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Case report

POLYCYSTIC KIDNEY DISEASE IN A PERSIAN CAT

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SUMMARY

A 6-year-old intact Persian cat was presented for the primary complaint of inappetence and weight loss. Irregular surface of kidneys was palpated during physical examination. Abdominal radiograph findings were indicative of renomegaly. Ultrasonography revealed multiple anaechoic structures within the renal parenchyma. The cortex, medulla and renal pelvis were unable to be differentiated. Both radiographic and ultrasonographic findings were suggestive of polycystic kidney disease. Blood test revealed normochromic, normocytic anaemia with azotaemia whereas urinalysis findings were hypostenuria and proteinuria, consistent of chronic kidney disease due to polycystic kidney. Ultrasound is a useful antemortem diagnostic tool to diagnose polycystic kidney disease in cats.

Keywords: Polycystic kidney disease, Persian cat, Ultrasonography.

INTRODUCTION

Polycystic kidney disease (PKD) is an inherited disorder characterised by more than one fluid-filled cysts found in the kidney (Eaton *et al*., 1997). Humans, cats especially Persians and Persian-related breeds, and dogs were reported to be affected with PKD (Chalifoux *et al*., 1982; Biller *et al.,* 1996; Eaton *et al*., 1997; Igarashi *et al.,* 2002). These cysts tend to multiply in numbers and grow in size over time, causing progressive deterioration of kidney tissue and often leads to potentially fatal kidney failure (Wills *et al*., 2005). To date, development of these cysts in the kidney has been associated to genetic anomaly that is evident primarily in Persian cats. Autosomal dominant polycystic kidney disease (ADPKD) has been identified as an inherited form in Persian cats (Cooper *et al.,* 2000). This article focuses on the importance of diagnostic work up mainly, ultrasonography, for the diagnosis of polycystic kidney disease and the treatment regime.

CASE REPORT

A 6-year-old intact male Persian cat was presented to University Veterinary Hospital, Universiti Putra Malaysia (UVH-UPM) for the primary complaint of inappetence and weight loss. Cat was previously diagnosed with urolithiasis and kidney disease about two years ago. The definitive diagnosis of kidney disease was not investigated.

Physical examination revealed normal temperature and normal pulse rate but the cat had an increased respiratory rate of 48 breaths per minutes (tachypneic).

The cat was 7% dehydrated with pale mucous membrane and the capillary refill time was less than 2 seconds. Halitosis was noted. Upon palpation of the abdomen, the cat has a small flaccid and compressible urinary bladder of about 2 cm in size and diluted urine was collected upon manual bladder compression. The kidneys were bilateral enlarged with irregular surfaces but were not painful upon palpation. Polydipsia and polyuria were observed during hospitalisation. The differential diagnoses at this point of time were polycystic kidney disease, neoplasia such as lymphoma, pseudonephritic cyst, renal hematoma, and renal abscess. Diagnostic work-up carried out were complete blood count and serum biochemistry, urinalysis, abdominal radiography and ultrasonography.

Complete blood count (Table 1) on day-1 revealed low normal packed cell volume (PCV) with elevated plasma protein which was consistent with the physical examination findings of dehydration. Serum biochemistry findings (Table 2) were hypochloremia, hyperphosphataemia, azotaemia (elevated blood urea nitrogen and creatinine concentrations) and elevated globulin concentrations. After five days of fluid therapy to correct the dehydration and for the purposes of diuresis, the chloride and inorganic phosphate level were back to normal but the cat were hypokalaemic and hypocalcaemic. The urea and blood urea nitrogen level were persistently high despite of slight reduction compared to day-1.

Urinalysis on day-1 revealed urine with specific gravity of 1.010 despite the dehydration. Findings indicated that the kidneys were unable to concentrate urine probably due to impaired renal tubular function. Urine protein and creatinine ratio of 4.8 (<0.5) revealed evidence of proteinuria, suggestive of protein-losing nephropathy and glomerular disease such as glomerulonephritis and glomerular basement membrane damage (Villiers and Blackwood, 2005).

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Table 1. Complete blood count results on Day-1 (prior to treatment) and Day-5 post hospitalisation.

Complete blood count	Day-1	Day-5	Normal range
PCV (L/L)	0.27	0.18	0.24-0.45
Plasma protein (g/L)	98.0	75.0	60.0-80.0
Reticulocytes (/100RBC)	0.1	-	0.5-1.5
Erythrocytes (x10^{12}/L)	5.6	-	5.0-10.0
Haemoglobin (g/L)	95.9	-	80.0-150.0
MCV (fL)	48.0	-	39.0-55.0
MCHC (g/L)	355.0	-	300.0-360.0
WBC (x 10^9/L)	11.9	-	5.5-19.5

Day-1, first day of admission prior to treatment; Day-5, day-5 post hospitalisation; PCV, packed cell volume; RBC, red blood cells; MCV, mean corpuscular volume; MCHC, mean corpuscular haemoglobin concentration; WBC, white blood cells; L/L, litre per litre; g/L, gram per litre; fL, femtolitre.

