Clinical findings and management of hereditary optic atrophy

Health & Medicine, Disease

Abstract

The hereditary optic atrophies (neuropathies) are a very rare heterogeneous group of disorders that are primarily characterized by bilateral optic atrophy. It is an autosomal dominant inheritance disorder that typically presented at first decade within insidious visual loss. Some patent may develop other systemic abnormalities that associated with the optic atrophy. 7 Optic atrophy indicates damaging of retinal ganglion cell axons which comprise the optic nerve results in pale optic nerve appearance on the fundus exam. Optic atrophy can arise from different causes of optic nerve lesions in the visual pathway from the retina to the lateral geniculate. It usually indicates poor visual prognosis in that eye since this pathway carries the retinal information to the brain. 6 Optic atrophy can be primary to a relative absence of mesenchymal and glial tissue or secondary to gliosis and propagation of astrocytes on and about the optic disc2. However, it is important to obtain genetic counseling in cases of hereditary optic atrophies to confirm the diagnosis.

History

This case involves a 16 years old White girl presented to the low vision department at the eye institute on June, 11 2018 with binocular reduced vision secondary to optic atrophy OU. This patient is a 10-grade student who seek for vision aids to help her use her remaining vision functionally. Her vision concerns are to able to see faces and signs at distance, to read without an aid in school and at home independently, and to complete school work at home and in school. She is taking standardized test like PARCC and

in her school, they didn’t make the right accommodation for her, but she has an aide who blows things up for the handout. To reduce the effect of the low vision, patient sets in the front of the classroom using auditory learning and 36 print size to help her during class. She had tried magnifiers, but she could not tolerate the glare. Also, because of her dexterity she was not able to use handheld devices. She also has problems with glare from the computer screen and also reported difficulty with light dark adaptation. She stopped using transition lenses because she noticed that it takes a long time to clear. She also noticed a fluctuation in her vision which increases at the end of the day. Currently, she has bilateral myopia and her best-corrected visual acuity (BCVA) is 20/300 in the right and 20/125 in the left her prescription in the right eye: -3. 50-0. 75@088, and: -2. 25-0. 50@089 in the left eye. At near her corrected vision with +2. 75 add was 0. 2/8 OD and 0. 2/4 OS. During the examination, the left side of her visual field was impaired in both eyes. No history of ocular trauma, injury, and surgery were reported. Evaluation of the patient’s gait showed abnormal gait and the patient uses cane occasionally. She is currently receiving physical therapy and occupational therapy and seeing mobility specialist. The patient medical’s record showed history of seizures and she use keppra Levetiracetam as treatment. She also has hydrocephalous and done ventriculoperitoneal shunt, and third ventriculostomy. Dates of ventriculoperitoneal shunt, and third ventriculostomy were not available. She has hypertension and using clonidine to control her blood pressure. No history of other systemic disorders or surgeries. She reported no allergy or smoking or alcohol and drugs using. In the patient family history, her grandfather diagnosed with

Age- related macular edema (AMD), and diabetes mellitus was diagnosed in her grandfather and grandmother. No personal or family history of a genetic disorder, or ocular history of optic atrophy, or vision loss was reported.

TESTS AND MEASUREMENTS

Upon initial visit, the external examination showed pupils equally round, reactive to light, no afferent pupillary defect. Pupil size was in bright light 3. 5 mm in both eyes and 4. 5 mm in dim light in both eyes. She has constant right esotropia. She has also left homonymous hemianopsia that was diagnoses using confrontation test. Examination of extraocular muscles showed bilateral directional nystagmus, horizontal dampens on left gaze worst on right gaze. In the right eye, the nystagmus reduced on the left gaze and increases on right gaze. In the left eye, left-beating nystagmus on left gaze and right-beating nystagmus on right gaze. She also has photophobia. The patient was not dilated in this visit. Under biomicroscopic examination, the anterior segment examination showed clear lid and lashes, clear bulbar and palpebral conjunctiva, clear cornea including (endothelium, epithelium, stroma), normal tear film, deep and quiet anterior chamber, hazels iris, and clear lens (lens capsule, cortex, and nucleus). Her anterior chamber angle using Van Herick technique was 4/4 in both eyes. Undilated fundus examination revealed clear vitreous in both eyes. The cup to disc ration in right eye was . 3 vertical and horizontal and . 4 vertical and horizontal in left eye. Temporal optic disc pallor in right eye and 360 optic disc pallor in the left eye to extent viewed given the diagnostic possibilities of bilateral optic atrophy. Normal retinal vessel reflections OU and 2/3 arterial/venous ratio observed OU. No scarring or atrophy noted in the macula. No perimetry

