Thyroglossal Duct Carcinoma in a Cat

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ABSTRACT
A 14 yr old castrated domestic shorthair cat presented for a fluid-filled structure in the ventral cervical region that had been present for 1 yr and had not resolved after repeated aspiration and drainage. Cervical computed tomography showed an approximately 10 cm, fluid-filled, multilobulated mass located on the ventrolateral right side of the cervical region extending into the thoracic inlet. Cytologic examination of the fluid revealed cystic fluid with evidence of chronic hemorrhage. The mass was surgically removed, and histopathologic examination revealed a thyroglossal duct carcinoma. Thyroid and parathyroid gland origin were ruled out by negative immunohistochemical staining for thyroglobulin, parathyroid hormone, calcitonin, and synaptophysin. No adjunctive treatment was performed and no recurrence was noted at 14 mo. Thyroglossal duct carcinoma has not been previously reported in a cat. There are two previous reports of squamous cell carcinoma of the thyroglossal duct in dogs. In humans, with complete removal and no evidence of metastasis, carcinoma of the thyroglossal duct has a good prognosis for recovery. (J Am Anim Hosp Assoc 2016; 52:251–255. DOI 10.5326/JAAHA-MS-6266)

Introduction
The thyroid gland in the developing fetus arises as a midline invagination of the foregut at the level of the first pharyngeal pouch from the site of the future foramen cecum at the caudal aspect of the tongue.1,2 It migrates caudally and ventrally until it reaches its adult location within the cervical region. During this migration it remains attached to the foramen cecum by the thyroglossal duct, which normally involutes between the sixth and 10th fetal week.2,3,4 If the duct fails to involute, cyst formation can occur. The four general locations where thyroglossal duct cysts are found in humans include the level of the hyoid bone or between the thyroid cartilage and the hyoid bone, also known as the infrahyoidal or thyrohyoidal locations (61%), supraphyoidal (24%), suprasternal (13%), and intralingual (2%).5 Many of these thyroglossal duct cysts contain ectopic and functional thyroid tissue (62%), which has been reported as far caudal as the pericardial sac in humans, cats, and dogs.6,7 Histologically, thyroglossal duct cysts are characterized by the presence of ectopic thyroid tissue within the cyst wall and are lined by cuboidal to occasionally squamous epithelial lining with a few ciliated cells.1,5 Thyroglossal duct cysts are rare in people, affecting approximately 7% of the population, and are even more rare in veterinary species, with only sporadic reports in dogs, cats, horses, goats, and cattle.2,3,5,8–14 Malignant transformation of any of the cells within the thyroglossal duct can lead to the formation of a thyroglossal duct carcinoma. This case report documents the presence of a thyroglossal duct carcinoma in a cat and provides a comparative review of this condition in humans.

Case Report
A 14 yr old castrated domestic shorthair cat presented for evaluation of a fluid-filled swelling of the ventral cervical region. The mass was present for approximately 1 yr and had been treated with intermittent needle aspiration and drainage. Within 2 wk of drainage, the mass would recur at the same size as prior to drainage. The cat was not showing any signs of respiratory difficulty or dysphagia. Serum biochemistry, complete blood count, and total serum thyroxine (T4) performed prior to referral were

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CT (computed tomography); T4 (thyroxine)

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within normal limits. Upon physical examination at Oklahoma State University, there was a large, nonpainful, fluctuant mass on the ventral aspect of the cervical region. The mass was located slightly to the right of midline and was palpably displacing the trachea to the left. It extended from immediately caudal to the mandible to the level of the thoracic inlet and was firmly attached to the underlying tissue. The cat had a body condition score of 4.5/9. The remainder of the physical examination was unremarkable.

Preliminary diagnostics at Oklahoma State University included a serum biochemistry, complete blood count, cystic fluid total T₄, cystic fluid cytology, and thoracic radiographs. Cytologic examination of the fluid revealed very low cellularity with evidence of chronic hemorrhage. There were no infectious organisms or neoplastic cells identified in the fluid. Serum biochemistry, complete blood count, and T₄ were within normal limits. Thoracic radiographs did not show any evidence of cardiovascular, pulmonary, or metastatic disease. At the margin of the thoracic radiographs, a large, soft tissue opacity was visible within the ventral cervical region, where it displaced the trachea dorsally. A computed tomography (CT) scan pre- and post-administration of intravenous contrast of the cervical region showed a large, multilobulated fluid-attenuating mass in the ventrolateral right aspect of the cervical region (Figure 1). It displaced the trachea to the left, the internal jugular vein and internal carotid artery dorsolaterally to the right, and the external jugular vein ventrolaterally to the right. The mass extended from immediately caudal to the temporomandibular joint to the level of the second rib (approximately 10 cm). The left thyroid lobe appeared normal and the right thyroid lobe was not definitively visualized. The mass had non-uniform peripheral enhancement consistent with a wall or capsule with no enhancement of the central regions consistent with fluid.

