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CASE REPORT - BRAIN TUMORS

Endonasal surgery for suprasellar germ cell tumors: two cases and review of the literature

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Abstract

Germ cell tumors are rare malignant tumors frequently located in the suprasellar region. Definitive treatment is chemotherapy and radiation. However, in some circumstances, surgery is indicated for biopsy or resection. There are limited reports of the role of the endonasal endoscopic approach (EEA) in the management of this tumor. We present two cases in which EEA was utilized for successful management of germ cell tumor. The most challenging aspect of germ cell tumor management for the treating physician is knowing the proper indications for surgery. In this paper, we highlight two specific instances, namely diagnosis and tumor refractory to chemoradiation. Given the suprasellar location, EEA is an ideal approach.

Keywords Endoscopic endonasal · Germinoma · Intracranial germ cell tumor · Suprasellar · Outcome

Introduction

Germinomas are rare malignant tumors representing about two-thirds of germ cell tumors which constitute 0.1–3.4% of all intracranial tumors and about 3–11% in pediatric age group. They can originate anywhere in the midline axis but usually in the suprasellar cistern or the pineal region. The pineal region is the most common site (50%) while the sellar/suprasellar region is the second most common (20–30%). Few patients (5–10%) present both locations at the time of diagnosis and this peculiar association is pathognomonic of germinomas. Other off-midline sites include the basal ganglia, thalamus, and brainstem [8, 9, 19, 34, 35].

Although germinomas are highly susceptible to irradiation and chemotherapy and hence curable, if undiagnosed early, they may be fatal. Ideally, the diagnosis is made non-invasively though blood and CSF tumor markers; in some cases, the diagnosis may be ambiguous and tumor biopsy is indicated, especially uncertain cases with atypical presentation [16]. Other indications for surgery are those tumors that are refractory to treatment, usually of mixed pathology.

In the treatment of suprasellar tumors, the extended EEA is becoming more useful as a minimal invasive technique to reach this region. Improved endoscopic illumination and neuronavigation permit safe access to the suprasellar region which is a common site for germinomas [6, 13, 18, 23, 26, 33].

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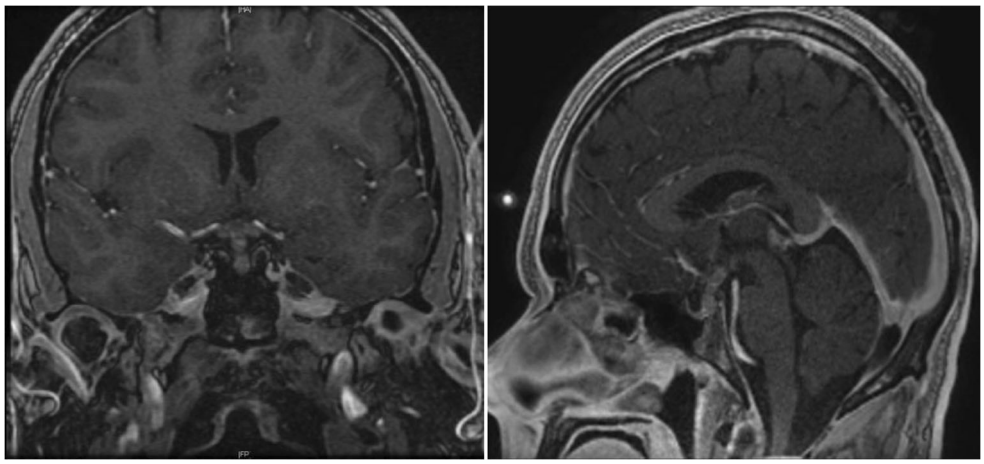

Fig. 1 Case 1. Pre-operative T1WI MRI with contrast coronal and sagittal views showing thickening of the pituitary stalk, measuring 2 mm at its inferior aspect and 6 mm at its posterior aspect in AP dimension. Infundibular thickening possibly impinges upon the optic chiasm. Posterior pituitary bright spot is absent. There was no pineal mass evident

There are currently only limited reports of EEA for germinomas or mixed germ cell tumors [12, 20, 19]. In this paper, we add two additional cases and discuss the indications for surgery.

