Cystocentesis is essential for reliable diagnosis of urinary tract infections in cats

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Summary

Urine samples were taken from 79 cats with clinical signs of acute feline lower urinary tract disease (FLUTD) by means of cystocentesis, catherization, or at voiding and were cultured. No bacteria were cultured from 79% of the samples taken by cystocentesis, 55% of the samples obtained by catherization, and 17% of the samples obtained at voiding. Samples obtained by cystocentesis most often yielded pure cultures, whereas the voided samples were often contaminated, yielding mixed cultures. Therefore, it is difficult to interpret culture results for voided or catheterized urine samples, which may lead to overdiagnosis of urinary tract infections. *E. coli* was the most prevalent bacterial species. Numbers of bacteria were low (10^2 to 10^3/ml) in three out of eight culture- positive samples taken by cystocentesis, indicating that the number of bacteria present in the bladder of cats with urinary tract infections may be low. This may lead to underdiagnosis of urinary tract infections when interpreting culture results for voided and catheterized samples, because bacterial counts lower than 10^3 colony-forming units/ml of urine are generally considered not clinically relevant.

In conclusion, cystocentesis is the preferred method of sampling for the evaluation of cats with suspected urinary tract infection.

Samenvatting

Urinemonsters van 79 katten met klachten van acute FLUTD (feline lower urinary tract disease) werden afgenomen door blaaspunctie, catheterisatie of werden verkregen via spontane mictie. Uit 79% van de urines verkregen door cystocentesis, 55% van de catheter-urines en 17% van de spontane urines werden geen bacteriën gekweekt. Bij de kweek van monsters verkregen via cystocentesis vonden wij meestal een reïncultuur, terwijl uit de spontane en catheter-urines vaak een mengcultuur werd gekweekt. Hierdoor zijn de resultaten van het bacteriologische onderzoek van catheter- of spontane urines vaak moeilijk te interpreteren en dit kan leiden tot de onterechte diagnose bacteriële cystitis en onnodig antibioticumgebruik. Bij katten met bacteriële cystitis werd vaak *E. coli* gevonden. Bij monsters verkregen via cystocentesis werden in drie van de acht positieve kweken slechts geringe aantallen bacteriën (10^2 tot 10^3/ml) gevonden. Dit wijst erop dat de aantallen bacteriën in de blaas bij een urineweginfectie soms laag zijn. Dit kan weer leiden tot het missen van de diagnose bacteriële cystitis bij catheter- of spontane urine, omdat aantallen bacteriën onder de 10^3 kolonievormende eenheden/ml urine meestal als niet klinisch relevant worden beschouwd.

De conclusie van ons onderzoek is dan ook dat cystocentesis de beste methode is voor het afnemen van urine voor bacteriologisch onderzoek bij katten verdacht van urineweginfecties.

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Introduction

Clinical signs of lower urinary tract disease are common in cats. However, only a small proportion of cats with signs of feline lower urinary tract disease (FLUTD) actually have significant bacteriuria, indicative of lower urinary tract infection (UTI). Therefore, a definitive diagnosis of UTI depends on complete urinalysis combined with quantitative and qualitative urine culture (1). Urine samples for culture can be taken by ante pubic cystocentesis, by catheterization of the bladder, or at voiding (voluntary or manually induced). The urine contained in the bladder is normally sterile. Contamination of urine with bacteria from the distal urethral microflora can lead to false-positive culture results and consequently overdiagnosis of UTI and unnecessary use of antimicrobial agents. The objective of our study was to assess the effect of three collection methods on the results of bacterial culture and its interpretation in cats with suspected acute UTI.

Material and methods

Study design

Urine samples were taken during a clinical field trial that compared the efficacy of two antimicrobial drugs in the treatment of cats with clinical signs of acute lower UTI. To confirm UTI, urine samples were taken before treatment by either one of the following three methods: cystocentesis, catheterization, or voiding (voluntary or induced). Cystocentesis was performed as described by Kruger *et al*. (6). The practitioner (n=9) selected the method of sampling used.

Animals

Cats older than 16 weeks with clinical signs of FLUTD for up to 7 days were eligible for inclusion. Clinical signs of acute UTI included increased frequency of urination, decreased urine volume per voided sample, haematuria, stranguria, or urgency. Cats that had received treatment (AO-inhibitors, 5HT-reuptake inhibitors, antimicrobial drugs, or anti-inflammatory drugs) within 14 days prior to admission or injectable corticosteroids within 6 weeks prior to admission were excluded.

Urinanalysis

Urinanalysis was performed using Multistix® 10 SG reagent strips (Bayer, Mijdrecht) according to the manufacturer's instructions.

Table 1. Culture results of urine from cats with signs of acute urinary tract infection.

Culture result	Total (n=79)	Cystocentesis (n=39)	Catheterization (n=11)	Voiding (n=29)
no growth	42 (53%)	31 (79%)	6 (55%)	5 (17%)
E. coli pure culture	15	5	3	7
Staphylococcus intermedius	1	0	1	0
other staphlylococci	2	1	0	1
Bacillus spp.	2	0	0	2
Streptococcus spp.	1	0	0	1
Enterobacter spp.	1	0	0	1
mixed cultures	15	2	1	12

Bacteriological examination

A dip-slide (Uricult®, Mediphos Medical Supplies BV, Renkum, the Netherlands) was inoculated with urine immediately after sampling and sent to the Veterinary Microbiological Diagnostic Centre of Utrecht University by post. This method meant that the bacterial count reflected the bacteriuria directly after sampling. The dip-slides were incubated at 37°C for 18 hours. Bacterial growth was determinated semi-quantitatively according to the manufacturer's instructions. For further identification, colonies were streaked onto blood agar and MacConkey's agar, incubated aerobically at 37°C for 18 hours, and identified using routine methods.

