Surgical management of cerebral metastases from melanoma: outcome in 147 patients treated at a single institution over two decades


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Object. The aim of this study was to review the outcome of patients who underwent surgery for treatment of cerebral metastatic melanoma.

Methods. A retrospective analysis was performed in 147 patients with cerebral metastases from melanoma who were treated surgically at a single institution between 1979 and 1999. Almost all patients underwent postoperative whole-brain radiation therapy. The mean patient age was 53 years (range 17–76 years); 69% of patients were male. A single cerebral metastasis was identified in 84% of patients, although 56% had synchronous extracranial metastases. The 30-day postoperative mortality rate was 2% and neurological symptoms resolved or improved in 78% of patients. Recurrence of intracerebral disease was seen in 55% of patients and 26% died of intracerebral metastases. Twenty-four patients underwent reoperation for recurrent cerebral disease. The median survival duration from the time of surgery for all patients was 8.5 months; the 3- and 5-year survival rates were 9% and 5%, respectively. Factors that significantly influenced survival on univariate analysis were the number of cerebral metastases (p = 0.015), a macroscopically complete excision (p < 0.05), and reoperation for recurrence (p = 0.02). The presence of extracranial metastases did not significantly influence survival. On multivariate analysis only the number of cerebral metastases significantly affected survival (p = 0.04).

Conclusions. For the majority of patients with cerebral metastases from melanoma, surgery with adjuvant radiation therapy is a treatment option that improves neurological symptoms and produces minimal morbidity. Long-term survival (> 3 years) most likely occurs in patients with a single cerebral metastasis and no demonstrable extracranial disease. Reoperation for recurrent cerebral disease may be appropriate in selected cases.

KEY WORDS: • brain neoplasm • melanoma • metastasis • radiation therapy • outcome

MELANOMA is the most common cancer in young adults in Australia and in many other Western countries. It is currently the third most common cause of cerebral metastases, after lung and breast cancers. The magnitude of this clinical epidemic is due to a steadily increasing incidence of the primary disease and an increased ability to detect its metastatic complications.

Melanoma has a propensity for multiorgan involvement, and central nervous system complications are frequent. The prognosis of patients with disseminated melanoma is particularly poor if cerebral metastases are present. Conventional treatments of cerebral melanoma metastases, including either WBRT or chemotherapy, result in only a modest improvement in survival. Nevertheless, surgical resection of metastases is feasible in a subgroup of these patients and may prolong their survival.

For patients with one or a few cerebral metastases, the more aggressive treatment options have included surgery and radiosurgery. The evidence for additional benefit from these treatments has been largely based on the results from studies of nonmelanoma cerebral metastases and small surgical studies of patients with melanoma. There are few recent large series with long-term follow-up.

The aim of this study was to review the results of surgery and adjuvant WBRT at a single institution over the last two decades, to evaluate their effectiveness, and to compare these with other treatment modalities. Guidelines for the use of surgery and radiation therapy in cerebral metastatic melanoma are suggested, based on this clinical review and our experience.

Clinical Material and Methods

Patient Population

Between January 1979 and March 1999, 147 patients with histologically proven cerebral metastases from melano-
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Ananoma underwent surgical treatment in the Department of Neurosurgery at the Royal Prince Alfred Hospital. Most (80%) had been referred from the Sydney Melanoma Unit at the Royal Prince Alfred Hospital, and 20% were referred directly to the treating neurosurgeon. The majority of patients lived in New South Wales, with small numbers living in other states or overseas. Demographic and primary melanoma data were recorded for each patient, including date of diagnosis, tumor site, histological findings, and staging.

Tumor Management

All patients were diagnosed using CT scanning initially, either for investigation of symptoms or for screening purposes, and were referred for neurosurgical consultation. Beginning in December 1991, MR imaging was used as well as CT scanning. In patients who presented following an intracerebral hemorrhage with no history of melanoma, the diagnosis was established using intra- and postoperative histopathological studies. In general, patients were offered surgery if they had a single, surgically accessible cerebral metastasis and either stable or no extracranial metastasis. Some patients with more than one cerebral metastasis or poor performance status were selected for surgery if one of the lesions was imminently life threatening. Patients who did not meet these criteria were referred for consideration of radiation therapy. Preoperatively, patients were placed on a regimen of dexamethasone and phenytoin, and they also underwent investigations to determine the extent of extracranial disease; this testing routinely included a chest x-ray film and CT scans of the chest, abdomen, and pelvis. Detailed information regarding the cerebral metastases, presence and site of extracranial metastases, extent of resection, histopathological findings, hospital stay, complications, neurological improvement, adjuvant treatments, and recurrence was recorded.

