

A retrospective study of chronic nasal disease in 75 dogs

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ABSTRACT

Chronic nasal disease is a common problem in dogs. To determine the aetiology, a retrospective study in 75 dogs with persistent and chronic nasal disease was done. All dogs were evaluated by means of survey nasal radiographs, antegrade and retrograde rhinoscopy, bacterial and fungal cultures, and histopathology. A definitive diagnosis was made in 74/75 cases (98.6 %). Nasal neoplasia was the most common diagnosis (46.7 %), median age 108 months, followed by lympho-plasmacytic rhinitis (20 %), median age 112 months, and fungal rhinitis (10.7 %), median age 53.5 months. Other diagnoses included nasal foreign body (5.3 %), median age 51 months, and primary bacterial rhinitis (6.7 %), median age 116.5 months. Rare aetiologies identified were nasal polyps, granulomatous rhinitis, oro-nasal fistula and naso-pharyngeal stenosis. This study showed that by using a structured combination of survey radiography, rhinoscopy, cultures and histopathology, a diagnosis could be made in dogs with chronic nasal disease.

Keywords: fungal, lympho-plasmacytic, neoplasia, rhinitis, rhinoscopy.

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INTRODUCTION

Chronic nasal disease is characterised by nasal and/or ocular discharge, sneezing, and nasal stertor and can be a common problem in dogs^{3,19}. There are, however, only a few published reports concerning the prevalence of the different aetiologies in the dog¹⁹. Signs of chronic nasal disease may include sneezing, nasal discharge, epistaxis, nasal stertor, paroxysmal reverse sneezing, coughing, halitosis, open-mouth breathing, facial deformities, facial pain, discoloration of the nares and/or exophthalmos. Various diseases of the nasal cavity present with similar clinical signs, with no one sign being pathognomonic for any particular disease⁴, rendering clinical diagnosis difficult.

Common causes of chronic nasal disease in dogs include nasal neoplasia, fungal rhinitis, and lympho-plasmacytic rhinitis (LPR), also referred to as inflammatory rhinitis^{2,4,12,19,20}.

Other causes include nasal foreign body, rhinitis secondary to dental disease, parasitic rhinitis (*Pneumonyssoides caninum*), and primary ciliary dyskinesia¹⁶. In a retrospective study of 143 cases of chronic nasal discharge in the dog and cat, the most common causes of chronic nasal discharge were neoplasia, fungal infection and bacterial infection; with neopla-

sia and fungal infections resulting in destructive changes within the nasal cavity². In another retrospective study, 31 % of dogs were diagnosed with neoplasia, 37 % with hypertrophy of the nasal conchae, 18 % with foreign bodies, and 8 % with fungal infections¹⁰. In a more recent retrospective study of 80 dogs, 23.7 % were diagnosed with non-specific rhinitis, 15 % with neoplasia, 8.7 % with nasal aspergillosis, 8.7 % with cleft palate, 4 % with periodontal disease, and 1.3 % each with parasites, foreign bodies and primary bacterial disease. In 36.3 % of cases no aetiology could be established¹².

In chronic nasal disease, establishing an accurate diagnosis is essential for implementing appropriate medical or surgical treatment. Although it has been reported that a definitive diagnosis can be made in the majority of dogs with nasal disease using a structured combination of radiography, rhinoscopy, and invasive nasal biopsies¹⁹, in 1 report a diagnosis was not made in 36 % of cases. Computed tomography and magnetic resonance imaging have recently been advocated as favoured modalities for diagnosing nasal cavity and paranasal sinus disease in companion animals. However, the majority of veterinary clinics do not have these diagnostic modalities readily available¹⁶.

