Temporal lobe tumor demonstrating ganglioglioma and pleomorphic xanthoastrocytoma components

Case report

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The case is reported of a 16-year-old boy with a left temporal lobe tumor composed of a ganglioglioma and a pleomorphic xanthoastrocytoma. Histologically, the tumor had two different components. One component involved the cortex of the left posterior temporal lobe and showed an aggregation of neuronal cells with an astroglial stroma. Ultrastructurally, numerous dense-cored vesicles, diagnosed as ganglioglioma, were found in the neuronal cells. The other component involved the adjacent cortex and white matter of the left anterior temporal lobe and the surrounding subarachnoid space. This was composed of pleomorphic cells with many multinucleated giant cells and occasional foamy cells. Most of the tumor cells were positive for glial fibrillary acidic protein. These features correspond well to earlier descriptions of pleomorphic xanthoastrocytoma. At 24 months following total tumor extirpation, the patient is alive and has had no evidence of tumor recurrence.

Key Words: brain neoplasm · pleomorphic xanthoastrocytoma · ganglioglioma · astrocytoma

Gangliocytomas and gangliogliomas are central nervous system tumors composed of mature ganglion cells and various amounts of glial cells. They are possibly the result of dysembryoplasia. On the other hand, pleomorphic xanthoastrocytomas are defined as superficially located supratentorial gliomas. The pleomorphic xanthoastrocytoma is a somewhat controversial entity: morphologically, it resembles fibrous histiocytoma; however, its astrocytic origin has recently been confirmed.

Ganglioglioma and pleomorphic xanthoastrocytoma are both rare brain tumors affecting young patients and both have a relatively favorable prognosis. The temporal lobe is one of the more frequent sites for their occurrence. They are commonly accompanied by a marked mesenchymal reaction (desmoplasia). Recurrent tumors after a protracted clinical course tend to manifest features of a malignant glioma. Although these two tumors have similarities, a case of coexisting ganglioglioma and pleomorphic xanthoastrocytoma has not previously been reported to our knowledge. We describe such a case which we hope will contribute to the histogenetic understanding of several types of brain tumors occurring in young patients.

Case Report

This 16-year-old boy was admitted to our hospital with a 3-month history of generalized seizure.

Examination. Neurological examination revealed no obvious abnormalities, and laboratory data were within normal limits. Computerized tomography scans showed a ring-like calcified low-density lesion, 4 × 3 cm in size, in the left temporal lobe (Fig. 1 left). Magnetic resonance imaging with homogeneous enhancement demonstrated a demarcated tumor with cystic areas extending from the surface of the temporal lobe to the wall of the lateral ventricle (Fig. 1 right). No evidence of mass effect was observed. Carotid angiography demonstrated an avascular mass. The preliminary diagnosis was a glioma.

Operation. A left temporal lobectomy was performed. The tumor, which was found to be covered by a small arachnoid cyst in the temporal lobe containing...
a hematoma, was excised. Postoperative irradiation was administered with 50 Gy delivered to a limited left temporal field. Twenty-four months after the surgical treatment, the patient remains well except for right upper quadrant hemianopsia. He has had no evidence of tumor recurrence.

Pathological Examination. The surgical specimens were fixed with phosphate-buffered 4% paraformaldehyde and embedded in paraffin. The following stains were used: hematoxylin and eosin (H & E), reticulin silver impregnation, Klüver-Barrera, periodic acid-Schiff, and Bodian’s method. We performed immunohistochemical testing of the paraffin-embedded sections for glial fibrillary acidic protein (GFAP) using the peroxidase-antiperoxidase method, for neurofilament (200 kD + 70 kD) using monoclonal antibodies, and for leukocyte common antigen using the avidin-biotin-peroxidase complex method. We also used the murine monoclonal antibodies KP1 (anti-human macrophage, CD68) and MAC 387 (anti-human myeloid/histiocyte antigen), employing the labeled streptavidin biotin method. The type and dilution of the antibodies were as follows: GFAP (rabbit polyclonal antibody, x 500), neurofilament (mouse monoclonal antibody, x 25), leukocyte common antigen (mouse monoclonal antibody, x 50), and KPI and MAC 387 (mouse monoclonal antibodies, x 100).*

For electron microscopic examination, small fragments of tumor tissue were fixed with phosphate-buffered 3% glutaraldehyde-1% paraformaldehyde. The tissues were postfixed with 1% osmium tetroxide, dehydrated through a graded ethanol series, and embedded in Epon 812.

Histologically, the tumor had two different components (Fig. 2), both of which contained many calciospherites. One component, located in the cortex of the left posterior temporal lobe, was composed mainly of mature neuronal cells showing abundant cytoplasm with Nissl substance and round vesicular nuclei with prominent nucleoli (Fig. 3a). Binucleated neuronal cells were occasionally observed, separated by a reticulin fiber network (Fig. 3b). Many cell processes were shown to be positive for neurofilament (200 kD + 70 kD) (Fig. 3c). Stromal glial cells were rare, and only a few GFAP-positive cells were found. This component, containing many neuronal cells, was surrounded by an area of well-differentiated astrocytoma with occasional neuronal cells (Fig. 3d). Electron microscopically, the neuronal cells contained numerous dense-cored vesicles, measuring 100 to 200 nm in outer diameter; synaptic structures were also seen (Fig. 3e). These findings were consistent with those of ganglioglioma.

