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A HIATAL HERNIA IN A NORTHERN ELEPHANT SEAL
(*MIROUNGA ANGUSTIROSTRIS*)**

Author(s): Rebecca Greene, D.V.M., William G. Van Bonn, D.V.M., Sophie E. Dennison, B.V.M. & S., Dipl. A.C.V.R., Denise J. Greig, Ph.D., and Frances M. D. Gulland, Vet. M.B., Ph.D.

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LAPAROSCOPIC GASTROPEXY FOR CORRECTION OF A HIATAL HERNIA IN A NORTHERN ELEPHANT SEAL (*MIROUNGA ANGUSTIROSTRIS*)

Rebecca Greene, D.V.M., William G. Van Bonn, D.V.M., Sophie E. Dennison, B.V.M. & S., Dipl. A.C.V.R., Denise J. Greig, Ph.D., and Frances M. D. Gulland, Vet. M.B., Ph.D.

Abstract: A female northern elephant seal (*Mirounga angustirostris*) weaned pup presented with malnutrition. During rehabilitation, the seal developed regurgitation and reduced lung sounds on auscultation. Radiographs and endoscopy performed under sedation suggested a diaphragmatic hernia. A Type I (or sliding) hiatal hernia was confirmed with a positive contrast upper gastrointestinal study, revealing varying degrees of herniation of the gastric fundus through the diaphragm into the caudal thorax as well as esophageal reflux. The animal was treated preoperatively with an H₂ antagonist and antiemetic medication. A laparoscopic gastropexy was performed under general anesthesia. The animal recovered well postoperatively and resolution of clinical signs was achieved. The animal was released back into the wild 21 kg above admit weight. To our knowledge, we report here the first surgical correction of a hiatal hernia in a marine mammal.

Key words: Gastropexy, hiatal hernia, laparoscopic, *Mirounga angustirostris*, northern elephant seal.

BRIEF COMMUNICATION

An underweight (40.5 kg) female northern elephant seal (*Mirounga angustirostris*) weaned pup was admitted to The Marine Mammal Center, Sausalito, California for treatment of malnutrition. During rehabilitation the animal intermittently regurgitated during standard tube feedings. Initial thoracic auscultation revealed normal lung sounds, but as the animal's clinical signs progressed (increased regurgitation, poor weight gain, dehydration, and lethargy), re-examination revealed diminished breath sounds in all lung fields. Radiographs performed under sedation with tiletamine HCL and zolazepam HCL (Telazol®, Pfizer, Inc., New York, New York 10017, USA; 0.8 mg/kg i.v.), showed abnormal soft tissue opacity in the caudal thorax, suggesting a diaphragmatic hernia (Fig. 1). A positive contrast study using Gastrografin® (diatrizoate meglumine and diatrizoate sodium solution USP, Bracco Diagnostics Inc., Princeton, New Jersey 08543, USA; 2.0 ml/kg delivered via endoscope biopsy port) confirmed this. The contrast study revealed varying degrees of herniation of the gastric cardia

and fundus through the diaphragm into the caudal thorax as well as esophageal reflux (Fig. 2). A Type I (sliding) hiatal hernia was diagnosed. The animal was placed on famotidine (West-Ward, Eatontown, New Jersey 07724, USA; 0.9 mg/kg i.m. s.i.d.) and metoclopramide (Hospira, Lake Forest, Illinois 60045, USA; 0.2 mg/kg i.m. t.i.d.) while a plan was developed to correct the defect.