All patients underwent craniotomy and tumor excision. In patients who underwent surgery for hematoma removal without a preoperative diagnosis of melanoma metastasis, the clot and adjacent cerebral tissue were sent for histopathological review and visible tumor was removed. In patients with more than one metastasis, only the symptomatic lesion was removed. Standard procedures were used for microneurosurgical tumor resection and frozen-section histopathological analysis intraoperatively. A definitive pathological diagnosis could only be confirmed postoperatively. In the last 5 years of the study, frameless stereotaxy (Optical Tracking System; Radionics, Burlington, MA) was used at the discretion of the surgeon to plan the craniotomy and aid in tumor localization and removal. This allowed smaller skin incisions and craniotomy flaps to be fashioned, leading to reduced patient morbidity. Deep tumors could be approached via the most direct corridor, and tumor limits identified. Postoperatively, in most patients a CT scan with contrast material was obtained to determine the extent of tumor resection and exclude the presence of hematoma.

After craniotomy, most patients (92%) underwent WBRT, usually commencing within 2 weeks of surgery. The most common WBRT regimen was 30 Gy in 10 fractions, but regimens ranged from 20 Gy in five fractions to 45 Gy in 25 fractions. Patients continued to take oral corticosteroid drugs (dexamethasone) throughout WBRT and were maintained on phenytoin indefinitely. Radiosurgery was performed in conjunction with surgery in two patients. In one case it was used to treat a partially resected lesion; in the other, it was used to treat the smaller metastasis in a patient with two cerebral lesions.

Systemic chemotherapy was administered to 22% of patients at some time after craniotomy, mainly for progressive extracranial disease. In most patients dacarbazine was used, although a small number received lomustine or fotemustine for recurrent intracranial disease.

Statistical Analysis

Kaplan–Meier survival curves and median values were calculated by standard formulas with commercially available software (SPIDA, Statistical Package for Interactive Data Analysis; Maquarie University, North Ryde, NSW, Australia). A comparison of the median survival times among treatment groups was performed using log-rank tests. Standard tests of multivariate and univariate analysis were performed using the Cox proportional hazards regression model. Statistical significance was defined at the 5% level.

Follow-Up Review

Follow-up review was performed postoperatively by the neurosurgeon by using CT scans, and MR images were obtained in patients being considered for reoperation. Assessment and management of extracranial melanoma was undertaken as appropriate by surgeons, medical oncologists, and radiation oncologists affiliated with the Sydney Melanoma Unit. All but two patients were followed up either until death or for a minimum of 6 months, by using a direct patient and general practitioner interview when required. No patient was excluded. The cause of death was recorded when available, either from case notes or by inquiring of the local doctor.

Results

The demographic profile of the patients is summarized in Table 1. The median patient age was 53 years (range 17–76 years) and 69% of the patients were men. Fifteen percent of primary lesions were more than 4 mm in thickness. Primary sites on the trunk (29%) and head/neck (14%) were the most common, and 11% of lesions were occult. The American Joint Commission on Cancer staging of melanoma was Stages I/II for 60%, Stage III for 18%, and Stage IV for 22%.

Annual patient accrual ranged between three and 15 cases per year, with a greater accrual in recent years. The characteristics of the patients at the time their cerebral metastases were diagnosed are presented in Table 2. Most patients (71%) had symptoms and signs of a space-occupying lesion, with localizing symptoms and signs in 27%. Seizures had occurred in 14% of patients. One patient with a history of melanoma was asymptomatic, and the diagnosis was made when CT scanning was performed as a routine screening investigation.

Most patients (84%) had a single cerebral metastasis. This was assessed using CT scanning only over the period of 1979 through 1990, and by MR imaging beginning in 1991. Of the remainder, 13% had two metastases and 3% had three metastases. Forty percent of patients had a metast-
Primary lesion characteristics

- Breslow thickness in mm:
  - <0.76: 11 (12)
  - 0.76–1.5: 25 (26)
  - 1.6–4.0: 45 (47)
  - >4.0: 14 (15)
  - NK: 52

- Stage at initial diagnosis of melanoma:
  - I/II: 89 (60)
  - III: 26 (18)
  - IV: 32 (22)

- Interval to cerebral metastasis in yrs:
  - 0: 16 (11)
  - 1–4.9: 85 (58)
  - ≥5: 46 (31)

* NK = not known.
† According to the American Joint Commission on Cancer classification.
‡ Melanoma was diagnosed following presentation with cerebral metastasis.

