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Primary hyperparathyroidism due to a cystic parathyroid adenoma in a cat

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Abstract
A 15-year-old neutered female domestic shorthair cat was presented for weight loss, polydipsia/polyuria, and lethargy. A large fluctuant mass was palpated in the ventral right cervical region. Biochemistry results were consistent with primary hyperparathyroidism. Parathyroid hormone level in the fluid was higher to that observed in the plasma, consistent with a cystic parathyroid lesion. Right parathyroidectomy and thyroidectomy were performed without complications. Ionized calcium normalized within a few hours. Histopathology yielded a diagnosis of cystic parathyroid adenoma. Follow-up showed complete recovery of clinical signs and normalization of ionized calcium. This case shows an uncommon presentation of feline primary hyperparathyroidism secondary to a cystic parathyroid adenoma and is, to our knowledge, the first case presented with a large palpable mass in which parathyroid hormone concentration was measured. This report highlights the value of selective hormonal analyses of the cystic fluid to confirm the origin of the cystic lesion pre-operatively.
Keywords: Adenoma, Calcium, Cyst, Hyperparathyroidism, Parathyroid hormone.

Introduction

Functional parathyroid lesions are very uncommon in cats and most proliferative parathyroid lesions are classified as adenomas while parathyroid carcinoma and hyperplasia are rarely found (Feldman, 2010). Parathyroid cystic tumors in cats have rarely been reported in the veterinary literature (Kallet *et al*., 1991; Phillips *et al*., 2003; Cavana *et al*., 2006). In humans, cystic parathyroid lesions are unusual with less than 300 cases reported (McCoy *et al*., 2009; Dutta *et al*., 2013).

Case Details

A 15-year-old neutered female domestic shorthair cat weighting 3.8 kg was presented for weight loss despite normal appetite, polyuria, and polydipsia (PUPD) for 3 yr and lethargy for 1 mo. On physical examination, the cat was underweight (body condition score 3/9) and had small irregular kidneys. A large (7 × 5 cm), fluctuant, non-painful mass was present in the ventral right cervical region (Fig. 1).

Differential diagnosis for a fluid-filled mass in the cervical region includes a cyst of thyroid, parathyroid, branchial, ultimobranchial or dermoid origin, necrotic neoplasia, salivary mucocele, and abscess (Capen, 2002; Phillips *et al*., 2003; Tolbert *et al*., 2009; Nelson *et al*., 2012).

Blood biochemistry revealed mild azotemia and mild ionized hypercalcemia (Table 1). Serum phosphorus and total thyroxine were within reference range. Serum parathyroid hormone (PTH) concentration, measured at the same time as ionized calcium concentration, was in the upper half of the reference range. Given the absence of severe azotemia, these findings were consistent with primary hyperparathyroidism (Kruger *et al*., 1996; Geddes *et al*., 2013; Parker *et al*., 2015). Urinalysis revealed a specific gravity of 1.016, compatible with the reported PUPD. Findings of azotaemia, isosthenuria, and small irregular kidneys were consistent with chronic kidney disease.

Radiographs of the neck and thorax were performed (Fig. 2). Cervical ultrasonography identified an anechoic fluid-filled structure with distal enhancement, delimitated by a thin wall, on the right side of the trachea, consistent with a cyst. A significant amount (40 ml) of yellow-brown, thick fluid was aspirated. Cytological examination was inconclusive. Total thyroxine concentration in the cystic fluid was low (12.9 nmol/l). The PTH concentration was above 2,000 pg/ml. On the basis of these findings, the cystic mass was diagnosed

