Effect of radiation therapy on extracerebral cavernous hemangioma in the middle fossa

Report of three cases

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Intracerebral cavernous hemangiomas are relatively easy to remove surgically, but extracerebral cavernous hemangiomas attached to the cavernous sinus are extremely difficult to treat. The authors report three cases of extracerebral cavernous hemangioma in the middle fossa that were treated with radiotherapy. The follow-up studies with serial computerized tomography (CT) scans during and after irradiation are described.

In Case 1 radiotherapy after partial removal of the tumor decreased the tumor size on the contrast-enhanced CT scans, reduced its Hounsfield units on the nonenhanced CT scans, and facilitated later total tumor removal. In Case 2 the tumor responded to irradiation with approximately 3000 rads, showing significant reduction in size and Hounsfield units of the tumor. Subtotal removal was then possible. In Case 3 the tumor responded to irradiation, and the patient's vertigo improved after delivery of approximately 3000 rads. The CT scan showed significant reduction in the size and Hounsfield units of the tumor. No surgical intervention was deemed necessary.

It is concluded that, in cases of extracerebral cavernous hemangioma with massive hemorrhage, irradiation with up to 3000 rads may be the treatment of choice. Radiation therapy offers an increased probability of total removal of the tumor and the possibility of eliminating surgery.

Key Words: cavernous hemangioma, middle fossa, radiation therapy

Extracranial cavernous hemangiomas of the middle fossa differ from other brain tumors in that surgical removal is nearly impossible due to the risk of profuse bleeding at surgery. Three cases of giant cavernous hemangioma originating in the middle fossa are presented and the follow-up changes after irradiation are described.

Case Reports

Case 1

This 44-year-old woman noted a progressive blurring of vision, and in August, 1978, an ophthalmologist found bilateral papilledema. She was referred to the Nagasaki University Hospital.

Examination. On admission, she was alert but almost autistic. Her uncorrected visual acuity was 20/25 in the right eye and 20/30 in the left. Bilateral papilledema was confirmed, and a left hemiparesis was found. On nonenhanced computerized tomography (CT), a well-circumscribed round high-density area was found in the right middle fossa extending to the sella turcica; the area enhanced on intravenous injection of contrast material. Plain skull x-ray films disclosed bone erosion extending from the tuberculum sellae to the sphenoid ridge. The arterial phase of a right carotid angiogram showed that the middle cerebral artery was elevated at the base and the anterior cerebral artery was shifted to the left. A large avascular area appeared in the temporal region associated with an enlarged meningohypophyseal trunk. The venous phase revealed a faint oval shadow of the lesion.

First Operation. A cavernous hemangioma in the middle fossa was suspected from the above findings, and surgical removal was attempted on February 7, 1979. The temporal lobe was pressed upward by a fist-sized dark-brown tumor covered by a membrane. Total resection was not possible because of profuse intraoperative bleeding. There were markedly dilated proliferating vessels with a thin endothelial membrane containing thrombosed lumina; histological examination
of these vessels confirmed the diagnosis of cavernous hemangioma (Fig. 1 left).

The patient's blurred vision and left-sided hemiparesis progressed after surgery, and bilateral abducens palsy developed. Radiotherapy was started 1 month after surgery. Neurological findings improved gradually after irradiation, and after delivery of 5000 rads the hemiparesis and abducens palsies disappeared completely. The tumor also diminished markedly in size. Nonenhanced CT scans demonstrated a radical change from a high-density to a low-density area, even when the tumor shadow was intensified with enhancement.

**Second Operation.** Due to the marked shrinkage of the tumor following radiotherapy, reoperation was attempted on May 21. Bleeding was less than during the first surgery, and subtotal resection of the tumor was successful, leaving only the capsule which adhered to the cavernous sinus and the sphenoid bone. On histological examination, partial necrosis of the tumor was found, possibly as the result of irradiation. Thrombosis was also identified in the enlarged vessels near the membranous capsule. In the central portion, detachment and edematous change of the interstitial tissues were visible, along with marked narrowing of vessels which partially lacked endothelial cells (Fig. 1 right).

The postoperative course was uneventful, but meningitis developed from a subcutaneous abscess at the site of the wound. After successful treatment of the meningitis, hydrocephalus developed and a ventriculoperitoneal shunt was placed. The patient later developed an intracerebral hematoma and ventriculitis, and died in September, 1979.

**Pathological Course.** Figure 2 shows the changes in the tumor before, during, and after irradiation. Following the delivery of 2750 rads, the tumor had shrunk to 63% of its preirradiation size and the Hounsfield units on the nonenhanced CT scans had decreased from 57 to 15. After delivery of 5000 rads, however, further shrinkage was minimal.

**Case 2**

This 52-year-old woman suffered a grand mal seizure on September 13, 1982. A brain tumor was suspected on CT examination on September 22, and she was hospitalized.

