Case Report of Polycystic Kidney Disease in a Persian Cat in IPB University Veterinary Teaching Hospital

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ABSTRACT

A 7-year-old male Persian cat was referred to IPB University Veterinary Teaching Hospital with clinical signs of lethargy, weight loss, and loss of appetite and was diagnosed with nephrolithiasis before being referred to IPB University Veterinary Teaching Hospital. Physical examination revealed tachycardia, tachypnoea, pale mucous membrane, 5–6% dehydration rate, cachexia, and palpated masses on the left and right side of the abdominal region. The abdominal cavity was seen as more radiopaque, which resulted in some organs being invisible in the radiographic view. Abdominal ultrasonography showed abnormalities in the liver, gall bladder, and kidneys. The patient was diagnosed with polycystic kidney disease (PKD) with the prognosis of *infausta,* as the patient was already in a sternal recumbency and could not stand by himself. During hospitalization, the patient was force-fed with a commercial renal diet, and the medical treatments given were intravenous ceftriaxone, vitamins, furosemide, Azodyl®, and intravenous infusion. The patient regained standing ability and survived until the seventh day of hospitalization. However, the owner persisted in bringing the patient home on the seventh day of hospitalization, and the patient died the next day after being brought home.

Keyword: feline, polycystic kidney disease, Persian cat, ultrasonography

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INTRODUCTION

The Persian cat is one of the oldest cat breeds and is popular globally in the top five most numerous pedigree cat breeds. Persian cats are predisposed to urinary system diseases, including polycystic kidney disease (PKD), urolithiasis, and congenital defects affecting the bladder. Renal disease is one of the common causes of death in Persian cats (O'Neill *et al.,* 2019). However, Persian-derived exotic breeds such as British Shorthairs, Himalayas, and Scottish Folds can also be contracted by PKD (Guerra *et al.* 2019). Polycystic kidney disease (PKD) is an autosomal dominant hereditary disease with high prevalence in Persian and long-haired cats, and the afflicted gene is PKD1 (Tavasolian *et al.,* 2018; Guerra *et al.,* 2021; Schirrer *et al.*, 2021).

Feline PKD is characterized by multiple cysts formation in the unilateral or bilateral kidneys and occasionally in the liver and pancreas. The enlargement of these cysts leads to the development of chronic kidney disease (CKD). The formation and growth of cysts progress slowly, and renal function gradually deteriorates in PKD-affected cats (Sato *et al.,* 2019). According to genetic testing or ultrasonography, the prevalence of PKD in Persian cats ranges from 35 to 57 percent (Chew *et al.,* 2011). Nururrozi *et al.* (2021) reported clinical signs of PKD in Persian cats include subnormal body temperature (36.3 ^{o}C), slow skin turgor, pale mucous membranes, capillary refill time of more than 2 seconds, dehydration (8%), left submandibular lymphadenitis, rhonchi respiratory sound, halitosis, and hypersalivation. Guerra *et al.* (2020) also reported the symptoms of PKD as fatigue, cough, emaciation, dyspnea, cyanosis, exercise intolerance, syncope or pre-syncope, convulsion, and ascites. However, not all PKD cats exhibit clinical symptoms indicative of renal disease. They may look like healthy, normal cats without azotemia, and renal cysts are frequently discovered by accident during routine abdomen ultrasounds used for health screenings (Phoon *et al.* 2015). In addition, several neurological abnormalities have been documented in cats to cause multifocal syndrome. Mydriasis, non-responsiveness to consensual and direct pupillary reflexes to light, decreased level of consciousness, involuntary motor pedaling movement, sporadic thoracic limb stiffness, opisthotonos, lack of proprioceptive positioning, and lack of hopping ability are some neurological symptoms (Benedito *et al.* 2020). Ultrasonographic evidence can be found as early as six to eight weeks of age. Symptoms usually appear later in life and are progressive and permanent. Due to its insidious and late start, early detection using genetic techniques and ultrasonography is required to remove afflicted cats from breeding programs (Nivy *et al.* 2015).

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This report confirms the PKD in a male Persian cat's left and right kidneys through physical examination and ultrasonography with other laboratory results (hematology, blood biochemistry, and radiography). This report is the first case of PKD to be reported in IPB University Veterinary Teaching Hospital.

