Late appearance of meningioma at the site of partially removed oligodendroglioma

Case report

JUNICHI TANAKA, M.D., JULIO H. GARCIA, M.D., MARTIN G. NETSKY, M.D., AND J. POWELL WILLIAMS, M.D.

Departments of Pathology and Radiology, University of Maryland School of Medicine, Baltimore, Maryland, and Department of Pathology, University of Virginia School of Medicine, Charlottesville, Virginia

A case is presented in which a meningioma and a glioma grew in the region where, 23 years before, a glial tumor had been partially removed and irradiated. The authors suggest that surgical trauma and ionizing radiation may have influenced the tumor's development.

KEY WORDS • brain tumor • glioma • recurrent mixed tumor • radiation therapy • meningioma • oligodendroglioma

Several mixed intracranial neoplasms have been reported, including tumors having both mesenchymal and neuroepithelial origins. These cases include the coexistence of glioma with meningioma, lymphoma, and sarcoma, as well as others. The case presented here represents a rare example of an apparently mixed brain tumor in which cells of mesenchymal and neuroectodermal origins were found intracranially in adjoining areas. The case presented here represents a rare example of an apparently mixed brain tumor in which cells of mesenchymal and neuroectodermal origins were found intracranially in adjoining areas.

Case Report

First Brain Tumor

In September, 1949, the patient, who was then a 17-year-old girl, was admitted to the Hospital of the University of Virginia because of nausea, headaches, and visual disturbances, and the findings of decreased visual acuity, bilateral papilledema, and diplopia. After ventriculography revealed a large mass in the frontal horn of the left lateral ventricle, a left frontal craniotomy was performed and a large intraventricular tumor subtotally resected. Neoplastic tissue was removed until the blocked foramen of Monro had been opened but the surgeon stated that much tumor remained along the medial wall of the lateral ventricle. Histological preparations of this surgical specimen removed in 1949 showed small cells containing hyperchromatic nuclei and relatively scanty cytoplasm. The cells were arranged in sheaths and cord-like patterns, intersected by prominent vascular stroma. The tumor cells had moderately pleomorphic nuclei, ill-defined cytoplasmic outlines, and a suggestion of perinuclear halos. Occasional mitotic figures
Mixed brain tumor

were seen. Phosphotungstic acid hematoxylin (PTAH) stain did not demonstrate glial fibers among the tumor cells (Fig. 1). The histological diagnosis was oligodendroglioma. Shortly after surgery, the patient received 6660 rads to the head through four portals. The tumor dose was calculated as being 3663 rads. The patient was discharged in satisfactory condition on the seventh postoperative day.

Second Brain Tumor

The patient was admitted to the University of Maryland Hospital at the age of 40 years because of signs of recurrent brain tumor. During the intervening 22 years she had done well except for occasional seizures, for which she was treated with diphenylhydantoin sodium. In early January, 1974, while working as a microanatomy technician, she began suffering from daily headaches and her skill deteriorated. Within 2 weeks she became confused and disoriented, began to vomit, and developed a shuffling gait. When examined at the University of Maryland Hospital, she was disoriented and recent memory was impaired. She had a probable right homonymous hemianopsia. The left pupil was smaller than the right, but both reacted to light. There was nystagmus on gaze to the right. Motor activity was minimally diminished in the right arm where there was also a slight deficit in proprioception. Deep reflexes were more active on the right than the left. Electroencephalography revealed an epileptogenic focus in the left anterior quadrant and an accompanying diffuse encephalopathy. Radioisotope scan was positive in the left frontoparietal region. A left carotid arteriogram (Fig. 2) showed a large left frontal mass. The upper anterior portion of the mass was supplied from the callosomarginal artery and from the anterior falx branch of the anterior ethmoidal artery. This upper portion of the tumor showed a sunburst configuration and a delayed blush on the venous films, typical of meningioma. Along its inferior and posterior margins, there were multiple small abnormal arteries comparable to those more commonly seen in gliomas (Fig. 2).

Operation. A left frontal craniotomy was performed on February 1, 1974. Within a large zone of fibrous adhesions to the dura and at the site of the previous surgical incision, a large, firm, yellowish, tumor projected into the wound and compressed the adjacent cerebral tissue. Under the posterior aspect of this tumor, soft, dark, tumor tissue of a different sort extended toward the sphenoid wing. A cleavage plane was noted between the latter tissue and the adjacent brain. The large yellow neoplasm which was attached to the

Fig. 1. Histological preparations of the first tumor, removed at the age of 17. The cells have large nuclei and scanty cytoplasm; no specific patterns break the monotony of their arrangement. Left: PTAH, × 40. Right: PTAH, × 100.
falx medially was excised as a whole; it was firm, rubbery, homogenous, and weighed 45 gm. The softer second mass was removed by suction; samples weighed approximately 1.0 gm in aggregate.