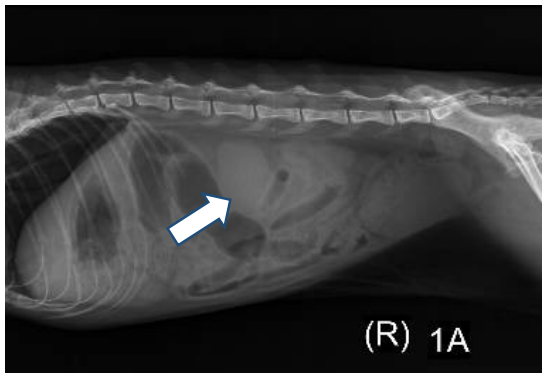
Table2. Serum biochemistry on Day-1 (prior to treatment) and Day-5 post hospitalisation.

Serum biochemistry	Day-1	Day-5	Normal range
Sodium(mmol/L)	148.9	151.2	146.0-156.0
Potassium (mmol/L)	3.9	3.5	3.9-5.5
Chloride (mmol/L)	105.1	112.2	110.0-132.0
Calcium (mmol/L)	-	1.8	2.2-2.9
Inorganic Phosphate (mmol/L)	3.9	2.6	1.1-2.8
Urea (mmol/L)	72.9	44.5	3.0-10.0
Creatinine (µmol/L)	749.0	522.0	60.0-193.0
Total Protein (Serum) (g/L)	77.2	-	55.0-75.0
Albumin (g/L)	31.0	-	25.0-40.0
Globulin (g/L)	46.2	-	25.0-45.0
A:G ratio	0.7	-	0.5-1.4

Day-1, first day of admission prior to treatment; Day-5, day-5post hospitalisation; mmol/L, millimol per litre; µmol/L, micromol per litre; g/L, gram per litre.

Radiographic findings (Figure 1) showed bilaterally enlarged kidneys with the measured width three times the width of the second lumbar vertebrae indicating renomegaly. Ultrasonographic findings (Figure 2) revealed mutiple anaechoic structures within the renal parenchyma suggestive of cysts and poorly differentiated structure of the cortex, medulla, and renal pelvis. Approximately, there were 19 and 18 cysts of various sizes in the left and right kidney, respectively of various sizes. Approximately 50% of the renal parenchyma was estimated to be affected in both kidneys. Combination findings from all the diagnostic work-outs concluded that the cat had chronic kidney disease Stage IV (IRIS, 2013) due to polycystic kidney disease.

The cat was managed as a chronic kidney disease Stage IV patient throughout hospitalisation. As



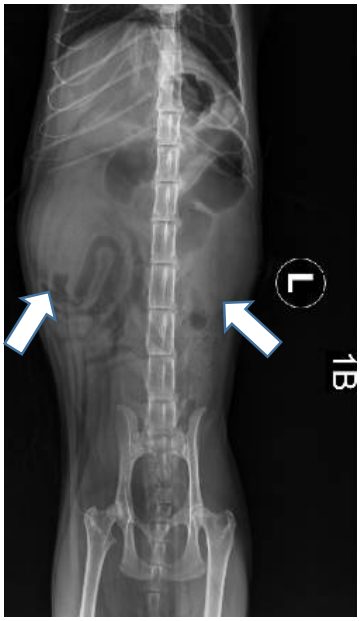


Figure 1. (Top and left) Abdominal radiograph revealed bilateral enlarged kidney suggestive of renomegaly.

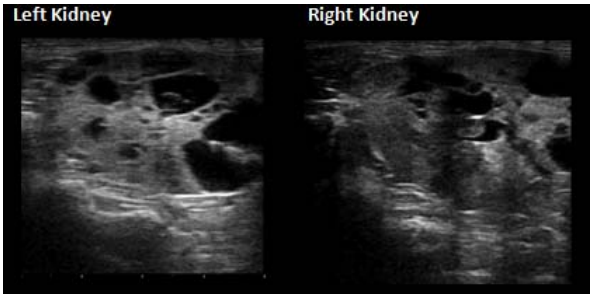


Figure 2. Ultrasonography images of left and right kidneys revealed multiple anechoic cysts in renal parenchyma.

hypokalaemia was present on day-5 of hospitalisation, potassium chloride was supplemented to the fluid therapy. Ipakitine (Vetoquinol, United Kingdom) at the dosage of 1 g/ 5 kg PO BID was added in food which acted as a phosphate binder for hyperphosphatemia. Ornipural (Vetoquinol, United Kingdom), a liver protectant was administered at the dosage of 1 ml/cat IV BID to prevent hepatic lipidosis, and vitamin B complex (Pharmaniaga, Malaysia) as an appetite stimulant was administered as the cat was inappetent. Additionally, a/d® Canine/Feline

Critical Care (Hill's® Prescription Diet®, Hill's Pets Nutrition, United States) was fed to maintain adequate calories intake of the cat. The prognosis of the cat was poor to guarded. On day-6 of hospitalisation, the owner opted to stop treatment and the cat was discharged.

