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BRIEF COMMUNICATION

Thyroid hyperplasia in a saker falcon (*Falco cherrug*)

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Abstract An adult female saker falcon (*Falco cherrug*) presented to our falcon medical and research hospital with intermittent regurgitation, dyspnea, and squawking sound. Physical, radiographic, and endoscopic examination revealed a markedly enlarged thyroid gland. Hematological and blood biochemical results were within normal ranges apart from a slight increase in creatinine phosphokinase and aspartate aminotransferase. Cytological evaluation of fine-needle aspirate from the enlarged gland showed few RBCs and cellular debris. Neither inflammatory nor neoplastic cells were found. The condition was diagnosed clinically as unilateral thyroid hyperplasia, a condition which has not been previously reported in saker falcons.

Keywords Thyroid hyperplasia · Saker falcon · *Falco cherrug*

Introduction

The avian thyroid glands are paired, oval, dark red glands located on the medial side of the jugular vein at the thoracic inlet. The glands adhere to the common carotid arteries just cranial to the bifurcation of the subclavian arteries (Fig. 1). Each gland consists of thyroglobulin-containing follicles lined by a single layer of low epithelial cells. Avian thyroglobulin is far more iodinated than that of mammals and contains monoiodotyrosine, diiodotyrosine, T3, and T4 (Lumeij 1994; Orosz 1997). The size of thyroid glands in birds varies with species, age, sex, environment, nutrition, and level of activity, while their functions include controlling the metabolic rate and regulating reproduction, molting, and the growth and development of muscles and bones (Schlumberger 1955; Wentworth and Ringer 1986).

Thyroid enlargement could be hyperplastic or neoplastic (Latimer 1994). Thyroid hyperplasia is common in many species of domestic and wild birds, particularly in budgerigars (*Melopsittacus undulatus*) and pigeons, and its clinical signs typically include dyspnea and a distinctive squawk on vocalization (Sasipreeyajan and Newman 1988). However, both thyroid hyperplasia and neoplasia are rare findings in raptors, and only a few cases have been reported in these birds during postmortem examination (Forbes et al. 2000; Garner et al. 2002). This communication describes a clinically diagnosed case of thyroid gland hyperplasia in a female saker falcon.

Case report

An adult female saker falcon (*Falco cherrug*), weighing 1,040 g and acquired 2 years earlier, was brought to the Falcon Medical and Research Hospital of the Fahad Bin Sultan Falcon Center, Riyadh, Kingdom of Saudi Arabia, for clinical examination. The bird presented with a large swelling in the neck, intermittent regurgitation, inspiratory dyspnea, and a squawking sound. Prior to the appearance of these symptoms, the falcon was in good condition and performed well during flight and hunting. When not hunting (e.g., during molting), it was housed in an air-conditioned

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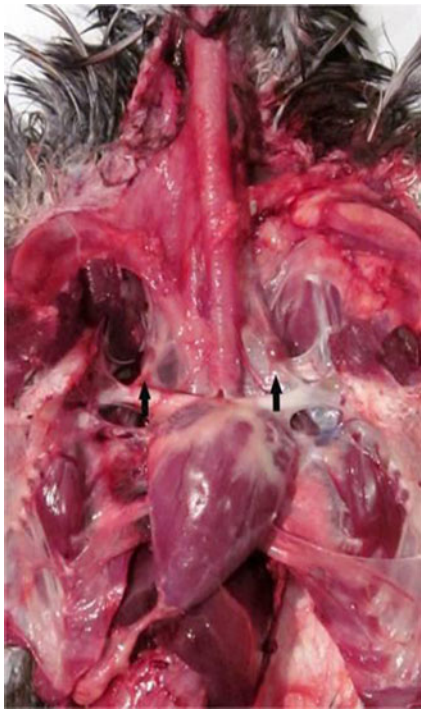

Fig. 1 Normal thyroid glands (*arrows*) of the saker falcon (*F. cherrug*) appear as small, oval, red-brown structures adjacent to the carotid arteries as shown in this figure from a necropsied bird

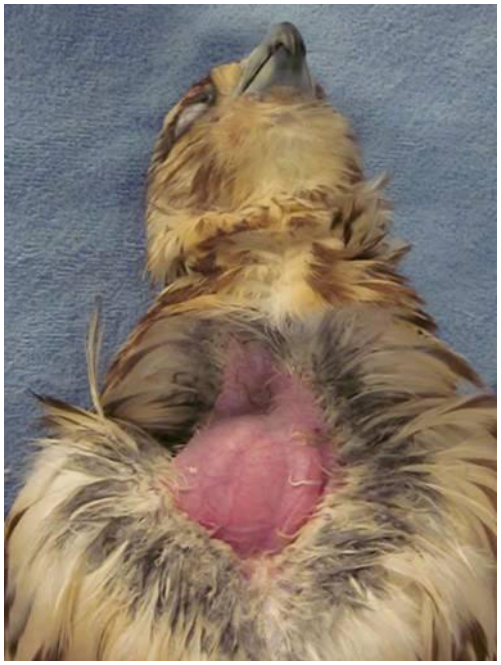

Fig. 2 Ventral view of the neck of the affected saker falcon (*F. cherrug*) showing a large mass at the base of the neck just above the thoracic inlet, displacing the distal portion of the trachea ventrally

room and fed on a diet comprised of fresh pigeon meat, frozen quail, and chicken liver. The bird had no history of exposure to organophosphorus compounds or chlorinated biphenols.

