Cranial granular-cell tumor of the trigeminal nerve

Case report

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Granular-cell tumors are exceedingly rare neoplasms in the central nervous system. Their histogenesis has been a subject of longstanding controversy but substantial findings support the current theory of a Schwann cell origin. Other recent histopathological studies point to an astrocytic origin in those tumors which arise from the cerebral hemispheres. A case of a granular-cell tumor arising from the trigeminal nerve is described. The origin, clinical course, radiological features, and treatment of such unusual intracerebral tumors are discussed.

KEY WORDS • brain neoplasm • granular-cell tumor • trigeminal nerve • differential diagnosis

Granular-cell tumors (GCT) were first described in 1926 by Abrikossoff, who postulated a myogenic origin and hence the name “granular-cell myoblastoma.” More recently, histochemical, immunoperoxidase, and microscopic studies favor a Schwann cell origin. These uncommon neoplasms are usually found in the oral cavity, mainly on the tongue (in more than 40% of cases), and in the skin. A 2:1 female to male ratio prevalence has been noted, with a peak in the fourth to sixth decades. Another characteristic situation is the occurrence of granular-cell tumors on the gum pads in the newborn much like a congenital benign neoplasm or congenital epulis. Granular-cell tumors of the central nervous system are very rare. There is a slight predilection for occurrence in the pituitary gland, especially in the neurohypophysis, and sporadic cases of cranial and peripheral nerve involvement have also been described. We report a case of a granular-cell tumor arising from the fifth cranial nerve that resembled a trigeminal neurinoma.

Case Report

This 42-year-old man suffered from a left-sided trigeminal neuralgia for 3 years, and despite medical therapy, the symptoms became progressively worse during the 3 months prior to his admission to our institution.

Neurological Examination. A neurological examination disclosed a hypesthesia in first, second, and third divisions of the fifth cranial nerve and a significant weakness of the muscles; namely, the temporal, masseter, and pterygoid on the left side. On contrast-enhanced computerized tomography, a mass attached to the Meckel’s cave that enlarged the foramen ovale and partially destroyed the petrous apex was revealed (Fig. 1). Magnetic resonance (MR) imaging showed a 3 x 2-cm tumor on the trigeminal ganglion that invaded the cavernous sinus and enhanced homogeneously on a gadolinium-enhanced T1-weighted sequence (Fig. 2).

Operation. A left frontotemporal craniotomy using a transsylvian approach revealed a hard tumor mass that was very adherent to the surrounding structures and invaded the cavernous sinus. The tumor was also very adherent to the carotid artery and trigeminal nerve. A piecemeal tumor removal was accomplished with preservation of the surrounding neurovascular structures.

Pathological Examination. The tumor specimens were embedded in paraffin and examination by microscope showed that the tumor consisted of medium-sized cells in nests divided by irregular thin connective tissue septa with small blood vessels (Fig. 3). The cells showed broad cytoplasm with distinct granules,
periodic acid-Schiff (PAS) positivity and medium regular round nuclei with inconspicuous nucleoli. In addition, mitosis was absent.

Immunohistochemistry examination using the alkaline phosphatase antialkaline phosphatase (APAAP) technique revealed positive staining of the cytoplasm for S-100 protein, neuron-specific enolase, vimentin, Leu7, and CD68.* Staining for keratin, glial fibrillary acid protein, synaptophysin, chromogranins, prolactin, and MiB1 was negative. The final diagnosis was granular-cell tumor.

**Postoperative Course.** The postoperative course was uneventful. The trigeminal pain cleared and the patient was discharged with unchanged slight left-sided trigeminal hypesthesia and weakness of the masticatory muscles.

**Discussion**

**Literature Review**

Since 1926 when Abrikossoff first described the granular-cell tumor as originating from muscle and called it “granular cell myoblastoma,” several reports concerning its origin have been made but unfortunately until now without a consensus.33 Granular-cell tumors arise in different parts of the body, in particular the tongue, subcutaneous tissue, and breast. Other sites such as urogenital, gastrointestinal, and respiratory tract have also been described.3,12,33

Baden, et al.,4 have proposed three main theories concerning the origin of granular-cell tumors: neurogenic, myogenic, and histiocytic. Recent advances in the electron microscopic and immunohistochemical studies suggest a Schwann cell origin, based primarily on the positivity of the cytoplasm for S-100 protein and a negative reaction with myogenous markers.5,43 The positive staining of associated glycoprotein with Leu7 and electron microscopic findings of a continuous basal lamina around the tumor cells support this theory. Furthermore, Garancis, et al.,16 have postulated as the etiological factor a focal lysosomal defect on the Schwann cells.

