Comparison of urine dipstick, sulfosalicylic acid, urine protein-to-creatinine ratio, and species-specific ELISA methods for detection of albumin in urine samples of cats and dogs

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Objective—To evaluate the use of dipstick, sulfosalicylic acid (SSA), and urine protein-to-creatinine ratio (UP:C) methods for use in detection of canine and feline albuminuria.

Design—Evaluation study.

Sample Population—599 canine and 347 feline urine samples.

Procedures—Urine was analyzed by use of dipstick, SSA, and UP:C methods; results were compared with those for a species-specific ELISA to determine sensitivity, specificity, positive predictive value (PPV), negative predictive value, and positive and negative likelihood ratios.

Results—Positive results for dipstick and SSA tests (trace reaction or greater) in canine urine had moderate specificity (dipstick, 81.2%; SSA, 73.3%) and poor PPV (dipstick, 34.0%; SSA, 41.8%). Values improved when stronger positive results (≥2+) for the dipstick and SSA tests were compared with ELISA results (specificity, 98.9% and 99.0% for the urine dipstick and SSA tests, respectively; PPV, 90.7% and 90.2% for the dipstick and SSA tests, respectively). Data obtained for cats revealed poor specificity (dipstick, 11.0%; SSA, 25.4%) and PPV (dipstick, 56.6%; SSA, 46.9%). Values improved slightly when stronger positive test results (≥2+) were used (specificity, 80.0% and 94.2% for the dipstick and SSA tests, respectively; PPV, 63.5% and 65.2% for the dipstick and SSA tests, respectively). The UP:C had high specificity for albuminuria in dogs and cats (99.7% and 99.2%, respectively) but low sensitivity (28.7% and 2.0%, respectively).

Conclusions and Clinical Relevance—Caution should be used when interpreting a positive test result of a dipstick or SSA test for canine or feline albuminuria. (J Am Vet Med Assoc 2010;236:874–879)

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**Abbreviations**

AUC = Area under the curve

CKD = Chronic kidney disease

LR– = Negative likelihood ratio

LR+ = Positive likelihood ratio

NPV = Negative predictive value

PPV = Positive predictive value

ROC = Receiver operating characteristic

SSA = Sulfosalicylic acid

UA:C = Urine albumin-to-creatinine ratio

UP:C = Urine protein-to-creatinine ratio

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Persistent proteinuria with an inactive urine sediment is an established marker of CKD. Evidence also suggests an association between renal proteinuria and progression of CKD in dogs and cats; the greater the magnitude of proteinuria, the greater the risk for progression of renal disease and possible death. Importantly, treatments that attenuated proteinuria in dogs and cats with CKD also have been associated with slowed progression of CKD, improved survival, or both. For these reasons, screening for renal proteinuria and longitudinal assessment of renal proteinuria have received renewed interest.

Proteinuria is a general term that describes any type of protein, such as albumin, globulins, Bence-Jones proteins, and others, in the urine. Proteinuria of renal origin results from 2 major mechanisms. The first is a loss of selective filtration that results in an increased amount of protein in the filtrate. The second is an impaired resorption of the filtered protein that results in overt proteinuria. Albumin is the predominate protein in urine of healthy dogs and cats as well as those with...
renal disease, and the urine dipstick and SSA screening tests as well as the UP:C are more sensitive for detecting albumin than they are for detecting other proteins.

A urine dipstick colorimetric test is the typical first-line screening test for the detection of proteinuria-albuminuria. False-positive reactions for protein are common with the urine dipstick method. Many laboratories use the SSA turbidimetric test to confirm positive reactions for protein on a urine dipstick test. Proteinuria detected by use of the urine dipstick or SSA screening tests (or both) that is believed to be of renal origin is often confirmed and quantitated by use of the UP:C. The purpose of the study reported here was to assess the diagnostic performance of the urine dipstick colorometric test, SSA turbidimetric test, and UP:C methods for detection of albumin in canine and feline urine samples in comparison with results for a species-specific ELISA for urine albumin.

Materials and Methods

Sample population—Healthy dogs (n = 117) and cats (71) owned by faculty, staff, and students at the Colleges of Veterinary Medicine at Colorado State University, Kansas State University, and North Carolina State University were examined longitudinally every 6 months from February 2002 through September 2005. All dogs and cats were regarded by their owners as free of clinical signs of illness. Health status was further determined on the basis of results of a complete physical examination, CBC, serum biochemical analysis, and urinalysis performed at each visit. Owners of all dogs and cats provided informed consent for inclusion of their animals in the study. The study protocol was approved by an institutional animal care and use committee at each university.

