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CLINICAL, NEUROLOGICAL AND IMAGING DIAGNOSIS ON CANINE AND FELINE INTRACRANIAL MASSES - A CASE SERIES REPORT

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Abstract

Intracranial masses are a large group of malign and benign structures, that can affect any system of the body, including the nervous system. Since the incidence of this pathology is influenced by several factors, this paper aims to present the epidemiological data collected from 58 cases - 41 dogs (70.68%) and 17 cats (29.31%) diagnosed in the Clinic of the Faculty of Veterinary Medicine in Bucharest between 2018 and 2020. The reviewed factors included signalment data like species, breed, age, and sex. Also, for each case, clinical and neurological deficits were analysed and the results were used to localize the lesion within the nervous system and to establish the differential diagnoses according to "VITAMIND" acronym. The confirmation and the anatomical site of the mass were recorded based on the imagistic features obtained on MRI. This study is limited only to a provisional diagnosis, as the animals included in the database were not subjected to a post-mortem examination.

Key words: *neurological examination, brain mass, intracranial mass, nervous system MRI.*

INTRODUCTION

Intracranial masses are structures of a benign or malignant nature whose point of origin is represented by the anatomical structures of the nervous system. In veterinary medicine, they are an important cause of mortality, especially in geriatric dogs (Klopfleisch, 2016). Previous studies showed a predisposition of brachycephalic breeds to develop glial and pituitary tumors, while dolichocephalic breeds show a predisposition to meningioma. Top affected breeds include Boxer, Doberman, Golden Retriever, and Scottish Terrier (Kishimoto et al., 2020). Clinically, intracranial neoplasia will progress to chronic signs and slow progress. The most common manifestations in affected patients are seizures, changes in behaviour (walking in a circle, head pressing, disorientation), and discrete deficits in neurological examination that may express as a reduced response to menace or contralateral paresis (in advanced stages) (Schwartz et al., 2011). Although surgical techniques and antemortem biopsy are diagnostic procedures commonly used in developed countries, not all types of masses can be addressed in these ways, and high costs can be a limiting factor for pet owners (Dickinson, 2014). Therefore, advanced imaging techniques, and especially MRI, are a non-invasive alternative by which the clinician may suspect intracranial neoplasia and may choose between treatment or euthanasia, depending on the situation (Troxel et al., 2004; Bentley, 2015).

Starting from the previously discussed framework, this chapter aims to present the cardinal aspects of the clinical, neurological, and imaging data recorded in canine and feline patients diagnosed with cerebral masses within the clinic of the Faculty of Veterinary Medicine of Bucharest.

MATERIALS AND METHODS

The study was conducted between January 2018 and December 2020 and included 58 patients (41 dogs and 17 cats) diagnosed with intracerebral masses at the Clinic of the Faculty of veterinary medicine in Bucharest. For each case, the recording of the history and the performance of the clinical and neurological examination were mandatory steps, indispensable for establishing the neuroanatomical

diagnosis. Thus, depending on the specificity of the symptoms, the lesion was located in the forebrain, cerebellum, brainstem, or vestibular apparatus. Differential diagnosis and choice of paraclinical investigations were made based on the acronym "VITAMIND" (vascular/ inflammatory/trauma/anomaly/meta-bolic/ idiopathic/neoplastic/degenerative (Dewey & da Costa, 2016). The main inclusion criterion in this study was the confirmation of a mass within the brain by the MRI technique.

All data were manually collected from the Consultation Register and relevant information regarding signalment factors, symptomatology, and neurological deficits were analysed to establish their correlation with the intracranial mass development.

RESULTS AND DISCUSSIONS

Regarding the impact of species on the results obtained, the percentage of affected dogs (70.68%, n = 41) was higher compared to the number of affected patients within the feline population (29.31%, n = 17). As for the breed, 70.73% (n = 29) of the dogs were purebred and 29.26% (n = 12) were crossbreed. Purebreds included in the study belonged to: Maltese Frise (n = 8), French Bulldog (n = 3), Beagle (n = 3), Poodle (n = 2), Pug (n = 2), American Pitbull (n = 2), Boxer (n = 1), Basset Hound (n = 1), Bullterrier (n=1), Pinscher (n = 1), Siberian Husky (n = 1), Yorkshire terrier (n = 1), Spitz (n = 1), Labrador (n = 1) and Pekingese (n = 1).

In the feline population, the highest percentage was associated with the European breed (70.58%, n = 12), followed by the Burmese breed (23.52%, n =4) and the Persian breed (5.88%, n = 1).

Few previous studies provide data on the incidence of intracranial tumours in domestic carnivores, as there are many differences in homogeneity of populations and growth systems between countries (Kishimoto et al., 2020). However, there have been several reports who showed a higher incidence in Bulldog and Boxer (Miller et al., 2019) confirming the data obtained in this study.

