SCREENING OF GERIATRIC DOGS FOR CHRONIC KIDNEY DISEASE AND ITS MANAGEMENT

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Abstract

A total of 105 geriatric dogs presented to the University Veterinary Hospitals were screened for Chronic Kidney Disease (CKD) based on serum creatinine, urine protein creatinine ratio (UPC) and urinalysis. Ninety-one dogs were diagnosed with CKD, out of which thirty-nine dogs were in stage 1, twenty-six in stage 2, six in stage 3 and twenty in stage 4. Twenty-two dogs were studied in detail and were further sub-staged on the basis of proteinuria and blood pressure. Stage 1 and 2 dogs were the ones having asymptomatic CKD. The symptoms of CKD were evident in two out of four dogs in stage 3 and all dogs in stage 4. Diseases like pyometra and microfilariosis existed concurrently with CKD in some dogs. Body condition score, serum creatinine, UPC, serum phosphorous and systemic blood pressure were monitored in all dogs. Dietary modifications, proton pump inhibitors, intestinal phosphate binders, gastric protectants, omega 3 and omega 6 fatty acid supplementation, treatment of specific diseases, treatment of urinary tract infections, treatment of proteinuria and hypertension, supportive therapy with fluids as and when necessary and anti-emetics were the line of treatments adopted. The patients were managed and observed for a period of three months. Intermittent haemodialysis was performed in two dogs, one each in stage 3 and 4 for temporary stabilization. Chronic kidney disease progression was effectively slowed down in all dogs of stage 1, five out of six dogs of stage 2, two out of four dogs of stage 3 and two out of six dogs of stage 4 CKD. The study revealed the importance of timely intervention and management to slow down the progression of CKD among dogs.

Keywords: *Geriatric dogs, chronic kidney disease(CKD), stages of CKD*

Ageing is an irrevocable and irreversible process of life. Being old is not a disease, but it is definitely a time when many diseases are more likely to occur. Geriatric pets are prone to have many multisystemic disorders e.g. neoplasia, chronic kidney disease, hypothyroidism, dental disease, diabetes mellitus and arthritis. Veterinarians should recommend regular geriatric patient testing to establish a database. Early disease detection allows earlier intervention and more successful treatment outcome. Routine monitoring after initiation of therapy is equally necessary.

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Chronic kidney disease (CKD) prevails more in geriatric population of dogs. Veterinarians have the greatest potential for early diagnosis of CKD, thereby, implementing appropriate therapeutic measures and thus slowing the progression of CKD. This minimizes morbidity and gives a better quality life for the patient. Thus, early diagnosis and treatment is the mainstay of managing CKD. International Renal Interest Society (IRIS) has given guidelines for staging of patients with CKD based on serum creatinine concentration; further the patients are sub-staged on basis of proteinuria and hypertension.

Evaluation of both, blood and urine tests for detection of changes in renal function are potentially effective strategies for early diagnosis of CKD. Urine tests serve as a helping hand in early detection of CKD. Proteinuria and microalbuminuriaare potential detectors of CKD as well as markers of progression of the same. Blood pressure measurement is another important procedure to assess hypertension which leads to end-organ damage. Once the diagnosis of CKD is established and the pet is staged and sub-staged, a staged therapeutic approach forms the basis of CKD management. Specific therapy, renoprotective therapy and symptomatic therapy are the three therapies undertaken in patients with CKD. Effective treatment strategies that minimize morbidity and prolong survival in CKD pets include dietary modification, control of hyperphosphatemia and renal secondary hyperparathyroidism, blood pressure control, correction of anaemia and control of on-going blood losses, maintenance of hydration status, correction of metabolic acidosis and electrolyte imbalances. Renal replacement therapies, e.g. intermittent haemodialysis need to be implemented in the advanced stages of CKD to ameliorate the azotemia and to sustain life.

Treatment goal should be set before the initiation of therapy and patient should be regularly assessed to know how far the treatment has achieved the goals set. Follow up visits should assess the medical history, previous and ongoing medication, physical examination, body weight and nutritional status, complete blood count, biochemical profile, complete urinalysis and blood pressure. This study throws light on the early diagnosis of CKD, so that appropriate treatment regime can be adopted and quality of life can be improved along with increased survival time.