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as having a parathyroid origin and was suspected to be the cause of primary hyperparathyroidism.
Parathyroidectomy was recommended. In order to plan surgery, a computed tomography (CT) of the cervical region was performed under general anesthesia, using a 64-slice helical CT scanner (Brilliance, 64-slice; Phillips) and contrast media (iohexol) (Fig. 3A and B).
For the surgical procedure, the patient was placed in dorsal recumbency and the area was aseptically prepared. A ventral midline skin incision was made from the larynx to the manubrium. The right sternocephalic and sternohyoidus muscle were retracted medially. A well-encapsulated mass was visualized, directly adjacent to the trachea and the thyroid gland (Fig. 4). No adherences to surrounding structures were observed. Dissection and hemostasis were performed with a vessel sealer/divider device (LigaSure Atlas; Valleylab; Covidien; Vetoquinol) and the mass was marginally excised with the right thyroid gland. Incisions were closed routinely.
The cat recovered well and showed no clinical signs of hypocalcaemia. Within 14 h, ionized calcium concentration normalized (Table 1). The cat was discharged 2 d after surgery.
Histopathology of the mass was consistent with a cystic parathyroid adenoma (Fig. 5). The lesion was composed of rows of epithelial cells separated by a thin fibrovascular stroma. Some neoplastic cells formed single layer cysts. The cells were polygonal, with a moderately abundant, lightly to intensely eosinophilic cytoplasm, and with central ovoid nucleus with stippled chromatin and a small nucleolus. The cells displayed mild anisocytosis and anisokaryosis with less than 1 mitosis per high-power field.
Upon re-evaluations in the following year, the cat was doing well with an improvement, albeit not resolution, of the PUPD. Ionized calcium remained within reference interval and azotaemia was stable (Table 1). A renal diet was prescribed. The cat was euthanized 2.5 yr later following an acute onset of neurological signs.

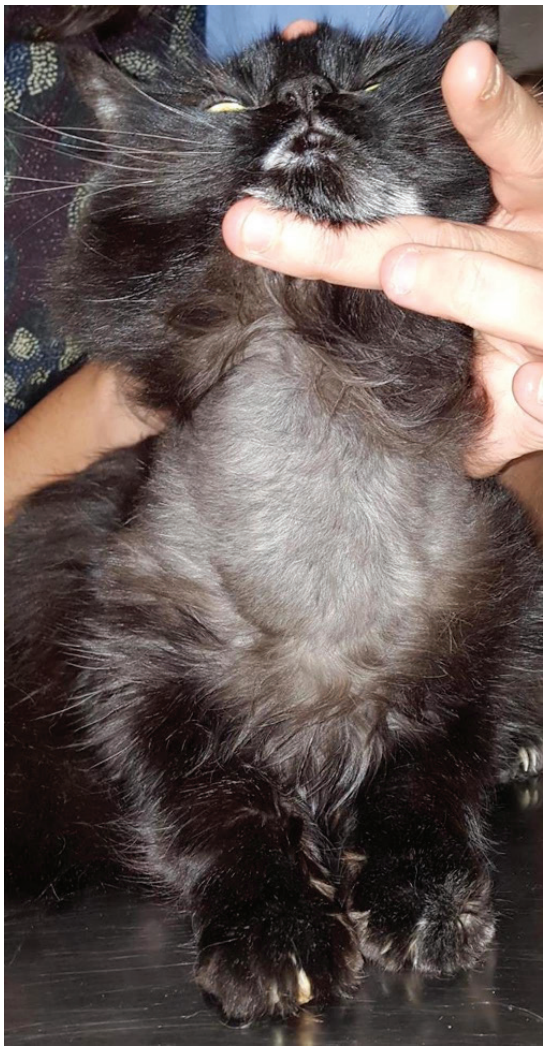

Fig. 1. Photograph of the cat presented with a large mass in the ventral right cervical region.

Discussion

This case report is the second description of a functional cystic parathyroid adenoma in a cat and is, to the authors' knowledge, the first presented with a large, palpable, unilateral cervical mass in which PTH concentration was measured in the cystic fluid confirming its origin (Kallet *et al*., 1991).

Table 1. Blood biochemistry and electrolytes results.

Parameters	Units	At presentation	14 hours after surgery	2 weeks after surgery	6 weeks after surgery	7 months after surgery	2.5 years after surgery	Reference range
Ionized calcium	mmol/l	1.58	1.23	1.28	1.28	1.27	1.33	1.1–1.4
Phosphorus	mg/dl	4.7	/	/	5.3	4.7	6.7	3–6
PTH	pg/ml	130	/	/	/	/	/	50–200
BUN	mg/dl	53	43	45	49	42	20	10–33
Creatinine	mg/dl	2.4	1.6	1.8	2.0	2.3	1.5	0–2
Total thyroxine	nmol/l	30.1	/	/	/	/	/	10–60

Determining the origin of a cervical mass is important as it may have implications for treatment (Phillips *et al*., 2003). While some functional cystic thyroid lesions can be managed medically, surgical excision is considered the treatment of choice for most other lesions, such as functional parathyroid cysts (Pontikides *et al*., 2012).