**Examination.** At admission on September 25, no neurological abnormality was found, but the nonenhanced CT scan revealed a round high-density area in the left middle fossa that intensified with contrast enhancement. Plain skull x-ray films disclosed the interrupted left innominate line and destruction of the anterior and posterior tuberculum sellae. The arterial phase of left carotid angiogram showed that the middle cerebral artery was elevated. There was a large avascular area in the temporal region associated with a dilated meningohypophyseal trunk. A thin round tumor shadow was demonstrated in the venous phase. Based on these findings the tumor was diagnosed as a cavernous hemangioma of the left middle fossa. Radiotherapy with 3000 rads diminished the size of tumor as shown on CT scans.

**Operation.** Craniotomy was carried out on November 1, 2 weeks after the last irradiation. The tumor was a red-brown mass which was removed piece by piece. Bleeding from the tumor was minimal, and a subtotal resection was performed leaving a small portion adhering to the inner margin of the sphenoid bone and the dura along the cavernous sinus. Histological study of the surgical specimen revealed a thin-walled vascular lumen with thrombus and edematous interstitium lacking cellular components. The patient was discharged from the hospital 12 days after surgery without any neurological deficit.

**Pathological Course.** Figure 3 illustrates the CT changes in the tumor before, during, and after irradiation. The tumor diminished markedly following delivery of 2000 rads, and was 66% of its original size with radiotherapy totaling 2850 rads. The Hounsfield units
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Fig. 2. Case 1. Changes in tumor size (broken line) and Hounsfield units (solid line) as seen on computerized tomography (CT) scans taken during and after irradiation (lower). The relevant CT scans are also shown (upper). The tumor was measured at its greatest width on enhanced CT scans, and the difference in enlargement was corrected by grid measurement.

also decreased from 48 to 37 after 2850 rads of irradiation.

Case 3

This 62-year-old woman complained of vertigo beginning in May, 1984, and was treated for Ménière's disease for 1 year. On May 22, 1985, a CT scan revealed a brain tumor and she was admitted to the University Hospital on May 29.

Examination. Neurological findings were normal on admission, but a nonenhanced CT scan revealed the presence of a well-circumscribed round high-density area in the left middle fossa, and the mass was intensified evenly by injection of contrast medium. Plain skull x-ray films demonstrated bone destruction extending from the left posterior tuberculum sellae to the petrous bone. The arterial phase of a left carotid angiogram revealed that the middle cerebral artery was elevated and a large avascular area was seen in the temporal region. A round thin tumor shadow appeared in the venous phase.

Course. Based on these findings a diagnosis of cavernous hemangioma was made, and irradiation with 3000 rads was given. The tumor responded well to radiation and 2000 rads more were added. The patient was discharged without surgery on August 29, 1985, and was well at the time of her follow-up study on February 28, 1986.

Pathological Course. Figure 4 shows the changes in the tumor. After delivery of 3000 rads the tumor had not changed much in size, but it had diminished to 67% of its original size after an interval of 1 month. The Hounsfield units decreased from 59 to 44 1 month after delivery of 3000 rads irradiation. However, further reduction was minimal when an additional 2000 rads of irradiation was given 1 month later. Follow-up radiation treatment after 2 months and again after 5 months failed to achieve any further improvement.

Discussion

Reports on cavernous hemangioma have been rare, but they are not uncommon in Japan, and there must be a number of unreported cases. Cavernous hemangiomas are found most often among women of middle age, usually originating from the cavernous sinus and extending to the subdural and epidural spaces with equal frequency. Unlike intracerebral tumors which are usually resectable, total resection of cavernous hemangioma is difficult because of its hemorrhagic nature. In most cases only subtotal resection is possible. Only one case treated with radiation at this clinic has previously been reported.
FIG. 4. Case 3. Changes in tumor size (broken line) and Hounsfield units (solid line) as seen on computerized tomography (CT) scans during and after irradiation (lower). The relevant CT scans are shown (upper). There was a delay of 1 month between the delivery of 3000 rads of irradiation and maximum improvement. Only minimal reduction in tumor size followed further treatment.

Our follow-up study of three cases of cavernous hemangioma shows that the size of the tumor and Hounsfield units of the nonenhanced CT scan decreased markedly after irradiation with 3000 rads. A decrease in Hounsfield units suggests a diminished blood flow, based on the fact that histological studies after irradiation revealed mainly loose interstitial tissue. Therefore, radiotherapy is an effective pretreatment before attempting total removal of an extracerebral cavernous hemangioma. Furthermore, radiotherapy alone may be sufficient treatment for those tumors that do not present severe symptoms. In any case, 3000 rads appears to be a sufficient dose of radiation. Even when the early effect of radiation seems doubtful, follow-up studies 1 month or more later may reveal a delayed effect on the tumor.

Conclusions

Radiotherapy should be considered as preoperative treatment for extracerebral cavernous hemangioma in the middle fossa. Irradiation decreases the size of the tumor and reduces blood volume in the tumor, facilitating an attempt at total resection. In addition, radiotherapy may be sufficient treatment in those cases without severe neurological disturbances or in which marked neurological improvement results from radiation alone.

References


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