Case Report

Anterior and posterior suprasellar extensions of a symmetrical trilobed nonfunctional giant pituitary adenoma in the sagittal plane: a case report and review of literature

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\textbf{ABSTRACT}

Introduction: To the best of our knowledge, the presence of a trilobed nonfunctional giant pituitary adenoma has never been described before in the literature. These tumors present unique diagnostic and therapeutic challenges. Tumors of this etiology can be managed with pharmacologic treatment or aggressive surgical intervention. The following case illustrates an unique visual presentation of a giant pituitary adenoma.

Case Presentation: We report the case of a 40-year-old Hispanic man who presented with new onset seizures. Radiological imaging showed the presence of a trilobed giant pituitary adenoma extending anterior into the frontal lobe, posterior to the hypothalamus, and inferior. The patient underwent a right pterional craniotomy to remove majority of his tumor.

Conclusions: The large size of the tumor should be considered in the differential diagnosis of various other conditions leading to a pituitary region mass such as a craniopharyngioma, pituitary metastasis, pituitary carcinoma, and a meningioma. Careful planning and outlining of therapeutic interventions are needed to rectify this abnormality. Those patients who meet the qualifications of a combined transsphenoidal and transcranial procedure should opt for this method of tumor resection.

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Introduction

The pituitary gland belongs to a group of endocrine organs, which is responsible for the synthesis and/or release of hormones, which act on various organs through the body.

Neoplastic transformation of this organ can lead to the overproduction of certain hormones, which is amenable by various pharmaceutical agents or by surgical intervention, especially for those when conservative treatment has failed. Pituitary growths with normal hormonal levels are defined as

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a nonfunctional pituitary adenoma. Nonfunctional pituitary adenomas are the most common types of pituitary adenomas [1]. Additional methods of grouping these tumors include classifying them by size. Tumors smaller than 1 cm are termed microadenomas, whereas those larger than 1 cm are defined as a macroadenoma.

Additional increases in size greater than 4 cm are classified as a “giant adenoma” [2]. Occasionally, these giant tumors are often very aggressive and can follow a malignant course [3]. The invasive nature of giant adenomas is anatomically classified using the modified Hardy system. The system is divided looking at the extrasellar extension and intersellar invasion and/or spread of the tumor. The extrasellar extension is further subclassified as either having a suprasellar extension or a parasellar extension. Each of these are further subdivided depending on their extent. Intersellar extension and/or spread is further subclassified as either floor of sella intact, sphenoid extension, or having distant spread. These groups are even further subclassified. Hardy’s classification of the suprasellar extension of pituitary adenomas uses the relationship of the superior capsule of the tumor with the third ventricle and takes into account asymmetric extension in the coronal plane [4].

Here, we discuss a giant trilobed pituitary adenoma with bilateral suprasellar extensions anterior and posterior, with an intersellar invasion and/or spread. We also discuss the pathogenesis of this lesion.

### Case presentation

A 40-year-old Hispanic man of Mexican descent, with no relevant medical history, was brought into the emergency department with his wife for a new onset seizure. The patient has no family history or prior seizure episodes.

When returning home from work, he had a seizure episode in the shower witnessed by his wife, which at that point she called 911. En route to the hospital, the patient had a second episode and was admitted. His wife states that she had noticed a change in the husband’s personality these past several months stating it to be a “child-like behavior.” Electrolyte imbalance and the presence of recreational drugs were ruled out as a possible cause of the seizure episodes. Vital signs were within normal limits at the time of admission. Magnetic resonance imaging (MRI) showed the presence of a trilobed pituitary tumor measuring 42 mm craniocaudal, 50 mm anteroposterior, 28 mm transverse, and a height of 46 mm. (Figs 1A-D). The left anterior cerebral artery is displaced to the left side by the mass. The right anterior cerebral artery is also displaced to the right by the mass (Fig. 1I). With the help of the modified Hardy classification system, the tumor fits the category of a stage D (intracranial/intradural) and grade IV (diffuse perforation of sellar floor). The patient was transferred to the intensive care unit for further observation. The physical examination performed by general surgery, demonstrated a loss of peripheral vision. The patient was later transferred under the service of neurosurgery. Under the service of neurosurgery, hormone levels were obtained showing to be within normal reference range. Formal visual testing confirmed the presence of bitemporal hemianopsia.