The cat was taken to surgery, and a ventral midline approach was used to access the mass. The mass was not drained prior to surgery, to aid in dissection of the mass. The paired sternocleidomastoideus muscles were separated on midline, which immediately allowed visualization of the mass due to the displacement of the trachea to the left. A combination of sharp and blunt dissection was used to isolate the neurovascular structures that were in close association with the mass, namely the jugular veins, carotid arteries, vagosympathetic trunk, and the left recurrent laryngeal nerve. During the dissection, the lumen of the mass was entered and the fluid contents were spilled into the surgical field. The area was lavaged with sterile 0.9% saline, and dissection continued. The portion of the mass that was protruding into the thoracic inlet was able to be retracted back into the cervical region and, therefore, a median sternotomy was not needed to gain access to this portion of the mass. No cranial extension of the mass to the hyoid bone was noted at surgery. The right thyroid gland was also not visualized at surgery. The cystic fluid and surgical site were cultured prior to closure and a closed suction drain was placed in the surgical wound due to the contamination from the cyst rupture and because of the large amount of dead space left once the mass was removed. The surgical wound was closed in layers using poliglecaprone. The skin was closed with staples and the drain was secured with silk suture in a Chinese finger-trap pattern. The cat inadvertently removed the drain the night of surgery but healed otherwise without complication. The cat was administered cefazolin at 22 mg/kg (10 mg/lb) perioperatively and was transitioned onto oral amoxicillin/clavulanic acid at 14.6 mg/kg (6.6 mg/lb) postoperatively for 14 days. The culture of the cystic fluid and surgical site revealed no aerobic or anaerobic bacterial growth.

FIGURE 1 Transverse computed tomography (CT) image at the level of the third cervical vertebra showing the fluid-filled cyst (C) causing displacement of the trachea (white arrow), the internal jugular vein (black arrow), internal carotid artery (black arrowhead), and the external jugular vein (white arrowhead). The endotracheal tube is within the tracheal lumen (*). The left and right sides are labeled L and R, respectively.
Histopathologic evaluation of the mass showed a cystic structure with a wall composed predominantly of dense collagenous stroma that was segmentally lined by a single layer of low cuboidal epithelium surrounding a lumen filled with blood. Multifocally, several small to moderately sized, densely cellular islands of neoplastic cells infiltrated the collagenous stroma of the cyst wall and formed poorly demarcated, unencapsulated aggregates of follicles or cords (Figure 2) as well as papillary projections into the cyst lumen. The neoplastic cells were cuboidal to columnar with variably distinct margins, moderate amounts of wispy, eosinophilic cytoplasm, and centrally placed round to oval nuclei with finely stippled chromatin and a single, basophilic nucleolus. In regions where neoplastic cells formed follicular structures, lumens often contained eosinophilic matrix. Neoplastic cells infiltrated into the cystic wall in multiple regions and had moderate anisocytosis and anisokaryosis with a mitotic rate of 5/10 high power field (Figure 3). In a few foci, islands of normal follicular thyroid tissue were embedded within the cyst wall (Figure 4). The neoplastic cells were immunohistochemically negative for calcitonin (C-cell marker), parathyroid hormone (parathyroid chief cell marker), thyroglobulin (thyroid follicular cell marker), and synaptophysin (neuroendocrine marker). The immunohistochemistry staining profile rules out thyroid and parathyroid origin and is consistent with a diagnosis of thyroglossal duct carcinoma with the neoplastic cells arising from the cyst epithelium. Malignancy of neoplastic cells was indicated by infiltration and invasion into the cyst wall, hence the diagnosis of carcinoma. Despite microscopic evidence of malignant potential, the cat has had no signs of local recurrence or metastatic disease at 14 mo post-operation.

**Discussion**

Thyroglossal duct carcinomas are even more rare than thyroglossal duct cysts in people, only affecting approximately 0.7–1.6% of patients diagnosed with thyroglossal duct cysts. The first report of a thyroglossal duct carcinoma was in 1911 by Brentano. Since that time, there have only been approximately 200 cases reported in the human literature. Most of these are single, isolated case reports.
There are two reports in the veterinary literature of a thyroglossal duct carcinoma. Both of these reports were of dogs that were diagnosed with squamous cell carcinoma of the thyroglossal duct. In humans, thyroglossal duct carcinomas arise most commonly from thyroid tissue (88%), with squamous cell carcinomas making up only approximately 6% of carcinomas reported in the thyroglossal duct in people. Unlike thyroglossal duct cysts, thyroglossal duct carcinomas present later in life, with the mean age in the 40s and a range from 1 to 82 yr. They are most often diagnosed postoperatively, as they present in the same manner as a thyroglossal duct cyst.

