Case Report

Navigation-guided endoscopic biopsy for pathological diagnosis for intraparenchymal pure germinoma near the ventricular trigone

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Abstract
Background: The authors report a case of intraparenchymal germinoma pathologically diagnosed using navigation-guided endoscopic biopsy.

Case Description: A 27-year-old man had mild left hemiparesis, transcortical motor aphasia, and amnesia. Magnetic resonance (MR) imaging revealed an intraparenchymal mass lesion near the left ventricular trigone. Navigation-guided endoscopic biopsy was performed, and histopathology revealed large neoplastic cells immunohistochemically positive for germinoma-specific antigens, which were diagnosed as pure germinoma. Chemotherapy with whole-brain radiotherapy was performed, and the neurological symptoms did not change during the treatment. Follow-up MR imaging 1 year after the surgery showed no evidence of recurrence or dissemination.

Conclusions: Navigation-guided endoscopic biopsy can be a useful technique in such intraparenchymal germinoma cases.

Key Words: Biopsy, brain tumor, endoscopy, germ cell tumor, navigation

INTRODUCTION

Germ cell tumors (GCTs) are rare neoplasms of the central nervous system (CNS); their incidence is 2.8% or less in all primary brain tumors.⁷ Germinoma is the most frequent pathological type accounting for over two-thirds of CNS GCTs. GCTs are commonly located in the pineal region and/or the neurohypophysis,⁵,⁶,¹⁵,²¹ but are rarely found in the basal ganglia (BG),¹⁷,²² the cerebellopontine angle, the lateral ventricle, the cerebellum, or the corpus callosum.⁸,¹² In very rare cases, they also appear in the brainstem,¹³ the cranial nerves,¹ or in the spinal cord.⁹ Pathological diagnosis by biopsy is essential for GCTs located in these uncommon regions, if there are no tumor markers detected. However, a small amount of tissue in biopsy samples often results in a misdiagnosis, such as a granulomatous lesion or other type of GCTs.⁵,¹⁰

Here, we report a case of intraparenchymal germinoma near the left ventricular trigone, pathologically diagnosed using navigation-guided endoscopic biopsy.

CASE REPORT

A 27-year-old man was introduced to our hospital with a
1-year history of gait disturbance. On admission, he had mild left hemiparesis, transcortical motor aphasia, and amnesia, with 80% of Karnofsky Index of Performance Status (KPS). Magnetic resonance (MR) imaging revealed an intraparenchymal mass lesion near the left ventricular trigone [Figure 1]. Computed tomography (CT) revealed a slightly high density mass with punctuate calcification. The serum levels of beta-human chorionic gonadotropin (β-HCG) and alpha-fetoprotein (α-FP) were within normal range. Cytology of the cerebrospinal fluid did not reveal any abnormalities. In the preoperative differential diagnosis, germinoma was highly suspected rather than high-grade glioma or malignant lymphoma, as there were atrophic changes in the left thalamus near the lesion.

Navigation-guided endoscopic biopsy was performed for differential diagnosis. First, the patient’s head was fixed with a Mayfield frame under general anesthesia. A transparent sheath was inserted into the front of the target lesion via the burr hole under the control of the navigation system (StealthStation®; Medtronic, Inc., Minneapolis, MN, USA) [Figure 2]. After the front of the lesion was observed with the rigid endoscope (EndoArm®; Olympus Corp., Tokyo, Japan), the lesion was removed partially with 30% of removal rate because a rapid diagnosis of probable germinoma was made by intraoperative pathology (IOP), made from a part of the photodynamic diagnosis (PDD)-positive specimen using 5-aminolevulinic acid in the targeted tissue. On histopathology, the tumor tissue contained a lot of large neoplastic cells, some of which had mitosis. Immunohistochemical examination showed the tumor cells were immunoreactive for placental alkaline phosphatase (PLAP) and c-kit, and negative for leukocyte common antigen and CD30. Syncytiotrophoblastic giant cells (STGC), which are positive for β-HCG, were not observed. The histological diagnosis was pure germinoma with a concentration of large neoplastic cells, although a typical two-cell pattern was not observed.

