Henry Ford Hospital Medical Journal

Volume 38 | Number 1 Article 19

3-1990

Surgical Removal of Metastatic Renal Adenocarcinoma to the Midbrain Tectum: A Case Report

Frank J. Tomecek

James I. Ausman

Ghaus M. Malik

Surgical Removal of Metastatic Renal Adenocarcinoma to the Midbrain Tectum: A Case Report

Frank J. Tomecek, MD,* James I. Ausman, MD, PhD,* and Ghaus M. Malik, MD*

A patient with adenocarcinoma of the kidney metastatic to the quadrigeminal plate of the midbrain presented with acute obstructive hydrocephalus and early tonsillar herniation. Because the majority of these carcinomas are resistant to radiation therapy, only limited treatment choices were available. Initially, a ventriculoperitoneal shunt relieved the hydrocephalus and neurologic symptoms. After a short course of improvement, with decompressed ventricles demonstrated by postoperative computed tomography, the patient developed additional neurologic signs, leading to the decision to excise the metastatic tumor. Convalescence was complicated but the patient survived for six months, succumbing to respiratory failure presumably caused by lung metastases. (Henry Ford Hosp Med J 1990;38:72-5)

Excision of a solitary intracranial metastasis can prolong and improve the life of carefully selected patients (1-5). Over the past several years uncontrolled retrospective studies of the effectiveness of surgical treatment for metastases have yielded conflicting results; some have shown benefit from surgery (3,6,7), whereas others have not (8-10). A recent randomized prospective trial conducted by Patchell et al (5) showed that patients with cancer who undergo surgical resection plus radiotherapy for a single brain metastasis live longer, have fewer recurrences in the brain, and have a better quality of life than similar patients treated with radiotherapy alone. Nevertheless, the decision to operate on a cerebral metastasis is controversial. Cushing (11) and Dandy (12) were among the first to express their pessimism concerning this form of therapy. A critical factor when comparing surgical intervention to other forms of treatment is the operative morbidity and mortality. Black (1) reported that operative mortality ranged from 11% to 21% with additional operative complications in 24% of patients undergoing excision of a solitary cerebral metastasis. Others reported lower mortality and morbidity (13). In our unpublished series of craniotomies in 168 patients with metastatic carcinoma of the lung (performed between 1955 and 1986), the operative mortality was 6.7% and morbidity was 15.3%. Recent improvement both in stereotactic localization of tumors and in microsurgical technique has resulted in even lower operative mortality and morbidity (2).

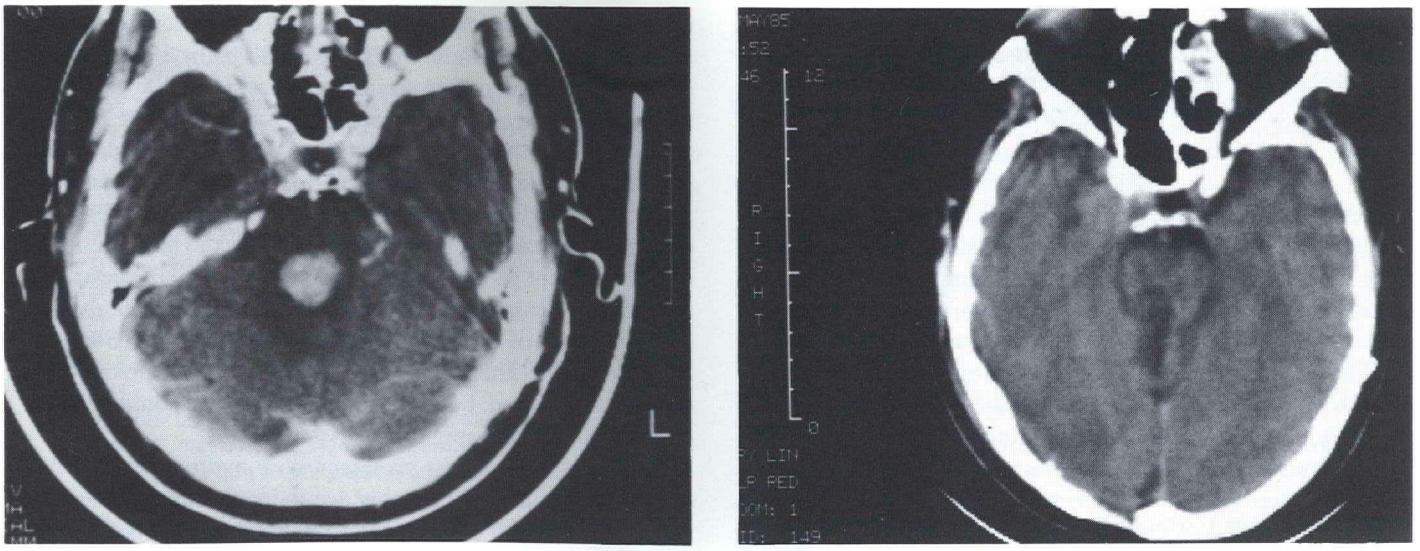
An unresolved issue is the operative approach to a solitary brainstem metastasis. Many believe that such tumors are inoperable because of their critical location and should be treated by radiation therapy alone (14-18). We are aware of only two previous reports describing the surgical treatment for midbrain metastasis (19,20). We present a patient with renal adenocarcinoma metastatic to the midbrain. Because an initial ventriculoperitoneal (VP) shunt did not relieve the symptoms of acute obstructive hydrocephalus, microsurgical excision of the tumor was performed utilizing a carbon dioxide laser.

