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Imaging findings of renal telangiectasia in a Maltese dog

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Abstract: A 13-year-old neutered male Maltese dog presented with a three-month history of haematuria. The abdominal ultrasound and computed tomography revealed a large, multifocally-calcified left renal mass that was disrupting most of the renal parenchyma. Most of the areas of this mass did not show any contrast enhancement on the CT. After a nephrectomy, renal telangiectasia was diagnosed on the histopathology. Renal telangiectasia is a hereditary dysplastic blood vessel disease only previously reported in Pembroke Welsh Corgi. This is the first diagnostic imaging report of renal telangiectasia and the first report in a Maltese. Renal telangiectasia should be considered for the differential diagnosis of destructive renal masses with faint or no contrast enhancement on a CT, even in cases of unilateral renal involvement in Maltese dogs or those in non-corgi breeds.

Keywords: canine; computed tomography; non-corgi breed; renal mass

The term renal telangiectasia was first used in 1983 in the field of veterinary medicine to differentiate it from renal haemangioma. Renal telangiectasia is defined as a rare dysplastic blood vessel disease in dogs (Moore and Thorton 1983). A similar haemangiomatous disease in humans is hereditary haemorrhagic telangiectasia characterised as an autosomal dominant, multi-systemic disorder of angiogenesis with severe and recurrent haemorrhaging (Sadick et al. 2005). Renal telangiectasia in dogs is also thought to be a genetic disorder, and, up to this point, has only been reported in Pembroke Welsh Corgis. In a previous report on Pembroke Welsh Corgis, the histopathological features of renal telangiectasia were described in detail, but diagnostic imaging was limited to radiographs only (Moore and Thorton 1983).

To the best of our knowledge, this article represents the first case report of renal telangiectasia in a Maltese and is the first to describe the diagnostic imaging findings with radiographs, ultrasonography, and computed tomography (CT).

Case description

A 13-year-old neutered male Maltese dog presented with a history of haematuria for three months. There was no prior history of urinary disorders, and the owner had not seen stranguria or dysuria. The patient was alert at presentation, and there were no significant findings on the physical examination other than the marked, continuous haematuria when pressure was applied to the ab-

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domen. The complete blood count tests were unremarkable and a serum chemistry panel revealed elevated blood urea nitrogen (570 mg/l; reference range, 70–270 mg/l) and lactate (32.9 mg/l; reference range, 5–25 mg/l). The urine stick test was not readable due to an excess of red blood cells in the sample.

Thoracic and abdominal radiographs were acquired (AccuRay-603R; DK Medical Systems, Seoul, Republic of Korea). On the abdominal radiograph, an irregularly shaped, soft tissue opacity in the left upper abdomen was suspected to be associated with the left kidney. A multifocal bone opacity material was sporadically distributed at the caudal portion of the mass. The contour of the right kidney was unclear to evaluate (Figure 1). No significant findings were observed on the thoracic radiographs.

An abdominal ultrasound was performed (Prosound F75; Hitachi Aloka Medical, Tokyo, Japan) with a linear array (10–13 MHz). A large, left-side renal mass with a heterogeneous echo pattern and multifocal mineralisation was visualised. The size measurement of the renal mass was confounded by its amorphous shape and poor distinction from the normal renal tissue. Anechoic fluid had accumulated in the renal pelvic region. Renal degeneration of the right kidney, multiple septated anechoic hepatic cysts, and prostatomegaly with small-sized cysts were detected (Figure 2A–2C).

Subsequent thoracic and abdominal CT images were acquired using a 32-slice CT scanner without contrast (Alexion; Toshiba Medical Systems, Ohtawara, Japan). The patient was positioned in ventral recumbency on the CT table under general anaesthesia. The CT technical parameters were as follows: 120 kV, 150 mA, a 1.0 mm slice thickness, and a 0.75 s rotation time. All the CT data were reconstructed as cross-sectional in the transverse, sagittal, and dorsal planes at 3 mm slice thickness. Contrast studies were then performed with the intravenous administration of iohexol (600 mg/kg; Omnipaque 300; GE Healthcare, Cork, Ireland) for 20 s using an autoinjector (Medrad®; Bayer HealthCare LLC, Whippany, USA). Three-phase post-contrast CT images were acquired 20, 30, and 90 s after injection. The left renal mass (5.1 × 5.4 × 5.9 cm) was irregularly marginated and isoattenuating (46 HU) originating from the cranial renal pole with parenchymal mineralisation in the caudal part of the mass. The mass occupied most of

