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# ENDOSCOPIC EVALUATION OF THE ESOPHAGUS AND STOMACH IN THREE LOGGERHEAD SEA TURTLES (*CARETTA CARETTA*) AND A MALAYSIAN GIANT TURTLE (*ORLITIA BORNEENSIS*)

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*Abstract:* Three loggerhead sea turtles (*Caretta caretta*) and a Malaysian giant turtle (*Orlitia borneensis*) were presented with suspected or confirmed esophageal foreign bodies. Esophagoscopy was performed on all turtles, and gastroscopy was performed on three turtles. In all cases, endoscopy was easy to perform, and allowed visualization of most upper gastrointestinal features. The papillated esophagus was easy to navigate, but mucosal papillae in the loggerhead sea turtles prevented examination of the underlying mucosa. The stomach was easily entered and examined in both species, but the working endoscope length (100 cm) prevented inspection of the pyloric antrum and the duodenum in all turtles. The turtles in this report may serve as references for future endoscopic examinations of these species.

*Key words:* Loggerhead sea turtle, *Caretta caretta*, Malaysian giant turtle, *Orlitia borneensis*, endoscopy, gastrointestinal.

## INTRODUCTION

The gastrointestinal tract in a number of species is routinely evaluated endoscopically, with techniques standardized in dogs, cats, and horses.[7,8] In birds, reptiles, and nondomestic mammals, the technique is relatively noninvasive and versatile.[2] Although aquatic turtles have been examined endoscopically, there are few descriptions of their normal endoscopic appearance or suggested protocols for examination.[3,5,7,9] Because the chelonian gastrointestinal tract is anatomically diverse, endoscopic examination techniques will probably vary between species.[6,10,11] This report describes the normal endoscopic appearance of the oropharynx, esophagus, and stomach in two species of aquatic turtles.

## CASE REPORTS

Three adult loggerhead sea turtles (*Caretta caretta*; turtles 1–3, all of unknown gender, 19.0–38.0 kg) and one Malaysian giant turtle (*Orlitia borneensis*; turtle 4, male, 36.4 kg) were presented to the North Carolina State University College of Veterinary Medicine, with confirmed or suspected esophageal foreign bodies. A large fishhook had recently been removed surgically from the mandible of turtle 1, a 35.4-kg juvenile of unknown sex, and esophagoscopy was performed to investigate an intraesophageal irregular mineral opacity identified radiographically. The esophagus was subsequently removed from another loggerhead sea turtle that had died of natural causes and was used as a guide for later esophagoscopic and gastroscopic examinations of the three other turtles (Fig. 1) for fishhook removal. The esophagus of turtle 3 was perforated during hook removal, and gastroesophagoscopy was repeated 6 mo after surgical repair and rehabilitation to reevaluate the surgical site.

The turtles had not consumed food for 1–3 days before endoscopic examination. Anesthesia was induced with ketamine (Fort Dodge Animal Health, Fort Dodge, Iowa 50501, USA; 5 mg/kg, i.v. or i.m.) and medetomidine (Orion Corporation, Espoo, Finland; 50 μg/kg, i.v. or i.m.) and was maintained with sevoflurane (Abbott Laboratories, North Chicago, Illinois 60064, USA; 0.5–3.0%) in oxygen through an endotracheal tube.[1] The turtles were placed in ventral recumbency, and an approximately 15-cm-long PVC pipe with 4.8-cm internal diameter was used as an oral speculum. A single endoscope with an external diameter of 1.1 cm and a working length of 100 cm was used for all examinations (Olympus Q20 gastrointestinal fiberscope, Olympus America Incorporated, Melville, New York 11747, USA). The endoscope was lightly lu-

