Disseminated intracranial meningioma in a cat: clinical, imaging and pathological findings

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A 10-year-old Persian male cat was referred with a history of left head tilt, generalized ataxia and apathy developed 20 days before. The neurological examination showed obtundation and bilaterally reduced menace reaction. The suspected neuro-anatomical localization was consistent with a multifocal/diffuse intracranial lesion. Tomographic examinations (CT, MRI) showed numerous (at least 11) intracranial masses, of variable size and similar tomodensitometric characteristics/signal intensity, compatible with neoplastic lesions. At the end of the imaging examinations the owner decided for euthanasia. At macroscopic examination, multiple nodular masses were evident, adherent to the dura mater. Histologically, the masses had a similar and overlapping appearance and were composed by spindle cells organized in undulated and swirling bundles with hyaline mineralized concentric bodies (psammoma bodies), infiltrating the brain parenchyma. The histological diagnosis was compatible with multiple psammomatous meningioma.

Keywords - Cat, Histology, Meningioma, Neoplasia, MRI, CT.

INTRODUCTION

Meningioma is a tumour that originates from the lining cells of the arachnoid villi and is the most frequent intracranial cancer of the cat.[1] It is a slow-growing tumour and in 50% of cases subjects may not exhibit clinical symptoms. The diagnosis may therefore be incidental during the post-mortem anatomopathological examination.

The average age of affected subjects is of 13 years, with a higher prevalence in males. In about 17-20% of cases, multiple malignancies may be present.[1]

This report describes the imaging and anatomopathological features of a case of disseminated multiple meningioma infiltrating the brain parenchyma of an adult cat.

Meningioma is the most frequent intracranial cancer of the cat and in about 17-20% of cases multiple malignancies may be present.

CASE DESCRIPTION

A 10-year-old neutered Persian male cat was referred for the sudden appearance of left head tilt, generalized ataxia and apathy. The subject was regularly vaccinated, FiV/FeLV negative and lived at home with another cat in good physical condition. The patient was immediately treated by the attending veterinarian with broad-spectrum antibiotic therapy and corticosteroid

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therapy and the cat showed an initial remission of symptoms. CBC and complete biochemical profile were also performed; mild monocytopenia was present while the remaining values were within the normal range. After about 15 days the patient presented an acute re-exacerbation of symptoms. In addition to generalized proprioceptive ataxia and left head tilt, the neurological examination detected obtunded mentation and bilaterally reduced menace response. A multifocal/disseminated intracranial lesion was therefore suspected, of a nature to be established. In view of the signalment and clinical history the presence of a neoplastic disease (lymphoma, meningioma) was highly suspected; degenerative, infectious/inflammatory and vascular diseases were considered less likely. The subject underwent CT examination of the skull under basal conditions and