Materials and Methods

A total of 105 geriatric dogs (seven years and above) presented to University Veterinary Hospital, Kokkalai and Veterinary College Hospital, Mannuthy formed the materials for this study. The identified dogs were screened for CKD using serum creatinine, urine protein creatinine ratio (UPC) and urinalysis. On the basis of the screening parameters, ninety-one dogs out of hundred and five were diagnosed to be having CKD and were staged into 4 stages of CKD, according to the International Renal Interest Society staging guidelines (IRIS-2013).

Out of the ninety-one dogs diagnosed to be having CKD, twenty-two dogs were subjected to detailed study, as only these cases were available for follow-up throughout the management period. These cases were further sub-staged based on proteinuria and blood pressure as per the IRIS guidelines and subjected toappropriate therapeutic management and were regularly monitored as and when required and at monthly intervals for a period of three months.

The dogs in each stage were managed according to the recommendations of Chew *et al.* (2011). Management measures adopted for Stage 1 CKD were dietary modifications, proton pump inhibitors, intestinal phosphate binders, gastric protectants and omega 3 and 6 fatty acids supplementation, treatment of specific diseases which concurrently existed with CKD, treatment of urinary tract infection and treatment of proteinuria and hypertension. Management measures of Stage 2 CKD included the ones of stage 1, in addition to treatment of hyperkalemia and anemia. Management of Stage 3CKD included the ones of stage 1 and 2 in addition to supportive therapy with fluids and anti-emetics and Intermittent haemodialysis (IHD) for temporary stabilization. Management measures adopted for stage 4 CKD included

the ones of all three stages with an addition of treatment of anaemia with recombinant human erythropoietin (EPO) and blood transfusion. Response to management of the first three stages of CKD was assessed, by measuring body condition score, serum creatinine, serum phosphorous, UPC and systemic blood pressure, on monthly basis for three months after initiation of management measures. Response to therapeutic management of only two dogs in stage 4 could be assessed. Data were analysed wherever indicated as per Snedecor and Cochran (1994). Data that exhibited abnormal deviations from the normal pattern were discussed separately.

Results and Discussion

Screening of the geriatric dogs was done using three parameters, namely serum creatinine, urine protein creatinine ratio (UPC) and urinalysis. A combination of the three parameters helped to diagnose CKD, especially in the early stages. This was done as per the suggestions of Lees and Metzger (2005). A total of ninety-one out of the hundred and five dogs were diagnosed to be having CKD. Out of the 91 dogs, thirty-nine (42.80 per cent) were in CKD stage 1, twenty-six (28.57 per cent) in CKD stage 2, six (6.59 per cent) in CKD stage 3 and twenty (21.9 per cent) in CKD stage 4. The high occurrence suggests that most of the geriatric dogs suffer from CKD. Similar findings were also reported by O'Neil *et al*. (2013), and suggested advancing age as a risk factor for CKD in dogs.

Four out of six dogs in stage 1 CKD group were brought for routine check-up and had no previous history of renal involvement.One dog was presented for a pre-operative (pyometra) check-up. This finding is characteristic of stage 1 CKD as it is generally symptomless. Chronic kidney disease is often diagnosed during routine screening, preanesthetic work-up or while investigating unrelated disease, as suggested by Langston (2011). During the physical examination no abnormality was detected in four out of six dogs brought for checkup in this group. This is a feature of the stage 1 CKD; dogs apparently show no signs of illness. This finding is in agreement with that of Brown*et al*. (2013) who reported that in stage 1 CKD, even though there was damage to the kidneys, clinical signs were not evident. The creatinine values of all the six dogs were < 1.4mg/dL. Although the serum creatinine values of these dogs were less than 1.4 mg/dL there was evidence of decreased urine concentrating ability and two dogs in this group were proteinuric. Hence they were considered as stage 1 CKD, as suggested by IRIS. Pale colour and low specific gravity of urine (range 1.015 to 1.019) were the findings in the dogs belonging to this group. In this stage, there was no azotemia but there was a reduction in the urine specific gravity. This finding is in agreement with Wamsley and Alleman (2007). One dog was at low risk level of hypertension (158/89 mm of Hg). Others were at minimal risk level of hypertension (< 150/95 mm of Hg). Hypertension occurred as a result of kidney disease, as suggested by Syme (2011). In this group, the values of serum phosphorous, were within the normal limits. This finding is in accordance with Polzin (2011) who reported that in CKD stage 1, serum phosphorous remained within the normal range because of a compensatory reduction in phosphorous reabsorption by surviving nephrons. Chronic kidney disease progression was effectively slowed down in all the dogs of this stage. The strategic approach of specific therapy and renoprotective therapy was applied, as suggested by Brown (2005). Dietary modification was the mainstay to manage CKD, as suggested by Elliot *et al.* (2000) and Jacob *et al*. (2002). Magnitude of proteinuria and level of hypertensionreduced post treatment with ACE inhibitors. This is in accordance with Grauer *et al*.(2000) and Lefebvre *et al*. (2007).

