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CASE REPORT

# Bilateral thyroid adenomas in an alpaca

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## Abstract

A 7-year-old neutered male alpaca (*Vicugna pacos*) was presented for evaluation of a 3-year history of large, bilateral, firm ventral cervical masses causing esophageal and tracheal impingement. Ultrasound examination, radiographic evaluation, histopathological findings, and magnetic resonance imaging confirmed the masses to be bilateral thyroid adenomas. Conservative medical treatment by unilateral chemical ablation, using 10% formalin by aspiration technique, was performed on the left mass. Chemical ablation proved to be effective in decreasing the size of the mass, with no apparent adverse effects. To our knowledge, this case is the first known report of bilateral thyroid adenomas in an alpaca, a condition previously described in humans, horses, dogs, and cats.

**KEYWORDS**
ablation, camelid, formalin, MRI

## 1 | INTRODUCTION

Thyroid pathology is observed in both human and veterinary medicine.[1,2] Clinical presentations of thyroid lesions are variable and classified by size, whether they are malignant or benign, and if they are endocrinologically active or inactive.[3] Diagnostic testing therefore is important to classify these lesions and dictate appropriate treatment.[2] We describe the clinical evaluation and treatment of benign, endocrinologically inactive, bilateral thyroid adenomas in an alpaca.

## 2 | CASE DESCRIPTION

A 7-year-old, 57.7 kg neutered alpaca was presented to the University of Adelaide Veterinary Health Centre for evaluation of large, firm masses on the ventral aspect of the cranial third of the neck. The masses had been increasing in size for the last 3 years causing progressive dysphagia. Despite repeated drainage by the referring veterinarian, the lesions reccurred.

On admission, the alpaca was bright, alert, and responsive and all vital signs were within normal limits (Supporting Information). The masses were located on the ventral aspect of the cranial neck, and were firm and well-circumscribed, with no pain upon palpation. The margin between the 2 masses was delineated by the trachea, which was visually displaced to the right. The left mass measured approximately 15 cm length × 8 cm width, with the right visually smaller, measuring approximately 9 cm length × 8 cm width.

Transcutaneous ultrasound (US) examination identified areas of heterogenous echogenicity with fluid-filled cysts bilaterally. Cytological evaluation of an US-guided fine needle aspirate (FNA) from the left mass was consistent with chronic hemorrhagic effusion.

Findings from CBC and Serum biochemistry were unremarkable. Serum thyroxine (T4) concentration was below the reference interval (RI) at 76.3 nmol/L (RI extrapolated from llamas: 90-283 nmol/L) with a serum thyroid stimulating hormone (TSH) concentration of 0.07 ng/mL (RI unavailable for South American camelids [SAC]).[4] An US-guided biopsy of the left lobe was performed, and histopathology was consistent with follicular thyroid adenoma (Figure 1). A capsule was not

**Abbreviations:** CT, computed tomography; GA, general anesthesia; MRI, magnetic resonance imaging; RI, reference interval; RR, reference range; SAC, South American Camelids; TSH, thyroid stimulating hormone; T4, thyroxine; T1WC, T1 weighted after contrast; US, ultrasound.

identified in the tissues examined and therefore a well-differentiated thyroid carcinoma could not be definitely excluded without advanced imaging or complete excisional biopsy that included evaluation of the capsule.

Based on preliminary findings, magnetic resonance imaging (MRI) with contrast under general anesthesia (GA) was performed to better identify the potential malignancy of the masses, to determine bilateral or unilateral pathology, and to aid in surgical planning for thyroidectomy (Supporting Information).[5-7] The MRI study identified 2 large, multilobulated masses adjacent to the proximal cervical spine. The lesions had well-defined margins and separation from surrounding tissues with no evidence of tumor capsular invasion, consistent with thyroid adenomas (Figure 2). The left mass measured 14.3 × 9.1 × 7.6 cm and the right 9.1 × 8.2 × 5.6 cm with no normal thyroid tissue observed. Megaesophagus was observed proximal to the lesion as a result of compression from the masses. Marked displacement of the common carotid artery and jugular vein was observed bilaterally.