Case Report

In 1985 a 62-year-old man presented with a two-month history of progressive diplopia, ataxic gait, generalized weakness, and somnolence. In 1983 he had undergone nephrectomy with lymph node dissection for adenocarcinoma of the kidney (hypernephroma). Subsequently he received chemotherapy which included progesterone. In April 1984, a rib resection for recurrent cancer was followed by chemotherapy with a combination of vinblastine, adriamycin, and cytoxan. He recovered and was well for one year.

On this admission examination revealed diplopia on both right and left lateral gaze. There was no papilledema. Extraocular movements were intact except for mild nystagmus on lateral gaze. The pupils reacted equally to light and accommodation. Neurologic examination revealed poor short-term memory, dysmetria on the right with falling to the right during tandem walking and performance of the Romberg test. Computed tomography (CT) of the brain demonstrated a 1.5 cm enhancing mass involving the quadrigeminal plate and associated with hydrocephalus (Figure). Four vessel cerebral angiography showed a highly vascular, round, circumscribed mass which stained irregularly and was located in the dorsal rostral aspect of the midbrain. The mass displaced the precentral cerebellar vein posteriorly and the anterior pontomesencephalic vein anteriorly indicating an intraaxial mass. In view of the history, metastatic hypernephroma was suspected, although a highly vascular primary lesion could not be excluded. Chest x-ray exhibited mild chronic obstructive pulmonary disease (COPD). Bone scan suggested the possibility of a single metastatic lesion in the left

Submitted for publication: December 13, 1989.
Accepted for publication: April 3, 1990.
*Department of Neurological Surgery, Henry Ford Hospital.
Address correspondence to Dr. Tomecek, Department of Neurological Surgery, Henry Ford Hospital, 2799 W Grand Blvd, Detroit, MI 48202.



Figure—Contrast-enhanced CT (left) reveals 1.5 cm homogeneously enhancing mass in the midbrain tectum. Postoperative CT (right) shows excision of the lesion and hypodense areas in the midbrain tectum and medial cerebellar hemisphere.

eighth rib, liver-spleen scan was negative, and CT of the chest showed interstitial changes consistent with mild COPD. Presence of an enlarged lymph node in the mediastinum was questioned but no intraparenchymal metastases were evident.

Dexamethasone therapy was instituted, but because the patient failed to improve he underwent placement of a VP shunt. The ventriculostomy was placed in the left frontal horn in case a future right-sided craniotomy became necessary. Cerebrospinal fluid obtained at the time of surgery was negative for infection or abnormal cytology.

Following placement of the VP shunt, the patient exhibited increased short-term memory and was less somnolent. He was discharged home on the sixth postoperative day receiving decreasing doses of dexamethasone.

One month later he returned because of recurrent diplopia, worsening of right-sided dysmetria, ataxia, and somnolence. Examination disclosed a mild right abducens nerve palsy, persistent diplopia, and dysmetria of the right arm and leg. CT showed normal-sized ventricles with the VP shunt in place and an enlarged mass in the midbrain tectum extending to the superior medullary velum. Six weeks following VP shunt placement the tumor was excised. Preoperatively the patient received loading doses of dexamethasone and phenytoin, both of which were continued postoperatively.

