Gross Total Removal of Adult Brainstem Glioma
—Two Case Reports—

Yoshio TAKASATO, Toshinari ARAI, Yoshihisa OHTA and Kazuaki YAMADA*

Departments of Neurosurgery and *Clinical Laboratory (Pathology), Tachikawa National Hospital, Tachikawa, Tokyo

Abstract

Two adult patients with brainstem glioma were successfully treated surgically. A 37-year-old male had a dorsally exophytic pontine glioma developing from the fourth ventricular fundus, and another 27-year-old male an intrinsic nodular mesencephalic glioma. Preoperative magnetic resonance imaging clearly visualized the tumor margin in both cases, and showed the relationship between the tumor and brainstem structure accurately. The tumors were radically excised using intraoperative evoked potential monitoring, ultrasonic surgical aspirator, and microsurgical techniques. Surgery is indicated when the tumor margin in the brainstem and adjacent region is clear, and the approach is possible without affecting the functional prognosis.

Key words: brainstem glioma, surgical indication, gross total removal, magnetic resonance imaging, intraoperative evoked potential monitoring, ultrasonic surgical aspirator

Introduction

Surgical treatment of brainstem gliomas has achieved a more favorable prognosis during the past 10 years using computed tomography (CT) and magnetic resonance (MR) imaging guidance, especially in pediatric brainstem gliomas.1,2,4,6,7,9,13,15) Brainstem glioma is more common during childhood and in comparatively young adults. The predominant locations are the pons, medulla, and midbrain,14) and the pathophysiology is almost the same, although child and adult cases demonstrate a slight difference in the location of onset.14) Surgical intervention is indicated for the pontine dorsally exophytic type and the intrinsic type in the cervicomedullary junction.3,4,6,13) In recent years, tumor localization has considerably improved based on multiplane MR imaging,8,10,12) and ultrasonic surgical aspiration and intraoperative evoked potential monitoring have been introduced.11) These new methods can provide better surgical planning, safety and accuracy in the treatment of brainstem glioma.4,5,7)

Here we describe two adult patients with brainstem glioma in the pons and midbrain in whom gross total removal was successful.

Case Reports

Case 1: A 37-year-old male was admitted to our hospital because of visual disturbance on September 29, 1989.

Examination found decreased visual acuity associated with bilateral papilledemas, anisocoria (larger on the left than right), bilateral abducens paralyses, nystagmus to the right, and ataxic gait. CT scans demonstrated a tumor centering around the fourth ventricular lower edge and obstructive hydrocephalus (Fig. 1). Cerebral angiograms showed only an avascular mass.

External ventricular drainage was continued for 10 days. The tumor was partially removed on October 9. Local (31.5 Gy) and whole-brain (22 Gy) irradiation was given from October 25 to December 21. CT scans showed no reduction in tumor size, and the
symptoms exacerbated gradually. MR images demonstrated the exophytic brainstem glioma with a clear margin extending to the extra-axial space from the fourth ventricle to the 2nd cervical vertebra (Fig. 2). The ineffectiveness of adjuvant therapy and aggravated symptoms indicated radical excision.

A midline incision with him in the prone position was made and laminectomy of the 1st and 2nd cervical vertebrae performed in addition to the previous suboccipital craniotomy in January, 1990. A grayish-pink tumor which easily hemorrhaged was observed. Adhesion with the cerebellar hemisphere, medulla oblongata, and cervical region of the spinal cord was comparatively slight. Exirpation of the tumor in the subependymal layer demonstrated strong adhesion to the fourth ventricular floor in the caudal region, suggesting this was the origin. Bradycardia and prolonged latency of the short-latency somatosensory evoked potential (SSEP) occurred during tumor excision around the medulla oblongata, but soon recovered during surgery (Fig. 3). Debulking of the tumor was easily performed using an ultrasonic surgical aspirator with an angled slender handpiece modified for microsurgery (SONOP Aloka Co., Tokyo). The histological diagnosis of
the surgical specimen was anaplastic mixed glioma.

The immediate postoperative course was satisfactory. The symptoms gradually improved (50 to 70% on Karnofsky’s performance status score), and he was discharged in favorable condition on March 10. MR images showed no tumor residue 1 month after surgery (Fig. 4). He was readmitted with brainstem dysfunction 6 months later, and died on July 15, 1990. Autopsy revealed softened foci in the midbrain to the medulla oblongata, probably due to radiation necrosis, but no tumor was found.