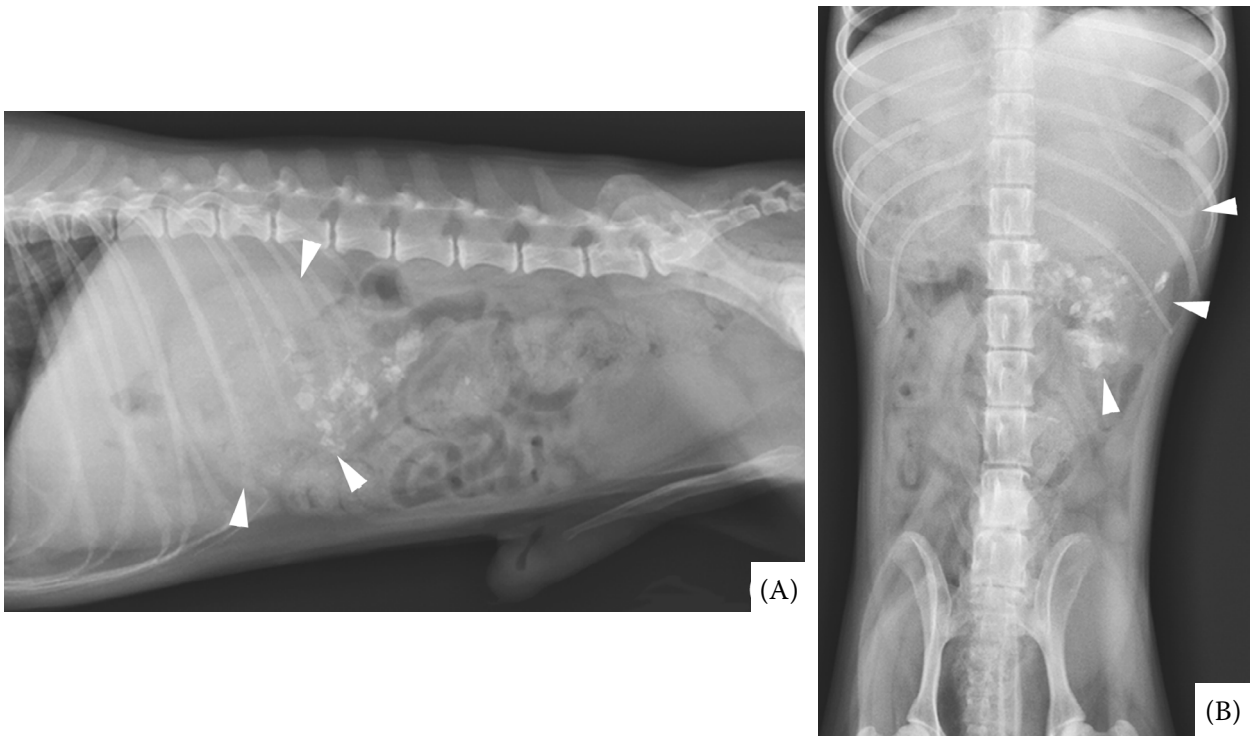

Figure 1. Right lateral (A) and ventrodorsal (B) abdominal radiographs. A well-defined, irregularly shaped, soft tissue mass (arrowheads) is visualised in the left upper abdomen. Multifocal bone opacity material is sporadically distributed at the caudal portion of the mass. Prostatomegaly and sacralisation of the seventh lumbar vertebrae are also observed

