Case Report

HYPOPITUITARISM WITH MOYAMOYA DISEASE INVOLVING THE POSTERIOR PITUITARY

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ABSTRACT

Objective: To describe a case of moyamoya disease associated with hypopituitarism.

Methods: We present a case of moyamoya disease presenting with hypogonadotrophic hypogonadism and central diabetes insipidus and review the literature.

Results: A 22-year-old female presented with secondary amenorrhea with loss of secondary sexual characteristics. Her follicle-stimulating hormone and luteinizing hormone levels were 1.4 mIU/mL and <0.1 mIU/mL, respectively. The results of water deprivation test indicated central diabetes insipidus. Her thyroid-stimulating hormone, thyroxine, and post-Synacthen cortisol levels were normal, and her prolactin was measured as 52.2 ng/mL (normal <20 ng/mL). Contrast-enhanced magnetic resonance imaging showed a partial empty sella with enhanced linear and curvilinear structures in the suprasellar cistern. Magnetic resonance angiography showed narrowing of the apices of the bilateral intracranial carotid, middle cerebral, and anterior cerebral arteries. It also showed collaterals of the middle cerebral artery, predominantly on the left side.

Conclusion: Moyamoya disease with hypopituitarism involving the posterior pituitary is rare but can be the result of ischemia due to internal carotid artery narrowing. **(AACE Clinical Case Rep. 2015;2:e115-e118)**

INTRODUCTION

Moyamoya disease is a vaso-occlusive disease involving the intracranial portion of the carotid artery and its branches, especially the middle and anterior cerebral arteries. It has bimodal peaks of presentation at 5 and 40 years of age. An early presentation is usually due to ischemic symptoms, and at later ages, half of the cases present with ischemia and half with hemorrhage. Intracranial hemorrhage is the result of rupture of the fragile collaterals formed due to chronic ischemia caused by obstruction of internal carotid, which is secondary to hyperplastic changes in the vasculature (1). Moyamoya syndrome is a vasculopathy associated with conditions like sickle cell disease, neurofibromatosis type I, Down syndrome, cranial therapeutic irradiation, and congenital cardiac anomalies (1). We report a case of hypopituitarism with hypogonadotrophic hypogonadism and central diabetes insipidus secondary to moyamoya disease.

CASE REPORT

A 22-year-old female presented to us for secondary amenorrhea. She had menarche at the age of 12 and a regular menstrual cycle for 3 years. At the age of 15 years she noticed amenorrhea, which was abrupt without a history of hypo- or oligomenorrhea. She also had a loss of axillary and pubic hair. She was given medroxy progesterone acetate (10 mg for 10 days) but did not experience withdrawal bleeding. She had a normal cycle when treated with a combination of estrogen and progesterone. There was no preceding history of stress, vigorous exercise, weight loss, antipsychotic drug intake, head trauma, or central nervous system irradiation or infection. On inquiry, she also reported polyuria and nocturia for the same duration of time, which was later quantified to 6 L. She was born at full-term

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via vaginal delivery and had a normal history of development and scholastic performance. Interestingly, she also had acongenital cleft lip that was surgically corrected at 4 months of age. No other midline defects were observed. She had a strong family history of diabetes; both parents and her father's 2 siblings were affected. Her height was comparable with that of her siblings and peers. She did not have any neurocutaneous markers.

Clinical examination did not reveal galactorrhoea. Her respective follicle-stimulating hormone, luteinizing hormone, and estradiol levels were 1.4 mIU/mL (Normal 1.8-11.2 mIU/mL), <0.1 mIU/mL (Normal 2.0-9.0 mIU/mL), and <27 pg/mL (Normal 27.0-246.0 pg/mL). On water deprivation test, she had an 85% increase in urine osmolarity 2 hours after vasopressin injection following a 3-hour period of stable urine osmolarity (266, 250, and 241 mOsmol/L). Her thyroid axis was normal with thyroid-stimulating hormone and thyroxine levels of 3.0 mIU/L and 6.9 μg/dL respectively. Her prolactin was 52.2 ng/mL (Normal <20 ng/mL), and post-Synacthen cortisol was 24.5 μg/dL (Normal >20 μg/dL) (Table 1). Her fasting and postglucose plasma glucose levels were normal.

Contrast-enhanced magnetic resonance imaging revealed a partial empty sella with enhanced linear and curvilinear structures in the suprasellar cistern (Fig. 1). Magnetic resonance angiography showed narrowing of the apices of the bilateral intracranial carotid arteries and its branches, as well as the middle and anterior cerebral arteries. She had also developed middle cerebral artery collaterals, predominantly on the left side (Fig. 2). This finding was confirmed on digital subtraction angiography (Fig. 3).

