



Invited lecture /Review

Urinary Tract Infections in Dogs and Cats

Šimundić Metka^{1,*}

¹. Veterinarske storitve, Ljubljana, Slovenia

* Correspondence: Metka Šimundić; metka.simundic3@gmail.com

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Abstract:

Urinary tract infection (UTI) is a very common health problem in dogs and cats, treated with antimicrobial drugs. As the antimicrobial resistance problem increases, clinicians should be more aware of how to treat patients with antibiotics. This article aims to highlight the importance of antimicrobial susceptibility testing before antimicrobial treatment and remind clinicians to follow updated guidelines of the International Society for Companion Animal Infection Diseases (ISCAID) recommendations (2019) and to monitor their local antimicrobial resistance situation. The short review includes sporadic bacterial cystitis, recurrent bacterial cystitis, pyelonephritis, and subclinical bacteriuria (Weese et al., 2019).

Keywords: Cystitis; Subclinical bacteriuria, Pyelonephritis; Antimicrobials; Canine; Feline



1. Introduction

Urinary tract infections (UTIs) are a prevalent health concern in dogs and cats. Various microorganisms, mostly pathogenic bacteria and rare infecting fungi, viruses or parasites, can instigate these infections.

UTIs are a common health issue in dogs and cats and one of the main reasons for antibiotic prescription. It is estimated, that 14% of dogs and 3-19% of cats will develop UTI at least once in their lifetime (Ling, 1984; White et al., 2013; Dorsch et al., 2016).

Bacterial cystitis occurs more commonly in female dogs and cats (Byron, 2019). UTI is more common in senior female cats, older than 10 years of age, mostly with comorbidities (Dorsch et al., 2014).

The development of UTI depends on the host immune system and defenses on one side and bacterial virulence on the other. Genital, rectal and perineal bacteria are the main reservoirs for UTI (Osborne et al., 1991; Johnson et al., 2003). The most common cause of UTI is uropathogenic *Escherichia coli* (UPEC) (Moyaert et al., 2017).

Veterinarians often prescribe antibiotics without urinary microbial culture and antibiotic susceptibility testing. Antibiotics commonly used in UTI are fluoroquinolones and 3rd generation cephalosporines (De Bruyne et al., 2014). These two antibiotics are on the list of highest priority critically important (Lhermie et al., 2020)

Antimicrobial resistance is a growing concern in veterinary and human medicine. We must also be aware of our responsibility for public health, as AMRD genes can transfer between animals and human pathogens (Ewers et al., 2012).

For this reason and for better therapeutic results, new recommendations regarding antimicrobial drugs, doses, duration and frequency of treatment should be followed and the health status of each patient should be carefully monitored.

2. Sporadic bacterial cystitis

Management of sporadic bacterial cystitis is based on ISCAID guidelines (2019) where bacterial cystitis results in inflammation and clinical signs such as stranguria, hematuria and pollakiuria occur. Sporadic bacterial cystitis is diagnosed when fewer than 3 episodes of cystitis in the preceding year occurred with or without comorbidities. The diagnosis includes clinical signs, urine analysis, and urine bacterial cultures. Urinalysis is the major diagnostic test and includes macroscopic (dipstick, specific gravity) examination and microscopic examination (urinary sediment). Microbiological analysis is preferred, and urine for bacterial culture should be obtained by ultrasound-guided cystocentesis in cases where other pathologies of the urinary bladder can be evaluated (such as masses, uroliths, etc.) If cystocentesis is risky for the animal, another option for obtaining urine is catheterization or a voided sample. Proper urine storage and quick laboratory analysis are important for accurate results (Weese et al., 2019).

Young and middle-aged cats rarely have bacterial UTIs. Feline idiopathic cystitis (FIC) and urolithiasis are the main reasons for feline lower urinary tract disease (Dorsch et al., 2014).