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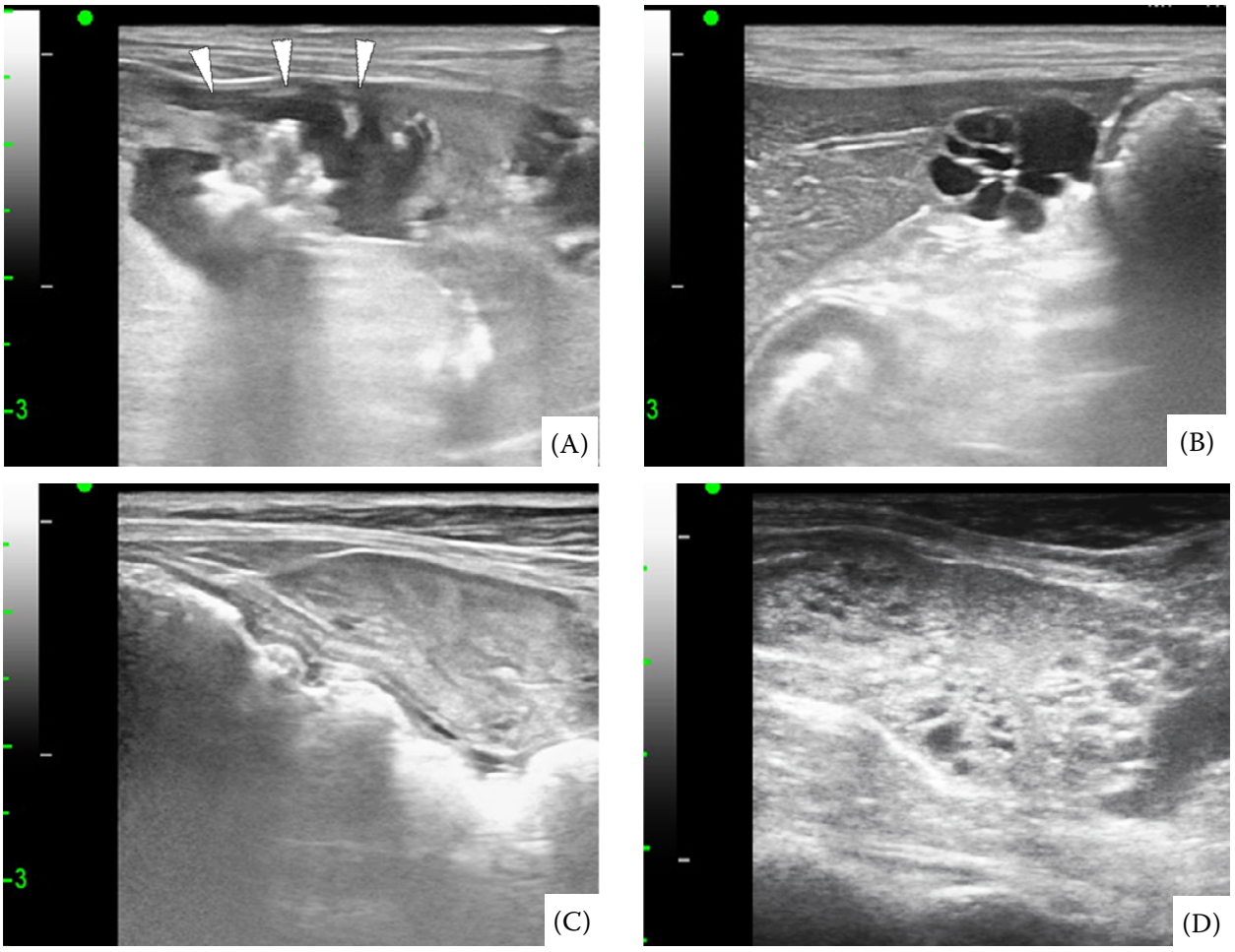

Figure 2. Ultrasonographic image of the renal mass (A), hepatic cysts (B), prostate at presentation (C), and prostate one year after the nephrectomy (D). The normal renal structure is disrupted, and the renal mass contains multifocal mineralisation and anechoic fluid (arrowheads) in the pelvic region (A). Septated anechoic hepatic cysts are shown (B). Small-sized prostatic cysts at presentation (C) is changed to multiple newly formed, spoke-wheels shaped prostatic cysts one year after nephrectomy (D)

the renal parenchyma and had invaded the left proximal ureter. Most of the renal mass was not contrast-enhanced, but the vessel and slight ring enhancement was shown (Figure 3). There was no apparent evidence of a pulmonary metastasis or regional lymphadenopathy. Multiple hepatic cysts (Figure 3) and prostatomegaly were detected.

From the above haematuria and diagnostic imaging findings, a malignant renal tumour was at the top of the list of differential diagnoses, but differentiating the subtype of the renal tumour was not possible on the CT.

