History

A 7-year-old female English budgerigar (Melopsittacus undulatus) was submitted to the University of Washington Veterinary Diagnostic Laboratory for postmortem examination. For 6 years prior, the bird periodically had been treated for presumptive avian gastric yeast infection with acidification of the drinking water with citric acid and occasional administration of Lactobacillus spp supplements. Treatment for avian gastric yeast infection (previously known as megabacteriosis) was based on the previous diagnosis of this disease in another budgerigar in the home and because of occasional regurgitation of undigested seed by the bird of this report (Figure 1). The bird submitted for postmortem examination had successfully fledged a clutch of 3 chicks 3 months prior to death. The owner had noticed general loss of body condition with a prominent keel (wasting) over the month prior to death, and the bird was found dead on the day of postmortem examination. There were 2 other budgerigars, including the bird for which a diagnosis of avian gastric yeast infection had been made, in the home, neither of which had similar clinical signs of illness.

Gross Findings

On necropsy, the bird was thin (body condition score, 1.5/5) with a prominent keel. There was mild, regionally extensive thickening of the proventricular wall (Figure 1). Cytologic examination of a sample of proventricular contents revealed abundant, long, narrow rod organisms approximately 40 to 60 µm in length and 2 µm in width. Giemsa stain; bar = 20 µm. Inset—Formalin-fixed section of proventriculus, with mild, regionally extensive thickening of the wall in the region of the junction with the ventriculus. L = Lumen.

Figure 1—Antemortem photograph (A) and cytologic image (B) of fixed proventricular contents of a 7-year-old female English budgerigar (Melopsittacus undulatus) that had been periodically treated for presumptive avian gastric yeast infection during a 6-year period. The budgerigar’s condition had deteriorated during the preceding month, leading to death. In panel A, notice the yellow-tinged regurgitated material on the beak and surrounding feathers. Microscopic examination of a sample of proventricular contents revealed long, narrow rod organisms approximately 40 to 60 µm in length and 2 µm in width. Giemsa stain; bar = 20 µm. Inset—Formalin-fixed section of proventriculus, with mild, regionally extensive thickening of the wall in the region of the junction with the ventriculus. L = Lumen.
Histopathologic Findings

Of the various tissues processed for histologic examination, those of most interest were associated with the gastrointestinal tract and the liver. Histologic examination of H&E-stained sections of the proventriculus and ventriculus revealed multifocal, moderate, ulcerative, and lymphocytic and plasmacytic with lesser heterophilic (chronic-active) proventriculitis and ventriculitis. Mats of elongated, poorly staining rod organisms approximately 20 to 80 µm in length and 2 to 3 µm in width, consistent with Macroorbodus ornithogaster, were adhered to the mucosal surface of the proventriculus and had infiltrated the glands (Figure 2). In the ventriculus, fewer organisms were present and there was mild, focal secondary degeneration and bacterial colonization of the koilin layer. These organisms stained poorly with H&E stain; however, the rods stained strongly and homogeneously (magenta in color) with periodic acid-Schiff (PAS) stain.

Expanding and infiltrating the submucosa of the proventriculus near the junction of the proventriculus and ventriculus was a nonencapsulated, poorly demarcated, and moderately cellular neoplasm. The neoplasm was composed of clusters of cuboidal to polygonal cells arranged in nests or that also formed acini in an abundant fibrovascular and desmoplastic stroma (Figure 2). Cells had distinct cell borders and abundant eosinophilic cytoplasm. Frequently, the cell cytoplasm was dilated with optically clear to lightly basophilic vacuoles on H&E staining and the nucleus was eccentric, which gave the cells a signet ring appearance. Cells had a basophilic, oval-shaped nucleus with 1 to 3 prominent central nucleoli. There was mild anisocytosis and anisokaryosis. Mitoses were rare. Neoplastic cells extended through the muscular tunics to the serosal surface of the proventriculus, and there was evidence of moderate multifocal heterophilic inflammation. In PAS-stained sections, the cytoplasmic vacuoles were lightly stained.