The patient underwent a right pterional craniotomy. Posteromedial to the optic nerve and carotid artery was an area discrete from the surrounding structures. The encapsulated mass correlated with the position of the tumor as using a frameless stereotactic device. The capsule was coagulated using bipolar cautery and incised with a #11 blade. Pink colored, moderately granular soft friable tumor was encountered within this capsule. As the tumor was soft and “suckable,” internal debulking of the suprasellar region of the tumor was begun using a combination of suction and bipolar cautery. In this manner, the ipsilateral optic nerve and the carotid artery were decompressed enough for the arachnoid of the opticocarotid cistern to be identified. Once this was identified, a #11 blade was used to carefully incise the arachnoid over the optic-carotid system with egress of more cerebrospinal fluid, which allowed for further brain retraction. In this manner, the entire frontal lobe portion of the tumor and its attached capsule was able to be resected in their entirety, and these were sent for pathology.

Further debulking of the posterior lobe of the tumor was carefully accomplished using a combination of suction and bipolar cautery technique. The posterior portion of the tumor was adjacent to the hypothalamus and the third ventricle, and this was carefully debulked in the same manner as the anterior lobe. Majority of the tumor was resected and sent for biopsy. Tumor capsule was again able to be identified and was able to be grasped with pituitary forceps, and in this manner, the posterior lobe of the tumor was able to be delivered from its position anterior to the third ventricle into the operative field where it could be further debulked and resected using intraoperative suction.

Once the posterior portion of the tumor was debulked further partial debulking of the intrasellar component was completed. Some residual intrasellar component was left intact as not to injure native functional pituitary tissue.

The final diagnosis was a pituitary adenoma. Microscopy revealed in general a homogenous cell population with minimal cytologic atypia, prominent vascular pattern imparting a perivascular pseudorosette feature without a mixture of other pituitary normocellular elements, and rare mitosis. Immunohistochemical stains for cytokeratin AE1/AE3 is strongly positive with focal to weak reaction with epithelial membrane antigen. Adrenocorticotropic hormone is positive only on the residual rim of pituitary gland, but the rest of the tumor is negative. Prolactin (PRL), luteinizing hormone, follicular stimulating hormone, and growth hormone are positive in varying degrees. PRL appeared to be predominant hormone. Thyroid stimulating hormone is negative. Glial fibrillary acid protein and CD99 are negative. Ki-67 demonstrates less than 5% proliferation index. S-100 is focally positive. The patient was kept in the Critical Care Unit for postoperative observation.

Postoperative day 2, MRI revealed the trilobed mass lesion had been removed. The posterosuperior lobe that was compressing the cerebral peduncles had been resected. The anterosuperior mass, which was compressing the frontal lobe, had also been resected. The mass consisting of the pituitary gland, and extending into, and occupying the suprasellar
space, and engulfing the optic chiasm had been resected. However, the MRI revealed the presence of enhancing tissue within the expanded sellar, like a combination of the pituitary gland, tumor tissue, and edema-blood (Fig. 2). In addition to these findings, acute subdural bleeding is appreciated in the right anterior lateral subdural space (Fig. 3). Postoperative day 9, a noncontrast computerized tomography was done revealing the presence of acute blood in the subdural space in the anterior right lateral subdural space. The maximal thickness of the blood in the area is 1 cm (Fig. 4). A repeat noncontrast computerized tomography done on postoperative day 23 revealed less fluid in the right frontal postoperative subdural space with a more chronic water attenuation appearance to the remaining fluid. New bleeding had not developed, and there were no signs of a mass effect. The brain appeared normal elsewhere (Fig. 5).

Postoperative day 6, endocrinology was consulted due to the patient having panhypopituitarism. Levels of cortisol, free T3, free T4, thyroid stimulating hormone baseline, and insulin-like growth factor or growth hormone were diminished. Sodium levels were elevated. To rectify these hormonal imbalances, the patient was started on synthroid 125 mcg, hydrocortisone 20 mg every morning and 20 mg in the afternoon. Intranasal desmopressin acetate was given to control the sodium levels. Careful observation for the next several days led to laboratory values returning to within normal reference range. The patient was subsequently discharged 16 days after the initial admission.

