Manifestations and therapeutic considerations in pineal yolk-sac tumors

Case report

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A 20-month-old patient with a paraventricular and parapineal yolk-sac tumor was treated with subtotal excision and total neuraxis irradiation. She has done well in the 3½ years since surgery. A comparative review of similar pineal and gonadal yolk-sac tumors suggests a role for surgery combined with radiotherapy and chemotherapy. Additional experience with these unusual germ-cell neoplasms should establish the need for aggressive extirpation, not only to determine the exact diagnosis, but also to provide the basis for subsequent adjunctive therapy. The latter may include specific combinations of antineoplastic drugs in addition to radiation.

KEY WORDS • yolk-sac tumor • radiotherapy • pineal gland • chemotherapy • pineal tumor • germ-cell tumor • endodermal sinus tumor

Pineal tumors comprise only 0.5% to 6.7% of all intracranial neoplasms.1,4,5,16 They arise from two main cell types — parenchymal pineal cells (the pineocytoma and its primitive counterpart, the pineoblastoma) and cells resembling germ cells.2,3,13,14 Using a modification of the World Health Organization Brain Tumor Commission classification,7,8,11 germ-cell tumors in the pineal gland can be divided into five groups: 1) germinoma; or 2) embryonal carcinoma, the cells of which can differentiate into 3) choriocarcinoma; 4) yolk-sac tumor (endodermal sinus tumor); or 5) teratoma. A pineal germ-cell tumor may be “pure” or composed of combinations of these different neoplasms.

We describe the case of a young girl with a rare tumor in the parapineal region. Unusual features for this neoplasm include the young age of the patient (the youngest recorded), the tumor’s unusual location, and the prolonged survival of the patient after combined surgical excision and radiotherapy.

Case Report

This 20-month-old girl was admitted to the Jackson Memorial Medical Center on March 21, 1977, with a 1-month history of lethargy, a poor appetite, and instability of gait. Two weeks before admission, she had experienced a seizure with left-sided, tonic-clonic movements, and she subsequently developed a persistent left hemiparesis. Her birth and developmental milestones had been unremarkable.

Examination. Physical examination revealed a lethargic child with a left central facial palsy and a mild left hemiparesis. The remainder of her examination was normal. Computerized tomography (CT) showed a large, enhancing mass extending from the midline to the right para-atrial region, with shift of the ventricular system from right to left and displacement of the right temporal horn (Fig. 1). Right carotid arteriography revealed tumor vascularity arising from the right anterior choroidal and lenticulostriate arteries.
FIG. 1. Postcontrast computerized tomography scan showing a relatively homogeneous, enhancing mass deep in the right cerebral hemisphere, extending from the third ventricular and pineal regions medially, and to the right para-atrial region laterally. A massive shift of the lateral ventricles to the left and an anteriorly displaced right temporal horn are seen.

FIG. 2. Right carotid arteriogram, lateral projection, showing elevation of the right middle cerebral artery and tumor vascularity (outlined by arrowheads), supplied by the anterior choroidal artery (white arrows), and branches of the pericallosal artery. A vertebral arteriogram (not shown) demonstrated supply from the right posterior choroidal artery and perforating thalamic branches.

and branches of the right pericallosal artery (Fig. 2). A vertebral arteriogram showed vascular contribution to the tumor from a right posterior lateral choroidal artery and perforating thalamic arteries. From the CT and arteriographic findings, a malignant neoplasm arising from the region of the atrium of the right lateral ventricle and spreading into the surrounding corpus callosum and thalamus was likely. An ependymoblastoma was the most probable diagnosis.

Operation. On March 24, 1977, the child underwent a right parieto-occipital craniotomy, and a friable vascular tumor, found mainly in the right lateral ventricle, was removed. The tumor infiltrated the right collateral eminence and extended through the choroidal fissure inferiorly and medially into the right posterior tentorial notch to the right posterolateral aspect of the midbrain. A portion of this tumor involved the pineal region. The patient tolerated the procedure well.

Postoperative Course. She exhibited a mild left seventh nerve paresis, but was able to move all extremities. The postoperative CT scan demonstrated probable residual tumor lying medial to the border of the right lateral ventricle. She received 4600 rads to the tumor site and 2600 rads to the entire craniospinal axis. No chemotherapy was administered.

A CT scan obtained 2 years postoperatively revealed no recurrence of the tumor. The patient is neurologically normal 3½ years after surgery.

