Implantation Metastasis of an Anaplastic Astrocytomas after Stereotaxic Biopsy

Anaplastik Astrositomada Stereotaksik Biyopsiden Sonra Gelişen İmplantasyon Metastazı

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Abstract: We report a case of local metastasis of an anaplastic astrocytomas in a six-year-old boy, occurring four months after a stereotaxic biopsy. In central nervous system, implantation metastasis after stereotaxic biopsy is a rare complication. The morphology of this particular dissemination is discussed with reference to in vitro studies of glial tumors.

Key Words: Astrocytomas, implantation metastasis, stereotaxic biopsy

Özet: Altı yaşında bir erkek çocuğunda anaplastik astrositomanın stereotaksik biyopsiden 4 ay sonra gelişen lokal metastazı sunulmuştur. Santral sinir sisteminde, stereotaksik biyopsiden sonra implantation metastazı görülmesi nadir bir komplikasyondur. Bu özel yayılımın oluşumu, glial tümörlerin in vitro çalışmaları ile beraber tartışılmıştır.

Anahtar Sözcükler: Astrositoma, implantasyon metastaz, stereotaksik biyopsi

INTRODUCTION

Anaplastic astrocytoma is a tumor of neuroepithelial tissue (9). Supratentorial presentation is seen more frequently among older people than children (3). If located in eloquent brain areas, surgical treatment could be limited only to stereotaxic biopsy. Generally, surgery is followed by radiotherapy and/or chemotherapy (1). The tendency of this tumor to disseminate is well known. We report here a particular case of implantation metastasis occurring in a six-year-old boy and we discuss the ensuring morphology of this spreading.

CASE REPORT

A six-years-old boy was referred to Pediatric Neurosurgery Department with a 2-week history of headache, vomiting and right sided weakness. Neurological examination revealed a right hemiparesis and a right positive Babinski sign with a bilateral papilledema. T1-weighted MRI scans showed a diffuse, poorly demarcated, isointense left thalamic lesion invading central gray nuclei and compressing third and lateral ventricles. No contrast enhancement was seen after injection of gadolinium (Fig 1).

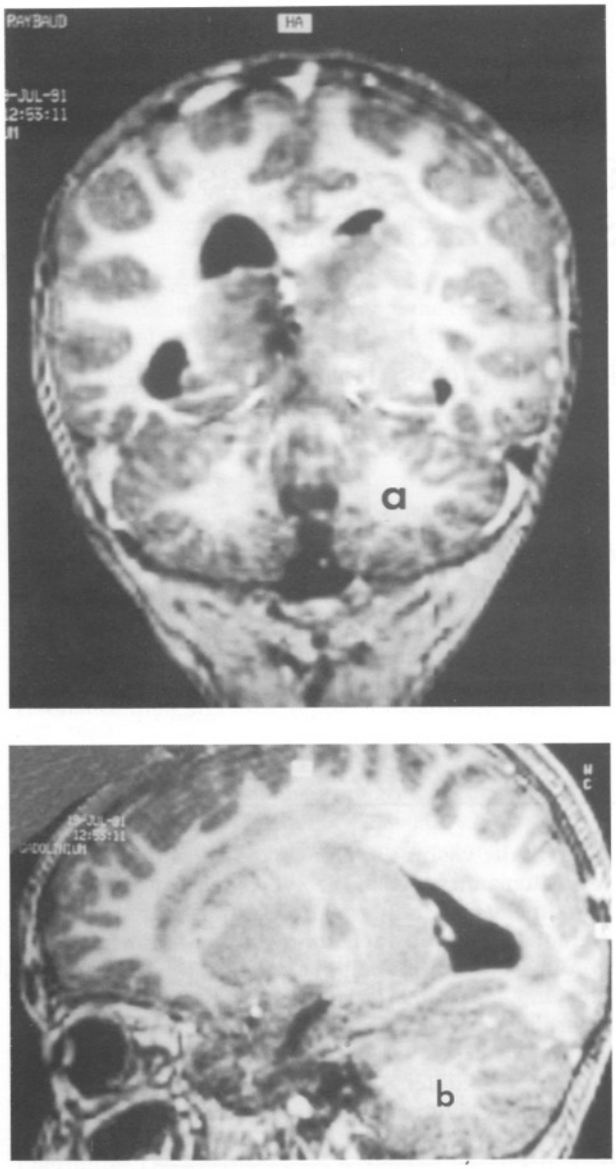

Figure 1. Contrast enhanced T1-weighted coronal (a) and sagital (b) MRI scans show a poorly demarcated, isointense left thalamic tumor.