Cases presentation

We reviewed a prospectively acquired database of endonasal endoscopic surgeries done by the senior authors (THS and VKA) between 2003 and 2018 at Weill Cornell Medicine/New York Presbyterian Hospital. Of 1170 cases, 2 suprasellar germ cell tumors were identified. Both patients had undergone extended EEA for tumor resection/biopsy and the diagnosis of germ cell tumors was histologically confirmed according to the criteria of the World Health Organization 2016 [24].

Case 1

A 27-year-old man presented to the doctor with 6 months of polydipsia, polyuria, weight gain (up to 118.8 kg), insomnia, and edema of his extremities. The endocrinologist diagnosed hypothyroidism and diabetes insipidus, as well as low growth hormone and elevated prolactin, and started hormonal replacement therapy. Brain MRI revealed thickening of the pituitary stalk and no pineal region mass (Fig. 1). Blood tests revealed mildly elevated beta-HCG and ACE, normal alpha-fetoprotein but negative testicular ultrasound, and negative lumbar puncture. Tumor board recommended a biopsy given the indolence of the symptoms. An EEA was performed for a biopsy to try to ensure maximal recovery of function. Post-operative MRI revealed partial resection of the mass (Fig. 2). Histopathology confirmed a pure germinoma. He received radiotherapy and chemotherapy to prevent the progression of disease. Total dose/Fx (4500 cGy) was over 2 months.

Case 2

A 16-year-old young man presented to the doctor with somnolence polyuria, polydipsia, and panhypopituitarism. His workup revealed a germ cell tumor with pineal and suprasellar locations**.** He was initially treated with carboplatin and etoposide and ifosfamide and 30.6 Gy to the whole ventricle (WVI) with a 23.4 Gy boost to only those areas of the brain

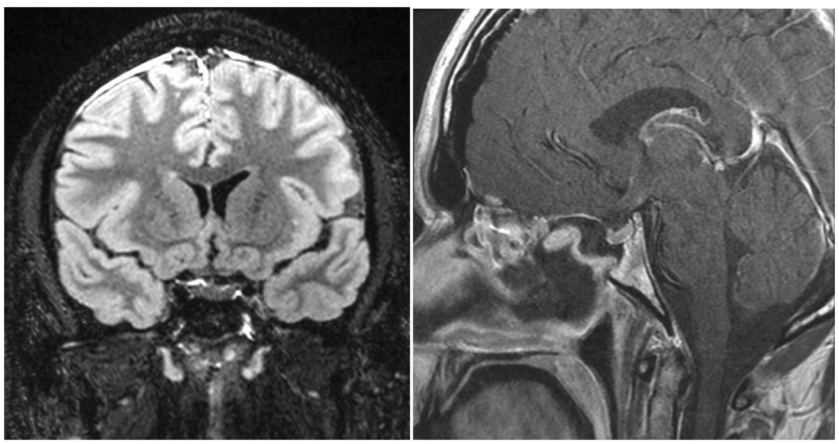

Fig. 2 Case 1. Post-operative T1WI MRI with contrast coronal and sagittal views showing post-endonasal biopsy of the pituitary stalk mass with expected post-operative change and no evidence of complication. Nasoseptal flap reconstruction of the skull base is evident

