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Congenital Mature Intracranial Teratoma in a Pampas Deer (*Ozotoceros bezoarticus*) in Brazil

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ABSTRACT: We describe a congenital mature intracranial teratoma in a Pampas deer (*Ozotoceros bezoarticus*) in southern Brazil. We found an irregular, spongy, space-occupying mass in the brain. The tumor consisted of well-differentiated tissues that derived from all three germ layers.

Teratomas are rare germ cell neoplasms composed of tissues derived from at least two, but usually three germ layers (Horowitz and Hall 1991). Histologically, teratomas are classified as mature or immature based on the presence of differentiated tissues or immature elements, respectively, and are anatomically divided into gonadal or extragonadal (Lakhoo 2010). Most teratomas described in domestic animals (Miyoshi et al. 2001; Catone et al. 2004; Headley et al. 2006) and humans (Jennings et al. 1985; Horowitz and Hall 1991) are gonadal. Extragonadal teratomas have been described in the placenta of a horse (*Equus caballus*; Gurfield and Benirschke 2003), adrenal gland of ferrets (*Mustela putorius furo*; Williams et al. 2001), the umbilical cord of a giraffe (*Giraffa camelopardalis reticulata*; Murai et al. 2007), skin of a roe dear (*Capreolus capreolus*; Barlow and Couper 2006), and kidney of a llama (*Lama glama*; Patel et al. 2004). Additionally, extragonadal intracranial teratomas were reported in a rabbit (*Oryctolagus cuniculus*; Bishop 1978), dog (*Canis lupus familiaris*; Patnaik and Nafe 1980), cat (*Felis catus*; Chénier et al. 1998), and alpaca (*Vicugna pacos*; Hill and Mirams 2008). We describe a congenital mature intracranial teratoma in a deer.

A young female Pampas deer (*Ozotoceros bezoarticus*) was found stranded and unable to move in a mud-laden pit at a natural reserve on the outskirts of the city of Telêmaco Borba, State of Paraná, southern Brazil. The animal was blind, with motor incoordination, and was maintained alive for 10 d. The deer received parenteral hydration and nutrition before dying spontaneously.

Significant pathologic alterations were restricted to the brain. Grossly, the sulci were shallow, and the gyri distended. A sagittal section revealed a 3.5×4.5-cm, irregular, grey-to-whitish, soft, spongy, space-occupying intracranial mass (Fig. 1A) that extended toward the optic chiasm, third ventricle, hypothalamus, and thalamus. The pituitary gland was not found. The tumor was well demarcated, protruded slightly from the brain, and contained various cystic areas; most cysts contained a serous or gelatinous secretion. Samples of multiple tissues were fixed in 10% neutral buffered formalin, routinely processed for histology, and stained with H&E.

Histologically, the tumor contained numerous cystic structures that were interconnected by a solid, but sometimes loose, fibrous stroma. The nervous tissue adjacent to the tumor had areas of malacia, neuropil vacuolization, neuronal shrinkage, with hypereosinophilia and karyorrhexis of neurons and glial cells. Two types of cystic structures were observed: large, irregularly shaped, dilated cysts that were lined predominantly by a stratified keratinized squamous epithelium that transformed into a pseudostratified or ciliated epithelia (Fig. 1B, C); and smaller