Urine assays—Urine samples (599 canine and 347 feline) collected via free catch, catheterization, or cystocentesis were included for analysis. Complete urinalyses were performed by technicians at the Clinical Pathology Laboratory at each teaching hospital (Colorado State University, 168 canine and 109 feline urine samples; Kansas State University, 234 canine and 124 feline urine samples; and North Carolina State University, 197 canine and 114 feline urine samples). Urine samples were excluded from further analysis when sediment examination revealed any of the following abnormalities: > 200 RBCs/hpf, > 5 WBCs/hpf, or bacteriuria.

Urinalysis (599 canine samples and 347 feline samples) was performed with a commercially available urine dipstick at Colorado State University and North Carolina State University and with another commercially available urine dipstick at Kansas State University. Scores for protein concentration on both dipsticks were negative, trace, 1+, 2+, 3+, or 4+. The SSA tests (517 canine samples and 295 feline samples) were performed by mixing equal volumes of urine supernatant and SSA (3% to 5%) in a glass tube and grading the resulting turbidity as negative, trace, 1+, 2+, 3+, or 4+, as compared with the turbidity for a set of standards. The UP:C (390 canine samples and 217 feline samples) was calculated by dividing the urine total protein concentration (determined via the benzethonium chloride reaction by use of an automated chemistry analyzer at each laboratory) by the urine creatinine concentration (determined via the buffered kinetic Jaffé reaction by use of the automated chemistry analyzer at each laboratory). Urine samples were frozen at −20°C until the quantitative ELISA was performed at a commercial laboratory. Briefly, urine albumin concentration was measured in a competitive ELISA by use of species-specific anti-canine albumin and anti-feline albumin monoclonal antibodies. The albumin concentration in each sample was determined by comparing absorbance for that sample with absorbance on a multiple-point standard calibration curve created with known concentrations of purified canine and feline albumin. To account for varying urine concentrations, results were normalized to a urine specific gravity of 1.010. Samples were considered positive for the ELISA when the albumin concentration in the sample was > 1 mg/dL. This competitive ELISA was the basis of the commercially available, semiquantitative point-of-care microalbuminuria immunoassays as well as the more recently commercially available quantitative immunoturbidimetric test used by reference laboratories.

Statistical analysis—All statistical analyses for assessment of test performance of urine dipstick and SSA tests were performed with a commercially available program. The canine and feline microalbuminuria immunoturbidimetric quantitative assays have superior sensitivity and specificity compared with those for urine dipsticks, the UA:C, and the UP:C, for detection of systemic disease in dogs and cats without overt proteinuria; therefore, the albumin concentrations as determined by use of the quantitative species-specific ELISA were used as the criterion-referenced standard for the study, and all data were categorized as positive or negative for analysis.

The effect of specific gravity and pH on the performance of each test was examined by stratification and assessment of results in categories of specific gravity and pH. The effect of study site on test performance was examined by comparing the results from each site. Urine dipstick and SSA test results were categorized as positive for all results with a trace reaction or greater, and then another analysis was performed in which test results were categorized as positive for all results ≥ 2+. In separate analyses, UP:C was categorized as positive for all results ≥ 0.2 for both canine and feline urine samples, ≥ 0.5 for canine samples, and ≥ 0.4 for feline samples. Results for the ELISA were considered positive when there was an albumin concentration ≥ 1 mg/dL in the urine. Data from the urine dipstick test, SSA test, and UP:C were analyzed separately for canine and feline samples. Urine dipstick and SSA test performance was also assessed in parallel (considered positive when either test result was positive) and in series (considered positive only when both test results were positive). An ROC curve was generated for the urine dipstick test, SSA test, and UP:C results, with the ELISA results used as the criterion-referenced standard, to assess overall performance of each test in canine and feline samples separately. For all analyses, values of P < 0.05 were considered significant.

Results

Test performance did not differ significantly among the study sites or relative to pH or specific gravity (data...
not shown). Results for the assessment of the urine dipstick and SSA test performance when classified as positive for all test results of trace or greater in canine urine samples were summarized (Table 1). Neither test performed well when used alone, in series, or in parallel. The PPVs were < 50% on all data sets, whereas the LR+ did not exceed 2.35, and the LR− was 0.39 to 0.42 for all values. The NPV for all tests was 87.1% to 88.5%.