CASE HISTORY

A 7-year-old male Persian cat was brought to IPB University Veterinary Teaching Hospital on the 15th of May, 2023, with a history of lethargy, weight loss (1 kg of body weight in 4 months), and loss of appetite. The owner reported that the patient was diagnosed with nephrolithiasis four months before (January 2023) and was brought to IPB University Veterinary Teaching Hospital without further laboratory, radiography, or ultrasonography examination. During the IPB University Veterinary Teaching Hospital clinical examination, the patient's body weight was 2 kg. According to the owner's history, the patient's body weight during the last visit to the veterinarian in January 2023 was 3 kg. The patient's body condition scoring (BCS) was 1 (Scale 1–5). Physical examination revealed normothermic (38.4 °C), tachycardia (212 beats per minute (bpm), normal: 120–200 bpm), tachypnoea (44 bpm, normal: 20–30 bpm), pale mucous membrane, dehydration rate 5–6%, cachexia, and palpated masses on left and right side of the abdominal region that suspected to be the left and right kidneys. Due to suspected masses, the veterinarian suggested hematologic, blood biochemistry, radiography, and ultrasonography.

Radiographic examination results showed a bronchial pattern and interstitial pattern on the right caudal lobe of the lungs, a slightly radiolucent figure of the large intestine, and more radiopaque of the abdominal cavity, which resulted in some organs were invisible on radiographic view seen in the abdominal radiography. Based on radiographical findings, differential diagnoses are mild bronchopneumonia, ascites, and peritonitis (Figure 1A and Figure 1B).

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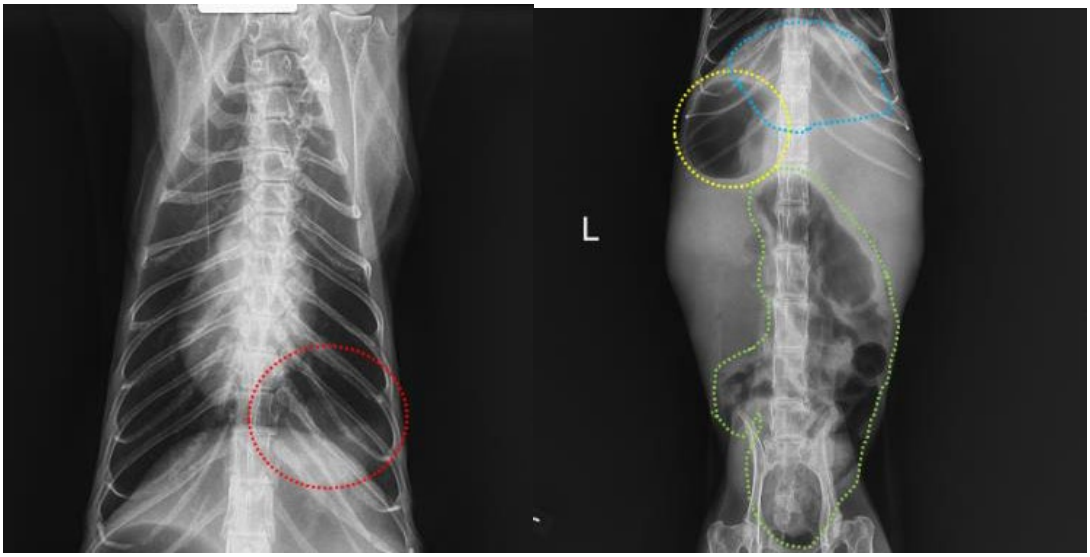

A **B**

Figure 1. Radiographical findings. (A) Radiography of thoracic region: bronchial pattern and interstitial pattern on the right caudal lobe of lungs (yellow). (B) Radiography of abdominal region: ascites were seen on the abdominal cavity (purple: stomach; red: liver; blue: large intestine).

Hematological findings revealed hypochromic microcytic anemia with low hemoglobin (5.6 g/Dl; normal range 9.3–15.3 g/Dl), hematocrit (17.1%; normal range 28.0–49.0%), mean corpuscular volume (MCV) (35.8 Fl; normal range 39.0–52.0 Fl) and mean corpuscular hemoglobin (MCH) (11.6 pg; normal range 13.0–21.0 pg). Thrombocythemia (729×10^3/µL; normal range 100–514×10^3/µL), granulocytosis (15.3×10^3/µL; normal range 2.1–15.0×10^3/µL), lymphopenia (9.7%; normal range 12.0–45.0%), and monocytosis (9.1%; normal range 2.0–9.0%) were shown in hematology examination. Blood biochemistry count revealed hyperproteinemia (8.5 g/Dl; normal range 5.4–8.2 g/Dl), hyperglycemia (194 mg/Dl; normal range 70–150 mg/Dl), azotemia (128 mg/Dl; normal range 10–30 mg/Dl), and hypercreatinemia (3.8 mg/Dl; normal range 0.3–2.1 mg/Dl).