Bacterial urine culture and antimicrobial susceptibility tests in cats are necessary to make a diagnosis of UTI and treat patients properly. Empirical antimicrobial treatment for dogs with no or limited history of antibiotic treatment without urine culture is acceptable (Weese et al., 2019).

ISCAID guidelines (2019) recommend amoxicillin (with clavulanic acid in case amoxicillin alone is not available) or trimethoprim-sulphonamides for antibiotic treatment of sporadic bacterial cystitis. The duration of therapy is 3-5 days. When urine culture and sensitivity have been performed, with resistance to empirical antibiotic detected but clinical signs have resolved, there is no need to repeat the urinalysis after treatment. Even if the antibiotic was in line with the results of urine culture and sensitivity but clinical signs persist, clinicians should reevaluate the diagnosis and find the reason (Weese et al., 2019).

The guidelines emphasizes that clinicians should consider local known antimicrobial resistance and presume alternate antimicrobials for better outcomes in empirical treatment. Treatment can be started with non-steroid anti-inflammatory drugs (NSAIDs) because of



inflammation (side effects of NSAIDs should be considered) and continued with antibiotics in case where clinical signs do not improve (Weese et al., 2019).

3. Recurrent bacterial cystitis

ISCAID guidelines (2019) defines recurrent bacterial cystitis as: three or more episodes of clinical bacterial cystitis in the preceding 12 months or two or more episodes in the preceding 6 months.

Recurrent UTIs include various scenarios: relapse of infection (with the same microorganism after successful treatment of the UTI, often seen in diseases like urolithiasis or pyelonephritis); reinfection (infection with a different microorganism after the initial microorganism responded to therapy, common in disease like diabetes mellitus); persistent infection (positive urine cultures with the same organism during treatment with appropriate antimicrobial agents); and superinfection (infection with new organisms that develop during antimicrobial treatment for the initial infecting organism, observed in diseases such as neoplasia or urinary catheterization) (Barsanti, 2009; Weese et al., 2019).

Concomitant factors and underlying causes are mostly the main reasons for recurrent UTI. Advanced diagnostics should be performed to identify the underlying disease responsible for the recurrent UTI (endocrinopathy, kidney disease, obesity, abnormal vulvar conformation, congenital abnormalities of the urogenital tract (e.g. ectopic ureter), prostatic disease, bladder tumor, polypoid cystitis, urolithiasis, immunosuppressive therapy, rectal fistula, urinary incontinence/retention). Diagnostic imaging with ultrasound, radiography, contrast imaging and cystoscopy is warranted. In some cases, biopsy of urinary bladder mucosa for pathophysiologic and microbiological examination is necessary (Olin & Bartges, 2015; Weese et al., 2019).

Proper diagnosis, treatment, and controlling diseases like Cushing's disease, diabetes mellitus, correction of ectopic ureter, vulvar skin fold, and others can end the cycle of recurrence of UTI.

The clinician must ensure adequate antibiotic concentration in the bladder, check dosage, regiment client compliance, etc.

Treatment should be based on the results of urinary culture and sensitivity. While awaiting urine bacterial culture results, NSAIDs can be administered, and if an empirical antibiotic is necessary, first-line amoxicillin or trimethoprim-sulphonamide should be initiated. In case of microbial invasion of urinary bladder wall, antimicrobials that are effective against *Escherichia coli* in tissue are prescribed. After obtaining urine culture and sensitivity results, clinical response to therapy should be considered. In case of clinical failure, bacterial culture-based antimicrobial changes should be indicated (Weese et al. 2019).

Treatment duration in case of reinfection is short, typically 3-5 days, and monitoring is based on clinical response. In cases of persistent and relapsing infections, longer treatment durations of 7-14 days are indicated, with repeating urine culture after 5-7 days of treatment being prudent. A positive urine culture mandates checking compliance with therapy and further evaluation of the patient. Negative results of urine culture do not guarantee microbiological cure and these are also authors' experiences. After 5-7 days post-treatment, urine culture should be repeated if clinical signs resolve. In cases of positive urine culture (relapse, reinfection, persistent) with the absence of clinical sign, subclinical bacteriuria is diagnosed, and referral to a specialist should be considered (Weese et al., 2019).

