

## Evaluation of Inflammatory Disease in the Nasal Cavity and Paranasal Sinuses using CT in Dogs and Cats

Ho-Jung Choi, Ki-Ja Lee\*, Seong-Jun Park, Seong-Mok Jeong, Kun-Ho Song and Young-won Lee<sup>1</sup>

College of Veterinary Medicine · Research Institute of Veterinary Medicine, Chungnam National University, Daejeon 305-764, Korea  
\*Obihiro University of Agriculture and Veterinary Medicine, Obihiro, Hokkaido, Japan

(Accepted: December 29, 2010)

**Abstract :** Inflammatory sinonasal disease was diagnosed in five dogs and two cats with clinical signs of nasal discharge and epistaxis. Survey radiography and CT were performed in all of patients. CT scan of the rostral cranium was performed with a thickness of 2 or 5 mm. Nasal cytology and culture from nasal smear were performed immediately after CT examination. Remarkable increase of opacity in the nasal cavities and frontal sinuses was observed in only 3 cases. On CT images, the cavitating lesions were isodense in nasal cavity (7 cases), frontal sinuses (3 cases), and nasopharynx (2 cases) with destruction of the nasal septum (4 cases), maxillary turbinates (5 cases), maxilla (3 cases), and hard palate (3 cases). The lesions were enhanced after intravenous contrast administration in 5 cases and were not enhanced in 2 cases. Inflammatory cells were observed in nasal cytology. Most of the cultures from nasal smear were bacteria. CT is useful to diagnose sinonasal disease and is more accurate in demonstrating the extent and character of lesions of nasal cavity than radiography.

**Key words :** CT, inflammation, dog, cat, nasal cavity.

### Introduction

Chronic sinonasal diseases such as aspergillosis, inflammation or nasal neoplasia are common in cats and dogs and are often challenging to diagnose (1,2,8). Diagnostic imaging is an essential component to determine the cause of chronic nasal disease and evaluate the nasal cavity in dogs (8,17). The radiologic features of sinonasal disease have been described (3-8). Although the radiography has a role in the investigation with nasal signs such as sneezing, epistaxis, and nasal discharge, the radiography is not very reliable for diagnosis of chronic sinonasal diseases based on the previous studies (5,6,7). Computed tomography (CT) and magnetic resonance imaging (MRI) were superior to radiography for evaluation of the nasal cavity and paranasal sinuses because of a better demonstration of some changes suggestive of sinonasal disease (6-9,18). CT was the best technique for detection of bone lysis and evaluation of frontal sinus (9). MRI was especially useful for differentiating between a primary inflammatory sinonasal disease caused by bacterial agents and secondary pathologic lesions attributed to primary causes (3,9).

The purpose of this retrospective study was to assess the value of nasal CT in dogs and cats with inflammatory sinonasal disease. Also, characteristics of inflammatory sinonasal disease was establish using CT and compare with previous studies.

### Materials and Methods

Inflammatory sinonasal disease was diagnosed in five dogs and two cats with chronic nasal discharge or epistaxis. All of patients underwent physical, radiographic, and CT examination. Swabs, cytobrush, and biopsy were taken for bacterial culture and sensitivity, fungal culture, cytology, and histologic examination. Rhinoscopic examination was performed in one dog. Definitive diagnosis was based on the histology, cytology, culture, rhinoscopy, and response of antibiotic treatment.

Radiographic examinations included a dorsoventral and a lateral projection of the entire skull in all patients and dorsoventral intraoral projection of nasal cavity in some patients. The X-Omat<sup>®</sup> regular film (Kodak Co., U.S.A) was used with intensifying screen.

The CT examinations were performed on a third-generation whole body scanner (CTmax<sup>®</sup>, GE, U.S.A.). All of patients were under general anesthesia by isoflurane for the imaging procedure. The patient was positioned in ventral recumbency and the head introduced in the CT unit. Contiguous transverse 2 or 5 mm thickness images of the nasal cavity were obtained from the nares to the caudal level of the frontal sinuses. Scanning was repeated in a same manner after intravenous contrast administration (Omnipaque<sup>®</sup>, Nycomed, Norway). The CT images were examined on soft tissue (WW: 250, WL: 20) and bone window (WW: 2000, WL: 200).

