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CONTRIBUTIONS TO THE DIAGNOSIS OF NEOPLASIA IN THE HEAD REGION IN DOGS

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Abstract

The purpose of this study was to establish some correlations between clinical signs and location of neoplasia - establishing the most commonly encountered clinical signs and the type of tumor most commonly involved in cerebral compression in dogs (primary or secondary neoplasia). All 20 canine patients, with suspicion for neoplasia in different locations in the head region following clinical and neurologic examination, were examined using a CT scanner, as well as cytology/histopathological examination. Meningioma was the most frequent diagnosed intracranial primary central nervous system tumor. Neoplasia in the head region are invasive, most of which have lead to cerebral compression. Carcinoma, originating in the mammary gland, spread by hematogenous path, has lead, in a large percentage, to brain metastases.

Key words*: neoplasia, head, dog.*

INTRODUCTION

Although in several epidemiological studies it has been reported that primary brain tumors do not show an increased frequency in dogs and cats, with the use of advanced imaging techniques (CT and MRI), they appear to be an important part of the pathology of the two species (Henry & Higginbotham, 2010; Morris & Dobson, 2001).

In veterinary medicine, in most cases, neoplasms are detected at an advanced stage, which is why cancer is one of the most common causes of exitus (Cooley et al., 2003; Lord et al., 2007; North & Banks, 2009).

MATERIALS AND METHODS

The research was carried out in the Imaging Diagnostics Laboratory and the Surgery Clinic of the Faculty of Veterinary Medicine in Timişoara, investigating 20 clinical canine patients, who, following clinical and neurological examination, were suspected of neoplastic disease in different segments of the head region.

Patients underwent CT scaning (Siemens Somatom Definition AS), under general anesthesia with 2% xylazine (Narcoxyl - MSD Animal Health)/acepromazine 2% (Aceprom - KEPRO B.V. NETHERLANDS) - Propofol 1% (Fresenius Kabi).

The obtained data were evaluated using multiplanar reconstruction technique (MPR) using 1 mm sections, and for an easier visualization of the lesions 3D reconstruction of the evaluated region using the volumetric rendering technique (VRT) was used. In patients with suspected neoplastic disease of the nasal cavities based on conventional CT imaging, we intended to identify the changes that were reported to be pathognomonic (Forrest, 2018; Schwarz & Saunders, 2011; Wisner & Zwingenberger, 2015): osteolysis of the turbinates and the bones forming the nasal cavities cavities, extension into the frontal sinuses, presence of soft-tissue mass in the nasal cavity, and lysis of the cribriform plate with extension into the cranial vault.

Regarding the patients in which brain involvement was noted on conventional CT, presence of the following aspects was investigated: mass component, lesion distribution (single / multiple), lysis of the cranial vault, deviation of falx cerebri and compression/deformation of the cerebral

ventricles, hydrocephalus. Postcontrast CT was performed at 1-3 minutes after intravenous administration of iodine contrast medium (Iopamiro 370-Bracco) at a dose of 2 ml/kg.
Contrast/density enhancement (uniform, non-uniform, in the center/periphery of the lesion) was then described.

RESULTS AND DISCUSSIONS

Out of the total of 20 cases with neoplasms, 12 had cerebral compression. Cerebral compression was due to an intracranial primary central nervous system tumor (Figure 1) in 16.66% of the cases, with the remaining 83.34% being the result of metastatic disease by various mechanisms. These secondary lesions were mostly the result of direct expansion of neoplasms in the nasal cavity (33.33%) and disemination of primary mammary gland neoplasms (25%).

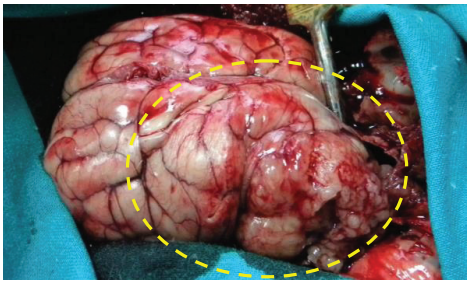

Figure 1. Meningioma and endotheliomatous fibromatosis localized in the frontal lobe of the brain - macroscopic aspects - extra axial mass with right frontal lobe compression

Cerebral compression occured in a small proportion by extension from the pituitary gland, the skull (Figure 11) and the external ear (in similar proportions of 8.33%). Other authors have also reported that the majority of secondary brain tumors in dogs are the result of local extension of nasal tumors, which represent 30% of CNS metastases (Henry & Higginbotham 2010).

