CASE REPORT

Pediatric ischemic stroke from an apoplectic prolactinoma

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Abstract

Introduction Pediatric pituitary neoplasms and associated pituitary apoplexy are uncommon. There are few reports in pediatric patients of pituitary apoplexy causing focal arterial compression or diffuse vasospasm resulting in cerebral infarction, and the acute, focal neurological deficits associated with stroke differ from the typical presentation of an apoplectic pituitary tumor. We report the first case of a teenage female with an apoplectic macroprolactinoma presenting with stuttering cerebral infarction secondary to compression of the internal carotid artery (ICA).

Case A 14-year-old female was transferred from an outside facility after presenting with right hand paresthesias and word-finding difficulty that eventually progressed to include right upper extremity weakness and mental status changes. Computed tomography (CT) and magnetic resonance imaging (MRI) revealed an apoplectic macroprolactinemia and diffusion-weighted imaging showed acute stroke in the left anterior and middle cerebral artery distributions. Evaluation

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² Department of Neurosurgery, Mayo Clinic, 200 First St SW, Rochester, MN 55905, USA of the cerebral vasculature with MRA showed focal compression of the left supraclinoid ICA. Despite prompt surgical decompression, the patient developed right lower extremity weakness in addition to her other deficits though her deficits improved after inpatient rehabilitation.

Conclusions In the pediatric population, there is only one other case of pituitary apoplexy presenting with stroke, which was secondary to vasospasm. We present the first case of pituitary apoplexy presenting with stroke secondary to ICA compression. Though rare, it is important to consider that pituitary apoplexy may present with non-classical symptoms such as ischemic stroke even in pediatric patients.

Keywords Pituitary adenoma · Apoplexy · Stroke · Pediatric · Prolactinoma

Introduction

While prolactinomas are the second most frequent sellar tumor in the pediatric population after craniopharyngioma, overall, pituitary adenomas are rare with variable incidences during pubescence [1]. Childhood adenomas typically present with gradual symptom progression from local mass effect or endocrine abnormalities. Pediatric patients rarely present with apoplexy. Classically, apoplexy presents with acute onset of ophthalmoplegia, visual decline, and/or nausea and vomiting. However, there are 25 case reports of pituitary apoplexy causing stroke, one of which was in a pediatric patient [2].

We present the case of a teenage girl with an apoplectic macroprolactinoma who presented with stuttering cerebral infarction secondary to focal compression of the internal carotid artery (ICA). She underwent prompt surgical decompression without improvement in her carotid stenosis and her neurological deficits stabilized. She improved after rigorous rehabilitation.

Case report

History and examination

A 14-year-old female was transferred from an outside facility with a 24 h history of right hand paresthesias and wordfinding difficulties. She had a 2-year history of intermittent migraine headaches. In the 2 months prior to presentation, her headaches had increased in frequency and severity with associated nausea, photophobia, and phonophobia. Her initial assessment was notable for the aforementioned sensory changes and speech difficulties with a non-focal motor exam. Initial computed tomography (CT) findings are shown in Fig. 1a and b. Her family history included an uncle with a pituitary mass.

Eleven hours after transfer, she developed behavioral changes, a right upper motor neuron facial droop, significantly decreased strength in the right upper extremity (distal greater than proximal), and worsening of her non-fluent verbal aphasia. The patient was transferred at night and she was stable so magnetic resonance imaging (MRI) was deferred until the morning. She was given 10 mg intravenous (IV) dexamethasone and continued on 4 mg IV every 6 h. By morning, she had improvement in her right upper extremity weakness though her speech deficit persisted. Vision and extraocular movements remained intact. MRI demonstrated compression of the optic chiasm by a pituitary tumor with cystic and hemorrhagic components (Fig. 1c) and associated narrowing of the left ICA (Fig. 1d). An acute cortical infarct in the left frontal lobe was readily apparent (Fig. 1e). CT angiogram verified greater than 90 and 95-99 % stenosis of the left cavernous and supraclinoid ICA, respectively (Fig. 1f). Shortly after her MRI, her right upper extremity became densely weak, and she was transferred to the pediatric intensive care unit (PICU). Her blood pressure was augmented due to concern for a perfusiondependent deficit.