Operation

With the patient in the three-quarters prone, operated side down position, a right parietal-occipital craniotomy was performed (21). The patient received furosemide and mannitol, and 100 mL of cerebrospinal fluid was drained through the spinal drain providing a slack brain. The occipital lobe was retracted laterally with minimal pressure and the tentorium was exposed. Incision of the tentorium parallel to the straight sinus exposed the superior cerebellum and vermis. A branch of the superior cerebellar artery was followed proximally leading to the cistern of the quadrigeminal plate. The area between the vein of Galen and the superior cerebellar artery contained a yellow amorphous mass. The tumor appeared to arise from the superior medullary velum and from the inferior colliculus. Because it was highly vascular, the tumor was removed piecemeal using bipolar electrocautery and a carbon dioxide laser thereby achieving adequate hemostasis. Although most of the tumor was resected, distinguishing tumor from the surrounding tissue was very difficult along its margins. The histological diagnosis was consistent with metastatic renal adenocarcinoma of the clear cell type.

Postoperative course

After the operation the patient exhibited a mild left hemiparesis. Although lethargic, he was easily aroused and followed commands appropriately. He required ventilatory support. Postoperative CT showed collapse of the ventricular system with effacement of the subarachnoid cisterns indicating increased intracranial pressure. Therefore, the patient was treated with mannitol, dexamethasone, and hyperventilation. Ten days postoperatively, while still requiring mechanical ventilation, he developed tracheobronchitis caused by hemophilus influenza and received a course of ampicillin. Five weeks postoperatively the patient was extubated and transferred from the intensive care unit (ICU). His prolonged stay in the ICU was primarily because of persistent increased tracheobronchial secretions and a continued need for ventilatory assistance. A few days later the patient exhibited repetitive chewing movements of his mouth and tongue and had a poor gag reflex. These movements were thought to be facial myoclonus and clonazepam was added to the increased dose of phenytoin. His postoperative course was also complicated by a urinary tract infection and an allergic reaction, probably to phenytoin, which was replaced by trihexyphenidyl and carbamazepine. With therapy, the patient became able to communicate short sentences. He required assistance with feeding and ambulation because of persistent moderate dysmetria of the right hand and leg. He also displayed mild left hemiparesis.

CT prior to discharge showed the following: a hypodense lesion along the right posterior midbrain probably represented the site of resection of the metastasis; an area of hypodensity in the right cerebellar hemisphere suggested an infarct; and a small curvilinear zone of enhancement of the lateral aspect of the surgical bed possibly represented postoperative enhancement, but residual tumor could not be excluded. The ventricles were small but not collapsed, and no mass effect was noted on the fourth ventricle.

Planned postoperative radiation therapy, 3,000 rads to the whole brain followed by an additional 1,000 to 1,500 rads to the metastatic tumor, was refused by the patient. He was discharged to a rehabilitation center.

During the next three months the patient slowly improved in ambulation and speech but he developed a productive cough. A chest x-ray demonstrated lung masses, presumably metastases, and he died at home one month later from respiratory failure.

Discussion

Central nervous system (CNS) metastases occur in approximately 15% to 20% of patients dying of cancer, and one-third of these are solitary (18,22). Solitary brainstem metastases, on the other hand, are rare. By 1983, Delaney and Martinez (23) stated that only 40 cases had been adequately described and several of these had been documented only by radiographs, not biopsy or necropsy. The ratio of the number of cases of solitary CNS metastasis to the number of solitary brainstem metastasis is 32:1, not significantly different from the ratio of weights of the involved structures (18). Thus, the brainstem is probably no more or less susceptible to metastasis than the remainder of the CNS.

When operating on the brainstem, the extent of the lesion must be precisely defined. Because it can distinguish infiltrating from well circumscribed tumors, magnetic resonance imaging (MRI) may be the study of choice for posterior fossa disease (24,25). However, T2-weighted MRI images are less reliable than contrast-enhanced CT in differentiating edema from tumor mass (22). Contrast-enhanced CT images have been reported to correlate closely with autopsy findings of solitary brainstem metastasis (17). Additional studies will be necessary before the same can be said about enhanced MRI. Perhaps the most accurate way to differentiate tumor from surrounding edema is to assess glucose utilization by the tissue using positron emission tomography (PET). Tumors exhibit high glucose utilization which can be contrasted from the lower glucose utilization of surrounding edematous tissue. Unlike MRI or CT, PET can also be used to differentiate recurrent tumor from postradiotherapy necrosis (26,27).