Physical examination of the bird revealed a large, palpable oval mass at the caudal region of the neck and the right side of the thoracic inlet (Fig. 2). When pushed caudally, the mass moved deeply into the thoracic inlet. The bird was anesthetized with isoflurane via facemask for further examination, and the following diagnostic procedures were performed: complete blood count, biochemical analysis, examination of fine-needle aspirate of the mass, endoscopic examination of the upper digestive tract, and lateral and ventrodorsal whole-body survey radiographs. Thyroid function test could not be undertaken as no facilities are available to us locally for thyroid hormonal assay in avian species. Besides, several factors are known to complicate thyroid function testing in avian species, such as diurnal and seasonal variation in thyroid activity, the lack of test validation, short T4 half-life which might entail more than one determination of T4 (Merryman and Buckles 1998), and the lack of specific T3 and T4 reference values for saker falcons in the literature.

The hematological results were found to be within normal ranges (Table 1), as were the blood biochemical findings (Table 2) apart from a slight elevation in creatinine phosphokinase (CPK) and aspartate aminotransferase (AST), whose values might fluctuate in falcons during training and exercise. No abnormal findings were observed on cytological and endoscopic examinations of the upper digestive tract, other than displacement of the thoracic esophageal wall as a result of direct pressure by the mass (Fig. 3). No evidence of inflammatory or neoplastic cells was seen during examination of needle aspirates from the mass after staining with Diff-Quik stain, apart from the presence of few red blood cells mixed

Table 1 Hematological values of the affected saker falcon (*F. cherrug*)

Variable	Analysis results		Reference values for saker falcons
	Result (absolute)	Results (%)	(Samour 2008)
RBC ($\times 10^{12}$/L)	3.6		2.43–3.96
Hb (g/dl)	16.0		11.5–26.5
PCV (%)	46.4		38–39
MCV (fl)	129.1		124–147
MCH (pg)	44.4		41.4–45.4
MCHC (g/dl)	34.4		30.4–34.9
WBC ($\times 10^{9}$/L)	5.2		3.8–11.5
Heterophils ($\times 10^{9}$/L)	3.22	62	2.6–5.85
Lymphocytes ($\times 10^{9}$/L)	1.98	38	0.8–4.25
Monocyte ($\times 10^{9}$/L)	–	–	0.0–0.8
Eosinophils ($\times 10^{9}$/L)	–	–	0.0–0.2
Basophils ($\times 10^{9}$/L)	–	–	0.0–0.4
Thrombocytes ($\times 10^{9}$/L)	20		12–25

Table 2 Blood chemistry values of the affected saker falcon (*F. cherrug*)

Variable	Results	Reference values (Samour and D'Aloia 1996)
CK IU/l	665	355–651
AST (GOT) IU/l 37 °C	109	45–95
ALT (GPT) IU/l 37 °C	51	36–55
ALP IU/l	287	285–450
Glucose mmol/l	13	12–14

with other cellular debris. Swabs from the esophagus and crop were negative for trichomoniasis. Lateral radiography revealed a large, oval soft tissue mass on the caudal region of the neck and the thoracic inlet, causing ventral displacement of the distal portion of the trachea. The mass approximately measured 5.0×3.5 cm (Fig. 4) and appeared on the ventrodorsal view to be mostly located above the thoracic inlet on the right side of the base of the neck (Fig. 5). Based upon these findings and the associated symptoms, the mass was diagnosed clinically as a unilateral thyroid gland hyperplasia.

Discussion

Thyroid enlargement can usually be hyperplastic or neoplastic. Thyroid neoplasms are, however, extremely rare in raptors, the majority of thyroid enlargements in these birds being due to hyperplasia associated with iodine deficiency or other causes such as ingestion of goiterogenic substances, acute septicemic diseases that cause thyroiditis, exposure to toxic levels of organophosphorus compounds and chlorinated biphenols, and hereditary biosynthetic defects (Samour et al. 2001). Garner et al. (2002) reported diffuse hyperplastic goiter in postmortem samples from eight captive-bred perinatal bald eagles (*Haliaeetus leucocephalus*). With iodine deficiency, there will be insufficient serum concentrations of