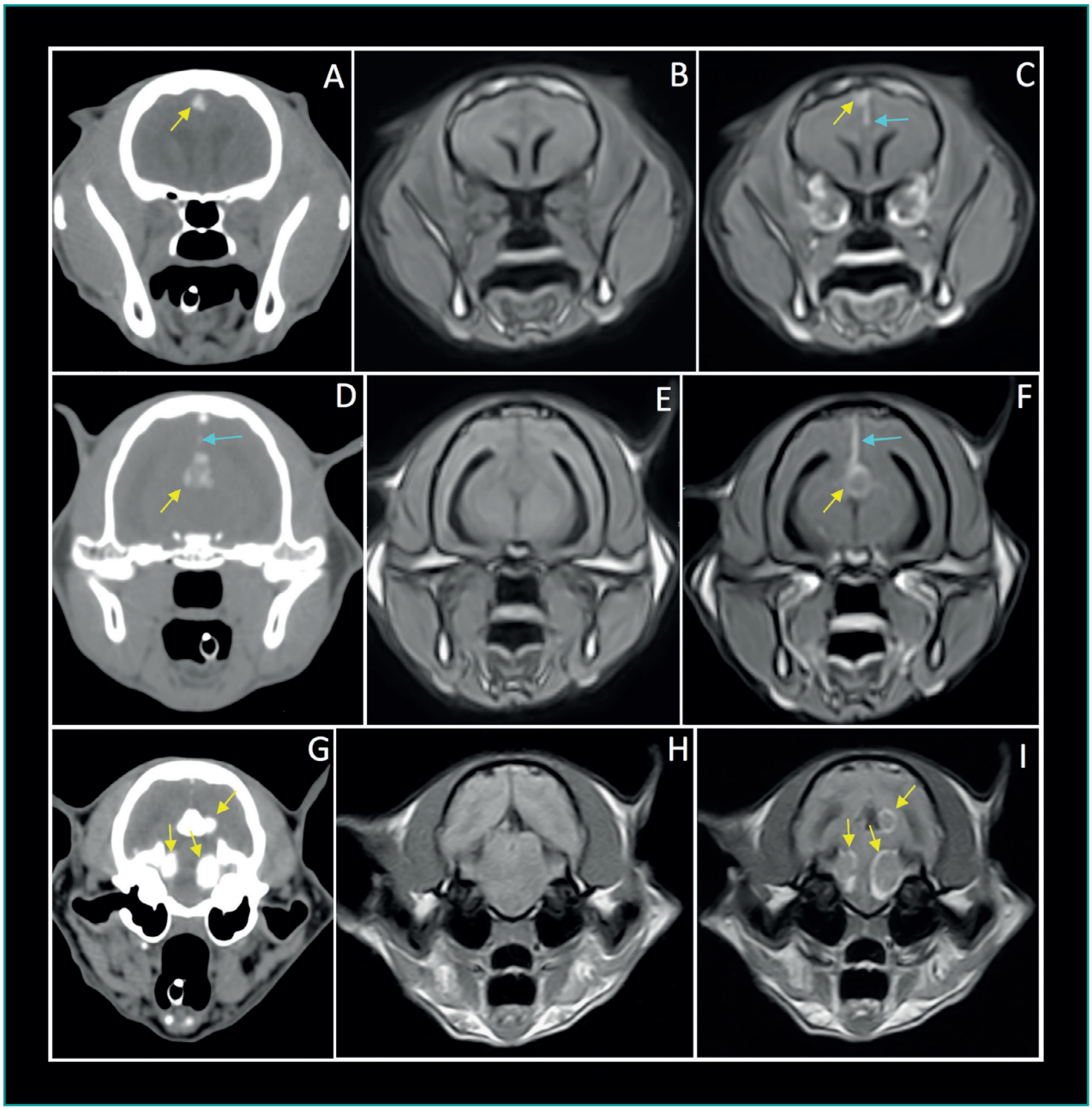

Figure 1 - From left to right, brain scans performed on the transversal plane, respectively obtained by CT (soft tissue window) and MRI (T1-weighted sequences) in basal conditions and after i.v. administration of paramagnetic contrast medium (Gadodiamide). From top to bottom, cross-sections of the brain obtained respectively at prosencephalic, mesencephalic and pontine levels. The yellow arrows identify numerous, variable-size spheroidal expansions with meningeal localization, characterized by marked CT hyperattenuation (Boxes A, D, G, yellow arrows). At MRI the lesions are characterized by slight and heterogeneous signal hypointensity compared to the cerebral parenchyma, showing a mainly peripheral discrete and heterogeneous enhancement (Boxes C, F, I, yellow arrows). The lesion located at the level of the tentorial incisure presents a dural tail that extends dorsally, characterized by hyperattenuation (Box D, blue arrows) and marked contrast enhancement (Boxes C, F, blue arrows).

The CT examination showed the presence of 11 hyper-attenuating masses disseminated along the meninges. At MRI, in T1-weighted sequences, such neoformations were characterized by signal hypointensity. In T2-weighted and FLAIR images, peripheral signal hyperintensity compatible with perilesional oedema was present. After the administration of contrast medium, discrete heterogeneous enhancement with dural involvement (dural tail) was observed.

MRI of the brain both under basal conditions and after intravenous administration of a paramagnetic contrast medium (Gadodiamide).

The CT examination (Brightspeed Elite 16 layers - General Electric Healthcare) showed the presence of multiple masses (about 11 distinct neoformations); the tumours, heterogeneously hyperattenuated, irregularly circular in shape and of variable sizes (maximum diameter 8.5 mm), often with ill-defined margins, were scattered along the meninges, were both supra- and infratentorial and involved both the convexity and the base of the brain (Figs. 1A, 1D, 1G; Fig. 2D, yellow arrows). The masses were located in the rostro-dorsal portion of the frontal lobe, in right parasagittal position with respect to the dorsal longitudinal sulcus, along the cerebral sulcus at the level of the parietal lobes, on the corpus callosum, cingulate gyrus and left occipital lobe and at the level of the pons and cerebellum.