Pathology. Microscopically, the large fibrous tumor was composed of elongated cells that formed whorls and frequent psammoma bodies. Individual tumor cells were interlaced with abundant collagen fibers and a few blood vessels (Fig. 3). Some islands of the same type of tumor were embedded in the fibrocollagenous tissue attached to the dura. The histological diagnosis was meningioma. The smaller, soft tumor consisted of cells having uniform, round or slightly oval nuclei, surrounded by scanty cytoplasm and frequent perinuclear halos. In some foci, the cells were arranged in a papillary or rosette-like pattern in which PTAH-positive glial fibers were recognizable (Fig. 3). Reticulin fibers could not be found by Wilder’s method. The diagnosis was a poorly differentiated glioma, with oligodendroglial, ependymal, and astrocytic

**Fig. 2. Arteriography of tumor recurrence.** Upper Left: Lateral projection shows downward and posterior displacement of the callosomarginal and pericallosal arteries and branches of the anterior Sylvian artery. The anterior ethmoidal (ant eth) branch of the ophthalmic artery can be seen entering the anterior fossa and supplying the anterior falx artery (ant falx). Upper Right: Enlargement of this view shows that the periphery of the large tumor (outlined by arrows) is delimited by abundant newly formed vessels and an early draining vein (most anterior arrow); both of these features are commonly seen in gliomas. In the upper portion of the tumor there is a “sunburst” appearance (crossed arrow) supplied by the anterior falcial and a branch of the pericallosal arteries, findings characteristic of a meningioma. Lower Left: Anteroposterior view shows a frontal shift of the pericallosal and callosomarginal arteries. The anterior falx artery ascends to the left of the midline and increases in caliber slightly as it reaches the upper part of the tumor. A large polar branch of the callosomarginal artery (arrow) enters the upper portion of the tumor.
Mixed brain tumor

Fig. 3. Photomicrographs characteristic of the two neoplasms resected 23 years after the first tumor removal. Upper: Meningiomatous portion with elongated, fusiform cells arranged in whorls. Psammoma bodies, now shown, were also easily demonstrated. H & E, × 25. Lower: Gliomatous portion of tumor. Small cells with a scanty cytoplasm are arranged in pseudorosette patterns consistent with oligodendrogioma. Lower Left: H & E, × 25. Lower Right: PTAH, × 100.

Clinical Course. Two weeks after craniotomy, the patient responded to commands with a few words or by shaking her head. One month postoperatively a pneumoencephalogram revealed dilated lateral ventricles, and a ventriculoatrial shunt was inserted. She began talking in short sentences several days later and was discharged with a slight paresis of the right leg. Subsequently she improved further, and was able to care for herself. Nine months after the second craniotomy she remains confined to her home, although needing minimal assistance.

Discussion

The contiguity of two different intracranial tumors in this patient suggests that the growth of one tumor may have been initiated by the presence of the other. Physical injury to the meninges during the first craniotomy could have been a stimulus for the growth of...
J. Tanaka, et al.

mucosal cells, and local proliferation of meningocytes may have caused the formation of an independent tumor at the site of surgical resection. Cushing and Eisenhardt\(^6\) regarded head trauma as a cause of intracranial meningioma. These authors stated that a link could be convincingly established in 33% of their 313 cases of intracranial meningiomas. This hypothesis, however, has not been widely accepted because the evidence is largely circumstantial.\(^9\) A major difficulty is that most patients who survive long after a craniotomy, if not cured, have recurrence only of the initial tumor. Even heavy radiation, a factor known to induce neoplastic growth after long intervals, seldom induces two types of tumor in the same patient.\(^6\)

Nevertheless, ionizing radiation as an etiological factor of intracranial meningioma must also be considered in this case, particularly in view of a report of two patients with gliomas who survived an initial operation and radiotherapy for 12 and 25 years, respectively, and in whom meningiomas were demonstrated at the site of the excised glioma.\(^9\) Furthermore, in a group of approximately 11,000 children who had received cranial radiation, the rate of intracranial meningioma was 0.4 per 1000 as opposed to 0.1 per 1000 in the control group.\(^9\)

In our experience, oligodendroglioma has been one of the least frequent components of a mixed intracranial tumor. Cerebral hemispheric oligodendrogliomas are often benign, as indicated by some postoperative survivals of 30 years or longer.\(^10\) Adequate histological criteria by which the more malignant examples of oligodendroglioma can be separated from those with a relatively benign course have not been developed. The presence of mitotic figures, usually associated with a rapid growth rate, is not necessarily accompanied by a more sinister prognosis after subtotal extirpation.\(^13,14,20\)

Although the opinion is widespread that gliomas soon recur if the tumor is not completely excised, Geissenger and Bucy\(^9\) described seven children with astrocytomas of the cerebellum who survived 12 to 39 years after incomplete removal. They speculated that the blood supply to the remaining tumor might have been sufficiently impaired and unable to sustain neoplastic growth, although the authors recognized that this explanation did not account for cures or for late regrowth when much of the tumor was undisturbed.

Another possibility is that immunological mechanisms are operative. Antibody-carrying lymphocytes may be cytotoxic when a "blocking" factor is absent from the serum.\(^9\) Most patients with cerebral astrocytomas harbor humoral factors against antigens that are demonstrable on the astrocytoma cell surface.\(^9\) Whether the mechanisms destructive to tumor cells are cell-mediated, humoral, or both is not yet known.

The presence of several glial elements in a given glioma is well recognized. According to Rubinstein,\(^12,18\) probably 50% of the tumors generally classified as oligodendroglioma in fact consist of a mixed-cell population that includes astrocytic and ependymal elements. This observation was confirmed in the case we have reported.

Acknowledgments

Sincere appreciation is expressed to James Dunn, Jr., M.D., who performed the second craniotomy and made important suggestions in preparation of the manuscript. The secretarial assistance of Mrs. Debra Haines is also gratefully acknowledged.

References

3. Cushing H, Eisenhardt L: Meningiomas. Their Classification, Regional Behavior, Life History and Surgical End Results. Springfield, Ill, Charles C Thomas, 1938

84 J. Neurosurg. / Volume 43 / July, 1975
Mixed brain tumor

10. Roberts M, German WJ: A long-term study of patients with oligodendrogliomas. Follow-up of 50 cases, including Dr. Harvey Cushing's series. J Neurosurg 24:697-700, 1966

Address reprint requests to: Julio H. Garcia, M.D., University of Maryland Hospital, 22 South Greene, Baltimore, Maryland 21201.