Performance for the urine dipstick and SSA test on feline urine samples when results were classified as positive for all test results of trace or greater was summarized (Table 2). When used alone, the urine dipstick had a good sensitivity of 90.1%, however, the specificity was only 11.0%. The LR+ and LR− were both approximately 1 (1.01 and 0.90, respectively), and the PPV and NPV were approximately 50% (35.6% and 47.2%, respectively), which indicated that the test results provided little diagnostic information. All measures of test performance for the SSA test results alone and the urine dipstick and SSA test results interpreted in series were extremely poor. The SSA test for feline urine had poor sensitivity (58.0%), specificity (25.4%), PPV (46.9%), and NPV (34.7%), and there was an inverted LR+ and LR− (0.78 and 1.66, respectively). The inverted LR+ and LR− indicate that a test is less likely to have a positive result when true disease is positive and more likely to have a negative result when true disease is positive, respectively. Results for the urine dipstick and SSA test when considered in series failed to significantly improve the sensitivity, specificity, PPV, or NPV (58.0%, 26.8%, 47.4%, and 35.9%, respectively) when compared with values for the urine dipstick alone. This data set also contained an inverted LR+ and LR−, which made the results of questionable validity. There were only 3 negative test results when results for the urine dipstick and SSA tests were interpreted in parallel, and estimates of test performance were not valid.

Performance for the UP:C on canine and feline urine samples was summarized (Table 3). The UP:C values for both canine and feline urine samples were highly specific (99.7% and 99.2%, respectively) for detecting albuminuria (as defined as ≥ 0.5 and ≥ 0.4 for dogs and cats, respectively). This high specificity was retained for canine samples (98.6%) but not for feline samples (90.8%) when UP:C values of ≥ 0.2 were used for detecting albuminuria. Canine samples also had a high LR+ (35.4 for ≥ 0.2 and 85.0 for ≥ 0.5) and good PPVs (91.8% for ≥ 0.2 and 96.4% for ≥ 0.5). In comparison, feline samples had lower LR+ and PPV values (LR+, 3.33 and 2.43 for ≥ 0.2 and ≥ 0.4, respectively; PPV, 74.4% and 66.7% for ≥ 0.2 and ≥ 0.4, respectively). Sensitivity was poor for both canine and feline samples regardless of the cut point used (47.9% for canine samples when ≥ 0.2 was used, 28.7% for canine samples when ≥ 0.5 was used, 32.7% for feline samples when ≥ 0.2 was used, and 204% for feline samples when ≥ 0.4 was used), which indicated a large number of false-negative results.

Performance of the urine dipstick and SSA tests for canine urine samples when the cut points were changed from greater than trace to ≥ 2+ was summarized (Table 4). Increasing the cut point decreased the sensitivity and increased the specificity of each test, compared with results for the ELISA. The LR+ and PPV of the urine dipstick or SSA test with a result ≥ 2+ were good,

Table 1—Results for urine dipstick and SSA tests for detection of albuminuria on the basis of analysis of 599 canine urine samples.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Positive for urine dipstick*</th>
<th>Positive for SSA test†</th>
<th>Urine dipstick and SSA test‡</th>
<th>Urine dipstick or SSA test§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>81.2</td>
<td>73.3</td>
<td>71.9</td>
<td>85.9</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>47.8</td>
<td>63.8</td>
<td>69.4</td>
<td>34.3</td>
</tr>
<tr>
<td>PPV (%)</td>
<td>34.0</td>
<td>41.8</td>
<td>45.3</td>
<td>31.6</td>
</tr>
<tr>
<td>NPV (%)</td>
<td>88.5</td>
<td>87.1</td>
<td>87.5</td>
<td>97.3</td>
</tr>
<tr>
<td>LR+</td>
<td>1.56</td>
<td>2.03</td>
<td>2.35</td>
<td>1.31</td>
</tr>
<tr>
<td>LR−</td>
<td>0.38</td>
<td>0.42</td>
<td>0.41</td>
<td>0.41</td>
</tr>
</tbody>
</table>

A species-specific ELISA was the criterion-referenced standard and was used to provide results for comparison. *Results were considered positive when the test had a trace reaction or greater. †Results for urine dipstick and SSA tests were interpreted in series; thus, a sample had a positive test result only when both tests had positive results. ‡Results for urine dipstick and SSA tests were interpreted in parallel; thus, a sample had a positive test result when either test had positive results.