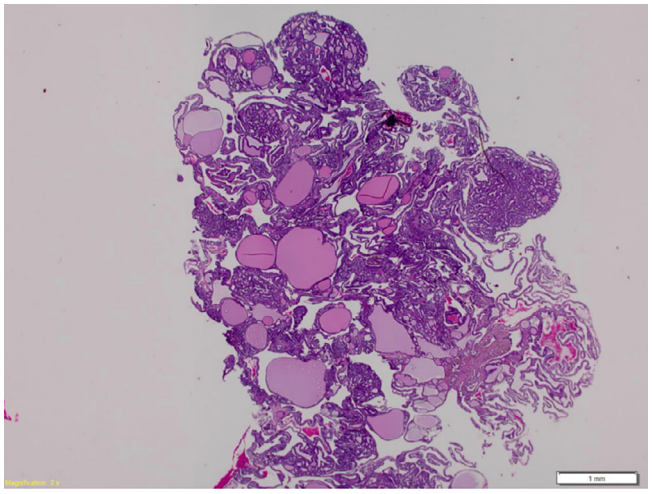

**FIGURE 1** Histopathology image of a left thyroid mass in an alpaca (hematoxylin and eosin, 2× magnification). Tissue is comprised of variably-sized small to moderate-sized follicles filled with eosinophilic translucent material (protein, colloid) or collapsed and empty. Follicles are lined by cuboidal to flattened nonciliated epithelium, supported by a fine fibrovascular stroma. Frequent regions of hemorrhage and fibrin exudation are present, and the tissue extends to all margins of the section

A diagnosis of endocrinologically inactive, benign, bilateral thyroid adenomas was made based on histopathology, MRI findings, and serum thyroid hormone concentration. The proposed treatment options included bilateral surgical excision, unilateral surgical excision, or chemical ablation of 1 or both masses. Unilateral chemical ablation was selected by the owner because of financial constraints associated with surgery. Furthermore, total thyroidectomy and bilateral ablation were ruled out because daily supplementation with levothyroxine was not feasible for the owner and the appropriate dosage for alpacas is unknown.[8]

Chemical ablation of the left thyroid mass was performed by injecting and then aspirating 60 mL of 10% formalin (4% formaldehyde) multiple times into the lesion. Dosing was determined based on visual mass distention and pressure during injection, rather than a specific dosage. Care was taken to prevent generating excessive pressure inside the mass, which could cause leakage of chemical into surrounding tissue. Once subjective resistance with an increase in required injection force was noted, the full dose was aspirated back into the syringe. To prevent inadvertent ablation of all functioning thyroid tissue, the right mass was not treated. Mild discomfort was noted after treatment, and flunixin meglumine (Flunixin, Ceva Animal Health Pty Ltd, Glenorie, NSW, Australia; 1.1 mg/kg IV q24h) was administered for 3 days after ablation to alleviate pain associated with the procedure.

The patient was discharged from hospital after 2 weeks. Instructions for continued care included monitoring for any swelling or pain