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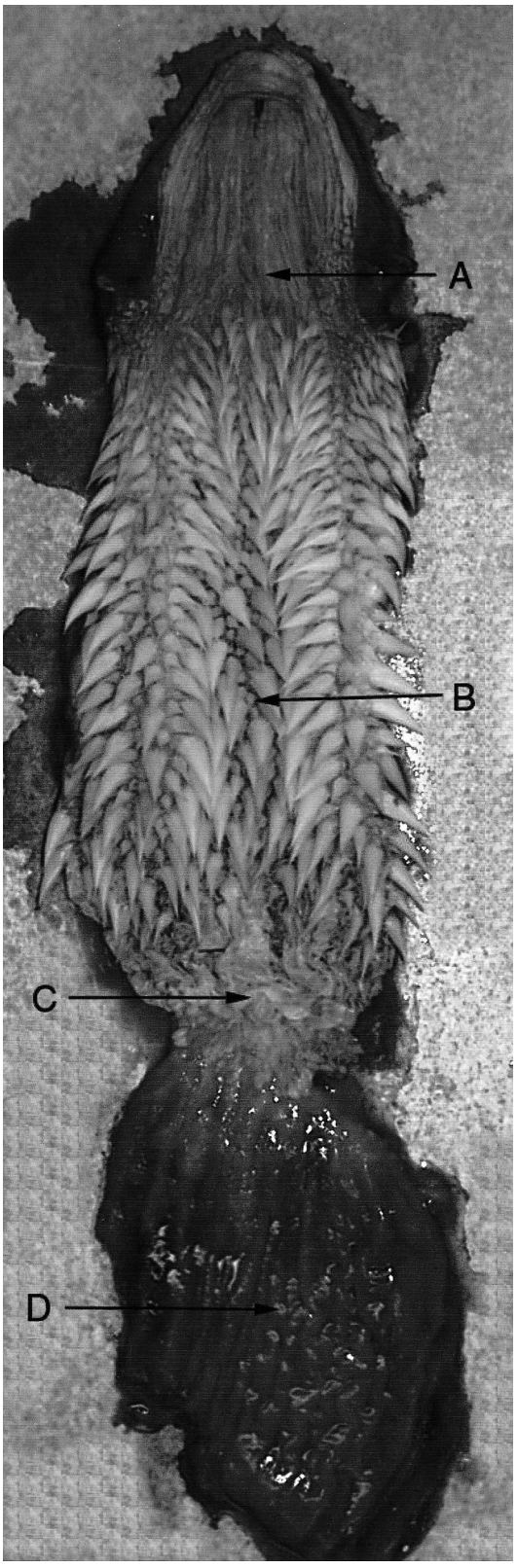



**Figure 2.** Endoscopic appearance of the glottis and proximal oropharynx of a loggerhead sea turtle (turtle 1). An endotracheal tube (**A**) is present in the foreground.

bricated and advanced through the speculum into the oropharynx and the esophagus.

**Loggerhead sea turtles**

The endoscopic appearances of the upper gastrointestinal tracts of the three loggerhead sea turtles were similar. In each turtle the oropharynx and the glottis were easily observed (Fig. 2). Passage of the endoscope into the esophagus was facilitated by extending the head to straighten the neck. The large, aborally directed papillae that lined most of the esophagus could be only minimally displaced by the endoscope, preventing observation of the underlying mucosal surface (Fig. 3). Air insufflation only partially distended the papillated region of the esophagus, but a lumen was always identifiable. The endoscope could be advanced with slightly more pressure than was required in the esophagus of dogs and cats. Foreign bodies (fishhooks, mollusk shells) that had been identified radiographically were often lodged between papillae and were only partially visible during endoscopy. Although objects that were not embedded within the mucosa could be grasped and retrieved with endoscopic foreign body retrieval forceps, several attempts were

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**Figure 1.** Prosected proximal gastrointestinal tract of a loggerhead sea turtle, with (**A**) oropharynx, (**B**) papillated esophagus, (**C**) nonpapillated esophagus, and (**D**) proximal stomach.

