Case Report
Granular cell variant of meningioma: a case report and review of the literature

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Received March 5, 2019; Accepted March 28, 2019; Epub June 1, 2019; Published June 15, 2019

Abstract: We describe a diagnostically challenging case of granular cell variant of meningioma. The tumor was observed in the temporal and parietal lobes of the right cerebrum. Microscopically, neoplastic cells with granular and eosinophilic cytoplasm were round, polygonal, or spindled with no apparent mitosis or atypia. Immunohistochemistry showed the neoplasm arose from meninges, cytoplasmic granules were positive for periodic acid-Schiff (PAS) staining, and electron microscopy showed abundant mitochondria in the cytoplasm. Therefore, we made the diagnosis of granular cell variant of meningioma after excluding the differential diagnoses through morphologic, immunohistochemical, special staining, and ultrastructural examination.

Keywords: Meningioma, granular cell meningioma, granular cell tumor, EMA, PR

Introduction
Granular cell subtype of meningioma has not been included in the updated World Health Organization (WHO) classification of brain tumors [1] because only a few cases of meningeal granular cell variant of meningioma have been reported to date [2-6], and its relationship with arachnoid cells is uncertain. Therefore, we share here a rare and diagnostically challenging case of granular cell meningioma, and present a literature review.

Materials and methods
Clinical materials
A 49-year-old woman had an initial manifestation of walking unsteadily. Magnetic resonance imaging (MRI) demonstrated a lobulated mass measuring 5.3 × 6.7 × 5.2 cm in size and located in the right temporal and parietal region. The lesion demonstrated hypointense signal on T1W1 and slight hyperintensity on T2W1. After Gd-DTPA injection, obvious inhomogeneous enhancement was seen. In the center of the tumor, cystic necrosis was seen. Moderate edema was found around the tumor; the lateral ventricle was compressed, and the midline structures shifted to the left (Figure 1). The patient underwent complete surgical excision of the mass with craniotomy performed under a microscope. Intraoperatively, the surgeons found that the mass was gray in color and soft in nature, with a clear border around the tumor. However, the adjacent dura mater was compressed.

Methods
Postoperatively, the tumor sample was routinely processed using 10% neutral-buffered formalin fixation, paraffin embedding, standard hematoxylin-eosin (H&E), immunohistochemistry (streptavidin-peroxidase conjugate [SP] method), and periodic acid-Schiff (PAS) staining. The following antibodies were used in our experiments: EMA, PR, CD68, GFAP, S-100, Olig-2, NSE, ER, Lysozyme, NF, CD163, STAT6, Vim, CD34, CK-pan, SOX10, synaptophysin, desmin, CD117, SMA, DOG-1, H-caldesmon, E-cad, CD21, and Ki-67, which were all purchased from FuZhou Maixin Biotechnology Development Co., Ltd. The electron microscopy...
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Results

H&E staining showed round, polygonal, or spindled neoplastic cells, which were bundled in whorls, fibrous, or fascicular arrangements, and had granular eosinophilic cytoplasm with low nuclear:cytoplasmic ratio and minimal nuclei pleomorphism with smooth nuclear membranes (Figure 2A). Chromatin distribution was even; however, the staining intensity ranged from darkly basophilic in some cells to lightly basophilic in others. The nucleoli were only rarely observed, and no karyokinesis was found.

Immunohistochemical analysis revealed that the tumor was positive for EMA, PR, CD68 (Figure 2B-D), CD163, STAT6, E-cad, vim, and synaptophysin; negative for GFAP, S-100 (Figure 2E, 2F), Olig-2, NSE, ER, lysozyme, CD34, CK-pan, SOX10, desmin, CD117, SMA, DOG-1, H-caldesmon, and CD21; and had a low Ki-67 index. A few cells were NF positive.

Cytoplasmic granules were positive by PAS (Figure 2G).

Electron microscopy showed abundant chondrosomes without other special components in the cytoplasm (Figure 2H).

Discussion

Granular cell tumor (GCT) is a benign neoplasm with eosinophilic, granular cytoplasm and round or polygonal cell bodies, which was first described by Abrikosoff [7] in 1926 and therefore also named as Abrikosoff’s tumor. Even though GCT was originally considered as granular cell myoblastoma [8], GCT was identified as originating from peripheral nerve because of its close association with peripheral nerves and differentiation of Schwann cells suggested by electron microscopic examination and immunohistochemistry. GCT can occur in many areas; however, most cases are located in the skin and subcutaneous tissue of the trunk, extremities, and the head and neck [9, 10]. The tongue is the most common single site, accounting for about a quarter of the cases. In the CNS, the common locations of GCTs were the suprasellar area [5], cervical spinal cord [4], cerebellum [6], and unspecified intracranial locations [11].

In this article, we described a rare case of an intracranial mass arising from the meninges, although containing some GCT features. The immunohistochemical findings of this case support the diagnosis of GCT of meninges. EMA and PR immunoreactivity and the absence of GFAP, S-100, and Olig-2 revealed that the present neoplasm arose from meninges and not astrocytes and oligodendrocytes at the molecular level, even though others reported that some GCTs were GFAP positive and probably represent granular variants of astrocytoma [11]. CD68 immunoreactivity of neoplastic cells was also consistent with findings of some studies [6]; however, not with others [2], indicating CD68 was not a specific histiocytic marker.

S-100 is usually positive in extracranial GCT, although it can be negative in those of the CNS [6]. However, in a study with domestic animals [12], most of the neoplastic cells were strongly

Figure 1. A 49-year-old female with lesion in the right temporal and parietal region. A: MRI plain scan image (T1). B: MRI plain scan image (T2). C: MRI enhanced scan image (T1).
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positive for S-100 protein and negative for GFAP. In our case, the neoplastic cells were negative for S-100, consistent with Vang’s report [6]. Though S-100 positivity is one of the common features of GCT, especially for soft tissue GCT [13-15], the fact that this case was S-100 negative does not exclude the diagnosis.

Only abundant chondrosomes were observed in the electron micrograph, without other apparent and special materials. This may be because the electron microscopic specimen was from the specimen fixed by conventional formalin, making some structures not particularly clear, including the link between cells.

The differential diagnosis includes reactive histiocytic proliferations, common subtypes of meningioma, and metastatic tumors. Reactive histiocytic proliferations usually have multinucleated cells, foreign bodies in cells, hemosiderin or hemorrhage, and surgery or trauma history, which were not seen in this reported case. Moreover, the neoplastic cells were positive for EMA and PR, indicating meningeal tissue derivation. The common subtypes of meningioma and metastatic tumors can also be excluded, as the case lacked histologic features of common meningioma, and was negative for CK-pan and without evidence of mitosis or atypia.

Therefore, we gave a challenging diagnosis: granular cell variant of meningioma, after excluding the differential diagnoses using a combination of morphologic features, immunoreactivity, PAS and electron microscopy examination.

Acknowledgements

The authors would like to appreciate Mr. Zhongling Wang and Guoxin Song for assistance in the interpretation of MRI images, immunohistochemistry and electron microscopy examination.

Disclosure of conflict of interest

None.

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