The average age in the canine population was 10.36 years and the patients ranged from 6 to 18 years. The best-represented group included patients with an age higher than nine years (63.41%). Similar results were obtained in the feline population, in which the average age was 12 years, the examined cats belonging to a group ranging from 7 to 20 years old. In this species, the category of patients over 9 years was represented by over 94% of cases. The obtained results reiterate the data cited by the literature according to which for any patient over middle age who shows progressive clinical signs, the suspicion of neoplasia must be considered for every differential diagnosis performed (Song et al., 2013).

Regarding the gender distribution in the population, the number of males was significantly higher than the number of females in both species, the percentage obtained being 56.09% in dogs (n = 23) and 58.82% (n = 10) in the cat population.

The anamnesis revealed the presence of epileptiform seizures in 72.41% of patients (n = 42, of which 30 dogs and 12 cats). The seizures were generalized, tonic-clonic, and the patient's recovery to a normal mental status was prolonged. Owners have noticed changes in behaviour, compulsive walking in a circle, with a tendency to get stuck in corners. These deficits were accompanied by a series of non-specific clinical signs, with progressive evolution such as reduced body weight, decreased appetite, and a depressed mental status, with loss of interest in the owner or environmental stimuli.

Clinical examination revealed the presence of several pathologies associated with the geriatric age, such as the presence of heart murmurs, degenerative eye lesions - cataracts, glaucoma, or tumours of the skin or mucous membranes (Figure 1, A and B).

Figure 1. [A] Crossbreed dog, 11 years old, with mastocytoma in the carpal area of the right forelimb and [B] Yorkshire, 8 years old, with epulis in the oral cavity. Both cases showed epileptiform seizures and the MRI revealed the presence of intracranial masses

The aim of the neurological examination was the localization of the lesion within the central nervous system, by correlating the recorded deficits with the neuroanatomical diagnosis.
Thus, in 36 patients (28 dogs and eight cats), the neurological signs were compatible with a lesion of the cerebral hemispheres/cortex, being expressed as depressed mental status, head turn, circling, absent/reduced menace response unilaterally or bilaterally, contralateral proprioceptive deficits (Figure 2).

Figure 2. Crossbreed dog, 13 years old, with a mass in right cerebral hemisphere. The neurological examination revealed a gait characterized by circling on the right side, with the tendency to get stuck in corners. All proprioceptive tests were modified for the right thoracic and pelvic limbs

A total of eight patients (five dogs and three cats) had brainstem lesions, expressed by a severely depressed mental status (stupor), permanent decubitus, multiple cranial nerve deficits, associated with impaired respiratory and cardiac function (Figure 3).
Lesions with localization in the central vestibular system were identified in six patients (four dogs and two cats) who manifested head tilt, walking in small circles, nystagmus, and proprioceptive deficits ipsilateral to the direction of the head tilt.
Four other cases (three dogs and one cat) had neurological deficits compatible with cerebellar dysfunction, showing incoordination, hypermetropia, cerebellar ataxia, the inability of performing goal-targeted movements.

Figure 3. European cat, 16 years old, with a mass at the level of the brainstem. The neurological examination revealed a severely depressed mental status (stupor) accompanied by permanent decubitus and the head turn on the right side. The respiratory and cardiac functions were also affected

Also, for four patients (three dogs and one cat), the neurological expression was nonspecific, the deficits being associated with dysfunction of several brain segments, which led to a diffuse/multifocal neurolocalisation.
The chronic, progressive, focal evolution of the symptoms, corroborated with the average age of the population (10.36 years in dogs and 12 years in cats), were the main criteria in establishing the differential diagnosis. To exclude vascular and metabolic causes, the prioritization of paraclinical investigations included blood tests (biochemical and haematological profile), cardiological examination, abdominal ultra-sound, chest radiography, and MRI imaging technique.
Based on the results, patients with systemic disorders were excluded and we studied only those cases for which the MRI technique revealed aspects compatible with the presence of intracranial masses (well-delimited structures, with T1 isointense signal, T2/FLAIR hyperintense signal and T1 hyperintense contrast enhancement, with mass effect on adjacent structures).
For all cases, the imaging technique confirmed the neurolocalisation established in the previous stage. The highest percentage, 58.46% (n = 36, 28 dogs and eight cats), was attributed to patients with masses located within the cerebral hemispheres (Figure 4, A, B).