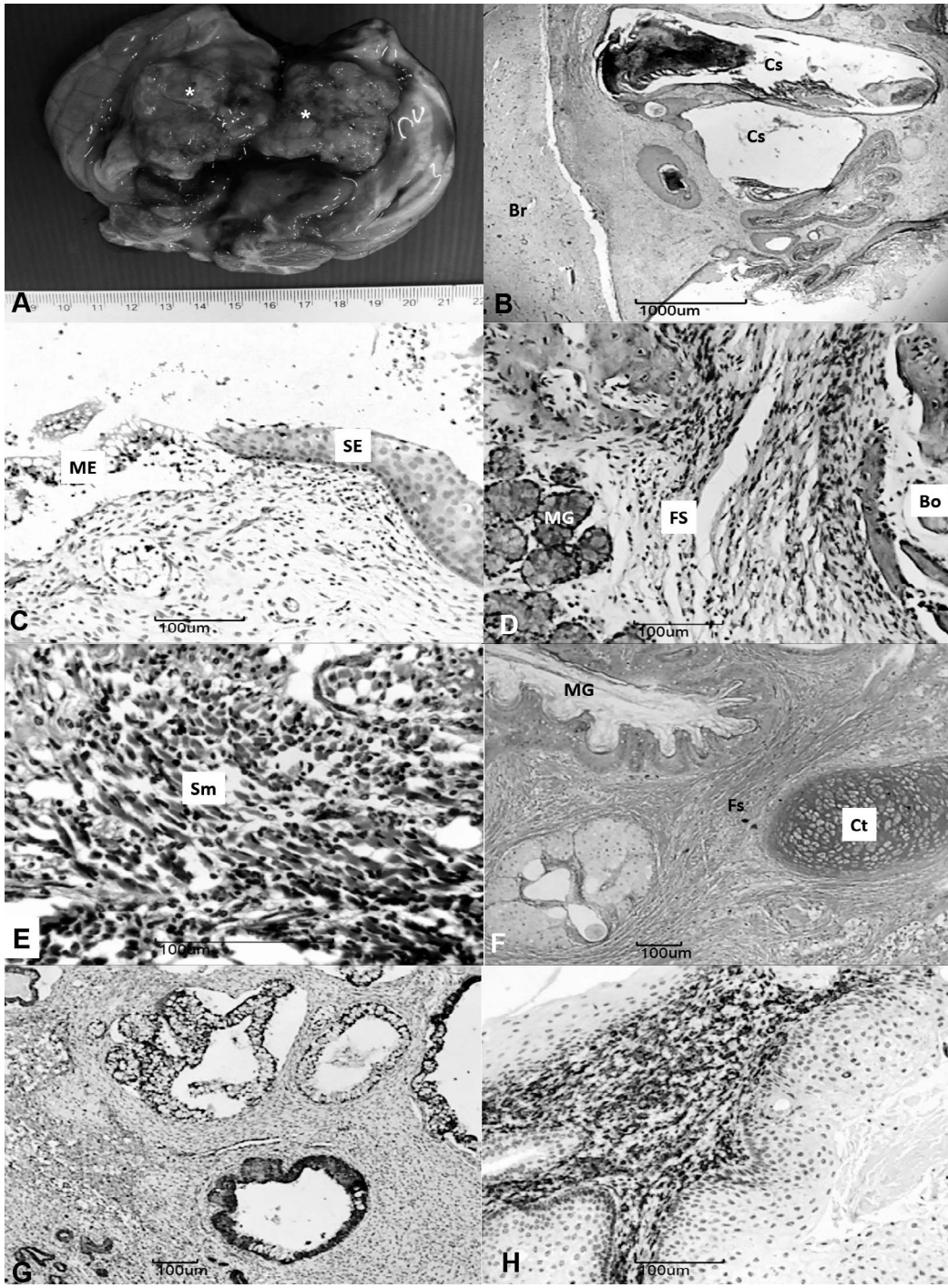

FIGURE 1. Gross and microscopic images of an intracerebral teratoma in a Pampas deer (*Ozotoceros bezoarticus*). (A) Brain, sagittal section demonstrating the space-occupying intracerebral mass (*); scale in centimeters. (B) Several dilated and enlarged cystic structures (Cs) within the tumor are adjacent to the nervous tissue (Br); H&E stain. (C) The enlarged Cs are lined by a predominant squamous epithelium (SE) that was transformed into a mucouslike epithelium (ME). (D)–(F) The fibrous stroma (Fs) contained islands of solid bone (Bo), mucous glands (MG), smooth muscle (Sm), and cartilage (Ct). (D) Periodic acid–Schiff

cystic structures, lined by a pseudostratified epithelium containing goblet cells. The larger cystic structures contained variable amounts of loose, irregularly arranged keratin flakes, resulting in keratin lakelike formations (Fig. 1B). Smaller cysts contained a mucinouslike secretion. Intermingled between these cystic structures were haphazard accumulations of sebaceous and seromucus glands, hair follicles with cutaneous adnexa, smooth and striated muscle, and islands of bone and cartilaginous tissues (Fig. 1D–F) within a mesenchymal base consisting of normal-appearing fibroblasts.

