Implantation metastasis of pineoblastoma after stereotactic biopsy

Case report


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A case is reported of implantation metastasis occurring 2 months after stereotactic biopsy of a pineoblastoma was performed in an 18-month-old child. Although implantation metastasis is well recognized after needle biopsy of solid tumors, it has not been described following stereotactic biopsy of a brain tumor. Implications for the role of stereotactic biopsy in the management of brain tumors is discussed.

KEY WORDS • pineoblastoma • brain neoplasm • stereotactic biopsy • tumor seeding

A computerized tomography (CT)-guided stereotactic biopsy is a safe, accurate method for the diagnosis of brain tumors, allowing for early planning of therapy and formulation of prognosis. The management of pineal region tumors remains controversial, however, initial biopsy is becoming more important in planning the treatment of these neoplasms and is performed safely by the stereotactic approach. We describe the first reported case of metastatic seeding of a pineoblastoma along the needle track 2 months after transfrontal stereotactic biopsy.

Case Report

This 18-month-old boy was brought to the Royal Children's Hospital, Victoria, Australia, with a 3-week history of progressive ataxia, lethargy, left strabismus, and headache.

Examination. The patient was a pale, wasted child with a left sixth nerve palsy, papilledema, and impairment of upward gaze. A CT scan showed a large enhancing mass lesion in the pineal region, with moderate hydrocephalus (Fig. 1 left). A ventriculoperitoneal shunt was inserted and the boy responded well, with partial relief of his signs and symptoms, including the upward gaze palsy. Measurements of alpha-fetoprotein and beta-human chorionic gonadotropin in the cerebrospinal fluid were negative. Nine days later a right transfrontal stereotactic biopsy was performed, using the Brown-Roberts-Wells (BRW) system and a 2-mm Nashold biopsy needle* via a twist-drill opening in the skull. Several core biopsy samples were obtained without complication.

Histological examination showed fragments of a highly cellular tumor with extensive necrosis. The tumor cells had oval to slightly angular nuclei, fine even chromatin, and two to three nucleoli per nucleus. Mitoses and apoptosis were prominent (Fig. 2). Cytoplasm was scanty and cell margins were poorly defined. Rosettes and fibrillary areas were not seen. Special staining demonstrated no glycogen, and teratomatous elements were not seen. Ultrastructural studies showed tumor cells with mainly smooth outlines joined by occasional zonula adherentes and puncta adherentes. The cytoplasm contained moderate numbers of ribosomes and occasional profiles of rough endoplasmic reticulum.

* Brown-Roberts-Wells stereotactic system and Nashold biopsy needle manufactured by Radionics, Inc., Burlington, Massachusetts.
FIG. 1. Axial computerized tomography scans with contrast enhancement. Left: Prebiopsy appearance showing the rounded pineal mass. Right: Postbiopsy appearance showing extension of the pineal tumor along the previous needle track.

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FIG. 2. Photomicrograph showing poorly differentiated tumor with prominent mitoses and apoptosis. H & E, × 170.

Discussion

Needle-track implantation is presumed due to tumor cells adhering to the needle being released as it is withdrawn from the tumor; it may also be due to suction of tumor cells along the track when a sample is aspirated into the biopsy needle. Malignant seeding following needle biopsy of carcinomas of the lung, 22-24 kidney, 15 prostate, 11,15 pancreas, 8,18 thyroid, 18 liver, 18 retroperitoneum, 14 and ocular melanoma, 9 has been well documented. The risk of this complication appears to be very low. Smith 25 reported three cases of needle-track seeding among 63,108 cases, a rate of 0.005%; Sinner and Zajicek 24 reported one among 1264 cases, an incidence of 0.079%, after needle biopsy of pulmonary lesions. Haddad and Somsin 13 reported a 0.34% occurrence among more than 6000 cases of needle biopsy of prostatic tumor, and Glasgow, et al. 9 reported no instances of tumor seeding in 6500 fine-needle biopsies.

We could find only one report of a central nervous system (CNS) tumor seeding after needle biopsy: a 10-year-old boy developed a frontal lobe deposit of cri-nopharyngioma which was clearly seen on magnetic resonance imaging to be connected to the primary suprasellar mass by tumor along the line of the needle track. A nonstereotactic method of multiple needle punctures of the suprasellar mass had been performed via a burr hole. In our case, CT clearly showed development of pineoblastoma along the path of the biopsy needle 2 months after the stereotactic procedure (Fig. 1).

