Review Article

Exploring Fungal Invaders in the Urinary Tracts of Cats and Dogs

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Abstract

Lower urinary tract infections (UTIs) are common in cats and dogs, often caused by various infectious agents, including fungi. *Candida albicans* is the most frequently isolated fungal species in the urine of these animals, while other fungi like Torulopsis spp. and *Cryptococcus spp*. have also been identified. Fungal UTIs are rare, accounting for less than 1% of cases, partly due to insufficient fungal culture testing following bacterial infections. Factors such as antibiotic use, compromised immune systems, and underlying conditions like diabetes predispose animals to these infections. Diagnosis relies on clinical symptoms, laboratory tests, and culture of pathogens, while treatment typically involves addressing predisposing factors and using antifungal medications like fluconazole, which is effective and safely excreted in urine.

Keywords: cat, dog, fungal, fluconazole

Lower urinary tract infections (UTI) are one of the most common diseases in cats and dogs and occur due to various reasons. Infectious causes due to bacterial, viral, parasitic and fungal agents are just one of them (Koenhemsi ve Or, 2018). Normally the urine did not have fungal agents, when funguria exist it means an infection (Bartges, 2004).

Candida albicans is the most commonly isolated fungal species in the urine of cats and dogs (Jin and Lin, 2005, Reagan et al., 2019; Olin and Bartges, 2015). *Torulopsis spp., Cryptococcus spp., Blastomyces spp., Trichosporon spp., Aspergillus spp., Histoplasma spp.*, and *Rhodotorula spp.* were the other fungal agents that isolated from the urine of cats and dogs. Variations in the isolates may be attributed to differences in geographic region, climate, sample size, and the testing methodologies employed in these studies (Jin and Lin, 2005).

Fungal UTI's detected rarely in dogs and cats (Olin and Bartges , 2015). In a retrospective analysis of urinary tract infections in dogs, Candida species were detected in 0.38% of 8,354 positive urine cultures (Ling et al, 2001). Fungal agents account for fewer than 1% of urinary tract infections in most of the studies, partly because fungal cultures are often not conducted once bacterial infections are identified. This has led to the view that fungal causes are rare, causing them to be sought less frequently in cases of urinary tract infections (Jin and Lin, 2005). Another reason of this low prevalance is while there are many studies on bacterial cystitis in cats and dogs, there are not enough articles on fungi (Lulich and Osborne, 1996).

Fungal agents are opportunistic; they become pathogenic and proliferate when the immune system is compromised. Factors that predispose

animals to fungal urinary tract infections include antibiotic and glucocorticoid use, blood disorders, diabetes mellitus, acidic urine pH, indwelling urinary catheters, and malignant tumors (Jin and Lin, 2005, Lulich and Osborne, 1996; Reagan et al., 2019). For example broad spectrum antibiotics and the ones that inhibits gram negative bacteria can harm the colonization of the *Candida spp.* (Jin and Lin, 2005). A 2005 study found that in cats with fungal urinary tract diseases, urinary tract infections were more frequently associated with diabetes mellitus, tumors, and kidney diseases (Jin and Lin, 2005). As animals age, the prevalence of these diseases increases due to their prolonged exposure to predisposing factors (Koenhemsi and Or, 2018). In a 2005 study, researchers linked the increased incidence of fungal infections in colder seasons to reduced water intake, considering this as one of the predisposing factors (Jin and Lin, 2005).

German shephard dogs were predisposed to fungal diseases due to their immune defects. However in a study of Reagan et al. They found no significant association with this breed in candiduria (Reagan et al., 2019).

Candida species are normally harmless commensals residing on mucosal surfaces; however, they can become pathogenic when they breach tissue barriers, typically following disruptions in mucosal integrity or when local or systemic immune defenses are compromised (Reagan et al., 2019). Co-infection by ther colonizing organisms may change the adherence of the fungus in the mucosa. For example, while streptococci can reduce Candida's adherence to mucosal surfaces, E. coli may enhance it (Jin and Lin, 2005).

Diagnosing a fungal urinary tract infection relies on evaluating clinical symptoms, conducting laboratory tests, and isolating the pathogen. These infections often occur alongside diseases that weaken the immune system, making it difficult to identify clinical symptoms and rutine blood tests. Urinalysis of fungal species were found similiar to those in bacterial cystitis in a study of Jin and Lin (2005). Classical UTI signs like hematuria, dysuria and pyrexia are mostly detected in these patients (Jin and Lin, 2005; Koenhemsi and Or, 2018). Budding yeasts or elongated hyphae are commonly observed. Yeasts can be challenging to differentiate from red blood cells in urine (Lulich and Osborne, 1996). In addition to this fungal agents can be challenging to identify in dilute urine, complicating the diagnosis of UTI's (Bartges, 2004).

Diagnosis can be achieved by identifying yeast and mycelium in the urine sediment. A conclusive diagnosis is obtained by culturing the pathogens on Sabouraud's dextrose agar or cycloheximide-free blood agar (Koenhemsi ve Or, 2018; Lulich and Osborne, 1996; Olin and Bartges , 2015). It is essential to collect, preserve, and transport the urine sample properly to prevent contamination, or proliferation bacteria (Bartges, 2004).

There is limited evidence releted to the treatment of fungal UTI in the current literature (Jin and Lin, 2005). One of the first steps in treatment is to eliminate the predisposing factors. For example, if corticosteroids are being used, they should be discontinued, and if the animal has a catheter, it should be removed (Lulich and Osborne, 1996).

Alkalinizing the urine could be beneficial, as Candida species thrive most effectively at a urine pH between 5.1 and 6.4 (Greene and Chandler, 1990; Lulich and Osborne, 1996). Urine alkalinization can be achieved through the oral administration of sodium bicarbonate (12 mg/kg every 8 hours) or potassium citrate (50 mg/kg every 12 hours), with the dosage adjusted to elevate urine pH to 7.5 or higher (Lulich and Osborne, 1996).

In humans with fungal UTIs, intravenous and intravesical amphotericin B, oral azoles, and oral flucytosine are commonly used. Research on the effects of these medications on this disease in animals is still ongoing (Jin and Lin, 2005). Amphotericin B has nephrotoxic espicially in cat so that it must used caution. For urinary bladder irrigation in humans, a concentration of 200 mg of amphotericin B per liter of sterile water is recommended. This solution is administered at a dosage of 5 to 10 mL/kg into the lumen of the urinary bladder daily for a duration of 5 to 15 days (Lulich and Osborne, 1996).

Ketoconazole and itraconazole fail to reach therapeutic levels in the urine. So that can't used

in the UTI's. Instead, fluconazole is recommended to use initially in fungal UTI's, as it is excreted in the urine and high margins of safety (Jin and Lin, 2005; Olin and Bartges , 2015). Fluconazole can be used 5–10 mg/kg PO q 12h for 4–6 wk (Olin and Bartges , 2015).

Primary fungal urinary tract infections can be managed with a minimum of 6 to 8 weeks of antifungal treatment, along with regular monitoring during and after the therapy (Olin and Bartges , 2015).

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