Intracranial Epidural Mucocele in a Cat

An 18-month-old, spayed female, domestic shorthaired cat was presented with clinical signs of depression and reluctance to walk, which progressed to nonambulatory tetraparesis. Increased opacification of both frontal sinuses and a cyst-like abnormality causing compression and displacement of the right frontal lobe were seen on computed tomography. Bilateral frontal sinus trephination and right transfrontal craniotomy revealed clear, viscous fluid in the right frontal sinus and rostral fossa, compatible with an intracranial mucocele. At a 6-month follow-up examination, no signs of recurrence were appreciated. **J Am Anim Hosp Assoc 2005;41:74-77.**

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Introduction

Paranasal sinus mucoceles and sphenoethmoid mucoceles with intracranial extension are extremely rare in humans, and both disorders can be confused with other intracranial disease processes.[1-3] Intracranial epidural mucocele has never been reported in cats. Paranasal sinuses are air-filled cavities that are often occupied by the nasal turbinates.[4] Paranasal sinuses are located in the maxilla, frontal, and sphenoid bones.[4] Paranasal sinuses are small at birth, enlarge with age, and are lined by a mucoperiostium.[4] The sinuses may be divided into several compartments that drain directly or indirectly into the nasal cavity.[4] Mucoceles are thought to occur from occlusion of the natural orifice of the paranasal sinus, with subsequent intrasinus accumulation of excreted substances.[3,5] If inflammation occurs, altered mucous secretion and obstruction of the sinus ostium may produce a mucocele.[2,6] Sinus mucoceles are presumably rarer in dogs and cats because of their larger nasofrontal openings.[5]

Case Report

An 18-month-old, spayed female, domestic shorthaired cat was referred because of a 7-day history of progressive lethargy, anorexia, and reluctance to walk. The owner also reported that vision was diminished 2 days prior to referral. Neurological examination revealed the cat had depressed mental status, ambulatory tetraparesis with severe proprioceptive deficits on both thoracic and pelvic limbs, and an absent menace reflex on the left side. Within several hours of admission, the cat's neurological status deteriorated to a nonambulatory tetraparesis with blindness (i.e., lack of menace reflexes in both eyes).

The initial clinical signs were suggestive of a right forebrain lesion with subsequent, progressive, bilateral forebrain involvement. Differential diagnoses included feline infectious peritonitis; feline leukemia virus; feline immunodeficiency virus; bacterial, fungal, and protozoal (e.g., toxoplasmosis)

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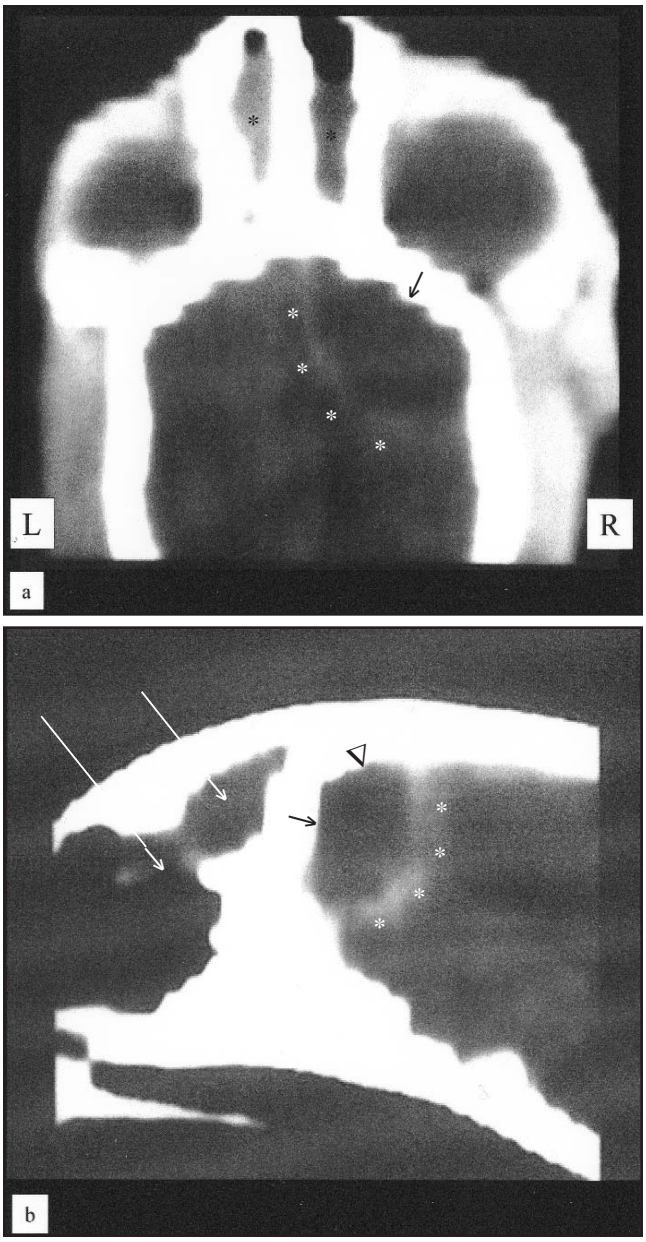
infections; neoplasia; metabolic encephalopathies; congenital defects (e.g., hydrocephalus); and vascular diseases (e.g., hemorrhage or ischemia). A complete blood count, serum biochemical profile, and urinalysis were within reference ranges. Serological test results for feline corona virus, feline leukemia virus, feline immunodeficiency virus, and toxoplasmosis were negative.

