Osteopetrosis-Like Disease in a Cat with Respiratory Distress

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ABSTRACT. Magnetic resonance (MR) and computed tomography (CT) were performed in an 8-year-old, spayed female cat with chronic effort respiration at the inspiration phase and stertor. Increased bone opacity in the areas of the head, neck and thorax were observed on radiography. MR images showed no signal intensity on both transverse T1WI and T2WI of the nasal cavity. CT revealed increased density of the bone with hypertrophy of the nasal turbinate and a narrowed nasal passage. From these results, we concluded this case had osteopetrosis-like disease, and that the respiratory distress was caused by hypertrophy of the nasal turbinate.

KEY WORDS: feline, osteopetrosis-like disease, respiratory distress.

Osteosclerotic diseases such as osteopetrosis are rare disease entities characterized by generalized or local osteosclerosis [1]. Patients with osteopetrosis vary from those without any clinical signs despite radiographic evidence of bone sclerosis to those with fatal or serious clinical signs. Human osteopetrosis is thought to be an inherited metabolic bone disease having either an autosomal dominant or recessive pattern of inheritance, where insufficiency in bone's resorptive function by osteoclasts may be the cause [7, 8].

Osteopetrosis has been reported in dogs [10, 14], mice [12], rats [11], birds [16], sheep [1], cattle [3], manatee [2] and cats [4, 6, 9, 19]. There have been only four reports of cats with this disease. Hoover et al. [6] reported in 1974 that neonatal kittens experimentally infected with feline leukemia virus (FeLV) developed anemia due to osteopetrosis. Kramers et al. [9] in 1988 described two cats that were affected with acquired osteopetrosis; one had anemia in conjunction with osteosclerosis and the other was incidentally found. The cause of the disease was unknown in these cases. Wright et al. [19] in 2002 and Hanel et al. [4] in 2004 reported that the clinical features of feline acquired osteopetrosis differed from those reported in human cases, and that osteosclerosis may be more suitable to explain the feline osteopetrosis.

We performed computed tomography (CT) and magnetic resonance imaging (MR) on a cat with chronic dacryorrhea and inspiratory stertor. The findings revealed an osteopetrosis-like disease with hypertrophy and increased bone opacity of the nasal turbinate as well as the systemic bones, which could be the cause of the respiratory distress in this case. An 8-year-old, spayed female cat was brought to a private veterinary clinic with a history of dacryorrhea and stertor over a period of 6 months. Since signs were not improved by administration of an antibiotic and a proteolytic enzyme agent, the client took her to another private veterinary clinic.

Physical examination at this veterinary hospital revealed effort respiration and stertor at the inspiration phase. On radiography, increased bone opacity was found in the head, neck and thoracic regions. Under anesthesia, the oral cavity and laryngopharyngeal area were examined, but there were no abnormal finding. A 3 Fr. catheter was inserted into the nasal cavity to obtain a tissue or pituita sample; however, resistance to the insertion was encountered. The patient was then referred to the Animal Medical Center at Nippon Veterinary and Life Science University for a precise examination of the nasal cavity.

At admission, clinical signs of stertor and effort respiration were present. A complete blood count and blood chemistry revealed mild thrombocytopenia (12 × 10^4/μl; reference range 15–45 × 10^4/μl) and no other abnormal findings such as decreased PCV (42%; reference range 32–45%) or elevations of Ca (10.11 mg/dl; reference range 8.2–11.9 mg/dl) or P (4.23 mg/dl; reference range 1.7–7.2 mg/dl). Results of FeLV and feline immunodeficiency virus-serologies (ELISA) were both negative.

On radiography, increased bone opacity was observed in the areas of the head (Fig. 1-A) and neck and thorax (Fig. 2-A). The same areas in a normal cat (Fig. 1-B, Fig. 2-B, respectively). No splenomegaly was noted. MR and CT were performed under general anesthesia and controlled respiration. For the MR imaging, a 1.5Tesla superconducting MR imaging system was used (VisartTM, Toshiba Medical System Co., Ltd., Tokyo, Japan) with a radio frequency coil for knee. T1-weighted spin echo imaging (T1WI) and T2-weighted fast spin echo imaging (T2WI) were performed. Pulse sequences were: TR/TE=410/15 ms and 4000/100 ms for T1WI and T2WI, respectively; field of view=10 cm, matrix size=256 × 256 and slice thickness=2.2 mm, enabling total scan times of 525 s (T1WI) and 452 s (T2WI). On MR imaging, no signal intensity on both transverse T1WI and T2WI of the nasal cavity was shown (Fig. 3-A, B, C).
B). Note the same area in T2WI of the normal nasal cavity in a cat (Fig. 3-C). CT was performed with a conventional CT system (Image Max II, Yokogawa Medical Systems Co., Ltd., Tokyo, Japan) (slice thickness=5 mm, window width=2000, window level=547). CT scan revealed higher CT numbers for the skull and nasal turbinate (1515 ± 15.62 HU and 1258 ± 33.33 HU, respectively) than those of 3 normal cats (average: 634.35 HU and 293.6 HU, respectively). In addition, hypertrophy of the nasal turbinate and a narrowed nasal passage were observed (Fig. 4-A). Note the same area in CT images of the normal nasal cavity in a cat (Fig. 4-B).

