Esophageal stricture in a White Tiger

Case Report

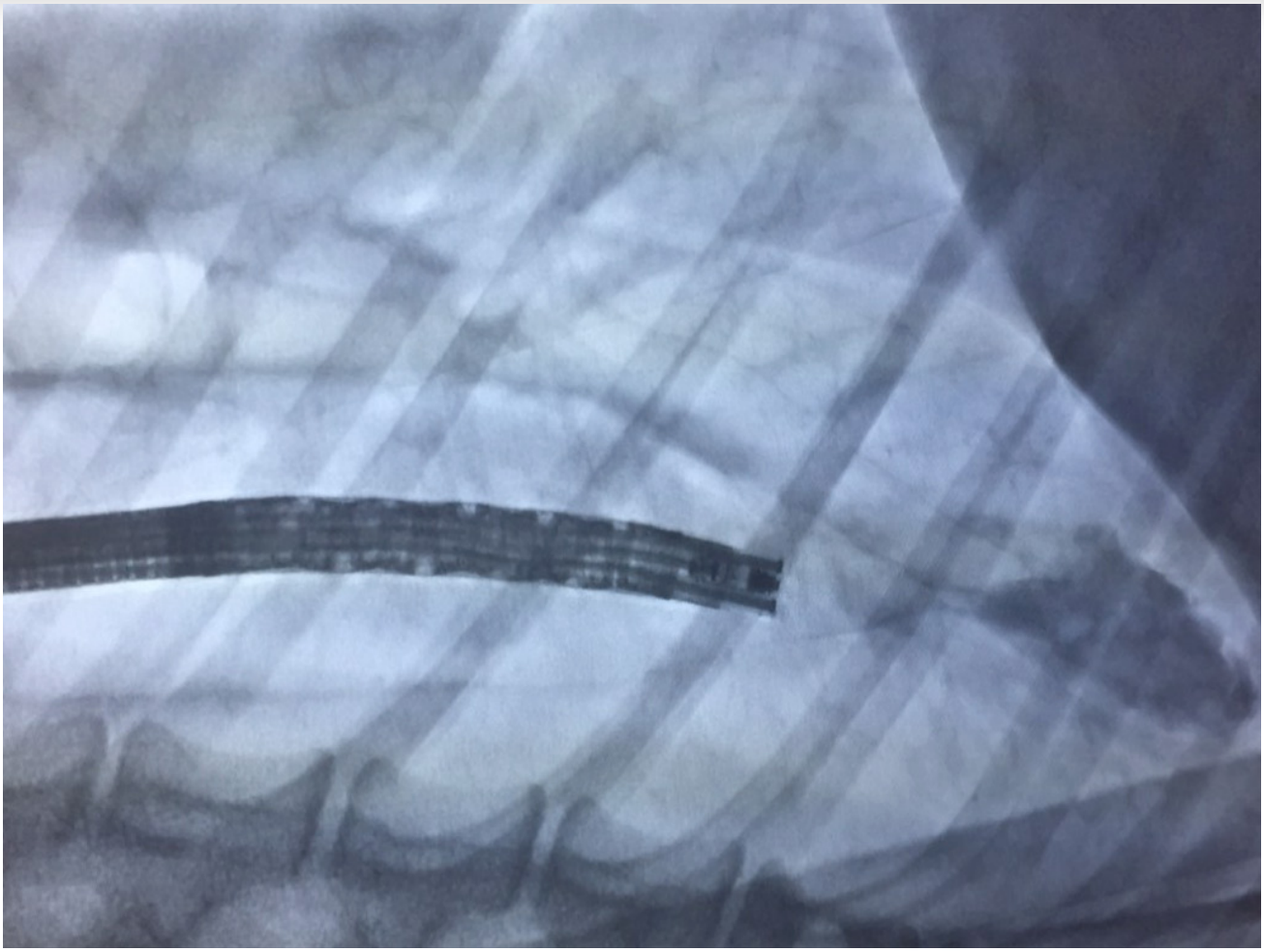
A five-year-old, intact, female, captive-born white tiger, 350 pounds, was presented due to a one-month history of dysphagia and regurgitation. Her etiology is complex. At four months of age, the tiger was diagnosed with urinary and fecal incontinence that was determined to be neurological in nature, along with hip dysplasia and hind limb paresis. Recurrent urinary tract infections were treated with Amoxicillin as needed. One month before admittance to the University of Florida Veterinary Hospital, the tiger suffered a stressful event when a tractor repeatedly drove past her habitat on 23 July 2018, harassing the tiger, causing her to loudly vocalize, race the length of her habitat, and slam into the cage doors. She stopped eating immediately.