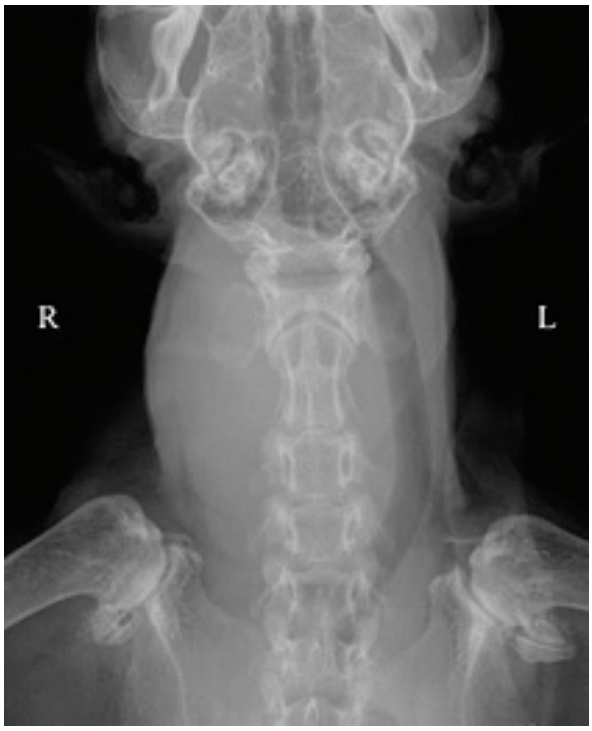

Fig. 2. Ventrodorsal radiography of the neck showing a large homogeneous right cervical soft-tissue mass with marked lateral deviation of the cervical trachea to the left.

The distinction between cystic parathyroid and thyroid lesions can be quite difficult, both lesions may present as asymptomatic cervical masses with occasional signs related to the compression of adjacent structures. Ultrasonography, CT, and 99mTc-MIBI scans can be used but may not differentiate between thyroid and parathyroid cysts (Yalcin *et al*., 2014). Fine needle aspiration and cytology of cystic fluid is a valuable diagnostic tool but may be inconclusive, such as in the reported case. Parathyroid cysts often contain a clear, watery fluid, whereas thyroid cysts usually contain blood-tinged, brown-colored material (Phillips *et al*., 2003). However, in the case of functional parathyroid cystic lesions, the aspirate may also be yellow-brown due to a pre-existing degenerated or infracted parathyroid adenoma containing hemosiderin, as observed here (Pontikides *et al*., 2012). The better tool to establish a diagnosis is to obtain total thyroxine and PTH concentrations in the fluid. Thyroid cystic fluid usually presents high concentrations of total thyroxine and undetectable PTH, whereas in parathyroid cystic lesions (functional and non-functional), PTH concentrations are elevated in the fluid comparatively to serum.

In this case report, the ionized hypercalcemia and serum PTH concentration in the upper half of reference range were consistent with primary hyperparathyroidism, strongly suggesting that the cystic cervical mass was of parathyroid origin. However, confirmation was only possible after hormone measurement in the cystic

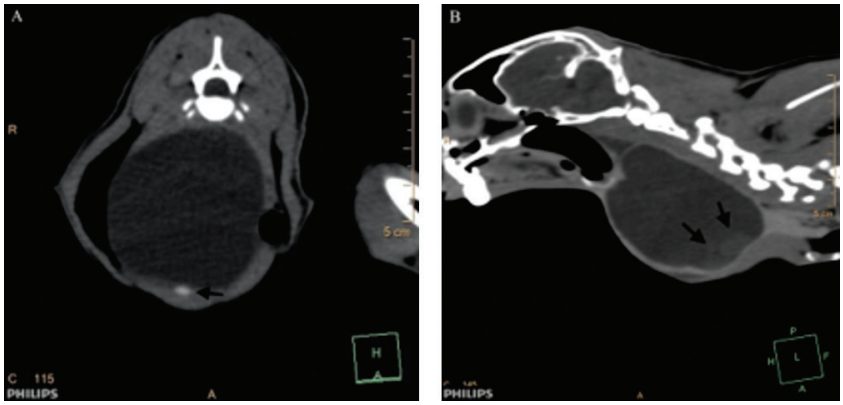

Fig. 3. Transverse (A) and sagittal (B) CT images of the cervical region, respectively, before and after IV contrast media administration, showing a well-defined, non-enhancing fluid-filled mass, surrounded by a thin enhancing wall, measuring 6.4 cm craniocaudally and 4.2 cm lateromedially and ventrodorsally, deviating the trachea, esophagus, and surrounding vascular structures to the left. The right lobe of the right thyroid gland was displaced ventrally and caudally and localized along the ventral wall of the mass, in its caudal half (A, arrow). Agglomerated slightly hyperattenuating cellular material was observed in the dependent part of the lumen of the cyst, consistent with a blood clot, likely secondary to the fine-needle aspiration previously performed (B, arrow). No invasion of surrounding structures was observed.

