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# Renal oncocytoma in a cat with chronic renal failure

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## Abstract

*Case summary* A 9-year-old male neutered domestic shorthair cat presented with anorexia. Ultrasonography showed an irregularly shaped hypoechoic mass in the cranial pole of the right kidney. Ultrasound-guided fine-needle aspiration of the renal mass was performed. Cytology revealed moderate cellularity smears composed of epithelial cell clusters, which consisted of an exclusive population of oncocytic cells seen in sheets and papillary clusters along with abundant single cells. A moderate-to-abundant amount of densely stained granular cytoplasm with round nuclei and indistinct nucleoli was seen. The cytological diagnosis was renal oncocytic neoplasm. CT and surgical resection revealed a firm tan mass in the right kidney. A final diagnosis of renal oncocytoma was made on the basis of histology, immunohistochemical staining profile (positive for cytokeratin, and negative for chromogranin A, neuron-specific enolase and vimentin) of neoplastic cells, together with the electronic microscopy results.

*Relevance and novel information* We believe that this is the first report of the cytological features of feline renal oncocytoma.

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## Introduction

Primary renal tumours are uncommon and make up about 1.5–2.5% of all feline neoplasms.[1] In 1999, Henry et al reported 19 primary feline renal tumours that consisted of tubulopapillary or tubular carcinoma (n = 13), transitional cell carcinoma (n = 3), adenoma (n = 1), haemangiosarcoma (n = 1) and nephroblastoma (n = 1).[2] Feline renal leiomyosarcoma, squamous cell carcinoma and sarcomatoid renal cell carcinoma have also been sporadically reported.[3–5] However, feline renal oncocytoma has not yet been reported. Oncocytes are large cylindrical or polyhedral cells characterised by abundant eosinophilic, granular cytoplasm, which is caused by the presence of large numbers of mitochondria. These cells are believed to be of epithelial origin.[6] So far, feline oncocytomas have only been reported in the nasal cavity,[7] salivary gland[8] and nasopharyngeal lesion.[9] However, renal oncocytomas were first reported in humans in 1942[10] and in dogs in 2000.[11] Human renal oncocytomas are relatively common: 3–7% of all renal tumours vs two cases of canine renal oncocytomas.[11–13]

## Case description

A 9-year-old male neutered domestic shorthair cat was brought to the Irion Animal Hospital in Korea appearing anorexic. The cat was formerly diagnosed with chronic renal failure (IRIS stage 3) and had been treated with isotonic polyionic replacement fluid for several years. Its siblings died a few years previously from renal failure. Its haematological manifestations were unremarkable. Biochemical analysis of the blood with Vettest8008 (IDEXX Laboratories) revealed highly elevated concentrations of blood urea nitrogen (>130 mg/dl; reference interval [RI] 16–36 mg/dl), creatinine (7.5 mg/dl; RI

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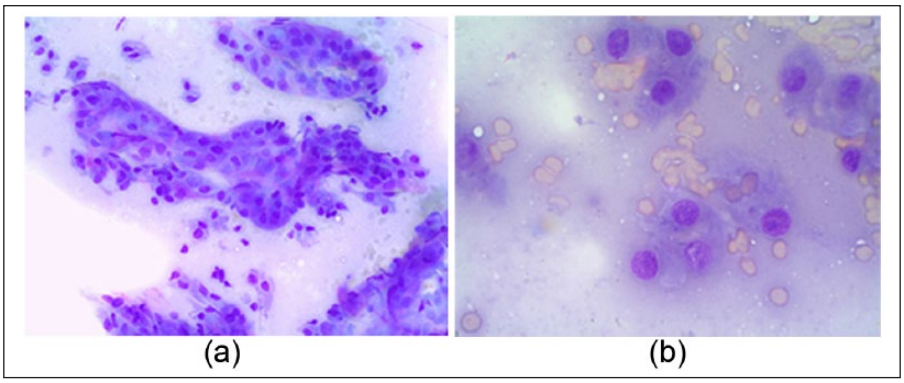


**Figure 1** (a) Cytological examination revealed moderate cellularity smears composed of epithelial cell clusters consisting of an exclusive population of oncocytic cells seen in sheets and papillary clusters, along with abundant single cells (magnification × 40). (b) Moderate-to-abundant densely stained granular cytoplasm with round nuclei and indistinct nucleoli (magnification × 100)

0.8–2.4 mg/dl) and phosphate (8.8 mg/dl; RI 3.1–7.5 mg/dl). Urine specific gravity was 1.010 and urine protein creatinine ratio (URC) was 0.1 (Vettest8008; IDEXX Laboratories). Blood pressure was 140 mmHg.