The following day, the patient was taken urgently to the operating room for surgical decompression and pathological diagnosis, and for cerebral angiography for post-surgical evaluation and intervention if indicated. Though pending at the time of surgery, laboratory workup revealed central hypothyroidism, hyperprolactinemia, central hypogonadism, and growth hormone deficiency (Table 1).

Operation

The patient was placed under general anesthesia and positioned supine. A neurosurgeon and otolaryngologist collaborated for the procedure. A standard endoscopic approach with a naso septal mucosal flap was used to access the sphenoid sinus [3]. The soft sellar mass was immediately evident due to erosion through the floor of the sella turcica. A nasal speculum was placed and an operative microscope was used for the tumor resection. The dura was incised, and necrotic pituitary tumor with xanthochromic fluid suggested recent apoplexy. The tumor was intentionally subtotally resected along the left cavernous sinus and sella given concern for tumoral invasion of internal carotid arterial adventitia. The exposure was closed endoscopically with the naso septal flap.

She was subsequently taken for transfemoral cerebral angiography. The angiogram confirmed continued high-grade stenosis of the supraclinoid artery with modest leptomeningeal collateral flow and no suggestion of vasospasm (Fig. 2a–c). The compression was found to be above the level of the posterior communicating artery, limiting the collateral flow available to the cerebral hemisphere at risk. Therapeutic intervention with intraluminal angioplasty was deemed unsafe. She was extubated and awoke from anesthesia with new onset right lower extremity weakness. Her blood pressure was optimized with fluid resuscitation and her right lower extremity weakness improved. She was transferred to the PICU in stable condition.

Pathological findings

Gross evaluation demonstrated a tannish-pink gelatinous specimen. Tumor cells verified strong immunoreactivity for prolactin and sporadic reactivity for growth hormone, chromogranin, and Periodic-Acid-Shift stain. This pathological profile was consistent with a pituitary prolactinoma.

Postoperative course

An immediate postoperative brain MRI was done to evaluate the lower extremity weakness. The imaging confirmed subtotal resection of a pituitary macroadenoma and extension of the left hemispheric infarctions consistent with supraclinoid arterial occlusion (Fig. 2d). Speech and right-sided motor dysfunction gradually improved throughout the postoperative course. Evaluation by speech pathology revealed global aphasia with verbal and oral apraxia. Her facial weakness gradually improved while her right arm and leg weakness persisted. Cabergoline therapy was started. An endocrine evaluation was consistent with panhypopituitarism. Thyroid supplementation was started while gonadotropin and growth hormone replacement was deferred. Prophylactic high-dose corticosteroids were tapered to a physiologic level. On postoperative day seven, she was discharged to inpatient rehabilitation with physical, speech, and occupational therapy.

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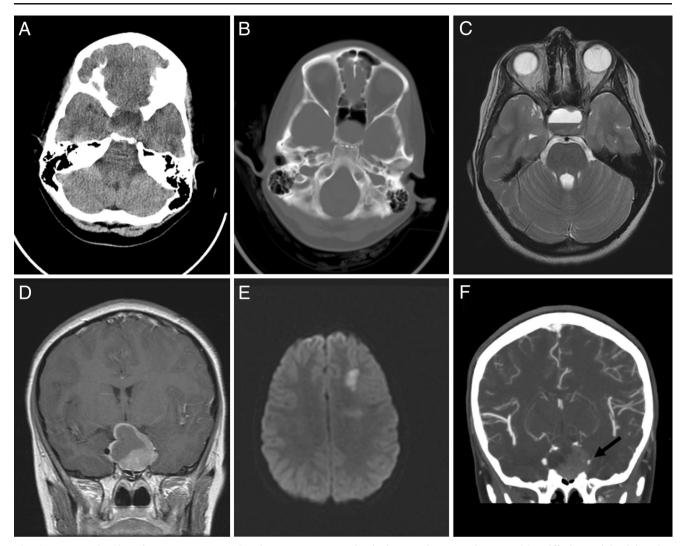


