Case Report

Magnetic Resonance Imaging Features of Olfactory Neuroendocrine Carcinoma in a Dog

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ABSTRACT

Olfactory neuroendocrine carcinoma is rare in small animals. A 4-year-old female mix-breed dog in a stupor state was presented with a history of weight loss, cachexia, paroxysm, ptyalism, absence of the light reflex in the left eye, and grade 4 lameness in the left forelimb. In the magnetic resonance imaging (MRI) images, an extra-axial space occupying a mass lesion was detected extending directly from the nasal fossa to the bulbous olfactorius of the frontal cerebral lobe through the destructed cribriform plate, consistent with high-grade nasocranial neoplasia. Histopathological findings confirmed high-grade olfactory neuroendocrine carcinoma.

Keywords: Carcinoma, Dog, Magnetic resonance imaging, Nasal, Neuroendocrine

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Introduction

Neuroendocrine (NE) cells originate embryologically from the gut and are widely distributed in several tissues, such as the roof of the nasal vault, pancreas, liver, tracheobronchial tree, and genitourinary system (Ashley, 1990; Youssef et al., 2015). Many NE tumors are benign, while some are malignant (Ramage et al., 2005). In humans, NE carcinoma (so-called carcinoid) has been found in many organs, the gastrointestinal and pulmonary tracts being the most common sites (Ashley, 1990; Youssef et al., 2015). In domestic animals, NE tumors have occasionally been reported in the intestine, liver, bile duct, lungs, gallbladder, esophagus, skin, and nasal cavity (Carakostas et al., 1979; Sako et al., 2003). Olfactory NE carcinomas, however, are rare in small animals and have been reported only in dogs and horses (Patnaik, 2017; van Maanen et al., 1996). In dogs, there have been a few reports of olfactory NE carcinomas (Patnaik, 2017; Nakagaki et al., 2021; Kuwata et al., 2010), one of which described using MRI to process identifying a disease (Kitagawa et al., 2006). This short communication describes the MRI features and histopathology in diagnosing olfactory NE carcinoma in a dog.

Case Presentation

A 4-year-old female mix-breed dog in a stupor state was presented to a private small animal clinic with a history of cachexia and paroxysm. According to the owner, the dog lost 8 kg during the last month. Clinical signs included ptyalism, absence of the light reflex in the left eye, and grade 4 lameness in the left forelimb. The dog clinically recovered after treatment with 1 mg/kg intravenous diazepam (Kimidaru, Iran), 0.1 mg/kg intramuscular dexamethasonem (Alborz Darou, Iran), and 3 mL intramuscular Neurobion (Merck KGaA, Darmstadt, Germany). After three days, because of the return of the symptoms, the dog was referred to the Veterinary Diagnostic Imaging Center of the University of Tehran for more MRI (magnetic resonance imaging) studies.

Diagnostic testing

The MRI study included sagittal T2W, transverse and dorsal T1W, T2W, T2*W, FLAIR, and T1W dark fluid following post 0.1 mmol/kg gadolinium contrast medium (OMNISCAN, GE Healthcare) administration transverse and three-dimensional T1W sequences of the skull.

Assessments

The MRI images detected an extra-axial space occupying a mass lesion extendingfrom the nasal fossa to the bulbous olfactorius of the frontal cerebral lobe through the destructed cribriform plate (Figure 1). The lesion has two compartments. The rostral compartment, which was extended caudally to the level of the optic chiasma, showed well-demarcated, homogeneous T2w and FLAIR hyperintense and T1W isointense signal compared to the grey matter with moderate heterogeneous contrast enhancement (Figure 2). The caudal compartment was a cystic lesion with a thin wall and without contrast enhancement originating from the caudal aspect of the mass tissue and extending caudodorsally to the level of the osseous tentorium (Figure 2). Overall, the lesion displaces the nasal bone and falx cerebri to the left side and compresses and displaces the midbrain and the ventricular system ventrocaudally. Marked perilesional vasogenic edema was observed in the cranial vault (Figure 3). There was moderate to severe subtentorial herniation of the midbrain associated with marked flattening of the rostral border of the cerebellum and moderate caudally herniation of the cerebellar vermis throughout the foramen magnum, consistent with increased intracranial pressure. The MRI features of the lesion were well-compatible with high-grade nasocranial neoplasia. By the owner's request, due to a poor prognosis, the dog was euthanized, and the mass was examined through a histopathological examination at the Cancer Biology Research Center, University of Tehran, Tehran City, Iran. Histopathological findings suggest that olfactory NE carcinoma is associated with multifocal necrosis, a mitotic count of 11 in 10/HPF (high-power field), and additional lymphocyte proliferation (Figure 4). Immunohistochemistry analysis confirmed the diagnosis by having positive over 70% malignant cells in Chromogranin-A (CgA), over 40% in cytokeratin AE1/AE3 (Pankeratin), and over 55% in NES (nestin) markers.