Pre- and postcontrast brain computed tomography (CT) scans, using a soft-tissue window in a transverse plane with 4-mm slices, were obtained.[a] Postcontrast CT was conducted after intravenous (IV) injection of 2 mL/kg contrast medium.[b] On precontrast CT, increased opacification within both frontal sinuses and the left paranasal sinus was observed. On postcontrast CT, a round, homogeneous, hypodense area with a peripheral, homogeneous line of contrast enhancement was also evident over the right frontal lobe [Figure 1]. This round lesion appeared to cause internal displacement of the right frontal lobe. Dorsal and sagittal plane CT confirmed the round shape of the lesion [Figures 2A, 2B]. The sagittal plane view showed extension of the lesion within the right frontal sinus [Figure 2B]. The CT abnormalities were suggestive of an abscess secondary to sinusitis, a congenital subarachnoid cyst, chronic subdural or extradural hematoma, or a parasitic cyst.[7] Because of the risk of intracranial or foramen magnum herniation, cerebrospinal fluid was not collected.[8]

Figure 1—Postcontrast computed tomographic image from an 18-month-old cat with neurological signs localized to the right frontal lobe. An intracranial, round, cyst-like lesion (large asterisk) is seen over the right frontal lobe. The lesion is well delineated by a line of contrast enhancement (small asterisks) and is causing internal displacement of the right frontal lobe (black arrow). L=left, R=Right.



Figures 2A, 2B—Postcontrast computed tomographic image from the cat in Figure 1. The dorsal **(2A)** and sagittal **(2B)** views show that the rostral edge of the lesion is confined by the right orbital (black arrow) and temporal frontal bones (triangular marker). These views also illustrate the severe internal displacement of the right frontal lobe (white asterisks) and the abnormal fluid collection within both frontal sinuses (black asterisks). The sagittal plane view reveals extension of the lesion within the right frontal sinus (white arrows).

Because of the progressive worsening of the cat's neurological status, an emergency surgical decompression was performed, with bilateral frontal sinus trephination and right transfrontal craniotomy. The cat was premedicated and induced with diazepam[c] (0.3 mg/kg IV) and thiopental sodium[d] (10 mg/kg IV). Anesthesia was maintained with isoflurane[e] in oxygen. Thirty minutes before the craniotomy, mannitol[f] (1 g/kg of an 18% solution, IV) was given over 15 minutes, followed with methylprednisolone sodium succinate[g] (30 mg/kg IV). Methylprednisolone sodium succinate (15 mg/kg IV) was repeated after 3 and 6 hours. Before the

craniotomy, manual hyperventilation at 12 breaths per minute with 3.5 L per minute of oxygen flow and 1.5% of isoflurane was begun in order to lower the blood carbon dioxide level and prevent an increase in intracranial pressure. During surgery, isoflurane concentration was maintained between 2.5% and 3%. Near the end of surgery, spontaneous ventilation was achieved by reducing the oxygen flow to 1.5 L per minute and the respiratory frequency to four breaths per minute.