Discussion

Giant pituitary adenomas are those tumors, which are greater than 4 cm in the maximum measured dimensions. These tumors can be classified depending on the extent of spread by classifying them into various grades. Grade I are those, which remain within the confines of the sella dura and inferior to the diaphragm sellae, but no invasion into the cavernous sinus. Those adenomas which spread to the medial wall and followed with invasion into the cavernous sinus are grade II.

Elevation of the dura of the superior wall of the cavernous sinus and spread into various brain compartments is categorized as grade III. At last, the adenomas, which have a

Fig. 1 – (A) T2 sagittal MRI showing the trilobed giant pituitary adenoma with anterior and posterior suprasellar extensions. (B) T2 sagittal MRI showing the craniocaudal dimensions of the tumor measuring at 41.95 mm. (C) T2 sagittal MRI showing the anteroposterior dimensions of the tumor measuring at 50.37 mm. (D) T2 axial MRI showing a transverse measurement of 28.11. The bilobed appearance can be appreciated by this view. (E) Transverse image of the tumor showing the masses displacing both the left and right anterior cerebral arteries (arrows).
supradiaphragmatic–subarachnoid extension, are classified as grade IV [5].

Treatment options for these giant adenomas vary from either medical management or with surgical management. The former is restricted to adenomas which are PRL secretors. Dopamine agonists such as bromocriptine can be used to manage these patients. However, a recent study has shown that bromocriptine had been an effective therapeutic agent for a giant nonfunctional pituitary adenoma, based on the absence of enlargement, after an early bromocriptine treatment withdrawal. The study by Barquiel et al. [6] had bromocriptine levels that were progressively increased from 1.25 to 3.75 mg orally daily. Bromocriptine dose for a prolactinoma ranges 2.5-15.0 mg per day. Serum PRL levels normalized within 2 months of initiation of bromocriptine.

The mass showed a maximum diameter of 1.3 cm after 6 months of treatment. Before initiation, the maximum linear diameter was 2.3 cm. After, the adenoma had decreased to a maximum linear diameter of 0.9 cm. In addition to these findings, signs of an extrasellar invasion had also disappeared. For those patients where pharmacologic intervention does not have any affect on the tumor, surgical intervention can be done.

Surgical intervention of giant pituitary adenomas with suprasellar extensions can present a daunting task. These tumors with suprasellar extension and visual compromise were indications for a transfrontal approach for the past 2 decades [7]. Traditionally, a transsphenoidal approach was the surgical method of choice for pituitary tumors [8]. Zhang et al. [9] in 1999 found that the transsphenoidal approach is safe and advantageous in that it allows for rapid and adequate decompression of the optic nerves and chiasm, and the incidence of side effects was lower compared with the transfrontal approach. However, one of the disadvantages found with the transsphenoidal procedure is the lack of direct visualization of the optic nerves and their blood supply [10]. In
addition, the approach is limited for larger lesions with extrasellar extension that have a favorable configuration. Tumors where the diaphragm sellae are compromised around the pituitary stalk can extend and expand into the suprasellar region — making the transsphenoidal approach difficult. At last, a fibrous consistency of the tumor is another limitation for the transsphenoidal approach [10].

For many, the transcranial approach continues to play a role in the management of pituitary adenomas that have an irregular shape or eccentric extensions that could not be reached through the transsphenoidal route [7]. Compared with the transsphenoidal procedure, patients having undergone a transcranial procedure showed greater visual improvement; however, the postoperative pituitary dysfunction offsets the visual improvement. In addition, limited visualization of the intrasellar area and amount of brain retraction are 2 additional disadvantages to this procedure [8].

