Nasal Hydropulsion: A Novel Tumor Biopsy Technique

Elizabeth A. Ashbaugh, DVM, Brendan C. McKiernan, DVM, DAVCIM*, Carrie J. Miller, DVM, DACVIM†, Barbara Powers, DVM, DACVP

ABSTRACT

Intranasal tumors of dogs and cats pose a diagnostic and therapeutic challenge for small animal practitioners. Multiple nasal biopsy techniques have been described in the past. This report describes a simplified flushing technique to biopsy and debulk nasal tumors, which often also results in immediate clinical relief for the patient. Based on the results of this retrospective study, the authors recommend high-pressure saline hydropulsion as a minimally invasive diagnostic, and potentially therapeutic, technique for nasal tumors in dogs and cats. (*J Am Anim Hosp Assoc* 2011; 47:312–316. DOI 10.5326/JAAHA-MS-5608)

Introduction

Intranasal neoplasia accounts for approximately 1–2% of all tumors in dogs and cats. An accurate diagnosis and treatment can be challenging; therefore, an alternate biopsy method is desirable.[1] Clinical signs associated with intranasal tumors often include nasal obstruction (uni- or bilateral lack of airflow, stertorous breathing, interrupted sleeping), nasal discharge, sneezing, reverse sneezing, epistaxis, pain, and/or nasal deformation.[1,2] Several imaging techniques have been used to diagnose intranasal tumors, including radiography, computed tomography (CT), and MRI.[1,2] Rhinoscopy with associated nasal biopsy/histopathology is considered the most definitive method to confirm a diagnosis of a nasal neoplasia, but biopsies obtained under rhinoscopic guidance are only 83% successful in identifying tumor type.[3] Due to their location, nasal tumors can be difficult to biopsy despite the fact that several techniques have been previously described. These techniques include diagnostic nasal flushing, punch biopsy, catheter techniques, fine-needle aspiration, sinus trephination, and rhinoscopy-assisted mucosal biopsies.[1–8] A successful diagnosis may depend on tissue volume obtained.[1] A relatively noninvasive technique to obtain a larger portion of tissue may help improve diagnostic accuracy. In this report, the authors describe a hydropulsion method of forceful nasal flushing, which is minimally invasive and obtains a large sample for biopsy. The authors believe that this hydropulsion method will allow for the collection of a larger volume of nasal tissue and improve clinical signs while awaiting histology results that will help guide treatment options.

Materials and Methods

Medical records of all rhinoscopies performed at Wheat Ridge Veterinary Specialists between Jan 2006 and April 2008 were included. Patients with suspected intranasal tumors, based on clinical signs or CT findings, were rhinoscopically evaluated and biopsied with the hydropulsion technique, a traditional biopsy method, or a combination of the two.

Patients were premedicated (butorphanol[a], glycopyrrolate[b]), anesthetized (diazepam[c], propofol[d]), intubated with an endotracheal tube with a well-inflated cuff, and maintained on inhalant anesthesia (isoflurane[e]).[12] A CT scan was recommended in all cases, but was only performed on 6/41 patients.

To perform the nasal hydropulsion, patients were positioned in sternal recumbency on a wet table with clean towels placed

From the Wheat Ridge Veterinary Specialists, Wheat Ridge, CO (E.A, C.M.); Southern Oregon Veterinary Specialty Clinic, Medford, OR (B.M.); and the Department of Pathobiology, Colorado State University, Fort Collins, CO (B.P).

Correspondence: mariposa_elisabet@hotmail.com (E.A.)

CT *computed tomography*

*B. McKiernan's present affiliation is the University of Illinois Veterinary Teaching Hospital, Urbana, Illinois.

†C. Miller's present affiliation is the Virginia Veterinary Specialists, Charlottesville, VA.