Tumors localized in the nasal cavities

The most common symptoms in these cases were dispneea (62.5%), epistaxis (50%) and exophthalmos (50%). Swelling in the naso-frontal region and chronic serous-muco-purulent discharge were observed in similar proportions of 37.5%.
Examination of the nasal cavities revealed lysis of the turbinates and the nasal septum, as well as replacement of these structures with fatty-like tissue mass, which in some cases resulted in lysis of the cribriform plate and infiltration / compression of the cerebral parenchyma (Figure 2).

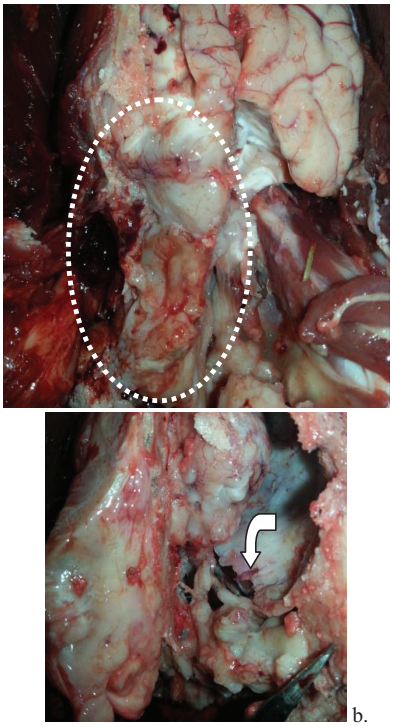

Figure 2. Bilateral nasal tumor with frontal sinus invasion, osteolysis of the cribriform plate (b) and infiltration of the frontal lobes of the cerebral hemispheres (a)

The most commonly diagnosed tumors originating in this site were adenocarcinoma (40% - two cases) and squamous cell carcinoma (40% - two cases). In a smaller proportion, undifferentiated carcinoma was identified (Figure 3) (20% - one case).
The results are similar to the data in the literature, according to which adenocarcinoma is the most common intranasal tumor in dogs (Henry & Higginbotham, 2010), and squamous cell carcinoma is a frequently diagnosed tumor (Morris & Dobson, 2001).

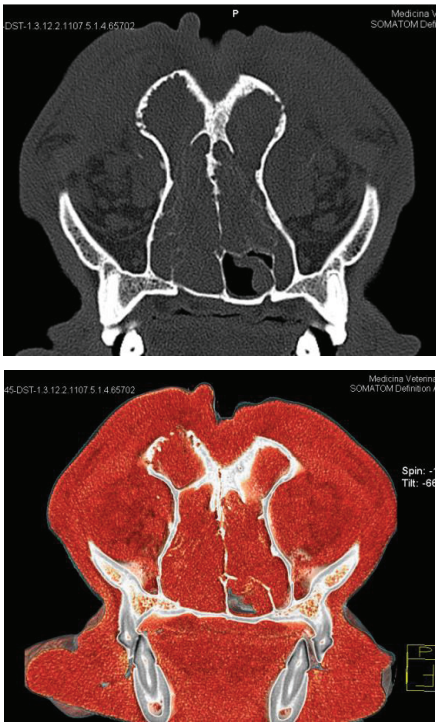

Figure 3. Undifferentiated carcinoma with bilateral localition in the nasal cavities

Tumors localized in the oral cavity (5 cases)
The most commonly associated clinical signs were the presence of an ulcerative mass (Figure 4), located in the caudal portion of the hard palate mucosa, anorexia and halitosis (60%).

Figure 4. Oral tumor: lesion with ulcerated surface

Out of the total five cases studied, in only four was a histopathological diagnosis of certainty established. Tumor types diagnosed in equal proportions (25% - one case) were malignant melanoma, squamous cell carcinoma (Figure 5), plasmocytoma, and a metastasis secondary to a vaginal sarcoma.