After obtaining the owner's consent, the dog underwent a nephrectomy of the left kidney. Cefazolin (20 mg/kg, Cefozol; Hankook Korus Pharm Co., Seoul, Republic of Korea) and meloxicam (0.2 mg/kg, Metacam; Boehringer Ingelheim, Ingelheim, Germany) were administered intravenously for prophylaxis and analgesia. Anaesthesia was induced with propofol and maintained with isoflurane (Ifran®; Hana Pharm., Seoul, Republic of Korea) and the dog was positioned in a dorsal recumbency. After routine preparation of the abdomen for aseptic surgery, a ventral midline incision was made. Upon surgery, the left kidney was easily separated from the peritoneum. Overall, the left kidney was enlarged and well-capsulised without any peritoneal adherence containing an irregularly marginated brownish cranial pole.

Using a vascular clip, the kidney with capsule and ureter were removed together. Closure of the surgical wound was performed in a routine fashion. The dog was hospitalised for 5 days for postoperative observation.

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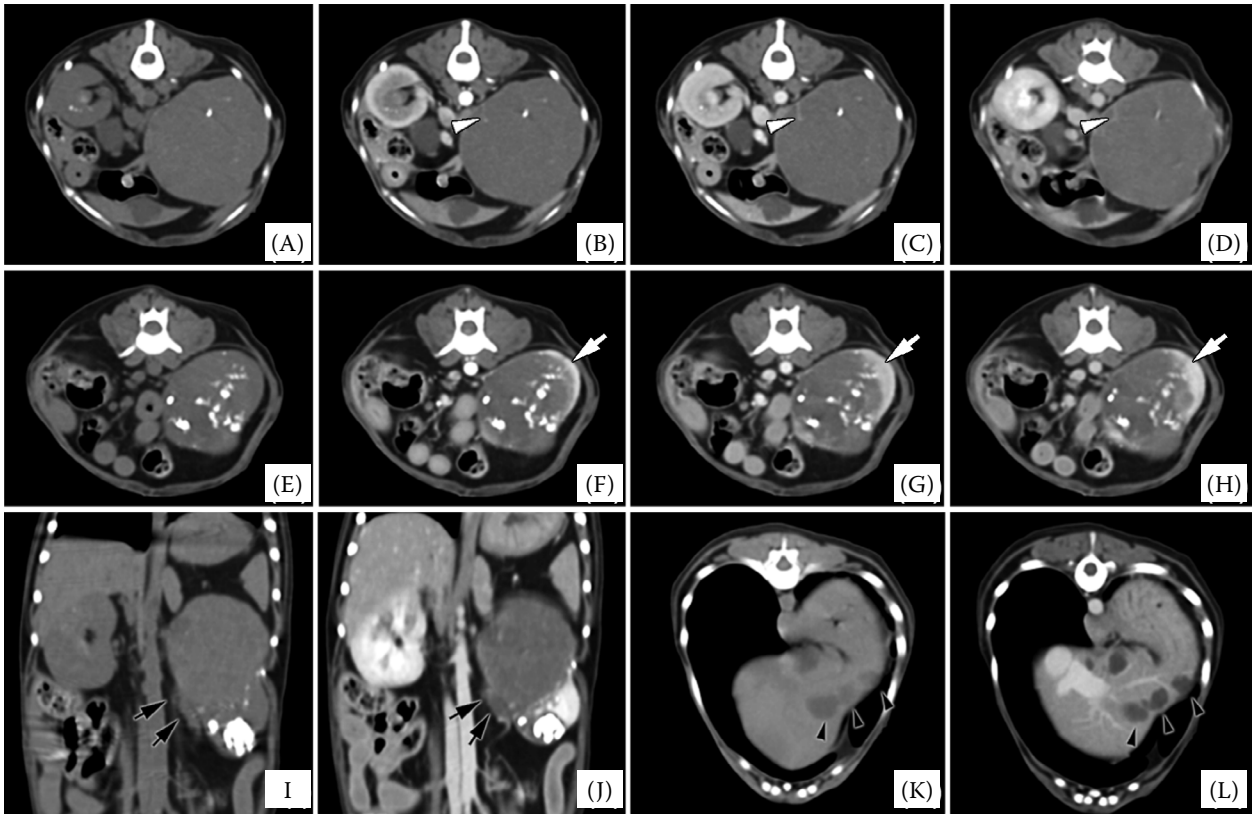