Pathological Examination. The excised tumor consisted of irregular, reddish-purple fragments of soft tissue, measuring 5 x 5 x 2 cm in aggregate, and four irregular, deeply hemorrhagic fragments of rubbery tissue, tan-gray-yellow in color and measuring 6 x 5 x 3.5 cm in aggregate. The initial histopathological diagnosis was a moderately differentiated (Grade II) malignant papillary ependymoma, which was later confirmed to be an embryonal carcinoma of the yolk-sac variety.

Light microscopy revealed a loose meshwork of spaces and channels lined with cuboidal epithelium and, focally, with flattened or vacuolated cells ("reticular pattern") (Fig. 3 upper left). Some areas possessed a "festoon pattern" with glomerular-like structures (Schiller-Duval bodies) and tumor papillations typical of yolk-sac neoplasms (Fig. 3 upper right). A solid pattern included a dense proliferation of undifferentiated epithelioid cells (Fig. 3 lower left). Although the polyvesicular vitelline pattern of microcysts was not seen, focal multinucleated tumor cells were evident, and adjacent neural parenchyma showed a reactive astrocytosis. As described in other yolk-sac tumors,
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Fig. 3. Photomicrographs of the neoplasm. Upper Left: The microscopic appearance is typical of a yolk-sac tumor, and demonstrates a reticular pattern with channels lined by flattened cells. H & E, × 140. Upper Right: Other histomorphological features include glomerular-like structures (Schieller-Duval bodies) with tumor papillations. H & E, × 140. Lower Left: A solid undifferentiated tumor pattern is shown. H & E, × 275. Lower Right: Focal periodic acid-Schiff-staining bodies shown here were recognized as alpha-fetoprotein on immunoperoxidase staining. H & E, × 430.

nonglycogen hyaline droplets that stained positive to periodic acid-Schiff were present (Fig. 3 lower right). Using immunoperoxidase techniques, alpha-fetoprotein was noted in formalin-fixed sections, but human chorionic gonadotropin was not.

Discussion

The majority of yolk-sac tumors have been found in the ovaries and testes of young children. The origin of these unique neoplasms is the germ cell, which arises from the yolk sac and migrates throughout the embryonic midline. These cells occasionally populate not only the gonads, but extragonadal areas as well, including the vulva, vagina, cervix, prostate, sacrococcygeal region, retroperitoneum, anterior mediastinum, liver, face, and pineal region. Yolk-sac tumors have been reported in the pineal region in only 24 patients; 10 of these were pure yolk-sac tumors (Table 1).

Because of their embryological and histological similarities, an analogy may exist between gonadal and pineal yolk-sac tumors in their response to surgery, chemotherapy, and radiotherapy (Table 2). Testicular yolk-sac tumors, which behave more aggressively in adults, are favorably affected by surgical extirpation and appropriate postoperative chemother-

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TABLE 1

<table>
<thead>
<tr>
<th>Case No.</th>
<th>Author, Year</th>
<th>Sex, Age (yrs)</th>
<th>Treatment*</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Albrechtsen, et al., 1972</td>
<td>M, 15</td>
<td>surgery</td>
<td>died immediately postop</td>
</tr>
<tr>
<td>2</td>
<td>M, 20</td>
<td>surgery</td>
<td>died immediately postop</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>Scully &amp; McNeely, 1974</td>
<td>F, 12</td>
<td>radiotherapy</td>
<td>died postop (removal of spinal cord metastases)</td>
</tr>
<tr>
<td>4</td>
<td>Burger &amp; Vogel, 1976</td>
<td>M, 24</td>
<td>VA shunt, surgery, radiotherapy, &amp; chemotherapy</td>
<td>massive hemorrhage into tumor alive at 12 mos</td>
</tr>
<tr>
<td>5</td>
<td>Prioleau &amp; Wilson, 1976</td>
<td>M, 20</td>
<td>surgery, radiotherapy, &amp; chemotherapy</td>
<td>died 20 mos after onset of symptoms alive</td>
</tr>
<tr>
<td>6</td>
<td>Yoshiki, et al., 1976</td>
<td>M, 20</td>
<td>shunt, surgery, &amp; radiotherapy</td>
<td>died at 6 wks</td>
</tr>
<tr>
<td>7</td>
<td>Lee, et al., 1978</td>
<td>M, 13</td>
<td>VP shunt, subtotal resection, radiotherapy</td>
<td>died at 7 mos</td>
</tr>
<tr>
<td>8</td>
<td>Chapman &amp; Linggood, 1980</td>
<td>F, 13</td>
<td>radiotherapy &amp; spinal decompression</td>
<td>well at 3½ yrs postop</td>
</tr>
<tr>
<td>9</td>
<td>Murovic, et al., 1981</td>
<td>F, 1.7</td>
<td>surgery &amp; radiotherapy</td>
<td>well at 3½ yrs postop</td>
</tr>
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*VA = ventriculoatrial; VP = ventriculoperitoneal.