The patient was investigated for conditions associated with moyamoya syndrome. A fundus examination for morning glory disc anomaly was normal. Anti-hepatitis C antibody and sickle cell tests were negative. Her serum ferritin was 20 μg/L (Normal 15-200 μg/L), and serum β-human chorionic gonadotropin was <1 IU/L.

Her final diagnosis was hypopituitarism with hypogonadotrophic hypogonadism and central diabetes insipidus, with the most likely etiology being vascular insufficiency secondary to moyamoya disease. She was intially managed with intranasal desmopressin, estrogen, and progesterone and will ultimately undergo revascularization surgery.

Table 1
Pituitary Hormone Profile

Parameters	Values[a]
FSH	1.4 mIU/mL (1.8-11.2)
LH	<0.1 mIU/mL (2.0-9.0)
Estradiol	<27 pg/mL (27.0-246.0)
TSH	3.0 mIU/L (0.5-5.0)
T4	6.9 μg/dL (4.6-12.4)
Prolactin	52.2 ng/mL (<20)
Post-Synacthen cortisol	24.5 μg/dL (>20)
Water deprivation test	85% increase in urine osmolarity 2 hours after vasopressin injection

Abbreviations: FSH = follicle-stimulating hormone; LH = luteinizing hormone; T4 = thyroxine; TSH = thyroid-stimulating hormone.
[a]Normal values are given in parentheses.

DISCUSSION

Moyamoya disease is the progressive stenosis of the intracranial portion of the carotid artery and its branches. Carotid artery stenosis eventually reduces blood flow in the major vessels of anterior circulation and induces the development of compensatory collaterals. These are mainly formed off small vessels near the carotid apices, cortical surface, leptomeninges, and branches of the external carotid artery supplying the dura and skull base (1). We report a case of moyamoya disease presenting with hypopituitarism in a patient with a midline defect in the form of a cleft lip. Hypopituitarism involving both the anterior and posterior pituitary has been reported in other pituitary infarctions like Sheehan syndrome, which is caused by infarction of a physiologically enlarged pituitary secondary to postpartum hemorrhage that classically leads to lactation failure and hypopituitarism (2). To our knowledge, this is the first case report of hypopituitarism in in the setting of moyamoya disease involving both the anterior and posterior pituitary in a physiologically enlarged pituitary during puberty. Growth failure with moyamoya disease is a well-known presentation in pediatric patients, but hypopituitarism is not a common finding due to moyamoya disease in adulthood. Shibata et al reported the case of a 15-year-old female with central diabetes insipidus and moyamoya due to suprasellar germinoma, and diabetes insipidus is a well-known presentation of this condition (3). Although our patient had diabetes insipidus, there was no evidence of mass lesion or stalk thickening. Partial empty sella syndrome in cases of pituitary apoplexy in the setting of Sheehan syndrome is well known. The mild hyperprolactinemia in our patient can be explained by sparing of the prolactin axis. A number of sellar and suprasellar masses have been found in conjunction with moyamoya disease including craniopharyngioma; a pituitary adenoma secreting growth hormone, prolactin, and thyrotropin; and germinoma (4-7). Therefore, other etiologies involving the pituitary should be kept in mind when confronted with hypopituitarism in the setting of moyamoya disease. The other explanation for hypopituitarism could be a mass effect of the space-occupying vascular mass where compression of the pituitary or hypothalamus induces pituitary dysfunction (8). Our patient had hypogonadotrophic hypogonadism and partial empty sella. Lin et al described a 34-year-old male patient

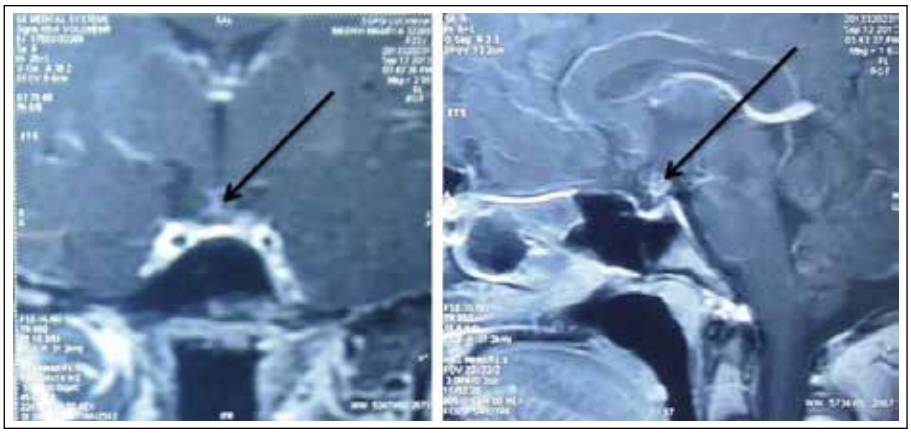

Fig. 1. Coronal and sagittal magnetic resonance images showing a partial empty sella with enhanced linear and curvilinear structures (*black arrow*) in the suprasellar cistern.