Totally four cycles of carboplatin and etoposide (CarE) therapy were performed. Concurrent with third cycle of the CarE therapy, 30.6 Gy of whole-brain radiotherapy was also performed. MR imaging just after the initial cycle of the CarE showed that the tumor disappeared [Figure 3]. The patient’s neurological symptoms did not change during these therapies. One month after the

Figure 1: Magnetic resonance imaging revealing a solitary mass lesion in the intraparenchymal region near the ventricular trigone. The mass of high intensity appears on both T2-weighted images (WI) and diffusion-WI (a and d), and that of low intensity on T1-WI (b). Axial, sagittal, and coronal views on T1-WI with gadolinium demonstrate homogenous enhancement of the mass lesion (c, e, and f). The left thalamus and the parietal lobe near the lesion have atrophic changes.

Figure 2: Navigation-guided endoscopic biopsy performed for the differential diagnosis. (a) A transparent sheath of diameter of 10 mm (Neuroport®; Olympus Corp.) with a removable inner tube, inserted into the front of the target lesion via the burr hole under the control of the navigation system. (b) Endoscopic view using rigid endoscope (EndoArm) shows the tumor tissue (arrow heads) near the ventricle wall (arrow).

Figure 3: Axial views on T1-weighted images (WI) with gadolinium and T2-WI after the initial cycle of chemotherapy showing that the enhanced mass has disappeared (a and d). Follow-up MR images at 5 months (b and e) and 1 year (c and f) after the surgery show no evidence of recurrence. T2-WI (f) 1 year after the surgery shows mild ventricular dilatation and high-intensity changes in the thalamus and parietal lobe.
initial therapy, he was able to walk without any assistance and had no deterioration of transcortical motor aphasia or amnesia (80% of KPS). Follow-up MR imaging and Thallium 201 single-photon emission CT 1 year after the initial therapy showed no evidence of recurrence or dissemination.

**DISCUSSION**

In the present case, the solitary germinoma was located in the intraparenchymal region near the ventricular trigone. To our knowledge, this is a particular case of intraparenchymal germinoma, although there were multiple cases of BG germinoma\(^{[11,14,17,22]}\) and limited cases of GCT located in multiple regions extending into the ventricular trigone\(^{[19,10]}\) in the previous reports. It has been proposed that nongonadal GCTs arise from ectopic primordial germ cells\(^{[20]}\) and migration error can occur in any intraparenchymal region including BG. On the other hand, subependymal infiltration was suggested in a previously reported case with a synchronous lesion at BG and para-lateral ventricle.\(^{[21]}\) We speculate that in our case the ventricular trigone germinoma occurred solitary owing to the migration error theory; however, we cannot deny a possibility of subependymal infiltration from a BG lesion undetectable on MR imaging.

Intracranial germinomas located in the common regions, pineal region and the neurohypophysis, are considered to be curable.\(^{[3,15]}\) In contrast, patients with BG germinomas have high rate of treatment failure.\(^{[2,17]}\) In the present case, we considered that the intraparenchymal germinoma might have a high rate of treatment failure, similar to BG germinomas. Thus, the sequential whole-brain irradiation and multiple cycles of CarE chemotherapy, which are considered to be the optimal treatment for BG germinomas,\(^{[22]}\) were applied in the present case.

Needle biopsy is useful for tissue sampling of intraparenchymal tumors of the CNS, such as glioma. However, in the case of germinoma, misdiagnosis as a granulomatous lesion or other type of GCTs often occurs,\(^{[1,10]}\) probably due to the sampling error and the small amount of sampled tissue. Recently, the navigation-guided endoscopic biopsy has been used to overcome the drawbacks of needle biopsy and open biopsy via small craniotomy.\(^{[2,24]}\) In this new biopsy, operators can modify needle trajectory and biopsy point if the ventricular trigone lesion undetectable on MR imaging is owing to the migration error theory; however, we cannot deny a possibility of subependymal infiltration from a BG lesion undetectable on MR imaging. Furthermore, in handling endoscopic biopsy, this method has longer operation time and higher than that in the latter.\(^{[24]}\) Moreover, in handling the pial regions containing many vessels, microscopic visualization is superior to endoscopic visualization. Stereotactic needle biopsy and/or microscopic open surgery via craniotomy are more suitable in the basal ganglia and brain stem. Thus, the navigation-guided endoscopic biopsy can be a useful technique in some types of intraparenchymal tumor cases.

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