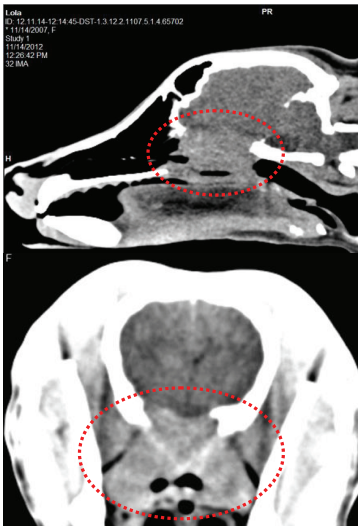

Figure 5. SCC (squamous-cell carcinoma) originating in the nasal cavity which resulted in extension in the orbit and cranial vault: cerebral compression through direct extension

The most common malignant tumors of the mandible and maxilla in dogs are, in decreasing order, malignant melanoma, squamous cell carcinoma (SCC) and fibrosarcoma (FSA) (Henry & Higginbotham, 2010; North & Banks, 2009). Squamous cell carcinoma (SCC) is the most common malignant tumor of the oral cavity in dogs, accounting for approximately 20-30% of all oral malignant tumors according to some authors (Morris & Dobson, 2001; North & Banks, 2009).
Malignant melanoma accounts for approximately 30-40% of all malignant tumors of the oral cavity in dogs (Morris & Dobson, 2001).
Extramedullary Plasmacytoma (EMP) has been reported in association with multiple myeloma. EMP is characterized by neoplastic cell infiltration into soft tissues without bone marrow involvement (Henry & Higginbotham, 2010).
In dogs, this condition appears to originate from the cutaneous or mucosal tissues, with more frequent localization in the oral cavity and the skin of the head and digits (Henry & Higginbotham, 2010). Oral form of plasmocytoma may be associated with periodontal disease (Henry & Higginbotham, 2010).

Tumors located in the orbit/zygomatic region (1 case)

The only case studied with a mass originating in the orbit was diagnosed as being a malignant giant celltumor/malignant fibrous histiocytoma (histopathological examination) (Figure 6).

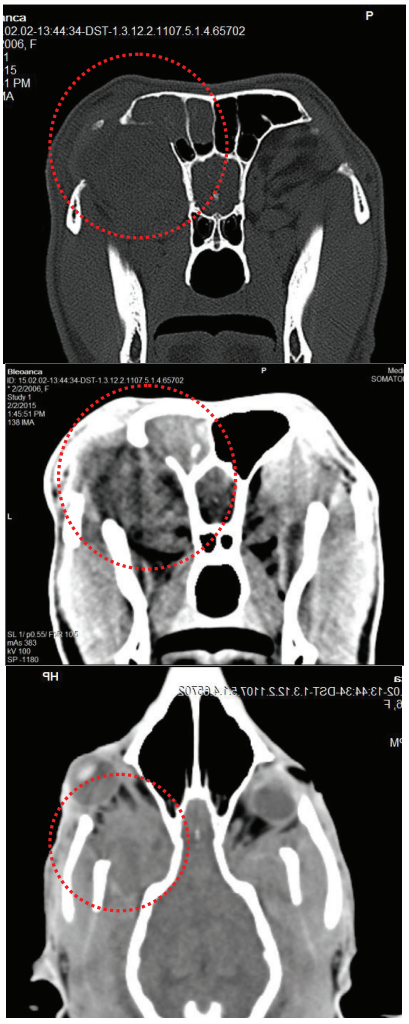

Figure 6. Tumor with orbital localization with extension into the frontal sinus and nasal cavity

Tumors located in the ear (2 cases)

The identified types of tumors were adenocarcinoma (1 case - 50%) (Figure 7) and high-grade malignant sarcoma (1 case - 50%).