Fear can cause psychological stress in animals and frightening noises can cause environmental stress (Matthews 2014). This tiger was tormented for an extended time period by the tractor which produced extremely loud, frightening noises as the driver hit the railroad tie barriers adjacent to the tiger's cage, ramming the ties into the sides of the cage.

The tiger was presented to Julington Creek Animal Hospital in Jacksonville, Florida, sedated with 2cc Telazol (Tiletamine/ Zolazepam), and given a bolus of 2 liters of IV lactated ringers. Blood work showed elevated WBC (56.94 K/uL). After three weeks of anorexia and general depression, the tiger was transported to First Coast Veterinary Specialists in Jacksonville, Florida. Radiographs confirmed an intestinal blockage and an abdominal exploratory surgery was performed. The patient was manually deobstipated, and large quantities of hair, sand, and feces were removed.

One week later, clinical signs did not subside, anorexia continued and white blood cell count remained elevated. The tiger was presented to the University of Florida (UF) Veterinary hospital due to inappetance, depression, significant weight loss, and increased white blood cells.

The tiger received IV fluids while under anesthesia, and was treated with oral Enroflaxacin, the antacid Famotidine, the anti-emetic Cerenia and B vitamins. The next day, the tiger suffered two seizures. An anti-convulsive drug (Levetiracetam) was administered and a CSF tap performed, which was mildly reactive with no evidence of infection. Distemper, toxoplasma, neospora, and blood cultures were negative. CT scan revealed small, mineralized intraluminal material in the mid-esophagus of unknown origin, which was also noted in the stomach. CBC revealed elevated white blood cell count (61,000) with moderate toxicity and decreased red blood cell count (PCV 27%). Urinalysis revealed glucose in the urine



Endoscope on left, nearing the stricture. Dark area on right is the stomach.

(>2,000 mg/dL), >3+ blood in urine; no bacteria or white blood cells seen. The tiger returned home five days after eating well at the UF hospital, and was discharged with Baytril, Keppra, Cerenia, and Omeprazol. Three weeks later, on 7 September 2018, the tiger was returned to UF for an endoscopy. She had eaten very little horsemeat since returning home and began vomiting white foam. Her weight decreased from her original healthy weight of 350 pounds to 162 pounds.

On presentation, the animal was obtunded and ataxic, suspected secondary to sedation with 2cc Telazol prior to travel. She exhibited moderate ptyalism, also suspected secondary to travel. After sedation with 300mg Ketamine, 7.5mg Midazolam and 3mg Dexmetomidine intramuscularly, the patient was anesthetized with Isofluorane. The coat was examined and determined unkempt, and the tiger exhibited severe muscle wasting, worse in the hind limbs. Dehydration was estimated at 7–10% based on moderate skin tenting. CBC revealed mild anemia (6.67M/uL), mild thrombocytosis (546K/uL), and mildly elevated total white blood cell count (19K).

The tiger's blood chemistry revealed mild hypoalbumenia (2.5), hyperglobulinemia (5.5), mild hyperkalemia (4.9), hyponatremia (142),

Table 1. Represents esophageal stricture changes during each of the six treatments.

Date	Weight	Stricture Dilation	Endoscopy Findings	Patient Response
07.ix.2018	Original weight 350 lbs. Now 162 lbs.	12mm scope, 15mm balloon catheter, then 18mm catheter	Esophagitis on smooth muscle of distal esophagus	Within 4 days, stricture prevented the animal from eating
18.ix.2018	178 lbs.	7.8mm scope, 18mm balloon catheter, then 20mm catheter	Healing abrasions observed from previous endoscopy and dilation. Mytomycin applied	Within 6 days, stricture prevented the animal from eating
05.x.2018	No weight taken	7.8mm scope, 18mm, 19mm and 20mm balloon catheter	Stricture is 5mm long, narrowed at rostral end. Irritation and fibrous tissue observed, making it difficult to dilate. Dilated to 30mm	Within 8 days, stricture prevented the animal from eating
12.x.2018	192 lbs.	35mm balloon catheter, dilating the site to 35mm	Based on amount of tearing through fibrotic tissue, stricture was expected to recur	Within 5 days, stricture prevented the animal from eating
23.x.2018	208 lbs.	7.8mm scope inserted 95cm. CO2 laser used to score stricture. 35mm balloon used to dilate to 35mm	Stricture's length decreased since last dilation	Within 8 days, stricture prevented the animal from eating
06.xi.2018	No weight taken	35mm balloon used to dilate to 35mm.	This was the final procedure. Quality of life poor, euthanasia recommended	Within 10 days, stricture prevented the animal from eating