Three dogs in stage 2 CKD group were presented for routine check-up and had no previous history suggesting renal involvement. Three dogs were presented for various complaints. Chronic kidney disease was diagnosed on screening them. Stage 2 CKD could also be asymptomatic like stage 1, as observed by Langston (2011). Polydipsia and polyuria were reported in one dog. This sign is seen in the early stages of CKD and is noticed only by the observant owner, as suggested by Robertson and Seguin (2006) and Chew *et al.*

Table 1. Response of selected parameters to the therapeutic management in stage 1 CKD dogs

Parameters	Before management (Range)	During management		
		First month	Second month	Third months
Body condition score	3-4	4	4	4
Serum creatinine (mg/dL)	1.02-1.36	1.02-1.36	1.02-1.36	1.02-1.36
Serum phosphorous (mg/dL)	3.0-4.9	3.0-4.9	3.0-4.9	3.0-4.9
UPC	0.19-2.50	0.19-1.70	0.18-1.35	0.19-1.10
Systemic blood pressure (mm of Hg)	113/85-158/99	112/70-131/82	114/72-130/83	111/79-130/81

(2011). No abnormality was detected during the physical examination of three out of six dogs. This is a feature of stage 2 CKD as like stage 1; dogs showed no sign of illness. This finding is in agreement with Brown (2013) who reported that even in stage 2 CKD, clinical signs are not evident in all affected dogs. Average creatinine value of these six dogs was 1.71 mg/dL (ranged from 1.4 to 2.0 mg/dL) which was in accordance to the IRIS guidelines (IRIS, 2013) and hence these dogs were included in stage 2. Pale color and low specific gravity (1.015-1.019) of urine were the salient findings of urinalysis in this group. Three dogs were proteinuric. Average UPC value of this group was 0.57. Proteinuria could be because of the glomerular damage which is present in this stage. It was the result of glomerular damage, as observed by Grauer (2009). One dog had systemic hypertension and was at high risk level (182/136).This dog was proteinuric and also had a high UPC value. UPC ratios in hypertensive dogs are higher. It is observed that there exists an association between high systemic blood pressure and glomerular structural changes (Bacic *et al*. 2010).

In this group the values of serum phosphorous were within the normal limits. This finding is in accordance with Polzin (2011). Five out of six dogs in this group responded positively to the management throughout the observation period. The strategic staged approach to CKD which included specific therapy and renoprotective therapy was applied on the dogs in this group (Brown, 2005). This line of treatment was found to be appropriate as the essential parameters such as body conditionscore, serum creatinine, serum phosphorous, proteinuria and systemic blood pressure were improved and stabilised. The delay in the progression of CKD could be attributed to the early detection and appropriate therapeutic management strategy adopted.

Two dogs out of four dogs studied in stage 3 CKD were presented with the complaint of anorexia, weakness and dullness. These signs could be because of the advanced CKD. Stage 3 is the overt stage of CKD wherein symptoms are exhibited by the patients. Two dogs were brought for routine check-up and had no previous history suggestive of renal involvement. In spite of being in advanced stage, the dogs were still symptomless. These findings were in accordance with Langston (201l). No abnormality was detected during the physical examination of two dogs. These dogs showed no signs of illness, in spite of being in an advanced stage of CKD.They were diagnosed only due to the screening. Uremic smell, oral ulcers, dehydration and vomiting were the important clinical findings seen in two dogs. These signs exhibited by the dogs are complications of uremia (Polzin, 2011). The creatinine values of all dogs in this group were in the range 2.15 to 3.7 mg/dL. Hence they were included in stage 3, as suggested by IRIS (2013). Marked isothenuria was a common finding in this group. Specific gravity range in this group was 1.007 to 1.012. All dogs in this group were proteinuric. Mean UPC value of this group was 1.22. Three dogs were at minimal risk level. Hyperphosphatemia was seen in one dog(8.5 mg/dL). This was because of the advanced stage of CKD, wherein the compensatory mechanisms failed to prevent hyperphosphatemia (Polzin, 2011).