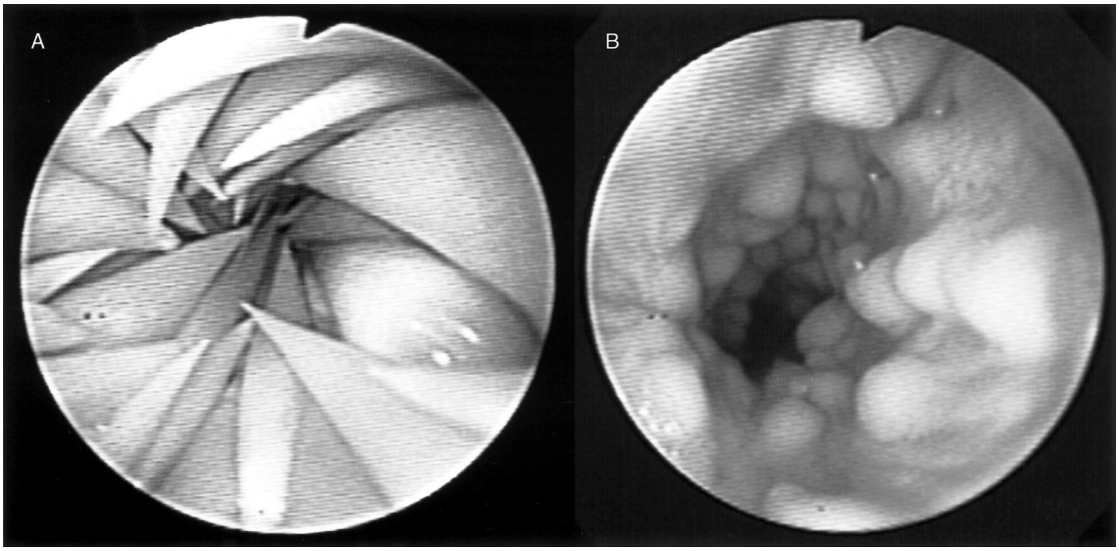


**Figure 3.** Endoscopic appearance of the papillated region of the esophagus of (**A**) a loggerhead sea turtle (turtle 3) and (**B**) a Malaysian giant turtle (turtle 4).

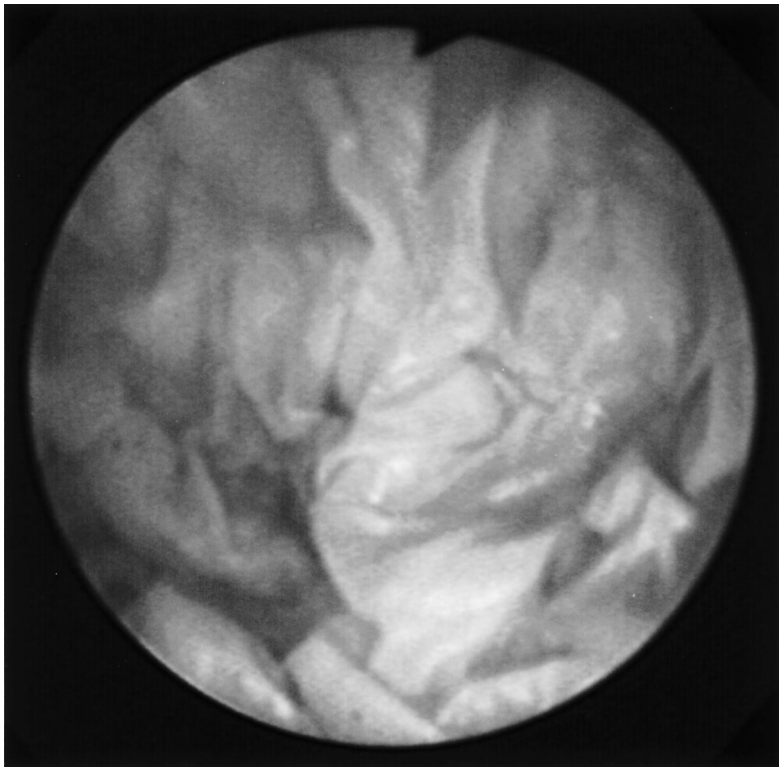

**Figure 4.** Endoscopic appearance of the transitional, nonpapillated region of the esophagus of a loggerhead sea turtle (turtle 2).