Figure 3. CT images of the non-contrast (A, E, I, K), post-contrast corticomedullary (B, F), early (C, G), and late (D, H, J, L) nephrographic phases in a soft tissue window setting (WW 450, WL 40). The left renal mass occupies most of the renal parenchyma, while only a small portion of normal renal structure remains(white arrows). This renal mass is shown as isoattenuating (46 HU) except for the mineralisation lesions (A). Most of this area does not contrast enhance (46, 45, and 46 HU on the corticomedullary, early, and late nephrographic phases, respectively), but the vessel (white arrowheads) and slight ring enhancement are shown in the corticomedullary and nephrographic phases (B–D, F–H). Furthermore, sporadic parenchymal mineralisations in the caudal part of the mass are shown (E). This renal mass invades the left proximal ureter (black arrows; I, J). Multiple hepatic cysts (black arrowheads; 11 and 13 HU on the non- and post-contrast, respectively) are detected (K, L)

The postoperative histopathologic diagnosis of the mass was renal telangiectasia (Figure 4). The patient recovered well and showed no further haematuria. At the one-year follow-up, the dog was still healthy without any clinical signs of urinary disease. However, an abdominal ultrasound showed multiple progressive cystic lesions in the liver and newly formed, spoke-wheel shaped cysts in the prostate gland (Figure 2D).

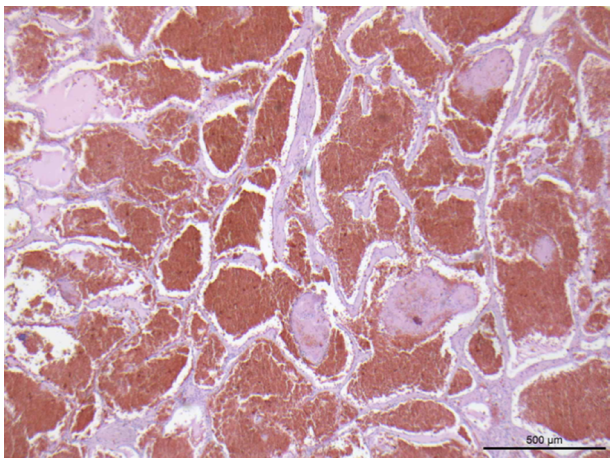

Figure 4. Histopathological section of the renal mass showing large numbers of blood-filled cysts replacing most of the renal parenchyma. The cysts are made up of single-layered, well differentiated endothelial cells and separated by thick, fibrous septa without neoplastic changes. The dilated vessels contain large numbers of red blood cells, fibrin thrombi, and acute inflammatory cells such as neutrophils. The image also shows diffuse interstitial renal fibrosis and multi-focal calcification. Haematoxylin-eosin stain; Scale bar = 500 µm

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DISCUSSION AND CONCLUSIONS

Renal telangiectasia is a genetic, rare dysplastic blood vessel disease in dogs that has only been reported in Pembroke Welsh Corgis (Moore and Thorton 1983). In this case, a primary renal tumour was at the top of the differential diagnosis based on the clinical and diagnostic imaging findings, while the histopathologic diagnosis was renal telangiectasia. In general, differential diagnoses of unilateral renomegaly with contour distortions include primary renal neoplasia, metastatic neoplasia, abscesses, haematoma, granuloma, cysts, or hamartoma (Seiler 2018).

In cases of haematuria with a unilateral renal mass and obliteration of the normal renal structure, a primary renal tumour such as renal carcinoma, sarcoma, or nephroblastoma is often strongly suspected, and nephrectomy is indicated to improve the likelihood of the survival (Nyland et al. 2002; Bryan et al. 2006; Seiler 2018).

In this case, these prior perspectives were not sufficient to distinguish the renal telangiectasia from a primary renal tumour. This unilateral renal mass also differed from findings in a previous renal telangiectasia study showing bilateral renal involvement (Moore and Thorton 1983). Suppositions regarding this discrepancy include that renal telangiectasia may only be apparent unilaterally, or that the second, mildly affected kidney may not show any structural changes that could be detected on the imaging, necessitating a histopathology for confirmation. In either possibility, renal telangiectasia should be considered in the differential in cases of haematuria with a unilateral renal mass in the imaging, in both the Corgi and Maltese breeds.