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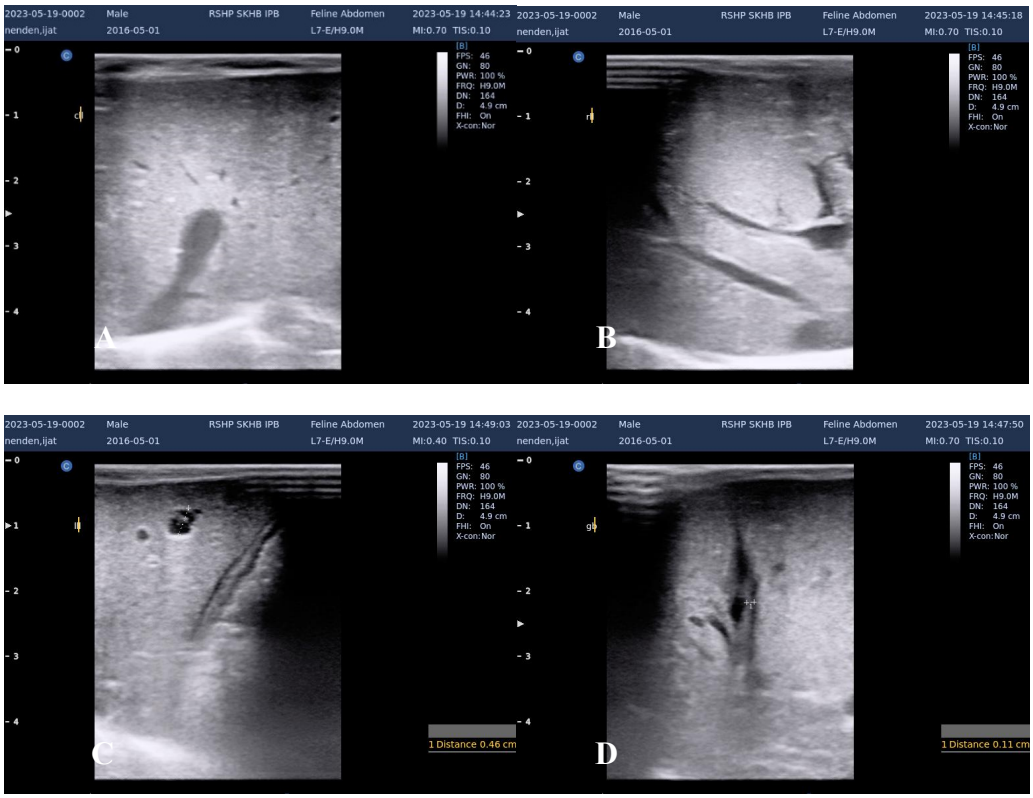

Figure 2. Liver ultrasonography: (A) caudate liver lobe was hypoechoic to hyperechoic with inhomogeneous texture, (B) right liver lobe was seen with a distended portal vein and hepatic vein, (C) hepatic cyst (diameter 4.6 mm) was seen in left liver lobe, (D) gall bladder was constricted with no bile found.