The growth of implanted tumor cells depends on the cytokinetic characteristics of the seeded cells such as their adhesiveness and growth potential, the "fertility" of the tumor and prominent precentral cerebellar veins which impeded access. Postoperatively, the boy was initially lethargic, then recovered well.

Postoperative Course. Twelve days postoperatively, the patient was begun on a course of chemotherapy. This included 0.8 mg vincristine and 95 mg carboplatinum. Over the following 10 weeks he received a further seven courses of this regimen. Three weeks after his last course, he was brought in for evaluation of a 6-day history of upward gaze palsy. Repeat CT showed tumor seeding along the path of the stereotactic biopsies (Fig. 1 right). In view of his recent findings it was decided to treat him with a more aggressive regimen of "eight in a day" chemotherapy. This included 0.8 mg vincristine, 60 mg methylprednisolone every 6 hours for 3 days, 40 mg 1-(2-chloroethyl)-3-cyclohexyl-1-nitrosourea (CCNU), 50 mg procarbazine, 2000 mg hydroxyurea, 180 mg cytoseine arabinoside (Ara C), 180 mg cyclophosphamide, and 60 mg cisplatin. The tumor partially responded but recurred soon after cessation of chemotherapy. The child died 32 weeks after the initial presentation, and permission for autopsy was refused.

Operation.

Eight days later, subtotal excision of the tumor was performed via a suboccipital craniectomy and supracerebellar approach. Adequate cytorreduction could not be achieved because of the hypervascularity mitochondria, and Golgi apparatus. Surface and synapse differentiation were not seen and cytoskeleton was scanty. Immunohistochemical studies to demonstrate glial fibrillary acidic protein and tyrosine hydroxylase by RCH PH12 were negative for both. The features were those of a primitive neuroectodermal tumor, and the location was consistent with it being a pineoblastoma. 20

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The growth of implanted tumor cells depends on the cytokinetic characteristics of the seeded cells such as their adhesiveness and growth potential, the "fertility"
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of the host tissue, and the number of seeded cells. The last of these factors depends on the needle size and the amount of normal cells in the tumor.13 The narrower the needle, the lower is the risk of seeding.9,22 Smear cytology of stereotactic biopsies17 allows for accurate interpretation of small biopsy specimens (< 1 mm in diameter) and could theoretically lower the risk of seeding a malignant brain tumor if a narrow-gauge needle is used.

Sheathing the needle does not appear to reduce the risk of seeding.8 However, as multiple passes of the biopsy needle through an outer cannula are often required when a brain tumor is biopsied, the use of a sheath may reduce the risk of seeding provided that the sheath has entered the tumor on the initial pass. This applies particularly when the free-hand CT-guided biopsy technique is used.10 Multiple needling of brain tumors without an outer sheath should be avoided, not only because it causes more trauma but also because it may increase the risk of seeding. The more aggressive the tumor type, the higher appears to be the risk of seeding.10

Ryd, et al.,21 demonstrated the seeding of 10^3 to 10^6 cells from fine-needle aspiration of solid tumors in mice. Eriksson, et al.,7 were unable to show seeding of a syngeneic tumor-host murine model except under extreme test conditions. More than 10^6 cells were required for successful implantation after subcutaneous placement in humans with advanced cancer.26,27 Glas- gow, et al.,9 examined exenterated eyes after previous fine-needle aspiration diagnosis of ocular melanoma. They were able to count up to 3162 melanoma cells in needle tracks, which is less than the number of cells required for successful implantation under experimental conditions in animals21 and humans.26,27 Thus, seeding of cells along needle tracks may occur commonly but not result in a large enough inoculum to set up a significant growth of tumor. The degree of malignancy and the time course after biopsy are also important considerations.

We consider it unnecessary to revise the indications for stereotactic biopsy of brain masses because of the apparent rarity of implantation metastasis occurring from this technique, and the course of a patient with a malignant CNS lesion is probably not altered by needle-track implantation assuming therapy is aggressive. However, the possibility of spreading a malignant brain tumor should be considered when planning a biopsy.

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References


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