A rare case of malignant pediatric ectomesenchymoma arising from the falx cerebri

Case report

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Malignant ectomesenchymoma is a rare tumor arising from mature ganglion cells with immature myogenous elements, with only 4 pediatric intracranial cases having been previously reported. The authors report a rare case of intracranial malignant ectomesenchymoma originating from the falx cerebri in a 10-year-old boy. The patient presented with a 2-week history of headache, nausea, and blurry vision, with mild lateral gaze diplopia. A CT scan revealed a solitary 7.2 × 3.8–cm dural-based mass that extended along the falx. No metastatic disease was identified, and the lesion was grossly resected without complication. Pathological investigation identified single and small groups of cells in a myxoid background, with polygonal or spindle-shaped cells containing eccentric nuclei and prominent nucleoli. Immunohistochemical staining of some cells was positive for smooth-muscle actin, CD99, and vimentin, whereas other cells (often process forming) were positive for S100 protein, synaptophysin, and neurofilament protein. Staining was negative for CD138, CD45, α-fetoprotein, CK AE1/3, glial fibrillary acidic protein, CK7, CK20, CD31, CD34, myoD, and desmin. Normal immunopositivity was seen for INI-1. The Ki 67 immunostaining had < 25% reactivity. The patient was treated with a sarcoma-based chemotherapy regimen and radiation to the craniospinal axis, and was found to be without recurrence or metastatic disease at 20 months. (DOI: 10.3171/2010.10.PEDS10261)

Key Words • malignant ectomesenchymoma • falx cerebri • intracranial mass • pediatric brain tumor

This article contains some figures that are displayed in color online but in black and white in the print edition.
**Examination.** His general examination results were normal, without skin manifestations. Ocular movements were full, without visual field deficits, but bilateral papilledema was noted. There was no facial weakness, and the remainder of the cranial nerve examination results were normal. The patient did not exhibit any motor weakness, apraxia, or difficulty with coordination. Results of the sensory examination were normal.

A CT scan revealed a 7.2 × 3.8–cm dural-based mass with minor calcifications that extended along the falx cerebri and was contiguous with the corpus callosum (Fig. 1A and B). The MR imaging studies identified a dural-based enhancing mass, with mild mass effect and edema (Fig. 1C–F). A patent sagittal sinus was confirmed by MR angiography, and the spinal MR imaging study was negative for metastases.

**Operation.** An interhemispheric approach was used to perform a gross-total resection of a firm and vascular mass arising from the falx and blending into gliotic cortex. A midline craniotomy was performed for resection of tumor from the interhemispheric fissure. The lesion was arising and involving the falx medially, and anteriorly the lesion blended into abnormal cortex, which was firm and rubbery. The mass was heterogeneously friable, soft, and rubbery. A gross-total resection was achieved.

**Pathological Findings.** Microscopic examination of the neoplasm showed occasional individual malignant cells that appeared singly and in small groups in a largely myxoid background, with admixed mature-appearing ganglionic cells (Fig. 2A and B). The cells varied from polygonal to spindled, with eccentric nuclei and prominent nucleoli. Two populations were apparent by immunohistochemistry, demonstrating both neural and mesenchymal differentiation. Many cells were immunoreactive for smooth-muscle actin, CD99, and vimentin, consistent with a smooth-muscle origin (Fig. 2C–E). Other cells, which often formed processes, were immunoreactive for synaptophysin, neurofilament protein, and S100 protein, suggesting neural origin (Fig. 2F–H). Immunohistochemical studies for INI-1 (BAF-47) performed at the University of Florida revealed normal positivity in neoplastic cells, mitigating against atypical teratoid/rhabdoid tumor. These findings are consistent with a diagnosis of malignant ectomesenchymoma.²

**Postoperative Course.** The patient developed transient right-sided hemiparesis, with mild residual right-handed apraxia. Immediate postoperative MR imaging studies confirmed a gross-total resection of the mass. Because of the aggressive nature of this tumor, the patient was treated with a sarcoma-based chemotherapy regimen that included 21-day cycles of vincristine (2 mg/m² × 1 dose, maximum dose 2 mg), doxorubicin (75 mg/m² over 48 hours), cyclophosphamide (1200 mg/m² × 1 dose) alternating with ifosfamide (1800 mg/m² daily × 5 days), and etoposide (100 mg/m² daily × 5 days). His fourth cycle was changed to carboplatin (600 mg/m² × 1 day) and etoposide (90 mg/m² × 3 days) due to difficulties tolerating the ifosfamide/etoposide cycle. He received 30.6-Gy radiation treatment to the craniospinal axis, with a 54-Gy boost to the tumor bed. The patient has returned to school and is stable neurologically, without tumor recurrence at 20 months after completion of his treatment.