Usual clinical signs of nasal tumors have been reported as facial malformation, epiphora, and unilateral epistaxis (Ogilvie & LaRue, 1992). This case displayed neurologic signs, but there were no signs of upper respiratory disease except ptyalism.

Conclusion

So far, there have been a couple of MRI reports from nasal fossa tumors extending into the intracranial cavity in dogs (Moore et al., 1991; Kitagawa et al., 2006). These reports revealed different results for tumor intensity in T1-weighted images and T2-weighted images.

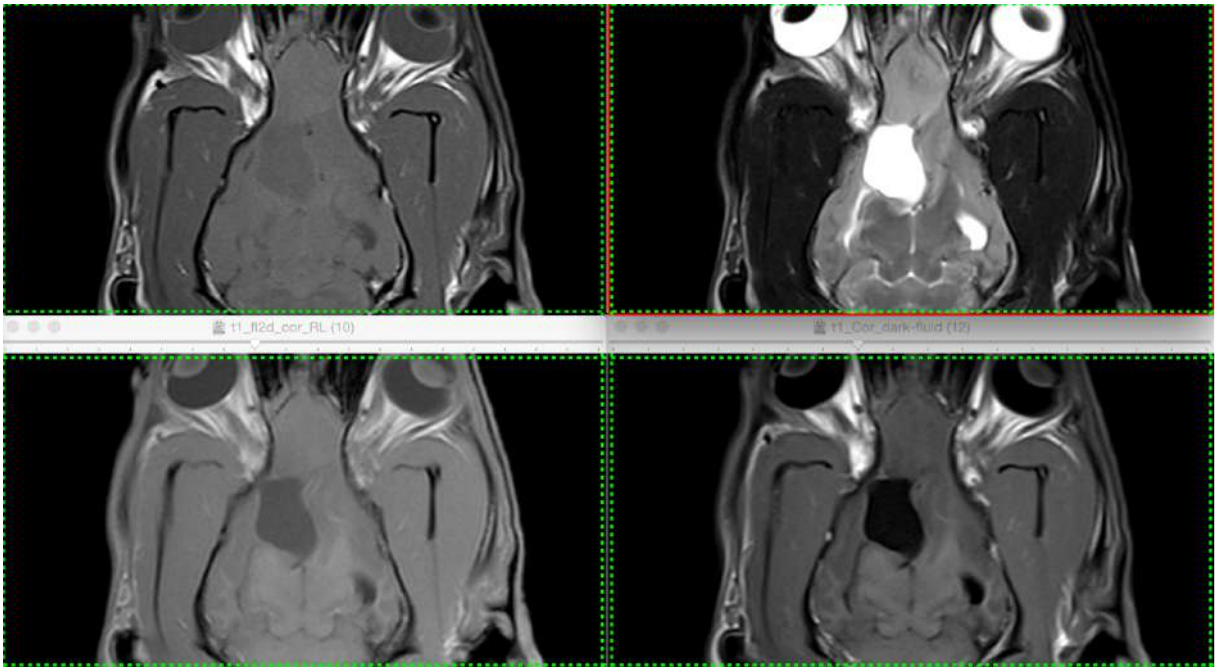

Figure 1. Olfactory neuroendocrine carcinoma (isointensity)

a) A T1-weighted dorsal image; b) A T2-weighted dorsal image (arrow) in a dog

Bently et al. reported two well-differentiated nasal adenocarcinomas and three anaplastic nasal carcinomas or sarcomas that invaded the rostral brain with isointensity on PDWI and T2WI and hypointensity on TlWI (Bentley, 2015). In contrast, Ródenas et al. reported six nasal tumors as mixed intensity on both T1 and T2-weighted images (Ródenas et al., 2011). Kitagawa et al. detecte a mass extending from the nasal fossa to the olfactory