### Results

The patients aged 3 years to 14 years (mean = 10.5 years) in

<sup>1</sup>Corresponding author.  
E-mail : lywon@cnu.ac.kr

**Table 1.** The radiographic signs and results of culture in 7 cases with rhinitis

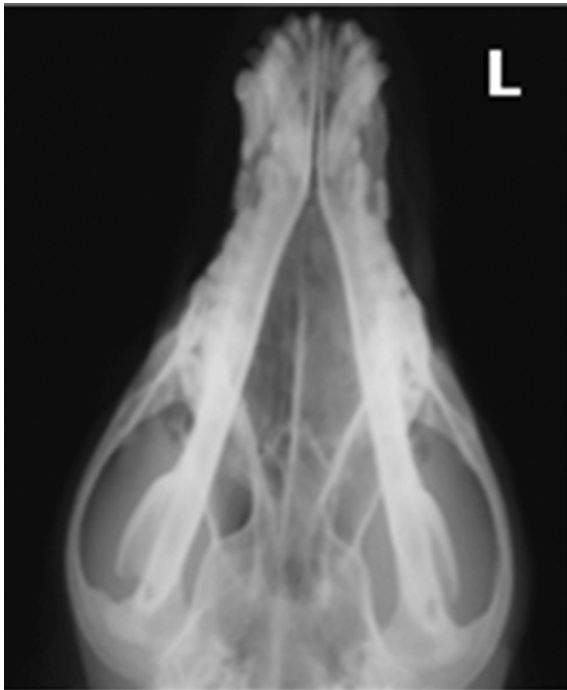
no.	Age/Sex/ Species/Breed	Clinical Signs	Radiographic Findings	Nasal Culture
1	10y FS Canine Pomeranian	Nasal discharge Sneezing halitosis	Periodontal bone destruction	No identification
2	14y Female Canine Pomeranian	Nasal discharge	Lt. External ear narrowing	<i>Pasteurella haemolytica</i> <i>Klebsiella</i> spp. <i>Streptococcus</i> spp.
3	12y Male Canine Mongrel	Nasal discharge Epistaxis	NSF	<i>Staphylococcus</i> spp. <i>Streptococcus</i> spp.
4	10y6m Female Canine Poodle	Nasal discharge Sneezing	NSF	<i>Staphylococcus</i> spp. <i>E. coli</i>
5	6y Male Canine Mongrel	Epistaxis	Increase of opacity of the NC and frontal sinuses	<i>Staphylococcus</i> spp. <i>Streptococcus</i> spp.
6	6y Male Feline DSH	Purulent discharge	Increase of opacity of the NC	<i>Pasteurella multocida</i>
7	3y MC Feline DSH	Nasal discharge Epistaxis Dyspnea	Increase of opacity of the NC and frontal sinuses	<i>Proteus</i> spp.

FS: female spayed MC: male castrated NC: nasal cavity NSF: no significant finding

dogs and 3 to 6 years in cats. Signalments of animals are described in Table 1. The breeds represented were two Pomeranian, one poodle, two mongrel, and two domestic shorthair cats. The major clinical signs for the study group were chronic nasal discharge (7 cases), epistaxis (3 cases), and sneezing (2 cases). Included in the study were 2 cases with bacterial rhin-

itis (*pasteurella* sp), 1 case with rhinitis secondary to dental disease, 1 case with traumatic rhinitis, and 4 cases with non-specific rhinitis.