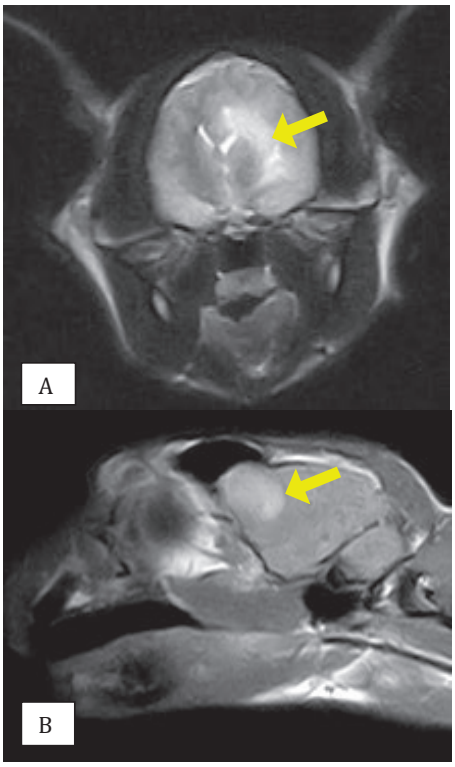

Figure 4. Feline, M, 9-years-old. [A] T2 Transversal and [B] T1 sagittal contrast enhancement MRI sections. Both sequences show a well delimited mass, of approximately 13x14 mm, with hyperintense signal T2, isointense signal T1 and hyperintense contrast enhancement T1, localized at the level of the frontal lobe of the left hemisphere (original)

The localisation of these structures in the brainstem was identified in 15.38% (n = 8, five dogs and three cats) of the patients (Figure 5, A, B), and at the level of the vestibular apparatus in 12.38% (n = 6, four dogs and two cats) of the patients (Figure 6 A, B).

The lowest percentage, 7.69% (n = 4, three dogs and one cat), was attributed to cerebellar localization. For other four patients (three dogs and one cat) the lesion was diffuse.

Although the MRI technique provides multiple useful aspects in formulating the differential diagnosis, we reiterate the idea that the establishment of a definite, etiological diagnosis, requires the corroboration of history information, with clinical signs and with the confirmation of histopathological examination.

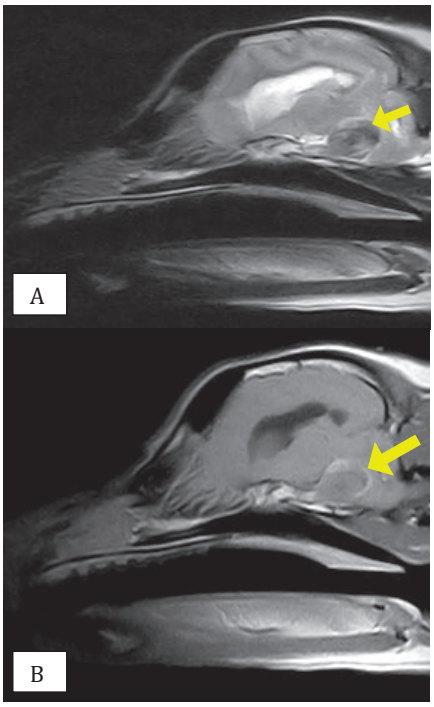

Figure 5. Mixed-breed dog, M, 12-years-old. [A] T2 and [B] T1 contrast enhancement sagittal MRI sections. All sequences show a mass with hypointense signal T2 and hyperintense contrast enhancement T1, localized at pontine level (original)

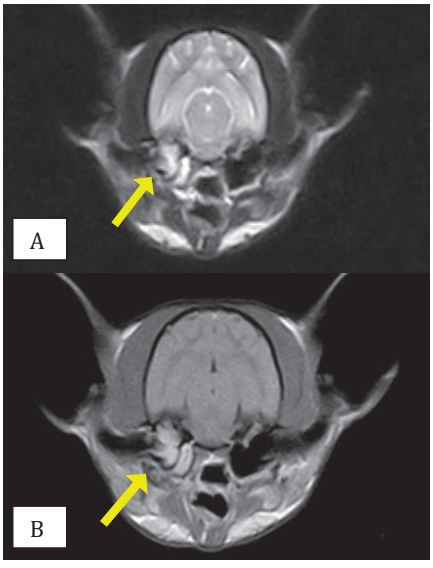

Figure 6. French-bulldog, M, 8-years-old. [A]T2 and [B] T1 contrast enhancement transversal MRI sections. All sequences show an area with hyperintense signal T2 and minimal hyperintense contrast enhancement T1 at the level of the tympanic bulla, compatible with otitis media and interna/mass - suspicion of cholesteatoma (original)

CONCLUSIONS

1. Intracranial formations were correlated with geriatric animals, the average age being 10.36 years in the canine population and 12 years in the feline population.
2. The anamnesis showed the presence of chronic, progressive clinical signs, and 72.41% (n = 42, of which 30 dogs and 12 cats) of the patients showed epileptic seizures.
3. Neurolocalisation was associated with lesions of the cerebral hemispheres for 36 cases (28 dogs and eight cats), of the brainstem for 8 cases (five dogs and three cats), of the vestibular apparatus for six cases (four dogs and two cats) and the cerebellum for four cases (three dogs and a cat).
4. In most patients, the confirmation of intracranial formations was based on MRI aspects, which revealed the presence of masses of variable size and localisations, with T2 hypersignal, T1 hyperintense contrast and mass effect on adjacent areas.
5. The etiological diagnosis implies the confirmation of the histological examination, which could not be achieved for the analysed patients.

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