Meningeal melanocytoma with invasion of the thoracic spinal cord

Case report

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A case is presented of meningeal melanocytoma that invaded the thoracic spinal cord of a 71-year-old woman. The light and electron microscopic features of the lesion indicate that it derives from melanocytes normally found in the leptomeninges. This tumor closely resembles the dermal cellular blue nevus and does not have the ultrastructure of a meningioma. “Melanotic meningioma” is consequently a misnomer and the name “meningeal melanocytoma” is more appropriate. These tumors may appear to be benign histologically, but they are locally aggressive. Total surgical excision offers the best chance for cure.

KEY WORDS: meningeal melanocytoma, melanotic meningioma, spinal cord tumors, melanoma

MENINGEAL melanocytomas are rare tumors. Only 11 cases have been reported,1,2,7,11,14,19,20,22 one of which involved the thoracic spinal cord. A second case involving the thoracic cord is presented with ultrastructural observations; recurrent disease developed locally and invaded the spinal cord. In this case, the invasion of the spinal cord is unique. Autopsy material from one other case has been studied by electron microscopy.18 Our findings indicate that these tumors are derived from melanocytes and are morphologically similar to the dermal cellular blue nevus.

CASE REPORT

This patient was a 71-year-old, right-handed woman. In 1971, she noted the insidious onset of diminishing sensation over the right half of the body extending from the upper thorax downward. She also noticed progressive weakness of the left leg. By June, 1973, she had moderate left leg weakness and sought medical attention. A Pantopaque myelogram was performed, revealing an intradural extramedullary lesion at the T-3 level. A thoracic laminectomy of T2–4 was performed in June, 1973, at which time a black-pigmented neoplasm was discovered. The tumor was located on the left anterolateral aspect of the spinal cord, and was densely adherent to both the dura and the cord surface. A subtotal excision was done. Postoperatively, 3000 rads of cobalt-60 irradiation were given to the tumor area.

Following surgery the patient regained most of the strength in the left leg, but
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Fig. 1. Pantopaque myelogram showing a partial block at the T-3 level (left), and widened spinal cord (right).

pain and temperature sensation deficits persisted on the right side of the body from the T-4 level downward. Her condition remained stable until July, 1976; at that time she noticed increasing weakness of the left leg, and decreased sensation to pain and temperature on the left side of the trunk. She continued to have reduced sensation to pain and temperature in the right side of the trunk and right lower extremity. The patient was referred to M. D. Anderson Hospital and Tumor Institute in October, 1976.

Examination. The general physical examination was normal. The neurological examination showed moderate weakness of the entire left lower extremity. Hypalgesia to pin-prick in the T-4 through S-5 dermatomes was demonstrated on the right side of the body. Proprioceptive sensation was slightly diminished in both lower extremities. Light touch sensation was intact. The patellar and Achilles reflexes were hyperactive, and a left Babinski's sign was elicited. A complete blood cell count, urinalysis, coagulogram, sequential multianalyzer screening, bone scan, and liver/spleen scan were all normal. A Pantopaque myelogram (Fig. 1) demonstrated an intramedullary lesion at the T-3 level.

Operation. In November, 1976, a second operation was performed. The original laminectomy incision was reopened, and the dura was incised, exposing the spinal cord. The spinal cord was widened, and a black-pigmented tumor could be seen just underneath the dorsal midline pia. The tumor was fibrous and adherent to the spinal cord anteriorly, separating it into two halves, and extended posteriorly to the dorsal spinal cord pia (Fig. 2). The tumor was not encapsulated. With the dissecting microscope, most of the tumor was removed by working from the dorsal cord pia between the separated halves of the cord to the anterior dura. Several tiny bits of firmly adherent and invasive tumor in the tumor bed wall in the spinal cord, and the invading tumor in the anterior midline dura were not removed.
Fig. 2. Artist’s drawing of the tumor. The tumor is adherent to the anterior dura and invades the cord to the dorsal pia.

Postoperative Course. The patient displayed good strength in the left hip flexors and quadriceps muscles, but weakness of the distal muscles of the left leg persisted. Almost complete loss of proprioception in the left lower extremity was evidenced. The right leg remained strong and other aspects of the neurological examination remained unchanged when compared with the preoperative status. A week after this operation, a superficial wound dehiscence developed, which necessitated a secondary wound closure. The postoperative course was otherwise uneventful. The patient was able to ambulate well with the aid of a walker 1 month after this operation. The wound was healed 6 weeks after surgery.

Pathological Examination. Multiple fragments of deeply pigmented tumor were processed routinely for light microscopy. A small slice was placed in 2% glutaraldehyde solution and embedded in Epon for electron microscopy. Thin sections of this material were stained with lead hydroxide and uranyl acetate and studied using a Zeiss EM-9S electron microscope.