and hypochloremia (109). These findings are consistent with regurgitation/vomiting of lower stomach acid, as well as mild inflammation, which is consistent with her clinical signs. Kidney and liver values were normal (Table 1).

While under anesthesia, an endoscopy was performed with a 12mm scope. Esophagitis was noted on the smooth muscle of the distal esophagus and a hard, white foreign body was lodged within the distal esophagus. The obstruction, a piece of bone, was removed and a 15mm balloon catheter was utilized to dialate the stricture to allow the scope to advance. The antrum of the stomach had small multifocal areas of digested blood. The remainder of the stomach and proximal duodenum did not have any gross abnormalities. Biopsies of the duodenum, stomach, and esophagus were submitted for histopathology. The esophageal stricture was dilatated with a 15mm balloon followed by an 18mm balloon.

The patient then received a 60ml bolus of fluids, followed by 2.5 liters of fluids IV and 1.5 liters SQ. Pantoprazole (100mg) was given IV. Pantoprazole is a proton pump inhibitor that works similar to omeprazole to decrease stomach acidity to help combat ulceration and inflammation of the esophagus and stomach. Patient also received Cobalamine (vitamin B-12)

2,000mcg subcutaneously due to her previously low Cobalamine and Folate levels. Recommended diet included a blended diet, such as Toronto brand horsemeat, formed into meatballs. The recommended amount was 2–3% of the animal's body weight per day. Because patient was anorexic for so long, patient was started on 2% of her body weight (3.5 pounds/day).

Due to the patient's esophageal stricture, bone shards are more likely to get lodged and cause or worsen strictures, so they should not be offered. Medications post OP include Cerenia, one-half tablet every 24 hours as needed for nausea or vomiting, Cisapride (20mg capsules), one capsule by mouth every eight hours, and Omeprazole (20mg capsules), four capsules by mouth every 12 hours for 14 days.

Approximately three weeks later on 18 September 2018, the tiger was returned to UF due to regurgitation. Her weight totalled 178 pounds, up 16 pounds from the last visit. The tiger wanted to eat, but could no longer pass any food into its stomach, after four days of eating successfully. Another upper gastric endoscopy, fluoroscopy, and balloon dilation were performed with a 7.8mm scope, showing healing abrasions from the previous endoscopy and dilation. An 18mm balloon and a 20mm balloon were used to dilate the stricture site, and Mytomycin, a chemotherapeutic drug, was applied to the fibrous tissue where the stricture was.

The patient returned to UF approximately three weeks later on October 5, 2018, exhibiting the same regurgitation symptoms after six days of eating normally. The tiger was sedated with the same drugs used previously. She was given a 1 liter bolus of lactated ringer solution IV and another 1 liter subcutaneously later on, which corrected her measured acidosis.

The patient was given 1mg/kg Maropitant intravenously and 1mg/kg Pantoprazole intravenously. She became hypotensive during anesthesia and was given 0.25mg/ml Dobutamine in 0.9% sodium chloride at a rate of 15mcg/hr for five minutes, which corrected her hypotension. Under anesthesia, a 7.8mm scope was inserted 90–95cm down the esophagus to the stricture site. The stricture was 5mm long and had a focal area of narrowing at the rostral end. Reddened irritation and a large degree of fibrous tissue were observed at the site. An 18mm, 19mm, 20mm balloon and a second balloon were used to dilate the stricture. There was more fibrous response from the esophagus during dilation, making it more difficult to dilate. The site could only be dilated to 30mm. Based on the amount of tearing through fibrotic tissue, the stricture was expected to recur. After the procedure, the tiger was reversed using 15mg Atipamezole and 500mcg Flumazenil, both intramuscularly.