From the above results, the diagnosis of an osteopetrosis-like disease was made, which induced osteogenesis and hypertrophy of the nasal turbinate and narrowed nasal passage.

Osteopetrosis is known to exhibit generalized bone sclerosis as seen in this patient. Osteopetrosis is defined as a rare congenital and inherited disease characterized by generalized or local osteosclerosis [1]. Osteopetrosis has been reported in many animals, in addition to humans. Hanel et al. [4] reported human osteopetrosis is classified into 4 types according to mode of inheritance, clinical signs, radiographic findings and prognosis.

Osteopetrosis has a specific pathogenesis. Defective osteoclastic resorption of bone, leading to failure of normal bone modeling and resulting in accumulation of primary spongiosa are the principle features of this disease. Clinically abnormal osteoclast function seems to be the major pathogenic factor rather than abnormal osteoclast differentiation [17]. In addition, radiographic findings of bone in osteopetrosis are typically an increase in bone opacity with hypertrophy of the bone cortex, without alternation of the overall bone shape [18]. For a definitive diagnosis, a bone aspirate is required.

In this case, effort upon with nasal respiration and stertor at the inspiration phase indicated that the area of the lesion was the nasal cavity. In addition, X-ray images showed an increase in bone opacity of the head and nasal turbinate and neck and thoracic regions. A point of this time, we suspected the presence of osteopetrosis. However, the soft tissue disease as nasal tumor or rhinitis might be upper airway disease could not diagnosed on radiography in this case. Therefore, we performed CT as a precise examination in a bone opacity of nasal turbinate and MR. MR images showed there were seen neither soft tissue view nor nasal turbinate view in the nasal cavity. CT images showed both hypertrophy of nasal turbinate with a high CT number and
narrowed nasal passage.

We did not make a diagnosis based on bone pathology nor was a genetic abnormality confirmed. As a differential diagnosis, there are craniometadiphyseal dysplasia (CMDD)[15] and bone disease with fungal infection. CMDD is an autosomal dominant disease, in which prominence of the paranasal cavity develops in the infant period and distortion occurs in the jaw and face by extension and hypertrophy of the skull and mandibular bone. As a result, there are recurrent nasal infections. On radiography, CMDD is characterized by sclerosis of the cranial base and orbital and long tubular bone with wide diaphysis and thin cortices. Radiographic findings of bone disease with fungal infection reveal a mixture of bone lysis and osteogenic changes.

In consideration of the above, we diagnosed that this cat with respiratory distress has an osteopetrosis-like disease.

The pathogenesis remains obscure. An osteopetrosis-like disease occurs in chickens in association with an infection by a leucosis virus [5]. But this case was FeLV- negative. The cats with osteosclerosis reported by Wright et al. [19] had lymphoblastic leukemia, systemic lupus erythematosus-related diseases, lymphoma, C cell tumor, myeloproliferative diseases, and renal failure. The cat reported by Hanel et al. [4] had fibrosarcoma, therefore Hanel et al. noted that the potential cause of the feline osteosclerosis might be related to tumors. An osteopetrosis-like osteopathy was described in a human patient with systemic mast cell disease. The
authors reported up to 80% of patients with systemic mastocytosis have concurrent osteosclerosis[13]. However, in the present case examinations revealed no signs of tumors nor were there signs of renal failure or immune-mediated diseases.

The most characteristic features of this case were increased bone density and hypertrophy of the nasal turbinate, leading to respiratory distress. As far as the author knows, in osteosclerosis of humans and animals other than cats, the major lesions are found in the skull, spine and long bones. The exception was the feline case reported by Hanel et al., in which the nasal turbinate were affected. The nasal turbinate is a cancerous bone plate separating the middle and ventral nasal passages. If the increased bone density was produced by decreased function of osteoclastic bone resorption, the nasal turbinates may be one of the primary lesion.

When we see a cat with respiratory distress by upper airway disease and hypertrophy of the skull and nasal turbinate on radiography, we have to not only consider upper airway diseases but also osteospetrosis-like disease in making the diagnosis.

REFERENCES