Case 2: A 27-year-old male developed sensory disturbance of the left lower leg in April, 1989, which extended to the left face for almost 1 year. He was admitted to our department on August 15, 1990 because CT scans indicated a brain tumor (Fig. 5). Neurological examination demonstrated left hemiparesthesia, anisocoria (larger on the left than right), sluggish light reflex, diplopia, left hemifacial hyperhidrosis, and reddening. The SSEP N20 wave was not detected on the right side. Auditory brainstem response showed a slight delay of the wave V on the right, but the hearing acuity test was normal. Cerebral angiograms showed no abnormalities. MR images demonstrated a clearly demarcated nodular mass which was uniformly enhanced, with perifocal edema (Fig. 6). The tumor was diagnosed as a benign mesencephalic glioma.

The tumor was removed with him in the right lateral oblique position, via the right occipital transtentorial approach. The right posterolateral surface of the midbrain was widely exposed, and the superior collicular brachium continuing to the superior colliculus could be easily identified. No abnormality of the brain surface adjacent to the lesion was observed macroscopically. When the superior collicular brachium was incised, a grayish-reddish, elastic hard tumor was observed several millimeters deep. The tumor had a slightly unclear border in the deep region, so the incision was made tangentially to the nodular tumor because the upper and lower external sides had clear borders. Histological examination showed fibrillary astrocytoma.

He awoke immediately after surgery and was unchanged neurologically. Local irradiation (57 Gy) was given over 6 weeks because the tumor border was partially unclear. He was discharged on November
the midline dorsal to the pons to 2nd cervical vertebra. In Case 2 with unilateral intrinsic mesencephalic tumor localized in the posterolateral region, the right occipital transtentorial approach from the slanting or tangential direction to the internal deep lesion was selected considering that surgery in this region is related to functional prognosis. This approach is less often used for the midbrain, although we consider this approach achieves high safety and accuracy in the dorsolateral midbrain.

References

14) Tokuriki Y, Handa H, Yamashita J, Okumura T,

Discussion

Brainstem glioma is generally the infiltrative or swelling diffuse type,2,4,6,7 and surgery is not normally indicated in such a case. However, surgical removal is possible for focal or exophytic brainstem tumors.

In our patients, MR imaging was essential to demonstrate the lower extension of the tumor in Case 1, and the tumoral localization and perifocal edema in the right midbrain in Case 2. The surgical indication and approach were based on MR imaging of the localized tumor with a clear border to the surrounding structures such as oculomotor nucleus, sensory tract, sympathetic nerve tract, light reflex tract, etc.

Surgical intervention for brainstem glioma may use the unilateral (retromastoid) approach,2,5,7 bilateral (median) suboccipital6,9,10 or suboccipital approach with laminectomy7 for tumors located in the pons to medulla oblongata, and the trans- and supracerebellar infratentorial,7,11 subtemporal transtentorial,11,15 or occipital transtentorial approach7 for tumors in the midbrain. In our Case 1, the bilateral suboccipital approach with laminectomy was selected because the tumor was located in the midline dorsal to the pons to 2nd cervical vertebra. In Case 2 with unilateral intrinsic mesencephalic tumor localized in the posterolateral region, the right occipital transtentorial approach from the slanting or tangential direction to the internal deep lesion was selected considering that surgery in this region is related to functional prognosis. This approach is less often used for the midbrain, although we consider this approach achieves high safety and accuracy in the dorsolateral midbrain.

Fig. 7 Case 2. Postoperative T1 (A), T2 (B, C), and gadolinium-enhanced T1-weighted (D) MR images, showing disappearance of the tumor and perifocal edema.

24 without change in admission status (Karnofsky's performance status score 90%). The diplopia was improving 3 months postoperatively and disappeared 1 month later. MR images showed that the tumor and cerebral edema had disappeared by the 4th postoperative month (Fig. 7). He now works normally, and no sign of recurrence has occurred in the 2-year follow-up period.

References

14) Tokuriki Y, Handa H, Yamashita J, Okumura T,


*Address reprint requests to:* Y. Takasato, M.D., Department of Neurosurgery, Tachikawa National Hospital, 1-32-1 Akebono-cho, Tachikawa, Tokyo 190, Japan.