Primary cavernous sinus germinoma with atypical extension pattern: a case report and review of the literature

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Abbreviations

AFP: alpha fetoprotein, ETV: Endoscopic third ventriculostomy, HCG-β: beta human chorionic gonadotropin, MRI: magnetic resonance imaging

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Abstract

Primary intracranial germinoma is a rare central nervous system tumor that usually arises in the pineal and the suprasellar region. Here, we report a rare case of primary intracavernous sinus germinoma with an atypical extension pattern, with a comparison to germinomas originating from the cavernous sinus as described in the existing literature. A 12-year-old boy was admitted to our hospital with the chief complaint of the left-side ptosis and double vision. Magnetic resonance imaging showed homogenous enhanced mass lesion in the pineal region together with mass lesions in the lateral ventricle, left cavernous sinus, and temporal lobe, extending into the left masticator space. The enhanced mass in the intracavernous sinus originated from the cavernous sinus. Endoscopic third ventriculostomy and tumor biopsy was done. Pathological diagnosis was pure germinoma. After 6 courses of chemotherapy followed by radiation therapy all the lesions decreased in size significantly. Only faint enhancement around the masticator space remained. We report a rare case of a germinoma that developed mainly in the cavernous sinus with additional tumor masses in the pineal region, ventricles, and temporal lobe. Although the lesions shrank significantly on the post-chemoradiation imaging, a long follow-up is necessary not only to check for symptoms, but also monitor imaging findings for possible serial changes in the residual region of

the masticator space.

Introduction

Primary intracranial germinoma usually arises from midline structures, such as the pineal gland, suprasellar region and, subsequently, the basal ganglia. Atypical locations of intracranial germinoma have been reported in the temporal lobe[14], corpus callosum[17], insular lobe[9], medulla oblongata[2,7,16], and the trigeminal nerve[1]. One study reported that germinoma in the cavernous sinus continuously extended from the suprasellar region[3]. However, the relationship between these two regions regarding the intracranial germinoma is not yet clearly understood. Here, we report a rare case of primary intracavernous sinus germinoma that had developed as a separately tumor mass without connection to the tumor in the suprasellar area.

Case presentation

A 12-year-old boy was referred to our hospital by the local ophthalmologist with the chief complaint of left side ptosis and double vision. Magnetic resonance imaging (MRI) showed a homogenous enhanced mass lesion in the pineal region accompanied by mass lesions in the right lateral ventricle, left cavernous sinus, and left temporal lobe, extending to the left masticator space via the left foramen ovale. The enhanced mass in the intracavernous sinus was not a continuation of the lesion in the suprasellar area,

although it extended to the temporal lobe (Figure 1). Tumor in the left cavernous sinus was thought to be the primary lesion, as it was larger in size than any of the other masses. The serum alpha fetoprotein (AFP) and human chorionic gonadotropin (HCG-β) levels were 1.4 ng/ml and 0.3 ng/ml, respectively. In the cerebrospinal fluid, the concentration of AFP was less than 0.1 ng/ml, and that of HCG-β was less than 0.1 ng/ml. Though the patient did not complain of headache or nausea, head MRI made on arrival at our hospital showed that there was a dilatation of the ventricles, especially the third ventricle and the inferior horn of the right lateral ventricle (Figure 2A, B). Therefore, we chose endoscopic third ventriculostomy (ETV) to improve the obstructive hydrocephalus. Endoscopic third ventriculostomy and tumor biopsy from the pineal lesion was done. During the surgery, we found that the aqueduct was almost completely obstructed by the tumor. Postoperative head MRI showed that the ventricles had diminished in size (Figure 2C, D). Pathological examination revealed a two-cell pattern consisting of sheets of large cells and infiltrating small lymphocytes. Immunohistochemical staining was positive for c-kit and placental alkaline phosphatase, and negative for AFP and HCG-β. The pathological diagnosis was pure germinoma. After 6 courses of chemotherapy (6 courses of carboplatin and etoposide regimen) followed by radiation therapy, almost all the lesions had significantly

decreased in size (Figure 3). Only faint enhancement around the masticator space remained. Follow-up MRI showed no recurrence 3 months after completion of chemoradiotherapy.