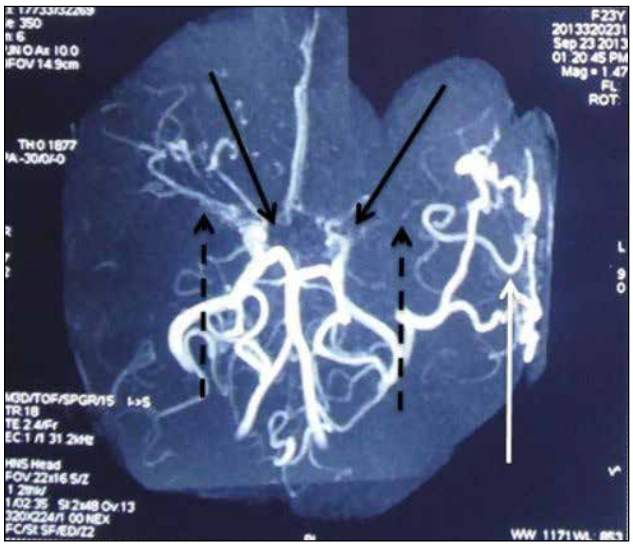

Fig. 2. Magnetic resonance angiography showing narrowing of the supraclinoid portion of the bilateral internal carotid arteries (*black arrow*), with nonvisualization of both middle cerebral arteries (*dashed arrow*) and the left proximal anterior cerebral artery with multiple collaterals from the left middle meningeal artery (*white arrow*).

who presented with intracranial hemorrhage due to moyamoya disease and was later diagnosed with hypogonadism and hypopituitarism secondary to moyamoya disease with empty sella syndrome (9). Midline defects have been noted in cases of moyamoya disease, and our patient had a cleft lip. Teng et al reported the case of a 2-year-old boy with moyamoya, a midline facial cleft, and basal encephalocele (a congenital malformation having a cranial bone defect and cystic-like herniation through the defect (10). Quah et al reported a 4-year-old boy who presented for assessment of convergent strabismus, and imaging and angiographic investigations showed midline cranial defects and abnormal carotid circulation (11). Other defects associated with moyamoya include pituitary stalk duplication, which was described in 2 patients (12). Gorrotxategi and colleagues also reported midline defects (13).

The primary disease process of moyamoya cannot be reversed. Rather, the aim of treatment is to reduce stroke incidence by improving blood flow to the affected cortex. Surgery is the preferred treatment for moyamoya disease; medical management is less effective. The main aim of

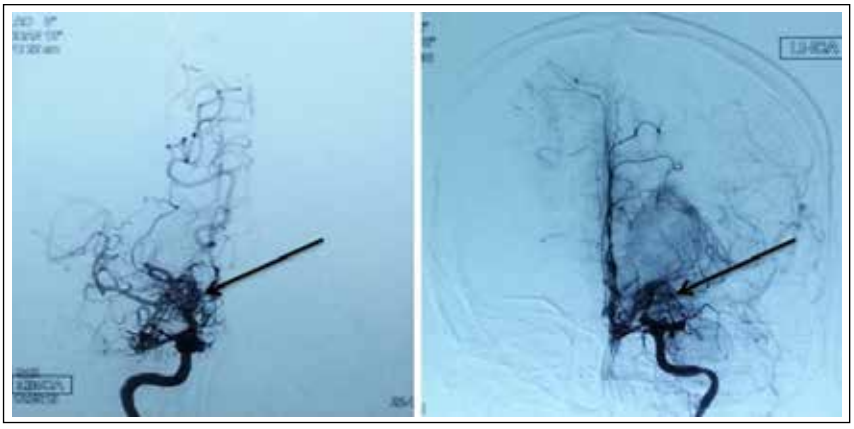

Fig. 3. Multiple collaterals are noted just above the terminal part of right internal carotid artery (right panel, *black arrow*). Collateral vessels are seen with angiographic blush (left panel, *black arrow*). The left middle cerebral artery is not filled.

surgery is to use the external carotid artery as a new source of blood flow to the ischemic hemisphere (1).

CONCLUSION

Although it is rare, moyamoya disease should be considered in the differential diagnosis of hypopituitarism if symptoms develop suddenly. Posterior pituitary involvement due to secondary pituitary insufficiency can occur in the setting of moyamoya disease. Digital subtraction angiography is the gold standard for diagnosis, and surgical management is more effective than medical management (14).

DISCLOSURE

The authors have no multiplicity of interest to disclose.

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