The radiographic diagnosis of inflammatory, infectious, and neoplastic lesions within the nasal cavity can be challenging,

as radiographic signs are non-specific¹⁶. Radiographic signs of diseases of the nasal cavity and sinuses demonstrate a spectrum of appearances ranging from minor increases in soft-tissue opacity to lytic bone lesions and expansible masses^{8,13,16,17}. Non-destructive patterns are characteristic of acute bacterial and viral infections, early foreign body reactions, nasal haemorrhage, oedema, and LPR, while a destructive pattern is more suggestive of fungal infection or neoplasia. Typical radiographic signs of non-destructive nasal disease in the dog includes increase in opacity throughout most of the nasal cavity, bilateral involvement, loss of conchal detail without bony destruction in the middle to rostral portion of the nasal cavity and normal frontal sinuses. Destructive nasal disease due to aspergillosis typically causes conchal destruction resulting in focal radiolucent areas, poorly circumscribed mass lesions, frontal sinus soft-tissue opacity and a mixed opacity in the caudal nasal cavity. Neoplasia of the nasal cavity and sinuses typically results in a homogenous soft-tissue opacity, initial unilateral involvement, increased opacity in the ipsilateral frontal sinus and erosion of the vomer bone, palatine bone, maxilla and conchae.

Rhinoscopy is an important part of the diagnosis of nasal disease as it allows visualisation of a mass lesion, fungal plaques and destruction of the nasal turbinates, as well as placement of a biopsy instrument at the area of interest^{1,4,19}. Bacterial and fungal cultures of the nasal cavity need to be interpreted cautiously as they may only reflect airway colonisation and not actually be the cause of a given invasive disease process¹. A definitive diagnosis of chronic nasal disease often requires histopathology of nasal biopsies^{6,19}.

The aim of this retrospective study was to determine the prevalence of different aetiologies of nasal disease in dogs that were evaluated for persistent and chronic nasal disease.

MATERIALS AND METHODS

The medical records of dogs that had been assessed for chronic nasal disease between January 2001 and November 2008 were retrospectively evaluated. For all dogs the following results were extracted

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from the records: history, full nasal and oral examination, survey radiographs of the nasal cavity, nasal culture, antegrade and retrograde rhinoscopy and nasal biopsy histopathology. Additional criteria were follow-up assessments and/or telephonic reports for a minimum of 6 months following the initial work-up.

The nasal examination determined the type of the nasal discharge, presence of nasal stertor, assessment of nasal patency and presence of facial asymmetry and/or pain. A full oral examination which included periodontal probing for occult dental disease was done under general anaesthesia to determine the presence of oral masses and dental disease.

Under general anaesthesia, 2 radiographic views were taken: a rostro-caudal skyline view of the skull to evaluate the frontal sinuses and an intra-oral dorso-ventral view to evaluate the nasal cavity. After the radiographs were taken, a sterile swab for bacterial and fungal cultures was inserted into each nasal cavity. The nasopharynx and caudal nares were then examined by retroflexed endoscopy using a 7.9 mm-diameter, 1.3 m-long flexible fibroptic scope. The dorsal, middle, and ventral meatus of both nasal chambers were examined by antegrade rhinoscopy using a 2.7 mm rigid arthroscope. Endoscopy was used to assess loss of symmetry and the presence of inflammation, haemorrhage, foreign bodies, fungal plaques, or masses.

Any obvious mass was biopsied using 2-mm-biopsy flexible endoscopic forceps. In cases where there was no obvious mass, between 5 and 10 biopsy samples of nasal turbinate and mucosal tissue were collected from both nasal cavities using flexible forceps. Histological examination of the nasal biopsies was performed on paraffin-embedded sections (6 µm) that were stained with haematoxylin and eosin.

Special staining for fungi (Periodic acid-Schiff (PAS), mycobacteria (Ziehl-Neelsen stain) and bacteria (Grams) was done if deemed necessary.

Bacteria were considered to be normal flora if there was a sparse growth and/or if they were those that have been reported cultured from the nasal passages of normal dogs⁹; whereas bacteria were considered pathogenic if there was a pure and heavy growth and if they were bacteria not previously reported cultured from the nasal passages of normal dogs.

A final diagnosis was made as follows – neoplasia: presence of neoplastic cells on histopathology; lympho-plasmacytic rhinitis: lympho-plasmacytic infiltration in the nasal mucosa on histopathology, absence of pathogenic bacteria and fungi on culture, and resolution of the rhinitis

Table 1: Summary of the diagnoses made in the 75 dogs with chronic nasal disease.