The other tumor component involved the cortex and white matter of the left anterior temporal lobe with extension into the surrounding subarachnoid space. This component was demarcated from adjacent non-neoplastic cerebral tissue. The H & E-stained section showed compactly arranged tumor cells with marked cellular pleomorphism and nuclear atypism (Fig. 4a),

* GFAP, leukocyte common antigen, KPI, and MAC 387 antibodies supplied by Dakopatts, Glostrup, Denmark; neurofilament antibody supplied by Sambio bv, Amsterdam, The Netherlands.
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FIG. 3. a-d: Photomicrographs of the excised ganglioglioma component. a: Mature neuronal cells showing round vesicular nuclei with prominent nucleoli. Klüver-Barrera, × 380. b: Neuronal cells are separated by a reticulin fiber network. Reticulin silver impregnation, × 190. c: Distended neurites positive for neurofilament (200 kD + 70 kD) are shown. ABC method, × 500. d: Section showing well-differentiated astrocytoma containing a few neuronal cells and a calciospherite. H & E, × 190. e: Electron micrograph showing axosomatic synapses. Numerous dense-cored vesicles were found in the neuronal cytoplasm and processes. × 26,000.

FIG. 4. a-d: Photomicrographs of the excised pleomorphic xanthoastrocytoma component. a: Compactly arranged tumor cells are demonstrated with marked cellular pleomorphism and nuclear atypism. H & E, × 190. b: Tumor cells are surrounded by reticulin fibers. Reticulin silver impregnation, × 190. c: Most tumor cells are positive for glial fibrillary acidic protein (GFAP). PAP method, × 190. d: Section showing foamy cells positive for GFAP. PAP method, × 940. e: Electron micrograph of a multinucleated giant cell containing lipofuscin-like material and glycogen granules. × 5300.
but no mitotic figures or necrotic foci were found. Many of the tumor cells contained hyaline protein material in their cytoplasm, and occasionally foamy tumor cells were found. Some tumor cells were surrounded by reticulin fibers (Fig. 4b); most of these tumor cells, including foamy cells, were positive for GFAP (Fig. 4c and d). The tumor cells were negative for leukocyte common antigen, which is usually found in fibrous histiocytomas. Since the tumor cells were also negative for KP1 and MAC 387, this component was excluded from a histiocytic cell origin tumor. These findings were consistent with those of pleomorphic xanthoastrocytoma.

A sufficient ultrastructural study of the pleomorphic xanthoastrocytoma component was not possible because this component was scarce in the glutaraldehyde immersion tissue. However, the following findings were confirmed: 1) the tumor cells contained a large amount of intermediate filaments; 2) occasional giant cells contained glycogen granules and lipofuscin-like structures in their cytoplasm (Fig. 4e); and 3) no lipid droplets in the tumor cells and basal lamina were encountered.

We interpreted this case as an example of coexistence of both ganglioglioma and pleomorphic xanthoastrocytoma within the same temporal lobe tumor.

**Discussion**

One component of the temporal lobe tumor in this patient showed synaptic structure and numerous typical dense-cored vesicles that are observed ultrastructurally in the neuronal cytoplasm and processes. These findings are pathognomonic of a ganglionic origin. Since a well-differentiated astrocytoma surrounds the neuronal cells, this component could be diagnosed as a ganglioglioma. The other component fulfills the criteria of pleomorphic xanthoastrocytoma described by Kepes and associates: namely, marked pleomorphism containing giant cells and foamy cells, most of which were positive for GFAP; a reticulin fiber network; and absence of mitosis or necrotic foci. Lipid-laden tumor cells were relatively scarce in the specimens from our case. However, the patient has enjoyed long-term survival, and the histopathological findings with immunohistochemical studies were compatible with pleomorphic xanthoastrocytoma. Therefore, it was concluded that this temporal lobe tumor consisted of two different histological components, a ganglioglioma and pleomorphic xanthoastrocytoma.

We know of no reports of tumors consisting of both ganglioglioma and pleomorphic xanthoastrocytoma components. Reinhardt and Nahser reported a temporoparietal tumor composed of a peculiar growth of neurons, glial tumor cells containing multinucleated and pleomorphic cells, and strands of collagen. They diagnosed the tumor as a gliofibroma originating from hamartoma-like lesions. However, the neuronal component of their case did not manifest ganglionic features. Maleki, et al., described the case of a 15-year-old boy with a right parietal pleomorphic xantho-astrocytoma in which atypical ganglion cells with focal synaptic differentiation and intracytoplasmic dense membrane-bound neurosecretory granules were found; we suspect that their case may resemble ours. However, they considered that there were too few ganglion cells to qualify within the ganglioglioma group.

It has been proposed that gangliocytomas and gangliogliomas arise from the dysgenetic neuronal cell nests and are of hamartomatous origin. Some have accompanied anomalies of a congenital nature, such as glioneuronal ectopias in the leptomeninges or temporal cortex. VandenBerg, et al., reported 11 cases of "desmoplastic infantile ganglioglioma," which is a special form of embryonal brain tumor exhibiting divergent astrocytic and ganglionic differentiation. They described the histogenesis of astrocytic tumor cells of desmoplastic infantile ganglioglioma as originating from subpial astrocytes because these astrocytic tumor cells were often surrounded by basal laminae. Kepes, et al., considered that pleomorphic xanthoastrocytoma was derived from subpial astrocytes. Therefore, the histogenesis of ganglioglioma and pleomorphic xanthoastrocytoma may be closely related.

The features of our case include a close interaction of neuronal, glial, and mesenchymal cells and the formation of a highly complex tissue. Our case may represent more than a coincidental occurrence of a ganglioglioma and a pleomorphic xanthoastrocytoma. We propose that both components were the result of a common maldevelopmental basis such as failure of migration leading to an ectopic position of neuronal and glial cells with mesenchymal pial tissue in the temporal lobe. Careful observation of the brain region adjacent to pleomorphic xanthoastrocytomas using immunohistochemistry and electron microscopy may lead to more examples of this kind of mixed tumor.

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**References**


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