4. Upper urinary tract infections (pyelonephritis)

Pyelonephritis is an inflammation of the renal parenchyma and pelvis, mostly caused by an ascending urinary infection rather than hematogenous spread (Parry, 2005). *Leptospira* should be considered in case of pyelonephritis (Sykes et al., 2011). Pyelonephritis can have acute or chronic course. Acute pyelonephritis is associated with fever, uremic signs (anorexia, lethargy, vomiting), painful kidneys, polyuria/polydipsia, anuria, lumbal pain, etc. Chronic pyelonephritis can present with mild (or even absent) clinical signs and slowly progressive azotemia, which can lead to kidney failure. Diagnosis of pyelonephritis is based on clinical signs, urinalysis, positive urine culture, compatible ultrasonographic



changes of the kidney, leukocytosis (neutrophilia) and azotemia. It is important to remember that not all patient with pyelonephritis have leukocytosis or azotemia (Olin & Bartges, 2015; Bouillon, 2018). In cases of negative urine culture, immunosuppressed animals, or those with fever, a blood culture is needed (Kim et al., 2017, Westropp & Sykes, 2017).

In a study of pyelonephritis in dogs, Bouillon et al. (2018) found, that 74.5 % of dogs with pyelonephritis presented with comorbidities.

Treatment should be started with antimicrobial agents effective against Enterobacteriaceae, taking into account regional antimicrobial susceptibility. Veterinary fluoroquinolone or cefpodoxime are the first choice. Cefotaxime and ceftazidime are important for intravenous application. If results of antibiogram show resistance to the initial antimicrobial and clinical response is not sufficient, substitution with a susceptible antimicrobial is necessary (not necessary if the clinical response is good). If therapy is initiated with two antimicrobials and both are susceptible, one of them might be discontinued if there is a good clinical response. If results of urinary culture and susceptibility identify multidrug - resistant microbes, consultation with a specialist is recommended (Weese et al., 2019).

The duration of the treatment is 10-14 days. One to two weeks after discontinuation of antimicrobials, a recheck is recommended (physical exam, urinalysis, bacterial culture, blood analysis). In cases of full clinical recovery and positive results of clinical culture, subclinical bacteriuria should be suspected (Weese et al., 2019).

5. Subclinical bacteriuria

Subclinical bacteriuria is defined as the presence of bacteria in urine as determined by positive bacterial culture from a properly collected urine specimen, in the absence of clinical evidence of infectious urinary tract disease. It is not uncommon in healthy animals, patients with comorbidities, and those treated with immunosuppressive drugs. In a Norwegian study of the prevalence of subclinical bacteriuria, in a cohort of 108 healthy cats with a mean age of 4 years, 0.9% were positive (Eggertsdottir et al., 2011). With age, prevalence increased. Another study reported 67 cats older than 7 years of age with a prevalence of subclinical bacteriuria in 10-13% (White et al., 2016).

Lamoureux et al. (2022) found that 32% of 62 dogs with chronic kidney disease (CKD), including 8 dogs in International Renal Interest Society (IRIS) stage 1, had positive urine culture, and only 8% showed clinical signs of urinary tract disease. Another study in cats with CKD reported a prevalence of 22-29% (Mayer-Roenne et al., 2007).

Current guidelines recommend that antimicrobials should not be used for treatment in subclinical bacteriuria. There are recommendations for treatment of specific conditions, such as animals with suspected pyelonephritis, those undergoing surgical or endoscopic procedures of the urinary tract likely to cause bleeding, etc. Clinicians should evaluate each case individually and decide whether to treat or not (Weese et al., 2019).

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