under the mouth to collect any tissue fragments following hydropulsion (**Figure 1**). Rhinoscopy of the anterior and posterior nasal cavities using both a multipurpose rigid telescope[f] and a flexible bronchoscope[g] was performed as previously described.[12] Once a nasal mass was confirmed, a Poole suction tip was inserted into the orad esophageal opening, and the cuff on the endotracheal tube was checked to ensure a tight seal. Hydropulsion was performed by digitally occluding one nostril. A 20–60 cc regular luer tip syringe containing room temperature sterile saline was inserted around the contralateral alar fold and into the anterior nasal cavity (**Figure 2**). Whenever possible, and depending on the size of the patient, a 60 cc syringe was used. Between 20 and 60 mL of saline was forcefully infused into the nasal cavity. The goal was to infuse 60 mL in <2 sec to generate high pressures in the nasal cavity (i.e., "hydropulsion"). This process was repeated in the contralateral nostril. The entire procedure was repeated between one and three times in each nostril to obtain tissue samples. The entire nasal cavity was re-evaluated via rhinoscopy, and hydropulsion was repeated until no additional tissue could be obtained. If no sample was obtained, the procedure was considered unsuccessful. Hydropulsed tissue was collected from the towel on the wet table, the oral cavity, or rhinoscopically from the nasopharynx. Hydropulsion was attempted in all patients, but when unsuccessful, an endoscopic pinch biopsy or needle biopsy was performed immediately after the hydropulsion attempt. Samples were preserved in 10% buffered formalin for histopathologic evaluation. All tissue samples were evaluated by the same board-certified veterinary pathologist (B.P.).

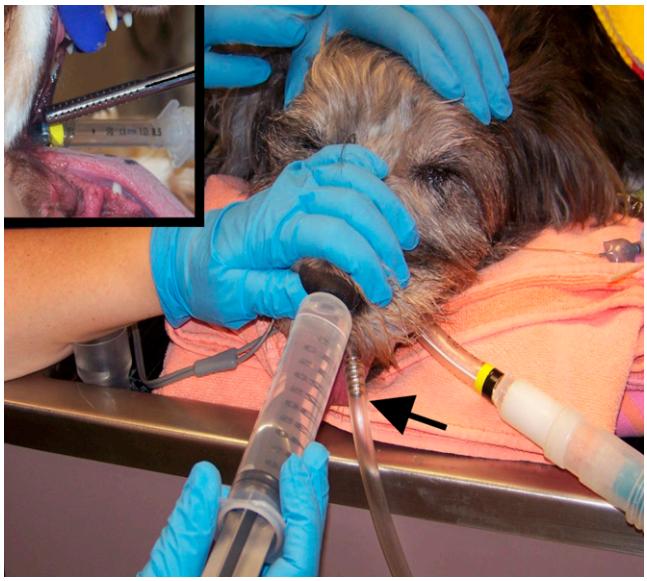

FIGURE 1 *Preparations for hydropulsion include placement of a Poole suction tip* (arrow, insert) *into the opening of the esophagus, insertion of the syringe tip into one nostril, and occlusion of the contralateral nostril.*

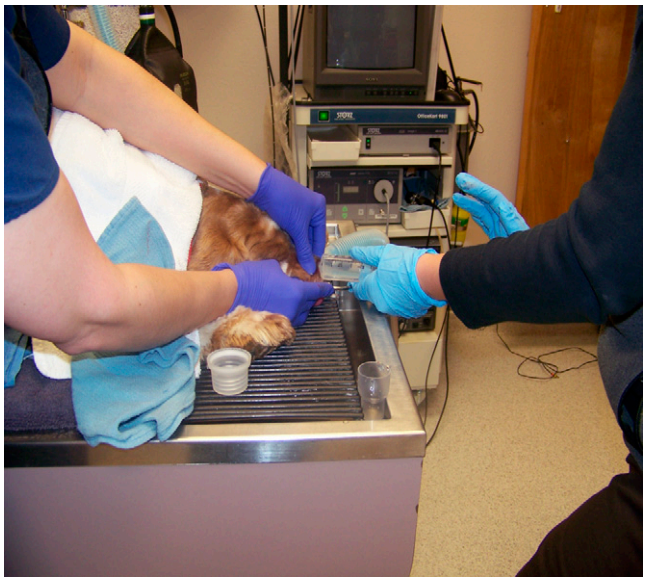

FIGURE 2 *Saline is forcefully infused or "hydropulsed" into the nasal cavity.*

Following hydropulsion, the oropharynx and trachea (rostral to the endotracheal tube cuff) were suctioned using either the endoscope or Poole suction catheter. Care was also taken to suction the cervical esophagus whenever possible. A damp gauze sponge was used to swab any remaining fluid from the oropharynx. Patients were recovered routinely and monitored for possible complications prior to discharge. **Figure 3** is an example of a typical amount of hydropulsed tissue.

