Case Report

Application of Various Diagnostic Approaches for Detection of Chronic Kidney Disease in a Local Household Cat

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Abstract | Chronic kidney disease (CKD) is one of the most common diseases in older cats. A 9-year-old male local cat was brought to the Teaching and Training Pet Hospital and Research Center with a history of off-feed, weight loss, polyuria, and skin disease. Clinical examination revealed dehydration and polydipsia and the cat was suspected of CKD. The Blood sample was collected for estimation of biochemical parameters e.g. ALP, ALT, AST, Phosphorus, Glucose, Total protein, BUN, and Serum creatinine. The Urine sample was taken also for determination of Urine pH, Specific gravity, Proteinuria, and Glucose. Ultrasonography was performed to check the condition of the kidney. Increased levels of BUN, Serum creatinine, Proteinuria, and thickened cortex of the kidney confirmed that the cat was suffering from CKD. The diagnosis and management of CKD at all stages requires the use of substantial evidence-based guidelines and principles.

Keywords | CKD, Polyuria, Ultrasonography, Biochemical Parameters, Ultrasonography.

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INTRODUCTION

Nowadays almost all elite class people have a pet. Most people prefer rearing a cat as their pet. Like human's cats also suffer from many health issues when they are getting old like kidney disease, heart disease, liver disease, and many more. The most frequent metabolic disorder in older household cats is Chronic Kidney Disease (CKD) (Brown et al., 2016). Its frequency will differ depending on the population (O'Neil et al., 2014). In a study, it was found that about 1.6-20% of cats all around the world are exposed to CKD at some point in their lives (Boyd et al., 2008; Watson., 2001; Ross et al., 2007). Household cats have a high frequency of CKD than the dog. It has been hypothesized that dietary factors play a role in the development of CKD in cats (Lappin et al., 2006). At present people all over the world are too busy with their professions, they have less time to take care of their pets. So they prefer commercially available food for their pets instead of homemade food. These Commercially available feed, acidifying diets having a lower amounts of potassium led to hypokalemia and thus developing CKD in healthy cats (Finch et al., 2016; Bang et al., 2007). Aging, Routine vaccination, Hyperphosphatemia, ischemia, are considered as risk factor for initiation of CKD in cat (Brown et al., 2016).

CKD in cat develops gradually often extend many months or even years. Gradual weight loss, polyuria, polydipsia, dehydration, vomition, Echimotic hemorrhage in eye due to high blood pressure, ammoniacal odor from mouth are the clinical sign of CKD (Sparkes et al., 2016). In laboratory diagnosis Higher creatinine level in blood, lower USG level on urinalysis, increased Blood Urea Nitrogen (BUN) level indicate the presence of CKD in cat (Bartlett

et al., 2010; Greene et al., 2014; Hughes et al., 2002; Jepson et al., 2009). Diagnosis of CKD might be challenging sometimes. There are very limited study was performed for diagnosis of CKD (Poly et al., 2020) in cats in aspect of Bangladesh which are significant. Previously, CKD was diagnosed based on clinical sign and symptoms because of lack of diagnostic tools in aspect of Bangladesh. Therefore, the aim of this study is to emphasize on various diagnostic methods for detection of CKD in cat.

Case presentation

A nine years old local breed male cat was brought to Teaching and Training Pet Hospital and Research Center, Purbachal, Dhaka, Bangladesh with a history of off-feed, weight loss, polyuria and also having skin disease. The respective doctor examined the cat. On clinical examination, the cat was found dehydrated with the sunken eyeball and body temperature showed 101 degrees F (Supporting file_Figure 1). Based on history and clinical signs the cat was primarily suspected of CKD. The Doctor referred it to the laboratory for the investigation of the biochemical profile of blood and urinalysis for confirmatory diagnosis. Ultrasonography was also done for its proper diagnosis.

Blood collection and its biochemical analysis

Blood was collected from the medial saphenous vein of the cat and kept in two different vacutainers with anticoagulant and without anticoagulant (Supporting file_Figure 2). After collection of some parameters of blood e.g., Phosphorus, Glucose, Total protein, ALT and AST was estimated thoroughly by Humalyzer 3000 biochemical analyzer (Supporting file_Figure 3). After estimation, it was found that serum creatinine level was very high (3.3 mg/dl) where the normal range is 0.9-2.2 mg/dl (O'Brien et al., 1998) and also blood urea nitrogen (BUN) level was too high (101.93gm/dl) where the normal range was 19-34 mg/dl (O'Brien et al., 1998). Total protein, ALT and ALP level was normal in range. AST level was a little bit higher (Table 1).

Table 1: Biochemical analysis of the blood of CKD cat.

