Ganglioglioma of the brain stem

Case report

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A case of brain-stem ganglioglioma is reported. A review of the literature revealed only 13 other reported cases. Brain-stem gangliogliomas usually become symptomatic in the first and second decades of life and involve the medulla and pons. Clinical improvement and prolonged survival have been reported after partial resection.

Key Words • ganglioglioma • brain-stem glioma • glioblastoma

Gangliogliomas are neoplasms composed of two types of cells: ganglion cells (neurons), which seem to arise from primitive neuroblasts and mature during growth, and glial cells, usually astrocytic, in various stages of differentiation.16 This rare lesion comprises less than 2% of all intracranial neoplasms,3,7,9 grows slowly, is predominantly composed of glial cells, tends to be circumscribed, and is most frequently found above the tentorium in or near the third ventricle, in the hypothalamus, or in the frontal or temporal lobes.2 A recent case of ganglioglioma of the brain stem prompted us to review the literature, and we were only able to find 13 case reports of brain-stem gangliogliomas. The clinicopathological features of all 14 cases are summarized here and are compared with features of other brain-stem tumors.

Case Report

This 19-year-old man was well until a year before admission to the hospital when he noticed slowly progressive right-sided weakness, beginning in his leg then involving his arm. His family noticed changes in his mood, withdrawal, a flat affect, and a monotonous voice. Three months before admission he noticed diplopia on left lateral gaze, then on both right and left lateral gaze. Images were side by side. During the week before admission he complained of headache and became lethargic. There were no neurological diseases in the family. The patient had no previous neurological problems, there was no evidence of disease in other systems, and there was no history of head trauma.

Examination. Neurological examination revealed a lethargic young man who was able to converse appropriately and had good recent and remote memory. He had intact higher cortical functions, and normal orientation. The optic discs were normal. Neurological deficits included bilateral abducens nerve palsies, complete on the left and partial on the right, right supra-nuclear facial weakness without sensory abnormality; right spastic hemiparesis with hyperactive stretch reflexes; unsustained right ankle clonus; and bilateral extensor plantar responses (Babinski sign). There was no evidence of sensory or cerebellar deficit.

Computerized tomography (CT) showed dilated ventricles including the upper portion of the fourth ventricle, narrowed sulci over the convexity of the brain, a mass in the left side of the rostral pons that showed no enhancement after contrast injection and had a density measurement (Hounsfield units) indicative of calcium (Fig. 1). Angiograms demonstrated no vascular blush but revealed evidence of small calcifications and a mass effect with anterior displacement of the basilar artery against the clivus and superior displacement of the midbrain (Fig. 2). A ventriculoperitoneal shunt procedure was followed by dramatic improvement in consciousness and in the sixth nerve palsies, but no change in the hemiparesis.

Operation. A suboccipital craniectomy through a
left paramedial incision was performed 10 days later. There was a mass distending the left side of the pons rostral to the seventh and eighth nerve roots, displacing the eighth nerve root rostrally and ventrally. The lesion was dark gray and firm. One-fourth of the mass was removed. There was no change in the patient’s neurological deficit after this procedure.

Pathological Examination. Microscopic examination of this portion of the mass revealed a neoplasm composed predominantly of fibrillary astrocytes with scattered large bizarre neurons that contained well-defined Nissl granules (Fig. 3 left). No binucleated neurons were seen. There were occasional perivascular Rosenthal fibers and scattered calcospherites (Fig. 3 right). There were no mitoses. Blood vessels were not hyperplastic.

Discussion

Courville' introduced the term "ganglioglioma" to describe tumors composed of ganglion cells and glial cells. Several reviews, 3, 5, 15, 20 emphasize the rarity of this neoplasm, its prevalence in the first three decades of life, its slow growth, and its tendency to calcify. Most of these tumors are found above the tentorium, mainly in the floor of the third ventricle, or in the temporal or frontal lobes. Because of the rarity of these lesions in the brain stem, we reviewed all 13 cases reported to this date and have added our case (Table 1). Seven of the 14 patients were in the second decade of life when diagnosis was made. Eight were males. The medulla was involved in 11 of the 14 cases. The duration of symptoms varied from 2 weeks to 15 years. In nine patients symptoms were present for more than 1 year before diagnosis. Only the last four cases had CT of the head (Cases 11 to 14): two of the lesions were isodense but enhanced after intravenous contrast injection. Two lesions had higher density than brain tissue and did not enhance after contrast injection. In seven cases, the diagnosis was made at autopsy.

Seven patients had surgical procedures: shunts and either biopsy (Cases 10, 12, and 14) or partial removal of the tumor (Cases 6, 9, 11, and 13). In all patients who underwent surgery there was some clinical improvement, and this was dramatic in some (Cases 9, 10, 11, and 13). The follow-up period ranged from 3 months to 2½ years. Only one patient had preoperative irradiation and chemotherapy (Case 13). No irradiation was given or no information was available in the rest of the cases. Hoffman, et al., 10 recently reported a mixed group of brain-stem tumors, including two gangliogliomas, 1 that he treated successfully by subtotal surgical excision. Improvements in surgical technique, shunting procedures, and the use of operative microscopes and ultrasonic surgical aspirators 6-8 may improve the surgical treatment of these tumors. 18

Brain-stem gliomas are a group of tumors seen in children usually in the first decade of life, with a peak incidence between 5 and 8 years of age. 1, 12, 14, 19 In most reviews, there has been a low rate of histological confirmation of the tumor type 1 or the reviewers included different histological types of tumors, such as astrocytomas, spongioblastomas, glioblastomas, ependymo-
Ganglioglioma of the brain stem

**FIG. 3.** Photomicrographs of the biopsy specimen. H & E × 155. *Left:* Pleomorphic fibrillary astrocytes and a large neuron are shown. *Right:* Section showing calcospherites in a fibrillary astrocytic background.

