For several months the dog had been displaying skin lesions, such as hair loss, erythema, and pustule formation, on its head, neck, and back (fig. 1). The medical history showed that the dog had been correctly vaccinated and dewormed. Previous therapy with cephalosporins was unsuccessful; the clinical state of the patient worsened. Microscopic examination of skin scrapings revealed numerous *Demodex* mites. Samples from the pustules were taken for bacterial culture by swabbing purulent discharge. The material was inoculated on blood agar (clinical picture suggested staphylococcal folliculitis). Staphylococci failed to grow, however. Instead, small (0.5-1 mm in diameter), nonhemolytic, white colonies were isolated, and the organisms were recognized microscopically as yeasts. Owing to the suspicion of an incidental contamination of the sample, the microbiologic investigation was repeated. The second sample of purulent material was taken and plated on blood agar and Sabouraud Dextrose Agar. Numerous fungal colonies were obtained for the second time. On the basis of the colony's morphology, the yeasts were identified as *Candida* sp.

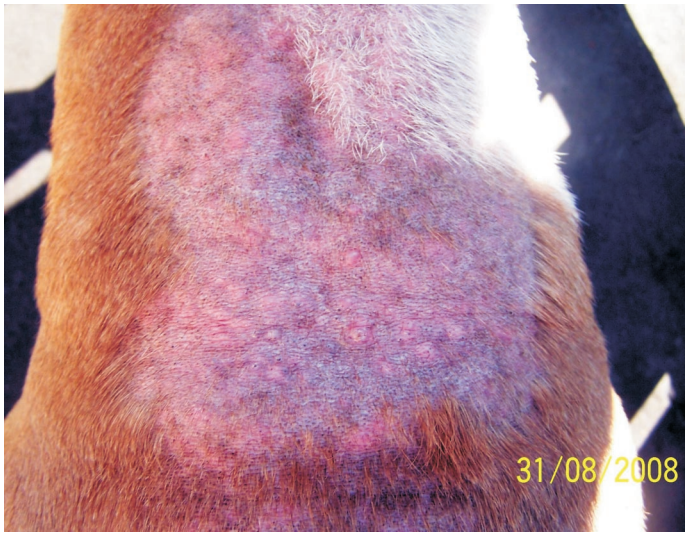

Fig. 1. Skin lesions on the back of a fourteen-month-old male American Staffordshire terrier with demodicosis and candidiasis

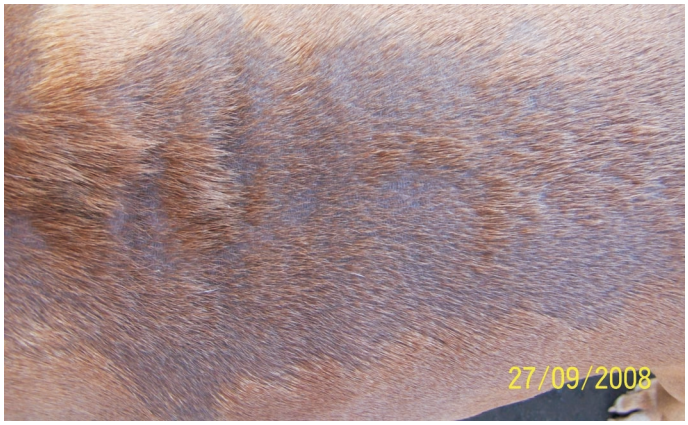

Fig. 2. The same dog after 4 weeks of antiparasitic and antifungal treatment

The germ tube test with human serum gave a positive result after 3 hours' incubation at 37°C. The final identification was performed using the ID 32 C system (bioMérieux). Biochemical properties (carbohydrate assimilation) enabled the recognition of the strain as *Candida albicans* biotype 1 (the code obtained was 7347 3400 15). In addition, the susceptibility of the isolated strain to antifungals was determined by ATB FUNGUS (bioMérieux). The organism was susceptible to flucytosine (MIC < 0.25 mg/ml), amphotericin B (MIC < 1 mg/ml), and nystatin, but only moderately susceptible to miconazole, econazole, and ketoconazole.

The dog was treated with amitraz (Taktic®; Intervet), applied topically every 7-10 days for 6 weeks, and ketoconazole (Nizoral®; Krka), applied orally at 15 mg/kg twice a day for 14 days, followed by miconazole cream (Daktarin®; Janssen). Its clinical condition improved considerably within a month of treatment (fig. 2). Pustules and erythema disappeared, and hair regrowth was observed on affected skin areas. A complete recovery was obtained within 8 weeks.