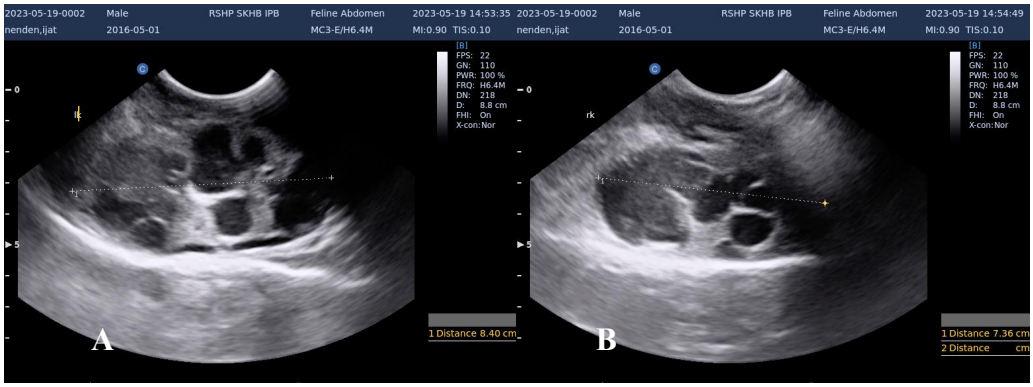

Figure 3. Renal ultrasonography revealed hyperechoic and hypoechoic polycystic were seen on the renal cortex on (A) the left kidney (diameter 8.04 cm) and (B) the right kidney (diameter 7.36 cm). Polycystic kidney disease was concluded as a diagnosis based on renal ultrasonography findings.

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Abdominal ultrasonography was performed on the patient. The caudate liver lobe was hypoechoic to hyperechoic with an inhomogeneous texture. The right liver lobe and left liver lobe were hypoechoic with homogeneous texture. The portal vein and hepatic vein were distended. Ascites and anechoic fluid accumulation with irregular walls (diameter 4.6 cm) were seen on ultrasonography. Hepatocytes began to undergo fibrosis. The diameter of the gall bladder wall was 0.11 mm (normal ≤ 1 mm). The gall bladder began to constrict with nearly no bile found. Hepatic congestion, ascites, hepatic fibrosis, and suspicion of the hepatic cyst were concluded as differential diagnoses based on liver and gall bladder ultrasonography.

Hyperechoic and hypoechoic polycystic were found on the renal cortex of both kidneys with length dimensions of cyst 7.36 cm (right kidney) and 8.04 cm (left kidney). The length dimension of the left kidney was 10.85 cm, with a normal range of length dimension of 3.0–4.3 cm. Anechoic cysts and hypoechoic mass were also found on both kidneys. Polycystic kidney disease was concluded as a diagnosis based on renal ultrasonography.

The patient was hospitalized for seven days and was treated with ceftriaxone sodium 25 mg/kg SID, Hematodin© (Romindo) 1 Ml SID, Biodin© (Romindo) 1 Ml SID, Azodyl© 25 mg/kg BID, furosemide 0.2 cc SID. The patient was given an intravenous infusion with ringer Lactate, but after being diagnosed with Polycystic kidney disease, the infusion was changed into normal saline (NaCl 0.9%). The patient was fed with Royal Canin© Recovery and was continued with Royal Canin© Renal for cats. During hospitalization, the patient's rectal temperature fluctuated between normal (38.0–38.5 °C) and subnormal (36.2–37.9 °C). The patient was given a heating pad to stabilize the temperature when the temperature was in subnormal conditions. The patient gained 0.68 kg of body weight within five days of hospitalization. The total days of hospitalization were seven days (15th of May 2023–21st of May 2023). The prognosis of the disease is *infausta* because of the report by the owner that before coming to IPB Veterinary Teaching Hospital, the owner was suggested by the other veterinarian about the possibility of a urinary tract problem. Still, the owner did not bring the patient for further laboratory or imaging diagnostics. in addition, the age of the cat is six years.

DISCUSSIONS

Polycystic kidney disease (PKD) is among the most frequent causes of death in Persian cats (Vucicevic *et al.* 2016). PKD is an autosomal dominant disorder with variable penetrance, and the afflicted gene is PKD1 (Tavasolian *et al.,* 2018; Guerra *et al.,* 2021). The

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condition is progressive and characterized by the formation of fluid-filled cysts of different sizes (one to more than one millimeter) in the renal cortex and medulla and occasionally in the liver, pancreas, and spleen (Scalon *et al.,* 2014; Vucicevic *et al.,* 2016; Guerra *et al.,* 2021). The development of renal cysts has been associated with a genetic anomaly that is evident primarily in Persian cats and secondary to other clinical circumstances, such as obstruction due to nephrolithiasis, lymphoma, and chronic kidney disease with interstitial nephritis (Phoon *et al.*, 2015; Guerra *et al,* 2019).