The radiographic signs and results of culture were summarized in Table 1. Accurate increase of radiographic opacity of the nasal cavities and frontal sinuses were observed in only 1 dog and 2 cats (Fig 1). Periodontal destruction was detected in one dog (Fig 2). The CT images were evaluated for nasal cavity, paranasal sinuses, or surrounding tissues and structures (Table 2). On CT images, the cavitating lesions were isodense in nasal cavity (7 cases), frontal sinuses (3 cases), and nasopharynx (2 cases) with destruction of the nasal septum (4 cases),



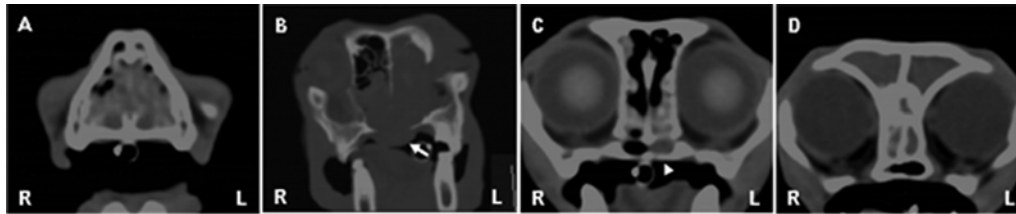
**Fig 1.** Dorsoventral radiography of the skull in case 5 with traumatic rhinitis. Note the unilateral increase of opacity in the left nasal cavity and the loss of turbinate detail.



**Fig 2.** Right lateral radiography of the skull in case 2 with rhinitis secondary to dental disease. Note the destruction of alveolar bone at molar teeth region (arrow) and severe dental calculi (arrowhead).

**Table 2.** CT findings in 7 cases with rhinitis

CT Characteristics		Location of Fluid Accumulation			Location of Destruction		Bone Lysis		Contrast Enhancing
		Nasal Cavity	Frontal Sinus	Naso-pharynx	Nasal Concha	Nasal Septum	Maxilla	Hard Palate	
Number of Dogs		5	2	1	4	4	2	3	3
Number of Cats		2	2	1	1	0	1	0	2



**Fig 3.** Precontrast CT images with soft tissue window (A,C,D) and bone window (B). (A) The cavitating isodense lesion bilaterally in nasal cavity and destruction of the nasal concha and nasal septum. (B) Fluid accumulation in the nasal cavity, destruction of the nasal concha, bone lysis of left maxilla and hard palate, and swelling (arrow) were detected. (C) The unilateral isodense lesion in the nasal cavity and nasopharynx (arrowhead). (D) The diffuse isodense lesion bilaterally in the frontal sinus of cat.

maxillary turbinates (5 cases), maxilla (3 cases), and hard palate (3 cases) (Fig 3). The lesions were enhanced after intravenous contrast administration in 5 cases and were not enhanced in 2 cases.

## Discussion

The most common causes of chronic nasal disease are neoplasia and aspergillosis in dogs (8) and idiopathic chronic rhinosinusitis and nasal neoplasia in cats (10). Nasal foreign body rhinitis, nasopharyngeal polyps, rhinitis secondary to dental disease, congenital abnormalities, and nasopharyngeal stenosis are less frequent, but important, causes of chronic rhinitis in dogs and cats (10-12). In this study, two patients (case 2,6) were considered as bacterial rhinitis because of identification of pasteurella species in culture. Case 1 was thought of rhinitis secondary to periodontal disease based on physical and radiographic examination and response of surgical treatment. Case 5 was strongly suspected traumatic rhinitis by reason of history that epistaxis was started after trauma.

Dogs with rhinitis tend to be younger than those with nasal neoplasia; however the age range of dogs affected by either of these conditions is wide (2,4). The typical signs associated with chronic nasal disease in dogs and cats are nasal discharge, sneezing, stertorous respiration, and epistaxis (13-15). The type and location of the nasal discharge may help limit differential diagnoses (10). However, a supplementary examination such as diagnostic imaging, cytology, and culture was required for accurate diagnosis.