Fig. 1 Preoperative imaging. Non-contrast CT demonstrates a heterogeneous hypointense sellar mass (a) with suprasellar extension (not shown) and bony remodeling (b). MRI of the head showing the sellar mass with a fluid-fluid level on T2 weighted imaging (c). On coronal T1 with contrast sequences, the tumor was partially cystic with an enhancing solid portion. Encasement of the left carotid artery with

Her rehabilitation period was uneventful with improvement in her deficits. At 10-week follow-up, she had returned

Table 1 Patient's presenting endocrine laboratory profile, whichdemonstrates hyperprolactinemia, hypogonadism, growth hormoneinsufficiency, and hypothyroidism

Laboratory name	Laboratory value (ng/mL)	Normal range
Prolactin	3971	3–27 ng/mL
LH	<0.3	0.3-17.2 ng/mL for Tanner III women
FSH	4.5	1.2-11.4 ng/mL for Tanner III women
IGF-1	90	249-519 ng/mL for Tanner III women
Thyroxine	0.7	0.8–1.8 ng/mL

luminal narrowing was also seen (d). Diffusion-weighted imaging showed an acute infarct of the left centrum semiovale and anterior frontal lobe (e). CT angiography demonstrated focal compression of the left supraclinoid carotid artery (*black arrow*) and narrowing of the carotid past the petrous segment (f)

to school. The right facial weakness resolved completely. She continued to have right-sided hemiparesis with mild spasticity; she was ambulatory without assistance. Her non-fluent aphasia had improved and she could participate in casual conversation, though she continued to have mild word-finding difficulties. MRI illustrated subtotal resection with decompression of the optic apparatus and no new evidence of ischemia (Fig. 2d). Her pituitary function tests were consistent with panhypopituitarism, so she remains on treatment for adrenal insufficiency and hypothyroidism with close observation of hypogonadism and growth hormone insufficiency. The prolactin level decreased to within normal limits (20 ng/ml) within 3 weeks on cabergoline therapy.

At 6-month follow-up, she has had no more strokes or transient ischemic attacks indicative of persistent underlying

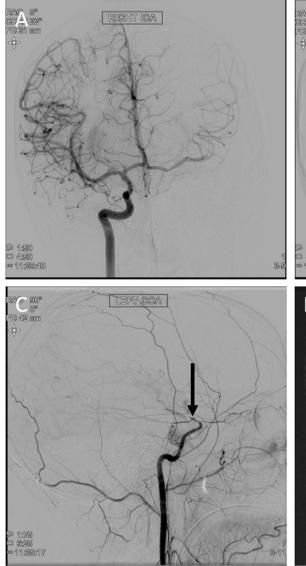
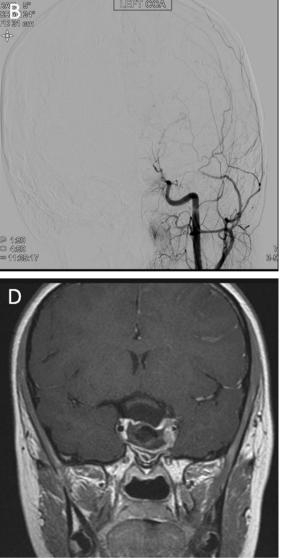


Fig. 2 Postoperative imaging. Anterior posterior cerebral angiography of the right internal carotid artery (a) and left common carotid artery (b). These showed severe narrowing of the left supraclinoid carotid artery (b) with slowed collateral flow through the anterior communicating artery.

cerebral ischemia. Thus, she is not receiving antiplatelet therapy. Six-month MRI demonstrated continued ICA stenosis and no residual tumor. Prolactin levels remained low (3 ng/ mL) at 9-month follow-up, and cabergoline was discontinued. Since delayed recurrence following apoplexy of a prolactinoma occurs relatively frequently, the patient is monitored with serial pituitary MRIs to screen for evidence of tumor recurrence.