recordings or fundus photography were possible due to the nystagmus. Her blood pressure was normal in this visit 118/66 mmHg.

Her next visit was on July 19, 2018 no change in her ocular health and patent was dilated with 1% cyclogyl, cycloplegic refraction and dilated fundus examination was obtained. Her manifest refraction was -3. 50 -0. 25 @090 in the right eye and -2. 50 -0. 50 @095 in the left eye. All anterior segment finding was normal including conjunctiva, cornea (endothelium, epithelium, stroma and tear film), iris, anterior chamber and lens (lens capsule, cortex, and nucleus), Posterior examination showed clear vitreous bilateral temporal optic nerve atrophy with cup to disc ratio . 4 in right eye and . 5 in left eye. No other abnormal change in the macula and peripheral retina. The intraocular pressures were measured at 16 mmHg in the right eye and 19 mmHg in the left eye using Icare at 1: 37 p. m. Differential diagnoses in this case of optic atrophy in children including the following:

- Leber hereditary optic neuropathy (LHON)
- Beher syndrome
- Wolfram syndrome- Inhered optic neuropathies: Dominant optic neuropathy,
- Leber’s-Plus
- Kjer syndrome
- Congenital or infantile optic atrophy (recessive or dominant form)

Leber hereditary optic neuropathy (LHON) is an inherited mitochondrial DNA (mtDNA) mutations that usually presented as a unilateral acute or subacute painless profound visual loss (20/200 or worse), followed in weeks to months

by loss of vision in the fellow eye (50% of cases in 2-3 months) It usually starts as a central scotoma that becomes larger and obscures vision. Predominantly in males, mean onset is 18-3 5years of age (80–90%), but the age of onset can be early or late in life. Color vision often affected earlier than visual acuity Central visual field defects. 8

Beher syndrome: It is an autosomal dominant inertance disorder that presents in first decades as diffuse optic atrophy with visual loss witch stabilize after a variable period of progression. the prognosis is variable with moderate to severe vision loss and nystagmus. Systemic abnormalities including spastic gait, ataxia, and mental handicap7

Wolfram syndrome is also referred to as DIDMOAD diabetes insipidus, diabetes mellitus, optic atrophy and deafness. It is an autosomal dominant inheritance disorder which presents between the ages of 5 and 21 years as a diffuse and severe optic atrophy that may be associated with disc cupping. Prognosis is very poor final VA is < 6/60 or 20/200. It associates with systemic abnormalities (apart from DIDMO) include anosmia, ataxia, seizures, mental handicap, short stature. endocrine abnormalities and elevated CSF protein. 7

Leber `plus’ disease is a mitochondrial inheritance disorder describes patients with the clinical features of Leber’s hereditary optic neuropathy (LHON; see term) in combination with other serious systemic or neurological abnormalities. These abnormalities include: postural tremor, motor disorder, multiple sclerosis-like syndrome, spinal cord disease, skeletal changes, Parkinsonism with dystonia, anarthria, dystonia, motor and sensory

peripheral neuropathy, spasticity and mild encephalopathy. It is caused by maternally-inherited mitochondrial DNA (mtDNA) mutations. 9

