ANATOMY AND PHYSIOLOGY OF THE AVIAN GI TRACT

Susan E. Orosz, PhD, DVM, DABVP (Avian), DECZM (Avian)
Bird & Exotic Pet Wellness Center
Toledo, OH

The proximal portion of the GI tract consists of the beak, oropharynx, cervical esophagus, crop, and thoracic esophagus. Diseases of the beak can have numerous causes. Infectious causes include mycotic (*Candida*, *Aspergillus* species), bacterial, viral (pox, PBFD), and parasitic (*Knemidokoptes*, *Oxispirura* species, and *Trichomoniasis*). Hepatopathies are associated with an increased rate of growth and/or necrosis of the beak but the mechanism remains unknown. Nutritional causes of beak abnormalities may include decreased ingestion of vitamin D and/or calcium. Deformed maxillary rhamphotheca may be due in part to deficiencies in folic acid, biotin, and/or pantothenic acid. Trauma from toys, cage mate aggression, or head-on collisions can also cause severe problems. Lateral deviations are one of the more common problems of neonates. The etiology is most likely multifactorial but is often associated with heavy-handed pressure to the beak during hand rearing and may improve with corrective trimming and/or pressure application. Mandibular prognathism is more common in cockatoo neonates and its etiology is associated with abnormal pressure or lack of appropriate pressure on the beak during hand rearing. Rostral traction and manipulation therapy may help or surgery may be required.

The oropharynx should be inspected on the physical examination, particularly the choanal slit. The choanal slit represents an incomplete closure of the maxillary bones. The air from the nasal cavity moves through the choanal slit into the open glottis. The choanal slit is bordered by choanal papillae that normally are caudally directed in psittacines. The number and length varies based on the species. Blunting of the papillae is suggestive of hypovitaminosis A and should be noted on the physical exam. Commonly birds on seed only diets demonstrate white plaques associated with the choanal slit. There are other reasons as well.

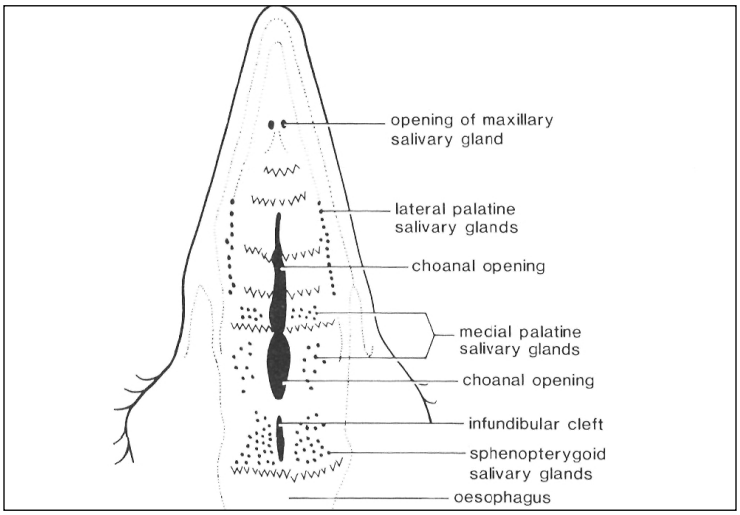

Figure 1. The roof of the oropharynx of the domestic fowl. Six rows of caudally pointing papillae are shown. There are numerous openings of salivary glands. From King AS, McLelland J. Digestive system. Philadelphia, PA: Balliere Tindall; 1984:85.

The esophagus of birds is distensible and sits on the right side of the neck- the opposite of mammals. Some, but not all, have a distensible portion of the esophagus, which is the crop or ingluvies. The crop is an esophageal diverticulum and varies in size depending of the species and the age of the bird. Young chicks will have a much larger crop than adults of the same species. In addition, the size of the crop decreases in size with sick birds that are not eating normal volumes of food. This is important when determining the volume to be fed for gavage feeding critically ill birds. In psittacine birds, the crop normally extends from the right side of the neck at the base of the thoracic inlet to the left before narrowing into the thoracic esophagus. From the thoracic esophagus, which lies on the left, the GI tract continues into the stomach.