Diagnosis	Number	Percentage
Neoplasia	35	46.7
Lympho-plasmacytic rhinitis	15	20
Fungal	8	10.7
Bacterial rhinitis	5	6.7
Foreign body	4	5.3
Nasal polyps	3	4
Granulomatous rhinitis	2	2.7
Oro-nasal fistula	1	1.3
Naso-pharyngeal stenosis	1	1.3
None	1	1.3

with systemic and/or topical cortisone therapy and/or desensitisation therapy; fungal disease: presence of fungal elements on histopathology; bacterial rhinitis: pyogranulomatous reaction with neutrophilic infiltration on histopathology, pathogenic bacteria on culture, a negative fungal culture and resolution of the rhinitis with systemic antibiotics; and granulomatous rhinitis: proliferative granulomatous rhinitis on histopathology, negative bacterial and fungal culture, poor response to therapy, and no progression of the disease over a 6-month period. A diagnosis of foreign body, nasal polyp, oro-nasal fistula, and naso-pharyngeal stenosis was made on rhinoscopy.

RESULTS

A total of 75 dogs was evaluated. There were 32 males (43 %) and 43 females (57 %). The median age of the dogs was 108 months with a range of 23 to 192 months. Table 1 provides a summary of the diagnoses made in the 75 dogs. Table 2 provides a summary of the signalment, clinical features, and radiographic changes.

Neoplasia

Nasal neoplasia was the most common diagnosis (35 cases, 46.7 %). Breeds included the Staffordshire terrier (5), Maltese poodle (4), Jack Russell terrier (4), Labrador retriever (4), Cocker spaniel (2), Doberman (3), Boerboel (3), Boxer (2), Husky (2), and Bull dog, Bull mastiff, German shepherd, Miniature Schnauzer, Border collie, and Shar Pei (1 of each). Twenty-six dogs (74 %) showed a haemorrhagic type of discharge, whereas the other 9 (26 %) had a mucoid to purulent discharge. Survey radiographs showed an increased opacity of the nasal cavity in 26 dogs (74 %) and trabecular destruction in 11 dogs (31 %). A mass was identified in 33 dogs (94 %) via antegrade rhinoscopy and in 17 dogs (47 %) on retrograde endoscopy. In 2 of the dogs only mucoid-purulent material was evident in the nasal passages on rhinoscopy. No bacteria

or fungi were cultured in 17 dogs (48 %), normal flora was cultured in 17 dogs (48 %), and a pathogenic bacterium (*Streptococcus canis*) was cultured in 1 dog. No fungi were cultured from any of the dogs. Histologically the neoplasia was classified as undifferentiated carcinoma (15) adenocarcinoma (9), transitional carcinoma (4), chondrosarcoma (3), fibrosarcoma (1), neuro-endocrine carcinoma (1), squamous cell carcinoma (1) and adenoma (1).

Lympho-plasmacytic rhinitis

Lympho-plasmacytic rhinitis was the second most common diagnosis (15 cases, 20 %). Breeds included the Yorkshire terrier (3), Dachshund (3), German shepherd (2), Cocker spaniel (2) and Staffordshire terrier, Jack Russell terrier, Cairn terrier, Maltese poodle, and Doberman (1 of each). Eleven dogs showed a mucoid type of discharge, 3 a purulent discharge, and 1 epistaxis. In all dogs radiographic changes were an increase in opacity of the nasal cavity with 5 dogs showing trabecular destruction. Antegrade rhinoscopy revealed hyperaemic nasal mucus membranes and a mucoid exudate in all dogs, whereas retrograde endoscopy showed no abnormalities. No bacteria were cultured in 6 of the dogs and in the other 9 only normal flora was cultured. Fungal culture was negative in all 15 dogs. Histologically, all 15 dogs showed a lympho-plasmacytic infiltration in the nasal mucosa.

Fungal rhinitis

Fungal rhinitis was identified in 8 cases (10.7 %). Breeds included the Staffordshire terrier (2), Labrador retriever (2), and Maltese poodle, Rottweiler, Boerboel and German shepherd dog (1 of each). All 8 dogs showed a mucoid to purulent discharge with 3 dogs having a haemorrhagic component to the discharge. Survey radiographs showed an increase in opacity of the nasal cavity in all 8 dogs with 7 dogs showing trabecular destruction. A purulent exudate was evident on antegrade

Table 2: Summary of the signalment, clinical features and radiographic changes in 75 dogs with chronic nasal disease.