A left transparietal stereotaxic biopsy was performed 6 days after insertion of a ventriculoperitoneal shunt. Using the Talairach system and a 1,4 mm Sedan biopsy needle, via a twist-drill opening in the skull (Fig 2a), three biopsy samples of satisfying quality were obtained on a single trajectory without any complications.

Histological examination revealed highly cellular, diffuse tumoral proliferation. Mitoses were prominent but no necrosis was seen. The tumor cells were pleomorphics and had a typical nucleus with nucleoli and eosinophilic cytoplasm. There was no vascular endothelial proliferation. The tumor cells were immunonegative with anti-LCA, anti-pankeratin, anti-T lymphocyte, anti-B lymphocytes, anti-CD-68, and slightly positive with antimyofibriller acid. The final diagnosis was an anaplastic astrocytoma (Fig 3).

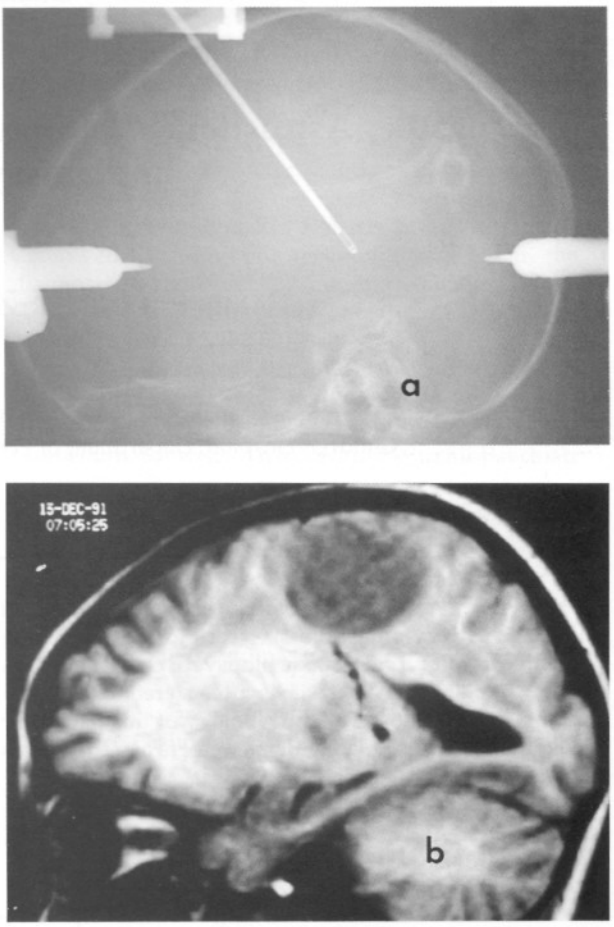

Figure 2. a, Lateral skull X-rays showing the trajectory of the biopsy needle; b, T1-weighted sagital MRI scan showing well demarcated, cortico-subcortical parietal tumor. Deep tumor still remaining, note the linear hypointensity between two lesions on the same trajectory as the biopsy needle.

The additional treatment consisted of a radiotherapy at a total dosage of 55 grays in 30 fractions with 1,8 grays per fraction in 45 days over a target volume customized to the tumor localization. A slight improvement of symptoms was noticed. However, two months after treatment, or four months after the stereotaxic biopsy, there has been a worsening of clinical status with the appearance of a left occular motor palsy, increasing of the right

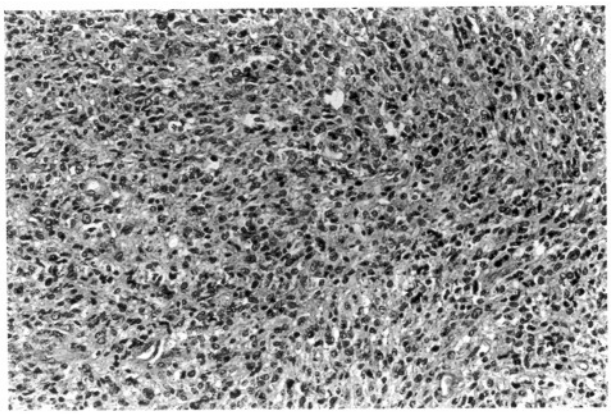

Figure 3. Photomicrograph showing highly cellular, poorly differentiated tumor with prominent mitoses. H & E × 25.

hemiparesis. MRI scans has shown the persistence of the deep invasive mass and a new, well demarcated, cortico-subcortical left parietal mass which was hypointense on T1-weighted images and completely separated from the deep thalamic mass. A linear hypointensity between the deep thalamic tumor and the new tumor was seen on the same trajectory of the biopsy needle (Fig 2b). Because of favorable location, surgery was taken into consideration. The tumor was haemorragic, relatively hard respect to parenchyma, well demarcated and joining the cortex without infiltration of the dura mater. Histological examination confirmed the same pathology as the primary tumor.