Table 2—Results for urine dipstick and SSA tests for detection of albuminuria on the basis of analysis of 547 feline urine samples.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Positive for urine dipstick*</th>
<th>Positive for SSA test†</th>
<th>Urine dipstick and SSA test‡</th>
<th>Urine dipstick or SSA test§</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensitivity (%)</td>
<td>90.1</td>
<td>58.0</td>
<td>58.0</td>
<td>98.7</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>11.0</td>
<td>25.4</td>
<td>26.8</td>
<td>0.70</td>
</tr>
<tr>
<td>PPV (%)</td>
<td>55.6</td>
<td>46.3</td>
<td>47.4</td>
<td>53.1</td>
</tr>
<tr>
<td>NPV (%)</td>
<td>47.2</td>
<td>34.7</td>
<td>35.9</td>
<td>33.3</td>
</tr>
<tr>
<td>LR+</td>
<td>3.01</td>
<td>1.78</td>
<td>0.79</td>
<td>0.99</td>
</tr>
<tr>
<td>LR−</td>
<td>0.90</td>
<td>1.66</td>
<td>1.57</td>
<td>1.76</td>
</tr>
</tbody>
</table>

| See Table 1 for key. |
which indicated a high likelihood that a sample with a result $\geq 2+$ was from a dog with positive results for the ELISA (PPV $> 90\%$ and LR$+$ $> 25$). A urine dipstick or SSA test result of $< 2+$ retained a modest likelihood that a sample was from a dog with a negative result for the ELISA (NPV $> 79\%$ and LR$-$ $< 0.73$).

Performance of the urine dipstick and SSA tests for feline urine samples by use of cut points of greater than trace or $\geq 2+$ was summarized (Table 5). Increasing the cut point decreased the sensitivity and increased the specificity for each test, compared with results for the ELISA. However, both the LR$+$ and LR$-$ remained poor, with confidence intervals for each that extended across 1.

The ROC curves for the urine dipstick, SSA, and UP:C tests results, compared with results for the criterion-referenced ELISA, were evaluated for canine urine samples and feline urine samples (Figure 1). The AUC for the ROC analysis for canine and feline urine samples and each test was summarized (Table 6). For canine and feline urine samples, the AUC was smaller for the urine dipstick, SSA test, and UP:C than for the ELISA test. For canine urine samples, the AUC was significantly larger for the UP:C than for the urine dipstick test or SSA test. For feline urine samples, the AUC was significantly smaller for the SSA test than for the urine dipstick test or the UP:C.

### Discussion

On the basis of the data obtained here, results for the traditional urine dipstick and SSA tests for detection of albuminuria should be interpreted with caution in urine samples collected from dogs and, even more so, from cats. In canine samples analyzed with the urine dipstick and SSA test and interpreted at the traditional cut point (trace reaction or greater considered a positive result), the false-positive rate was 52.2% and 36.1%, respectively. The false-positive rate decreased when trace were excluded in both analyses (9.3% and 11.5% for the urine dipstick and SSA test, respectively). The specificity was increased to 98.9% for the urine dipstick and to 99.0% for the SSA test when both trace and 1+ reactions were excluded. However, increasing the cut point to $\geq 2+$ for these tests resulted in a lower sensitivity of 32.9% for the urine dipstick and 27.4% for the SSA test, respectively.

The ROC curves for the urine dipstick, SSA, and UP:C methods for detection of albuminuria on the basis of analysis of 322 canine and 183 feline urine samples.

<table>
<thead>
<tr>
<th>Variable</th>
<th>Urine dipstick</th>
<th>SSA test</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>$&gt; \text{Trace}$</td>
<td>$\geq 2+$</td>
</tr>
<tr>
<td>Sensitivity (%)</td>
<td>67.2</td>
<td>28.1</td>
</tr>
<tr>
<td>Specificity (%)</td>
<td>49.7</td>
<td>80.0</td>
</tr>
<tr>
<td>PPV (%)</td>
<td>62.3</td>
<td>63.5</td>
</tr>
<tr>
<td>NPV (%)</td>
<td>55.0</td>
<td>47.3</td>
</tr>
<tr>
<td>LR$+$</td>
<td>1.34</td>
<td>1.41</td>
</tr>
<tr>
<td>LR$-$</td>
<td>0.66</td>
<td>0.90</td>
</tr>
</tbody>
</table>

### Table 6—The AUC for the ROC curves for urine dipstick, SSA, and UP:C methods for detection of albuminuria on the basis of analysis of 322 canine and 183 feline urine samples.