As has been reported previously, the radiographic signs for rhinitis were lack of ipsilateral sinus lesions, lucent foci, focal or multifocal loss of turbinate detail, and localized soft tissue opacities, whereas the those of nasal neoplasia were diffuse lesion of ipsilateral cavity, generalized loss of turbinate detail, invasion of bones, and generalized soft tissue opacities (2,4). In this study, radiographic abnormalities of nasal cavity

and paranasal sinuses were detected in only 3 cases (multifocal lesion of ipsilateral or bilateral nasal cavity; 3 cases, soft tissue opacities of frontal sinus; 2 cases, multifocal loss of turbinate detail; 3 cases). The reason for this result was considered that most of patient were small breeds or brachycephalic breeds and evaluation of nasal cavity was difficult on radiographs.

CT is a powerful tool for evaluation of the nasal cavities, frontal sinuses, and differentiation between a cavitated -like or a mass-like process (7). On CT, rhinitis appeared as a cavitating lesion that spared the paranasal sinuses, thickened and distorted or destroyed the turbinates, and widened the meatus in dogs (6,13). Unlike the CT of rhinitis, those of tumors appeared as space-occupying lesions that obliterated the turbinates, caused deviation of the nasal septum, and eroded bone in dogs (6,15). Although morphologically distinct on CT images, infectious rhinitis and nasal neoplasia could not be differentiated by attenuation measurements or degree of contrast enhancement (6). In cats, however, a recent study showed that pathognomonic difference was not found between nasal neoplasia and severe rhinitis using CT (16). Also, when compared with radiographic studies, CT was not more sensitive than radiographs at detecting the presence of nasal cavity abnormalities but was more sensitive at localizing these changes and determining the extent of disease (16). Findings often seen on CT with chronic sinonasal disease in cats include soft tissue opacification of the nasal cavity and frontal or sphenopalatine sinuses, lysis of nasal and frontal bones, turbinate destruction, and asymmetry of the cribriform plate (2,10,16). The cavitory lesion in nasal cavity, frontal sinus, and nasopharynx and destruction of nasal concha and nasal septum indentified in this study was similar to the recent reports on CT in dogs and cats with rhinitis (6,16). However, bone lysis of maxillary bone and hard palate that commonly detected in dogs and cats with nasal neoplasia was verified in 3 dogs and 1 cat in this study. Contrast enhancement was detected in 3 dogs and 2 cats. The contrast enhancement in patients with rhinitis or nasal neo-

plasia was not pathognomonic finding by reason of the marked vascularity of tissue in the normal nasal cavity (6). An absence of contrast enhancement in 2 cases was considered because of severe fluid accumulation in nasal cavity. Although there was the very small number of cases in cats, nasal cavity abnormalities were identified on radiographs and CT imaging and CT was more sensitive at determining the extent of disease like previous study (16).

One limitation in this study was the small number of cases. In the future, more cases should be accumulated for definitive assessment of CT in nasal cavity. Although the diagnosis should always be confirmed by cytologic or histopathologic examination of tissue and many of the CT findings associated with rhinitis overlapped those found with nasal neoplasia, CT is an excellent tool and greatly enhances the ability to establish an accurate definitive diagnosis of chronic nasal disease.