The neurosurgical approach to metastatic disease of the central nervous system includes tumor excision, decompression and/or cerebrospinal fluid shunting, or stereotaxic biopsy and interstitial radiation therapy (28). Alternatively, one may choose not to operate but to attempt palliation with radiation. The prospective randomized study of Patchell et al (5) has shown the advantages of surgical treatment for single metastasis to the brain. The indications for surgical treatment of single metastasis to the brainstem are not established. Tomita and Wetzel (17) as well as Weiss and Richardson (18) advised against operation for brainstem metastasis because of the critical location of the tumor.

To our knowledge, surgical excision of brainstem metastasis has been described only in two other cases. Hacker and Fox (19) were the first to report an attempt at surgical excision of a solitary brainstem metastasis in 1980. Their indications for surgery were to establish a diagnosis and because of increasing mass effect and fourth ventricle shift. They agreed with the radiologic indications for exploration of brainstem neoplasms recommended by Lassman (29): 1) marked hydrocephalus, 2) more than slight deviation of the fourth ventricle and aqueduct from the midline, and 3) a filling defect of the fourth ventricle. Tobler et al (20) first reported the complete excision of metastatic adenocarcinoma of the lung to the midbrain. Their decision to operate was based upon failure of radiation to palliate the patient's symptoms, the increasing size of the mass, lack of apparent active primary disease, the patient's generally favorable medical condition, and the long latent period which preceded the appearance of cerebral metastasis (1,18). With advanced microsurgery and the use of laser vaporization, Tobler et al (20) could decompress space occupying metastasis to the brainstem and obtain excellent postoperative results. Kelly et al (2) described stereotactic localization and successful excision of an alveolar cell carcinoma of the lung metastatic to the right middle cerebellar peduncle. There is yet no report of stereotactic biopsy and interstitial radiation, but if the radiation could be confined to the tumor, this approach might be very successful.

In our case the patient presented with hydrocephalus, right cerebellar dysfunction probably due to involvement of the right superior cerebellar peduncle, a mass effect on the brainstem, and early tonsillar herniation. He had a well-differentiated carcinoma of the kidney. Metastases of these neoplasms often exhibit indolent behavior after ablation of the source (30,31). Renal cell carcinomas are relatively resistant to radiation therapy (1,28). Although surgical excision was considered, the lower risk shunting procedure was chosen initially to obtain symptomatic relief from obstructive hydrocephalus. However, when the symptoms worsened one month postoperatively, we proceeded to excise the tumor. Survival with metastases unprecedented in other tumors has been documented in hypernephroma (32) and even cure after removal of a cerebral hemisphere metastasis has been recorded (33).

These unique characteristics of metastatic hypernephroma influenced our decision toward surgery. Other indications for surgical excision were the uncertain diagnosis, the long latent interval between diagnosis of the primary tumor and detection of the brain metastasis, the potential for the increasing mass to produce severe neurologic disability or death, the demonstrated fourth ventricle shift, and the low tumor burden elsewhere in the body suggesting the potential for prolonged survival. Unfortunately, the patient's general medical condition required a prolonged hospital stay although his neurologic status was stable postoperatively and did not contribute to his prolonged hospital course. Very likely, undetected pulmonary metastases worsened his already compromised pulmonary function and contributed to his death.

Nevertheless, with current microsurgical and stereotactic advances, brainstem metastasis can be accessible and treated with surgical excision.

References

1. Black P. Brain metastasis: Current status and recommended guidelines for management. Neurosurgery 1979;5:617-31.

2. Kelly PJ, Kall BA, Goerss SJ. Results of computed tomography-based computer-assisted stereotactic reaction of metastatic intracranial tumor. Neurosurgery 1988;22:7-17.

3. Sundaresan N, Galicich JH, Beattie EJ Jr. Surgical treatment of brain metastases from lung cancer. J Neurosurg 1983;58:666-71.

4. Yardeni D, Reichenthal E, Zucker G, et al. Neurosurgical management of single brain metastasis. Surg Neurol 1984;21:377-84.

