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Disorders of the Avian Digestive Tract: Part I

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The current distribution of animal patients presented to the zoological medicine service at the Veterinary Teaching Hospital (VTH) at Colorado State University is approximately 30% birds, 30% small mammals, 30% reptiles, and 10% fish, herptiles, and animals from zoological parks, public aquaria, and animal rehabilitation facilities and sanctuaries. In the late 1980s and early 1990s, avian patients represented a percentage of nearly 50% of patients seen by the service. Most avian patients were privately owned psittacine birds. A review of the medical records during a 28-year period (1988-2016) revealed that many avian patients presented with a disorder involving the digestive tract.

Common developmental disorders of the beak of psittacine birds included lateral deviation of the premaxilla (scissor beak) and mandibular prognathism. Most cases were treated by frequent trimming; however, a few severe cases in young macaws were treated surgically using the acrylic ramp technique or the pin and rubber band technique involving trans-sinus pinning as described by Bennett (2011). Bacterial, fungal, viral, and parasitic agents also commonly affected the beaks of birds. *Knemidokoptes* mange was a common disorder of the beak of Budgerigars (*Melopsittacus undulatus*) which was treated with Ivermectin (Ivomec, Merial Limited, Boehringer Ingelheim, 3239 Satellite Blvd, Duluth, GA, USA), in all cases. Necrosis of the beak occurred in advanced cases of Psittacine Beak and Feather Disease (PBFD) caused by the PBFD virus. Traumatic injury to beaks (i.e. broken tips, fractures, and punctures) was also common. Overgrown beaks presumed to be the result of malnutrition or systemic disease (i.e. liver disease) was reported in a few cases. Neoplasia involving the beak of birds included carcinomas, sarcoma, and malignant melanomas; common tumors of birds according to Reavill (2004).

Birds presented with oral lesions often demonstrated yawning behavior, frequent beak rubbing, or halitosis. Common disorders of the oral cavity involved infectious agents, such as bacteria, yeast, viruses, and parasites as well as nutritional deficiencies, foreign bodies, and traumatic injury. Bacterial stomatitis generally involved Gram-negative bacteria (i.e. *Klebsiella* spp. and *Pseudomonas* spp.) and was often considered to be the result of generalized immunosuppression or damage to the oral mucosa. Treatment included topical and systemic antibiotic therapy based upon culture and sensitivity results or use of broad spectrum medication. Candidiasis (known as thrush by falconers) was presumed to be caused by *Candida albicans* based on cytologic appearance of the organism. Candidiasis, however, was more commonly associated with the ingluvies (crop) than the oral cavity. Because this organism was a normal inhabitant of the gastrointestinal tract of psittacine birds, an overgrowth signaled an immunosuppressive condition, such as systemic disease, or a local disease of the oropharynx. Treatment consisted of topical (chlorhexidine or nystatin) and systemic antifungals (itraconazole, ketoconazole, or fluconazole). Viral infections involving the oral cavity of birds, such as avian poxvirus (fowl pox in chickens) and herpesvirus (pigeons and owls), were treated with supportive care. Trichomoniasis was the most common parasitic disease affecting the oral cavity of birds; typically involving pigeons and raptors (e.g., American kestrels, *Falco sparverius*) and treated with metronidazole in most cases. Hypovitaminosis A resulted in squamous metaplasia of salivary gland tissue associated with the tongue (lingual salivary glands or sublingual salivary glands) and the choanal slit in the roof of the mouth (causing blunting or missing choanal papillae). Hypovitaminosis A was successfully treated with parenteral vitamin A and correcting the birds' diet. Although uncommon, neo-

plasia (especially squamous cell carcinoma) of the oral cavity was also reported.

