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Case Report

Thyroid Adenoma and Ectopic Thyroid Carcinoma in a Guinea Pig (*Cavia porcellus*)

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A 56-mo-old male guinea pig (*Cavia porcellus*) presented with gradual weight loss from 757 to 691 g during the preceding month. Cardiac-specific diagnostics detected decreased cardiac contractility, moderate cardiomegaly, pericardial effusion, and pulmonary edema. At 1 mo after presentation, the guinea pig died while under treatment. Necropsy revealed a 5 × 3 × 3-mm, tan, smooth nodule on the base of the heart. On histology, the nodule contained moderately cellular neoplastic tissue comprising cuboidal cells arranged in variably sized follicles. Immunohistochemically, the neoplastic cells were positive for thyroglobulin and thyroid transcription factor 1, consistent with ectopic thyroid carcinoma. Other significant histologic lesions included thyroid adenoma of the right thyroid gland, myocardial hypertrophy and degeneration, suppurative bronchopneumonia, and centrilobular hepatocellular degeneration. Although serum total thyroxine concentration was not evaluated, we considered that the tumors in this case were functional because concurrent lesions related to hyperthyroidism were present. In guinea pigs, reports of endocrine tumors, including thyroid tumors, have been increasing. To our knowledge, the current report represents the first documentation of ectopic thyroid carcinoma in this species.

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Guinea pigs (*Cavia porcellus*) are rodent species belonging to the family Caviidae. These animals were raised by the Incas for food and use in religious ceremonies and were brought to Europe about 500 y ago.[6] Guinea pigs have been used frequently in research for more than 200 y and have contributed to a wide variety of studies in areas including anaphylaxis, asthma, immunology, otology, and nutritional disease.[9] Currently guinea pigs are popular pets and are common in zoological collections in many countries. Neoplasia is relatively common in guinea pigs, especially in those older than 3 y.[9] In this species, tumors of the hematopoietic system are the most common, followed by those of the respiratory system, integument, reproductive tract, mammary glands, cardiovascular system, and endocrine glands.[1,9] Over the last decade, thyroid tumors in guinea pigs have been reported with increasing frequency.[4] In particular, one report provided morphologic and immunohistochemical characterizations of thyroid tumors from 19 cases.[2] The current case report describes the case of a guinea pig with an ectopic thyroid tumor and related lesions.

Case Report

A 56-mo-old male pet guinea pig presented with gradual weight loss from 757 to 691 g during the preceding month. The patient was kept in a commercially available wire cage containing pine shavings as bedding and had free access to a water bottle. The food fed included pellets (Yester, Hyogo, Japan), Western timothy hay (Oxbow, Omaha, NE), orchard grass hay (Oxbow), and botanical hay (Oxbow). Another male guinea pig had been housed in the same cage but had died from a urinary obstruction 6 mo before the current animal presented. Hematologically, only mild to moderate polycythemia (60%; reference range, 39% to 55%) was present. Approximately 1 mo after the initial presentation, the patient showed labored respiration. Thoracic radiographs suggested pulmonary edema. Echocardiography revealed decreased cardiac contractility, moderate cardiomegaly, and pericardial effusion were detected. As a symptomatic treatment, furosemide (1.5 mg/kg PO twice daily; Nichi-Iko, Toyama, Japan), benazepril (0.25 mg/kg PO twice daily; Elanco, Tokyo, Japan), and pimobendan (0.5 mg/kg PO twice daily; Kyoritsu Seiyaku, Tokyo, Japan) were administered. However, the animal's respiratory condition worsened despite treatment. To alleviate the labored respiration, the patient was hospitalized in an oxygen chamber with 40% oxygen but died due to respiratory failure during treatment.

Necropsy revealed a 5×3×3-mm, tan, smooth nodule at the base of the heart (Figure 1). The apex of the heart was rounded, and the left ventricle and ventricular septum were thickened, with moderate amounts of serosanguineous pericardial fluid. Other significant gross lesions included enlargement of the right thyroid gland, which measured 8×5×5 mm, and an irregular, nodular appearance of all hepatic lobes.

All organs removed were fixed in 10% neutral-buffered formalin. Representative trimmed tissues were processed routinely, embedded in paraffin, sectioned at 5 µm, and stained with hematoxylin and eosin. Immunohistochemistry for thyroglobulin and thyroid transcription factor 1 was performed by using routine methods. Briefly, sections were labeled with rabbit polyclonal antithyroglobulin antibody (ready for use; Nichirei, Tokyo, Japan) and mouse monoclonal antithyroid transcription factor 1 antibody (ready for use; Nichirei). After deparaffinization, antigen retrieval was achieved by using target retrieval solution (DakoCytomation, Carpinteria, CA) at 95 °C for 20 min for both antibodies. Labeling was visualized by

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Figure 1. A 5×3×3-mm, tan, smooth nodule was present at the base of the heart (arrow).

using 3,30-diaminobenzidine substrate (Nichirei), and sections were counterstained with Mayer hematoxylin. Positive controls for immunohistochemistry included normal thyroid gland from the guinea pig. For negative controls, primary antibodies were replaced with homologous nonimmune sera.