Most (35/41) patients were discharged the same day the procedure was performed. Exercise restriction for 1 wk was advised to prevent further sneezing and dislodging of any blood clots. All patients were routinely discharged with piroxicam[h] (0.3 mg/kg *per os q* 24 hr) while awaiting histopathology results and treatment option decisions.[9–11]

Results

Between Jan 2006 and April 2008, 41 cases met the inclusion criteria and were included in this report. A total of 29 dogs and 12 cats were identified, with a mean age of 10.25 yr (cats) and 10.62 yr (dogs). Clinical signs prior to rhinoscopy included obstructed breathing/snoring, nasal discharge (including epistaxis), and occasional coughing.

Despite an older population, anesthesia was tolerated well by all patients. Rhinoscopy identified an obstructive tissue mass in all cases. A diagnostic sample was successfully dislodged from the nasal cavity in 37/41 nasal tumors (90.2% overall success rate).

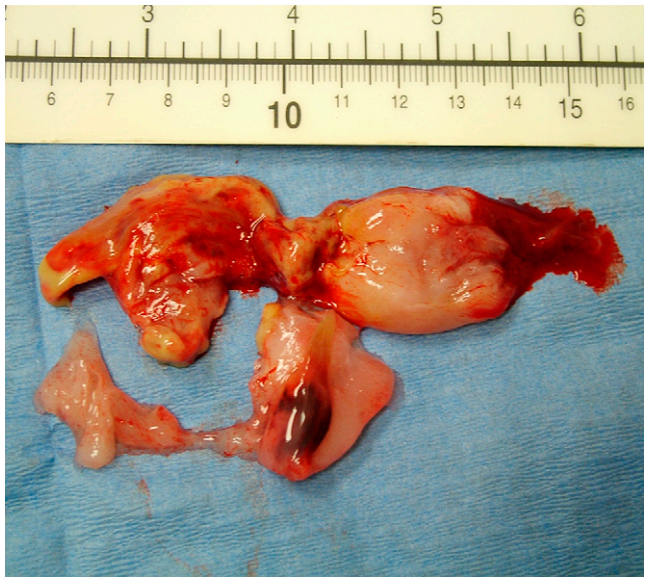

FIGURE 3 *An example of the amount of tissue obtained via nasal hydropulsion.*

A sudden decrease in resistance was often felt as tissue broke free and was hydropulsed through the nasopharynx. Hydropulsion was unsuccessful in 4/29 dogs (13.79%) and in 1/12 cats (8.9%). Nasal tumors diagnosed in included patients were: adenocarcinoma (n=13); other carcinomas (n=8); lymphoma (n=6); osteosarcoma (n=3); other sarcomas (n=10); and spindle cell tumor (n=1). In the four dogs in which hydropulsion was unsuccessful, endoscopic pinch biopsies (n=3) or needle biopsies (n=1, a mutilobulated osteosarcoma) were obtained (**Table 1**). A histopathologic diagnosis was made from these biopsies in these four cases where hydropulsion failed.

Immediate relief of nasal obstruction was not an outcome that was initially evaluated; however, in approximately one-third of the evaluated patients, nasal flow was considered improved based on nasal stethoscopic auscultation performed pre- and posthydropulsion. Two cats and three dogs had hydropulsion performed multiple times to alleviate recurring clinical signs of obstructive nasal breathing and epistaxis. In one cat, three hydropulsions were performed over a 24 mo period from Jan 2004 to Feb 2006 (only one hydropulsion was included in this report).

Minor postoperative complications included sneezing, reverse sneezing, and mild postoperative epistaxis. In three cases, submucosal or retrobulbar swelling was noted immediately following hydropulsion (**Figure 4**). One dose of furosemide[i] (2 mg/kg IV) was administered to each of these patients. Clinically, these three patients appeared to recover without difficulty between 6 hr and 12 hr postprocedurally. No anesthetic complications were encountered.

Discussion

The success rate for definitive diagnosis in this study (90.2%) was higher than previous reports of nasal flushing and endoscopic pinch biopsy techniques, which range from 50% to 83%.[2,4] In the patients where hydropulsion was successful, a large quantity of tissue was dislodged for histopathologic review. Although a limited number of samples were available, it did not appear that the gross rhinoscopic appearance of the mass (e.g., smooth bordered, lobulated, polypoid) appeared to influence the success of the hydropulsion. This technique was successful in obtaining tissue from a variety of tumor types.