Stasis and dilatation of the esophagus and ingluvies (crop) was often associated with impactions, loss of muscle tone, infections, and traumatic injury. Impactions of the crop were either the result of an atonic crop or the ingestion of materials that prevented the passage of ingesta through the ingluvies. An atonic crop often resulted from an ingluvitis, heavy metal toxicity (usually lead), or avian bornavirus. Ingluvitis was common in hand-fed psittacine chicks and generally involved *Klebsiella* spp., *E. coli*, and *Pseudomonas* spp., which was typically treated by flushing with a chlorhexidine solution along with antibiotic therapy or antibiotic (often trimethoprim-sulfa or enrofloxacin) therapy alone. Candidiasis of the crop was also common in these young birds and was treated by flushing with a chlorhexidine solution along with antifungal therapy or use of antifungal therapy alone. Often yeast infection involved narrow-based budding yeast and hyphae discovered on the cytology of crop aspirates that prompted use of systemic antifungals, such as itraconazole, ketoconazole, or fluconazole. Heavy metal toxicity was based on either blood lead or zinc levels or radiographic evidence of a metallic object in the gastrointestinal tract and treated by chelation with calcium disodium edentate. Crop impactions were more commonly seen in backyard chickens fed table scraps that resulted in chronic stretching of the ingluvies. Before their numbers as patients dropped significantly, ratites (emus and ostriches) presented with crop impactions when exposed to a novel foodstuff according to records in the late 1980s and early 1990s. Chronic stretching of the ingluvies involving hand-fed psittacine chicks was also reported in the earlier records. The decline in reported occurrences of psittacine chicks presented with flaccid, stretched crops in later years likely was the result of improved hand-feeding techniques and availability of commercial hand-feeding formulas available to bird owners and the decline in the number of local aviaries that breed birds. Although uncommon, stenosis of the distal esophagus by neoplasia or a coracoid fracture resulted in crops stasis. Trichomoniasis was the most the common parasitic disease affecting the ingluvies of pigeons, raptors, songbirds, and those included in the avicultural term of softbills. Trichomoniasis was treated with metronidazole in most psittacine cases; however, carnidazole was generally the treatment of choice for raptors. Puncture wounds and fistulas of the crop were also commonly reported. Crop fistulas were generally seen in hand-fed psittacine chicks and resulted from either a thermal burn from a hot feeding formula or trauma with a feeding tube. Most cases required surgical repair. Only one case of neoplasia of the ingluvies, a squamous cell carcinoma in an Amazon parrot, was found in the medical record search. According to Reavill (2004), leiomyosarcomas were also common tumors of the crop of psittacine birds.

Disorders of the proventriculus and ventriculus commonly reported in the records included proventricular dilatation disease, gastric yeast (*Macrorhabdus ornithogaster*) infection (or simply yeast infection or in older records, megabacteriosis), and foreign body ingestion (usually metallic objects). Gastric impaction with foreign material in ratites and psittacine chicks was frequently reported in older records (late 1980s and early 1990s).

As with most diseases, the medical records reflected the veterinary profession's growing knowledge of the disease commonly known as Proventricular Dilatation Disease or PDD. Older records referred to the disease as macaw wasting disease as described by Payne et al. (2012), but PDD was the most frequently used term. Because medical records coders are generally resistant to changes in terminology, more recent terms for the diagnosis of this disease, Avian bornavirus (ABV) infections or Avian bornaviral ganglioneuritis, were not listed in the search, but the newer terms could be found in the medical summaries. However, this may be appropriate as dilatation of the proventriculus may have many etiologies and a definitive antemortem diagnosis of avian bornaviral ganglioneuritis, a term proposed by Dahlhausen and Orosz (2015), can be difficult to achieve. Psittacine birds with disorders that mimic those of PDD include gastric yeast (*M. ornithogaster*) disease, heavy metal toxicity, and gastrointestinal parasites and neoplasia. The majority of PDD cases had a presumptive diagnosis based upon clinical signs and diagnostic imaging only. Although histopathology of crop biopsies, ELISA serology, and PCR testing had been used in some cases, they generally failed to provide a diagnosis, an outcome that was also supported by Hoppes et al. 2013. According to Dahlhausen and Orosz (2010), many apparently healthy birds test PCR positive that fail to develop the disease indicating that the virus is common in the captive psittacine population. A few suspected cases of PDD (ABV) in birds with the severe form of the disease tested serologically positive, but a confirmatory PCR test or histopathology was not made. Cases with a definitive diagnosis of PDD presumed to be caused by an avian bornavirus

ganglioneuritis were based on necropsy results that revealed lymphoplasmocytic ganglioneuritis on histopathology. More recent sophisticated testing, such as anti-ganglioside antibody test, may improve the ability to obtain an antemortem diagnosis of avian bornaviral ganglioneuritis according to Dahlhausen and Orosz (2015). Suspected cases of PDD (ABV) were given supportive care that variably included cisipride to increase gastrointestinal motility, meloxicam as an anti-inflammatory agent, gabapentin to relieve pain, and syringe feeding with commercial critical care diets. Hoppes et al. (2013) indicate that meloxicam, a once popular treatment for PDD, did not slow the progression of the disease. The records indicated that birds with the severe form of the disease failed to survive regardless of treatment. Many were euthanized as a request of the client. Hopefully better treatment protocols will likely evolve as more is learned about this autoimmune disease of birds.

Fortunately, no cases of Newcastle disease (*Avian paramyxovirus 1*), which can present as combination of respiratory and gastrointestinal disease, were found in the medical record search. However, the records did record paramyxovirus infections in wild pigeons, which presented with neurologic disorders.