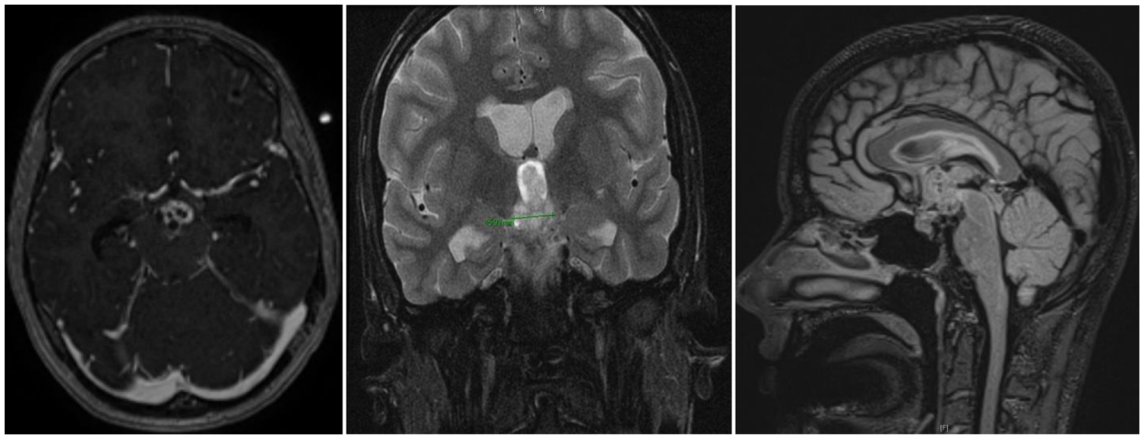

Fig. 3 Case 2. Pre-operative MRI with axial T1WI, coronal T2WI, and sagittal T1WI with contrast views after initial chemotherapy and radiotherapy showing slightly increased size of multicystic suprasellar mass extending to the anterior third ventricle compatible with reported history of germinoma

involved by tumor. He had a complete response with a total resolution of tumor; however, on routine imaging follow-up imaging, there was recurrence of disease and he underwent second-line chemotherapy with stem cell rescue without response. He was referred for surgical excision of a large multicystic enhancing suprasellar mass (Fig. 3). Using endonasal approach, gross total resection of the suprasellar mass was achieved successfully (Fig. 4). There was no post-operative meningitis or CSF leak. Histopathology showed mixed germ cell tumor comprising germinoma (10%) and mature teratoma (90%). He underwent chemotherapy, stem cell transplant, and WVI again after surgery as well as recommended by the oncologists. It has been 2 years after surgery, and he is now disease free, on endocrine replacement therapy, and being home-schooled with a BMI of 28.2.

Literature review

We reviewed the Pubmed database using the following keywords: germinoma, germ cell tumor, endonasal, and endoscopic. We identified 32 abstracts. Of 124 cases of sellar-suprasellar germinoma operated on in the literature, 19 (15.3%) were performed using EEA and of these, only 15 (12%) were purely suprasellar.

Discussion

The cranial germ cell tumors are common in Asia representing about 15–18% of all CNS tumors of childhood, while in the western countries, they are about 3–5%. The average age is at 10–12 years, which could be younger in non-germinomatous GCTs (NGGCTs) than pure germinomas [11, 14].

Germ cell tumors can be divided into germinomatous and non-germinomatous germ cell tumors. The germinomatous type can be divided into pure germinoma and germinoma with syncytiotrophoblastic giant cells (STGC), while the non-germinomatous type includes teratoma, embryonal carcinoma, yolk sac tumor, and choriocarcinoma. Generally, Cranial NGGCTs are associated with worse outcomes compared with cranial germinomas [12, 37, 39].

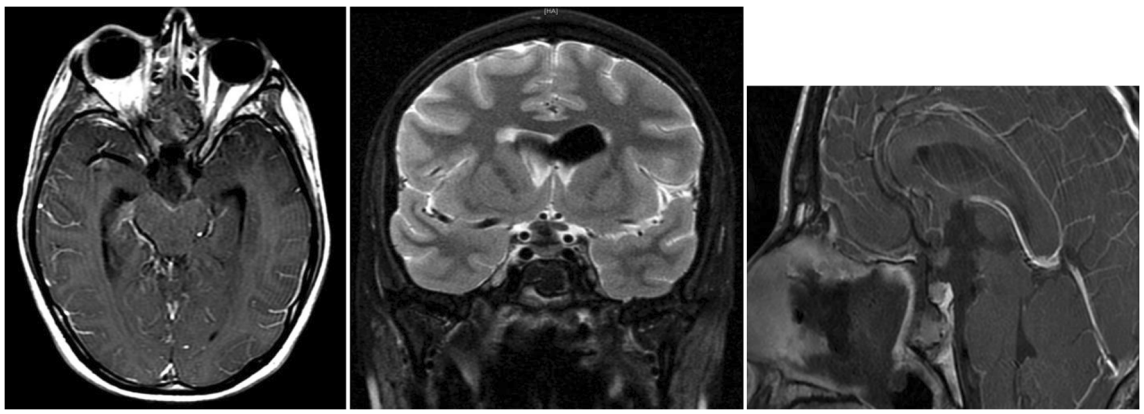

Fig. 4 Case 2. Post-operative MRI with axial T1WI, coronal T2WI and sagittal T1WI with contrast views showing: Interval gross total resection of suprasellar multicystic mass with expected postsurgical change.