Discussion

Germinoma is a rare central nervous system tumor with synchronous development of several tumor masses in different regions occurring in 5-10% of all germinoma cases[6]. Frequently, dual intracranial germinomas are located in the pineal and suprasellar regions. Although rare, atypical locations of intracranial germinoma have also been reported[1,2,7,9,14,16,17]. Among them, one report showed trigeminal germinoma in the cavernous sinus despite a previous study stating that germinoma in the cavernous sinus always originated from the suprasellar region[1,3]. Previous reports have also described atypical locations of primary germinoma, which have including the cavernous sinus (Table 1) [1, 3-5,10,11,13,18]. However, in our case, the tumors were located in the pineal region, right lateral ventricle, and left intracavernous sinus, extending to the temporal lobe. The enhanced lesion in the left intracavernous sinus had no relationship with the suprasellar area. The tumor mass compressed the pituitary stalk to the medial side, which strongly suggested that the tumor arose not from the suprasellar region but

from the intracavernous sinus itself. Moreover, MRI revealed that the left external wall of the intracavernous sinus was enhanced irregulary with tumor mass penetration. The masticator muscle itself was strongly enhanced with gadolinium, with the enhanced tumor mass extending through the foramen ovale inferiorly. The same mechanism similar to our case was described in a previous report[8]. The tumor mass also penetrated the external wall of the cavernous sinus exteriorly and extended to the middle cranial fossa and the temporal lobe.

Why do germinomas develop in multiple tumor masses in the intracranial space simultaneously? There are currently 2 hypotheses about germ cells originating in the central nervous system [9,15]. The first hypothesis states that primordial germ cells become misplaced during migration, so germinomas arise both intracranially and extracranially[9]. The second states that germ cells are widely distributed in the brain, liver, thymus, and bone marrow. Some have suggested that the atypical origin of intracranial germinoma may reflect the entrapment of migrating totipotent cells during early rostral neural tube development[12], while one report stated that as the distance from the midline increases, the chance of migration decreases[9]. In the present case, primordial germ cells may have been misplaced to the left cavernous sinus during migration in and the germinoma developed near the midline.

Generally, germinomas are highly sensitive to radiation and the addition of chemotherapy may help to decrease the dose of radiation and minimize the irradiated area. In our case, the tumor has shown no recurrence after the completion of chemotherapy and radiotherapy. Further long-term follow-up is needed to monitor the patient for onset of new symptoms and appearance of enhanced lesions on MRI, especially around the masticator space.

Conclusion

We report a case of a 12-year-old boy with primary cavernous sinus germinoma presenting with ptosis and double vision. The tumor was located mainly in the cavernous sinus and extended to the temporal lobe, and pineal and intraventricular regions. The patient was treated with radiotherapy following 6 courses of carboplatin and etoposide chemotherapy. Long-time follow-up should be carried out to trace the possible onset of new symptoms and enhanced areas on MR images, especially in the masticator space.

Conflict of Interest: The authors declare that they have no conflict of interest.

Ethical approval: This article does not contain any studies with animals performed by any of the authors.

Informed consent: Informed consent was obtained from the next of kin.

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Figure Captions

Figure 1.

Initial MRI showed an enhanced mass lesion in the left cavernous sinus without suprasellar extension. The mass invaded the temporal lobe by penetrating the lateral wall of the cavernous sinus. Inferiorly, the mass extended into the masticator space through the foramen ovale (B, C: arrow). Other enhanced lesions were observed in the pineal region (E) and the frontal horn of the right lateral ventricle (F: arrow) with

obstructive hydrocephalus.

Figure 2.

Initial axial MRI (T2 weighted image) showed that there was a dilatation of the ventricles, especially the third ventricle (A: arrow) and the inferior horn of the right lateral ventricle because of the aqueductal stenosis induced by the tumor (B: arrowhead). Seven days after endoscopic third ventriculostomy and tumor biopsy from the pineal lesion, head MRI showed that the ventricles diminished in size (C: arrow: third ventricle, D: arrowhead: inferior horn).

Figure 3.

MRI after 6 courses of chemotherapy followed by radiation therapy. The lesions in the left cavernous sinus, the pineal region and the frontal horn of the right lateral ventricle are almost all disappeared. However, faint enhancement remained around the masticator space.