The cat was positioned in sternal recumbency with the head elevated and immobilized in a custom-made headstand that provided uninterrupted jugular venous drainage (to help reduce intracranial pressure). At the beginning of surgery, cefazolin[i] (20 mg/kg) was given IV. A midline longitudinal skin incision was made over the frontal and nasal bones, starting from the caudal extent of the frontal sinus to the level of the medial canthus of the eyes.[9] The underlying subcutaneous tissues, frontalis muscle, and periosteum were reflected laterally on each side of the incision. A standard bilateral frontal sinus trephination using a pneumatic air drill was performed, creating two holes approximately 0.5 cm in diameter. Colorless, watery, serous-mucoid fluid was collected from the right frontal sinus, and a yellowish mucoid material was aspirated from the left frontal sinus. No apparent communication was observed between the two frontal sinuses. Samples were taken for aerobic and anaerobic bacterial culture and antibiotic sensitivity testing, and both sinuses were flushed with a sterile saline solution. Unfortunately, the harvested fluid was not submitted for cytology. The septum between the two frontal sinuses was completely removed, and the nasosinus ostium was enlarged on both sides, breaking through the turbinates with a periosteal elevator. This latter procedure allowed adequate drainage into the nose, which was confirmed by observing the lavage fluid exiting from both nares during flushing of the sinuses.

The aperture on the right frontal bone was enlarged with Kerrison rongeurs and the air drill. For the craniotomy, an additional hole approximately 0.5 cm in diameter was made over the orbital portion of the right frontal bone. Abundant serous and colorless fluid that was under pressure rapidly flowed from the craniotomy opening, and it was collected for culture and sensitivity. The surgical site was flushed with sterile solution until the dura mater was visualized. The dura mater appeared intact but reddish in color. The discoloration was suspected to be secondary to an inflammatory process. The frontalis muscle and subcutaneous tissue were apposed with simple interrupted sutures using *3-0* polyglactin-910.[i] The skin was closed using simple interrupted *3-0* silk.[j] Postoperative cephalexin[k] (22 mg/kg per os [PO] *q* 8 hours) was administered for 10 days.

During the first 24 hours postoperatively, the cat had mild bilateral epistaxis. On the second day after surgery, the cat started eating and drinking, and over the following 10 days she made a full neurological recovery. Cultures yielded no bacterial growth. At a 6-month follow-up examination, no clinical signs of recurrence were appreciated.

Discussion

Cats and dogs possess both frontal sinuses and maxillary recesses.[10] The maxillary recess is not a true sinus, because it does not lie between two plates of bone. The recess is bound laterally by the maxilla and medially by the ethmoid.[10] The frontal sinus is the largest of the sinuses and occupies the brow ridge and supraorbital process of the frontal bone. Right and left frontal sinuses are separated by a median septum. In dogs, each frontal sinus is composed of three separate cavities (i.e., lateral, medial, and rostral), which communicate separately with the nasal fossa via the nasofrontal opening.[4,10] This is not the case in the cat.[10] It is not clear if this anatomical difference played a role in the occurrence of the mucocele in the case reported here.

The maxillary recess is found at the level of the carnassial tooth between the orbit and infraorbital canal. It communicates with the middle meatus by a spacious nasomaxillary opening, which is flanked by the nasal conchae.[10] The maxillary recess houses the nasal gland on its lateral wall.[10] Macroscopically the gland appears like thickened mucous membrane, and cytologically it is a serous salivary gland.[10] The medial wall of the recess bears small, compound alveolar glands.[10]

