Balloon dilatation of nasopharyngeal stenosis in a dog

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A 12-month-old 12.6-kg (27.7-lb) spayed female Whippet was referred to the Mathew J. Ryan Veterinary Teaching Hospital of the University of Pennsylvania with a 6-month history of progressively worsening inspiratory stridor that began immediately after ovariohysterectomy had been performed at 6 months of age. The dog had reportedly regurgitated gastric contents at the end of anesthesia, and this material had been seen coming out of both nares. Since that time, the dog could not breathe normally when its mouth was closed. Inspiratory stridor that was worse during inspiration was evident when the dog's mouth was closed, but was not evident when its mouth was open. There was no history of nasal discharge or any change in the dog's bark or activity level. The dog had reportedly regurgitated gastric contents at the end of anesthesia, and this material had been seen coming out of both nares.

Case Description—A dog was examined because of a 6-month history of upper airway stridor that began after postoperative regurgitation of gastric contents. Clinical Findings—Constant stridor was evident during inspiration and expiration, although it was worse during inspiration. The stridor was not longer evident when the dog's mouth was manually held open. Computed tomography, rhinoscopy, and fluoroscopy were used to confirm a diagnosis of nasopharyngeal stenosis.

Treatment and Outcome—The dog was anesthetized, and balloon dilatation of the stenosis was performed. Prednisone was prescribed for 4 weeks after the procedure to decrease fibrous tissue formation. Although the dog was initially improved, signs recurred 3.5 weeks later, and balloon dilatation was repeated. This time, however, triamcinolone was injected into the area of stenosis at the end of the dilatation procedure. Two months later, although the dog did not have clinical signs of stridor, a third dilatation procedure was performed because mild stenosis was seen on follow-up computed tomographic images; again, triamcinolone was injected into the area of stenosis at the end of the dilatation procedure. Three and 6 months after the third dilatation procedure, the dog reportedly was clinically normal.

Clinical Relevancy—Findings suggest that balloon dilatation may be an effective treatment for nasopharyngeal stenosis in dogs. (J Am Vet Med Assoc 2006; 229:385-388)

On initial examination at the Ryan Veterinary Teaching Hospital, the dog appeared bright and alert. Constant stridor was noticed during inspiration and expiration, although it was worse during inspiration. The dog did not attempt to open its mouth to breathe, but when the dog's mouth was manually held open, the stridor was no longer evident. No nasal discharge was present. Airflow through the right nostril was reduced, compared with expected airflow; minimal airflow was detected through the left nostril. Results of the remainder of the physical examination were unremarkable.

Differential diagnoses for the respiratory noise that were considered included choanal atresia, nasopharyngeal stenosis or stricture, foreign body migration, neoplasia, and nasopharyngeal or nasal granulomatous disease. Results of a CBC, serum biochemical profile, and coagulation profile were within reference limits, and thoracic radiographs were unremarkable. On a lateral radiographic view of the cervical region, the soft palate appeared moderately thickened, compared with normal.

The following day, the dog was premedicated with midazolam (0.1 mg/kg [0.045 mg/lb], IM), butorphanol (0.2 mg/kg [0.09 mg/lb], IM), and glycopyrrolate (0.01 mg/kg [0.0045 mg/lb], IM) and anesthetized with propofol (6 mg/kg [2.7 mg/lb], IV). An endotracheal tube was placed, and anesthesia was maintained with isoflurane in oxygen.

Examination of the oral cavity during placement of the endotracheal tube did not reveal any evidence of laryngeal paralysis, masses, polyps, or eversion of the laryngeal saccules. Computed tomography of the nasopharyngeal region was performed before and after IV administration of iohexol (3.5 g, IV). On axial computed tomographic images and sagittal and dorsal image reconstructions, severe stenosis of the nasopharynx was seen caudal to the palatine bone with irregular, mildly enhancing material with a soft tissue density evident throughout the narrowed region (Figure 1). Additional findings included fluid in the left frontal sinus and severe left deviation of the rostral portion of the nasal septum with no evidence of concurrent nasal disease. Because the nasal septal deviation appeared to be unrelated to the initial complaint, it was considered to be an incidental finding.

A decision was made to attempt balloon dilatation of the nasopharyngeal stenosis. Measurements obtained from the computed tomographic images for use in treatment planning included distance from the nasal planum to the area of stenosis (9 cm), width of the nasopharynx rostral to the area of stenosis (9 mm), minimal width of the stenotic area (1.5 mm), width of the nasopharynx caudal to the area of stenosis (12 mm), and length of the stenotic area (15 mm).