The absence of S-100 protein in some cases and its positive staining with other cells such as melanocytes, epidermal Langerhans, and chondrocytes indicate, however, that this protein is not restricted to the glia and Schwann cells and cannot be considered “brain specific,” as previously described.4,20 With regard to those granular-cell tumors that arise from the cerebral hemispheres, Ule, et al.,40 noted glial filaments in some cases and therefore suggested a glial origin. Other authors, using electron microscopy, have observed the presence of both fibrillary and gemistocytic astrocytes.11,17,30,34

Granular-cell tumors are also encountered in the peripheral nervous system and well-documented cases have been published showing the involvement of the radial, median, sciatic, and recurrent laryngeal nerves.10,35

Granular-cell tumors are rarely encountered in the brain, especially in the neurohypophysis and the orbit.19 These tumors are usually benign, slowly growing tumors, clinically silent, and mostly incidentally found at autopsy. Enzinger and Weiss5 judged that 2% of all granular-cell tumors were malignant. In 1983, Boyce and Beadles8 described the first case in the neurohypophysis and termed it “choristoma,” which indicated its hamartomatous origin during development of the pituitary gland.

More uncommonly, granular-cell tumors can affect the cerebral hemispheres or the intracranial

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* Antibodies supplied by the following: S100 protein, neuron-specific enolase, vimentin, Leu7, CD68, glial fibrillary acid protein, and chromogranins from Dako, Hamburg, Germany; prolactin and MiB1 from Dianova, Hamburg, Germany; keratin from Becton-Dickinson, Heidelberg, Germany; and synaptophysin from Biostest, Dreieich, Germany.
Trigeminal granular-cell tumor

A granular-cell tumor of the trigeminal nerve is exceptionally rare. To our knowledge only two cases of trigeminal granular-cell tumors have been reported. Rao, et al.,\textsuperscript{31} described the case of a tumor that arose from the mandibular division. The tumor was firm, encapsulated, and subtotally removed. Facial nerve involvement has been described by May, et al.\textsuperscript{25}

Concerning the cerebral hemispheres, several authors have reported the presence of an astrocytic population that is either benign or malignant. Kornfeld\textsuperscript{21} documented two cases of granular-cell glioblastomas and suggested that the granular cells had developed from neoplastic astrocytes, rather than consisting of a second component. The tumors he studied were predominantly subcortical, and total surgical removal was usually not possible due to extensive infiltration of the tumors into the surrounding structures.

Diagnosis and Treatment

Because of the usual lack of malignant features in the pathological examination, Gambou\textsuperscript{15} classified malignant granular-cell tumors into the following two types: 1) histologically and clinically malignant, and 2) histologically benign but clinically malignant. Benign and malignant granular-cell tumors are very similar in their histological features and even metastasizing granular-cell tumors that are histologically indistinguishable from benign types have been reported.\textsuperscript{12,38} An extensive review of the literature has suggested that rapid growth, invasive features, and local recurrence are strong clinical indicators of malignant potential despite pathological diagnosis.\textsuperscript{12,38}

Computerized tomography of the brain usually shows a well-defined, rather rounded mass without calcification, which enhances uniformly after administration of contrast medium.\textsuperscript{6,28,31} Only occasional descriptions of MR imaging studies have been published, and these usually depict a solid, round mass, frequently with a homogeneous contrast enhancement in T\textsubscript{1}-weighted images. There is no definitive finding on cerebral angiography.\textsuperscript{6,7} Becker and Wilson\textsuperscript{6} and other authors observed a tumor blush in some cases; however, definitive diagnosis was always reached only by histological examination.

Operation is the treatment of choice for intracranial granular-cell tumors. Unfortunately, total removal using microsurgery is not always achieved, especially when extensive surgical excision would produce unacceptable morbidity. Adjuvant radiotherapy is a controversial issue. Albuquerque, et al.,\textsuperscript{2} reported 10 cases of cerebral granular-cell tumors in which radiotherapy was administered with no benefit. Becker and Wilson,\textsuperscript{6} and Harris, et al.,\textsuperscript{17} also concluded that radiation therapy neither prolongs survival nor changes the outcome for the patients. On the other hand, some authors have advocated that adjuvant therapy be considered in certain tumors with a pathological and/or clinical criterion of high risk for recurrence, especially when total surgical removal is not possible.\textsuperscript{28,32}

Conclusions

Intracranial granular-cell tumors are very rare, and until now there has been no definitive proof that these neoplasms always have the same histogenesis. Depending on the location of the tumor, different histopathological patterns may be established (such as, astrocytic, Schwann cell, and histiocytic).\textsuperscript{26,39} Their clinical course seems usually to be benign, and total surgical removal is the primary treatment. Further studies need to show the effectiveness of adjuvant radiotherapy for it to be used principally in malignant cases.

References

8. Boyce R, Beadles CF: A further contribution to the study

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