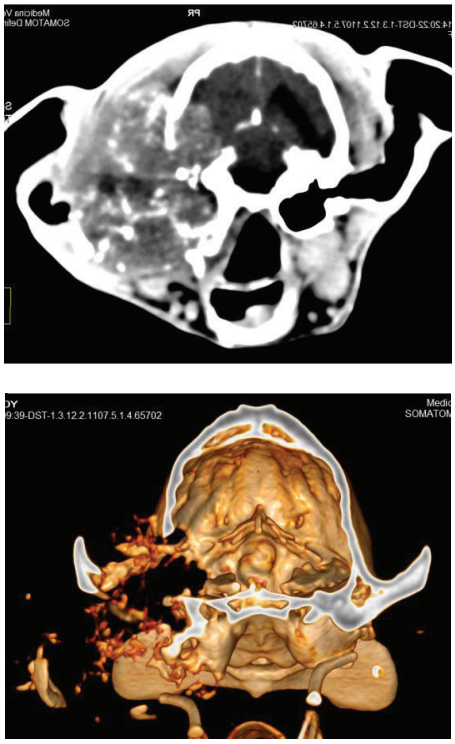

Figure 7. Adenocarcinoma originating in the external ear: osteolysis of the cranial vault - the temporal bone especially (squamous part, petrous portion, tympanic bulla); soft tissue mass showing scattered bone remnants; cerebral compression through direct extension

In the literature (Ayres & Liptak, 2012; Morris & Dobson, 2001), it has been reported that adenocarcinoma of the ceruminous glands, alongside with squamous cell carcinoma and carcinoma of unknown origin, are the most common malignant tumors encountered at this level. Carcinoma of the ceruminous glands and other carcinomas from the ear canal are locally invasive tumors, resulting in destruction of the cartilage and deep bone that are adjacent to the ear (Morris & Dobson, 2001).

Adenocarcinomas originating in the ear are also extremely destructive, leading to tympanic bulla osteolysis and erosion/lysis of the petrous and squamous parts of the temporal bone (Wisner & Zwingenberger, 2015), severe changes seen also in the dog with adenocarcinoma included in our study. The proportion in which squamous cell carcinoma (SCC) produces invasion and lysis of adjacent bone tissue reported in the literature varies between

70% (Morris & Dobson, 2001) and 77% of cases (Evans & Shofer, 1988; North & Banks, 2009).

Intracranial central nervous system tumor

The observed macroscopic aspects varied from the presence of extraaxial lesions with brain compression (Figure 1) or intraaxial infiltration.

The lesions inside the cranial vault were located either in meninges (Figure 1) or in the parenchyma (Figure 8), or were the result of extension from other regions (the cranial vault) (Figure 11). These lesions were either tissue masses that contained necrotic portions or well-defined nodules highly vascularized.

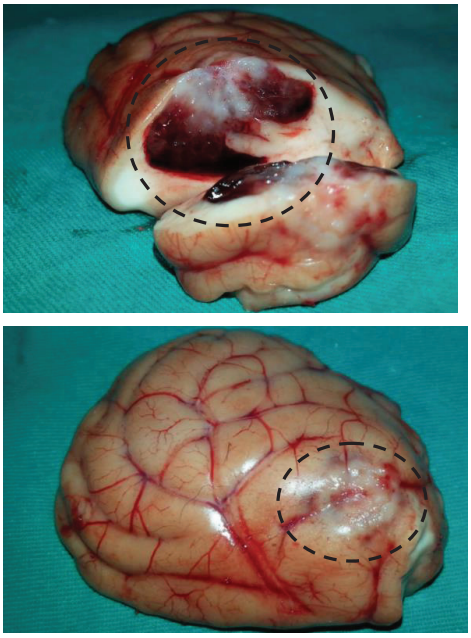

Figure 8. Metastasis in the left frontal lobe secondary to a mesenchymal malignant sarcoma originating in the mammary gland

Both intracranial primary tumors were meningiomas (Figure 9) (2 cases - 100%).

The results are in accordance with data in the literature that state that meningioma is the most common cerebral tumor in dogs, accounting for approximately 40% (Vandevelde et al., 2012) - 45% of primary intracranial neoplasms (Henry & Higginbotham, 2010).

