Oculocutaneous Albinism (OTHER)

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Introduction

Oculocutaneous albinism (OCA) is a group of disorders in which melanin biosynthesis is disrupted, typically resulting in no pigmentation, or a reduction of pigmentation, of the hair and skin, as well as the eyes. These conditions are inherited in an autosomal recessive or X-linked pattern.[1] Patients with OCA present with reduced acuities due to foveal hypoplasia. Other findings include nystagmus, strabismus, reduced stereopsis, and high refractive error. Patients often have normal contrast sensitivity and full visual fields. In this case study, a patient with OCA is discussed, and the cultural implications of albinism on the African continent are discussed.

Case Report

Patient O.N., a 24 year old African female from the Democratic Republic of Congo presented to the clinic for a low vision evaluation. Her low vision was secondary to OCA, and she was unsure if she was tyrosine positive or negative or in which gene the mutation occurred. She emigrated from the Democratic Republic of Congo and came to the United States for asylum. Her primary goals were to update her spectacle prescription, to learn more about computer resources available to her, and to investigate if she was a candidate for driving. She was studying at a local community college and working towards her degree in biology. Her medical and ocular histories were otherwise unremarkable. Her family and social histories were non-contributory to the case. She was not taking any medications and did not have any known drug allergies.

O.N. reported that in the lecture hall she often would take screenshots of the board and projected slides and then zoom in on the photo to view certain materials. Her current low vision devices were limited to single vision distance glasses and her tablet device. The patient reported glare issues in the daytime for which she wore sunglasses. She also reported that bright lights were bothersome at night.

Her best corrected distance visual acuities were 12.5/100 (equivalent to 20/160) in her right eye and 12.5/80 (equivalent to 20/125) in her left, measured with a back-illuminated Bailey-Lovie chart. VA scores have been converted to a 20 foot equivalent value throughout this report. Under simulated dim illumination using 4% transmission filters (NoIR U23 lenses), the patient's visual acuity with both eyes open was stable at 20/125. During retinoscopy, her pupillary reflexes were bright and equal and there was an absence of media opacities. The patient exhibited mild pendular nystagmus. Her extraocular muscles were intact. Trial frame refraction over her current single vision distance glasses yielded neither a subjective nor an objective improvement in visual acuity, and the patient's spectacle prescription was updated but not modified.

Entering spectacle prescription

OD: -10.00 DS
OS: -10.75 -1.00 x 180

Retinoscopy over current spectacles
OD: -0.75 DS
OS: -2.25 -0.75 x 090

Refraction over spectacles OD:
+0.25 -2.00 x 180
OS: plano -1.50 x 130
**Subjective appreciation of left eye over-refraction only.

Final spectacle prescription
OD: -10.00 -0.50 x 175
OS: -10.75 -1.00 x 175

Her near vision was tested with a Bailey reading card. She preferred reading without her distance prescription in place, likely to reduce her accommodative demand. The patient was able to read 1.25M (11.25 point) print at a distance of 20 centimeters. This finding was consistent with the expected reading acuities, based on O.N.'s distance acuity. Efficient reading, determined as the print size which allows for fluid reading without difficulty and without errors, was measured at 2.0M (18 point) print at a distance of 20 centimeters.

Contrast sensitivity was measured with the Berkeley Discs contrast test. Under normal illumination conditions described as full room lighting, the patient's contrast sensitivity was measured at 1.95 log units, equivalent to 1.1% Weber contrast. This is considered above normal limits. Contrast sensitivity was also measured under simulated dim illumination using 4% gray transmission No Infrared (NoIR) fitover sunglasses (U23). Under these conditions, her contrast sensitivity remained unchanged and normal. Clinical experience has shown that re-measuring contrast under dim illumination causes a 0.3 log unit reduction in contrast sensitivity in normally sighted individuals. However, many patients with OCA perform similarly under normal and dim illumination conditions.

Kinetic confrontation visual fields measured with a transilluminator at 40 centimeters showed no defects in either eye.

