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Polycystic Kidney Disease in Mongrel Puppy

Tae-Ho Oh[1], Hwa-Young Youn* and Hong-Ryul Han*

College of Veterinary Medicine, Kyungpook National University, Daegu 702-701, Korea
**College of Veterinary Medicine, Seoul National University, Seoul, Korea*

잡종견에서 발생한 다발성 낭종성 신증

오태호[1] · 윤화영* · 한홍율
경북대학교 수의과대학
*서울대학교 수의과대학

Abstract : Five-month-old a female mongrel puppy weighing 3.5 kg showed no systemic disorder and particular discomfort except abdominal distension at the first visit. On physical examination an irregular abdominal mass was palpated. One month later she was clumsy and uncoordinated. In addition, lethargy and anorexia were appeared. Then she became comatose and died in spite of initial therapy. In radiographic examination enlargement of both sides of kidney was observed. The hematological examination the dog had WBC of 16,250/μl, RBC of 7.2×10^6/μl, PCV of 32%, total protein of 8.0 g/dl, and fibrinogen of 900 mg/dl. In serum chemistry BUN was 87.4 mg/dl and creatinine was 5.1 mg/dl. Urinalysis revealed pH of 5.6, SG of 1.009 and protein of 500 mg/dl. In urine sediment test many RBCs, leukocytes, inflammatory cells and a few epithelial cells were observed. On histopathologic examination the size of right and left kidney were 15 cm, 16 cm in length, 6 cm, 6 cm in widths, respectively. Both sides of kidney were filled with brown-orange fluid and had irregular capsular surface. The cysts of various sizes were located throughout the cortex and medulla. No abnormality was found in any other organs. Histologically, cyst was lined by cuboidal to slightly flattened tubular epithelium and surrounded by mature fibrous connective tissue. Glomeruli, tubule and renal pelvis remained normal between cysts and exfoliated epithelial cells.

Key words **:** dog, kidney, polycystic disease, histopathology

Introduction

Polycystic kidney disease has been seen in most domestic animals. In certain breeds, e.g. Cairn terrier[10], West Highland terrier[9], Bull terrier[11] and Persian cats, it is a congenital renal disease. Especially in Persian cats and Bull terrier this disease is an autosomal dominant[3]. Although it occurs much less than the acquired renal disorders do, congenital kidney diseases are the frequent causes of renal failure in dogs. Although various chemicals have been reported to induce renal cysts in laboratory animals, corticosteroids and diphenylamine are the ones, which induce renal cysts most often[2]. Renal cysts involving one or both kidneys have been reported in dogs, swine, mice, rabbits, rats, and cats, and other species[3]. Since polycystic kidney disease has occurred in many breeds, especially in bull terrier recently, clinicians are required to be aware of the clinical and pathological features of the disease and methods of diagnosis. We report herein the occurrence of renal cysts in mixed breed puppy.

[1]Corresponding author.
E-mail : thoh@knu.ac.kr

Case Report

Six-month-old, female mixed breed puppy was presented with abdominal distension. In physical examination there was no systemic disorder and particular discomfort at first visit except abdominal distension. At that time, she was appetent although there was an irregular abdominal mass palpated on physical examination.

After one month she became clumsy, uncoordinated, lethargy, anorexia, and fell in lethargy so she was brought in again. We performed plain radiography and angiography and found at that the both sides of kidney were enlarged. In hematological examination, leukocyte 16,250/μl, RBC 7.2×10^6/μl, PCV 32%, total protein 8.0 g/dl, and fibrinogen 900 mg/dl were observed. In serum chemistry BUN was elevated to 87.4 mg/dl and creatinine was 5.1 mg/dl. In urinalysis urine pH was 5.6, specific gravity was 1.009, and protein was 500 mg/dl. Many RBCs, leukocytes, inflammatory cells and a few epithelial cells were appeared on urine sedimentation test. We diagnosed acute renal failure and initiated therapy with 0.9% saline, broad-spectrum antibiotics, and electrolytes, especially potassium aggressively. However, the puppy died shortly thereafter. Radiography and