Right renomegaly was noted on abdominal radiographs. Ultrasonography revealed an irregularly shaped mass that was hypoechoic to renal cortex and medulla at the cranial pole of the right kidney and a minimally hyperplastic lymph node in the cranial abdomen region. Ultrasound-guided fine-needle aspiration (FNA) of the renal mass was performed using a 23 G needle attached to a 10 ml syringe. Blood mixed particulate material was obtained and air dried, and 95% ethanol-fixed smears were then made and stained with Diff-Quik. The cranial abdominal lymph node was insufficiently large and surrounded with vasculatures for the performance of FNA. Cytological examination revealed moderate cellularity smears composed of epithelial cell clusters consisting of an exclusive population of oncocytic cells seen in sheets and papillary clusters, along with abundant single cells. A moderate-to-abundant amount of densely stained granular cytoplasm with round nuclei and indistinct nucleoli was seen. Intracellular eosinophilic materials were also found (Figure 1). A cytological diagnosis of renal oncocytic neoplasm was made. The differential diagnoses were oncocytoma, chromophobe carcinoma, clear cell renal cell carcinoma and neuroblastoma-associated renal cell carcinoma. Under general anaesthesia, a CT scan of the whole body was performed. The CT image indicated a heterogeneous, less contrast-enhanced kidney mass. No enlarged or atypical abdominal lymph nodes were found. Metastasis was not noted. Surgical removal was performed.

In gross appearance, the tumours were mahogany or dark reddish brown, well circumscribed and contained a central scar (approximate size 2.83 cm × 2.2 cm × 3.5 cm) (Figure 2).

The mass was sent to the Comparative Pathology Department of Asan Medical Center (Korea) for histopathological examination. The tissues were fixed with 10% buffered formalin and embedded in paraffin; 5 µm sections were stained with haematoxylin and eosin. Histologically, the tissue was composed of solid nests, anastomosing cords and closely packed glands separated by a delicate fibrovascular stroma. Individual neoplastic cells were cylindrical to polyhedral in shape, had distinct cell borders and contained moderate amounts of finely granular eosinophilic cytoplasm and round-to-oval nuclei (Figure 3). Replicate sections of selected tumour samples were used for immunohistochemistry. Commercially available antibodies against chromogranin (clone DAK-A3, 1:1600; Dako), cytokeratin (clone AE1/AE3, 1:400; NOVO), neuron-specific enolase (clone BBS/NC/VI-H14, 1:400; Dako) and vimentin (clone V9, 1:500; Zymed) were used, with various secondary polyclonal antibodies. Immunohistochemical staining was performed using a

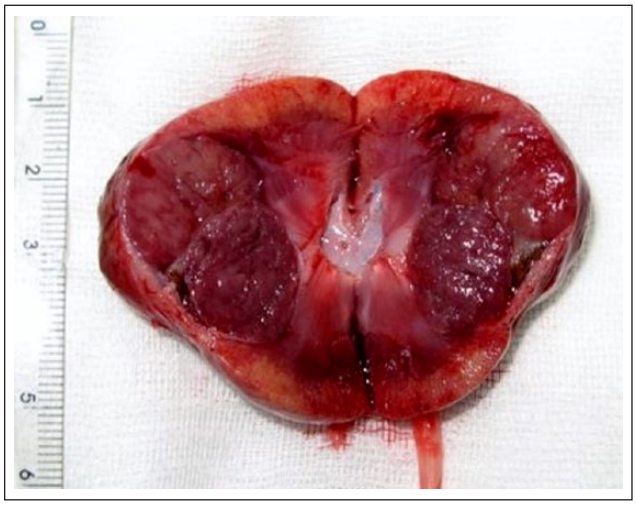

**Figure 2** The tumours were mahogany/dark reddish brown, well circumscribed and contained a central scar (approximate size 2.83 cm × 2.2 cm × 3.5 cm). A rim of compressed normal renal parenchyma was found