<table>
<thead>
<tr>
<th>Test</th>
<th>Canine</th>
<th>Feline</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urine dipstick</td>
<td>0.7792$^{a}$</td>
<td>0.6045$^{b}$</td>
</tr>
<tr>
<td>SSA</td>
<td>0.7638$^{a}$</td>
<td>0.5348$^{b}$</td>
</tr>
<tr>
<td>UP:C</td>
<td>0.6525$^{a}$</td>
<td>0.6940$^{a}$</td>
</tr>
</tbody>
</table>

$^{a,b}$Within a column, values with different superscript letters differ significantly ($P < 0.05$). See Table 1 for remainder of key.
other disease. The prevalence of albuminuria could not be determined in the study reported here because each patient contributed several urine samples to the overall data pool.

In 1 study, an overall good correlation was reported between results for the urine dipstick, SSA test, and UP:C and those of a point-of-care microalbuminuria immunoassay.

However, in samples that had mildly positive results for the urine dipstick (trace or 1+), there was a high false-positive rate (69%). Similar to results for the present study, this indicates that the use of a urine dipstick to detect albuminuria in dogs has poor diagnostic value at lower protein or albumin concentrations and that the high number of false-positive results in that study may have improved the association that was found with results for the immunoassay.

Detection of albuminuria in cats by use of the urine dipstick and SSA tests is more difficult to interpret. When evaluated separately, the urine dipstick and SSA tests had extremely low specificity (11.0% and 25.4%, respectively), which indicated large numbers of false-positive results. Furthermore, the LR+ and LR– values for use of the urine dipstick to test feline samples were both approximately 1.0, with PPVs and NPVs of approximately 50%. The LR+ and LR– values of approximately 1 indicate that the test result does not provide any diagnostic information; a positive test result is as likely to have been for a sample from a patient without the condition as from a patient with the condition. When the urine dipstick and SSA test data were analyzed in series, there was no increase in specificity (Table 2). When analyzed in parallel, only 3 feline urine samples were found to have negative results for both the urine dipstick and SSA test. Such few numbers of samples that had negative results for both the urine dipstick and SSA test invalidated the data analysis. Increasing the cut point for the urine dipstick and SSA tests for feline samples had a similar but less dramatic effect on test performance than did the same adjustment for canine samples. Increasing the cut point to greater than trace resulted in an increase in specificity from 11.0% to 49.7% for the urine dipstick and from 25.4% to 68.8% for the SSA test. The specificity improved more (80.0% for the urine dipstick and 94.2% for the SSA test) when the cut point was increased to ≥2+. However, although the canine data retained a moderate NPV of 81.7% and 79.4% for the urine dipstick and SSA test, respectively; analysis of the feline data with the higher cut point resulted in poor NPVs of 47.3% and 47.8% for the urine dipstick and SSA test, respectively. This resulted in an unacceptable number of false-negative results and decreased the utility of these screening tests.

In 1 study, 62% of the feline urine samples with a UP:C ≤ 0.5 (used as the negative cut point for that study) had positive results when tested by use of the urine dipstick. This finding is similar to that in the present study in which there was a false-positive rate of 89.0%. However, investigators in that other study used the UP:C as the criterion-referenced standard, whereas in the study reported, we used a species-specific ELISA as the criterion-referenced standard.

The UP:C cut points of ≥ 0.2 as the lower limit for canine and feline urine samples and cut points of ≥ 0.5 and ≥ 0.4 as the upper limits for canine and feline urine samples, respectively, were chosen on the basis of data from a recent study in cats and current recommendations. Dogs and cats are considered to have negative results for proteinuria when the UP:C is < 0.2, considered borderline proteinuric when the UP:C is ≥ 0.2 to 0.4 (dogs) and ≥ 0.2 to 0.3 (cats), and considered to have overt proteinuria when the UP:C is ≥ 0.5 and ≥ 0.4 for dogs and cats, respectively. Decreasing the cut point to ≥ 0.2 failed to improve the sensitivity for the UP:C analysis. The low sensitivity for the UP:C in our study most likely reflected the use of results for the species-specific ELISA as the criterion-referenced standard. It is likely that many samples with low positive results for the ELISA were interpreted as negative by the UP:C, even with the cut point set at ≥ 0.2. The UA:Cs were not determined in this study. The UP:C detects albumin as well as other proteins in the urine; the UP:C will usually be higher than the UA:C in any particular sample. In human patients, the UA:C is considered to be abnormal when the value is > 0.03. Similar to the UP:C cut point currently used in veterinary medicine will most likely not detect patients with low-level albuminuria.

