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RECOMMENDATIONS FOR MANAGEMENT OF URINARY TRACT INFECTION IN DOGS
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Concepts - Urinary tract infection (UTI) refers to infection or colonization with bacteria of a single or various sites of the urinary tract. UTIs are installed when there is an imbalance between uropathic infections agents and host resistance. Lower urinary tract infection - urethrocystitis; Upper urinary tract infection - renal parenchyma and pelvis.

Simple or uncomplicated urinary tract infection - It is related to the presence of UTI, more likely to be caused by a transient, self-limiting, and potentially reversible abnormality in host defenses.

Complicated urinary tract infection - Often there are identifiable diseases that interfere with normal defense mechanism and the bacterial invasion occurs secondarily. The major causes involved are the interference with normal micturition, anatomic defects, alterations of urothelium, altered volume, frequency or composition of urine, and impaired immunocompetence. Once those causes are corrected or removed, the bacterial infection is eradicated; however failure to identify and correct them could cause the development of recurrent (relapse, reinfection, or superinfection) UTI.

Recurrent UTI - relapse - Relapse is defined as the presence of the same species and serologic strain of microorganism within days to several weeks (7 to 14 days) after cessation of the antimicrobial. However, if bacteria can be isolated from urine during therapy, it is called as persistent infection (persistent infection is a variant of relapsing infection); thus, it is not possible to differentiate between a persistent infection and relapse if no urine culture has been performed during or within a week of concluding therapy. Check for causes that could cause failure of antimicrobial therapy. It is also important to investigate the site of the tissue infection and any underline disease that could be involved for allowing the sequestration of bacteria or the reinoculation of the organism to urinary tract (e.g. from prostate).

Recurrent UTI - reinfection - Reinfection is defined when the infection recurs after weeks to months after cessation of therapy and the urine was sterile in that time; it is caused by different microorganism from the initial diagnosis. That kind of recurrence suggests that normal defense mechanism of the host may be involved (anatomical defects, urolithiasis, urine retention, neoplasia, immunocompetence).

Recurrent UTI - superinfection - Superinfection is related to unusual situations like severe anatomic abnormalities, indwelling catheter, after surgical procedures, and then a new infection develops during the therapy besides the initial infecting microbe.

To identify UTI
Urinalysis – data observed in urinalysis are lack of information to confirm UTI
Urine culture – methods of collection and interpretation according to the number colonies of bacteria. Bacteria in urine are not synonymous of UTI because the bacteria may represent contaminants or pathogens. Urine culture is the gold standard test to confirm UTI, and the isolation of bacteria from a properly collected urine (cystocentesis) is important for the diagnosis.

Interpretation of antibiogram – antimicrobial susceptibility results are only considered as rough guidelines for treatment of UTI. The importance of antimicrobial choice is to consider the renal excretion of its active form (also considering the presence of normal renal function). In addition, even though antimicrobial susceptibility showed resistant, the higher renal excretion of that drug may assure good results of the treatment, and also associated with the ability of the animal to concentrate the urine. Other method of choosing the drug for UTI treatment is to determine the minimum inhibitory concentration (MIC). To consider the effectiveness of the antimicrobial, it has to achieve urine concentration at least four times the MIC.
Treatment

**Simple infection** – estimate the microbes considering the most common organisms related to UTI (E. coli, Staphylococcus spp, Enterococcus spp, Proteus spp, Klebsiella spp, Streptococcus spp, Pseudomonas spp, Enterobacter spp as well as no previous antimicrobial therapy in the past 4 or 6 weeks. The choice of drug is based on the ability to achieve high concentration in urine and properties of the antimicrobial to eliminate the most common bacteria that infect the urinary tract. Selected antimicrobials → amoxicillin, amoxicillin clavulanate, cephalosporins, trimethoprim-sulfadiazine and enrofloxacin. Drugs should be given in 2 to 3 equal subdoses per day, and one of the dose administered prior to a period of confinement. The antimicrobial therapy should last for **10 days to 2 weeks**.

Complicated infection (relapse / persistent, reinfection and superinfection) – based on urine culture and choose antimicrobial according to high renal and urinary excretion, no nephrotoxicity, and side effects. Choice of an even resistant antimicrobial is also possible, and it is based on pharmacokinetics and pharmacodynamic (it is recommended to use of high dose, increase the frequency of administration, for instance), and the most important is to recognize the predisposing factors as well to treat or solve them. When complicated UTI is associated with kidneys or prostate infections – consider antimicrobial that could achieve high serum and urine concentrations, and based on urine culture results treatment for at least 8 weeks. For pyelonephritis → trimethoprim-sulfonamide and quinolones. For prostate infection → trimethoprim-sulfonamide and quinolones, erythromycin and clindamycin.

**Treatment for persistent / relapse UTI** – antimicrobial should be administered for at least 6 weeks based on susceptibility test (MIC). Urine culture should be performed while the animal is receiving the antimicrobial (as an *in vivo* method of susceptibility testing) as well as also after therapy. If urine culture was negative during therapy, but after discontinuation of the antimicrobial the initial microbe was isolated after days (brief period), then antimicrobial should be administered for 4 to 6 months and it is important to investigate possible underline causes. If the relapse was detected 10 or more days after ceased the therapy, repeat the treatment with a different antimicrobial agent and for a longer period. *Suppressive therapy* could be recommended for patients that relapsing occurs each time that antimicrobial therapy is stopped → recommendation of a single dose (1/2 to 1/3 of daily dosage) per day to be administered when the animal is to be confined.

**Treatment for recurrent UTI - reinfection** – each episode of reinfection is treated individually; antimicrobial administration for at least **6 to 8 weeks**, and urine culture must be negative during and after treatment. If positive urine culture was detected – isolation of different bacterium - after 1, 2, 3, 6 and 12 months, it identifies another reinfection. Ideal duration of the therapy has not been determined as single procedure; the period must be individualized according to clinical and laboratory findings. *Prophylactic therapy* → infections must be treated until urine culture is negative before beginning prophylactic therapy; the drug must be given once a day, 6 to 12 hrs before the period that animal will be confined; duration of therapy is for 6 months (monitor urine culture monthly); if no bacteriuria were found for 6-month period, the prophylactic therapy can be ceased. Alert - prophylactic therapy may induce antimicrobial resistance and drug toxicity. It is very important that underline causes that could interfere with the mechanisms of host defense must be identified and treated or solved in order to avoid reinfection.

**References:**