The patient returned to UF after one week on 12 October 2018. She weighed 192 pounds. She stopped eating normally after eight days and began regurgitating her food once again. During this procedure, a 35mm balloon was used to dilate the stricture. The site could

only be dilated to 35mm. Based on the amount of tearing through fibrotic tissue, the stricture was expected to recur. The patient was able to eat normally for five days before beginning regurgitation.

The tiger was again transported to UF for treatment on 23 October 2018. A body condition score of 2/5 was determined, with a weight of 208 pounds. She had mild to moderate muscle wasting with severe muscle wasting in her hind limbs. Her mucous membranes were pink and moist, her CRT was <2 seconds, and she appeared euhydrated. Under anesthesia, a 7.8mm scope was inserted 95cm down her esophagus to the stricture site.

The stricture's length had decreased since the last balloon dilation, with a focal area of narrowing at the rostral end. Reddened irritation and fibrous tissue in the dorsal portion of the esophagus was observed at the site. A CO2 laser was used to score the area of the strictured esophagus and allow better stretching of the esophagus with balloon dilation. A 35mm balloon was then used to dialate the stricture. The site could only be dilated to 35mm. The area was completely opened, including the focal area of narrowing at the rostral end. Triamcinolone was injected into the wall of the esophagus where the balloon dilation occurred to help prevent fibrosis of the esophagus. The tiger was diagnosed with a urinary tract infection and treated accordingly.

After eight days of eating normally, on 6 November 2018, the tiger again resumed regurgitation and vomiting up of white foam. She was again transported to UF for her sixth and final endoscopy procedure. The patient's mobility decreased over the past few days. She was able to take four or five steps before lying down. Veterinarians were concerned about her quality of life at this time. She still had no control over urination or defecation. Complete blood count and chemistry panel were within normal limits. An ultrasound was performed. Her bladder, cervix, uterus and kidneys were all within normal limits. A small, hypoechoic, non-symmetrical structure was seen in the right inguinal region at the level of the insertion of the prepubic tendon. This structure may have been a muscle insertion or lymph node, which is unusual. A balloon dilation was performed via fluoroscopy to allow veterinarians to see a "moving x-ray," providing a clearer view of the stricture.

As in the past, the caudal portion of the previous stricture was closed down very small. The length of the restricted portion of the esophagus was mildly shorter than in the past. A 35mm balloon was used to dilate the stricture. The site was dilated to 35mm. The area was completely opened and Triamcinolone was injected into the wall of the esophagus where the balloon dilation occurred to help prevent fibrosis of the esophagus. Patient was able to eat normally for 10 days before resuming regurgitation.

Veterinarians discussed this tiger's quality of life. While she appeared happy and ate a substantial amount for several days after her six procedures, with her limited mobility and recurrent esophageal stricture, her prognosis

for a normal life was determined to be poor. The tiger was prescribed steroids to decrease inflammation associated with her esophageal stricture and hind limb weakness. The patient was prescribed Prednisolone, 6mg, six tablets by mouth every 12 hours. She still had an active urinary tract infection at this point. An injection of Excede (Ceftiofur) was recommended and administered.

As of 29 November 2018, the tiger had eaten little to nothing. Regurgitation resumed, and the animal was again losing weight. Euthanasia was recommended. On 30 November 2018, the owner began pureeing ground chicken and milk, offering the tiger four pounds of the mixture along with two quarts of milk twice daily. The tiger drank all of it. The next morning, no regurgitation was evident; the tiger was able to keep the blended mixture down. The tiger resumed regurgitation periodically, however, until she was only able to keep food down for a day or two before regurgitating all of her diet for several days in a row. This continued until 14 January 2019, when it was determined that her quality of life was only going to deteriorate more rapidly from this point on.

Other case studies

It is unknown if stricture formation in exotic felids is a common occurrence, due to lack of diagnosis, treatment, or lack of reporting. Desmarchelier described an esophageal stricture in a large felid in 2009, whereby a seven-month-old Cougar *Puma concolor* was diagnosed with a segmental intraluminal esophageal stricture in the middle of her esophagus, believed to have been caused by previous anesthesia. The cougar required three endoscopic balloon dilations. Two months after the successful third procedure, she was killed by a cage mate, so no further study could be accomplished (Desmarchelier 2009).

Ayala (2018) discussed esophagitis and a 13mm stricture in an African Lion *Panthera leo*. The lion's stricture was successfully dilated with a 20mm balloon followed by a 35mm balloon. The lion required no further treatment and exhibited no further signs after one year.