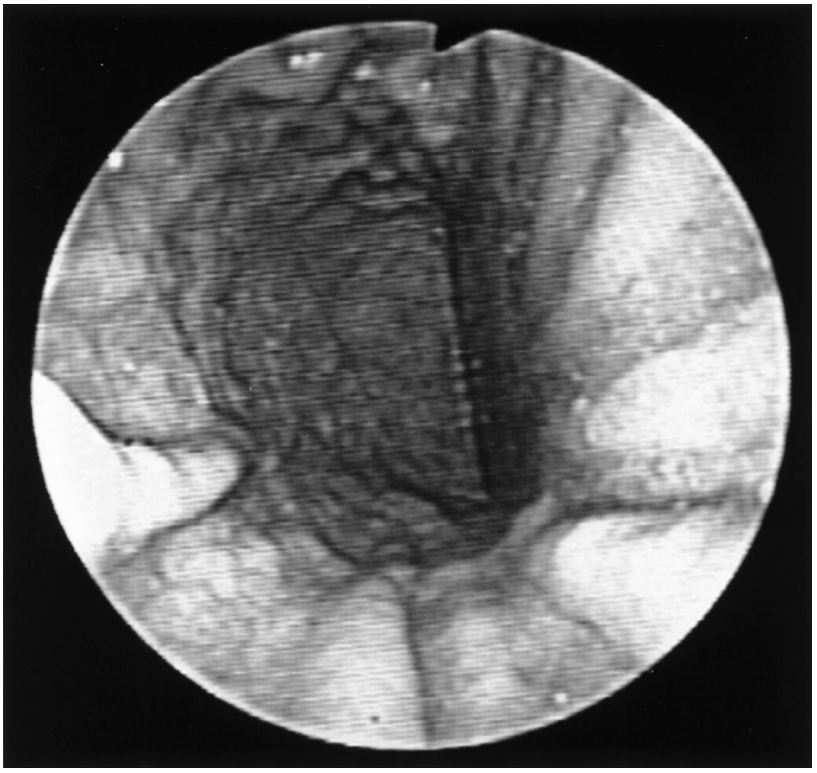

**Figure 5.** Endoscopic appearance of the gastric lumen of a loggerhead sea turtle (turtle 3). The pylorus is visible in the distance.

often necessary because the orientation of the papillae would resist retrograde movement of the endoscope and the foreign bodies.

Passage of the endoscope through the transitional, nonpapillated esophagus was more difficult than in the papillated region. Mucosal folds often obscured the lumen and the lower esophageal sphincter (Fig. 4); orientation was lost several times during endoscopic examination of the transitional region, and the endoscope had to be withdrawn to the distal papillated esophagus and then readvanced in an attempt to find the gastroesophageal sphincter. Despite the difficulty encountered in passing the endoscope, the mucosa of the transitional region could be examined easily with air insufflation and manual pressure on the neck to prevent orad escape of infused air.

The gastroesophageal sphincter was typically partially open and could be easily passed through by the endoscope. The stomach was usually inflated before entry by, presumably, air that had been used to insufflate the esophagus (Fig. 5). The gastric mucosa appeared uniformly colored and rough, but discrete rugae were not visible upon full insufflation. The endoscope was too short to examine the pyloric antrum or to enter the duodenum. The stomach was deflated before removal of the endoscope.

### Malaysian giant turtle

As with the loggerhead sea turtles, papillae were throughout the majority of the esophagus, although they were smaller, blunted, and less dense, and allowed observation of the entire esophageal mucosa and easier passage of the endoscope to the stomach (Fig. 3). A moderate amount of thin mucus was present throughout the esophagus. The endoscope was easily advanced through the esophagus, and air insufflation allowed full observation of the distended esophageal lumen.

The transitional region lacked papillae, as in the loggerhead sea turtles. However, mucosal folds were absent in the transitional region, permitting observation of the gastroesophageal sphincter.

The endoscope passed easily into the stomach. The gastric mucosa resembled that of the loggerhead turtles but was pale pink with a small amount of mucus. The endoscope was too short to examine the pyloric antrum or to enter the duodenum.

## DISCUSSION

The esophagus and the stomach in all the turtles were easily examined endoscopically and were of uniform appearance in the loggerhead sea turtles. Although we cannot be certain that the endoscopic appearance of the single Malaysian giant turtle was normal, there were no obvious gross lesions, and the turtle appeared to be in good health.

The distal stomach and the duodenum could not be examined because of insufficient working endoscope length (100 cm). Longer commercially available colonoscopes might be useful for visualization of these structures. The combination of opioids and antimuscarinics as preanesthetic agents may interfere with the passage of an endoscope through the canine pyloric sphincter,[4] although it is not known if this is true for turtles.

In conclusion, endoscopy of the upper gastrointestinal tract in these two species of aquatic turtles was relatively easy to perform, and experienced endoscopists should be able to examine other species of turtles, particularly with prior knowledge of their anatomy.

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