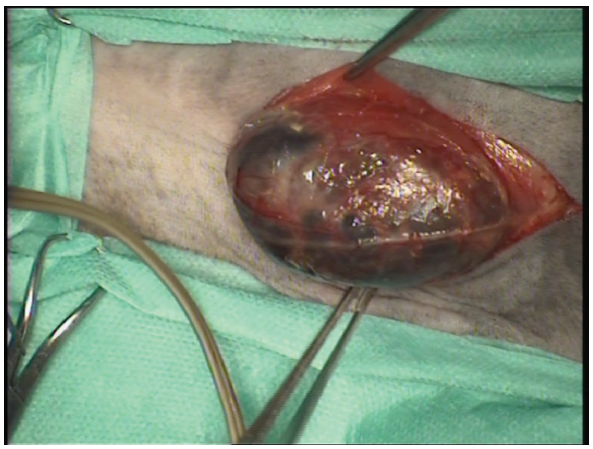

Fig. 4. Photograph of the mass obtained during surgery. The mass is well-encapsulated and measured 8 cm × 5 cm.

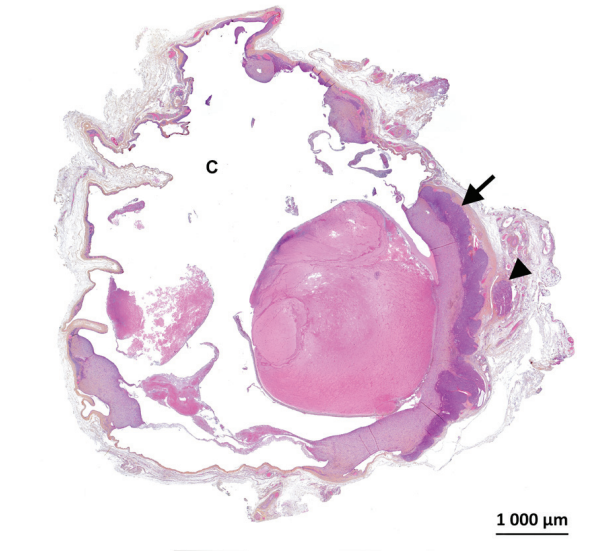

Fig. 5. Microphotograph of the cystic parathyroid adenoma. Within the severely atrophic parathyroid parenchyma, a 2 cm in diameter encapsulated round cystic tumor with compressive growth was observed. The tumor (arrow) includes a large cyst (C) containing an organizing hematoma. A diffuse atrophy of the right thyroid gland (arrowhead) was observed, consistent with mass compression. Hematoxylin–eosin–saffron stain, bar = 1,000 µm.

fluid, as primary hyperparathyroidism could occur concurrently with cystic lesions of other origin.

Surgery was elected because of the functional nature of the parathyroid cystic lesion and because of the size of the mass which compressed the surrounding structures (Pontikides *et al*., 2012). In dogs, primary hyperparathyroidism has also been treated by ultrasound-guided chemical ablation and ultrasonographically guided radiofrequency heat ablation (Rasor *et al*., 2007; Guttin *et al*., 2015). However, none of the cases described were associated with a cystic lesion.

After surgery, ionized calcium normalized within a few hours and no recurrence of hypercalcemia was observed. Post-operative hypocalcaemia is a common condition reported in dogs and can also be observed in cats after unilateral parathyroidectomy. For this reason, ionized calcium levels should be closely monitored after surgery (Cavana *et al*., 2006). In humans, serum PTH levels are also monitored during and after surgery (Dutta *et al*., 2013).

In this case, biochemical analyses revealed primary hyperparathyroidism and mild renal azotaemia. Renal azotaemia may have been the result of concurrent chronic kidney disease or of irreversible structural changes secondary to hypercalcemia (Polzin, 2017).

In conclusion, the case presented here is a very uncommon description of a cystic parathyroid adenoma. This report intends to highlight the importance of pre-operative selective hormonal analyses of cystic fluid. Surgical resection of these functional lesions allows a cure. Definitive diagnosis of parathyroid adenoma is based on histopathology results. After the surgery, close monitoring of calcaemia is mandatory.

Conflict of interest

The authors declare that there is no conflict of interest.

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