The animal was sedated with Telazol (Pfizer, Inc.; 0.9 mg/kg i.v.) and butorphanol tartrate (Dolorex®, Merck Animal Health, Summit, New Jersey 07901, USA; 0.1 mg/kg i.v.), then intubated and maintained on isoflurane anesthesia. After routine surgical skin preparation, a laparoscope portal was made just caudal to the umbilicus. A 10-mm rigid endoscope (Karl Storz, 78532, Tuttlingen, Germany) was used to explore the abdomen, and a sliding hiatal hernia was confirmed. The stomach was reduced into the abdominal cavity by introducing an orogastric tube and applying gentle traction to the stomach using laparoscopic forceps via a paramedian instrument portal while the patient was positioned in reverse Trendelenberg. To hasten scar formation at the gastropexy site, the serosal surfaces of the gastric fundus and the body wall caudal to the last rib (left and lateral to the umbilicus) were scarified using a monopolar cautery unit. The gastropexy was performed using absorbable, 4-0 polyglycolic acid suture material on a 16-ga straight needle (Integra Miltex, York, Pennsylvania 17402, USA), which was introduced through the skin into the abdominal cavity and through the body wall guided by observation via the laparoscope

From The Marine Mammal Center, 2000 Bunker Road, Fort Cronkhite, Sausalito, California 94965, USA (Greene, Van Bonn, Dennison, Greig, Gulland). Present addresses (Van Bonn): John G. Shedd Aquarium, 1200 South Lake Shore Drive, Chicago, Illinois 60605, USA; (Dennison): Marine Mammal Radiology, P.O. Box 3344, Oakton, Virginia 22124, USA. Correspondence should be directed to Dr. Greene (rebeccakg@yahoo.com).

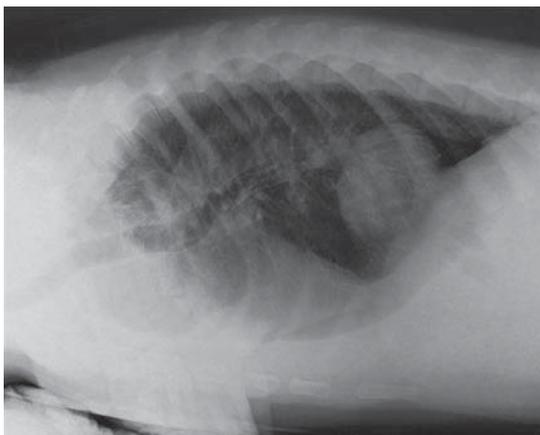


Figure 1. Lateral thoracic radiograph with abnormal soft tissue opacity in the caudal thorax.

(Fig. 3). The needle was then grasped by forceps and guided to the prepared fundic area of the stomach, driven through the serosa and muscularis layers, then passed back through the body wall. The sutures were then secured with simple interrupted hand ties extracorporeally. Triple antibiotic ointment (neomycin and polymixin B sulfates and Bacitracin Zinc Ointment USP, E. Fougera & Co., Melville, New York 11747, USA) was applied to the suture sites.

The animal recovered well postoperatively, began to eat within 24 hr, and experienced no further regurgitation. A single dose of ketoprofen was administered on the first day after surgery (Ketofen®, Fort Dodge Animal Health, Fort Dodge, Iowa 50501, USA; 1.0 mg/kg i.m.).

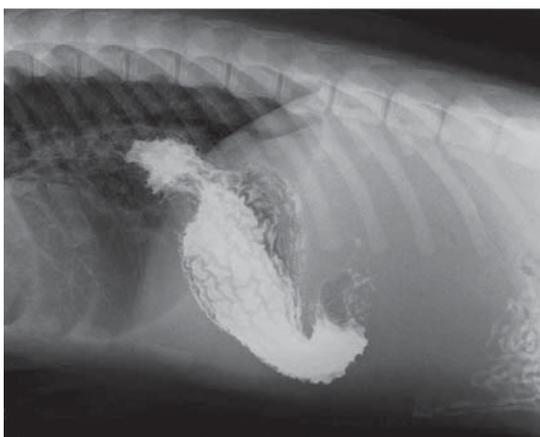


Figure 2. Lateral thoracic radiograph using contrast to demonstrate herniation of the gastric cardia and fundus through the diaphragm into the caudal thorax.

