Occurrence and correlates of azotaemia in dogs presented for veterinary care in a tertiary veterinary hospital in Nigeria

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Occurrence and Correlates of Azotaemia in Dogs Presented for Veterinary Care in a Tertiary Veterinary Hospital in Nigeria

Nnenna Tochi Emejuo, Jacinta Ngozi Omeke, John Ikechukwu Iheodioha y Shodeinde Vincent Olu Shoyinka

Abstract
This study evaluated the occurrence of azotemia and the relationship between azotemia, breed, sex, and age in dogs brought for veterinary treatment at a tertiary veterinary hospital in Eastern Nigeria. A total of 304 dogs of varied breeds and ages comprising males and females were evaluated in this study. Renal dysfunction was assessed by evaluation of serum creatinine levels using the International Renal Interest Society criterion for diagnosis of renal dysfunction, a cut-off serum creatinine value of ≥ 1.4 mg/dl was used to classify the dogs as positive for azotaemia or not. Results of the study showed that 34 (11.2%) dogs in the sample had azotaemia. There were significant variations (p < 0.05) in the occurrence of azotaemia among breeds, with Caucasians having the highest occurrence (5.9%), followed by Mastiffs (2.6%), Mongrels (2.0%), and Alsatians (0.7%).

The occurrence of azotaemia was significantly higher (p < 0.05) in females than in males. There was significant variation (p < 0.05) in the occurrence of azotaemia among the different age groups, with young dogs having a higher occurrence than puppies and adults.

Keywords: Azotaemia; age; sex; breeds.

Occurrencia y correlaciones de la azotemia en perros presentados para atención veterinaria en un hospital veterinario de tercer nivel en Nigeria

Resumen
Este estudio evaluó la ocurrencia de azotemia y la relación entre azotemia, raza, sexo y edad en perros que llevados para tratamiento veterinario a un hospital veterinario de tercer nivel en Nigeria del este. Un total de 304 perros de diversas razas y edades, machos y hembras, fueron evaluados en este estudio. La disfunción renal se determinó evaluando los niveles de creatinina sérica, usando los criterios de la Sociedad Internacional de Interés Renal para el diagnóstico de disfunción renal, se usó un valor de creatinina sérica de corte ≥ 1.4 mg/dl para clasificar a los perros como positivos para azotemia o no. Los resultados mostraron que 34 (11.2%) perros de la muestra tenían azotemia. Se
encontraron variaciones significativas (p < 0.05) en la ocurrencia de azotemia entre razas, los perros caucásicos tuvieron la mayor ocurrencia (5.9%), seguidos del mastín (2.6%), mongrel (2.0%) y alsaciano (0.7%). La ocurrencia de azotemia fue significativamente mayor (p<0.05) en hembras que en machos. Se encontró una variación significativa (p<0.05) en la ocurrencia de azotemia entre los grupos de edad, los perros jóvenes tienen una mayor ocurrencia que los cachorros y los adultos.

**Palabras clave:** Azotemia; edad; sexo; razas.
Introduction

Azotemia is an increase in the concentration of non-protein nitrogenous compounds like creatinine and urea in the blood (1). It affects humans and animals including dogs. Serum creatinine and urea are widely used to screen for azotemia and are used to determine the glomerular filtration rate (GFR), with serum creatinine and urea increasing as GFR decreases (2). The impaired ability of the kidney to excrete waste products of protein catabolism, particularly creatinine and urea results in the intravascular increase of nitrogenous waste products which leads to azotemia (3, 4). Azotemia occurs when 75% or more of the nephrons are non-functional (5). It may have a pre-renal, renal, or post-renal origin (6). Pre-renal azotemia occurs when decreased renal perfusion results in a diminished glomerular filtration rate. Common causes of pre-renal azotemia include volume depletion, vascular collapse, thrombotic disease, and shock. Renal azotemia occurs when nephrons are directly damaged by toxins or infectious, inflammatory, ischemic or neoplastic processes. Post-renal azotemia is caused by urinary tract obstruction of any process distal to the renal tubules, which interferes with the collection, containment or excretion of urine (7, 8).

The prevalence of kidney disease in humans in the United States of America (USA) is 7.2% in people aged 30 and older; in the population of 64 years and older, the prevalence is about 23.4-35.8% (9). The prevalence of kidney disease in humans in Nigeria is 11.4% (10) while in Africa it ranges from 2 to 41% (11). The prevalence of kidney disease in cats in the US is estimated at 7.6% with a higher prevalence in older cats (12) while in dogs, the reports say it is at 5.8% of caseload (13). The total incidence rate of kidney disease in a population of 10,000 dogs was estimated at 15.8%, while the mortality rate was 9.7% in Sweden (14). In a clinical study conducted by (15) in Hyderabad, India, involving a population of 237 dogs, 33.33% had various renal disorders associated with several causes. Some risk factors for kidney disease in dogs include age, breed, body size, and periodontal disease (16, 17). There is no report in the available literature on the occurrence of azotemia in apparently healthy dogs in this locality.