At MRI (Vet-RM 0.18 T - Esaote S.p.A.) the masses were characterized, when compared to the brain parenchyma, by signal isointensity in T1-weighted sequences (Figs. 1B, 1E, 1H), heterogeneous and predominantly peripheral hyperintensity in T2-weighted sequences, central hypointensity and peripheral hyperintensity in FLAIR sequences and discrete heterogeneous post-contrastographic enhancement, whose predominantly peripheral distribution delineated a ring effect (Figs. 1C, 1F, 1I; Fig. 2E, yellow arrows). The post-contrastographic study showed widespread

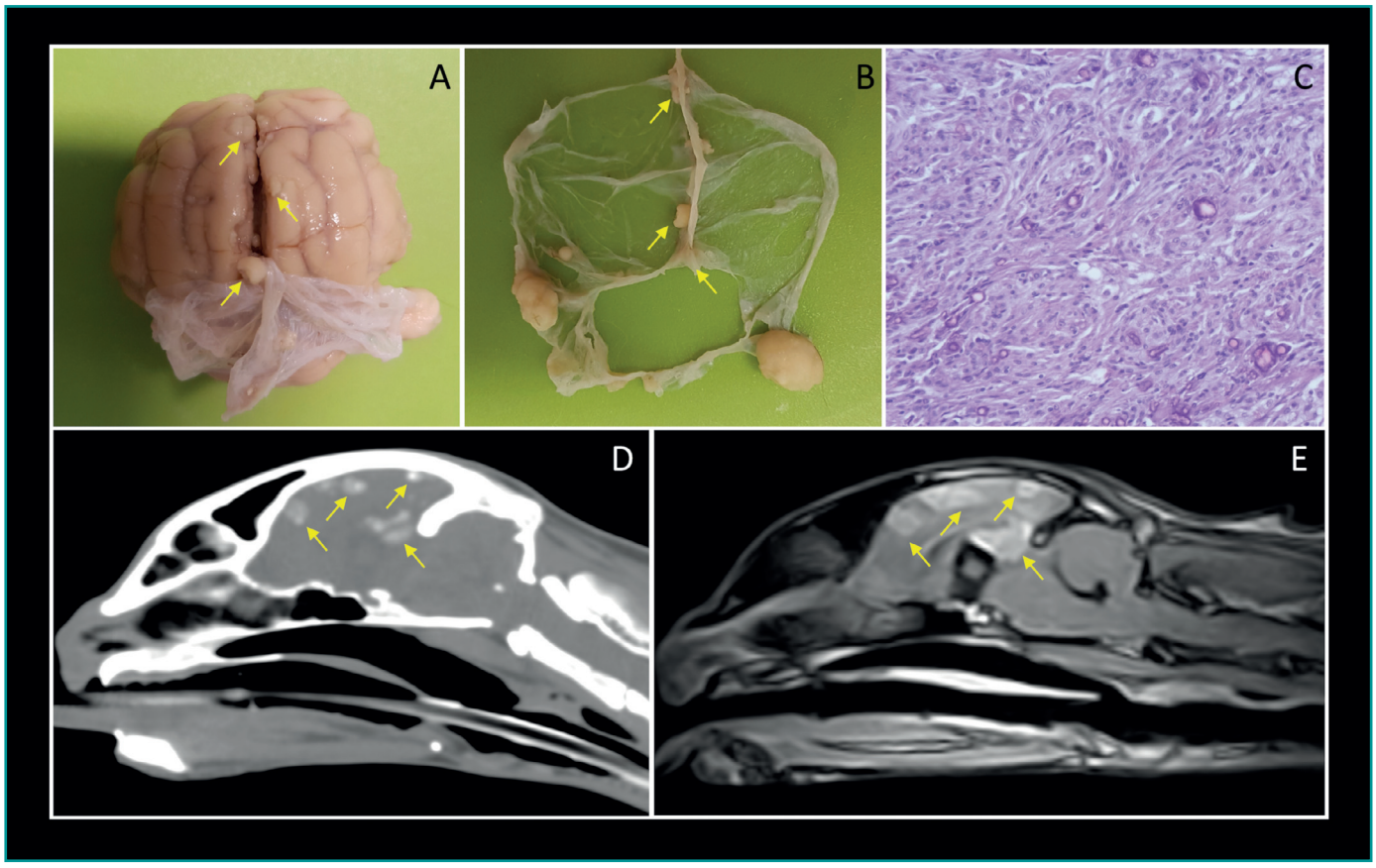

Figure 2 - Boxes A and B: isolated brain and dural lining; presence of evident multiple nodular formations, partially adhering to the dura mater, whitish, of hard texture, irregular and lumpy, of variable diameter between 1 mm and 9 mm (yellow arrows).
Box C: histological finding; neoplasia predominantly formed by spindle cells organized in undulated or swirling bundles, characterized by hyaline concentric and mineralized central concretions (psammoma bodies).
Boxes D and E: sagittal plane CT reconstruction with soft tissue window and post-contrast T1-weighted RMI scan. Multiple hyperattenuating-hypercaptant nodular lesions are distributed along the cerebral falx and the membranous portion of the tentorium.

meningeal impregnations in apparent contiguity (dural tail) with the masses located in correspondence with the tentorial pons and incisure (Figs. 1C, 1F, blue arrows). The scans showed initial involvement of the aboral portion of the cerebellar vermis in the foramen magnum, moderate dilatation of the quadrigeminal cistern and of the third ventricle, as well as moderate deformation of the interthalamic adhesion, which appeared compressed dorsoventrally. The cerebral sulci presented moderate thickness reduction. Due to the mass effect at pontine and tentorial level, a slight dorsocaudal dislocation of the cerebellar parenchyma was observed.

Macroscopic examination of the brain showed multiple nodular formations adhering to the dura mater which expanded downwards along the encephalic convolutions, affecting the ventricular spaces. Histologically, the masses were compatible with disseminated psammomatous meningioma.