Parameters	Test results	Reference values
Phosphorus	7.9 mg/dl	3.0-6.1mg/dl
Glucose	70.6 mg/dl	60-120mg/dl
Total protein	7.1 g/dl	6-7.9 g/dl
ALT	70 U/L	25-97 U/L
AST	50.8 U/L	7-38 U/L
ALP	46.0 U/L	0-45 U/L
BUN	101.93 mg/dl	19-34 mg/dl
Serum creatinine	3.3 mg/dl	0.9-2.2 mg/dl

*ALT: Alanine Aminotransferase; AST: Aspartate Aminotransferase; ALP: Alkaline Phosphatase; BUN: Blood Urea Nitrogen

Urine dipstick test

For urinalysis, urine of the cat was collected by catheterization and some parameters of the urine e.g. specific gravity, pH, protein and glucose was checked by urine dipstick test (Supporting file_Figure 4). The pH and specific gravity of urine were found in the normal range. The Protein level was high from the reference value. Glucose level was found in the normal range.

Table 2: Biochemical analysis of urine for CKD cat

Parameters	Test results	Reference values
pH	6.3	6-7.5
Specific gravity	1.007	1.001-1.085
Protein	1.0 gm/dl	0.2-0.4 gm/dl
Glucose	100 gm/dl	80-120 gm/dl

Ultrasonography

For CKD diagnosis, it is important to check the morphology of both kidneys. So, the cat was lying on lateral recumbency, and Ultrasonography of the ventral lower abdomen was performed for further confirmation of CKD. In USG, it was found that the cortex of the kidney was thickened and the diameter of the medulla becomes decreased (Supporting file_Figure 5). The ratio of cortex and the medullary portion of kidney was below normal, which is seen in typical CKD patients. After that, the confirmatory diagnosis was done.

DISCUSSION

For the confirmatory diagnosis of CKD in cats, it is very important to check the biochemical profile of blood. In this case, an increased value of AST, Blood urea nitrogen (BUN), and Serum creatinine was found in the biochemical tests (Table 1). AST is produced by hepatocytes and muscles. High levels of AST indicate muscle necrosis or liver damage (Poli, 2016). Blood urea nitrogen or BUN is the main byproduct of protein metabolism. High levels can be a sign of renal illness or failure, dehydration, shock, eating a high protein diet, ingesting specific toxins, poor kidney circulation, and urinary blockage (Canon, 2016). Additionally, BUN levels rise in the conditions such as decreased blood flow through the kidney, heart illness, hemorrhage, ischemia, and post renal rupture (Poli, 2016). In this case, there was also found elevation of serum creatinine levels from the normal value (Table 1). Creatine is a waste product of muscle metabolism; its production rate is largely constant and related to the animal's muscular mass (Hall et al., 2014). It is expelled through the kidneys, and a considerable decrease in GFR (Glomerular Filtration Rate) will result in creatinine retention; however, non-renal conditions, including changes in muscle mass and the presence of dehydration, may also influence serum

creatinine (Bartges, 2012). The serum creatinine level is the fundamental biomarker used by the IRIS system to stage renal illness (Canon, 2016; Braff et al., 2014).

Table 3: Stages of Chronic kidney disease based on serum creatinine level (IRIS staging of CKD, 2019)

Stage of CKD	Serum creatinine level (mg/dl)
Stage 1	<1.6 mg/dl
Stage 2	1.6-2.8 mg/dl
Stage 3	2.9-5.0 mg/dl
Stage 4	>5.0 mg/dl

Cats suffering from Stage 1 or Stage 2 CKD have a chance of survivability if they are diagnosed and treated properly. In the case of stages 3 and 4, it is very difficult to survive and in most cases cats suffering from CKD stage 3 or 4 died within some days of diagnosis. In our study, the serum creatinine level of the cat was 3.3 mg/dl (Table-1). Therefore, the patient was suffering from stage 3 Chronic kidney disease (Table-3).

High proteinuria was found in urinalysis in this patient (Table-2). In a study, it was revealed that Proteinuria can develop as a result of CKD, and renal proteinuria is related to accelerated disease development and a considerably lower survival duration (Syme et al., 2006; King et al., 2007). International Renal Interest Society classified Feline CKD based on urine protein creatinine ratio (UPCR) and it is Non-Proteinuric: UPCR= <0.2 , Borderline Proteinuric: UPCR =0.2-0.4,Proteinuric: UPCR=> 0.4.

CONCLUSION

CKD is a prevalent condition in middle-aged to elderly cats**.** In the majority of cases, the underlying reason is unidentified. Pre-existing renal damage at the time of diagnosis will be incurable in all cases. In case of early diagnosis and appropriate management, there will be a chance of survivability. Substantial proof-based recommendations and guidelines are required for the diagnosis and treatment of CKD at all phases.

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CONFLICT OF INTEREST

There are no conflicts of interest.

AUTHORS CONTRIBUTION

All the authors contributed to research and manuscript writing.

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