For a definitive diagnosis of thyroglossal duct carcinoma, three criteria must be met: (1) the carcinoma must be in the wall of the thyroglossal duct cyst, (2) the thyroglossal duct carcinoma must be differentiated from a cystic metastasis to a lymph node by demonstrating epithelium lining the cyst wall and normal thyroid follicles within the cyst wall, and (3) there must be no malignancy in the thyroid gland or any other primary site that would lead to potential metastatic spread to the thyroglossal duct cyst. These criteria are a point of debate in the human literature, as approximately 11–45% of people with thyroglossal duct carcinoma have concurrent thyroid carcinomas, a percentage that is within the reported incidence of occult or incidental thyroid carcinomas found in cadaveric thyroid tissue at autopsy. The right thyroid gland in this case was suspected to be normal, as it was not visualized on the pre-operative CT scan. Absence of neoplasia in other locations supports interpretation of the thyroglossal duct cyst carcinoma as a primary tumor in this case. Furthermore, the histopathologic and immunohistochemical finding of neoplastic non-thyroidal epithelial cells lining the cyst lumen and infiltrating into the wall of the cyst is in favor of the diagnosis of thyroglossal duct cyst carcinoma, as is the presence of normal thyroid follicles elsewhere within the cyst wall. Based on these findings, the carcinoma was interpreted to be arising from the epithelial lining of the thyroglossal duct cyst.

The recommended treatment for thyroglossal duct cysts in humans is a Sistrunk procedure. This procedure was developed in 1920 by Walter Sistrunk because of the high rate of recurrence with previous procedures (20–50%). The Sistrunk procedure is described as removing a core of tissue, including the foramen cecum, from the base of the tongue, without entering the oral cavity, to the level of the hyoid bone, including removing a central portion of the hyoid bone. This procedure decreased the risk of recurrence to 3–5%. An extended Sistrunk procedure was developed to treat those with recurrence after the Sistrunk procedure. This included removing a core of tissue from the foramen cecum to the thyroid isthmus. The size of the cyst in our case did not allow for a removal of a normal core of surrounding tissue. The cyst did not extend to the level of the hyoid bone on pre-operative imaging, nor was there extension of the thyroglossal duct cranial to the cyst. If the entire thyroglossal duct was not removed, this may predispose this cat to a recurrence of the thyroglossal duct cyst in the future.

Thyroglossal duct carcinomas are most commonly a postoperative diagnosis, which was consistent with this case report. There are some reports in the human literature that support performing fine needle aspirate biopsies in cases of thyroglossal duct cysts. The results of these studies are widely variable, having anywhere from 25 to 100% diagnostic accuracy. This wide variability could be explained by the hypocellularity of the samples because of dilution from the cystic fluid. Fine needle aspirate biopsy has been recommended as a relatively minimally invasive and simple procedure that should be considered in adult patients with a thyroglossal duct cyst or any residual mass that is present after drainage of the cyst. In this case, fine needle aspiration of the cyst was performed to determine the cellular content and potentially identify infectious organisms or neoplastic cells. The cystic fluid was of very low cellularity, with evidence of chronic hemorrhaging and no evidence of infection or neoplasia.

The metastatic rate for papillary thyroglossal duct carcinomas ranges from 7 to 15%. In cases with no evidence of metastasis, the cure rate of papillary thyroglossal duct carcinomas with the Sistrunk procedure is 95–100%. Pre-operative imaging and surgical exploration of the cervical region revealed no evidence of metastatic disease in this case. However, since we did not perform a true Sistrunk procedure, potential for recurrence in the remaining thyroglossal duct still exists, although the absence of recurrence in the 14 mo after surgery leads us to believe that there is either no remaining thyroglossal duct or any remnant left is nonfunctional.

**Conclusion**

To the best of the authors’ knowledge, this is the first report of a thyroglossal duct carcinoma in a cat. Therefore, it should be included as a differential diagnosis in the case of a cat with a fluid-filled ventral cervical swelling. Other differential diagnoses may include a thyroglossal duct cyst, branchial cyst, thyroid or parathyroid cyst, abscess, salivary mucocele, cystic lymphoid structure, or a soft tissue sarcoma. In this cat, excision of the mass appears to have been curative, with no evidence of recurrence at 14 mo post-operation. In conclusion, although more cases are needed to determine a true prognosis, thyroglossal duct carcinomas in cats with no evidence of pre-operative metastatic disease may have the potential for a good long-term prognosis following surgical resection.
REFERENCES