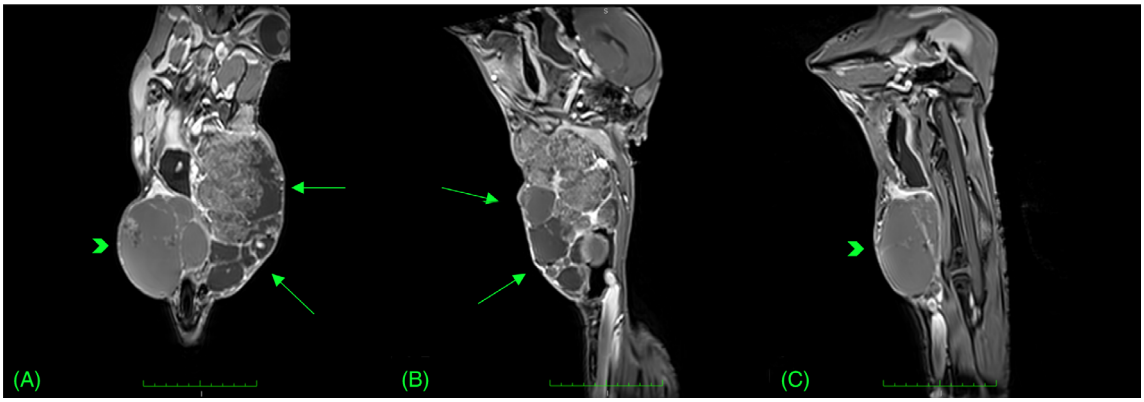


**FIGURE 2** Dorsal (A) and parasagittal (B, C) T1-weighted postcontrast MRI images of the cervical region of an alpaca. Both masses have well-defined margins and good separation from adjacent tissues. The left mass (arrow) has 2 different components; the cranial portion is heterogeneous with mixed iso- and hypointense signal intensity and moderate contrast enhancement. Caudally, multiple lobulations with T1-hypointense content can be seen. The right mass (arrowhead) is smaller and has multiple lobulations seen with T1-hyperintense content and focal areas of hypointensity


**FIGURE 3** Ventral view of bilateral thyroid masses in an alpaca pre- and postchemical ablation. The left-sided mass (arrow) showed a decrease in size with treatment, as depicted in the pretreatment (A) image compared to 7 months posttreatment (B)

in the treated area, monitoring for signs of dysphagia or dyspnea, and to place food and water at a raised level to prevent regurgitation and aspiration from the identified megaesophagus. Monitoring of the patient's progress included follow-up phone calls at 1, 3, and 5 months after treatment, with follow-up examination performed at the property 7 and 18 months after treatment. The examination at 7 months disclosed a marked decrease in size of the left mass from 15 × 8 cm to approximately 6 × 4 cm on gross appearance (Figure 3). On transcutaneous US examination, the left mass appeared more uniform in echogenicity, with little to no evidence of the cyst-like lesions previously noted. Repeat thyroid hormone concentrations after chemical ablation indicated minimal changes in both T4 and TSH. The owner reported that signs of dysphagia were no longer evident, and that the alpaca seemed to have gained weight. An increase in body condition score from 2/5 before treatment to a 3/5 at 7 months follow-up was noted on physical examination.[9] Follow-up at 18 months after treatment indicated that the left thyroid mass had subjectively increased in size (measurements unknown). A second chemical ablation using a similar technique as described above was performed by another veterinarian.

## 3 | DISCUSSION

Contradictory data on the incidence of thyroid lesions in SAC is present in the literature. A report on the prevalence of neoplasia in over 500 llamas and alpacas did not find evidence of thyroid lesions, attesting to the apparent rarity of this pathology in SAC.[10] However a retrospective study of necropsy findings in 77 llamas identified incidental benign thyroid adenomas and cysts in 29/77 animals.[11] In addition, a bilateral malignant thyroid carcinoma in a llama recently has been described.[12] Although almost half of the llamas in the retrospective necropsy study had evidence of thyroid lesions, this number equates to approximately 5% of the combined number of animals in the 3 aforementioned reports. This low incidence supports the rarity of the clinical condition, but thyroid lesions should not be ruled out as a differential diagnosis for cranial cervical mass lesions because evidence of their existence has been documented in SAC.[11,12]