We performed a series of trials with various forms of optical magnification. For distance spotting, two monocular telescopes were demonstrated. The first was a 2.5x Galilean monocular telescope used over the left eye. The patient achieved equivalent to 20/80 acuity with this device. With a 4x12 monocular telescope, the patient read the line equivalent to 20/63. The patient was not interested in either of these devices, as she preferred her current method for distance spotting with her camera phone.

For near vision requirements, the patient trialed various magnifiers. With a 3x/10D stand magnifier with LED light, a 3.5x hand-held magnifier with LED light, a 3x/8D EasyPocket magnifier, and the Pebble portable CCTV, the patient was able to view 1.0 M print (8 point font).These devices were chosen based on the equivalent viewing distance which would allow the patient to view 1.0M print comfortably based on her reading acuity. However, O.N. was not interested in pursuing near vision

devices at the time of the exam, specifically because she was able to remove her spectacles and achieve a strong effective add.

The patient met with the clinic rehabilitation specialist and trialed ZoomText and Magic software for the computer. She was interested in both programs and planned to pursue computer magnification software further. She was also referred to the Department of Rehabilitation; a state run organization that could aid in her desire to continue pursuing her education in the United States. Driving options were discussed with O.N. Due to her excellent contrast sensitivity and full fields, O.N. was advised that driving would be a viable option to pursue. Information regarding driving lessons with an instructor at the local driving school was released and the patient set up an evaluation with this instructor. O.N. was reminded to have annual, regular eye care, and to wear sunscreen outdoors.

General Exam Findings

Anterior segment findings showed mild Meiobomian gland dysfunction in both eyes. The cornea, sclera, and conjunctiva were clear in both eyes. Transillumination of the iris was present in both eyes. Anterior chambers were deep and quiet, and Van Herick angles were grade 4 nasally and temporally in both eyes. Intraocular pressure was OD 15, OS 16 measured at 2:45pm.

The patient was dilated with 1% tropicamide and 2.5% phenylephrine and a dilated fundus exam was performed with both 20D and 90D lenses. Optic nerve cup to disc ratio was 0.2 in each eye with an absent foveal reflex. The retinal vasculature was normal with a 2/3 A/V ratio in both eyes. An absence of retinal pigment resulting in a blonde fundus was noted in both eyes.

Classification of Albinism

Albinism has traditionally been classified in various ways. Current classification is based on the gene which is affected in the condition. OCA type 1 is caused by a mutation in the gene for tyrosinase. OCA type 2 is caused by a different mutation in the P gene. Both OCA type 1 and 2 are inherited in an autosomal recessive fashion; another type of mutation which is inherited in an X-linked manner is ocular albinism. Additionally, albinism may be seen in syndromic forms such as in Hermansky-Pudlak syndrome and Chediak Higashi syndrome. Hermansky-Pudlak syndrome (HPS) is a group of related autosomal recessive conditions; it results in genetic mutations that disrupt function in membrane and protein trafficking.[1] Similarly, Chediak-Higashi syndrome (CHS) is also a rare autosomal disorder, characterized by severe immunodeficiency.[2] The most commonly found form on the continent of Africa is OCA type 2. Although it is often fairly easy to identify the oculocutaneous form of the condition based on appearance, genetic phenotyping is important for specifying the exact type.[3]

The current leading classification is primarily based on the specific genetic mutation. These four types include TYR (OCA-1), OCA2 (OCA-2), TYRP1 (OCA-3), and SLC45A2 (OCA-4).[4] Although the patient was unsure of the classification of her albinism, it is likely that OCA-2 is the subtype and therefore most likely caused by a mutation on the OCA2 gene, as this is the most common subtype in Africa.[4]