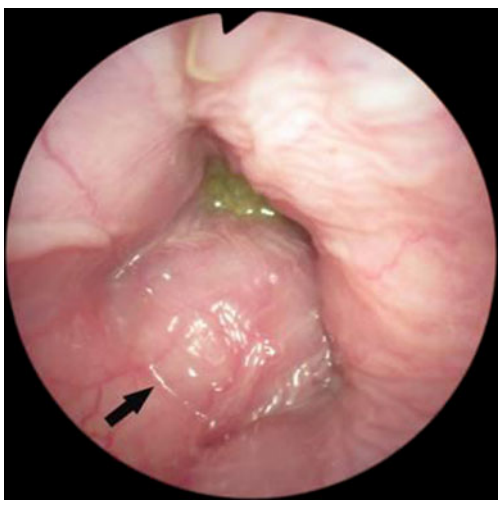

Fig. 3 Endoscopic view of the thoracic esophagus of the affected falcon showing the displaced esophageal wall of the thoracic esophagus (*arrow*) due to the direct pressure caused by enlarged thyroid glands, causing partial obstruction of the lumen of the thoracic esophagus

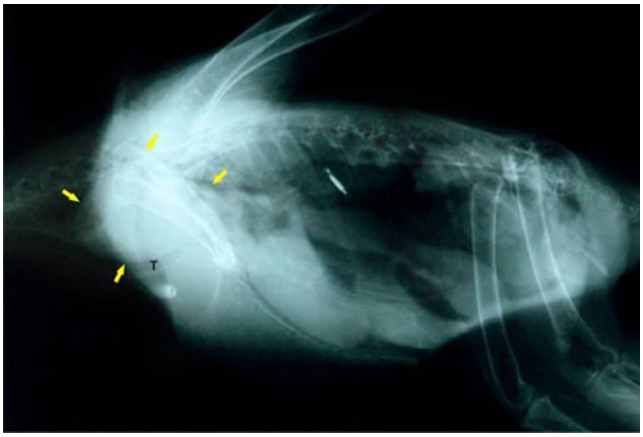

Fig. 4 Lateral survey radiograph showing an oval, soft tissue mass on the caudal region of the neck and thoracic inlet (*arrows*) of a saker falcon (*F. cherrug*) that presented with a history of intermittent regurgitation, inspiratory dyspnea, and squawking sound. The oval shaped, soft tissue mass approximately measured 5×3.5 cm, displacing the distal portion of the trachea (letter *T*) ventrally

Fig. 5 Ventrodorsal view showing the soft tissue mass (*arrow*) mostly located above the thoracic inlet and occupying the right side of the caudal region of the neck. On further examination, the mass was diagnosed as an enlarged thyroid gland

thyroxine to inhibit the production of thyroid-stimulating hormone (TSH) by the anterior pituitary gland. Excessive quantities of TSH cause proliferation of the thyroid follicular epithelium and accumulation of follicular colloid, resulting in a marked bilateral thyroid enlargement, which may be accompanied by cystic changes (Lumeij 1994; Latimer 1994). Clinical signs associated with this condition in birds include regurgitation, squawking, and dyspnea caused by pressure of the gland on the trachea and the esophagus (Lumeij 1994).

In contrast to thyroid hyperplasia, neoplasms of the thyroid glands are extremely rare in birds of prey, and most of them are incidental findings during postmortem examination. Out of 87 non-domesticated birds examined postmortem, Wadsworth and Jones (1979) recorded only one tumor of the thyroid gland, namely a small adenoma in the thyroid gland of a carrion crow (*Corvus corone*). A thyroid adenoma was also reported in a budgerigar (Blackmore and Cooper 1982). In a survey of neoplasms in birds of prey, Forbes et al. (2000) reported that out of 122 neoplasms from more than 40 different species of birds, only two cases of thyroid neoplasia were recorded, one being a cystadenoma in a caracara (*Polyborus plancus*) and the other a cystic fibroadenoma in a buzzard eagle (*Geranoaetus melanoleucus*). Bates et al. (1999) reported a thyroid adenocarcinoma in an American bald eagle (*H. leucocephalus*) that died of extensive tracheal hemorrhage, while Samour et al. (2001) reported a thyroid cystadenocarcinoma found incidentally during a postmortem examination of an adult female saker falcon (*F. cherrug*).

The morphologic differentiation of thyroid neoplasia from hyperplasia is difficult without histopathology. However, histopathology was not performed on the present bird because the owner declined the biopsy procedure. On the other hand, the clinical manifestations of thyroid enlargement in this bird resembled those reported on thyroid hyperplasia in other avian species. Furthermore, no neoplastic cells were found in needle aspirates from the mass. In light of these results, the bird was discharged with multivitamin, salt, and energy supplements with added iodine (Soluvet Plus, Vetafarm Pty Ltd, New South Wales 2650, Australia) to be taken daily with food for 2 weeks. The falconer was also advised to provide soft diet to the bird. When contacted a month later, the falconer reported that his bird was in better condition and that there was no further enlargement of the mass. When contacted again recently, i.e., more than 3 months after the falcon was first seen, he stated that the mass decreased significantly in size, all symptoms disappeared, and the bird was performing well during hunting. This suggests that the thyroid hyperplasia diagnosed in this bird might have been related to dietary factors or seasonal variation. To our knowledge, this is the first report of a thyroid gland enlargement, diagnosed clinically as thyroid hyperplasia, in a live saker falcon.

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