In veterinary species, thyroid lesions including benign and malignant pathology, are most commonly reported in dogs, cats, horses, and guinea pigs.[1] In horses, dogs, and cats, thyroid neoplasia more frequently is observed with advanced age, with mean age of 10.7 years in dogs and 12.4 years in cats, and a 75% prevalence in horses >20 years of age.[1,13,14] In the previously-mentioned necropsy analysis of 77 llamas, the authors found both micro- and macroscopic lesions in animals 10 to 20 years of age, and the majority of the animals with thyroid lesions were >13 years of age. The authors hypothesized that adenoma of the thyroid may progress to accumulation of colloid-like material, forming larger cysts as the animal ages.[11] Advanced age also was noted in the aforementioned report of a cystic, bilateral, thyroid carcinoma in an 18-year-old llama.[12] This finding indicates that age potentially may be a risk factor for the development of thyroid lesions in SAC.[11] These data are contradicted by the current case because the alpaca was 7 years of age at presentation, and 4 years of age when the mass was first noted. However, the report in over 500 SAC indicates that the mean age of alpacas with neoplasia (5.48 ± 3.7 years) was substantially less than that of llamas (12.53 ± 3.2 years).[10] Thyroid lesions should therefore be considered as a

differential when presented with cranial cervical masses in SAC of advanced age but should not be ruled out in younger animals, particularly alpacas.[10]

Laboratory testing performed in our alpaca indicated low serum T4 concentration when extrapolating from the RI in llamas, but because no validated RI is available for alpacas, these results potentially could be within the normal range. Serum thyroxine concentrations in the previously-mentioned report of the 18-year-old llama with the carcinoma were within the RI.[12] This observation suggests that despite a lack of RI for alpacas, both malignant and benign lesions could be endocrinologically inactive in SAC, but further endocrinological investigation of thyroid neoplasia in SAC is required to support this hypothesis.[4,12,15] Assessment of serum thyroid hormone concentrations from normal alpacas from the same herd could have helped interpretation of results by providing control intervals for comparison.

Veterinary literature indicates that 90% of thyroid tumors in dogs that are palpable on presentation are malignant.[1] However, it is uncertain if size can be used as a reliable indicator when determining malignancy in SAC because the benign adenomas in our case were of similar size to the previously reported malignant carcinoma in a llama.[12] The bilateral presentation in SAC is important information because it aids in narrowing the differential diagnosis list for lesions at the level of the cranial cervical region and helps dictate the treatment plan. Bilateral occurrence also may warrant a more grave prognosis because anatomical impingement of structures such as the trachea and esophagus can be expected to be worse than with unilateral pathology. The current clinical presentation of thyroid lesions in SAC according to the aforementioned reports and the present case appears to be that of bilateral, endocrinologically inactive lesions which may increase in size and warrant intervention.

Diagnosis of mass lesions commonly is confirmed by histopathological evaluation.[16] Characteristics of follicular adenomas include large follicles filled with colloid and hemorrhagic fluid and lined by flattened epithelium, features that were observed in our case.[13] It is difficult to differentiate thyroid carcinomas from adenomas because follicular carcinomas do not readily display conventional malignant features such as nuclear enlargement and hyperchromatism.[1,17] Diagnosis of thyroid carcinoma therefore generally is reliant on visualization of vascular or capsular invasion, with vascular invasion being the most reliable sign of malignancy in humans.[17,18] A capsule was not identified in the tissue submitted from this alpaca, which limited the use of histopathology in the differentiation between benign and malignant masses. Therefore, interpretation of the histopathological samples alongside advanced imaging was performed.

Ultrasonography is regarded as the mainstay imaging modality for detection and differentiation of thyroid masses in humans because it is safe, noninvasive, and generally easy to perform because of the superficial location of the gland.[2,19-22] Common features that indicate benign pathology include a similar, or hyperechogenic, signal compared to surrounding thyroid tissue, a hypoechogenic halo surrounding the nodule which indicates connective tissue, visualization of compressed thyroid tissue and the presence of cystic lesions.[19,20,22] A study comparing US, computed tomography (CT), and MRI in dogs presented with suspected thyroid lesions indicated that US has substantially lower sensitivity and specificity for identifying thyroid carcinomas. This decrease in diagnostic sensitivity when using US for these lesions is mostly a consequence of inability to view areas dorsal to the trachea, low contrast resolution, and difficulty in identification of mass origin when large masses, such as in our case, displace normal anatomy.[5] The study determined that, although US is a useful screening tool when performed by a skilled operator, MRI or CT can be justified as the preferred modalities.[5] In this alpaca, US was used to guide FNA and biopsy sampling, and to examine echogenicity. The large size of the masses skewed anatomical detail, obliterated normal thyroid tissue to use for comparison, and decreased visualization of surrounding structures, and therefore ultrasonography was not useful to determine malignancy.

