Evaluation of the accuracy of an electronic point-of-care analyzer to quantify blood creatinine concentration in goats

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Introduction

In veterinary medicine, disorders resulting in increased blood creatinine include dehydration, primary or secondary renal disease, and conditions resulting in the inability to void urine such as obstructive urolithiasis. Currently, there is no specific POC creatinine meter for goats commercially available although different devices, mainly VetScan ISTAT analyzers, have been used. The Nova StatSensor creatinine POC meter has been recently approved in North America and is primarily used in humans with chronic kidney disease or those being monitored closely while in intensive care hospital settings. A handheld creatinine POC meter such as the Nova StatSensor would be beneficial for patient triaging as well as improving overall case management both in veterinary clinic settings and in the field. However, the accuracy of this POC meter in goats remains unknown.

The main objective of this study was to validate the accuracy of the Nova StatSensor creatinine POC meter (measurement range: 0.3 to 12 mg/dL) for quantifying the blood creatinine concentration in goats presented to Oklahoma State University Boren Veterinary Medical Hospital. A secondary objective was to compare this POC meter against a standard chemistry analyzer to triage goats into 3 clinically applicable categories: healthy, pre-renal azotemia, and post-renal azotemia. We hypothesize that the Nova StatSensor POC meter will generate blood creatinine values comparable to those obtained via the chemistry analyzer.

Materials and Methods

Briefly, 100 healthy and sick goats presented from June 2018 to June 2019 were enrolled in the study. Whole blood was collected via jugular venipuncture and placed in a tube containing sodium heparin as an anticoagulant. Blood creatinine was measured concurrently by the Nova StatSensor creatinine POC (in duplicate) and Beckman Coulter AU680 Chemistry analyzer (gold standard). Data obtained was recorded in Excel throughout and analyzed at the end of the study.

Linear regression and correlation were performed using Microsoft Excel® to compare results generated by the POC meter between immediately duplicated measurements of each sample; and between POC results of first measurements and results from the gold standard. Results were assigned to 1 of 3 categories: 0.5 to 2 mg/dL (healthy); 2 to 4 mg/dL (pre-renal azotemia); and >4 mg/dL (post-renal azotemia). Freeware available online (vassarstats.net) was used to calculate Kappa statistic for agreement of the 2 tests in assignment to the 3 categories.

Results

At the time of submission, 82/100 samples have been collected and analyzed. Immediately duplicated measurements were available for 74 of the 82 measurements. The correlation was very high for the POC meter (adjusted R^2 =0.96, p<0.0001). The correlation of POC meter values with values reported by the chemistry analyzer (gold standard) was notably lower, but still considered moderate (adjusted R^2 =0.56, p<0.0001). The correlation did decline as the creatinine value increased. There was agreement in categorization for 71/82 observations, with a subsequent Kappa statistic of 0.74 (95% CI 0.60 to 0.88). The creatinine POC meter correctly assigned 51/54 goats into the "healthy" category, 9/13 goats as having pre-renal azotemia, and 11/15 goats as having post-renal azotemia. In terms of correctly categorizing goats with pre-renal azotemia, the POC meter demonstrated a sensitivity of 69.2% and a specificity of 90.0%. For post-renal azotemia, the POC meter had a sensitivity of 73.3% and specificity of 97.0%. Positive predictive value was 56.3% and 84.6% for pre-renal and post-renal azotemia, respectively. Negative predictive values were 94% for both conditions.

Significance

These preliminary results show that the Nova StatSensor creatinine POC meter, although not in agreement at high levels with the central laboratory method, can be useful in triage of healthy and sick goats for characterization of pre-renal and renal azotemia.