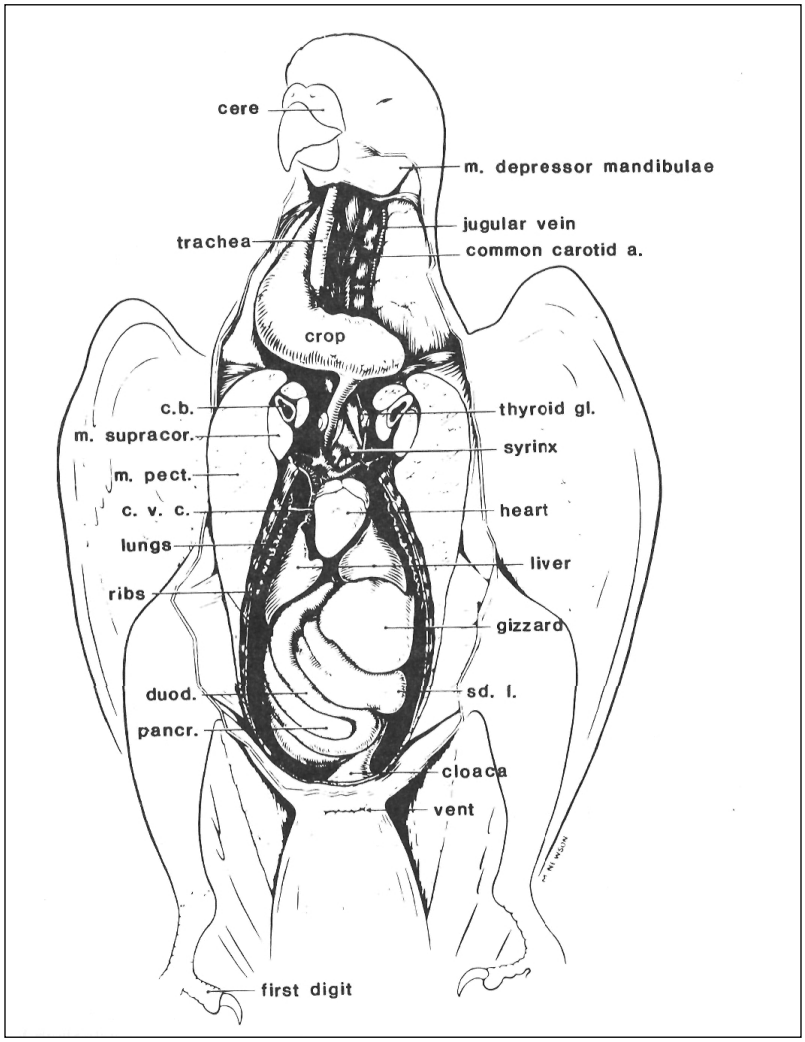

Figure 2. The digestive tract of the Budgerigar; the sternum and abdominal wall have been removed. a. = artery; c.b. = coracoid bone; c.v.c. = caudal vena cava; duod = duodenum; m. pect. = pectoral muscle; m. supracor. = supracoracoid muscle; pancr. = pancreas; sd.l. = supraduodenal loop. From Evans (1969) with kind permission of the publisher.

The stomach of birds consists of the proventriculus, isthmus, and ventriculus or the gizzard. It lies on cranial left side of the thoracoabdominal cavity. Since birds do not have a diaphragm, it is termed the abdominal coelom. The proventriculus is the proximal portion and is the glandular portion that secretes the digestive enzymes. There is a narrow isthmus or intermediate portion followed by a saclike to highly muscular gizzard depending species. The gizzard grinds the food particles making it more readily available for the proteolytic enzymes to digest the food. In psittacines, there is a rotatory motion of the food in the stomach with food moving from the proventriculus to the ventriculus for grinding and then back into the proventriculus. This normal pattern is disturbed by a variety of disease processes with the most noted being proventricular dilitation disease or PDD.