Histologically, the nodule on the base of heart comprised moderately cellular neoplastic tissue composed of cuboidal cells arranged in variably sized follicles and papillae (Figures 2 and 3). Most follicles were filled with eosinophilic, homogeneous material consistent with colloid. The neoplastic cells showed small to moderate amounts of eosinophilic cytoplasm with distinct cell borders. Nuclei were round to oval in shape, with coarsely stippled chromatin and small nucleoli. Anisocytosis and anisokaryosis were moderate (2 mitoses per 10 high-power [400×] fields). Focally within the neoplastic tissue, ossified bone tissue had formed and contained cavitations that were filled with numerous hematopoietic cells (that is, osseous metaplasia).

The right thyroid gland was effaced by well-demarcated, densely cellular neoplastic tissue composed of follicular patterns lined by a single cell layer of cuboidal epithelial cells. Compared with the tumor at the base of the heart, the neoplastic cells in the right thyroid gland were more well-differentiated, with minimal anisocytosis and anisokaryosis. Mitoses were rare (that is, fewer than 1 per 400× field). Preexisting thyroid tissue was compressed to the periphery and appeared atrophied. Other significant histologic lesions included myocardial hypertrophy and degeneration, suppurative bronchopneumonia, pulmonary edema, and centrilobular hepatocellular degeneration.

Immunohistochemically, control sections demonstrated appropriate positive and negative reactions. The neoplastic cells of both the cardiac nodule and the right thyroid gland were positive for both antithyroglobulin and antithyroid transcription factor 1 (Figure 4). In addition, colloid was positive for antithyroglobulin. These findings are consistent with ectopic thyroid carcinoma and thyroid gland adenoma.

Discussion

Ectopic thyroid tissue is particularly common in dogs and can be located anywhere from the larynx to diaphragm; in addition, ectopic thyroid cells also give rise to thyroid tumors at the base of the heart.[3] Primary differential diagnoses for tumors of the heart and heart base include chemodectoma, ectopic thyroid tumor, hemangiosarcoma, rhabdomyoma or rhabdomyosarcoma, and lymphoma.[8] In our case, the neoplastic cells of the nodule

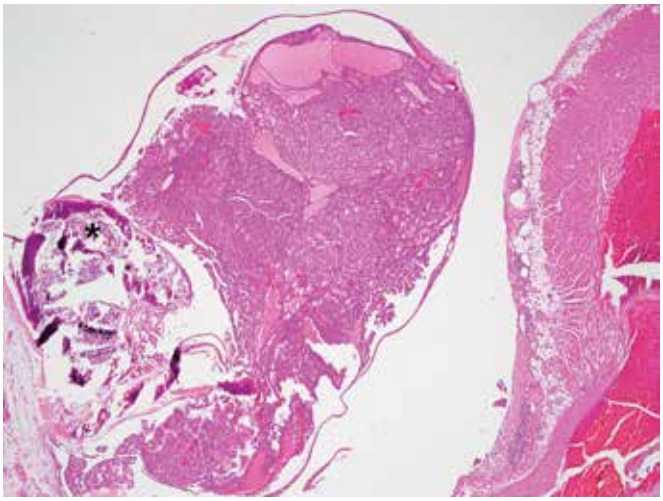

Figure 2. The nodule comprises moderately cellular neoplastic tissue composed of cuboidal cells arranged in variably sized follicles and papillae. The nodule contains an area of osseous metaplasia (asterisk). Hematoxylin and eosin stain; magnification, 40×.