M. ornithogaster was originally thought to be a large bacterium and was referred to as megabacteriosis which was reflected in the earlier records. Birds diagnosed with megabacteriosis that were treated with antibiotics failed to respond. Research in the early 2000s discovered that the organism was a yeast and not a bacterium. Tomaszewski et al. (2003), identified and named the organism *M. ornithogaster*. The majority of psittacine birds diagnosed with this disease were budgerigars and cockatiels (*Nymphicus hollandicus*), two of the most common species of birds presented to the VTH, which supported the findings of Filippich et al. (1998). The common clinical signs of affected birds included weight loss, regurgitation (often a thick mucoid fluid that adheres to feathers on the head), and passage of undigested seeds in the faeces. A few cases were given a presumptive diagnosis based on clinical signs alone, whereas a definitive diagnosis was based on either finding the organism in the faeces, regurgitant, gastric wash or on necropsy. Gross pathology revealed heavy mucous secretions covering the mucosa of the proventriculus and isthmus with the organism covering the glandular tissue, especially in birds that regurgitated mucoid fluid. The organism has been described by Phalen (2005), as a stiff straightened rod that measures 20-80 µm long and 3-4 µm wide with rounded ends that stains Gram-positive. Discussions about the pathogenicity of this organism has centered around whether it is a true pathogen or a commensal that is an opportunistic pathogen because it can be found in birds with and without detectable disease. Therefore, healthy birds can shed the organism and unhealthy birds may not always be shedding it. A variety of methods have been used to detect the organism in the faeces` of birds; Gram and Quik stains, PCR, culture, and wet-mounts. Phalen (2005) mentioned the advantage of using calcofluor white M2R with fluorescent microscopy to detect the organism: however, this technique is often unavailable to the clinician. Borrelli et al. (2015) describe the use of the rapid technique, mini-Flotac, designed to detect helminths in faecal samples could be a useful tool in detection of *M. ornithogaster* in bird faeces. A variety of anti-fungal drugs were used to treat affected birds in the earlier records; however, most birds did not survive. Treatment with amphotericin B and Itraconizole were identified as being affective in a few cases in more recent clinical records. According to Phalen (2014), resistance to amphotericin B has been reported.

Neoplasia of the proventriculus and ventriculus was uncommon and represented by two cases of adenocarcinomas of the ventriculus, a tumor described by Reavill (2004).

Many records revealed birds being presented for diarrhea based upon the owner's observation of wet droppings; however, those cases represented polyuria instead. Common infectious disorders of the intestines were reported as bacterial enteritis, mycobacterioisis, candidiasis, or protozoal infections. Bacteria frequently identified in cases of bacterial enteritis included *E. coli*, *Klesbsiella* spp., and *Clostridium* spp. Faecal cytology revealed either septic inflammation or a predominance of bacterial of one morphologic type. Mycobacteriosis involving the intestines was diagnosed on necropsy. Candidiasis was diagnosed based on the presence of numerous narrow-based budding yeast with or without hyphae formation on Romanowsky-stained faecal smears. Giardiasis was the most common protozoal infection reported. Cases involving birds with paralytic ileus were reported to be associated with heavy metal toxicity, PDD (ABV), peritonitis, or extraluminal compression by tumors or granulomas. A definitive diagnosis of intestinal disease in avian patients was generally obtained on post-mortem examinations; however, Sousa et al. (2008) have shown that positron emission tomography-computed tomography

(PET-CT) can be a valuable ante-mortem tool to evaluate the anatomic nature of disease, including the intestinal tract.

Tissue prolapsed from the cloaca was reported to be either from the intestinal tract, reproductive tract, or cloaca. Prolapse of urinary tract tissue was not reported. Phallus prolapse was reported in ducks with intestinal impactions. Straining from enteritis, egg binding (dystocia), or intestinal impactions were common causes of cloacal prolapses. Behavioral cloacal prolapse in cockatoos were also reported. In most of the cases, treatment for cloacal prolapse involved returning the prolapsed tissue to its normal anatomical location and placement of stay sutures on either side of the vent. Chronic prolapses involved rib cloacopexy. Infections of the cloaca involved bacteria, such as *Clostridium* spp., and Candida spp.. Cloacal impactions associated with uroliths were reported in raptors suffering from traumatic injury. Mucosal papillomas (papillomatosis) were frequent disorders of the cloaca of psittacine birds, especially macaws and Amazon parrots. These proliferative gray-white (when exposed to 3-5% acetic acid) growths on the mucous membrane of the cloaca were likely linked to psittacid herpesvirus according to Johne et al. (2002) and Styles et al. (2004). Affected birds commonly presented with blood in the droppings associated with bleeding at the vent (often associated with self-mutilation of the vent and cloaca) and cloacal prolapse. Treatment consisted of cautery of the mucosal lesion using either chemical cautery with silver nitrate or the use of CO_2 laser. Recurrence was commonly reported.

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