TABLE 2

Summary of clinical course in cases of gonadal yolk-sac tumors*

<table>
<thead>
<tr>
<th>Tumor Type†</th>
<th>% of Germ-Cell Tumors</th>
<th>Age Range</th>
<th>Alpha-Fetoprotein</th>
<th>Human Chorionic Gonadotropin</th>
<th>Radiation Therapy</th>
<th>Chemo-therapy</th>
<th>Survival Rate</th>
</tr>
</thead>
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<tr>
<td>testicular</td>
<td>13%-35%</td>
<td>2 yrs–26 yrs</td>
<td>+</td>
<td>+ (30%-50%)</td>
<td>–</td>
<td>+</td>
<td>22%-60% (improved with chemotherapy)</td>
</tr>
<tr>
<td>ovarian</td>
<td>22%</td>
<td>14 mos–45 yrs</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>+</td>
<td>16%-75% (5-yr survival, improving with chemotherapy)</td>
</tr>
<tr>
<td>central nervous system</td>
<td>?</td>
<td>20 mos–24 yrs</td>
<td>+</td>
<td>–</td>
<td>–</td>
<td>?</td>
<td>30% survival at 3½ years</td>
</tr>
</tbody>
</table>

* Abbreviations: + = present or responsive; – = absent or nonresponsive; ? = unknown.
† References: testicular tumors,† ovarian tumors,† tumors of the central nervous system.†,6,8,13,15,17,18

apy (vincristine, actinomycin D, 5-fluorouracil, and cyclophosphamide).10,12 They do not respond to radiotherapy.12 In females, the yolk-sac tumor is seen most often in the ovaries of children.7,8,10 Its prognosis is poorer than that of the same histological tumor in male adults and children but, with the use of surgery and similar chemotherapy, cures are reported (Table 2).7 Once again, this gonadal tumor is not responsive to radiotherapy.7

With the above approaches in mind, 10 pure cases of pineal yolk-sac tumor were evaluated with regard to their treatment (Table 1).1–3,5,9,13,15,18 There were three females and seven males; the ages ranged from 1.7 to 24 years. Two patients died immediately after surgery alone (the details of the surgery were not reported).1 One died shortly after a laminectomy for removal of spinal cord metastases, having received only radiotherapy.15 One patient (Case 4), who was treated by shunting alone, died from a massive hemorrhage into the tumor.5 Case 5 had surgery, radiotherapy, and chemotherapy (vincristine, actinomycin D, and cyclophosphamide) and was alive 12 months later.13 Two patients (Cases 6 and 9) died 20 months after onset of symptoms and 7 months postoperatively, respectively, following shunting, extirpation, and radiotherapy,8,18 and one (Case 7) is alive 2 years after a similar regimen.9 A 13-year-old girl received surgery, spinal decompression, and radiotherapy, but died 6 weeks after surgery.3 Our patient underwent surgery plus radiotherapy, without chemotherapy, and is alive 3½ years postoperatively.

The limited number of patients with pineal yolk-sac tumors precludes any definitive remarks about appropriate therapy. Nevertheless, successful treatment of embryologically and histologically similar germ-cell tumors in the gonds implies that similar therapeutic approaches for the intracranial variety may provide improved prognoses for these previously lethal and aggressive cancers. Intracranial microsurgical techniques in concert with total neuraxis radio-
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therapy with and without chemotherapy were associated with survival periods of greater than 1 year for three patients with pineal yolk-sac tumors (Table 1). Using alpha-fetoprotein as a marker, the cerebrospinal fluid could be monitored after an initial treatment program of surgery plus chemotherapy only, to determine subsequent reinstitution of appropriate chemotherapy. More experience may indicate that aggressive surgery should be followed immediately by both radiation and chemotherapy.

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References


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