Discussion

We have described a teenage female who presented with a non-fluent aphasia and transient right upper extremity



The level of compression was above the left posterior communicating artery, as seen on lateral left common angiography (**c**, *black arrow*). Postoperative MRI shows extensive resection of the prolactinoma with some residual tumor along the left cavernous sinus (**d**)

weakness from left ICA compression by an apoplectic macroprolactinoma, resulting in left hemispheric infarction. She did not experience acute headache or visual loss. Despite prompt surgical intervention, her ICA remained stenotic with diminished left hemispheric flow. Postoperatively, the patient's symptoms improved with intensive rehabilitation and tumor size decreased on dopamine agonist therapy.

Pituitary masses have a much lower incidence in children than adults. Pituitary apoplexy is seen in 2 % of all surgicallyresected pituitary adenomas [4]. The proposed pathophysiologic mechanisms of pituitary apoplexy focus upon alterations in the local vascular supply. Several suggested risk factors that predispose a tumor to apoplexy include tumor size, nonfunctioning or prolactin-producing subtypes, invasion of the cavernous sinus, and coagulopathy [5–11]. Though no rate is reported, pituitary apoplexy is rare in the pediatric population. In a series of 34 pediatric patients undergoing endonasal transsphenoidal pituitary surgery, only two presented with apoplexy [12]. In another series of 21 patients, four patients had evidence of apoplexy, though only one was symptomatic at presentation [13].

While pituitary apoplexy is defined by hemorrhagic or ischemic infarction within the tumor, an associated symptomatic gross cortical ischemic event is rare. Although the ICA passes through the cavernous sinus, the integrity of the arterial lumen is rarely compromised by invasive pituitary neoplasms [14]. Studies in adults have implicated meningiomas [15] and metastases [14] more likely to alter ICA structure than adenomas.

Two principal mechanisms for pituitary apoplexy as a cause for cerebral ischemia have been suggested: arterial compression and vasospasm. Compression occurs secondary to neoplastic encasement and stenosis of the ICA or through invasion of the arterial adventitia. Vasospasm is hypothesized to be secondary to blood extravasation into the subarachnoid space or tumor secretion of vasoactive molecules.

Several studies of pituitary apoplexy cite visual field deficit as the primary indicator for surgical versus medical management, though altered level of consciousness and decreased visual acuity have also been suggested [16–18]. A review by Banerjee et al. of stroke and pituitary apoplexy in 25 patients found those with stroke more likely to undergo surgery than those without [2]. Twenty patients managed surgically had decreased mortality (30 %) when compared to five patients managed medically (60 %). However, the authors draw limited conclusions due to small sample size and the fact that two patients who died in the medical treatment arm suffered apoplexy after undergoing surgery for other reasons [2]. For patients undergoing operative intervention, those with a compressive etiology were found to have better outcomes than those with vasospasm [2]. Only one prior apoplectic stroke in a child has been reported in the literature [19], and a compressive etiology has not been published previously [19–21]. In the case of our patient, angiography depicted a unilateral, focal arterial occlusion consistent with a compressive etiology (Fig. 2a-c). Surgery was undertaken in order to prevent continued compression of the ICA and subsequent ischemic events. The tumor resection along the left cavernous and supraclinoid ICA was limited given the concern for focal vascular invasion by the tumor.

Pituitary apoplexy is a rare event in pediatric patients and may present without classical symptoms. Focal compression may develop and lead to ischemic stroke. Surgical decompression may be indicated to prevent progression of the disease. **Acknowledgments** The authors would like to thank Mary Soper for assistance in preparing this manuscript.

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

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