Cysts are present from birth but are smaller in younger cats. Clinical signs manifest in older animals because the growth of cysts increases pressure on renal parenchyma, leading to renal insufficiency (Vucicevic *et al.,* 2016). Asymptomatic cats shall be assessed on their general status and renal function by monitoring hematological and biochemical parameters such as urea, creatinine, and phosphorus (Vucicevic *et al.* 2016). Cats with PKD diagnosed with kidney disease commonly present with clinical signs such as polyuria, polydipsia, inappetence, weight loss, nausea, vomiting, and lethargy (Phoon *et al.*, 2015). In cats with PKD, more than 70% of kidneys are no longer functional (Vucicevic *et al.* 2016).

Clinical signs of PKD are not pathognomonic as it manifests as chronic renal failure. The average onset of clinical symptoms is seven years, but they can appear between 3–10 years. Hematological and biochemistry findings are not specific, mainly indicating renal failures, such as anemia, azotemia, and remarkably high creatinine concentration (Schirrer *et al.,* 2021). The progressive development of PKD depends on individual cats; kittens with severe cyst involvement may die at eight weeks due to kidney failure. PKD is one of the causes of the development of CKD in cats, which causes deterioration of glomerular filtration rate and metabolic waste excretion (Lam *et al.,* 2020). In this study, the veterinarian observed irregular contours and increased volume of both left and right kidneys on palpation. Chew *et al.* (2011) state that an enlarged kidney indicates intrinsic renal failure, neoplasia, PKD, or hydronephrosis. In addition, the present case showed that the patient was cachexia due to weight loss, with the patient's body condition scoring (BCS) being 1 (Scale 1–5). Cats with CKD often exhibit a reduced appetite and weight loss (Hall *et al.* 2019). In addition, the present study showed that pale mucous membranes and general dehydration were observed during clinical examination, as reported previously by Nururrozi *et al.* (2021).

Further, indicative diagnostics of PKD used in this case study were diagnostic imaging, namely X-ray and ultrasonography. However, radiography showed radiopacity of all the abdominal cavity that caused some

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organs inside the abdomen, including kidneys, to be invisible. Therefore, the radiographic differential diagnosis was ascites and/or peritonitis. In addition, the sonogram showed hypoechoic and hyperechoic polycystic on the renal cortex of both kidneys. The length dimensions of the cyst were 7.36 cm (right kidney) and 8.04 cm (left kidney). The length dimension of the left kidney was 10.85 cm. According to this ultrasonographic measurement, both kidneys are more than the normal size of the kidney in cats, 3–4.3 cm (Martinez *et al.*, 2022), with a rough kidney surface. Ultrasonography examination is a valuable and reliable ante mortem diagnostic method for diagnosing PKD in cats (Phoon *et al.*, 2015). The kidneys of cats affected by PKD display numerous hypoechoic to anechoic cysts that are round or oval and are well differentiated from renal parenchyma (Lee *et al.*, 2010). Although renal cysts in PKD are detected easily by ultrasonography, hydronephrosis with dilated renal pelvis or renal cysts formed by dilation of urinary tubules in late-stage chronic nephritis can be mistaken as cysts of PKD (Sato *et al.*, 2019). The sensitivity and specificity of ultrasonography for cyst detection are 91% and 100% at 36 weeks (Guerra *et al.*, 2021). Drainage of infected renal cysts is frequently required to improve symptoms when they are large enough to obstruct proper medication penetration (Nivy *et al.*, 2015). However, this procedure was not conducted because the cat owner asked to bring the patient home after seven days of hospitalization. Another study found that clinical indications of PKD in cats improved after draining the cyst and administering systemic antibiotics (Nivy *et al.*, 2015).

Curative treatment of PKD in cats does not exist; however, PKD clinical signs in cats can be treated with palliative therapy (Schirrer *et al.*, 2021). Examples of palliative treatment in feline PKD include fluid therapy, furosemide, and analgesics. In the current case study, treatment of PKD in cats, the antibiotic ceftriaxone sodium 25 mg/kg SID, vitamins (Hematodin© (Romindo) 1 mL SID and Biodin© (Romindo) 1 mL SID), and furosemide 0.2 cc SID. Ceftriaxone is an antibiotic from the Cephalosporins group that can treat cats with chronic kidney disease (De Santis *et al.*, 2022). Ceftriaxone can be used for cats through intravenous, intramuscular, or subcutaneous routes with a recommended 25 mg/kg (Albarellos, Kreil, and Landoni, 2007). Furosemide was given as a diuretic with a 1 mg/kg dose through the SC route for ascites treatment (Plumb 2008). Azodyl® 25 mg/kg BID was administered. Azodyl® is a brand name for a probiotic supplement intended to maintain kidney health in renal-diseased cats and dogs. The patient was given an intravenous infusion with a lactated ringer, but after being diagnosed with polycystic kidney disease through ultrasonography, the

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infusion was changed into normal saline (NaCl 0.9%). The use of lactated ringer infusion for a British Shorthair cat that was hospitalized due to PKD has been reported before (Nivy *et al*., 2015).