We stained sections of the neoplasm with the Masson's trichrome, alcian blue, and periodic acid–Schiff reaction. The alcian blue stain identified numerous goblet cells within the epithelial cystic structures and seromucus glands, in addition to intraluminal secretion, myxoid connective tissue, and cartilage. All of these structures, except the myxoid connective tissue, were positive by the periodic acid–Schiff reaction. The Masson's trichrome stain easily identified muscular and bony tissues.

Sections of the neoplasm were submitted to immunohistochemistry for cytokeratin (AE1/AE3 clone) and vimentin (V9 clone). Immunohistochemistry confirmed the histopathologic features of the teratoma, in which all epithelial-appearing structures were immunoreactive to pancytokeratin (Fig. 1G), while the mesenchymal components were vimentin positive (Fig. 1H).

We made a diagnosis of teratoma because the neoplastic growth was composed of tissues derived from all three germ layers (ectoderm, endoderm, and mesoderm). In addition, we called the tumor a congenital mature intracranial teratoma because it originated from a neonate, was located at the diencephalic region, and contained a wide array of well-differentiated tissues.

Descriptions of intracranial teratomas in domestic or wild animals are rare and have occurred near the thalamic and hypothalamic regions of a cat (Chénier et al. 1998), the hypothalamic region of a dog (Patnaik and Nafe 1980) and a rabbit (Bishop 1978), and another extended from the dura mater in an alpaca (Hill and Mirams 2008). We found no cases of intracranial teratomas in deer in major online databases, although Barlow and Couper (2006) reported a cutaneous teratoma in a roe deer. Consequently, this case may be the first description of a congenital intracranial teratoma in a deer and may contribute to the documentation of this unique lesion of mammals.

In human medicine, congenital intracranial teratomas are rare, representing 2–4% of all teratomas, and accounting for approximately 50% of brain tumors diagnosed in neonates (Lakhoo 2010). Human intracranial germ cell tumors (germinoma, teratoma, embryonal carcinoma, ectodermal sinus tumor, and choriocarcinoma) originate between the suprasellar cistern and the pineal gland, near the third ventricle (Jennings et al. 1985). Neonatal intracranial teratomas are more frequently observed at the pineal gland but can occur in the hypothalamus, ventricles, cavernous sinus, cerebellum, and suprasellar region (Lakhoo 2010). Previous teratomas described in animals were located near the hypothalamic region (Bishop 1978; Patnaik and Nafe 1980; Chénier et al. 1998), as in our case. Germ cell tumors are thought to originate from misplaced components of embryologic organs or structures (Jennings et al. 1985) or from germ cells that became sequestered in the cranium during intraembryonal migration (Chénier et al. 1998) and represent mature or immature differentiation of the embryonic layers (Horowitz and Hall 1991). The main differential diagnoses based on the anatomic location would include other germ cell tumors (germinoma, embryo-

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reaction; (E) and (F) Masson's trichrome stain. (G) Note immunohistochemical demonstration of epithelial and mesenchymal (H) components of the intracerebral teratoma by positive immunoreactivty to pancytokeratin (G) and vimentin (H); (G) and (H) immunoperoxidase. Scale bars, (B) 1,000 μm; (C)–(H) 100 μm.

nal carcinoma, endodermal sinus tumor, and choriocarcinoma) and craniopharingioma. However, histologically, only teratomas are composed of multiple germ cell layers.

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