Kjer syndrome: It is an autosomal dominant inherited disease that typically presented in the first or second decade within insidious visual loss although it is occasionally in adult life. It may appear subtle and temporal or diffuse involving the entire disc. the prognosis is varied between (6/12-6/60) or (20/40-20/400) and can be varied within and between families typically, slow progression over decades. Some patent may develop sensorineural hearing loss, but the majority of the patent do not develop systemic abnormalities7

Congenital or infantile optic atrophy (recessive or dominant form)

TREATMENT

Case Report

Introduction

Optic Atrophy The combination of vision loss, an RAPD, and optic atrophy is nonspecific and might represent the chronic phase of any of the optic neuropathies described earlier. When historical features and clinical signs do not suggest a specific cause, baseline studies of optic nerve function and a screening workup for treatable causes are usually undertaken. The level of optic nerve function is established by visual acuity determination, color vision testing, and quantitative perimetry testing. The degree and pattern of atrophy are documented by fundus photography, preferably in stereoscopic views, to detect subtle changes in contour over time. Retinal nerve fiber layer thickness can be monitored using optical coherence tomography. Neuroimaging, preferably MRI of the brain and orbits with use of gadolinium

contrast and fat suppression, is warranted in any case without a clear cause. In a study of 98 adult patients with isolated optic atrophy, 20% harbored compressive lesions. There was low yield in screening for syphilis, vitamin B12 deficiency, folate deficiency, vasculitis, sarcoidosis, and heavy metal toxicity for patients without a history or examination suggestive of these specific diseases. In the appropriate clinical or historical setting, the clinician should pursue laboratory evaluation. Observation remains reasonable for patients with negative results from testing. However, if the condition worsens or new findings develop, reassessment of the initial testing or additional testing becomes necessary. Lee AG, Chau FY, Golnik KC, Kardon RH, Wall M. The diagnostic yield of the evaluation for isolated unexplained optic atrophy. Ophthalmology.

Discussion

One of the most common causes of optic atrophy in children is Hydrocephalus. It is difficult to determine if different types of hydrocephalus can cause the optic atrophy. In the adult, optic atrophy arises from increasing intracranial pressure while in children the optic atrophy may or may not associated with the stage papilledema. In hydrocephalic, bilateral visual defects can be from optic atrophy and/or cortical visual impairment. The following mechanisms have been proposed as possible causes of optic atrophy in hydrocephalus: (1) Long-term papilledema or acute severe papilledema with subsequent atrophy. This typically arises after placement with subsequent failure(s) since hydrocephalic infants tend not to develop significant papilledema due to their expansile cranium. (2) Stretching of the chiasm and its blood supply as a result of intracranial displacement the

brainstem in an effort to accommodate increasing cerebral volume. (3) optic nerve stretching by an expanding skull. (4) chiasmal compression by a dilated third ventricle. In such cases, such cases, bulging of the third ventricle anteriorly into the sella turcica can be demonstrated on CT or MR imaging. Most cases of atrophy associated with hydrocephalus are bilateral, although asymmetric and even unilateral cases do occur. Compression of one optic nerve, presumably against the internal carotid artery, with a unilateral visual loss, has been reported in a child with an obstructed shunt. (5) Transsynaptic degeneration of the retinogeniculate pathway after cortical damage. (6) Optic tract damage by shunt placement mild photophobia can be noticed in children with dominant optic atrophy but Jan et al study did not find a close link between the severity of photophobia and the visual loss or the peripheral field defect.

Hydrocephalus, Ventricular Shunt Failure Patients with hydrocephalus may show a spectrum of visual impairment with a variety of visual field defects, including homonymous hemianopia. patients with hydrocephalus can also have mixed-anterior and posterior visual damage 5 which can be either primary or following shunt malfunction. ” Damaging the anterior visual pathway may result from postpapilledema optic atrophy, chiasmal traction, a markedly dilated third ventricle that compresses the chiasm, compression of the optic tracts by the tentorial edge during herniation of the hippocampus, associated developmental anomalies, or from other vascular effects on the visual pathways. Damage to the posterior visual pathway due to

hydrocephalus or shunt malfunction presumably results from compression of the posterior cerebral arteries against the tentorium”.