Table 1 Literature review of EEA for suprasellar germ cell tumors

Author, year	Case numbers, pathology	Average age (years)	Gender	Degree of tumor removal
Konno et al. 2002 [21]	1, germinoma	6	F	Biopsy
Dehdashti et al. 2009 [6]	1, germinoma	24	M	Subtotal (< 40%)
Ceylan et al. 2009 [3]	1, anaplastic germinoma	13	M	Subtotal resection
Wong et al. 2010 [39]	1, germinoma with malignant transformation to non-germinomatous germ cell tumor	18	M	Biopsy
Thakar et al. 2013 [36]	1, mixed	8	F	Biopsy
Nitta et al. 2013 [30]	1, germinoma	21	M	Biopsy
Phi et al. 2013 [31]	4, mixed	8 to 17	2 M and 2 F	Biopsy (only pure suprasellar were selected from this series)
Guzzo et al. 2013 [15]	1, germinoma	24	F	Biopsy
Di Somma et al. 2014 [7]	1, mixed	12	F	Near total removal
Ajayi et al. 2016 [1]	1, mixed	18	F	Subtotal resection
Mesquita Filho et al. 2018 [27]	2, germinoma	11 and 13	F	Partial removal for 1st and subtotal for 2nd

Clinically, sellar and suprasellar germinomas present with either visual symptoms due to compression of the optic chiasma usually with upper gaze failure and obtundation or present with hypothalamic and pituitary dysfunction in the form of delayed sexual development or precocious puberty, hypopituitarism, and diabetes insipidus. Some may present by both visual and hormonal dysfunction [10, 21, 28].

Typical radiological features of suprasellar germ cell tumors are usually hyperdense on unenhanced CT with no calcification. Small tumors may frequently be missed in CT scans and in these cases, MRI is recommended although it is usually not easy to exclude other suprasellar pathologies with MRI alone. Tumor markers including human chorionic gonadotropin and alpha-fetoprotein in the blood and CSF samples are usually positive but can sometimes be negative, which then necessitates surgery to obtain a tissue diagnosis [17, 31].

The management of germinomas requires a multidisciplinary team, including a neurosurgeon and radiation and medical oncologist. Recent trials have examined ways to reduce radiation dose and the impact of combined versus single modality therapy. Yen et al. in 2010 presented a cohort of 38 patients receiving reduced radiation alone or in combination with chemotherapy. Their results showed that there was no benefit from adding chemotherapy and they recommended excluding chemotherapy in non-disseminated case [40].

Surgical approaches for suprasellar lesions include pterional or supraorbital craniotomy versus EEA. Each has advantages and disadvantages well highlighted in the literature. Transcranial approaches require a skin incision, may lead to cosmetic deformities form temporal muscle atrophy, and require some degree of brain retraction. Moreover, the optic nerves may limit visibility. EEA provides a more direct view of the suprasellar space without any brain retraction but has an increased risk of cerebrospinal fluid leak and other nasal or rhinological complications. Another advantage of EEA is the ease of access to intrasellar as well as suprasellar components of the tumor [4, 5]. The transsphenoidal approach was first utilized for this tumor in 1983 in the treatment of two patients with intrasellar germinomas. Two patients with diabetes insipidus, hypopituitarism, and enlarged sella turcica underwent this approach for diagnosis of intrasellar germinomas [2]. The first endonasal surgery for germinoma was published in 2001 with subtotal removal (<40 %) and the first suprasellar case was published in 2014 [6, 7]. In the last few years, a few other cases have been reported (Table 1) [1–3, 7, 8, 10, 12, 15, 21, 22, 27, 29–32, 36, 38, 41]. In the hands of well-experienced skull base surgeons, the pure endoscopic endonasal approach is followed by less morbidity, shorter hospital stay, and better quality of life compared with transcranial or even microscopic endonasal approaches [25].

Conclusion

The most difficult aspect of germ cell tumor management for the surgeon is knowing when is it appropriate to perform surgery versus chemoradiation. In this paper, we highlight

two specific indications, namely diagnosis and tumor refractory to chemoradiation. Given the suprasellar location, EEA is ideal for these situations.

Compliance with ethical standards

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

IRB/ethics committee approval and patient consent We have IRB approval for endoscopic skull base clinical case series that do not require patient consent.

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