The study aimed to evaluate the occurrence of azotemia in dogs and determine the relationship of variables such as breed, sex, and age in dogs positive for azotemia. The dogs screened were apparently healthy, those diagnosed with renal disorders were grouped considering breed, sex, and age to estimate the effect of these parameters on the occurrence of renal dysfunction.

Materials and Methods

This study was conducted at the Veterinary Teaching Hospital (VTH), University of Nigeria, Nsukka. The VTH dispenses clinical services to pet owners and farmers within Enugu State and handles referrals from clinics and communities in the neighboring states of Kogi, Benue, and Anambra.

This research was a cross-sectional survey of apparently healthy dogs that were physically examined and screened for renal dysfunction, comprising both genders, four age groups, and five breeds. A total of 304 dogs were evaluated in the study with the informed consent of the owners. For each dog included in the study, basic bio-data on age, sex, breed and health status were collected and documented. 2ml of blood was collected from each dog from the cephalic vein and dispensed into plain test tubes and allowed 30 minutes to clot. The serum was separated from the clot by centrifugation at 3000 revolutions per minute for 10 minutes and the harvested sera was used for determining the serum’s biochemistry parameters.

The determination of the serum creatinine was based on the modified Jaffe method (18, 19).

Dogs were considered positive for azotemia if they had a serum creatinine value of ≥ 1.4 mg/dl, based on the International Renal Interest Society classification (20). Data on the serum creatinine level was subjected to descriptive statistics and occurrence was presented.
as percentages. Age, breed, and sex variations in occurrences were subjected to Fisher’s exact test.

**Results**

Out of the 304 dogs sampled, 34 (11.2%) had serum creatinine levels at or above 1.4 mg/dl, while 270 (88.8%) had serum creatinine levels below 1.4g/dl. Out of the 34 dogs positive for azotemia, 18 (5.9%) were Caucasians, 6 (2.0%) were Mongrels, 8 (2.6%) were Mastiffs, and 2 (0.7%) were Alsatians (Table 1). There was significant variation (p < 0.05) in the occurrence of renal dysfunction among breeds (Table 1). Twenty-four out of the 34 dogs positive for azotemia (7.9%) were females while 10 (3.3%) were males. The occurrence of renal dysfunction was significantly higher (p < 0.05) in females than in males (Table 2). When categorized based on age, 10 out of the 34 dogs positive for azotemia (3.3%) were puppies, 22 (7.2%) were young dogs, and 2 (0.7%) were seniors. The occurrence of azotemia was significantly (p < 0.05) higher in young dogs than in all other age groups (Table 3).

**Discussion**

The 11.2% occurrence of kidney dysfunction in dogs in this study concurs with reports of previous studies that showed one in ten dogs is likely to develop kidney

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**Table 1. Breed Distribution of Dogs Positive for Azotemia in the Sample Population**

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Breeds</th>
<th>No. of Dogs with Serum Creatinine &lt; 1.4 mg/dl</th>
<th>No. of Dogs with Serum Creatinine ≥ 1.4 mg/dl</th>
<th>Total</th>
<th>% of each Dog Breed with Serum Creatinine ≥ 1.4 mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Caucasian</td>
<td>80</td>
<td>18</td>
<td>98</td>
<td>5.9%</td>
</tr>
<tr>
<td>2</td>
<td>Mongrel</td>
<td>74</td>
<td>6</td>
<td>80</td>
<td>2.0%</td>
</tr>
<tr>
<td>3</td>
<td>Mastiff</td>
<td>58</td>
<td>8</td>
<td>66</td>
<td>2.6%</td>
</tr>
<tr>
<td>4</td>
<td>Alsatian</td>
<td>50</td>
<td>2</td>
<td>52</td>
<td>0.7%</td>
</tr>
<tr>
<td>5</td>
<td>Rottweiler</td>
<td>8</td>
<td>0</td>
<td>8</td>
<td>0%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>270</td>
<td>34</td>
<td>304</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

**Table 2. Sex Distribution of Dogs Positive for Azotemia in the Sample Population**

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Sex</th>
<th>No. of Dogs with Serum Creatinine &lt; 1.4 mg/dl</th>
<th>No. of Dogs with Serum Creatinine ≥ 1.4 mg/dl</th>
<th>Total</th>
<th>% of each Dog Breed with Serum Creatinine ≥ 1.4 mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Females</td>
<td>144</td>
<td>24</td>
<td>168</td>
<td>7.9%</td>
</tr>
<tr>
<td>2</td>
<td>Males</td>
<td>126</td>
<td>10</td>
<td>136</td>
<td>3.3%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>270</td>
<td>34</td>
<td>304</td>
<td>11.2%</td>
</tr>
</tbody>
</table>

