Lead Toxicosis in Falcons: A Method for Lead Retrieval

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Abstract

Lead toxicity is the most common heavy metal toxicosis in free-living birds, and one of the most important diseases of toxic origin in captive avian species. Falcons commonly ingest lead pellets or lead fragments concealed in the body of shot prey. Treatment of heavy metal toxicosis is an integral part of avian emergency and critical care practice. The primary treatment for lead toxicosis consists of the retrieval of lead particles from the digestive tract, and the secondary treatment consists of the use of chelating agents and support therapy. Lead retrieval from falcons with lead toxicosis should be undertaken immediately after the metallic radiodense particles have been observed in the gastrointestinal tract on survey radiographs. Lead pellets and lead fragments are retrieved using a combination of stomach lavage, rigid or flexible endoscopy, and long biopsy forceps.

Key words: **Endoscopy; falcon; lavage; lead; plumbism; retrieval**

Plumbism, or lead toxicity, is the most common heavy metal toxicosis reported in free-living birds and has been diagnosed in whooper swans (*Cygnus cygnus*),[1] mute swans (*Cygnus olor*),[2] common loons (*Gavia immer*),[3] ducks and geese,[4] pheasants, quails, partridge, wader and shore birds,[5] and raptors.[5,6] Lead toxicosis has also been reported in captive birds, including sandhill cranes (*Grus canadensis*),[7] houbara bustards (*Chlamydotis undulata macqueenii*),[8] saker falcons (*Falco cherrug*), peregrine falcons (*Falco peregrinus*), lanner falcons (*Falco biarmicus*),[9] and psittacines.[10,11]Avian species can swallow lead intentionally, as in the case of waterfowl or game birds that ingest angler's sinkers or spent shotgun pellets as grit, or accidentally, as in the case of raptors that ingest lead pellets or fragments concealed in the body of shot prey. Therapy for lead toxicosis consists of primary treatment to remove lead pellets or fragments from the digestive tract and secondary treatment with chelating agents and supportive care.[12]

An innovative endoscope-assisted gastric lavage technique to retrieve foreign bodies from the upper gastrointestinal tract (GIT) of psittacine birds was recently described.[13] This technique relies on a 2.7-mm rigid endoscope placed within a sheath and inserted through the oropharynx or through a keyhole ingluviotomy to examine the crop, esophagus, proventriculus, and ventriculus for the presence of foreign bodies. Attachment of a video camera to the

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1055-937X/05/1402-$30.00
doi:10.1053/j.saep.2005.04.009

endoscope was recommended as the bird was suspended to an almost vertical position, making direct observation through the endoscope eye piece difficult. A 0.9% saline solution bag was attached to the port of the sheath to allow gentle infusion of the solution to dislodge foreign material.[13]

This paper describes a method to retrieve lead pellets and fragments from the upper GIT of captive falcons presented to the Falcon Specialist Hospital and Research Institute of the Fahad bin Sultan Falcon Centre, Riyadh, Kingdom of Saudi Arabia.

Clinical Diagnosis of Lead Toxicosis

Lead toxicosis in captive falcons is diagnosed at the author's hospital using a combination of anamnesis, clinical symptoms, radiographic examination, and the measurement of lead in whole blood.[9]

The most relevant information gathered in the clinical history is the periodic use of small mammals, such as jerboas (*Jaculus jaculus*) or gerbils (*Gerbillus cheesmani*), or birds, such as collared doves (*Streptopelia decaocto*) or domestic pigeons (*Columba livia*), shot by falconers to feed captive falcons. It is interesting to note that lead pellets have been observed radiographically in the ventriculus of falcons fed exclusively on pigeons purchased from local bird markets. Dealers commonly acquire pigeons from local farms where shooting is a widespread practice. The possibility remains that one or more shotgun pellets are left embedded in the muscle mass of some pigeons without causing fatal injury. These pigeons are later trapped and sent to bird markets, where unwary falconers purchase them to feed their falcons.

The clinical symptoms of lead toxicosis in falcons generally include amaurosis, ataxia, paresia of the wings and legs, hyperesthesia, and seizures. Subclinical lead toxicosis is, however, more difficult to diagnose as falcons are usually presented with nonspecific clinical symptoms, including reduction or absence of appetite, shredding and flicking of food, delayed emptying of the crop, progressive weight loss, green-colored urates, and reduced flight performance.[9] Survey radiographs, including both ventrodorsal and lateral views, should be taken to assist in the diagnosis.

Lead is the only heavy metal that falcons are exposed to in the Middle East. Thus, the detection of radiodense metallic pellets or fragments within the GIT of falcons is confirmation of a lead toxicosis.[9] However, the absence of lead particles from the GIT does not rule out lead toxicosis, as lead pellets and lead fragments are often cast out together with indigestible material such as fur and feathers. Measuring blood lead levels is the most reliable method for diagnosing lead toxicosis in birds.[9] At the author's hospital, blood lead levels are measured by using an electrochemical system (LeadCare Blood Lead Testing System, ESA Inc, Chelmsford, MA USA). Only 50 μL of whole blood is required for testing, and the results are obtained within 3 minutes and are expressed in micrograms per deciliter (μg/dL).[14]

After confirming the diagnosis of lead toxicosis, and in the absence of lead pellets or lead fragments in the upper GIT, treatment should proceed with a chelating agent and supportive therapy.[9] The chelating agent of choice in the therapeutic management of lead toxicosis in falcons is calcium disodium ethylenediaminetetracetate ($CaNa_2$ EDTA) (25% Sodium Calcium Edetate, Animal Care Ltd, Dunnington, York UK) (100 mg/kg, undiluted, IM q12 h). The author has used this in captive falcons for 5 to 25 consecutive days without evidence of muscle tissue damage or impairment of liver and kidney function.[15]

Lead Retrieval

Lead retrieval from falcons with lead toxicosis forms an integral part of the veterinary emergency and critical care practice. This technique should be undertaken immediately after diagnosis to prevent further absorption of lead.

The falcons are anesthetized for the survey radiographs. General anesthesia is achieved using isoflurane (Isoflo, Abbott Laboratories, North Chicago, IL USA), and is delivered with oxygen via a facemask. If metallic pellets or fragments are observed in the upper GIT (Figs 1 and 2), the falcon is prepared for the lead retrieval procedure. It is of the utmost importance to prepare in advance all the materials and equipment needed for the procedure (Figs 3 and 4).

First, the falcon should be intubated with an appropriately sized (3.5-4.0 mm ID) uncuffed endotracheal tube. Once the endotracheal tube is placed, it should be firmly secured around the head using gauze tape (Fig 5). Next, the opening of the choana should be blocked with a small ball of cotton wool to prevent stomach fluid from entering the upper respiratory system (Fig 6). Finally, the falcon should be wrapped in a kitchen tea towel to avoid mechanical damage to the feathers. The towel can be secured around the shoulders and the base of the tail using masking tape.

A blunt stomach catheter, 4 mm in diameter and 350 mm in length, commonly used to feed neonatal lambs (Lamb feeder, Arnolds Veterinary Products,