### TABLE 1
Clinical data in 14 cases of gangliogliomas of the brain stem*

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Authors &amp; Year</th>
<th>Age (yrs), Sex</th>
<th>Tumor Location</th>
<th>Duration of Symptoms</th>
<th>CT Scan</th>
<th>Surgery or Autopsy</th>
<th>Postop Follow-Up</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Pick &amp; Bielschowsky†</td>
<td>24, F</td>
<td>medulla, cervical cord</td>
<td>unknown</td>
<td>no</td>
<td>autopsy</td>
<td>incidental finding at autopsy in a patient with tuberculosis</td>
</tr>
<tr>
<td>2</td>
<td>Bielschowsky†</td>
<td>26, M</td>
<td>4th ventricle, pons, cerebellopontine angle</td>
<td>15 yrs</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>3</td>
<td>Foerster &amp; Gagel†</td>
<td>11, M</td>
<td>pons, medulla, upper cervical spinal cord</td>
<td>3 yrs</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>4</td>
<td></td>
<td>14, M</td>
<td>medulla, upper cervical cord</td>
<td>6 yrs</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>5</td>
<td>Richmond, et al., 1966</td>
<td>4, M</td>
<td>rt pons, cerebellopontine angle</td>
<td>2 wks</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>6</td>
<td>Tommasi, et al., 1966</td>
<td>23, M</td>
<td>medulla, cervical spinal cord</td>
<td>3–4 mos</td>
<td>no</td>
<td>partial removal of tumor</td>
<td>some improvement of quadripareisis</td>
</tr>
<tr>
<td>7</td>
<td>Feigin &amp; Budzilovich, 1974</td>
<td>18, F</td>
<td>cerebellum, pons, medulla</td>
<td>7 mos</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>8</td>
<td></td>
<td>9, F</td>
<td>midbrain, pons, medulla, cerebellum</td>
<td>7 yrs</td>
<td>no</td>
<td>autopsy</td>
<td>—</td>
</tr>
<tr>
<td>9</td>
<td>Garrido, et al., 1978</td>
<td>12, F</td>
<td>4th ventricle, medulla</td>
<td>2 yrs</td>
<td>no</td>
<td>partial removal of tumor</td>
<td>mild deficit 3 mos postop</td>
</tr>
<tr>
<td>10</td>
<td>Case 3</td>
<td>12, M</td>
<td>medulla, cervical spinal cord</td>
<td>1 yr</td>
<td>no</td>
<td>biopsy of tumor</td>
<td>mild deficit 18 mos postop</td>
</tr>
<tr>
<td>11</td>
<td>Case 9</td>
<td>13, F</td>
<td>4th ventricle, medulla, cerebellum</td>
<td>4 mos</td>
<td>dense lesion of 4th ventricle</td>
<td>partial removal of tumor</td>
<td>asymptomatic 2½ yrs postop</td>
</tr>
<tr>
<td>12</td>
<td>Friedman, et al., 1979</td>
<td>9, F</td>
<td>4th ventricle</td>
<td>4 mos</td>
<td>isodense mass in 4th ventricle</td>
<td>partial removal of tumor</td>
<td>improved clinically 15 mos postop</td>
</tr>
<tr>
<td>13</td>
<td>Epstein, et al., 1982</td>
<td>6, M</td>
<td>medulla, cervical spinal cord</td>
<td>16 mos</td>
<td>enhancing lesion of medulla &amp; spinal cord</td>
<td>partial removal of tumor (50%)</td>
<td>marked improvement; asymptomatic except for mild hypesthesia of V3 nerve; improvement of quadripareisis</td>
</tr>
<tr>
<td>14</td>
<td>Garcia, et al., 1984</td>
<td>19, M</td>
<td>midbrain, pons</td>
<td>1 yr</td>
<td>dense mass in upper brain stem</td>
<td>shunting followed by biopsy &amp; partial removal of tumor (25%)</td>
<td>improvement of sensormotor; no change in motor deficit 6 mos postop</td>
</tr>
</tbody>
</table>

* CT = computerized tomography.
† Cases reported in 1937 by Wolf and Morton.²⁰

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mas, or ependymoblastomas. In some series, the histological confirmation was made only at autopsy, and some of the reported cases may have a mixed histological pattern with areas of different degrees of astrocytic differentiation. Diagnosis during life has been made on the basis of the patient’s history, neurological examination, and neuroradiological findings suggestive of brain-stem enlargement. However, enlargement of the brain stem can be produced by lesions other than tumors, such as encephalitis, demyelinating processes, vascular diseases, and congenital defects. Emphasis has been given recently to the importance of tissue diagnosis, with biopsies in brain-stem gliomas and treatment by partial resection of some lesions or evacuation of cysts without change in operative mortality rates. Reigel, et al., were able to classify brain-stem tumors by histological type, concluding that astrocytomas were usually located in the upper brain stem and were associated with a better survival time than glioblastomas which were predominantly found in the medulla in patients who died within 9 months of the diagnosis.

Brain-stem gangliogliomas compared to brain-stem gliomas are seen in slightly older patients, more frequently involve the medulla, have a longer course before medical attention, are associated with a longer postoperative survival period, and are more often treatable by partial surgical resection. It is therefore important to attempt to differentiate brain-stem gangliogliomas from brain-stem gliomas, glioblastomas, and other lesions that may cause brain-stem enlargement such as anomalies of brain tissue or blood vessels, demyelinating processes, or inflammatory lesions. Clinicopathological features and radiological studies will be of increasing value in this effort.

References

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