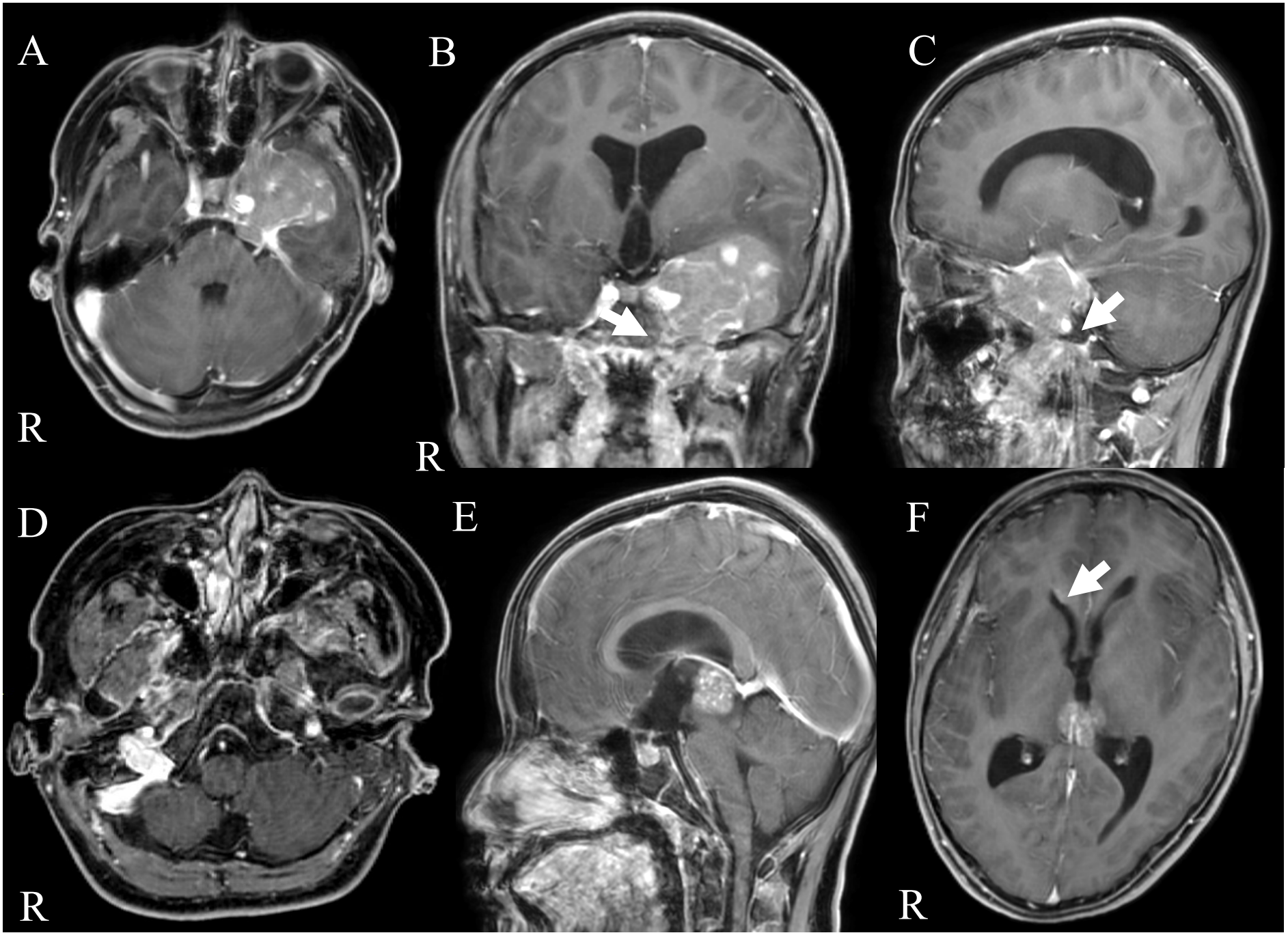
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Fig. 2