The only imaging findings discussed in the previous report of renal telangiectasia were renal calculi and calcification on conventional radiographs in a subset of dogs with haematuria that had persisted for several years (Moore and Thorton 1983). These findings were consistent with the present case that showed sporadic calcification throughout the renal mass upon imaging.

Several case studies have reported malignant renal tumours with calcification such as a renal adenocarcinoma (Konde et al. 1985), a renal interstitial cell tumour (Ditersand and Wells 1986), and a sarcomatoid renal cell carcinoma in dogs (Zini et al. 2003). In humans, malignant renal tumours are frequently calcified, particularly in renal cell carcinomas, while the calcification associated with benign renal tumours are relatively rare (Weyman et al. 1982). These reports suggest a tendency towards calcification in malignant renal tumours, though comprehensive studies in dogs have yet to be published. Considering that renal telangiectasia can also be calcified, the presence of the calcification alone is insufficient to distinguish renal telangiectasia from a renal malignant tumour on the diagnostic imaging.

In this case, the large area of the renal mass did not show any contrast enhancement on the CT that was different from other common renal tumours, such as renal cell carcinoma, renal sarcoma, and haemangioma (Sheth et al. 2001; Katabathina et al. 2010). Because of the low incidence and lack of large-scale CT studies on canine primary renal tumours, a potential correlation between the malignancy and contrast enhancement has yet to be verified. Only two cases of non-contrast-enhanced renal masses have been reported in dogs, for renal fibrosarcoma and renal angiomyxoma (Gajanayake et al. 2010; Park et al. 2015). The attenuation of the contrast enhancement also depends on the amount of iodine deposition in the target organ, the organ's intravascular blood volume, the vascular resistance, the capillary or venous anatomy, and the intravascular or interstitial environment (Herman 2004). A vascular malformation can cause increased interstitial pressure, hypoxia, and large diffuse distances for the intravascular molecules and the lack of contrast enhancement in the renal mass in this dog with renal telangiectasia may have resulted from dysplastic blood vessels (Jain and Kozak 2008).

Although CT studies on canine renal tumours are scarce, the presence of a non-contrast-enhanced renal mass may help differentiate the renal telangiectasia from other malignant renal tumours.

In this case, multiple progressive hepatic cysts and prostatic cysts were also identified. In a previous study of renal telangiectasia, multiple organs were found to be involved upon the histopathological examination, but no vascular abnormalities related to the haemangiomatous syndrome were reported (Moore and Thorton 1983). In humans, von Hippel-Lindau disease, a haemangiomatous syndrome, is associated with the cyst formation in multiple organs and an over-production of vascular endothelial growth factors affecting

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angiogenesis (Moore and Thorton 1983; Na et al. 2003; Sadick et al. 2005). Recent human studies have also revealed highly expressed vascular endothelial growth factors and the therapeutic effects of anti-vascular endothelial growth factors in hereditary haemorrhagic telangiectasia (Sadick et al. 2005; Ardelean and Letarte 2015). Vascular endothelial growth factors have also been implicated in polycystic liver and kidney disease (Cnossen and Drenth 2014). These findings suggest that the multiple progressive hepatic and prostatic cysts observed in this case could be associated with renal telangiectasia, although no empirical data therein has been reported for dogs.

Further studies about the correlation of overexpressed vascular endothelial growth factors with telangiectasia or a polycystic disease in canines are needed to elucidate their pathology and uncover appropriate therapeutic modalities.

There were several limitations to this case that must be acknowledged. First, a fine needle aspiration and tissue core biopsies of the mass were not performed before the nephrectomy. Second, the optimal artery, corticomedullary, nephrographic, and excretory phases of the kidneys were not acquired in the contrast CT study because bolus-tracking was not performed.

However, this case is valuable in that it describes several imaging findings in renal telangiectasia that could be helpful in distinguishing it from a primary renal tumour.

This study also indicated that renal telangiectasia may appear unilaterally on the diagnostic imaging and is not limited to Pembroke Welsh Corgis, unlike previous reported incidences of renal telangiectasia.

The findings also suggested that the renal telangiectasia might be related to multiple cystic lesions in other organs. In conclusion, renal telangiectasia should be considered for the differential diagnosis of destructive renal masses with faint or no contrast enhancement on a CT, even in cases of unilateral renal involvement in Maltese or other non-Corgi breeds.

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