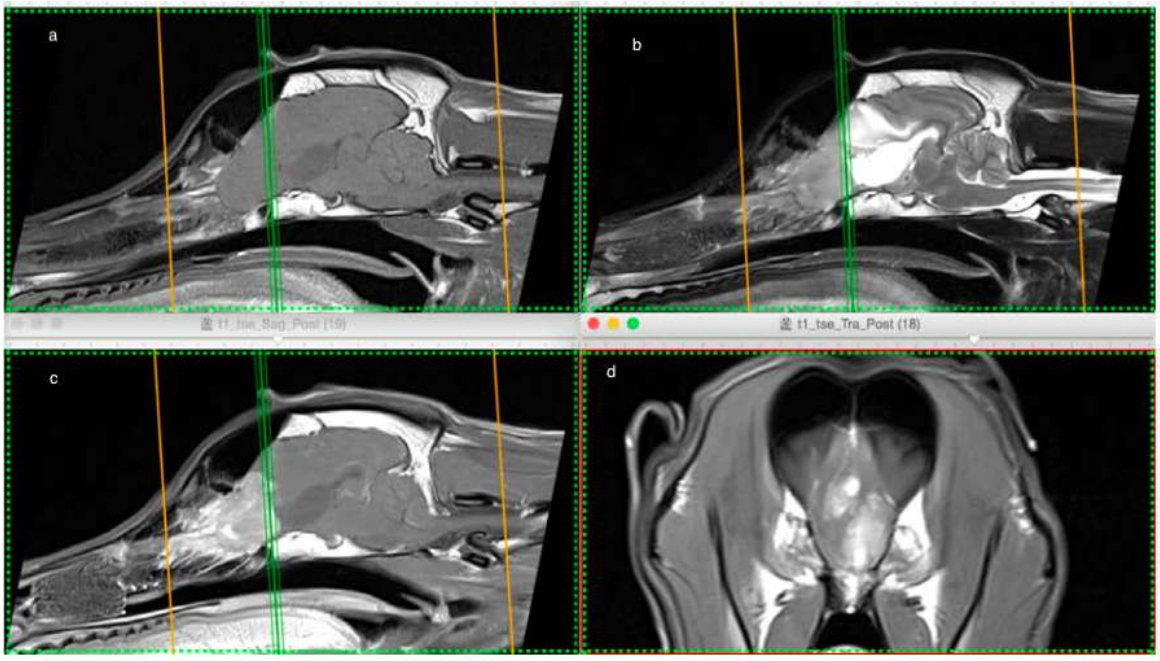

Figure 2. Olfactory neuroendocrine carcinoma in a dog (isointensity)

a) A T1-weighted sagittal image (arrow); b) A T2-weighted sagittal image (arrow); c) The rostral part of the tumor enhanced by the contrast medium (arrow); d) With multiple small cavitary lesions and marked mass effect

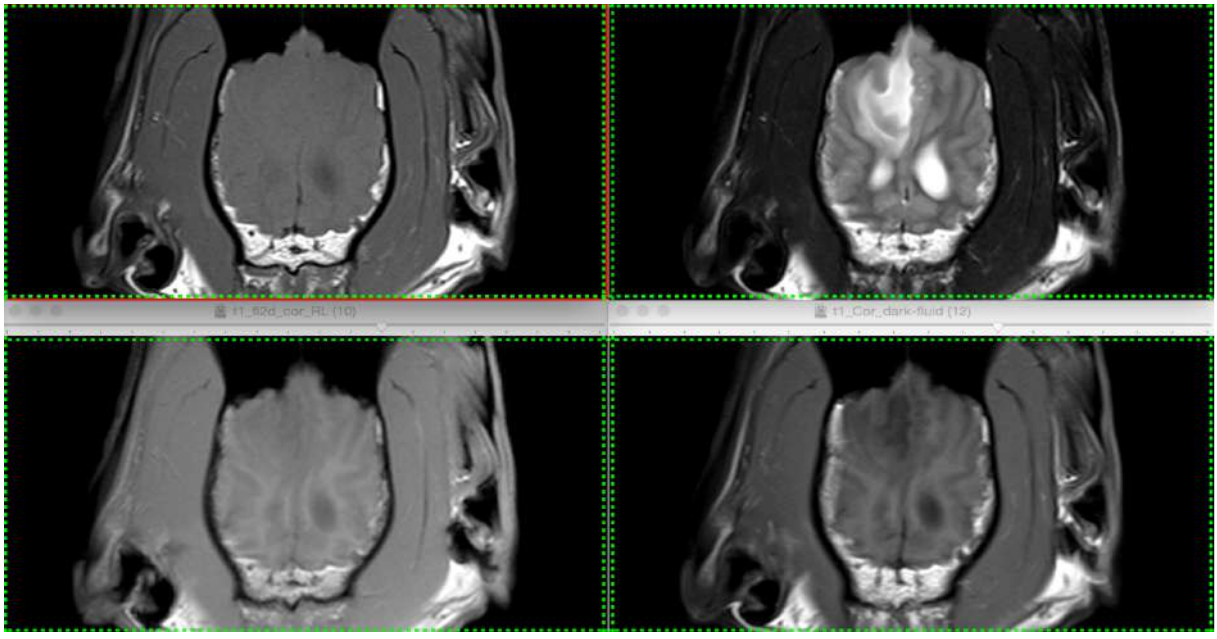

Figure 3. Olfactory neuroendocrine carcinoma in the brain of dog, showing marked perilesional vasogenic edema

bulb in an 8-year-old female golden retriever, showing isointensity on T1 and T2-weighted MRI images, which was enhanced subsequent injection of 0.1 mmol/kg of the contrast medium gadoteridol. After histopathological examination, they diagnosed the mass as olfactory neuroblastoma (Kitagawa et al., 2006).