Persian and Persian-related cats with PKD are characterized by renal, hepatic, and pancreatic cysts that could culminate in chronic renal failure (Noori *et al*., 2019). The hepatic cyst is an extrarenal manifestation in a few PKD cases. Pathological analysis of hepatic cysts in feline PKD shows that the cysts are lined with flattened epithelial cells and are not associated with hepatobiliary lesions (Sato *et al*., 2019). The stage of PKD could not be related to the formation of hepatic cysts, although some studies reported cases of related hepatic fibrosis in cats with PKD (Schirrer *et al*., 2021). Hepatic fibrosis is reported in 22–48% of cats with PKD with an age range of 1–14 years. The congenital biliary cystic lesion is associated with PKD in most cats (Guerra *et al*., 2015).

This case study, however, has limitations. Firstly, the patient's prognosis is infausta because it is a terminal disease, and no treatment can cure it. The treatment that can be given to PKD-affected cats is palliative therapy. In addition, when coming to the IPB University Veterinary Teaching Hospital, the patient's condition was already terrible, namely sternal recumbency. According to the history, the patient did not want to eat for weeks, so the patient's nutritional adequacy was not fulfilled. As a result, the patient also experienced a significant reduction in body weight of 1 kg within five months. In addition, the owner did not bring the patient for further diagnostics even though the veterinarian at the previous clinic five months before the hospital clinic had directed the owner to carry out laboratory or imaging examinations. Secondly, the result of the physical examination revealed renomegaly in both the right and left kidneys; however, the kidney size was not readily visible on an X-ray. Also, the owner's permission is required before further ultrasound examinations can be performed. Thirdly, the patient was forced to go home at the owner's request so that the patient's condition was not observed during treatment at home. The patient also died the day after returning home from the IPB University Veterinary Teaching Hospital. Lastly, feline PKD has been said to be frequent among Persian cats, although scientific publications on PKD cases in Indonesia are scarce. There is no gold standard test for PKD pre-mortem diagnosis. In this case study, the confirmation of feline PKD with necropsy or molecular tests was not performed. Necropsy was not carried out as the patient died at the owner's home. Even though ultrasound is only a screening tool, the gold standard for PKD diagnosis is an anatomical pathology examination and/or

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histopathological examination, which could not be performed in this study because the patient had already gone home and died one day later, as the owner reported to the IPB University Veterinary Teaching Hospital. In addition, in Indonesia, the diagnosis of feline PKD with molecular techniques is not yet available. Molecular diagnosis application is relatively expensive to implement in the veterinary daily clinic or hospital for owners with a limited budget. In this case, ultrasonography has proven to be the most lucrative imaging technique for evaluating renal phenotypic in potentially affected animals.

APPROVAL OF ETHICAL COMMISSION

This case report did not need ethical clearance as the study was conducted according to the medical records of IPB University Veterinary Teaching Hospital. Data of medical records, physical examinations, and laboratory diagnostics, including hematology, blood chemistry, radiography, and ultrasonography, were performed by certified veterinarians or under the supervision of certified veterinarians.

CONCLUSION

This report confirms the PKD in a male Persian cat's left and right kidneys through physical examination and ultrasonography with other laboratory results (hematology, blood biochemistry, and radiography). PKD is a genetic disease primarily evident in Persian and Persian-related cats. Polycystic kidney disease is characterized by the formation of cysts of different sizes in the renal cortex and medulla and occasionally in the liver, pancreas, and spleen. Ultrasonography is considered a reliable method for diagnosing polycystic kidney disease. The kidneys of cats affected by polycystic kidney disease display numerous hypoechoic to anechoic cysts that are round or oval and well differentiated from the renal parenchyma. Hypochromic microcytic anemia, azotemia, and elevated serum creatinine were marked as laboratory findings in this case. The differential diagnosis for this current case is chronic kidney disease, hepatic fibrosis, hepatic cyst, and renal cyst. PKD-positive cats should not be bred.

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