Discussion

Although strictures can be congenital in dogs and cats, acquired strictures occur due to injury of the esophagus, chronic vomiting, foreign bodies, thermal burns or from corrosive substances. The injured esophagus will heal by fibrosis and contracture of the wound, narrowing the lumen, resulting in esophageal obstruction.

The most common cause of stricture formation is from esophageal reflux that can occur when the animal is under anesthesia. Strictures in felines can also be caused by oral antibiotics, specifically, Clindamycin and Doxycycline. Such medication-induced strictures can occur when the tablet or capsule remains in the esophagus, resulting in esophagitis and the formation of strictures. It is recommended that a water bolus be administered after oral tablets have been consumed to clear the esophagus (Johnston 2018).

Although this tiger's stricture may have been caused while under anesthesia when the intestinal blockage was repaired, she has also received oral medications in the past, including Clindamycin; however, the tiger did not dry-swallow the drugs. The Clindamycin was placed inside of a piece of meat, which the tiger then swallowed. When dry-swallowed, capsules can become retained in the oropharynx or cervical esophagus (Glanemann 2008). Owner suspects that the stressful event involving a tractor that occurred on 23 July 2018, led to this tiger's complications with esophageal strictures.

The stressful event that this tiger experienced due to the tractor incident could have caused her intestinal blockage and inappetance, both of which occurred at the time of the stressful incident. Abdominal surgery and subsequent anorexia, followed by her appetite resumption and an overproduction of stomach acid could have led to the formation of the stricture.

Immunocompetence is modulated by stress, which possibly leads to an increased susceptibility to disease in animals (Beerda 1999). Stress is an effect that is produced by external physical or environmental events, or internal physiological or psychological factors. Fear can cause psychological stress, and frightening noises can cause environmental stress. This tiger was distressed, a state in which she could not escape from the stressors that resulted in negative effects on her well-being. Massaging the stressed animal produces the homeostatic effect of reducing stress hormones and increasing endorphins, serotonin and norepinephrine (Matthews 2014). Since the stressor incident, the owner took steps to reduce stress, to include visiting with the tiger several times a day, talking to her, brushing her, and minimizing noise levels, all techniques used to reduce stress. The damage, however, was already done with this tiger; after surgery and several dilation procedures, she had to be euthanized.

Gross necropsy findings

A necropsy was performed on 15 January 2019 by Lisa L. Farina, DVM, DACVP and Sunil N. More, DVM, PhD, Resident. The gallbladder contained a moderate amount of soft, black particulate material. There were numerous, tan colored, pin-point foci in the splenic parenchyma (lymphoid follicles) of the spleen. Urinary bladder was distended with yellow urine. The tissue surrounding the right and left ovaries each contained two 1-1.5 x 0.5-1 x 0.51cm cysts, filled with a pale yellow fluid. Lungs were multifocally mottled red; there were multifocal areas of air trapped in the connective tissue surrounding the hilus. A small amount of green grass material was found in the bronchi. The lungs exuded red-tinged fluid on severed sections.

In the digestive tract, the caudal portion of the esophagus was palpably firm. Approximately 2cm proximal to the gastroesophageal junction, the mucosa narrowed to approximately 3cm in circumference. The remaining mucosa was approximately 7cm in circumference. The muscularis of the caudal one-third of the esophagus was 0.4cm in thickness; the

muscularis of the cranial esophagus was 0.2cm in thickness. At the stricture level extending cranially, there were four, tan to yellow, shiny, sharply demarcated areas in the mucosa, presumed to be ulcers, that ranged in size of 1 x 0.3cm to 2 x 4cm. Mild dilation of the mid esophagus cranial to the stricture was found. Stomach was filled with granular, brownish food material. Contents of the intestines were brown and mucoid.

In the lumbar spinal cord, beginning at L4 to the cauda equine dorsally, a longitudinal cavitation was found, measuring from 2mm to 5mm. On cut sections, the dorsal spinal cord sections contained cystic space with a thin dorsal lamina. The spinal cord sections from L1 to L4 contained multiple cavitated areas up to 1mm in diameter surrounding the central canal.

Gross diagnoses

- Esophageal stricture, chronic, marked, mucosa of distal esophagus, with mucosal ulceration and gastric heterotopia.
- Presumptive syringomyelia, lumbar spinal cord.
- Paraovarian cysts, chronic, multifocal, mild, bilateral.

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