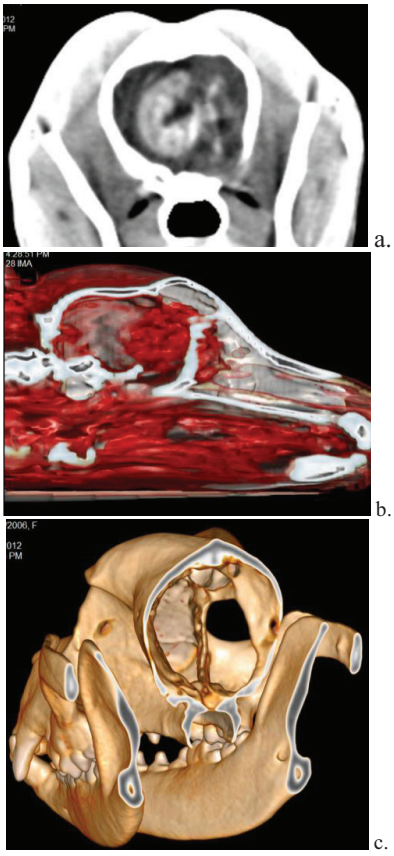

Figure 9. Fibromatous and endotheliomatous meningioma located in the right frontal lobe of the cerebral hemisphere; a. MPR postcontrast: Significant contrast enhancement, but uneven, the mass presents hypodense areas; b. and c. VRT: osteolysis of the cranial vault

Metastases resulting from haematogenic dissemination (3 cases) were secondary to mammary carcinoma (66.67%) (Figure 10) and in one case to mammary sarcoma (33.33%). In the three cases with secondary brain tumors that were studied, where the spread to the central nervous system (CNS) was done by haematogenic dissemination (originated in the mammary gland), pulmonary metastases were identified in two situations (66.66% - 2 cases).

The most common metastatic sites for mammary carcinomas are the lymph nodes and lungs. Metastasis in the bone, liver or brain is rare in animals compared to humans (Lana et al., 2007). According to other authors (Henry & Higginbotham, 2010) the presence of pulmonary metastases associated with those in the brain occurs in 80% of the cases.

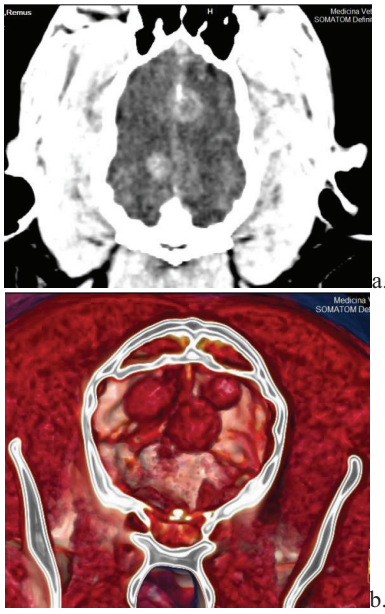

Figure 10. Cerebral metastases secondary to a mammary carcinoma: a. MPR; b VRT

Metastatic tumor types that have been reported in dogs as having a haematogenous CNS dissemination include transitional cell carcinoma, hemangiosarcoma (HSA), mammary carcinoma (Lecouteur & Withrow, 2007; North & Banks, 2009), adenocarcinoma, melanoma, lymphoma, undifferentiated sarcoma (Henry & Higginbotham, 2010) and prostatic and lung carcinomas (Lecouteur & Withrow, 2007; North & Banks 2009). Hemangiosarcomas (HSA) are the most common secondary cerebral tumors in dogs (29%) (Vandevelde et al., 2012) - (51%) (Henry & Higginbotham, 2010), followed by pituitary gland tumors (25%), lymphosarcoma (12%) and carcinomas (12%) (Henry & Higginbotham, 2010; Vandevelde et al., 2012).
Also in human medicine, brain metastases occupy the first position as frequency (approximately 50%) of intracranial tumors (Gorgan, 2012).
Tumor types that are reported to be responsible for occurrence of metastatic lesions are bronchial-lung cancer in men and breast cancer in women (Gorgan, 2012).
Tumors localized in the cranial vault (1 case)
The only case in the study originating in the bones of the cranial vault was diagnosed with chondrosarcoma (Figure 11).