Results

Seventy-nine cats, 34 females and 45 males, aged 6 months to 17 years (mean 5.19 ± 4.04) were included in the study. The majority (n=74) were European/Domestic shorthair cats and five were Persians. The mean interval between the onset of clinical signs and admission was 3 days (range 1 to 7 days). About two-thirds (n=56) of the cats had no history of UTI, whereas 23 cats had had FLUTD before.

Urinanalysis showed that leucocytes were present in 73 of the 79 samples. The samples which tested negative for leucocytes were sterile or yielded only low numbers of bacteria.

No bacteria were isolated from 31 of 39 (79%) urine samples taken by cystocentesis, 6 of 11 (55%) obtained by catheterization and 5 of 29 (17%) obtained at voiding (Table 1). Mixed cultures were isolated frequently from the voided samples, whereas pure cultures were most often found for samples obtained by cystocentesis (Table 1). *E. coli* was the most frequent bacterial isolate.

The number of viable bacteria was low (10^2-10^3/ml) in three of the eight culture-positive samples taken by cystocentesis (Table 2). Leucocytes were present in significant numbers in all of these samples.

Discussion

In samples taken via a catheter or at voiding, bacterial counts of a single species $>10^3$ or $>10^4$ colony forming units (CFU)/ml of urine, respectively, are generally considered to be clinically relevant, whereas counts lower than this are thought to represent contamination. Applying these limits to the present data, we found that samples taken at voiding or via a catheter together resulted in false positive results in 27% of the cats. This is similar to the results of Lees *et al*. (7), who found that all samples collected by cystocentesis from clinically normal cats were culture negative whereas only 22% of samples taken at voiding were culture-negative. The magnitude of bacteriuria in 17% of their voided specimens was greater than 10^4 CFU/ml, which would have resulted in an unjustified diagnosis of UTI in cats with clinical signs of FLUTD. In the present study, even catherization resulted in more culture positives (at least 10^4 CFU/ml) than were seen with cystocentesis, suggesting that, provided the distribution of collection techniques is at random, this sampling method also leads to overdiagnosis of UTI. However, the number of urine samples taken by catheterization in our study was relatively small, making conclusions difficult. Two studies of clinically normal dogs (3, 4) showed that the majority of urine specimens (84 to 100%) obtained by cystocentesis were sterile. Bacterial growth occurred in 20 to 26% of the specimens obtained by catheterization and in 60 to 85% of specimens obtained during midstream voiding from the same dogs. Together, these data indicate that urine samples taken by catheterization or at voiding lead to contamination of the samples by bacteria normally present in the lower urinary tract and this may result in overdiagnosis of UTI.

As the bacteria counts are crucial to the interpretation of voided and catheterized specimens, the risk of false-positive culture results is even greater when samples are stored and transported not using a dip-slide. Perrin and Nicolet (10) found that culture results of canine urine samples transported on dip-slides correlated very well with those of fresh urine samples. However, culture of samples stored in sterile tubes for 24 to 48 h yielded up to 65% false positive results. These results are similar to those of Padilla *et al*. (9), who found that if immediate culture of urine samples is not possible, the specimens may be stored for at least 6 h at refrigeration temperature without compromising the validity of results. Another disadvantage of catheterization is the risk of inducing UTI (2, 8).

In the present study, the numbers of viable bacteria were low (10^2-10^3/ml) in three of the eight culture-positive samples taken by cystocentesis (Table 2). Theoretically, this could be due to contamination during cystocentesis. However, two of these were pure cultures of potential uropathogens, and leucocytes were found in significant numbers in all three samples. Contamination from the skin would probably have resulted in even smaller numbers of bacteria, whereas contamination from the bowel would almost certainly have

Table 2. Comparison of bacterial numbers in urine samples collected by cystocentesis, catheterization, and voiding from cats with signs of urinary tract infection.

Viable bacterial count (CFU/ml)	Total (n=37)	Cystocentesis (n=8)	Catheterization (n=5)	Voiding (n=24)
10^2	6	1	0	5
10^3	7	2	0	5
10^4	7	2	1	4
10^5	8	1	2	5
10^6	9	2	2	5

resulted in mixed cultures. This suggests that the number of bacteria present in the bladder of cats with UTI is sometimes low and the application of the above-mentioned limits may lead to underdiagnosis of UTI. Hamaide *et al*. (5) demonstrated that bladder urine may even be sterile in the presence of UTI: they found that 19% of cultures of mucosal biopsies or uroliths were culture positive while cystocentesis samples were culture negative in dogs with recurrent UTI and uroliths.

Our data underline the importance of cystocentesis for the collection of urine for qualitative and quantitative bacterial culture in cats with suspected UTI. Use of the culture results for voided or catheterized urine introduces a considerable risk of producing both false-positive and false-negative diagnoses of UTI; in 50% of cats with clinical signs of FLUTD the diagnosis UTI would be disputable.

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