Risk categories for malignancy with advanced imaging include lymph node involvement, capsule disruption, extrathyroid spread to adjacent structures, and vascular invasion, none of which were identified in our alpaca using MRI. These findings further support the presumptive diagnosis of benign adenoma and attest to the value of advanced imaging in thyroid lesions in SAC.[5,6,23]

Treatment options for thyroid lesions vary among species, and factors that dictate the treatment plan include malignancy of the mass, endocrinological activity, space-occupying effects, and owner financial capability. In humans, chemical ablation of thyroid nodules has been well documented to be effective and safe in the treatment of both benign and recurrent malignant masses.[24,25] Two techniques are performed: (a) retention, where the injected chemical (usually ethanol) is left in the nodule, and (b) aspiration, where the ethanol is aspirated after a few minutes. Studies comparing both methods did not report significant differences in efficacy, but less pain was observed with the aspiration technique.[24-26] Chemical ablation with ethanol also has been used in veterinary medicine with some success seen in cats with thyroid nodules.[27] Similar treatment to the aspiration technique was performed in our alpaca using 10% formalin. Formalin commonly is used for chemical ablation of ethmoid hematomas in horses and is well documented to be effective in decreasing the size, and in some cases, completely obliterating these masses.[28,29] Because of the proven efficacy of formalin for treatment of ethmoid hematomas in horses, we selected it for chemical treatment. This treatment was found to be effective in decreasing the size of the adenoma (by approximately 50%). Therefore, formalin should be considered as a treatment option when presented with thyroid lesions in SAC. In our case, recurrence of the left thyroid mass occurred at approximately 18 months after-chemical ablation. In horses with ethmoid hematomas, repeated injections (mean of 5 treatments) often are required, with some lesions still recurring.[30] Therefore, it is possible that repeated injections may have prolonged the time to recurrence of the mass. The number of treatments required and the risk of recurrence after multiple treatments using intralesional formalin in SAC is currently unknown.

## 4 | CONCLUSION

Our case highlights the diagnosis and management of previously unreported, large, bilateral, follicular thyroid adenomas in an alpaca presenting with esophageal impingement and tracheal displacement. Thyroid adenoma should be included as a differential diagnosis for soft tissue masses in the cranial cervical region of SAC. The combination of histopathology with advanced imaging is useful in the identification of anatomic location, mass identification, demarcation, and assessment of malignancy. If thyroidectomy is not a reasonable treatment option, chemical ablation using 10% formalin (utilizing the aspiration technique) is a feasible alternative treatment to decrease the size, and therefore the space-occupying effects, of large lesions. However, it is currently unknown how many treatments are necessary to prevent recurrence of the lesions. Our case report aims to further improve the knowledge of thyroid adenomas in a previously unreported species and to help veterinarians determine their clinical approach when presented with a similar scenario in SAC. Further research about thyroid hormone RI and the actual prevalence of thyroid neoplasia in SAC is warranted to better understand thyroid pathology and treatment in these species.

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### CONFLICT OF INTEREST DECLARATION

Authors declare no conflict of interest.

### OFF-LABEL ANTIMICROBIAL DECLARATION

Authors declare no off-label use of antimicrobials.

### INSTITUTIONAL ANIMAL CARE AND USE COMMITTEE (IACUC) OR OTHER APPROVAL DECLARATION

Authors declare no IACUC or other approval was needed.

### HUMAN ETHICS APPROVAL DECLARATION

Authors declare human ethics approval was not needed for this study.

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## SUPPORTING INFORMATION

Additional supporting information may be found in the online version of the article at the publisher's website.

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