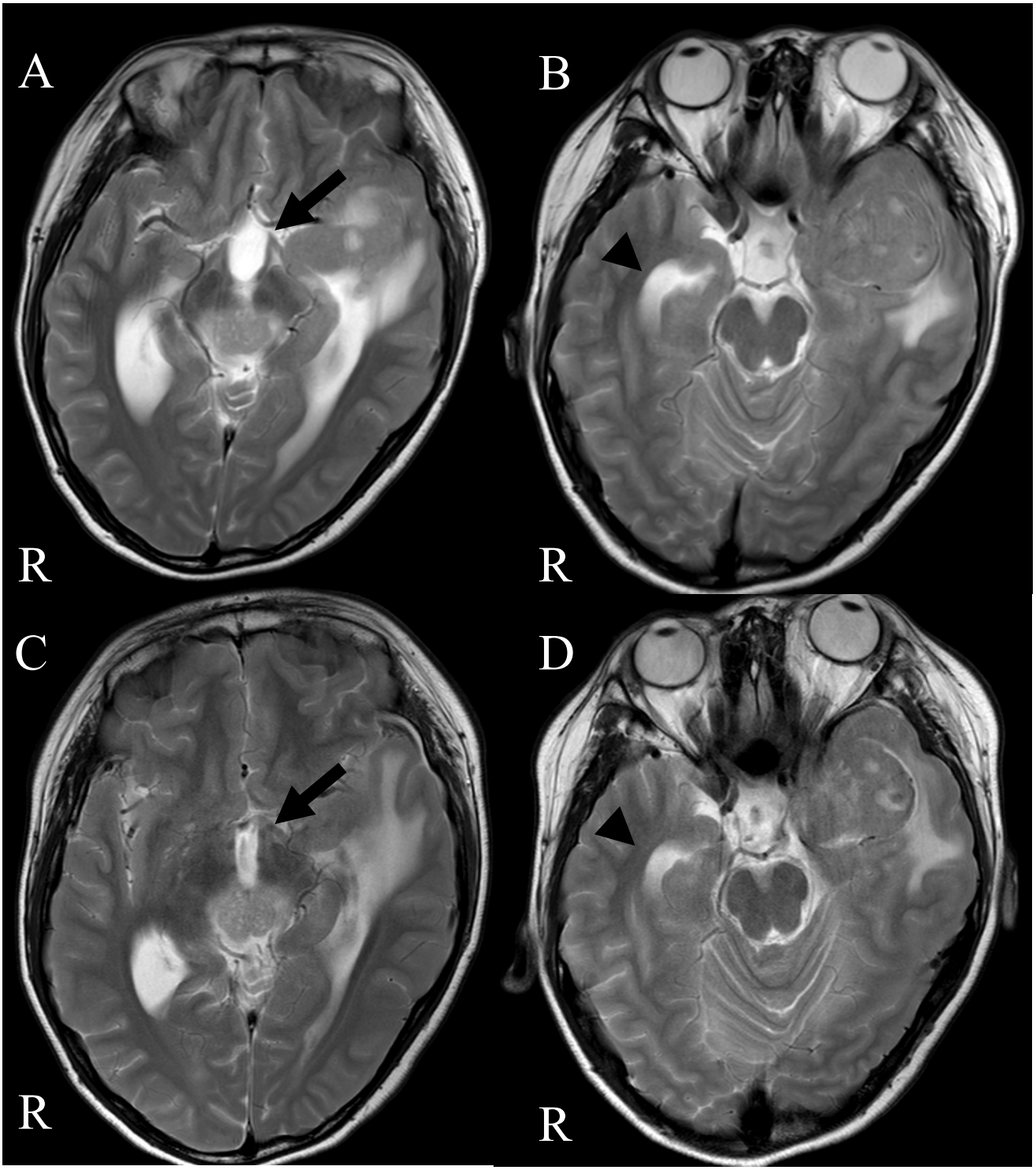

Fig. 3

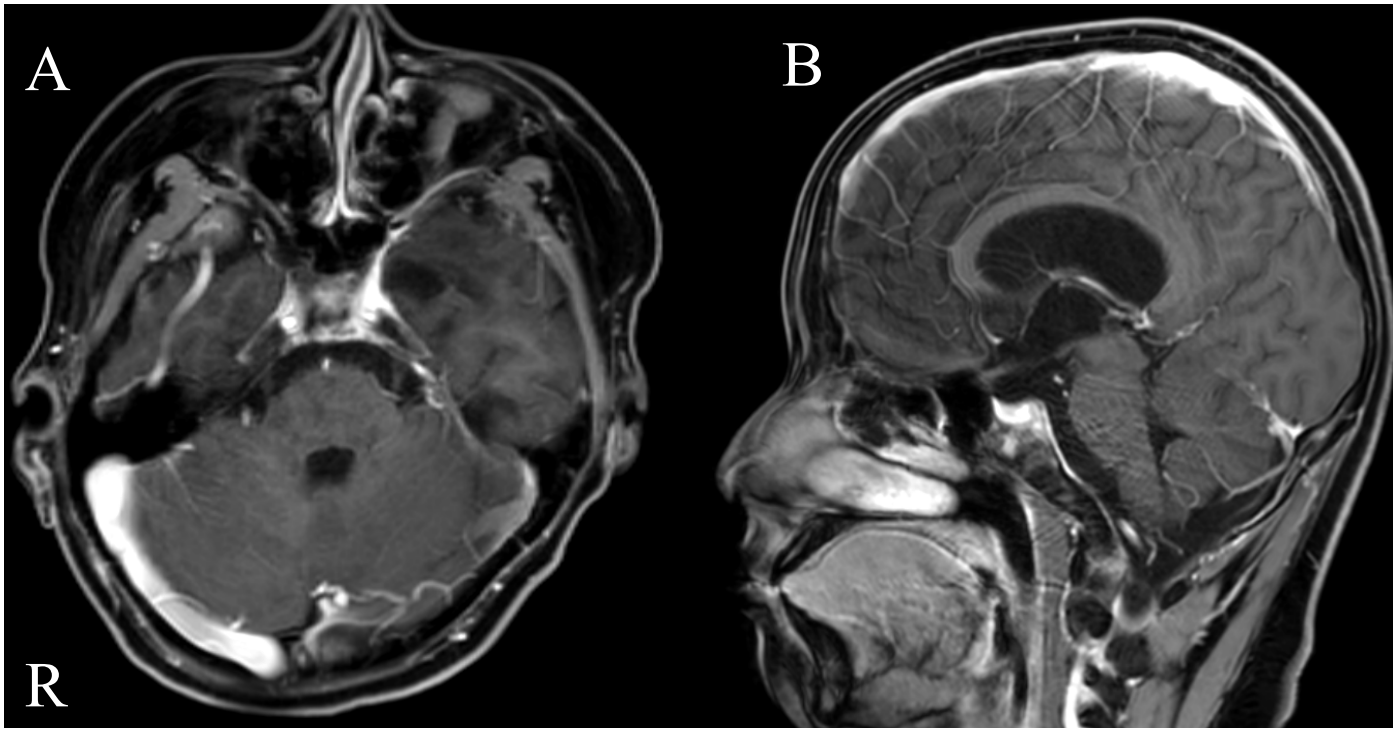

Table 1. Reports of primary germinoma including parallel growth in the cavernous sinus

Author (year)	Age/Sex	Locations	Main Symptoms
Poon (1988)	28/F	CS, Supra-sellar	Headache, Total opthalmoplegia
Endo (2002)	12/M	CS, Supra-sellar	Bitemporal hemianopsia, DI, panhypopituitarism
Torremocha (2002)	45/M	CS, Supra-sellar	Headache, extraocular muscle palsy
Baussart (2007)	22/M	CS	Headache, Trigeminal hypesthesia
Fukushima (2007)	13/M	CS, Supra-sellar	Bitemporal hemianopsia, DI, panhypopituitarism
Muroi (2012)	11/F	Bil. CS, Supra-sellar	Oculomotor and abducens nerve palsy
Zhou (2014)	15/F	CS, Supra-sellar, Intraorbital, ethmoidal and sphenoidal sinus	diuresis and diplopia
Duron (2018)	N.A.	CS, Supra-sellar, Pineal	N.A.
Duron (2018)	N.A.	CS, Supra-sellar	N.A.
Present case	12/M	CS, Temporal lobe, Pineal, Masticator space	Oculomotor nerve palsy, Ptosis, Double vision

M: Male, F: female, CS: cavernous sinus, DI: diabetes insipidus, N.A.: not available