DISCUSSION

PKD is a genetic disease that affects the kidney. It is a genetic disease which leads to the development of multiple cysts in the kidneys. PKD in Persians was identified as an autosomal dominant polycystic kidney disease (ADPKD). According to the Mendelian inheritance, autosomal dominant is one of several ways a trait or disorder can be passed down through families, where dominant conditions are expressed in individuals who have just one copy of the mutant allele (Genetic Alliance, 2010). Hence, in an autosomal dominant disease, the cat can inherit the abnormal gene from only one parent. Approximately 37% of Persian cats are affected with PKD according to the Cat Fanciers' Association registration published in 2004.

Lyons (2004) discovered a stop mutation at gene PKD1 in cats diagnosed with PKD. In human, most ADPKD arise from mutations in PKD1, encoding polycystin-1 (PC1), leading to deregulated renal cell growth, loss of epithelial cell polarity and fibrosis. Development of ADPKD is associated with the elevated activity of numerous signalling proteins that control proliferation and cell-environment interactions. This leads to erroneous tubulogenesis in the kidney. At the early stage, microcysts are hard to be noticed with naked eyes. As the patient ages, more and/or bigger cysts will be formed causing the kidney function to be compromised and eventually leads to renal failure and chronic kidney disease (Lyons *et al.*, 2004).

PKD cats diagnosed with kidney disease are commonly presented with the combination of clinical signs such as polyuria, polydipsia, inappetence, weight loss, nausea, vomiting, and lethargy (Eaton *et al*., 1997). However, not all PKD cats have clinical signs suggestive of kidney disease. They can appear as normal healthy cats without azotaemia and often, renal cysts are an incidental findings during routine abdominal ultrasound for health screening (Wills *et al.,* 2009).

There is no gold standard test for the ante mortem diagnose of PKD. A confirmatory diagnosis can be made at post mortem (Wills *et al.,* 2009*)*. Therefore, ultrasonography is a practical way to diagnose PKD as it is the safe, readily available, and least invasive when compared to other diagnostic tests such as computed tomography and magnetic resonance imaging (Eaton *et al*., 1997; Denez *et al.,* 2008). The sensitivity of ultrasound scanning in the detection of PKD is up to 91% (Eaton *et al*., 1997).

Recently genetic testings for PKD1 gene has been developed to identify ADPKD in Persians and Persian-related breeds. Genetic testing is useful for confirmation of the gene mutation but unfortunately, it is not available in Malaysia. This genetic test cannot predict the severity of disease, therefore, does not allow monitoring of disease progression in affected cats (Wills *et al.*, 2009). Clinicians often depend on ultrasonography and blood profiles to monitor disease progression for each individual cat. Another setback of the genetic test is that a cat can be diagnosed with PKD but it is not associated with this ADPKD gene that is detected by the mentioned test as ADPKD is not the only possible cause of a cyst in a cat's kidney. Other genetic forms of PKD are seen in humans where they make up around 15% of cases (Torres and Harris, 2006). AD-PKD1 is the only form recognised in cats but there are suspicions that other forms occur; albeit much less commonly (Kappe *et al* 2005, Helps *et al*., 2007, Bonazzi *et al.,* 2009, Lee *et al.,* 2010). Kidney cysts can also occasionally form in cats secondary to other causes of chronic kidney disease; these are most likely in older cats (Norsworthy, 2003).

Ultrasound guided drainage of the cyst has been reported as treatment for cats diagnosed with PKD (Norsworthy *et al.*, 2003). This procedure is usually carried out if the patient have severe painful kidney due to the severely enlarged renal cyst (Norsworthy *et al.*, 2003). Often PKD cats develop chronic kidney disease and are managed with the combination of diet control, fluid, and supportive therapy. Latest studies of signaling pathways in primary cilium of the epithelial cells composing the renal tubules that are perturbed in PKD have identified potential targets for pharmacological therapy (Patel *et al.,* 2009). Drugs that have shown efficacy in preclinical studies utilising orthologous animal models of PKD include tolvaptan, octreotide, src inhibitors, CFTR inhibitors, pioglitazone, etanercept, and triptolide. These drugs are currently being evaluated in humans (Patel, 2009) and have not been approved for clinical trial in cats.

CONCLUSION

PKD in Persian cats is a genetic disorder. As the renal cysts grow, the cat may develop chronic kidney disease. Screening before breeding is highly recommended. Any cat considered to be a possible carrier of the gene responsible for the disorder, especially a Persian cat must undergo a test to determine whether or not it is indeed harbouring the responsible gene. If it turns out that the cat is in fact carrying the gene, it must not be allowed to breed. However, this test is not available in Malaysia. The only practical way of prevention and control of the disease is screening via ultrasonography and cats diagnosed with PKD should not be bred.

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CONFLICT OF INTEREST

No conflict of interest.

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