Chronic sinusitis may occur in cats as the result of mucosal damage secondary to feline viral rhinotracheitis or calicivirus.[6,11] Severe mucosal ulceration and turbinate resorption allow secondary bacterial infections to develop, primarily from *Streptococcus* spp., *Staphylococcus* spp., *Pasteurella* spp., or from the coliforms.[12] Normal drainage of the frontal sinus fails from thickening of the mucosa and submucosa around the sinus ostium. Chronic infection occurs with or without mucocele formation.[6] However, in this case no prior history of nasal discharge or upper respiratory infection was reported. The watery and colorless fluid from the right frontal sinus was macroscopically similar to the fluid drained from the brain cavity and differed from the mucoid, yellowish appearance of the fluid in the left frontal sinus. The watery, colorless-mucoid fluid collected from the right frontal sinus and in the cranial vault was considered to be mucus. The thick, yellowish mucoid material from the left sinus was also assumed to be mucus, probably at a different stage from that of the right side or of different origin. Cytological examination of both fluids would have been of great value to characterize the type and the origin of the fluids, but unfortunately it was not performed. Bacterial culture and sensitivity testing were negative on all collected fluids. By definition, a mucocele is a dilatation, cyst, or a cavity filled with mucous secretions.[13] Based on CT and surgical findings as well as results of the limited fluid analysis, a presumptive diagnosis of intracranial epidural mucocele was made in this case.

Intracranial mucocele has been reported in people.[1-3] In humans, intracranial mucoceles are usually, but not always, caused by a known defect in the skull that allows extension of a paranasal mucocele into the calvarium.[1-3] Paranasal mucoceles in dogs have been reported as a consequence of trauma; however, there was no history of trauma in this

case.[5,14] In humans, the frontal sinus is thought to be the most frequent site for mucoceles, followed by the ethmoid sinus and the sphenoid sinus.[3] The primary site is not always identified because of the progressive osteolysis of bony walls adjacent to the mucous membranes.[3] The dura mater is so resistant to pressure or inflammation that it is rarely penetrated.[2] In human intracranial mucoceles, the color of the material in the sinuses ranges from gray-white to yellowish green or brown.[2] The consistency of the fluid varies from a sticky, mucilaginous fluid to purulent-looking material, or a somewhat viscous, fibrous tissue.[2] In humans, mucoceles usually have the same density as the brain on CT. Mucoceles also tend to fill the sinuses and compress the adjacent anatomical structures without infiltrating these structures.[2] Hyperdense or hypodense mucoceles have also been reported on CT.[2] In this report, the CT findings were consistent with a hypodense mucocele.

To the author's knowledge, this report contains the first description of a probable intracranial epidural mucocele in the cat. Two different hypotheses were considered to explain the intracranial epidural fluid accumulation in this case. The intracranial epidural fluid accumulation may have occurred as a consequence of chronic sterile sinusitis, with secondary sinus ostium occlusion and subsequent infiltration into the cranial cavity through microscopic lesions within the orbital frontal bone. The different macroscopic appearances of the fluid within the two frontal sinuses could have represented different stages of the same pathological process or two separate entities. However there was no historical evidence of chronic sinusitis and, unfortunately, no cytological analysis to support this theory. A second possible cause may have been obstruction of outflow from the salivary nasal gland contained in the maxillary recess. This type of obstruction might have explained the watery appearance of the fluid in the right frontal sinus and in the cranial cavity. This latter theory, however, doesn't explain the macroscopic difference in appearance of the fluid in the left frontal sinus.

Conclusion

A lesion compatible with an intracranial epidural mucocele was diagnosed in a young domestic shorthaired cat with mental depression and progressive tetraparesis. Evidence of a cystic-type lesion was identified on CT over the right frontal lobe of the brain. Surgical drainage of the frontal sinuses and the mucocele was associated with a favorable outcome. The exact origin of the mucocele was not identified.

[a] Toshiba TCT 300S; Toshiba Medical System, Amserdam, Netherlands
[b] Iopamiro 300; Bracco, Milan, Italy
[c] Diazepam 0.5%; Farmaceutici Gellini SpA, Aprilia (LT), Italy
[d] Pentothal Sodium; Farmaceutici Gellini SpA, Aprilia (LT), Italy
[e] Fluothane; Zeneca, Zeneca Ltd; Macclesfield, Cheshire, UK
[f] Mannitolo 18%; Pfizer Srl, Latina, Italy
[g] SoluMedrol; Pfizer Srl, Latina, Italy
[h] Totacef; Bristol-Myers Squibb, Sermoneta (LT), Italy
[i] Vicryl; Ethicon, Rome, Italy
[j] Silk; Ethicon, Rome, Italy
[k] Keflex; Eli Lilly Italia SpA Sesto Fiorentino (FI), Italy

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