The anterior and posterior suprasellar extension of our patient is due to the diaphragm sellae becoming compromised around the pituitary stalk. Neither transsphenoidal nor a transcranial route alone would be likely to completely resect the sellar and suprasellar components of the tumor. For these reasons, a combined approach would be effective. D’Ambrosio et al. [11] found the collaboration of a transcranial and transsphenoidal approach increased visualization of critical neurovascular structures. The combined approach was also found advantageous for patients with bicompartamental (types A-D stage) lesions and any of the risk factors for visual loss with transsphenoidal approach (ie, giant pituitary adenomas, previous visual impairment, “bottle-neck” or dumbbell-shaped tumors [type B in modified Hardy classification], previous surgery, and radiation therapy) [10].

A recent study by Alleyne et al., 9 of the 10 patients with the combined procedure all had visual improvement within 1 month after surgery. In 5 patients, the resolution was complete at 6 months after the surgery, whereas in the other 4 patients, the resolution was partial. None of the patients had worsening of vision. However, new oculomotor nerve palsy occurred in 3 patients. The palsy had resolved after 4 months follow-up in 1 patient and at 12 months in the other 2 patients. Complications, which were permanent in this study, included diabetes insipidus, hypothyroidism, and an infarct of the left head of the caudate nucleus.

Conclusions

In summary, we reported the findings of a trilobed giant pituitary adenoma in a 40-year-old man, which was removed by means a right pterional craniotomy procedure. Various surgical interventions have evolved to excise pituitary tumors, when pharmacologic intervention has failed or for those candidates where pharmacologic intervention would not help. Evolution of these procedures has aimed at minimizing intraoperative and postoperative complications in patients, all while maintaining safe and efficacious measures. A transfrontal procedure was initially used, which progressed to the use of a transsphenoidal procedure, due to minimization of side effects. The transcranial approach aimed at resection of tumors, which were out of the scope for transsphenoidal procedure. In addition, the transcranial method provided an increase in visualization of critical neurovascular structures, which the transsphenoidal method failed to do. Combining the transsphenoidal and transcranial methods, it has shown optimum results in many patients by having near total or complete resection of the tumor, partial or complete visual recovery, and no permanent complications.

References

[1] Lake MG, Lake M, Krook L. Pituitary adenomas: an overview. Am Fam Physician 2013;88(5):319–27.
[2] Sinha S, Sumit S, Mahapatra Ak, Sharma BS. Microsurgical management of prolactinomas—Clinical and hormonal outcome in a series of 172 cases. Neurol India 2011;59(4):532.
[3] Greenberg MS. Handbook of Neurosurgery, Vol. 2. Stuttgart: Thieme; 1997.
[4] Chacko AG, Chacko AG, Chandy MJ. Transsphenoidal line of vision on MRI for pituitary tumor surgery. Neurol India 2002;50(2):136–40.
[5] Goel A, Goel A, Nadkarni T, Muzumdar D, Desai K, Phalke U, et al. Giant pituitary tumors: a study based on surgical treatment of 118 cases. Surg Neurol 2004;61(5):436–45.
[6] Barquiel B, Fernández A, Frutos R, Rosado J, Pallardo L, Alvarez-Escolá C. Unusual response to bromocriptine of a giant pituitary adenoma and fertility restoration: a record of a pregnancy. Int J Case Rep Med 2014;2014:1–8.
[7] Matsuyama J, Kawase T, Yoshida K, Hasegawa M, Hirose Y, Nagahisa S, et al. Management of large and giant pituitary
adenomas with suprasellar extensions. Asian J Neurosurg 2010;5:48–53.

[8] Leung G, Law H. Combined simultaneous transcranial and transsphenoidal resection of large-to-giant pituitary adenomas—Springer. Eur J Neurosurg 2011;153:1401–8.

[9] Zhang X, Fei Z, Zhang J. Management of nonfunctioning pituitary adenomas with suprasellar extensions by transsphenoidal microsurgery. Surg Neurol 1999;52(4):380–5.

[10] Alleyne C, Barrow DL, Oyesiku N. Combined transsphenoidal and pterional craniotomy approach to giant pituitary tumors. Surg Neurol 2002;57(6):380–90.

[11] D’Ambrosio AL, Syed ON, Grobelny BT, Freda PU, Wardlaw S, Bruce JN. Simultaneous above and below approach to giant pituitary adenomas: surgical strategies and long-term follow-up. Pituitary 2009;12(3):217–25.