5. Patchell RA, Tibbs PA, Walsh JW, et al. A randomized trial of surgery in the treatment of single metastases to the brain [see comments]. N Engl J Med 1990;322:494-500.

6. Patchell RA, Cirrincione C, Thaler HT, Galicich JH, Kim JH, Posner JB. Single brain metastases: Surgery plus radiation or radiation alone. Neurology 1986;36:447-53.

7. Mandell L, Hilaris B, Sullivan M, et al. The treatment of single brain metastasis from non-oat cell lung carcinoma: Surgery and radiation versus radiation therapy alone. Cancer 1986;58:641-9.

8. Berry HC, Parker RG, Gerdes AJ. Irradiation of brain metastases. Acta Radiol Ther Phys Biol 1974;13:535-55.

9. Markesbery WR, Brooks WH, Gupta GD, Young AB. Treatment for patients with cerebral metastases. Arch Neurol 1978;35:754-6.

10. Posner JB. Diagnosis and treatment of metastases of the brain. Clin Bull 1974;4:47-57.

11. Cushing H. Intercranial tumors. Springfield: Charles C. Thomas, 1932.

12. Dandy WH. Surgery of the brain. Hagerstown: W. F. Prior, 1945.

13. French LA, Ausman JI. Metastatic neoplasms to the brain. Clin Neurosurg 1977;24:41-6.

14. Galicich JH, Sundaresan N, Arbit E, Passe S. Surgical treatment of single brain metastasis: Factors associated with survival. Cancer 1980;45:381-6.

15. Posner JB. Management of central nervous system metastases. Semin Oncol 1977;4:81-91.

16. Ransohoff J. Surgical management of metastatic tumors. Semin Oncol 1975;2:21-7.

17. Tomita T, Wetzel N. Metastasis to the midbrain: Report of two cases. J Neurooncol 1984;2:73-7.

18. Weiss HD, Richardson EP Jr. Solitary brainstem metastasis. Neurology 1978;28:562-6.

19. Hacker RJ, Fox JL. Surgical treatment of brain stem carcinoma: Case report. Neurosurgery 1980;6:430-2.

20. Tobler WB, Sawaya R, Tew JM. Successful laser-assisted excision of a metastatic midbrain tumor. Neurosurgery 1986;18:795-7.

21. Ausman JI, Malik GM, Dujovny M, Mann R. Three-quarter prone approach to the pineal-tentorial region. Surg Neurol 1988;29:298-306.

22. Simpson RK Jr, Sirbasku DM, Baskin DS. Solitary brainstem metastasis: Comparisons of x-ray computed tomography and magnetic resonance imaging to pathology. J Neurooncol 1987;5:57-63.

23. Delaney P, Martinez J. Solitary metastasis to the medulla oblongata. South Med J 1983;76:1324-5.

24. Han JS, Bonstelle CT, Kaufman B, et al. Magnetic resonance imaging in the evaluation of the brainstem. Radiology 1984;150:705-12.

25. Lee BC, Kneeland JB, Walker RW, Posner JB, Cahill PT, Deck MD. MR imaging of brainstem tumors. AJNR 1985;6:159-63.

26. Patronas NJ, Di Chiro G, Kufta C, et al. Prediction of survival in glioma patients by means of positron emission tomography. J Neurosurg 1985; 62:816-22.

27. Lilja A, Bergstrom K, Hartvig P, et al. Dynamic study of supratentorial gliomas with L-methyl-11C-methionine and positron emission tomography. AJNR 1985;6:505-14.

28. Lokich JJ. The management of cerebral metastasis. JAMA 1975;234:748-51.

29. Lassman LP. Tumors of the pons and medullar oblongata. Clin Neurol 1975;17:693-706.

30. Derby BM, Guiang RL. Spectrum of symptomatic brain stem metastasis. J Neurol Neurosurg Psychiatry 1975;38:888-95.

31. Goodwin WE. Regression of hypernephromas. JAMA 1968;204:609.

32. Saloman M. Metastatic brain tumors: Diagnostic and therapeutic management. Contemp Neurosurg 1979;26:1-5.

33. Lapin AL, Hermann HB, Pinto Z. Hypernephroma with solitary cerebral metastasis: Six year survival following nephrectomy. NY State J Med 1985;65:159-63.