Tomographic examinations highlighted the presence of numerous and disseminated intracranial masses, with apparent dural implantation, of different sizes and with practically identical tomodensitometric characteristics/signal intensity.

The lesions were compatible with masses of neoplastic nature, as a first hypothesis attributable to a multiple/disseminated meningiomatous formation. However, tomographic examinations do not allow to exclude a possible inflammatory/infectious multifocal granulomatous origin.

The hyperintense halo, observed around the larger masses in FLAIR and T2 sequences, was compatible with perilesional oedema. In addition, signs suggestive of a moderate increase in intracranial pressure were found. At the end of the examination, euthanasia was performed on the owner's request.

In order to establish the definitive diagnosis the whole brain was immersed in formalin and subjected to histological examination.

The macroscopic examination of the brain revealed the presence of multiple, whitish, hard textured, irregular and jagged nodular formations, adhering to the dura mater. The diameter of the formations varied from 1 mm to 8 mm (Figs. 2A and 2B, yellow arrows).

The brain was entirely sectioned into 5-mm thick parallel sections. Comparable multiple lesions were evident on the cut surface, involving all brain tracts and the meningeal surface and expanding downwards along the encephalic convolutions. Similar formations were also observed in the ventricular spaces.

At histology, the masses described were similar and superimposable and consisted of a multinodular neoplasm, infiltrating and dissecting the encephalic parenchyma.

The non-capsulated, non-demarcated, densely cellular neoplasm was formed by spindle-shaped to slightly polygonal cells, organized in undulated or swirling bundles, characterized by hyaline, concentric and mineralized central concretions (psammoma bodies). The cells showed a predominantly spindle-like morphology, with indistinct margins, eosinophilic cytoplasm and oval nucleus, granular chromatin and inconspicuous nuclei. Mitoses were rare and atypia limited (Fig. 2C).

A marked infiltration of the brain parenchyma by the neoplasm and areas of compression necrosis were present.

Histology was compatible with a diagnosis of multiple disseminated psammomatous meningioma.