In sections of the liver, there was evidence of moderate to focally marked, multifocal, random, and regionally extensive heterophilic and lesser lymphocytic and histiocytic hepatitis. Mild autolysis notwithstanding, there was mild, multifocal cytoplasmic pallor of hepatocytes and mild multifocal disruption of the normal cord and sinusoid hepatic architecture adjacent to the inflammatory cell infiltrates. Mild multifocal to coalescing hepatocellular vacuolation consistent with hepatic lipidosis was also detected. Focally within the liver parenchyma, a small cluster (approx 15 to 20 cells) of the previously described neoplastic cells (Figure 2) was observed. Periodic acid-Schiff–stained sections of the liver were examined; the mass had been largely cut through in the block, but a few PAS-positive neoplastic cells were present.

Morphologic Diagnosis and Case Summary

Morphologic diagnosis: adenocarcinoma of the proventriculus with liver metastasis and marked, diffuse chronic-active proventriculitis and ventriculitis with moderate M ornithogaster infection; marked, multifocal to coalescing and regionally extensive chronic active hepatitis.
Case summary: *M. ornithogaster* infection with concurrent metastatic proventricular adenocarcinoma in an English budgerigar (*M. undulatus*).

**Comments**

The bird of this report had avian gastric yeast infection and metastatic proventricular adenocarcinoma. *Macrorhabdus ornithogaster* is an ascomycetous yeast that colonizes the proventriculus and ventriculus of many avian species and can be associated with chronic wasting disease and acute hemorrhagic gastritis in captive-bred budgerigars, parrotlets, and canaries.† Clinical illness secondary to infection with the organism is often associated with distress or other disease states, and acute and chronic forms of disease have been described.† In the acute form of the disease, a bird will develop anorexia and regurgitation and its condition progresses rapidly to death within 24 to 48 hours.† In the chronic form of the disease, which is more common in budgerigars, a bird will develop apparent polyphagia, regurgitation, diarrhea, and weight loss.† Adult birds are most often affected, and differential diagnoses include candidiasis, trichomoniasis, heavy metal poisoning, and gastrointestinal neoplasia.† Following Gram staining of the organism, there is stain uptake by the cytoplasm but not by the cell wall.† *Macrorhabdus ornithogaster* does stain with PAS and silver stains.†

Adenocarcinoma of the proventriculus and ventriculus in birds is uncommonly reported, but several sporadic cases and case series of gastric neoplasia in a variety of avian species have been reported.‡ Proventricular carcinoma is more common than ventricular carcinoma, and psittacines, in particular the grey-cheeked parakeet (*Brotogeris pyrrhoptera*), are most frequently affected.‡ In a study of 2,281 domestic fowl necropsied over a 10-year period, 2 cases of proventricular adenocarcinoma were diagnosed. These tumors often develop at the junction of the proventriculus and ventriculus, potentially complicating accurate assessment of the tissue of origin.‡ Proventricular neoplasia may be distinguished from ventricular tumors by positive PAS staining of the polysaccharide-rich secretory products.‡ Metastasis of proventricular adenocarcinoma is common; potential sites of metastasis include lungs, liver, spleen, and heart, and implantation metastasis may occur in adjacent tissues.‡

To our knowledge, avian gastric yeast infection has not been diagnosed in conjunction with proventricular adenocarcinoma in birds, although systemic tuberculosis was also present in 1 hen with proventricular adenocarcinoma.‡ The role of *M. ornithogaster* infection in the development of the proventricular neoplasm in the budgerigar of the present report is uncertain; the 2 conditions were likely unrelated, given that infection with *M. ornithogaster* is common and often subclinical in budgerigars, and reports of upper gastrointestinal tract cancer in budgerigars and other avian species are rare.‡ However, chronic inflammation caused by infectious agents, principally viruses and bacteria, has been associated with cancer. One example is *Helicobacter pylori* infection and the development of gastric cancer in humans.‡ Another possibility is that changes in gastrointestinal tract motility and dysbiosis secondary to the neoplasm exacerbated the severity of the avian gastric yeast infection.

**References**