Discussion

In the present paper, we describe a clinical case of simultaneous demodicosis and *Candida albicans* infection in a dog. This case is interesting not only for its rarity but also because of its unusual clinical picture. The skin of the affected animal was dry, hairless, reddened and covered with papules and pustules that resembled staphylococcal folliculitis. While alopecia and erythema are often associated with a *Demodex* infection, the occurrence of pustules resulted undoubtedly from a secondary infection. Interestingly, carefully collected samples from intact pustules yielded *Candida albicans*. Yeasts, as mucosal and skin commensals, are often considered to be merely contaminants in clinical material. However, in the case described here *Candida* was isolated two times independently as the sole microorganism, which argues for a secondary fungal infection in the course of demodicosis. Similarly, the positive response of the patient to antifungal treatment also indicates that yeasts were implicated as pathogens.

Cases of cutaneous candidiasis in dogs are encountered quite rarely. Usually, these are secondary infections complicating skin diseases associated with a local impairment of immune defence or occurring in patients treated with immunosuppressive agents. For example, Moretti et al. (11) described a case of canine cutaneous candidiasis caused by *Candida albicans* and accompanied by scaling, crusting, and ulceration of the skin, and by alopecia. Established predisposing factors for this condition were an autoimmune disease (pemphigus foliaceus), long-term use of glucocorticosteroids (for 4 months), and a concurrent *Ehrlichia*

canis infection. Another *Candida* species, *C. guilliermondii*, was a cause of skin infection in the groin area as a consequence of castration (12). Clinical signs included severe erythema, as well as scaling and crusting of the skin. The crusts could easily be peeled off, leaving erosions. According to the authors, the fungal infection may have resulted from skin damage after clipper burn, followed by topical antimicrobial and anti-inflammatory therapy.

Some other parasitic skin diseases in dogs may also be complicated by yeast infections. Moretti et al. (10) found a *C. tropicalis* infection in a dog with leishmaniasis. Similarly to demodicosis, an infection by *Leishmania infantum* causes quantitative and qualitative alterations in the population of T-cells, which may render patients more susceptible to concurrent infections. However, in spite of a high prevalence of leishmaniasis in the Mediterranean area, simultaneous infections with fungi have also rarely been reported (10).

In the majority of cases of skin candidiasis in dogs described in the literature, clinical signs were dominated by alopecia, scaling, erosions, and crusting. Symptoms typical of *Candida albicans* infections are considered to be those described by Schwartzman et al. (16), who experimentally induced cutaneous candidiasis in dogs. Clinical signs take the form of acute dermatitis and include oozing and reddened plaques developing on macerated and suppurated skin surface. The reaction is identical to that of contact dermatitis induced by irritating agents, e.g., cationic detergents. Similar lesions have also been observed in the course of pyotraumatic dermatitis in dogs („hot spots") (16, 17).

Skin lesions resembling those observed in our case were only described by Kral and Uscavage (7). These authors isolated *Candida albicans* from skin lesions of a dog; the affected skin was dry, covered by papules, pustules, and crusts, and showed severe hyperkeratosis, resulting in the formation of thick folds. Bacteriologic examination also revealed a Gram-negative rod; therefore, papules and pustules may also have been a result of bacterial- or mixed infection.

Prognosis in canine cutaneous candidiasis depends mainly on the primary disease. Although *Candida* strains are usually highly susceptible to antifungal drugs, especially of the azole group (2, 15), the therapy of infections caused by yeasts may be ineffective in cases in which the predisposing factors have not been removed (10, 11).

The source of *Candida albicans* in the present case is unknown. The organism may have originated from the oral cavity of the dog and transferred to the skin during licking or scratching. It is also possible that the fungus was of human origin, and the infection was caused by grooming or previous treatment. It is noteworthy that strains of this fungus, displaying the same biochemical properties, were also found in humans – both healthy and with clinical symptoms (20). Moreover, the genotypic analysis of *C. albicans* strains derived from man and animals did not reveal the presence of host-specific genotypes (3); it was also stated that the transmission of *C. albicans* from humans to domestic animals is more likely than in the opposite direction (19).

The clinical case described here shows that the nature of some dermatoses in dogs can be fairly complex, and yeasts of the genus *Candida*, apart from *Malassezia*, should also be taken into account as a causative agent of skin infection.