**TABLE 1**

Demographic features in 147 patients who underwent craniotomy for cerebral metastases of melanoma*

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of Patients (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>age in yrs</td>
<td></td>
</tr>
<tr>
<td>17–29</td>
<td>24 (16)</td>
</tr>
<tr>
<td>30–49</td>
<td>48 (32)</td>
</tr>
<tr>
<td>50–69</td>
<td>64 (44)</td>
</tr>
<tr>
<td>≥70</td>
<td>11 (8)</td>
</tr>
<tr>
<td>sex</td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>101 (69)</td>
</tr>
<tr>
<td>F</td>
<td>46 (31)</td>
</tr>
<tr>
<td>primary lesion characteristics</td>
<td></td>
</tr>
<tr>
<td>Breslow thickness in mm</td>
<td></td>
</tr>
<tr>
<td>&lt;0.76</td>
<td>11 (12)</td>
</tr>
<tr>
<td>0.76–1.5</td>
<td>25 (26)</td>
</tr>
<tr>
<td>1.6–4.0</td>
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<td>&gt;4.0</td>
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<td>NK</td>
<td>52</td>
</tr>
<tr>
<td>stage at initial diagnosis of melanoma</td>
<td></td>
</tr>
<tr>
<td>I/II</td>
<td>89 (60)</td>
</tr>
<tr>
<td>III</td>
<td>26 (18)</td>
</tr>
<tr>
<td>IV</td>
<td>32 (22)</td>
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<tr>
<td>interval to cerebral metastasis in yrs</td>
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<tr>
<td>0</td>
<td>16 (11)</td>
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<tr>
<td>1–4.9</td>
<td>85 (58)</td>
</tr>
<tr>
<td>≥5</td>
<td>46 (31)</td>
</tr>
</tbody>
</table>

* NK = not known.
† According to the American Joint Commission on Cancer classification.
‡ Melanoma was diagnosed following presentation with cerebral metastasis.

Overall, more than half the patients in this series (56%) had evidence of extracranial metastases at the time their cerebral metastatic disease was diagnosed. Multiple metastatic sites (> two) were most common, followed by pulmonary or gastrointestinal metastases.

The details of treatment for the cerebral metastases and patient outcome are given in Table 3. Of the 174 craniotomies in 147 patients, 84% were performed by one surgeon (M.B.). A macroscopically complete tumor excision was achieved in 85% of patients. Subtotal resection or biopsy sampling were performed in the remainder, based on an assessment by the surgeon at the time of the procedure. Most patients (78%) had either a complete or partial neurological improvement when assessed at the time of discharge from the hospital. The median hospital stay was 14 days during the first decade of the study and 8 days in the second decade, although a stay of 6 days was most common at the time of reporting.

Clinical or radiological evidence of recurrent intracranial melanoma was found during follow-up review in 55% of patients. The recurrence rate dropped from 65% in the first decade to 50% in the second decade. Recurrence was assessed using CT scanning, followed by MR imaging if further surgical treatment was contemplated. Twenty-four patients with stable extracranial disease and good performance status underwent reoperation for recurrent intracranial disease, either at the initial site (14 patients) or for new metastases (10 patients). A third operation was performed in three patients. The median time between the initial and second craniotomy was 8 months. Radiosurgery was chosen in one patient with intracranial tumor recurrence.

Progressive intracerebral melanoma was the direct cause of death in 27% of the entire cohort and in 50% of the group that underwent reoperation. The remainder died of progressive extracranial disease.

There were five deaths within 30 days of craniotomy. Three patients died of uncontrolled intracranial disease despite tumor debulking, and there was one case each of death due to pulmonary embolism and to multiorgan failure. Postoperative morbidity included four postoperative hematomas requiring reoperation, eight wound infections (six of which required repeated craniotomy), seven pulmonary emboli, five deep venous thromboses, and four urinary tract or lung infections. There were new neurological deficits in seven patients, most of which were transient and responded to high-dose glucocorticoid agents.