DISCUSSION

Although in the literature multiple meningiomas have been reported in the cat, studies on their clinical and therapeutic course are quite rare.[2,3,4,7,8] Moreover, a multinodular presentation as massively disseminated and infiltrating the brain parenchyma as the one described in this case indeed represents a particularly rare finding.

For the presumptive diagnosis of meningioma advanced imaging studies, including CT and/or MRI, are necessary. In the dog, in the presence of intracranial meningioma the diagnostic accuracy of CT is of about 80% while in the cat no studies are available.[5] MRI, on the other hand, has a sensitivity of between 66% and 100% in the dog[5] and of 96% in the cat.[6]

The MRI features observed in this particular patient, such as ring enhancement and dural tail, together with the localization of the lesions, confirmed the suspicion of multiple meningioma, as reported by Troxel *et al.* (2004).

Tomographic examinations are of particular importance in the planning phase of the surgical excision, which is the treatment of choice for meningioma in the cat; surgery is often facilitated by the clear demarcation of the mass compared to the cerebral parenchyma. In fact, in the cat, meningiomas tend to have an expansive growth, with no or minimal cerebral involvement. In the cat, prognosis for single meningiomas following surgical excision is good and the mean survival interval is of 37 months,[7] compared to subjects treated with medical therapy alone (18 days).[8]

In the case described, a transient improvement of clinical symptoms was reported after the initial antibiotic-steroid therapy. Corticosteroids, in fact, help to reduce the perilesional oedema, reduce intracranial

pressure and attenuate symptoms.[9] As already reported in the literature, in this case the transient effect could be explained with the large size and the high number of nodules present.

In general, the age of the subject, the localization and the presence of multiple meningiomas apparently do not seem to influence the survival time and clinical course after surgery.[8] Surgical excision, when possible, is therefore indicated also in the case of multiple meningiomas.[2,3,4,7,8]

However, in the subject described in this report, a complete surgical excision was not possible due to the high number of lesions (at least 11), their localization and the partial infiltration of the brain parenchyma. Cases of multiple meningiomas described in the literature in the cat report a limited number of masses and often with a clear demarcation, which facilitates the surgical approach. The subject of the present study presented disseminated lesions with parenchymal infiltration, an extremely rare occurrence in veterinary medicine.

Forms of multiple meningiomas are described in human medicine; they are defined as the presence of 2 or more tumours developing simultaneously in the same patient. In humans, their incidence varies from 1% to 16%.[10]

The distinction between multiple meningiomas and metastatic lesions is very difficult to establish. Cases of leptomeningeal dissemination from intracranial meningiomas through cerebrospinal fluid have been described.[10] Although meningiomas derive from arachnoid villi, from the choroid plexus and leptomeninges, and are therefore naturally in contact with cerebrospinal fluid, in humans, leptomeningeal dissemination is in fact extremely rare. This type of spread appears to be more frequent with meningiomas located in ventricular spaces.[10]

In cats, meningiomas tend to have an expansive growth and surgical excision is the treatment of choice, with a prognosis of about 37 months. The presence of disseminated masses, infiltrating the brain parenchyma, does not allow a surgical approach and the prognosis is inauspicious. A possible leptomeningeal dissemination through the cerebrospinal fluid is not to be excluded.

In veterinary medicine, no cases of leptomeningeal dissemination have been described; however, in the present case, the high number of lesions, together with their localization, are suggestive of a possible CSF metastasis.

In conclusion, in cats with neurological symptoms of suspected intracranial origin a tomographic study is necessary in order to identify the localization and number of the masses present; disseminated forms of encephalic meningiomas, with infiltration into the cerebral parenchyma, should be included in the differential diagnosis.

KEY POINTS

- Meningioma is the most frequent intracranial cancer of the cat; it is a slow-growing tumour and it is often asymptomatic.
- In about 17-20% of cases multiple meningiomas may be present, with well-defined nodules and an expansive growth.
- For the presumptive diagnosis of meningioma advanced imaging studies, including MRI and/or CT, are necessary.
- Surgery is the therapy of choice.
- In the cat, the prognosis for single meningiomas following surgical excision is good.
- In the presence of meningiomas infiltrating the parenchyma, either multiple or disseminated, surgical treatment is not feasible.
- In the present case, the high number of lesions-microlesions adjacent to CSF spaces was suggestive of a possible metastasis through the CSF.

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