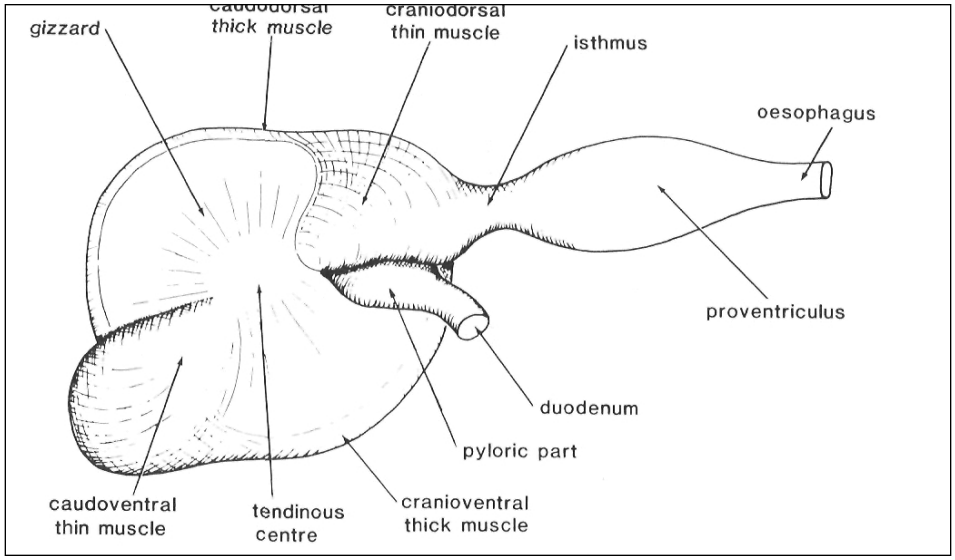

Figure 3. Right (medial) aspect of the stomach of the domestic fowl.
From McLelland (1975) with kind permission of the publisher.

The anatomy of the small intestine includes the duodenum (descending and ascending limb), jejunum, and ilium. The majority of the pancreas lies between the 2 limbs of the duodenum, although the splenic portion contains more of the endocrine portion of the pancreas. The bile duct and pancreatic ducts open near the terminal portion of the ascending duodenum. In most species of birds, the jejunum and ileum are composed of a number of U-shaped loops along the edge of the dorsal mesentery. The vitelline diverticulum is a shortened blind remnant of the yolk sac and duct. It represents the demarcation between the jejunum and ileum. Birds have a limited length to the small intestine and have a unique peristalsis-retroperistalsis pattern to digest and absorb nutrients. This most likely is to reduce weight of the GI tract for flying.

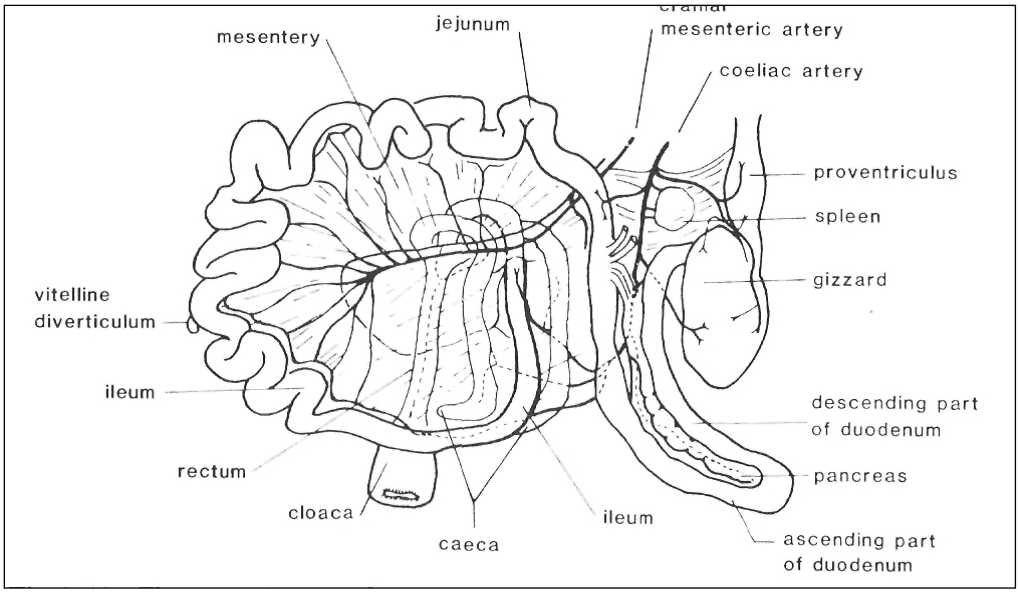

Figure 4. The gastrointestinal tract of the domestic fowl. The jejunum and ileum are arranged in short garland-like coils, not U-shaped loops. Two pancreatic ducts and two ducts from the liver are visible entering the distal end of the ascending part of the duodenum. There is often a third pancreatic duct. From King AS, McLelland J. Digestive system. Philadelphia, PA: Balliere Tindall; 1984:103.