The overall median survival time from diagnosis of cerebral metastasis was 8.5 months, with 9% survival at 3 years (Fig. 1). The median survival time after the initial diagnosis of melanoma was 56 months.
TABLE 3

Treatment of cerebral metastases in 147 patients with melanoma*

<table>
<thead>
<tr>
<th>Variable</th>
<th>No. of Patients (%)</th>
<th>Survival (mos)</th>
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</thead>
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<tr>
<td>treatment</td>
<td></td>
<td></td>
</tr>
<tr>
<td>surgery</td>
<td>9 (6)</td>
<td>1</td>
</tr>
<tr>
<td>surgery/WBRT</td>
<td>102 (69)</td>
<td>9</td>
</tr>
<tr>
<td>surgery/WBRT/chemo†</td>
<td>33 (22)</td>
<td>11</td>
</tr>
<tr>
<td>surgery/chemo†</td>
<td>3 (2)</td>
<td>1D</td>
</tr>
<tr>
<td>repeated craniotomy</td>
<td>24 (16)</td>
<td>15</td>
</tr>
<tr>
<td>surgery/WBRT/radiosurgery</td>
<td>2 (1)</td>
<td>5</td>
</tr>
<tr>
<td>extent of resection</td>
<td></td>
<td></td>
</tr>
<tr>
<td>macroscopically complete</td>
<td>125 (85)</td>
<td>10</td>
</tr>
<tr>
<td>subtotal</td>
<td>19 (13)</td>
<td>3</td>
</tr>
<tr>
<td>biopsy only</td>
<td>3 (2)</td>
<td>3</td>
</tr>
<tr>
<td>neurological symptoms</td>
<td></td>
<td></td>
</tr>
<tr>
<td>resolved</td>
<td>76 (52)</td>
<td>7</td>
</tr>
<tr>
<td>improved</td>
<td>39 (26)</td>
<td>8</td>
</tr>
<tr>
<td>unchanged</td>
<td>13 (9)</td>
<td>1</td>
</tr>
<tr>
<td>NA</td>
<td>19 (13)</td>
<td>9</td>
</tr>
<tr>
<td>intracranial recurrence</td>
<td></td>
<td></td>
</tr>
<tr>
<td>op site</td>
<td>32 (22)</td>
<td>11</td>
</tr>
<tr>
<td>same lobe</td>
<td>22 (15)</td>
<td>6</td>
</tr>
<tr>
<td>adjacent lobe</td>
<td>27 (18)</td>
<td>7</td>
</tr>
<tr>
<td>none</td>
<td>66 (45)</td>
<td>6</td>
</tr>
<tr>
<td>outcome</td>
<td></td>
<td></td>
</tr>
<tr>
<td>alive, no disease</td>
<td>11 (7)</td>
<td></td>
</tr>
<tr>
<td>alive w/ melanoma</td>
<td>17 (12)</td>
<td></td>
</tr>
<tr>
<td>death from disseminated melanoma</td>
<td>80 (54)</td>
<td></td>
</tr>
<tr>
<td>death from intracerebral metastases</td>
<td>39 (27)</td>
<td></td>
</tr>
</tbody>
</table>

* Chemo = chemotherapy; RS = radiosurgery.
† Chemotherapy was given from time of craniotomy until death for either cerebral or systemic metastases.

On univariate analysis, repeated craniotomy for recurrence was associated with a significantly prolonged survival (p = 0.03), as was a macroscopically complete excision (p < 0.05). Neither the presence nor extent of extracranial metastases (lung metastasis only compared with multiple extracranial metastases) influenced survival significantly following craniotomy. Other factors that did not affect survival included patient age, sex, the time interval from primary melanoma to cerebral metastasis, size of the cerebral metastasis, the type of symptoms on presentation (for example seizure), the era of treatment (1st compared with 2nd decade of the study), and the location of the cerebral lesion (infra- or supratentorial).

On multivariate analysis, the only factor with an independent and significant influence on survival from the time of craniotomy was the number of cerebral metastases (Fig. 2). For one, two, and more than two cerebral metastases the median survival times were 8, 6, and 3.5 months respectively (p = 0.04).

Thirteen patients (9%) survived for more than 3 years. Their ages ranged from 17 to 72 years. All had a single cerebral metastasis that was resected completely, and all underwent postoperative WBRT. Two underwent a repeated craniotomy and two had synchronous extracranial disease. Only one of these patients presented with a solitary cerebral metastasis with no evidence of a primary melanoma.