	Sex		Age (months)		Facial asymmetry		Nasal discharge or pain		Radiographic changes: nasal cavity		Radiographic changes: frontal sinuses	
	Male	Female	Median	Range	Present	Absent	Unilateral	Bilateral	Unilateral	Bilateral	Unilateral	Bilateral
Neoplasia	17 (49 %)	18 (51 %)	107	54–185	12 (34 %)	23 (66 %)	6 (17 %)	29 (83 %)	2 (6 %)	33 (94 %)	19 (54 %)	1 (3 %)
Lympho-plasmacytic rhinitis	6 (40 %)	9 (60 %)	119	28–169	0	15	6 (40 %)	9 (60 %)	5 (33 %)	3 (20 %)	1 (7 %)	1 (7 %)
Fungal	4 (50 %)	4 (50 %)	53.5	36–145	0	8 (63 %)	5 (37 %)	3 (75 %)	6 (25 %)	2 (12.5 %)	1 (12.5 %)	1 (75 %)
Bacterial	3	2	116.5	60–174	0	5	5	0	4	0	0	0
Foreign body	2	2	51	34–108	0	4	3	1	2	0	0	0
Polyps	0	3	132	100–143	0	3	3	0	3	0	0	0
Granulomatous disease	1	1	121.5	84–159	0	2	1	1	0	2	1	1

rhinoscopy in all dogs and fungal plaques were present in 5 of the dogs. Purulent material was evident in the naso-pharynx of 2 dogs on retrograde endoscopy. Fungal culture was positive in 3 dogs: *Cryptococcus* in 1 dog and *Aspergillus fumigatus* in 2 dogs. In 2 dogs pathogenic bacteria were also cultured – *Streptococcus canis* and *Staphylococcus aureus*. Two dogs showed no bacterial growth and in 4 only normal flora was cultured. In all 8 dogs a pyogranulomatous rhinitis with the presence of fungal elements was evident on histopathology, *Aspergillus* in 7 and *Cryptococcus* in 1.

Bacterial rhinitis

Primary bacterial rhinitis was identified in 5 dogs (6.7 %). There were 5 breeds in this group: Maltese, Doberman, Scottish terrier, Border collie, and a Dachshund. All 5 dogs had a purulent nasal discharge and all showed trabecular destruction on nasal radiography. Purulent exudate within the nasal passages on both antegrade rhinoscopy and retrograde endoscopy was evident in all dogs. Pathogenic bacteria were cultured from all 5 dogs: *Actinomyces hordeivulneris*, *Actinobacillus*, *Corynebacterium amycolatum*, *Klebsiella pneumonia*, and *Streptococcus canis*. Fungal culture was negative in all 5 cases. In all 5 dogs a pyogranulomatous reaction with neutrophilic infiltration and necrosis was evident on histopathology.

Foreign body

Nasal foreign body was identified in 4 dogs (5.3 %). There were 4 breeds in this group: Jack Russell terrier, Fox terrier, German short-hair pointer, and a Boerboel. In all 4 dogs a purulent nasal discharge was present. On nasal radiography an obvious foreign body (pin) was evident in 1 dog, 1 showed focal trabecular lysis with focal increased in opacity of the nasal cavity, and 2 dogs showed no radiographic changes. A foreign body was evident in all 4 dogs on antegrade rhinoscopy: a pin and piece of wood in 1 dog each and grass awns in the other 2. In all 4 dogs fungal culture was negative and only normal bacterial flora was cultured. In all 4 dogs a pyogranulomatous reaction was evident on histopathology.

Nasal polyps

Nasal polyps were identified in 3 Labrador retrievers (4 %) with 2 dogs having a haemorrhagic nasal discharge and the other one a mucoid-haemorrhagic discharge. All dogs showed a unilateral increase in opacity of the nasal cavity without any evidence of trabecular destruction. A nasal polyp was identified in

all dogs on antegrade rhinoscopy; whereas retrograde endoscopy was normal and bacterial and fungal cultures were negative. Inflammatory nasal polyp was diagnosed on histopathology.