The dog was positioned in sternal recumbency, and retroflex rhinoscopy was performed with a flexible pedi-
Atretic gastroscope to allowed examination of the stenotic area (Figure 2). A small orifice could be seen in the caudal aspect of the nasopharynx, dorsal to the soft palate. With the rhinoscope fixed in place, the dog was then positioned in lateral recumbency. Under fluoroscopic guidance, a hydrophilic, angled, 0.035-inch guide wire was advanced into the right ventral nasal meatus (the left ventral meatus was not used because of the nasal septal deviation). A marker catheter was then advanced over the guide wire, and the guide wire was advanced into the esophagus. With the marker catheter in place in the stenotic area, radiographic measurements were obtained to confirm computed tomographic measurements of length of the stenotic area and nasopharyngeal width (Figure 3). The marker catheter was then removed, and a 5-F catheter with a percutaneous transluminal angioplasty balloon that was 10 mm in diameter and 40 mm in length was advanced over the guide wire under fluoroscopic guidance. As the balloon catheter was advanced, the rhinoscope was used to observe the balloon as it passed through the stricture. The balloon was inflated manually with diluted iohexol while monitored fluoroscopically. When pressure in the balloon was approximately 7 times atmospheric pressure, the waist of the balloon, representing the area of stenosis, was seen to expand. The balloon was then fully inflated to a diameter of 10 mm (10 times atmospheric pressure) and was held at this pressure and position for 2 minutes. The dilatation procedure was repeated 2 additional times. Expansion of the stenotic area was observed rhinoscopically after the balloon catheter was removed.

Approximately 10 minutes after the dilatation procedure was completed, the dog developed severe bradycardia (heart rate, 34 beats/min). Heart rate increased to 114 beats/min after administration of atropine sulfate (0.02 mg/kg [0.009 mg/lb], IV), and the dog was allowed to recover from anesthesia. No further complications were encountered, and the dog was discharged from the hospital the following day. Prednisone (0.8 mg/kg [0.36 mg/lb], PO, q 12 h for 7 days; then 0.8 mg/kg, PO, q 24 h for 7 days; then 0.4 mg/kg [0.18 mg/lb], PO, q 24 h for 7 days; then 0.25 mg/kg [0.11 mg/lb], PO, q 24 h for 3 days; then 0.25 mg/kg, PO, q 48 h for 3 days) was prescribed in an effort to prevent re-stenosis and reduce fibrous tissue formation. No adverse effects of the procedure were reported by the owner.

Immediately following the dilatation procedure, there was a marked reduction in the intensity of the stridor, both at rest and during activity. However, 3.5 weeks later, clinical signs recurred, although they were not as severe as initially. Follow-up computed tomography revealed that the stenotic area was shorter (4.5 vs 15 mm) and that minimal width of the stenotic area was greater (2.1 vs 1.5 mm). The left frontal sinus still contained fluid.

Balloon dilatation of the stenotic area was performed as described previously. Following the dilatation procedure, triamcinolone (0.2 mg/kg) was injected through a 25-gauge endoscopic needle with a 4-mm
projection tip6 into the stenotic area. The total dose of triamcinolone was divided into 4 aliquots and injected in 4 quadrants around the stenotic area.

The dog again became bradycardic 15 minutes after the dilatation procedure but responded to atropine sulfate administration as before. The dog was discharged, but oral administration of prednisone was not prescribed.

Two months later, the owner reported that the upper airway stridor had resolved and that the only ongoing clinical signs were intermittent serous nasal discharge and nasal congestion that were responsive to chlorpheniramine treatment (4 mg or 0.1 mg/kg, PO, q 12 h to q 8 h). The dog's activity level and attitude were also improved.

Follow-up computed tomography, fluoroscopy, and rhinoscopy were performed at this time. On computed tomographic images, a small area of focal narrowing of the nasopharynx caudal to the palatine bone could be seen. The area of narrowing was shorter (3 mm) and minimal width of the nasopharynx was greater (2.9 mm) than prior to the second balloon dilatation procedure. A third balloon dilatation procedure was performed while the dog was anesthetized to decrease the risk of recurrence, and triamcinolone was injected into the narrowed area after the dilatation procedure as described previously. Three and 6 months after this third procedure, the dog continued to be clinically appropriate, without recurrence of clinical signs.

Discussion

Nasopharyngeal stenosis is a rare cause of upper respiratory tract obstruction in cats1–5 that generally is thought to be a sequela of upper airway infection, inflammation, trauma, or ulceration.1,3–5 In affected cats, a thin membrane partially or fully obstructs the nasopharynx, resulting in inspiratory stridor, gagging, and dyspnea. To our knowledge, this condition has been described only once previously in a dog.6 In that dog, nasopharyngeal stenosis was thought to be secondary to congenital choanal atresia, and treatment consisted of surgery.