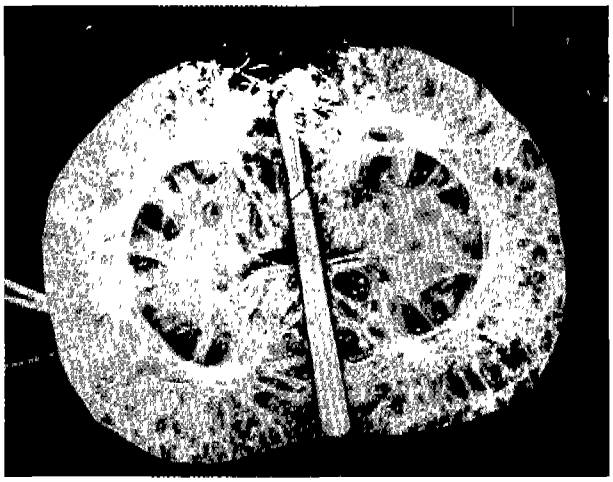

Fig 1. Sagittal section of a kidney from a dog with polycystic kidney disease showing multiple variable sized cysts in the cortex and medulla

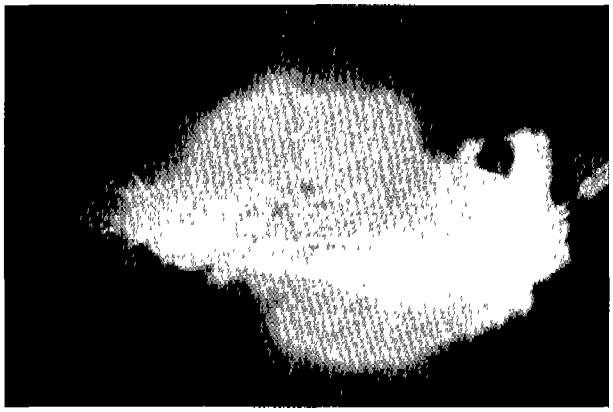

Fig 2. Radiographic image of a kidney from a dog with polycystic kidney disease. (VD view)

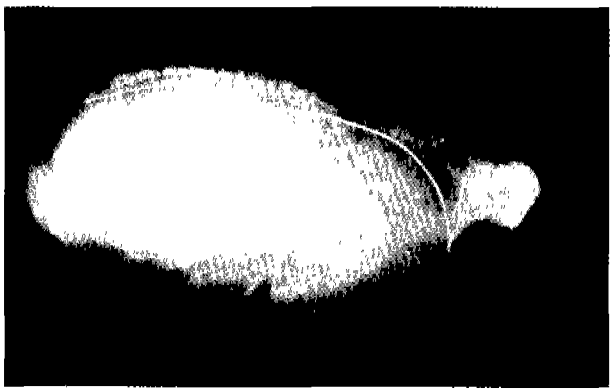

Fig 3. Radiography of a kidney from a dog with polycystic kidney disease (lateral view)

renal angiography revealed the enlargement of both sides of kidneys (Fig 2,3).

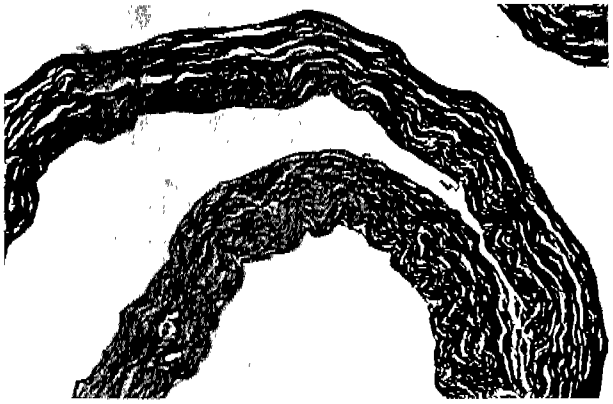

Fig 4. Histological section showing a multiloculated renal cyst with squamous lining, supported by a collagenous wall of varying thickness.

Fig 5. Histological section showing a renal cyst lined with a cuboidal and focally stratified lining. The cyst contains sloughed cells.

Gross necropsy findings included both sides of kidneys that were filled with brown-orange fluid. The capsular surface was irregular and the various sizes of cysts were observed throughout the cortex and medulla(Fig 1). Size of right kidney was 15 cm in length and 6 cm in width, and that of left kidney was 16 cm and 6 cm. No abnormality was found in any other organs.

Histopathologically, the kidney had cysts lined by cuboidal to slightly flattened tubular epithelium and surrounded by mature fibrous connective tissue. Glomeruli and tubules remained normal between cysts and exfoliated epithelial cells. Both sides of kidneys were equally and diffusely involved (Fig 4, 5).