## References

- Lefebvre J, Kuehn NF, Wortinger A. Computed tomography as an aid in the diagnosis of chronic nasal disease in dogs. *J Small Anim Pract* 2005; 46: 280-285.
- Tromblee TC, Jones JC, Etue AE, Forrester SD. Association between clinical characteristics, computed tomography characteristics, and histologic diagnosis for cats with sinonasal disease. *Vet Radiol Ultrasound* 2006; 47: 241-248.
- Eggesbo HB. Radiological imaging of inflammatory lesions in the nasal cavity and paranasal sinuses. *Eur Radiol* 2006; 16: 872-888.
- Russo M, Lamb CR, Jakovljevic S. Distinguishing rhinitis and nasal neoplasia by radiography. *Vet Radiol Ultrasound* 2000; 41: 118-124.
- Park RD, Beck ER, LeCouteur RA. Comparison of computed tomography and radiography for detecting changes induced by malignant nasal neoplasia in dogs. *J Am Vet Med Assoc* 1992; 201: 1720-1724.
- Coder EC, Lulus Ag, Miller JB, Gavin PR, Gallina A, Barbee DD. Comparison of computed tomography with radiography as a noninvasive diagnostic technique for chronic nasal disease in dogs. *J Am Vet Med Assoc* 1993; 202: 1106-1110.
- Saunders JH, van Bree H. Comparison of radiography and computed tomography for the diagnosis of canine nasal aspergillosis. *Vet Radiol Ultrasound* 2003; 44: 414-449.
- Saunders JH, van Bree H, Gielen I, de Rooster H. Diagnostic value of computed tomography in dogs with chronic nasal disease. *Vet Radiol Ultrasound* 2003; 44: 409-413.
- Saunders JH, Clercx C, Snaps FR, Sullivan M, Duchateau L, van Bree HJ, Dondelinger RE. Radiographic, magnetic resonance imaging, computed tomographic, and rhinoscopic features of nasal aspergillosis in dogs. *J Am Vet Med Assoc* 2004; 225: 1703-1712.
- Kuehn NF. Chronic Rhinitis in Cats. *J Small Anim Pract* 2006; 21: 69-75.
- Van Pelt DR, McKiernan BC. Pathogenesis and treatment of canine rhinitis. *Vet Clin North Am Small Anim Pract* 1994; 24: 789-806.
- Van Pelt DR, Lappin MR. Pathogenesis and treatment of feline rhinitis. *Vet Clin North Am Small Anim Pract* 1994; 24: 807-823.
- Windsor RC, Johnson LR. Canine Chronic Inflammatory Rhinitis. *J Small Anim Pract* 2006; 21: 76-81.
- Benitah N. Canine Nasal Aspergillosis. *J Small Anim Pract* 2006; 21: 82-88.
- Malinowski C. Canine and Feline Nasal Neoplasia. *J Small Anim Pract* 2006; 21: 89-94.
- Schoenborn WC, Wisner ER, Kass PP, Dale M. Retrospective assessment of computed tomographic imaging of feline sinonasal disease in 62 cats. *Vet Radiol Ultrasound* 2003; 44: 185-195.
- Pownder S, Rose M, Crawford J. Radiographic Techniques of the Nasal Cavity and Sinuses. *J Small Anim Pract* 2006; 21: 46-54.
- Kuehn NF. Nasal Computed Tomography. *J Small Anim Pract* 2006; 21: 55-59.

## 개와 고양이에서 컴퓨터단층촬영술을 이용한 비강의 염증성 질병 평가

최호정 · 이기자\* · 박성준 · 정성목 · 송근호 · 이영원<sup>1</sup>

충남대학교 수의과대학 · 동물의과학연구소

\*오비히로 수의과대학

**요 약** : 만성적 비강 삼출물 및 비출혈로 내원한 5마리의 개와 2마리의 고양이가 내원하여 일반 방사선 검사 및 컴퓨터단층촬영 (CT), 비강의 세포학적 검사와 미생물학적 검사를 실시하여 비염으로 진단한 증례를 선정하여 이의 CT 영상상의 특징을 비교 평가하였다. 비강의 일반 방사선 검사에서 3 증례에서만 비강의 비정상 소견을 확인하였다. CT 검사 결과, 비강 (7증례) 및 전두동 (3 증례), 비인두 (2증례)에서 공동을 갖는 isodense한 병변을 확인하였으며 비중격의 소실 (4 증례), 비갑개의 파괴 (5 증례), 상악 (3 증례) 또는 경구개 (3 증례)의 골융해 소견이 관찰되었다. 병변의 조영증강효과는 5 증례에서 확인하였다. CT는 비강의 질병을 평가하고 특히 병변의 범위를 결정하는데 매우 유용하다.

**주요어** : 개, 고양이, 비강, 염증, 컴퓨터단층촬영술