Discussion

The prognosis is poor after the development of cerebral metastases in patients with melanoma. The majority of patients with multiple lesions have a median survival time of 2 to 3 months after palliative treatment with corticosteroid drugs and cranial irradiation.1,10,28 By contrast, in the minority who have a single or few cerebral metastases, surgery or radiosurgery may offer the prospect of a prolonged median survival time (8 to 9 months) and even potential cure. In the absence of randomized studies, recommendations for the treatment of these cases have been based largely on small series of selected groups of patients.1,9,10,19–21,27,38 This retrospective analysis of 147 patients who underwent craniotomy for cerebral metastatic melanoma is the largest single-institution surgical series reported to date.

The findings in this study concur with many previous reviews regarding the demographics of patients with cerebral metastatic melanoma, namely a male preponderance, a high proportion of trunk, head, and neck primary sites, some patients (11%) with occult primary melanomas, and the presence of extracranial metastases in many cases.2,10,16,24,38,43,49 The majority of patients in this series had concurrent extracranial disease (56%), more than has been reported in several previous surgical series.19–21,38 The high frequency of cerebral hemorrhage, the small numbers of patients with single metastases and occult primary sites, and the time interval from primary to metastatic cerebral lesions (median 4 years) are also consistent with findings in previous studies.10,43,49 As in the findings of Sampson, et al.,43 seizures were not a common form of presentation in this study (14%), compared with other studies in which incidence rates as high as 50% have been cited.10,21 Despite this, anticonvulsant medications were prescribed for all patients in this series on presentation, as advocated by Lavine, et al.,27 in their radiosurgery series.

In this series the most significant determinant of survival following diagnosis of cerebral metastasis was the number of cerebral metastases (p = 0.04). All patients who survived more than 3 years had only a single cerebral lesion. This has been a consistent finding in most, but not all, previous studies.19,43,47,48 Stevens, et al.,48 demonstrated that patients with a single lesion were less likely to have extracranial disease than those with multiple lesions. Unlike other surgical series, in our study there was a substantial number of...
patients (23) with more than one cerebral metastasis. Only one of them survived for 2 years, and the median survival figures were 6 months for two cerebral metastases and 3.5 months for three or more. These figures are similar to the results seen with WBRT alone in some studies, but less than those from some radiosurgery series.

Therefore, in the absence of an imminently life-threatening cerebral lesion, the role of surgery in patients with more than one tumor is debatable. Other authors have reported similar survival rates, however, for patients with one or more cerebral lesions that are completely resected, and advocate a more aggressive approach to cerebral metastatic disease.

A macroscopically complete excision significantly affected survival on univariate analysis in this study (p < 0.05), and all long-term survivors had a complete excision. In contrast, the median survival for the 22 patients who had an incomplete excision was 3 to 4 months, similar to radiation therapy alone in some series. Therefore, unless a macroscopically complete excision can be performed, the benefit of surgery is doubtful, as Stevens, et al., also concluded. There was a tendency toward improved survival with smaller tumors; the ability to achieve complete clearance may be an explanation.

Another important factor determining tumor clearance that is of particular relevance to melanoma was the presence of preoperative hemorrhage, which occurred in many patients. Melanoma metastases have been associated with hemorrhage in up to 50% of patients in some reports. In patients with no history of melanoma who presented solely with an intracerebral hemorrhage, the presence of tumor was unknown until histological examination of the hematoma was performed postoperatively. In such patients, who often require emergency surgical decompression, the aim of the operation was primarily hematoma evacuation, with complete tumor clearance a secondary consideration.

Reoperation was performed in 24 patients, mainly for recurrent local disease. Although resection of recurrent intracranial tumors was associated with improved survival compared with those managed conservatively, as noted also by Bronski and Arbit, the value of this procedure is debatable because there was a strong selection bias toward patients offered further surgery. Also, patients with recurrent brain metastases tend to survive longer as a group. Nevertheless, only two patients who underwent reoperation became long-term survivors and half died of intracranial melanoma. Therefore, reoperation may be beneficial provided that the morbidity rate is low, as Overett and Shiu suggested in their review of the outcome of resection of distant melanoma metastases.

An apparent reduction in the intracranial tumor recurrence rate, which has not been noted in previous studies, occurred in the second decade of this study. Possible explanations for this observation could be the introduction of MR imaging, which coincided with this observation and can more clearly demonstrate the presence of recurrent tumor than CT scanning, and the introduction of stereotaxy, which allows more precise resection. Although patient survival was unchanged throughout the study, we believe that this factor is important and suggest future examination.