Determining the UA:C in lieu of the UP:C or use of the species-specific ELISA as a screening test for low-level albuminuria could remedy the problem of false-negative results for the UP:C in some urine samples. The low sensitivity of the UP:C in the present study suggests that it is not an ideal test for detection of low-level albuminuria.

An ROC curve plots the sensitivity of a test on the y-axis against the value of 1 minus the specificity on the x-axis. The AUC for the ROC curve summarizes the overall performance of the test. An AUC of 1 indicates a perfect test, whereas an AUC of 0.5 indicates a test that is not informative. The AUC values for the 3 tests evaluated here were not high. When considered in conjunction with the other results of the study, they indicate that the urine dipstick, SSA test, and UP:C methods have overall poor diagnostic performance. This is particularly true with feline urine samples.

It is unclear why analysis of feline urine samples with the urine dipstick and SSA tests resulted in such a high rate of false-positive results. An unidentified component of feline urine that reacts with the indicating reagent on the urine dipstick or creates turbidity with the SSA test is 1 possible explanation. Because trained laboratory personnel performed all analyses in a timely manner, error in test performance or interpretation is considered less likely. With regard to the urine dipstick method, there was no difference in test performance when location and products were compared. A positive reaction to a protein (other than albumin) is also a possible explanation for the high rate of false-positive results for the urine dipstick method, but this is considered unlikely because the UP:C, which can also detect proteins other than albumin, appeared to correlate well with results for the ELISA. On the basis of the statistical analysis, variations in urine specific gravity and pH were also excluded as potential causes of the high rate of false-positive results for the urine dipstick and SSA test methods (data not shown).

Repeated freezing and thawing of feline urine can cause albumin degradation in up to 10% of samples. There-
fore, even though samples in the present study were frozen and thawed only once, the true false-positive rate for the urine dipstick and SSA test results may be slightly lower than that observed.

A confounding factor in this study was the comparision of results for the urine dipstick, SSA test, and UP:C (determined by use of the benzethonium chloride reaction) methods, all of which can detect protein in addition to albumin, with results for an albumin-specific ELISA. Inasmuch as the specificity of the UP:C for the detection of albuminuria was relatively high, compared with the specificity for the urine dipstick and SSA tests, the possibility that the presence of nonalbumin urine proteins caused false-positive results for the urine dipstick and SSA tests was believed to be less likely. Another limitation of this study was that data analyzed here represented results for apparently healthy animals, and the prevalence of animals with proteinuria-albuminuria is known to be higher in patients with kidney disease or systemic disease. Additional studies are needed to determine the accuracy of albuminuria detection with routine diagnostic tools for patients with specific underlying pathological conditions.

For canine urine samples, a urine dipstick or SSA test result of ≥2+ yielded a high probability that the sample had positive results for albumin. However, when a urine dipstick test has a trace positive reaction, a turbidimetric SSA test should be performed to confirm the diagnosis of proteinuria. When both tests are performed simultaneously, they should be interpreted in series (both tests should have positive results to consider the sample as having positive results for albuminuria), rather than in parallel; this will increase specificity. When both the urine dipstick and SSA test results are in the trace to 1+ range, positive results should be confirmed with a more specific assay, such as the species-specific ELISA.

For feline urine samples, both routine screening tests (i.e., the urine dipstick and SSA test) performed poorly and appeared to be of minimal diagnostic value because of an unacceptably high number of false-positive results. On the basis of these data, detection of albumin in the urine of feline patients should always be performed with a higher-quality assay, such as the species-specific ELISA. Use of the UP:C resulted in an unacceptable number of false-negative results. Therefore, it should not be used as a routine screening test for the detection of albumin in urine of clinically normal dogs or cats, especially for animals with low-level albuminuria.

References

b. Roche Chemstrip 9, Roche Diagnostic Corp, Indianapolis, Ind.
c. Multistix, Bayer Health Care Diagnostics, Elkhart, Ind.