Granulomatous rhinitis

Granulomatous rhinitis was identified in 2 dogs (2.6 %): 1 male German short-hair pointer and 1 Labrador retriever female. Both dogs showed a mucoid-purulent discharge and increased opacity of the nasal cavity without any evidence of trabecular destruction on nasal radiography. Both dogs showed congested and friable mucosa and the presence of mucopurulent material within the nasal passages on antegrade rhinoscopy, whereas retrograde endoscopy was normal. Normal bacterial flora was cultured from both dogs and fungal culture was negative. A proliferative granulomatous rhinitis was evident on histopathology.

Miscellaneous causes

Non-specific nasal disease, oro-nasal fistula, and naso-pharyngeal stenosis was diagnosed in 3 dogs. None of the dogs showed facial asymmetry or pain. The non-specific nasal disease was diagnosed in a 192-month-old male terrier cross that showed bilateral nasal stertor and mucoid nasal discharge. Nasal radiographs, endoscopy, and fungal and bacterial cultures were all negative and a mild neutrophilic rhinitis was diagnosed on histopathology. The oro-nasal fistula was diagnosed in a 120-month-old female dachshund that showed bilateral nasal stertor and unilateral purulent nasal discharge. The fistula was at the level of the maxillary canine on the same side as the nasal discharge. Bilateral opacification of the nasal cavity was evident on nasal radiographs. Congested mucosa and mucopurulent material within the nasal passages were evident on antegrade rhinoscopy, whereas retrograde endoscopy was normal. Fungal culture was negative, bacterial culture yielded a non-pathogenic bacterium, *Streptococcus sobrinus*, and a neutrophilic rhinitis was diagnosed on histopathology. The naso-pharyngeal stenosis was diagnosed in a 23-month-old female Doberman that showed unilateral nasal stertor and mucoid nasal discharge. Nasal radiographs showed no abnormalities. Occlusion of the left opening into naso-pharynx was present on antegrade rhinoscopy; whereas retrograde endoscopy showed a unilateral naso-pharyngeal stenosis. Fungal culture was negative, bacterial culture yielded an opportunistic bacterium, *Stenotrophomonas maltophilia*, and a neutrophilic rhinitis was diagnosed on histopathology.

DISCUSSION

In this retrospective study of chronic nasal disease in dogs, using a combination of survey radiographs, rhinoscopy, microbiology, and histopathology, a specific diagnosis was made in 98.6 % of cases. Other studies have reported no specific diagnosis in 9.5 %¹⁹ and 36.3 %¹² of cases. The most common diagnoses in this study were neoplasia, LPR, and fungal infection, which accounted for 77.4 % of the cases.

Nasal neoplasia accounted for the highest number of cases and typically affected older animals, which is what has been previously reported^{11,19} although only an incidence of 15 % has recently been reported¹². There was no obvious sex prevalence in this study, whereas a male predilection has been reported previously¹¹. In this study facial deformity was present in more than a third of the cases with the majority of cases showing bilateral nasal disease and a haemorrhagic nasal discharge. The most commonly reported clinical signs with intranasal neoplasia were epistaxis, mucopurulent nasal discharge, facial deformity, and occasionally epiphora¹¹. Typical radiographic changes seen in this study were opacification of the nasal passages and involvement of the frontal sinuses, whereas turbinate destruction occurred in approximately 33 % of cases. Radiographic changes that have been reported with nasal neoplasia are increased opacity within the nasal cavity, frontal sinus involvement, and trabecular destruction^{7,19,21}. In this study rhinoscopy identified a mass in 94 % of cases, whereas in previous studies rhinoscopy has either been unreliable¹⁴ or has a reported success rate of 31 %, 97.5 %, 12 % or 93 %¹⁹. Nasal carcinoma was the most common neoplasia and only 1 dog had benign neoplasia. The majority of reported intranasal cancers are adenocarcinoma, squamous cell carcinoma and undifferentiated carcinoma^{7,11}.