In light microscopic sections, the tumor cells ranged in shape from round to fusiform; the majority were elongated (Fig. 3). An organoid architecture was not obvious by light microscopy, although a tendency to form compact, small groups of cells was evident in some areas. Little cellular pleo-

Fig. 3. Photomicrograph of the ovoid to fusiform tumor cells showing little pleomorphism or mitotic activity. Clusters of melanophages can be seen. H & E, × 400.
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Arrangement of the cells into compact groups was apparent by electron microscopy, but the aggregates varied greatly in size and shape; some were small and angular (Fig. 4). Nevertheless, each group was bordered by a well defined basal lamina (Fig. 5). The stroma included dense bundles of mature collagen fibrils with fibroblasts, small blood vessels, and a considerable number of macrophages containing dense lysosomal aggregates in which melanosomes could be recognized.

Although pleomorphism of the tumor cells was not a striking feature of the neoplasm on light microscopy, the cell contours, and particularly the nuclear profiles, were seen to be irregular on electron micrography. Some nuclei had jagged outlines, and multiple large nucleoli were common. Within the groups of tumor cells, the plasma membranes of adjacent cells were closely apposed, and united by occasional small desmosomes. Complex infoldings of cell membranes were not seen, and there was no suggestion of acinar formation.

The cytoplasm of the tumor cells contained organelles in moderate numbers, and occasional lipid droplets were also present. Numerous melanosomes were seen, and a premelanosomal framework with its characteristic periodicity could be detected in some of the less heavily pigmented melanosomes. The quantity of these pigmented bodies varied considerably; many cells contained large numbers of these bodies, but in some they were sparse.

Fig. 4. Electron micrograph showing the tumor cells arranged into compact groups bordered by basal laminae. Melanosomes in varying stages of maturation are present within cytoplasm. × 4600.
FIG. 5. Electron micrograph showing basal laminae surrounding the groups of tumor cells. The nuclear profiles are irregular, and nucleoli are large. A macrophage containing phagocytosed melanin is present in the stroma between the nests of tumor cells. × 8200.

Discussion

Melanin-containing neoplasms of the meninges are uncommon. They include malignant melanoma metastatic to the meninges, primary malignant melanoma of the meninges, and the rarely reported clinicopathological entity that has been variously named "pigmented meningioma," "melanotic meningioma," "meningeal melanocytoma," and "cellular blue nevus."1,2,7,11,15,16,20-22

The clinicopathological features of primary leptomeningeal melanomas have been described.4,5,10,13 These tumors are almost invariably fatal due to rapid local growth, spread to secondary sites within the nervous system, and distant metastases. The histological features14,20 reflect their highly malignant character: nuclear and cellular pleomorphism, large nucleoli, numerous mitotic figures, and secondary changes of necrosis and hemorrhage.

The term "melanotic meningioma" has been used to describe a cellular, pigmented, spindle-cell neoplasm that arises from meninges and has relatively benign histological features. Pleomorphism, mitotic figures, necrosis, and hemorrhage are absent or at most minimal. In contrast to malignant melanomas, these neoplasms are slow-growing tumors that compress and rarely invade the nervous system locally; they usually do not metastasize to other parts of the central nervous system or to distant sites. Long duration of symptoms and long-term survival have been the rule in previously reported cases, although severe neurological deficits and death may occur due to local compression and invasion of important structures (Table 1).
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TABLE 1
Survey of reported patients with meningeal melanocytoma (melanotic meningioma)

