Use of Urine Albumin/Creatinine Ratio for Estimation of Proteinuria in Cats and Dogs

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ABSTRACT. The clinical utility of the urine albumin/creatinine ratio (UAC) using a simplified analyzer for estimation of proteinuria was studied in cats and dogs. Measurement results for diluted feline and canine albumin standard solutions showed linearity. Although conversion formulas ($y=1.28x+1.04$ and $y=1.67x+10.47$ for cats and dogs, respectively) were necessary, urine albumin concentrations could be determined in both animals. In cats and dogs with proteinuria, the UAC changed parallel with the urine protein/creatinine ratio (UPC), and the Log UAC and Log UPC were significantly correlated ($r=0.803$ ($p<0.01$) in cats, $r=0.801$ ($p<0.01$) in dogs). The UAC using an UAC analyzer could be used clinically as one of the basic in-hospital laboratory tests for estimation of proteinuria in cats and dogs.

KEY WORDS: proteinuria, urine albumin/creatinine ratio, urine protein/creatinine ratio.

Recent studies have mentioned the importance of proteinuria associated with renal morbidity, renal mortality and mortality of all causes in cats and dogs [3, 4, 9, 12, 13]. For the estimation of proteinuria, serial measurements are needed to exclude the transient proteinuria, and it is also important to confirm the tendency of increasing [6]. In cats and dogs, it is difficult to collect the total urine volume for 24 hr, so that urine protein/creatinine ratio (UPC), which correlates with 24-hr urinary protein loss, is used for the evaluation of proteinuria [6]. In veterinary practice, urine protein concentration is generally determined in medical laboratories, because no convenient determination method has been developed. The careful control of animals with kidney diseases, however, requires the rapid and quantitative determination of urine protein concentration by practitioners inside the veterinary hospital. Recently, a simplified albumin/creatinine ratio (UAC) analyzer (DCA™ Systems; Siemens Medical Solutions Diagnostics, Tokyo, Japan) for human has been utilized in Japan [5]. We examined whether the UAC data obtained with the analyzer can be applied to cats and dogs instead of conventional UPC, as one of the basic in-hospital laboratory tests.

Forty-three cats and 41 dogs, which were presented to a private veterinary practice in Nagoya, Japan, from March 1996 to November 2007, were used in the present study. All of these cats were diagnosed as chronic renal failure. Of 41 dogs, 18 were chronic renal failure, 18 were diabetes mellitus, and 5 were hyperadrenocorticalism. Chronic renal failure was diagnosed on the basis of case histories, clinical signs (such as, lethargy, anorexia, loss of bodyweight and vomiting) and a high plasma creatinine concentration (>2.0 mg/dl) [2, 3]. Diagnosis of diabetes mellitus was carried out from clinical signs (i.e., polyuria, polydipsia and weight loss), persistent fasting hyperglycemia (plasma glucose concentration >180 mg/dl) and glycosuria (Multistix, Bayer Medical, Tokyo, Japan) [7]. Hyperadrenocorticalism was diagnosed on the basis of clinical signs (i.e., polyuria, polydipsia and potbellied appearance) and a high plasma cortisol concentration (>22 µg/dl) at 1 hr after injection of ACTH (0.25 mg/head, Cortrosyn, Daiichi-Sankyo, Tokyo, Japan) [2]. Peripheral venous blood had been collected into a lithium heparin tube for plasma biochemical measurements. Plasma creatinine and glucose concentrations were determined using a dry chemistry system (Spotchem; Arkay, Kyoto, Japan). Plasma cortisol concentration was measured by electrochemiluminescence immunoassay (ECLusys, Roche Diagnostics, Tokyo, Japan). Urine specimens were collected by cystocentesis. These animals had positive proteinuria (± to 3+) (Multistix), urine culture using blood agar mediums (Poremedia; Eiken Chemical, Tokyo, Japan) indicated negative infection, and urine sediment had no inflammatory findings. Although causes of these proteinurias were not confirmed histopathologically, at least these animals had no signals of hemolysis, muscular disorder and hyperglobulinemic or lower urinary tract diseases. Urine protein concentrations were determined by the pyrogallol red-molybdate complex method (MicroTP-testWako; Wako Pure Chemical Industries, Tokyo, Japan) [10]. Urinary albumin and creatinine concentrations were determined by the immuno-turbidimetric assay with anti-human albumin goat polyclonal antibody and the Benedict reaction [1], respectively using an UAC analyzer. The UPC and UAC were calculated by dividing urine protein and albumin concentrations by urine creatinine concentrations, respec-
The measurement results using the analyzer for diluted albumin standard solutions (250, 125, 62.5 and 31.25 mg/l) for cats (Feline albumin quantitative determination kit; ECOS Laboratory, Ohsaki, Japan) and for dogs (Canine albumin quantitative determination kit; ECOS Laboratory) showed linearity (Fig. 1). Conversion formulas were as follows: $y=1.28x+1.04$ for cats, and $y=1.67x+10.47$ for dogs. The slope and y-intercept were slightly larger in dogs, indicating slightly lower antibody affinity. Variation coefficients at 10-time measurements in each diluted solution were under 6%; $3.59 \pm 1.38$ (mean ± SD)% for cats, and $4.92 \pm 0.88$% for dogs.

The UAC was $78.4 \pm 133.9$ (range; 1.0–583.0) for cats, and $146.5 \pm 195.1$ (1.0–819.0) for dogs. The UPC was $0.81 \pm 1.22$ (0.01–5.32) for cats, and $1.14 \pm 1.87$ (0.04–10.90) for dogs. The UAC changed parallel with the UPC (approximate expression; $UAC=101.3 \times UPC-3.51$ for cats, $UAC=88.3 \times UPC+46.01$ for dogs). Both UAC and UPC have logarithmic distributions, and the log UAC was correlated with the log UPC with a significant correlation coefficient in cats ($r=0.803$, $p<0.01$) and in dogs ($r=0.801$, $p<0.01$) (Fig. 2).

UAC was demonstrated to be determined with a convenient UAC analyzer with conversion formulas. In addition, the UAC was significantly correlated with UPC in cats and dogs with proteinuria. UAC has been reported to have the same clinical meaning with UPC in cats with chronic renal failure [9]. Although any relationship between UAC and UPC has not been demonstrated on other pathologic condi-
tions in cats and dogs, UAC might be not equal to UPC on the conditions with Bence Jones protein, hemoglobin, myoglobin, tubular protein or the like in urine [8]. In such conditions which are presumed to have urine protein out of albumin, componential analyses of urine protein by electrophoresis and UPC measurement should be carried out as well as UAC. Hence, although the UAC data obtained with the simplified analyzer might not perfectly substitute for conventional UPC, on appropriate pathologic conditions such as chronic renal failure, diabetes mellitus and hyperadrenocorticalism the UAC could be applied as one of the basic in-hospital laboratory tests for estimating proteinuria in cats and dogs.

REFERENCES