Lympho-plasmacytic rhinitis was a common diagnosis in this study, with a predilection for the Yorkshire terrier and dachshund. Typical radiographic changes were opacification of the nasal passages, which is in agreement with a previous studies^{3,19}; however, in this study nasal turbinate destruction was uncommon, which is in contrast to a previous study where nasal turbinate destruction was commonly identified³. Hyperaemic nasal mucous membranes were evident on rhinoscopy, which is what has previously been reported¹⁹. Secondary bacterial rhinitis was not identified in any of the dogs. Lympho-plasmacytic infiltration in the nasal mucosa was identified on histopathology. The aetiology of LPR has

not been determined, although infectious, allergic and immune-mediated mechanisms have been suggested²⁰. Idiopathic LPR is recognised with increasing frequency in the canine population and the diagnosis is made *via* histopathological identification of a lympho-plasmacytic infiltrate in the nasal mucosa with exclusion of specific causes of chronic inflammation²⁰.

Fungal rhinitis was not a common diagnosis, with no sex or breed predilection, and was more common in young dogs, which is what has been reported¹⁸. Only 3 dogs had a positive fungal culture, whereas on histopathology all dogs had a pyogranulomatous rhinitis with the presence of fungal elements. The definitive diagnosis of nasal fungal infection requires microscopic demonstration of hyphal invasion within nasal biopsies¹. In this study it would appear that a combination of rhinoscopy and nasal biopsies was diagnostic for fungal rhinitis, rather than fungal culture. *Cryptococcus* is an opportunistic systemic fungal infection of worldwide significance that usually originates in the nasal cavity and paranasal tissues and is typically seen in dogs younger than 4 years of age showing signs of upper airway stertor, nasal discharge and sneezing, and epistaxis¹⁸. Organism identification allows for definitive diagnosis and can usually be made cytologically or histologically. Canine nasal aspergillosis results from the colonisation and invasion of the nasal passages and frontal sinuses by the saprophytic fungus, *A. fumigatus*, which causes a destructive rhinitis often accompanied by frontal sinus osteomyelitis¹. This opportunistic pathogen usually remains confined to the nasal cavity and paranasal sinus, causing marked destruction of turbinate mucosa and bone, although it may invade the periorbital soft-tissue structures and/or the cranial vault^{1,5}. Destruction of the nasal cavity was evident in this study but on the survey radiographs that were taken none of the dogs showed invasion into the periorbital soft tissue or cranial vault. Although German shepherds and Rottweilers are commonly affected breeds⁵, this was not evident in the current study. Hallmarks of canine nasal aspergillosis are a profuse mucoid to haemorrhagic chronic nasal discharge that may alternate with periods of epistaxis, ulceration of the external nares with crusting, and pain or discomfort in the facial region¹. Apart from the facial pain, all these changes were evident in this study.

Nasal foreign body was not a common diagnosis, with rhinoscopy being diagnostic in all dogs. Nasal foreign bodies usually affect young dogs and often present

with acute clinical signs²¹. The dogs in this study were young but all presented with chronic signs. They all showed a pyogranulomatous inflammatory reaction on histopathology but none had developed a secondary bacterial rhinitis, which may have been due to the use of antibiotics prior to evaluation.

Primary bacterial rhinitis was an infrequent diagnosis, with dogs showing a unilateral purulent nasal discharge and radiographic evidence of trabecular destruction. In all the dogs pathogenic bacteria were cultured, with a pyogranulomatous reaction and necrosis present on histopathology. Primary bacterial rhinitis is rare in dogs but bacterial rhinitis can be caused by foreign bodies or disorders where there is disruption of normal mucociliary mucosal integrity²¹.

Primary granulomatous rhinitis was identified in 2 dogs by means of histopathology. In these dogs fungal infection, primary bacterial rhinitis, foreign body reaction and neoplasia were excluded as the other important causes of a granulomatous reaction. Possible aetiologies for the granulomatous rhinitis in these dogs could be infection with *Bartonella*, as *Bartonella vinsonii* has been reported as a cause of granulomatous rhinitis in the dog¹⁵.

Polyps in the nasal cavity are rare in dogs and diagnosed by rhinoscopy and biopsy, which reveals inflammatory tissue⁷, which is similar as in this study.

CONCLUSIONS

This study showed that by using a structured combination of survey radiography, rhinoscopy, cultures, and histopathology, a definitive diagnosis could be made in dogs with chronic nasal disease.

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