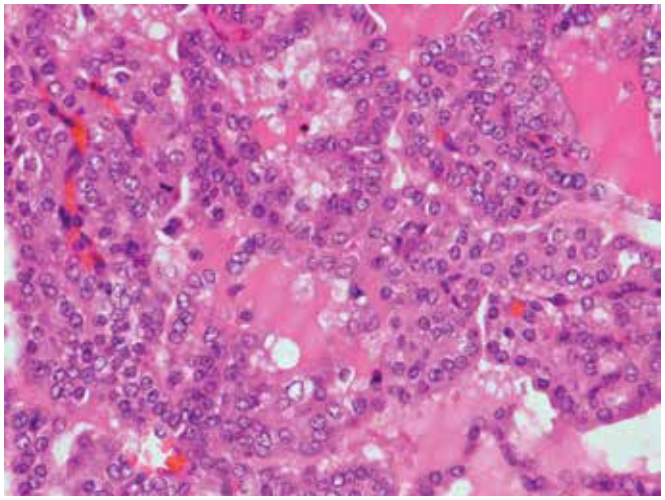

Figure 3. Most follicles are filled with colloid. Neoplastic cells show moderate degrees of cellular and nuclear atypia. Hematoxylin and eosin stain; magnification, 400×.

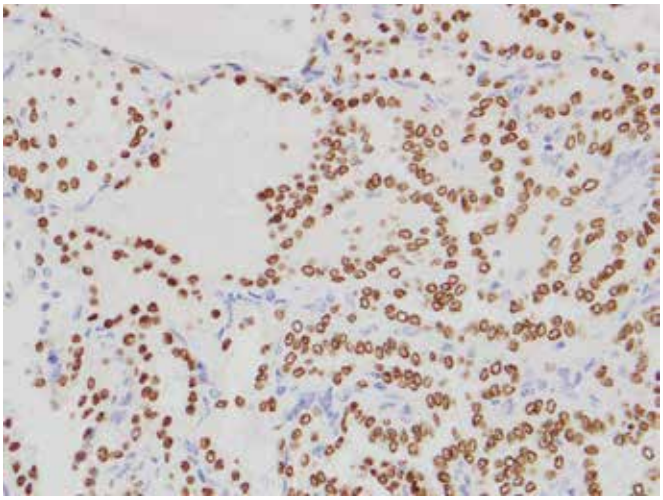

Figure 4. The nuclei of most neoplastic cells immunolabelled with antibody to antithyroid transcription factor 1. Mayer hematoxylin counterstain; magnification, 200×.

at the base of heart shared similar histologic characteristics with malignancy of thyroid gland origin, as well as positive immunohistochemical labeling with antithyroglobulin and antithyroid transcription factor 1. Histologically and immunohistochemically, our case was consistent with ectopic thyroid carcinoma, and other tumors were ruled out. In guinea pigs, thyroid tumors have been reported with increasing frequency.[4] In one report, thyroid tumors were detected 19 of 236 cases (3.6%), and the authors characterized various morphologies, including macrofollicular thyroid adenomas, thyroid cystadenoma papillary thyroid adenoma, and follicular thyroid carcinoma.[2] However, to our knowledge, no previous reports have described ectopic thyroid tumor in guinea pigs.

Thyroid tumors are common in dogs and cats, especially in aged animals. Patients with thyroid tumors often develop clinical hyperthyroidism.[7] Excessive levels of thyroid hormone result in an increase in the basal metabolic rate. Common clinical signs in aged cats with hyperthyroidism are weight loss despite normal or increased appetite, polydipsia, polyuria, increased activity, and tachycardia due to cardiomegaly.[7] In guinea pigs with hyperthyroidism, clinical signs consistent with functional thyroid gland tumors are very similar to those observed in feline hyperthyroidism.[4] Human patients with hyperthyroidism can show increased cardiac output, due to both increased cardiac contractility and increased peripheral oxygen requirements, leading to tachycardia, palpitations, cardiomegaly, and congestive heart failure.[5] In one report describing guinea pigs, various concurrent lesions related to functional thyroid tumors were reported.[2] Our case demonstrated similar cardiac lesions, including myocardial hypertrophy and degeneration, and we attributed the centrilobular hepatocellular degeneration to congestive heart failure. Because clinical signs of hyperthyroidism were not apparent in our case, serum total thyroxine concentration was not evaluated, but we considered that either the ectopic thyroid carcinoma at the base of the heart or right thyroid adenoma was functional because the concurrent lesions were consistent with hyperthyroidism. We attributed the death for our patient to congestive heart failure in addition to respiratory insufficiency due to suppurative bronchopneumonia and pulmonary edema. No obvious causes of pneumonia were detected on the lung sections examined, but secondary bacterial infection and aspiration of foreign bodies are possible.

In summary, a guinea pig with an ectopic thyroid carcinoma and thyroid gland adenoma showed some concurrent lesions, especially in the heart. These lesions were very similar to those observed in humans and animals and were considered due to hyperthyroidism related to functional tumors. To our knowledge, the current report represents the first description of ectopic thyroid carcinoma in *Cavia porcellus*. When hyperthyroidism and cardiac signs occur concurrently, consider both ectopic thyroid tumors and thyroid tumors as differential diagnoses.

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