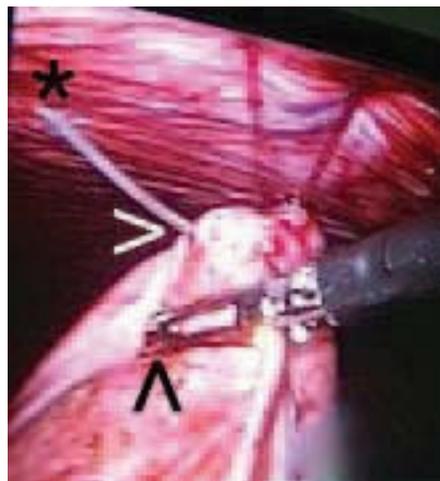


Figure 3. Laparoscopic image demonstrating forceps grasping the stomach (black arrow) while the needle is guided through the abdominal wall (black asterisk) toward the fundic area of the stomach (white arrow).

Antimicrobial therapy with ciprofloxacin (500 mg tablets, PACK Pharmaceuticals, LLC, Buffalo Grove, Illinois 60089, USA; 9.8 mg/kg p.o. s.i.d. for 5 days) was instituted postoperatively after mild erythema and a small amount of mucopurulent discharge was noted at the suture sites during suture removal. Wound care was performed with 1% povidine-iodine solution (First Priority, Inc., Elgin, Illinois 60123, USA) followed by triple antibiotic ointment application. A follow-up positive contrast upper gastrointestinal study, performed under Telazol sedation, confirmed position of the entire stomach within the abdominal cavity (Fig. 4). Three weeks after laparoscopic gastropexy the animal was released back into the wild at 61.5 kg (21 kg above admit weight).

Hiatal hernia is a diaphragmatic defect that allows the prolapse of part of the stomach into the thoracic cavity.⁵ Type I, or sliding hiatal hernia, is the most-common type in mammals; it allows the proximal part of the stomach to be intermittently displaced through the esophageal hiatus into the thoracic cavity. Only one published case study has described a diaphragmatic hernia in a living marine mammal, a harbor seal (*Phoca vitulina*); however, the outcome in that case was unsuccessful.² Other cases have been reported postmortem including in harbor seals, sea lions (*Phocarcos hookeri*), dolphins (*Stenella coeruleoalba*), and porpoises (*Phocoena phocoena*).^{1,3,4,6,7}

Type 1 hiatal hernia repair in veterinary medicine typically includes a combination of dia-

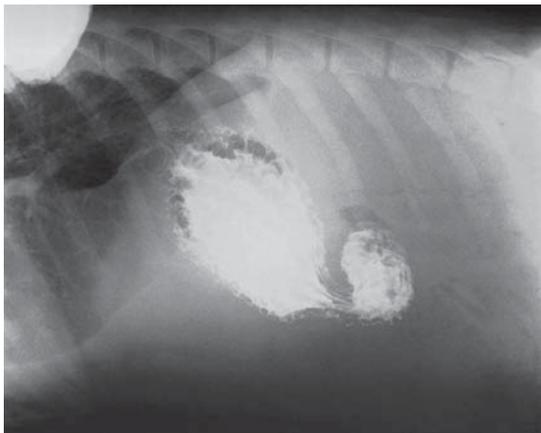


Figure 4. Lateral thoracic radiograph using contrast to demonstrate resolution of gastric herniation.

phragmatic hiatal plication, esophagopexy, and left-sided gastropexy.⁵ In this case it was decided to attempt a single procedure to reduce anesthesia time and potential complications. A laparoscopic approach was chosen because open abdominal surgery in marine mammals presents unique challenges and increased risks, and the outcome was successful in this case at least to the point of release. The case described demonstrates the importance of performing a full work-up in persistently regurgitating marine mammals in

the rehabilitation setting and provides description of a minimally invasive approach for gastropexy.

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