The final segment of the GI tract includes the large intestine or rectum and the cloaca. The large intestine begins at the level of the paired ceca. It is short and straight and probably homologous to the mammalian rectum. The ceca arise at the ileal—rectal junction. However, psittacines don't have ceca or are rudimentary and the ceca of passerines are small. Poultry and ostrich have very large ceca. The large intestine of birds functions similarly to mammals—its major task is to reabsorb water.

The cloaca of birds is divided into the coprodeum, urodeum, and proctodeum. Its basic organization is similar between species, except for the possible phallus in waterfowl and ratites. The coprodeum is the cranial-most compartment and it stores fecal material. The coprodeum is continuous with the large intestine, but is separated from the urodeum by the coprourodeal fold. The urine and urates are stored in the urodeum prior to evacuating the cloaca, as the ureters open into this receptacle. The oviducts or ductus deferens open into the urodeum. Interestingly, urine can move by retroperistalsis from the urodeum into the coprodeum and large intestine for reabsorption of water. The more caudal fold is the uroproctodeal fold that separates the urodeum from the central and distal-most cavity—the proctodeum. The cloacal bursa opens into the proctodeum. The vent is the opening of the proctodeum to the outside.

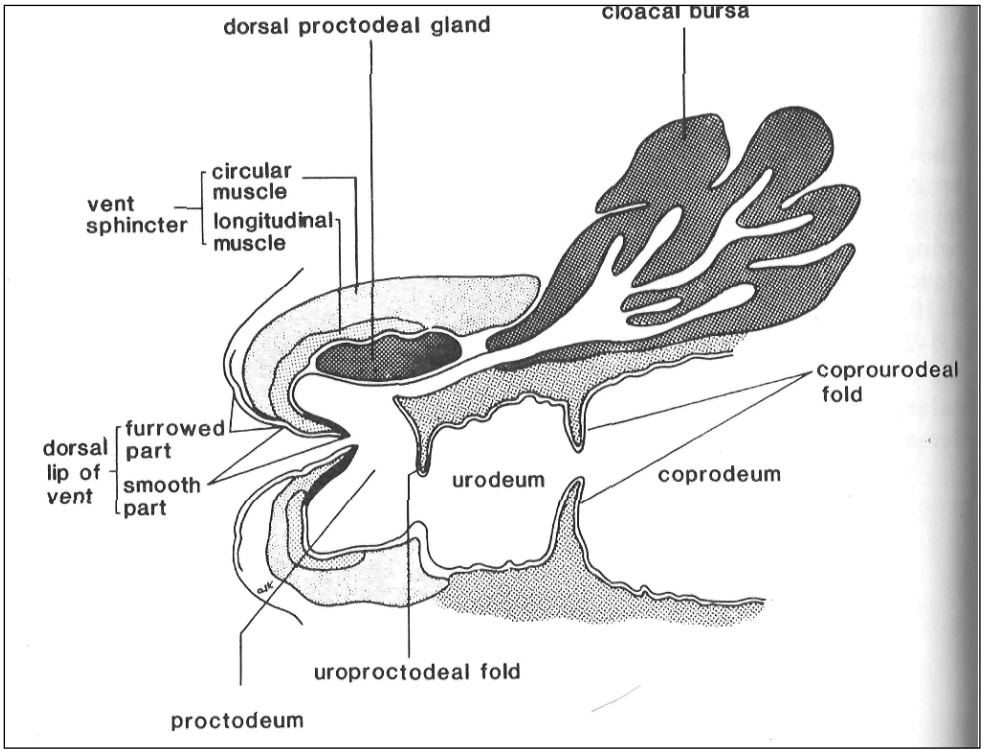

Figure 5. Median section of the cloaca of a 4-month-old female domestic fowl. The black epithelial zone on the inner surface of the lips of the lips of the vent represents the extent of the stratified squamous epithelium. From the King (1975), with kind permission of the publisher.