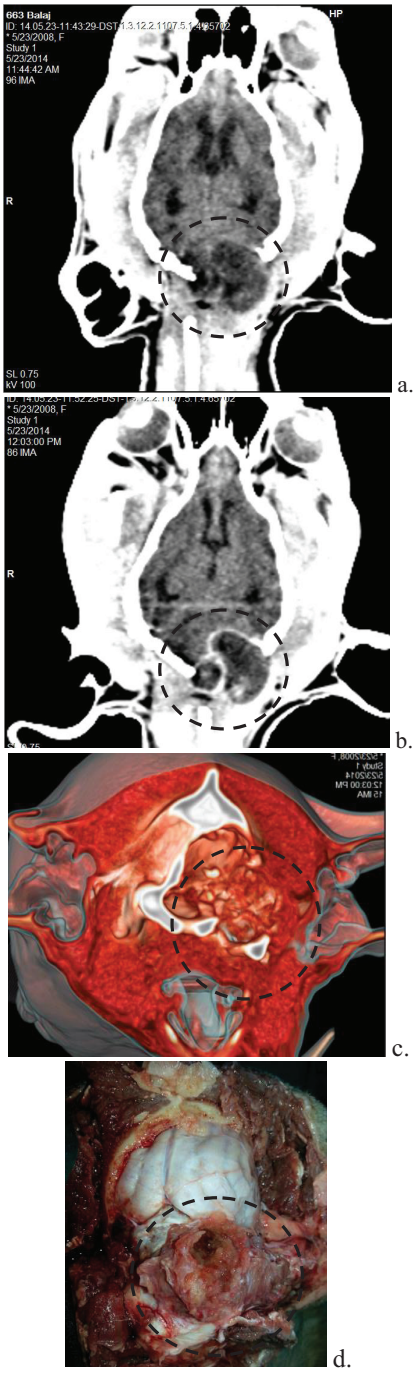

Figure 11. Tumor of the cranial vault extending within the cranial vault and direct metastasis in the brain (chondrosarcoma) (663/23.05.2014): a. MPR precontrast; b. MPR postcontrast; c. 3-D VRT reconstruction (occipital, atlas and temporal bone osteolysis); d. macroscopic appearance

Chondrosarcoma represents the second primary bone tumor as frequency encountered in dogs, representing approximately 5-10% of the total primary bone tumors (Morris & Dobson, 2001). Compared to OSA, chondrosarcoma (CSA) occurs in younger patients (average age of 6-7 years) and usually affects medium to large breeds (Henry & Higginbotham, 2010). The bone tissue of the skull, and the temporal bone may be affected by primary bone tumors such as osteosarcomas and chondrosarcomas, and less frequently by benign tumors such as osteomas (Schwarz & Saunders, 2011; Withrow et al., 2013).

This information corresponds to the changes presented by the animal studied, which was a 6 year old medium-sized mix-breed dog.

In the cases which presented primary and secondary tumors with cerebral compression (direct or indirect), convulsions were the most common clinical sign (12 cases), representing 50% of the cases (6 cases). It has been associated with cerebral cortex compression - frontal lobes. Ataxia was present in 25% of the cases, and circling, tetraplegia and abnormal head positions (tilt) were detected in similar proportions of 16.66%. The results obtained in this study are consistent with data reported in the literature, according to which the most common clinical signs associated with brain tumors are: convulsions (45%), circling (23%), ataxia (21%) and head tilt (13%) (Henry & Higginbotham, 2010). Convulsions are the most common clinical signs associated with these tumors, and are often one of the first signs of a tumor in the cerebral cortex (Morris & Dobson, 2001; Bagley et al., 1999; Snyder et al., 2006; North & Banks, 2009). Brain neoplasms should be considered as a differential diagnosis in cases where the first episode of seizures occurred after the age of 4 years (Henry & Higginbotham, 2010). Convulsions are one of the most common clinical signs associated with these tumors, and are often one of the first signs of a tumor in the cerebral cortex (Morris & Dobson, 2001; Bagley et al., 1999; Snyder et al., 2006; North & Banks, 2009).

This was also noticed in the present study except for one case (24/10.01.2014), in which the first episode of seizures occurred at the age of 2.5 years and was the result of a frontal lobe compression secondary to enlargement of an undifferentiated carcinoma in the nasal cavity.

Performing CT or MRI investigations is of primary importance in patients with neurological deficit (Horner's syndrome or peripheral vestibular syndrome) in order to assess the degree of invasion in adjacent structures (Ayres & Liptak, 2012).

CONCLUSIONS

Meningioma was the most frequently diagnosed intracranial primary central nervous system tumor. Neoplasia in the head region are invasive, most of which have lead to cerebral compression (60%). Carcinoma, originating in the mammary gland, spread by hematogenous path, has lead, in a large percentage (66,67%), to brain metastases.

Convulsions (50%) and ataxia (25%) were clinical signs most commonly associated with primary or secondary tumors with cerebral compression.

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