The MRI images in this dog were similar to the previous report mentioned above, but from our histopathologic examination findings, the mass was identified as olfactory NE carcinoma. Studies of canine nasal tumors suggested that adenocarcinoma, transitional carcinomas (nonkeratinizing squamous cell carcinomas), and squamous cell carcinoma are more common. In contrast, olfactory NE carcinoma, ol-

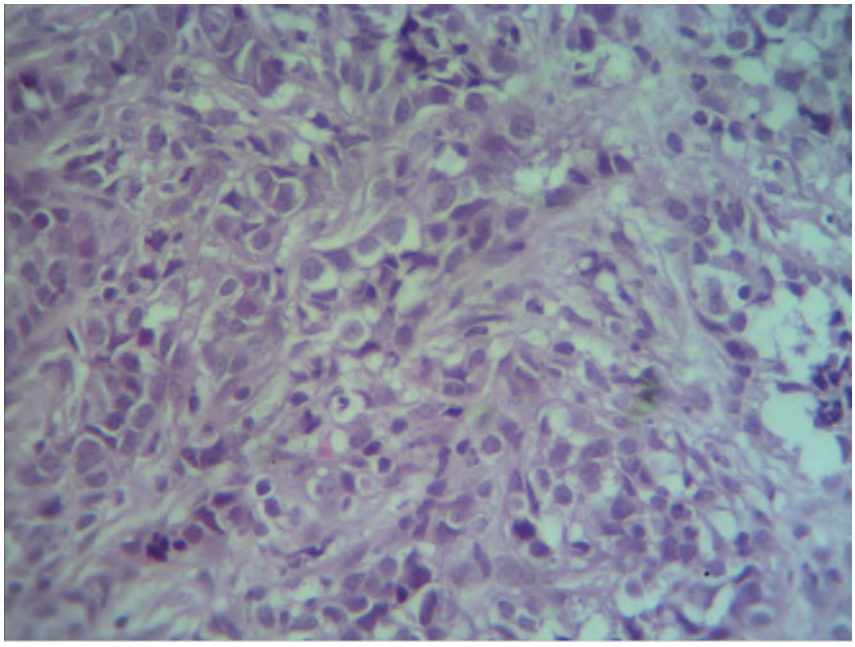

Figure 4. Microscopic appearance of the tumor

Note: Manifesting densely packed, uncommon basophilic cells, fibrillary connective tissue, and vascularity; natural black 1 and eosin stain, at x400 magnification.

factory neuroblastoma, fibrosarcoma, chondrosarcoma, osteosarcoma, and undifferentiated reticulum cell sarcoma are infrequently noted (Ashley, 1990; Patnaik, 2017; Ogilvie & LaRue, 1992) with prevalent MRI features. Based on somewhat similar MRI characters of different nasocranial neoplastic lesions, the authors consider that olfactory NE carcinoma should be regarded as one of the diagnostic imaging differential diagnoses.

Ethical Considerations

Compliance with ethical guidelines

All ethical principles are considered in this article.

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Authors' contributions

All authors equally contributed to preparing this article.

Conflict of interest

The authors declared no conflict of interest.

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مطالعه موردی

ویژگی‌های تصویربرداری رزونانس مغناطیسی کارسینوم نورواندوکرین بویایی در سگ

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چکیده

کارسینوم نورواندوکرین بویایی در حیوانات کوچک نادر است. یک سگ ۴ ساله ماده نژاد مخلوط با علائم بی‌حالی و با سابقه کاهش وزن، کاشکسی، پاروکسیسم، خونریزی از بینی، عدم وجود رفلکس نور در چشم چپ و لنگش درجه ۴ در اندام جلویی چپ ارجاع داده شد. در تصاویر تصویربرداری تشدید مغناطیسی(ام آر آی)، یک ضایعه توده فضاگیر خارج مغزی که از حفره بینی تا حباب بویایی لوب قدامی مغزی همراه با تخریب صفحه کریبریفرم مشاهده شد. تشخیص اولیه نئوپلازی نازوکرانیال درجه بالا در نظر گرفته شد و یافته‌های هیستوپاتولوژیک کارسینوم نورواندوکرین بویایی با درجه بالا را تأیید کرد.

کلیدواژه‌ها: کارسینوما، سگ، تصویربرداری رزونانس مغناطیسی، بینی، نورواندوکرین

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