Contrary to the results published in previous studies, the presence of extracranial disease at the time of craniotomy did not significantly affect survival in this series. Possible reasons for this finding include differences in patient selection, tumor biology and staging, extent of extracranial disease, and use of systemic chemotherapy. Since 1993, positron emission tomography scanning has been used to detect systemic melanoma metastases at our institution. This modality has a reported sensitivity of 94% and a specificity of 83%, and it has even been suggested that positron emission tomography could completely replace other staging investigations. Despite this, most patients in this series died of extracranial disease, indicating that even if it is not detectable, such disease may be present. This is consistent with previous studies such as that by Amr, et al., who found that 15 of 17 patients who died with confirmed pulmonary metastases had nondiagnostic chest X-ray films in the 3-week period preceding their deaths.

In the literature, the reported median survival time after craniotomy for an apparently single cerebral melanoma metastasis varies between 5 and 22 months. The median survival of the patients in this study (8.5 months) is equivalent to that reported in most surgical series and also to that achieved with radiosurgery for metastatic melanoma (9 months). Almost 10% of patients survived for 3 years, two after a reoperation. Such prolonged survival after the use of nonsurgical treatment modalities has not been consistently demonstrated to date.

Although in several studies it has been suggested that there is an independent survival benefit from surgery, in others it has been claimed that selection biases may be solely responsible for these differences. In our study, patients were selected primarily on the basis of the resectability of their cerebral lesions for palliation. A second cerebral metastasis was not always a contraindication to operation, nor was the presence of visceral disease, nor poor performance status (provided that this was caused by the cerebral metastasis). In other surgical series it has been suggested that patients with visceral disease and a second metastasis should not be considered for surgery. Although such patients are unlikely to achieve long-term survival, our results indicate that they can still obtain excellent palliation.

The 30-day surgical mortality rate in this series was 3%, which is low compared with rates found in reports from contemporary series, which range from 0 to 28%.

The surgical morbidity included postoperative hematomas
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and infections in 12 patients (8%), which prolonged their hospital stay. The increased use of stereotactic tumor localization in the last 5 years may have helped to minimize these problems as well as ensuring completeness of tumor excision; the number of unplanned returns to the operating room for infection or hematoma was zero in the last 5 years, compared with 10 for the first 15 years. The rate of neurological complications and length of hospital stay also decreased in recent years, probably for similar reasons.

There is continued debate regarding the role of WBRT following resection of a single metastasis. In our series WBRT was routinely recommended for all patients except those with poor performance status who were considered unlikely to survive for the duration of treatment. This policy has been based on reports of reduced tumor recurrence, good palliation, and few short-term side effects after cranial irradiation. Furthermore, autopsy studies have repeatedly demonstrated microscopic leptomeningeal and cerebrospinal fluid spread of disease in association with apparently single metastases demonstrated on CT and MR studies. Surgery and radiation therapy are complementary treatment modalities, with evidence of reduced intracranial recurrence when both are used. Whether WBRT extends survival beyond that related to surgical excision alone has been questioned by several authors. Most recently, Wronska and Arbit showed a nonsignificant trend toward improved survival in patients with cerebral metastases from melanoma who underwent postoperative radiation therapy.

Neurotoxicity is a well-recognized late complication of WBRT and is of concern in patients who may have a prolonged survival. Although neuropsychological functioning was not assessed formally in this series, there was no obvious evidence of late radiation damage in the small group of long-term survivors. For the majority of patients, who have an anticipated short survival time, intracranial tumor control was considered to be of greater importance.

In this series the use of radiosurgery was individualized. It was used to treat recurrent lesions in patients who would not tolerate reoperation well, metastases in surgically inaccessible locations, and multiple cerebral metastases. An important limitation for radiosurgery is tumor volume. This may be difficult to define in the presence of hemorrhage, with investigators in most series treating tumors up to 3 cm in diameter for optimal results. In our study 40% of tumors measured greater than 3 cm, which would have rendered them ineligible for radiosurgery. Further studies will be required to establish the role of radiosurgery in the treatment of metastases from melanoma.

Conclusions

Although the prognosis remains poor for patients with cerebral metastases from melanoma, surgery with adjuvant postoperative radiation therapy remains an excellent palliative treatment for those with one or two resectable lesions. Rapid relief of symptoms is provided and the majority of patients will avoid progression of neurological disease. Survival is greatest in those patients with a single cerebral lesion in whom a macroscopically complete excision is achieved, and least in patients with more than one cerebral metastasis. Repeated craniotomy may be used in selected patients with tumor recurrence to prolong survival further.

References


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