Based on these results, the authors encourage hydropulsion attempts in all cases of nasal airflow obstruction, especially where a nasal tumor is suspected. This technique could also be useful in the removal of non-neoplastic secretions and flushing nasal foreign bodies.

This technique is designed to push tissue through and out of the nasopharynx; therefore, packing the oropharynx with gauze, as previously reported, is not necessary.[6] As described herein, careful suctioning and cleaning of the proximal trachea, oropharynx, and nasopharynx is necessary following this procedure to prevent possible fluid aspiration and to collect all tissue fragments.

The pressures produced by forceful hydropulsion were successful in dislodging tissue from the nasal cavity. As might be expected, minor postoperative bleeding was not uncommon. In four cases, this bleeding was more moderate, requiring a slightly longer anesthesia to achieve hemostasis. Diagnostic evaluation of cases presenting with epistaxis should include a minimum database, blood pressure measurement, platelet evaluation, and coagulation studies prior to rhinoscopy.[13] Other common postoperative observations that were noted included sneezing and reverse sneezing, which were most likely in response to irritation caused by the endoscope and/or the fluid/tissue on the nasopharyngeal mucosal surfaces. In the few cases (n=3) where tissue was not easily dislodged by the forceful hydropulsion, fluid appeared to accumulate submucosally because mucosal swelling was evident upon visual inspection of the nasopharynx. All of these cases resulted in successful tissue dislodgement via hydropulsion, and no further complications were documented in these patients.

Although not performed in all included cases, a CT scan of the nasal cavity is recommended before all hydropulsion procedures to evaluate the cribriform plate. Only six patients in this study had a CT performed prior to the procedure. The decision to not perform a CT was based on financial constraints of the owner. No postoperative neurologic complications (e.g., seizures) were encountered in this study population, but this would be a concern if the cribriform plate was compromised by a mass. Potential

TABLE 1

Results of Nasal Biopsies Performed in 41 Dogs and Cats Between Jan 2006 and April 2008

Case number	Signalment	Method of biopsy	Histologic diagnosis
1	9 yr old FS Labrador retriever	Hydropulsion	Chondrosarcoma
2	10 yr old FS DMH	Hydropulsion	Osteosarcoma
3	9 yr old MN Labrador mixed-breed dog	Hydropulsion	Carcinoma
4	3 yr old MN DSH	Hydropulsion	Osteosarcoma
5	9 yr old MN papillon mixed-breed	Hydropulsion	Carcinoma
6	12 yr old FS Old English sheepdog	Hydropulsion	Chondrosarcoma
7	7 yr old MN shepherd mixed-breed	Hydropulsion	Lymphoma
8	7 yr old MN husky	Hydropulsion	Carcinoma
9	10 yr old FS golden retriever	Hydropulsion	Myxosarcoma
10	10 yr old MN shepherd mixed-breed	Hydropulsion	Carcinoma
11	14 yr old MN Cavalier King Charles spaniel	Endoscopic pinch	Osetosarcoma
12	14 yr old MN Wheaten terrier	Hydropulsion	Adenocarcinoma
13	13 yr old FS DSH	Hydropulsion	Adenocarcinoma
14	12 yr old MN pointer	Hydropulsion	Spindle cell sarcoma
15	6 yr old MN Maine coon	Hydropulsion	Lymphoma
16	6 yr old MN Persian	Hydropulsion	Lymphoma, large cell
17	8 yr old MN Rhodesian ridgeback	Hydropulsion	Carcinoma
18	9 yr old FS Labrador retriever	Endoscopic pinch	Sarcoma
19	12yr FS Labrador retriever	Hydropulsion	Chondrosarcoma
20	9 yr old MN miniature schnauzer	Hydropulsion	Adenocarcinoma
21	12 yr old MN Brittany	Hydropulsion	Adenocarcinoma
22	3 yr old MN DSH	Hydropulsion	Lymphoma
23	13 yr old MN husky	Hydropulsion	Carcinoma
24	16 yr old MN Siamese	Hydropulsion	Lymphoma
25	6 yr old MN cocker spaniel	Hydropulsion	Chondrosarcoma
26	14 yr old MN Persian	Hydropulsion	Adenocarcinoma
27	5 yr old MN golden retriever	Trucut	Multilobulated osteochondrosarcoma
28	10 yr old MN Pomeranian	Hydropulsion	Adenocarcinoma
29	13 yr old MN DLH	Hydropulsion	Lymphoma
30	9 yr old MN DLH	Endoscopic pinch	Adenocarcinoma
31	12 yr old FS bearded collie	Hydropulsion	Adenocarcinoma
32	12 yr old FS keeshound	Hydropulsion	Sarcoma
33	12 yr old FS keeshound	Hydropulsion	Sarcoma
34	15 yr old MN DMH	Hydropulsion	Adenocarcinoma
35	15 yr old MN DSH	Hydropulsion	Adenocarcinoma
36	10 yr old FS Persian mixed-breed	Hydropulsion	Carcinoma
37	8 yr old MN Labrador retriever	Hydropulsion	Adenocarcinoma
38	16 yr old FS DSH	Hydropulsion	Squamous cell carcinoma
39	9 yr old FS Labrador retriever	Hydropulsion	Spindle cell tumor
40	16 yr old MN beagle mixed-breed	Hydropulsion	Adenocarcinoma
41	16 yr old MN beagle mixed-breed	Hydropulsion	Adenocarcinoma