During his treatment, the patient had an evaluation for tall stature (he had a growth spurt between 7 and 8 years of age). At diagnosis, his bone age was 2 SDs above the mean (14 years 0 months at 10 years 10 months chron-
He was noted to be Tanner Stage I–II at diagnosis, and endocrine workup at 14 weeks postsurgery showed a prepubertal testosterone level of < 7 ng/dl and a normal insulin-like growth factor–I level (215 ng/ml). At 1 year postsurgery, his bone age has not advanced (13 years 6 months at 11 years 11 months chronological age), and he is now beginning to enter puberty. It is unclear if this growth issue was related to the tumor, but it has now remained unchanged since tumor removal. No other medical problems have been noted.

**Discussion**

Pediatric malignant ectomesenchymomas typically present in the soft tissues, and only 4 intracranial lesions have been reported previously in children younger than 18 years of age.\(^2\)\(^3\)\(^4\)\(^5\)\(^6\)\(^7\)\(^8\) We describe a case of malignant ectomesenchymoma arising from the falx cerebri in a 10-year-old boy, the first reported instance in such a location. This rare lesion, initially suggestive of a meningioma on neuroimaging, should be considered in the differential diagnosis of dural-based lesions, especially in the pediatric population.

This tumor is composed of neoplastic cells of both neuroectodermal and mesenchymal derivation.\(^2\) These features led to its early designation as a gangliorhabdomyosarcoma, a term that was later replaced by malignant ectomesenchymoma.\(^2\)\(^3\) Without an awareness of this entity, the neural elements may be overlooked and the lesion may be misdiagnosed as a sarcoma (which may occur with limited sampling).\(^1\) The histological differential diagnosis of an intracranial malignant ectomesenchymoma includes rhabdomyosarcoma, primitive neuroectodermal tumor, anaplastic meningioma, and primary meningeal melanomas, among others.

Malignant ectomesenchymomas are rare intracranial tumors in children that are highly aggressive, requiring gross-total resection and chemotherapy (often based on a sarcoma protocol). Limited experience with this rare lesion (most are extracranial) suggests that aggressive excision offers the best long-term prognosis. The benefits of chemotherapy and radiation are as yet undefined in this small population.\(^2\) In the majority of cases, the malignant component is composed of rhabdomyosarcoma, leading to the decision to treat with sarcoma-based therapy.\(^2\)\(^3\)\(^4\)\(^6\)\(^9\) Most cases of extracranial location have been treated according to one of the protocols of the Intergroup Rhabdomyosarcoma trials.\(^1\) Due to the malignant mesenchymal elements of this tumor, several studies recommend early chemotherapy.\(^2\)\(^3\)\(^6\)\(^9\) In a review of 40 cases of malignant ectomesenchymoma published by Freitas et al.,\(^2\) 18 of the 25 surviving patients had a complete resection followed by chemotherapy. These authors suggested postoperative chemotherapy as an important treatment for this disease, based on their analysis.\(^10\)

For intracranial lesions, this approach probably needs to be modified due to the decreased penetrance of some chemotherapeutic agents.\(^8\) Three of the 4 patients whose cases were reported by Weiss et al.\(^10\) died within 14 months of diagnosis, and none of these received complete multimodal therapy at diagnosis. One patient had incomplete resection and radiation, I had chemotherapy and radiation therapy only, and I had only a complete resection initially, followed by chemotherapy and radiation therapy at relapse. The single survivor in this series received chemotherapy and craniospinal radiation (35.2 Gy, with a 55-Gy boost to the tumor bed) after complete resection. The only other case of an intracranial lesion was in a 4-year-old girl who presented with metastatic disease to the lungs, was not amenable to complete resection, and did not survive.\(^3\) Our particular case was amenable to gross-total resection, and the patient received upfront multiagent chemotherapy and radiation, with no evidence of recurrence or metastatic disease at 20 months.

**Conclusions**

Increasing experience with the treatment of intracranial malignant ectomesenchymoma via appropriate surgical...
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approaches, and combination chemotherapy and radiotherapy, may offer a better prognosis for children presenting with this rare and complex tumor.

Disclosure

The authors report no conflict of interest concerning the materials or methods used in this study or the findings specified in this paper.

Author contributions to the study and manuscript preparation include the following. Conception and design: Pearl. Acquisition of data: Altenburger, Eslin. Drafting the article: Pattisapu, Altenburger. Critically revising the article: all authors. Reviewed final version of the manuscript and approved it for submission: all authors. Administrative/technical/material support: Altenburger, Eslin.

Acknowledgments

The authors thank Santino Lamancusa for his expertise in digital imaging, and Dr. Marc Shapiro and Jason Lees at NeuroSkeletal Imaging in Winter Park, Florida, for their help in the acquisition of the high-quality MR images.

References


Accepted October 15, 2010.
The initial case report was presented in abstract/poster form at the 2009 American Association of Neuropathologists’ annual meeting in San Antonio, Texas, in June 2009.
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