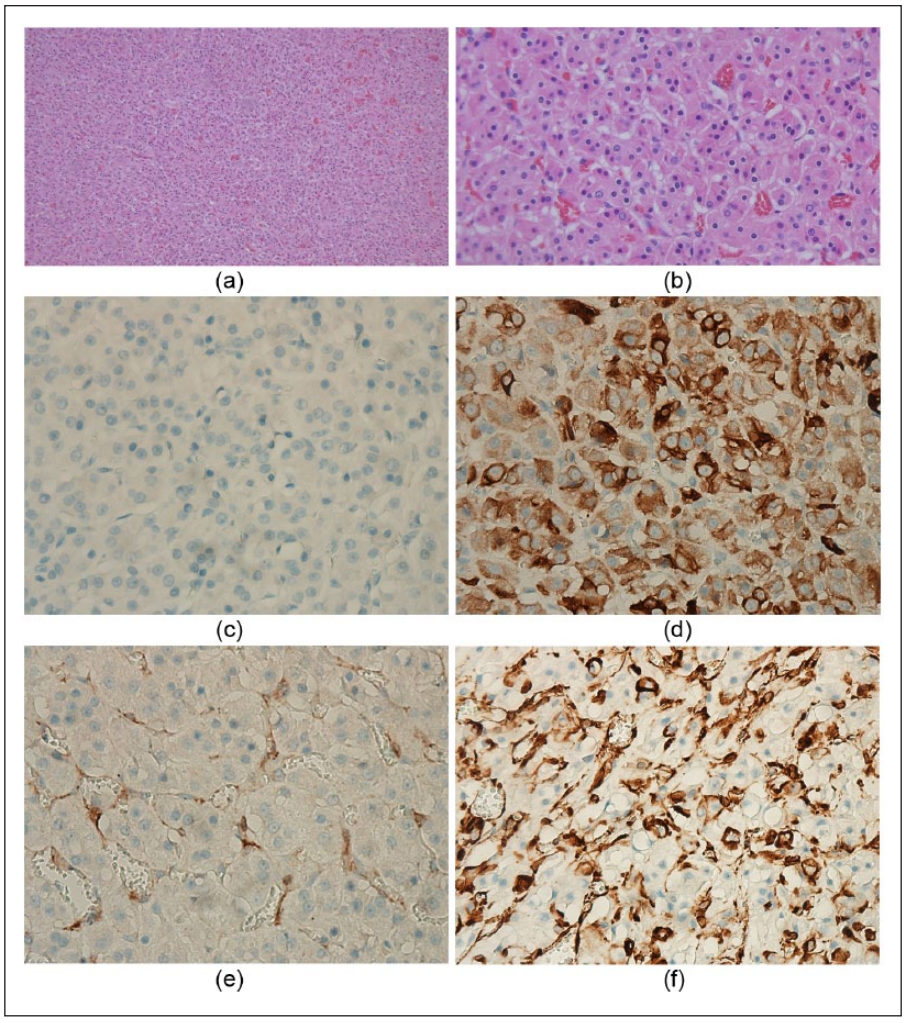


**Figure 3** (a) The tissue was composed of solid nests, anastomosing cords and closely packed glands separated by a delicate fibrovascular stroma (haematoxylin and eosin, × 10). (b) Individual neoplastic cells were cylindrical to polyhedral in shape, had distinct cell borders and contained moderate amounts of finely granular eosinophilic cytoplasm and round-to-oval nuclei (haematoxylin and eosin, × 40). (c) Chromogranin negative (magnification × 40). (d) Cytokeratin positive (magnification × 40). (e) Neuron-specific enolase negative (magnification × 40). (f) Vimentin negative (magnification × 40)

BenchMark XT autoimmunostainer with OptiView DAB detection kit (Ventana Medical Systems) according to the manufacturer's instructions and using the reagent supplied with the kit. Immunohistochemically, the neoplastic cells were positive for cytokeratin, indicating epithelial origin. The neoplastic cells were negative for chromogranin A, neuron-specific enolase and vimentin, indicating that the origin was not mesenchymal or neuronal/neuroendocrine (Figure 3b).

Ancillary testing using an electron microscope (JEM-1400; Jeol) was performed on slices prepared from fixed formalin mass. Ultrastructurally, neoplastic cells were interconnected via junctional complexes and contained numerous round-to-oval, electron-dense mitochondria (Figure 4). On the basis of the immunohistochemical staining profile of the neoplastic cells, together with electron microscopy results, a diagnosis of renal oncocytoma was made.