DLH, domestic longhaired; DMH, domestic mediumhaired; DSH, domestic shorthaired; MN, male neutered; FS, female spayed

neurologic complications were discussed with all owners before hydropulsion was attempted.

In this study, approximately one-third of the patients experienced immediate relief of their nasal obstruction following the hydropulsion. It is the authors' opinion that many animals with nasal tumors are euthanized due to the owners' concern regarding poor quality of life secondary to persistent obstructive breathing. By alleviating this clinical concern, the authors suggest that many owners would be willing to live with the other clinical signs associated with nasal tumors.

The use of piroxicam postprocedurally was chosen for both its chemotherapy and anti-inflammatory properties.[9–11]

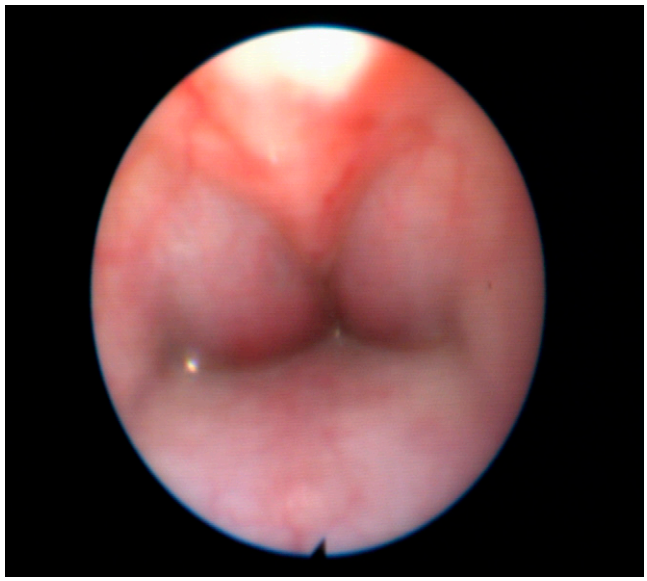

FIGURE 4 *Evidence of choanal submucosal swelling following hydropulsion in one dog.*

Conclusion

Several surgical and nonsurgical techniques have previously been described to obtain biopsies of intranasal masses.[1–6] Hydropulsion allows for the collection of large biopsy samples and the potential relief of nasal airflow obstruction. The authors also found that this technique can be repeated multiple times to debulk tissue, which specifically addresses one reason why animals with nasal tumors are commonly euthanized. Future prospective studies should be conducted to further evaluate the therapeutic utility of this method to relieve nasal obstruction in patients with nasal tumors.

FOOTNOTES

[a] Butophanol; Bedford Laboratories, Bedford, OH

[b] Glycopyrrolate; Baxter Healthcare Corporation, Deerfield, IL

[c] Diazepam; Watson Laboratories, Coronoa, CA

[d] Propofol; Bedford Laboratories, Bedford, OH

[e] Isoflurane; Hospira, Inc., Lake Forest, IL

[f] Karl Stortz Multi-Purpose Rigid Telescope, Germany

[g] Karl Stortz 5mm flexible canine bronchoscope; Karl Storz GmbH & Co. KG, Tuttlingen Germany

[h] Piroxicam; Pfizer, New York, NY

[i] Furosemide; Boehring Ingelheim, Ingelheim, Germany

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