Eleven days postoperatively, the patient received a chemotherapy protocol, "8 drugs in one day" (11). However, an MRI after chemotherapy revealed a recurrence of the tumor, and the needle trajectory was quite visible. The child died eight months after the initial presentation.

DISCUSSION

The aggressive behavior of anaplastic astrocytomas is well known. A variety of dissemination schedules of anaplastic astrocytomas are noticed: The local dissemination, the dissemination by the way of cerebrospinal fluid and extraneuronal metastasis which may be facilitated by surgical intervention that put the anaplastic cells in contact with the blood and lymphatic vessels (7,10,14). Our case of metastasis-implantation by stereotaxic surgery is a case of local dissemination, following the needle trajectory.

This particular way of dissemination is not observed only in astrocytic tumors. Several papers in the literature described cases of dissemination along the biopsy-needle trajectory in other organ systems (4,5,6,12,15,16,17). However, we could find only two similar cases in central nervous system (2,13).

The first case is a 10-year-old boy, with a cystic suprasellar craniopharyngioma (2). The patient had undergone multiple radiation treatments and repeated punctures of the cyst via previous craniotomy burr holes. Five years after the first diagnosis, CT and MRI images showed a new well defined frontal mass which was diagnosed as an intraparenchymal craniopharyngioma that seeded from the suprasellar craniopharyngioma via the needle track (2).

The second case is an 18-month-old boy, with a pinealoblastoma diagnosed by stereotaxic biopsy (13). Two months after biopsy, the CT scans showed extension of the pineal tumor along the previous needle track.

Astrocytic tumors were analyzed in vitro culture by Russel and Bland (14). Lumsden, in 1971, observed in vitro the formation of pseudopodes and certain migratory movements in astrocytic anaplastic cells (14). Ikuta, in 1979, has demonstrated that neuroglial cell migration was conducted by ruffle movement (8). A phase contrast-cinemicrographic observation even precised the speed of this migration (8). Ikuta mentioned in his article that ruffle movement can be seen only in cells of the early cell cycle and never in normal adult nervous tissue. Ruffle movement is certain to become active when astrocytes enter the cell cycle, namely pass the mitotic phase, in active pathologic conditions such as neoplasm or infarction (8). Even though in vitro and in vivo conditions are completely different, these studies facilitate the better understanding of the high potential of these neoplastic cells to disseminate.

Rosenfeld (13) suggested that 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 host tissue, the number of needle penetration and the number of seeded cells. The last of these factors depends on the needle size which was 1,4 mm in our case. We agree with these observations. In our case, similar to the cases of Rosenfeld and Barloon (2,13), tumor cells seeded by the the needle should have

been developed in situ, because of their cytokinetic characteristics and the fertility of the host tissue. However,in the light of the results of in vitro studies, it is possible to suggest that the new tumor is not implanted by the needle but the growth of the primary tumor along the needle trajectory. Figure 2 shows the trajectory of the needle which was located in a very distinguishable fashion between the two lesions. However, while the thalamic tumor has an infiltrating character, the second tumor was homogenous and well demarcated. It may be postulated that the anaplastic cells of the thalamic tumor have migrated through the orifice created by the needle and a cellular flow has started on this trajectory. The patient has received tumor localized radiotherapy, leaving out the trajectory of the needle. The new location of the tumor was far from the effects of this radiotherapy. The cells have finished their trajectory in their new localization by pushing gradually the parenchyma, without infiltrating it, which explains the good demarcation of the second tumor. Following the surgery, the trajectory of the needle was still remaining, a second colonization took place, but this time much more aggressive than the first one (Fig 2b).

This interpretation is based on the results of in vitro studies and the characteristics of the case reported here. Its justification is impossible. As a result, this is a rare complication of the stereotaxic biopsy that, in fact, may pose us the inclusion of biopsy trajectory to radiotherapy protocols in highly malignant brain tumors.

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