**Table 3. Age Distribution of Dogs Positive for Azotemia in the Sample Population**

<table>
<thead>
<tr>
<th>S/No.</th>
<th>Breeds</th>
<th>No. of Dogs with Serum Creatinine &lt; 1.4 mg/dl</th>
<th>No. of Dogs with Serum Creatinine ≥ 1.4 mg/dl</th>
<th>Total</th>
<th>% of each Dog Breed with Serum Creatinine ≥ 1.4 mg/dl</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Puppy (&lt; 1 yr.)</td>
<td>80</td>
<td>18</td>
<td>98</td>
<td>5.9%</td>
</tr>
<tr>
<td>2</td>
<td>Young (1 – 3 yrs.)</td>
<td>74</td>
<td>6</td>
<td>80</td>
<td>2.0%</td>
</tr>
<tr>
<td>3</td>
<td>Adults (4 – 8 yrs.)</td>
<td>58</td>
<td>8</td>
<td>66</td>
<td>2.6%</td>
</tr>
<tr>
<td>4</td>
<td>Seniors (&gt; 8 yrs.)</td>
<td>50</td>
<td>2</td>
<td>52</td>
<td>0.7%</td>
</tr>
<tr>
<td></td>
<td></td>
<td>270</td>
<td>34</td>
<td>304</td>
<td>11.2%</td>
</tr>
</tbody>
</table>
disease (21) and is close to but lower than the 15.3-
16.2% reported by Pelander et al. in Swedish dogs (22).
Some other researchers had found and reported a lower
prevalence (as low as 0.05-3.74%) of chronic kidney
disease, specifically, in dogs in the United Kingdom
(21, 16). A relatively recent study of the occurrence of
renal lesions in dog carcasses presented for necropsy in
western Nigeria showed that 15-33.3% of necropsied
dogs had lesions of renal failure (23).

The occurrence of renal dysfunction was highest in the
Caucasian breed of dogs with 5.9% occurrence followed
by Mastiffs (2.6%) and Mongrels (2.0%). Earlier studies
by Ahmed (24) reported a higher prevalence in Labra-
dors followed by German Shepherds, while a study by
Pelander (22) reported the highest prevalence of renal
dysfunction in Burmese mountain dogs. It should be
noted that higher occurrence and prevalence tend to
follow dog breed size categories — the Caucasians re-
corded with the highest prevalence in this present study,
the Burmese mountain dogs reported by Pelander et al.
(22) and the Labradors and German Shepherds report-
ed by Ahmed (24) are all large dog breeds. The findings
in this present study and literature reports show the
highest occurrence of renal dysfunction in large dog
breeds in contrast with breed disposition of a disease
such as diabetes mellitus in dogs, which is highest in
smaller dog breeds (25). Moreover, earlier studies by
Lund et al. (26) and Sosnar et al. (27) showed the re-
ported prevalence of canine renal dysfunction regard-
ing breed varies depending on the population studied.

In this study, the age-specific prevalence of renal dys-
function was highest in young dogs (7.2% prevalence),
which may be associated with familial renal diseases
that generally result in renal dysfunction before 5 years
of age (1), although Nabi et al (28) reported a higher
prevalence of renal dysfunction in dogs as they age
possibly due to the decrease in blood flow to the kid-
nels, loss of nephrons (29) and decrease in reabsorp-
tion processes of the nephrons (30). Additionally, the
findings show females have a significantly higher oc-
currence of azotemia than males, which is concurring
with earlier reports that showed that females (dogs,
cats, and humans) are more prone to urinary tract in-
flections that may result in renal dysfunction (31, 32,
33). A significant association between female urinary
tract infections with chronic kidney disease has been
reported (34, 35, 36). Bjorling recorded a higher preva-
lence in males, which they attributed to a more frequent
occurrence of urolithiasis in males (37).

**Conclusion**

This research determined the occurrence of azotemia in
apparently healthy dogs in this locality. It was con-
cluded that the occurrence of azotemia in the study
population was 11.2% and that azotemia occurred more
in the Caucasian dog breed, females, and young dogs.

**Acknowledgment**

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S.V.O Shoyinka and Prof J.I Ihedioha. Ethical ap-
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of Nigeria, Nsukka, Faculty of Veterinary Medicine,
institutional animal care use committee with approval
reference number FVM-UNN-IACUC-2020-0265.

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