References

1. *Dale J. E.*: Canine dermatosis caused by Candida parapsilosis. Vet. Med. Small Anim. Clin. 1972, 67, 548-549.
2. *Dąbkowska M., Garczewska B., Dzierżanowska D.*: Lekowrażliwość szczepów Candida oceniana mikrotestem ATB-Fungus firmy bioMérieux. Mikol. Lek. 1998, 5, 5-7.
3. *Edelmann A., Krüger M., Schmid J.*: Genetic relationship between human and animal isolates of Candida albicans. J. Clin. Microbiol. 2005, 43, 6164--6166.
4. *Guillot J., Bond R.*: Malassezia pachydermatis: a review. Med. Mycol. 1999, 37, 295-306.
5. *Jadhav V. J., Pal M.*: Canine mycotic stomatitis due to Candida albicans. Rev. Iberoam. Micol. 2006, 23, 233-234.
6. *Jin Y., Lin D.*: Fungal urinary tract infections in the dog and cat: a retrospective study (2001-2004). J. Am. Anim. Hosp. Assoc. 2005, 41, 373-381.
7. *Kral F., Uscavage J. P.*: Cutaneous candidiasis. J. Am. Vet. Med. Assoc. 1960, 136, 612-615.
8. *Kuwamura M., Ide M., Yamate J., Shiraishi Y., Kotani T.*: Systemic candidiasis in a dog, developing spondylitis. J. Vet. Med. Sci. 2006, 68, 1117-1119.
9. *McEwan N. A.*: Malassezia and Candida infections in bull terriers with lethal acrodermatitis. J. Small. Anim. Pract. 2001, 42, 291-297.
10. *Moretti A., Boncio L., Posteraro B., Mechelli L., Balducci M., Fadda G., La Sorda M., Di Chio M., Grelloni V., Agnetti F.*: Co-cutaneous infection in a dog: PCR-reverse identification of Candida tropicalis on skin biopsy. J. Mycol. Méd. 2006, 16, 30-36.
11. *Moretti A., Posteraro B., Boncio L., Mechelli L., De Gasperis E., Agnetti F., Raspa M.*: Diffuse cutaneous candidiasis in a dog. Diagnosis by PCR-REA. Rev. Iberoam. Micol. 2004, 21, 139-142.
12. *Mueller R. S., Bettenay S. V., Shipstone M.*: Cutaneous candidiasis in a dog caused by Candida guilliermondii. Vet. Rec. 2002, 150, 728-730.
13. *Pier A. C., Cabañes F. J., Chermette R., Ferreiro L., Guillot J., Jensen H. E., Santurio J. M.*: Prominent animal mycoses from various regions of the world. Med. Mycol. 2000, 38, Suppl. I, 47-58.
14. *Pressler B. M., Vaden S. L., Lane I. F., Cowgill F. D., Dye J. A.:* Candida spp. urinary tract infections in 13 dogs and seven cats: predisposing factors, treatment, and outcome. J. Am. Anim. Hosp. Assoc. 2003, 39, 263-270.
15. *Quindòs G., Abarca L., Carrillo-Muñoz A. J., Arèvalo M. P., Bornay F. J., Casals J. B., Hernández Molina J. M., Iglesias I., Linares M. J., Martín--Mazuelos E., Pereiro Ferreiròs M., Rezusta A., Rubio M. C., Salesa R., San Millán R., Torres-Rodríguez J. M.*: Multicenter survey of in vitro antifungal resistance in yeasts of medical importance isolated from Spanish patients. Rev. Iberoam. Micol. 1999, 16, 97-100.
16. *Schwartzman R. M., Deubler M. J., Dice II P. F.*: Experimentally induced cutaneous moniliasis (Candida albicans) in the dog. J. Small Anim. Pract. 1965, 6, 327-332.
17. *Scott D. W., Miller W. H., Griffin C. E.*: Muller&Kirk's Small Animal Dermatology. Saunders W. B. Company, Philadelphia 2001, s. 457-474.
18. *Van Cutsem J., Rochette F.*: Mycoses in domestic animals. Janssen Research Foundation, 1991, s. 96-97.
19. *Wrobel L., Whittington J. K., Pujol C., Oh S.-H., Ruiz M. O., Pfaller M. A., Diekema D. J., Soll D. R., Hoher L. L.*: Molecular phylogenetic analysis of a geographically and temporally matched set of Candida albicans isolates from humans and nonmigratory wildlife in central Illinois. Eukaryot. Cell 2008, 7, 1475-1486.
20. *Xiaobo S., Sun J., Hansen B. F., Olsen I.*: Oral distribution of genera, species and biotypes of yeasts in patients with marginal periodontitis. Microb. Ecol. Health. Dis. 2003, 15, 114-119.

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