Nasopharyngeal stenosis can be congenital or acquired,7 with congenital stenosis secondary to choanal atresia apparently common in children. Embryologic failure of the bucconasal membrane to rupture, which results in a lack of communication between the nasopharynx and nasal cavity, is thought to result in choanal atresia.6 Concurrent deviation of the nasal septum is common in children with choanal atresia, although this was not reported in the dog described previously.6

In the dog described in the present report, nasopharyngeal stenosis was thought to have most likely developed secondary to perianesthetic regurgitation. Stenosis of the nasopharynx secondary to trauma and inflammation in cats has been reported previously,1–5 and we postulated that inflammation secondary to mucosal irritation resulting from regurgitation during anesthesia may have induced the stenosis in this dog. However, we could not rule out the possibility that the dog had congenital stenosis that became worse after the regurgitation and attendant inflammation. Similarly, in children, nasopharyngeal stenosis most commonly occurs secondary to inflammation following adenotonsillectomy.7

In dogs, reflux of gastric contents has been associated with esophageal dysfunction and stricture.8,9 Factors that may affect the development of esophageal strictures include acidity of the refluxed fluid, the presence of gastric enzymes (eg, pepsin) in the reflux, resistance of the mucosa to injury, and contact time. It has been shown that the esophageal mucosa may be damaged by contact with gastric contents with a pH < 2.5 for as little as 20 minutes.9 When injury extends into the deeper layers of the esophagus, scar formation and stricture development may ensue,9 and we propose that the same may be true if regurgitated material enters the nasopharynx.

Clinical signs in the dog described in the present report were similar to those described previously for dogs and cats with nasopharyngeal stenosis.1–6 In particular, inspiratory stridor that was alleviated when the
mouth was held open was the most prominent sign. Diagnosis of nasopharyngeal stenosis requires not only identifying a stenosis in the correct anatomic area, but also differentiating it from choanal atresia. The normal choanae are paired oval openings that separate the nasal cavity from the nasopharynx. With choanal atresia, there is obstruction of 1 or both of the choanae. In contrast, in the dog described in the present report, there was a single stenotic area, and once this area was dilated, the choanae could be seen rhinoscopically.

The diagnosis of nasopharyngeal stenosis was made with a combination of computed tomography, fluoroscopy, and rhinoscopy in this dog. As expected, the stenosis could not be seen on survey radiographs. A previous report described the use of positive-contrast rhino- and fluorography to identify nasopharyngeal stenosis in a cat, but this was not necessary in the dog described in the present report. Computed tomography is the modality of choice for imaging nasopharyngeal stenosis in pediatric human patients. It is important to emphasize that retroflexed posterior rhinoscopy is part of a thorough rhinoscopic examination, and anterior rhinoscopy alone can fail to identify a nasopharyngeal lesion.

Ballooning dilatation of nasopharyngeal stenosis has been reported in cats, and is used in children, although to our knowledge, it has not previously been described in a dog. Multiple dilatation procedures are often required to achieve long-term resolution of clinical signs in cats and children. The use of triamcinolone to decrease fibrous tissue formation following balloon dilatation of nasopharyngeal stenosis has not, to our knowledge, been reported previously. Although its use has been reported following dilatation of esophageal strictures, balloon dilatation was selected for treatment of this dog because it is less invasive than surgical intervention. The patient was discharged from the hospital the same day following the second and third procedures with no appreciable postoperative discomfort and no evidence of recurrence 6 months after the third procedure.

Bradycardia occurred 10 to 15 minutes after the first 2 balloon dilatation procedures in this dog and has been reported previously. The fact that bradycardia did not occur following the third procedure may be attributed to either the minimal dilation that was needed or the fact that atropine, rather than glycopyrrolate, was used for premedication. This bradycardia may be a vagally mediated response caused by vagal afferent compression, and with both episodes, the dog responded to IV atropine administration. Prior to the second dilatation procedure, a higher dose of glycopyrrolate (0.02 mg/kg) was given as a premedication, but because of the time required for computed tomography, the dilatation procedure was performed approximately 1 hour after the glycopyrrolate was given, which likely was beyond the time of peak effect of the glycopyrrolate.

In the dog described in the present report, the third dilatation procedure was performed not because of any recurrence of clinical signs, but because a mild stricture was seen on follow-up computed tomograms. Thus, only 2 balloon dilatation procedures may have been necessary in this patient. Similarly, although triamcinolone was injected after the second and third procedures in an attempt to decrease fibrous tissue formation at the site of the stricture, we could not determine how much this contributed to the resolution of clinical signs.

A particular benefit of computed tomography in this patient was that it allowed us to accurately measure the dimensions of the nasopharynx just proximal and caudal to the area of stenosis. Computed tomography may give important information about the extent of the stenosis, tissue type involved in the stenosis, and other concurrent abnormalities, such as deviation of the nasal septum or choanal atresia. Measurements can also be obtained with the use of a marker catheter inserted under fluoroscopic guidance, but this does not allow measurement of the narrowest aspect of the stenotic region or provide detailed imaging of the nasal turbinates and septum. Measurements obtained with computed tomography were helpful in selecting the size and length of the balloon to be used, although the proper balloon could also have been selected on the basis of measurements obtained with the marker catheter. Thus, it is possible that balloon dilatation could be performed with a combination of rhinoscopy and fluoroscopy alone.

References