<table>
<thead>
<tr>
<th>Author, Year</th>
<th>Sex, Age (yrs)</th>
<th>Duration of Symptoms (yrs)</th>
<th>Location</th>
<th>Treatment</th>
<th>Survival (yrs)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ray &amp; Foot, 1940</td>
<td>F, 29</td>
<td>5</td>
<td>L-1 to L-3</td>
<td>complete resection</td>
<td>25*</td>
</tr>
<tr>
<td></td>
<td>F, 45</td>
<td>1</td>
<td>posterior fossa</td>
<td>complete resection, radiation therapy</td>
<td>11†</td>
</tr>
<tr>
<td>Bakody, et al., 1950</td>
<td>M, 45</td>
<td>2</td>
<td>L-2 to L-4</td>
<td>subtotal resection</td>
<td>8*</td>
</tr>
<tr>
<td>Keeegan &amp; Mullan, 1962</td>
<td>M, 51</td>
<td>6</td>
<td>pons</td>
<td>subtotal resection</td>
<td>3½*</td>
</tr>
<tr>
<td>Turnbull &amp; Tom, 1963</td>
<td>F, 35</td>
<td>2</td>
<td>Meckel's cave</td>
<td>subtotal resection, radiation therapy</td>
<td>19†</td>
</tr>
<tr>
<td>Russell &amp; Rubinstein, 1963</td>
<td>— — —</td>
<td>—</td>
<td>cervical cord</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td></td>
<td>— — —</td>
<td>—</td>
<td>cerebellum</td>
<td>—</td>
<td>—</td>
</tr>
<tr>
<td>Abbott, et al., 1968</td>
<td>M, 57</td>
<td>5</td>
<td>T-4</td>
<td>complete resection</td>
<td>1*</td>
</tr>
<tr>
<td>Scott, et al., 1971</td>
<td>F, 56</td>
<td>—</td>
<td>cervical cord</td>
<td>subtotal resection, radiation therapy</td>
<td>17</td>
</tr>
<tr>
<td>(multiple sites)</td>
<td></td>
<td>(multiple)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Limas &amp; Tio, 1972</td>
<td>M, 71</td>
<td>6</td>
<td>foramen magnum</td>
<td>none</td>
<td>autopsy diagnosis</td>
</tr>
<tr>
<td>Graham, et al., 1976</td>
<td>F, 52</td>
<td>2</td>
<td>C-6 to T-1</td>
<td>subtotal resection</td>
<td>3*</td>
</tr>
<tr>
<td>Steinberg, et al., 1978</td>
<td>F, 71</td>
<td>2</td>
<td>T-3</td>
<td>subtotal resection, radiation therapy</td>
<td>4*</td>
</tr>
</tbody>
</table>

*Alive at time of report.
†Died of unknown cause.
‡Died of unrelated cause; residual tumor present at autopsy.

The pathogenesis of these tumors is uncertain. Scattered melanocytes normally exist within the human leptomeninges and are most frequently found in the recesses of the sulci and around the base of the brain. Some authors have postulated that “melanotic meningioma” results from a transfer of melanin from non-neoplastic melanocytes to neoplastic meningotheial cells, or from the induced formation of melanin within meningotheial cells. In 1972, Limas and Tio reported the first case of “pigmented meningioma” in which electron microscopic examination of autopsy material was performed. They concluded that the tumor derived from melanocytes rather than meningotheial cells and suggested that these tumors be (more appropriately) named “meningeal melanocytomas.” Our observations support the melanocytic origin of pigmented meningiomas. The striking organoid structure of the tumor is similar to that of the dermal cellular blue nevus and not characteristic of malignant melanomas. The features commonly seen in meningiomas were not present in our case. Ultrastructurally, meningiomas display slender, branching, and loosely intertwining cytoplasmic membranes that create a distinctive diagnostic pattern, in addition to other features. The case differs from those previously reported. At the second operation, the tumor appeared to directly invade the spinal cord substance without a definite capsule surrounding the intramedullary portion of the tumor. Previous reports have indicated that these tumors often adhere to surrounding structures and generally possess a well defined capsule. Whether these tumors are naturally invasive or this invasion occurs as a result of previous surgery and/or irradiation is not known.

The best treatment appears to be total surgical excision, when possible. Because the number of cases that have been irradiated postoperatively is small, the value of radiotherapy is unknown. Although extensively employed in the treatment of malignant melanomas, chemotherapy has not, to our knowledge, been used in the treatment of meningeal melanocytomas.

Because of the inability to resect this patient’s lesion and her previous radiotherapy, an attempt to stabilize the disease with chemoimmunotherapy seemed war-
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ranted. Since there are no data on chemotherapy for this particular lesion, we elected to treat it as if it were a malignant melanoma. Although chemotherapy for melanoma has been disappointing, 

some improvements have been noted with the addition of immunotherapy. We elected to treat this patient using our recent regimen of chemoinmunotherapy employing intravenous Corynebacterium parvum, dimethyl triazeno imidazole carboxamide, and actinomycin D. Poor penetration of the central nervous system by these drugs may prove to be a major limitation to their use. Chemotherapy may be effective in controlling the extra-medullary portion of the tumor, while intra-medullary remnants may show no response. If the intramedullary tumor cannot be controlled by the above regimen, the use of drugs that can penetrate the blood-brain barrier, such as 1, 3-bis (2-chloroethyl)-1-nitrosourea (BCNU), procarbazine, hydroxyurea, or fluorafur (a tetrahydrofuryl derivative of fluorouracil), may be necessary. Intrathecal chemotherapy may be included in the treatment program for this patient.

In June, 1977, 7 months after surgery, our patient was ready to begin her seventh course of chemoimmunotherapy. Strength has improved in her lower extremities. She continues to ambulate with the help of a walker.

References

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