## Discussion

The first case of human renal oncocytoma was reported by Zippel in 1942.[10] The cytological features of renal oncocytoma have been described in several reports. Cytologically, smears from well-sampled human renal oncocytoma reveal numerous isolated cells or loose clusters with abundant, eosinophilic, granular cytoplasm, well-demarcated cell borders, and round nuclei with small or medium nucleoli.[14] In the current case, the smear consisted of dyshesive cells and eosinophilic-to-basophilic granular cytoplasm, and most features were equivalent to human renal oncocytoma. However, some cells were also aggregated in tubular or papillary

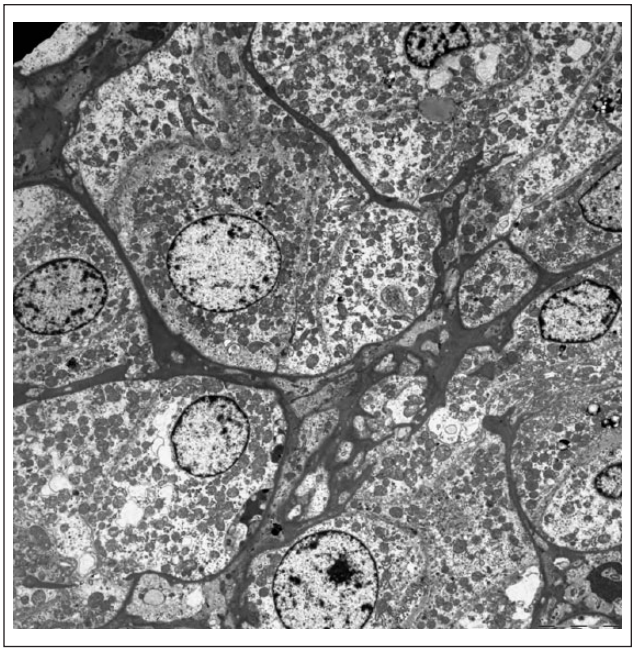

**Figure 4** The neoplastic cells were interconnected via junctional complexes and contained numerous round-to-oval, electron dense mitochondria (× 2500 electron microscope)

forms along with eosinophilic intracellular materials. These features have not yet been described in human renal oncocytoma.

Although renal oncocytomas are classified as 'benign' renal neoplasms according to the 2004 World Health Organization classification of renal tumours in human medicine,[15] Mai et al recently reported two cases of human oncocytic renal cell carcinoma. Those tumours not only revealed cytological atypia and lymph node metastasis, but also showed similar immunological features to renal oncocytoma.[16] Buergelt and Adjiri-Awere reported a canine bilateral renal oncocytoma that invaded the lumbar muscle.[13] With this in mind, renal oncocytomas should be considered as having very low rather than no malignant potential, although the typical classification is benign. In the present case, the cat has been alive for years since its diagnosis. A slightly enlarged lymph node in the cranial abdomen could not be evaluated by CT scan, but the cranial abdominal lymph node is being evaluated ultrasonographically every 1–2 months. To date, the cat only manifests clincal signs associated with chronic renal failure.

Although oncocytoma has characteristic features and FNA is helpful for preoperative diagnosis, Jing and Christina reported a great degree of overlap in the cytological spectrum between renal oncocytoma and renal cell carcinomas with eosinophilic granular cytoplasm.[14] This may impede accurate diagnosis in routine examination of FNA specimens, even although each tumour has classic cytological features.[14] In human medicine, clinical diagnostic dilemmas and the difficulty of cytological or histopathological differentiation of renal oncocytoma from chromophobe renal cell carcinoma still persist. In feline medicine, as renal cell carcinoma with eosinophilic granular cytoplasm has not been reported, a comparison was not possible. However, helpful information will be provided by ancillary immunohistochemical staining with electron microscopy examination in difficult cases, as in human medicine.

## Conclusions

Cytological features of feline renal oncocytoma were oncocytic cells in sheets or clusters with abundant single cells. However, some cells were also aggregated in tubular or papillary forms along with eosinophilic intracellular materials. A moderate to abundant amount of densely stained granular cytoplasm with round nuclei and indistinct nucleoli was also noted. Most cytological features of feline renal neoplasia are equivalent to human renal oncocytoma. To the best of our knowledge, this is the first cytological description of feline renal oncocytoma. Further analyses of feline renal oncocytoma and feline renal cell carcinoma with eosinophilic granular cytoplasm are needed.

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**Conflict of interest** The authors declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

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