Discussion

Cystic disease involving both the liver and the kidney was described in 1956 for the first time. Since then, polycystic disease has been subjected to clinical, genetic and pathological scrutiny but its classification still remains as a matter of

considerable discussion, controversy and confusion. Most authors agree that polycystic disease is an inheritable disorder that occurs in at least two different major types, which are involving both sides of kidney diffusely, an adult form and an infantile form with different modes of inheritance.

Genetic defect in ADPKD causes a cell or a small group of cells to begin to proliferate at a slow rate at discrete locations from the glomerulus to the collecting tubule in a small fraction of the nephron population. As these relatively undifferentiated epithelial cells proliferate, they balloon the lumen into a cyst that, as it grows, is likely to pinch off from the parent nephron. As the cyst expands, it impinges on neighboring nephrons and restructures the interstitial matrix. The defects in renal function that occur before the onset of renal failure are subtle in nature.

Glomerular filtration rate (GFR) of the patient with polycystic kidney disease may remain in the normal range long after cysts are discernable by radiological or sonographic techniques. Clearance of p-aminohippurate (PAH) and GFR may also remain in the normal range after development of hypertension, but the filtration fraction may be elevated[14]. However, the polycystic kidney disease patient with a normal GFR commonly exhibits a reduced urine concentrating ability[4,5].

Cysts can be divided into two categories: non-gradient or proximal cysts and gradient or distal cysts based primarily on the Na^+ concentration of their fluids as related to normal plasma values. Cyst fluid with a low concentration of Na^+ ion tends to have high concentration of K^+ and H^+ ions and low concentration of Cl^- ion, whereas the concentrations of these substances in non-gradient cysts drop to the approximate range, which can usually be seen in plasma[13]. In this case cystic fluid was tested by urine dipstick and results were same as voiding urine. We did not perform the analysis of cystic fluid for electrolytes, e.g. Na^+, K^+ but that were required to define the role of cystic epithelial cells in pathogenesis of this disease.

Diagnosis of polycystic kidney disease can be made by ultrasonography because of its high sensitivity, specificity and noninvasiveness. Ultrasonographically, cysts appear as smooth, round, focal anechoic structures with sharply marginated walls[5,8]. In case of end-stage polycystic kidney disease is diagnosed by necropsy. There is a report that there are difficulties in diagnosing early cases by renal ultrasonography or by renal biopsy in Autosomal dominant polycystic kidney disease[12]. Diagnostic criteria of autosomal dominant polycystic kidney disease is set up based on the presence of at least three cysts distributed throughout both sides of kidneys, and a family history of the disease which confirms cysts to be inherited rather than acquired during the patients lifetime. In the present case we had no familial history and the puppy had no experience of previous treatment. Therefore we couldnt find out the familial proof. However, hematology, serum chemistry, urinalysis, radiography and renal angiography played main role in diagnosing this case, and screened polycystic kidney disease.

Renal interstitial edema and cortical and medullary parenchymal inflammation have been observed in this case, and were thought to be associated with interaction of cysts with the renal parenchyma as in the case of ADPKD[6]. The high prevalence of pyelonehritis, renal fibrosis and renal cyst inflammation suggest that secondary bacterial urinary tract infection and renal disease are likely to occur in polycystic kidney disease.

Proteinuria is reported in human AD polycystic kidney disease, most commonly in the later stages of disease[1]. Severe proteinuria is associated with poor prognosis[1]. In patient with ADPKD, hematuria is often associated with more severe disease, and urinary tract infections are also common[6]. In this case increased numbers of red and white blood cells in the urine may result from polycystic kidney disease itself, or may reflect a higher prevalence of urinary tract inflammation as was observed histopathologically. Since we did not perform the microbiological test on urine, urine culture was required in the management of polycystic kidney disease.

For monitoring the signs of renal disease and urinary tract infections serial test of renal function, urinalysis, and renal ultrasonography may help to monitor disease progression. Azotemia, proteinuria and renal size, or the development of hematuria, are likely to be poor prognostic indicators. Early detection of this disease and prevention of complications may improve the quality and span of life for affected dogs.

Conclusions

Polycystic kidney disease is an inherited disease in dogs. Clinicians should be aware of this disease because of its high prevalence in some lines of show and breeding dogs, and breeders and owners should be encouraged to prevent breeding of affected animals and to promote breeding of dogs prescreened.

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