Response to management was good in two dogs of this group. Renal diet was the mainstay of therapeutic management. In-

Table 2. Response of selected parameters to the therapeutic management in stage 2 CKD dogs

Parameters	Before management	During management		
		One month	Two months	Three months
Body condition score	2-4	3-4	3-4	2-4
Serum creatinine(mg/dL)	1.51-1.91	1.51-1.91	0.64-1.91	1.4-1.91
Serum phosphorous(mg/dL)	2.7-3.7	2.7-3.7	3.0-4.0	2.9-3.8
UPC	0.10-1.40	0.10-1.20	0.12-1.19	0.12-1.10
Systemic blood pressure (mm of Hg)	131/77-182/136	133/78-145/89	131/81-143/85	132/80-214/164

spite of being in stage 3, the clinical signs and azotemia ameliorated in these dogs. This agrees with the suggestions given by Villaverde (2009) who reported that nutrition was an important treatment tool of CKD. The azotemia was rising in both these dogs in-spite of the therapeutic measures undertaken probably because of the loss of considerable amount of nephrons. One dog had to be euthanised. The other dog was subjected to IHD. Magnitude of azotemia reduced post dialysis, which increased again within two days and finally the dog was euthanised as per the owner's request.

Dullness, anorexia, vomiting and pale almost colourless urine were reported in all six dogs in stage 4 CKD group. Melena was reported in four dogs. Dogs in stage 4 were usually presented with these symptoms (Langston, 2011). One dog had a long standing history of pyometra. Ovariohysterectomy wasn't done in this dog. Pyometra causes glomerular damage and if untreated can lead to further damage and finally result in renal failure. The clinical history was also suggestive of advanced CKD. One dog had a history of recurrent infection of microfilaria. Microfilaria can cause glomerular damage by its mechanical presence or by its products. This glomerular damage could progress to CKD, as suggested by Chew *et al*. (2011). Marked uremic odour, oral ulcers, sub-lumbar pain, dehydration and pale mucous membrane were seen in the dogs of this group. These clinical manifestations are due to retention or loss of nitrogenous compounds, as suggested by Robertson and Seguin (2006) and Bartges (2012). Serum creatinine value of this group ranged from 5.1 mg/dl to 25.1 mg/dL. Hence they were included in stage 4, as suggested by IRIS (2013). Urine output in two dogs of this group was negligible, hence samples couldnot be collected for analysis. Isothenuria was the finding of urinalysis of the remaining four dogs in this group. Specific gravity ranged from 1.007 to 1.010. Proteinuria was a finding in this group. UPC ranged from 1.37 to 5.50. Three dogs were at minimal risk level. One dog was at low risk level and one dog was at moderate risk level. Systemic hypertension is associated withCKD; this is attributed to sodium retention in end-stage disease, as reported by Syme (2011). Hyperphosphatemia was the common finding in this group which was due tofailure of the compensatory mechanisms of the kidneys to excrete phosphorous. This finding is in agreement with Slatopolsky and Delmez (1995) and Polzin (2011).

The diet was well accepted by two dogs. There was no vomiting. Treatment slowed

Table 3. Response of selected parameters to the therapeutic management in stage 3 CKD dogs

Parameters	Before management	During management		
		One month	Two months	Three months
Body condition score	2-4	3-4	3-4	3-4
Serum creatinine (mg/dL)	2.15-3.7	2.1-2.5	2.2-2.5	2.2-2.5
Serum phosphorous(mg/dL)	4.4-8.5	4.0-4.5	4.0-4.5	4.0-4.5
UPC	0.95-1.60	0.8-1.2	0.8-1.2	0.8-1.2
Systemic blood pressure (mm of Hg)	136/82-157/99	135/81-140/85	132/80-135/84	130/81-133/82

progression of the disease and delayed onset of uremia, both these dogs survived for a month One of these dogs was subjected to IHD. Post IHD, the azotemia reduced. This was in agreement with the findings of Cowgill and Guillaumin (2013). Human recombinant erythropoietin (rHuEPO) was given to this dog. A small increase in RBC and Hb count from $2.8\times10^6/mm^3$ to $3.17\times10^6/mm^3$ and 4.8g/dL to 5.3g/dL was obtained. This finding is in agreement with Roudebush *et al*. (2009). Blood transfusion was also done in this dog to resolve the anaemia. Blood transfusion was an immediate treatment measure to correct anaemia of CKD, as suggested by Langston (2009).

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