Clinical Findings

Patients with OCA will often report photophobia and decreased visual acuity. Nystagmus, strabismus, and high refractive error are common findings. Ocular findings include iris transillumination, blonde fundus, and foveal hypoplasia. An additional clinical finding is that a majority of axonal fibers decussate contralaterally at the optic chiasm. This can be confirmed with visual evoked potential (VEP) if the diagnosis is uncertain, however it has been shown that the efficacy of this method declines as a patient ages.[5] That is, pattern onset stimulation has been shown to be more effective in adults whereas flash stimulation is more effective in infants.[6]

As the fovea develops, cone cells undergo morphogenesis both in the outer segment layer and in the outer nuclear layer. Adult cone cells are thin and elongated and this process occurs as the outer segment of the cone cells lengthens. As this occurs, the cone cells are able to migrate and pack more tightly. In OCA, this process is disrupted and this lack of cone packing results in a decrease in visual acuity.[7]

The lack of tight cone cell spacing at the fovea is one of the primary limiting factors for visual acuity in OCA. At low spatial frequencies, OCA patients have normal contrast sensitivity functions. However at higher spatial frequencies, the performance on contrast sensitivity testing may be affected by nystagmus, hence the reduced VA.[8] In the low vision clinic, we utilize low luminance testing to determine how patients perform under differing light conditions.[9] Clinically, most OCA patients have normal contrast in both normal and dim illumination, and their contrast sensitivity is not typically affected by dark conditions. O.N. exhibited this classic clinical finding during our examination.

Nystagmus is a broad term for involuntary, repetitive eye movements which can be classified into various wave forms. The most common form of nystagmus in OCA is pendular in wave form.[3] In general, many of the characteristics of idiopathic infantile nystagmus are similar to the nystagmus found in patients with OCA.[8] The underdevelopment of the fovea in OCA can result in infantile nystagmus syndrome which manifests by 6 to 8 weeks of age.[3,10]

In OCA, retinogeniculate projections abnormally decussate. This alters the layers of the lateral geniculate laminae and specifically results in abnormalities in the binocular cells of the visual cortex.[11] These binocular cells are the primary contributors to disparity detection between the two eyes. Thus, congenital misrouting of the visual pathway in OCA can result in an inability to detect disparity which can result in strabismus.[12]

A disturbance to visual stimulation in childhood has been shown to disrupt emmetropization and thus often results in a high refractive error.[13] There is a tendency toward high hyperopia, however high myopia and high with-the-rule astigmatism is also frequently encountered.[14] These common findings indicate that emmetropization is impaired in patients with OCA, although emmetropization may be spared to some degree in the vertical meridian where nystagmus is less likely to affect visual function.[14]

Low Vision Management

OCA patients function well with minimal magnification. Low powered monocular telescopes, hand-held magnifiers, and stand magnifiers can all be beneficial depending on the patient's needs. More

importantly, many OCA patients experience some degree of photophobia and require further protection from the sun, therefore a careful tint assessment is most beneficial.

Albinism Prevalence in Africa

The worldwide prevalence of OCA has been estimated to be 1 in 17,000.[15] The prevalence of OCA on the continent of Africa varies depending on the study. The range is as low as 1 in 15,000 to as high as 1 in 1,000.[13] Generally speaking, the prevalence tends to be higher in urban areas than in rural areas, although it is unclear if this is primarily due to the inability to include rural areas in large scale studies and surveys.[14] Mutations consistent with OCA2 are significantly more prevalent in African populations. In western Africa, it has a high prevalence in certain populations of Nigeria and Cameroon. In southern Africa, the highest frequency occurs in the Swazi-Sotho ethnic group (1 in 1500 to 2000) and lowest among the Nguni (1 in 4500).[16]

Medical Concerns

The absence of melanin in the skin of patients with OCA makes them more susceptible to damage from ultraviolet radiation. These patients also often suffer from extreme photophobia when outdoors. Photophobia and ultraviolet exposure are major public health concerns on the continent of Africa due to the high levels of sunlight and ultraviolet exposure throughout the continent. As a result of chronic ultraviolet exposure, actinic keratosis may develop and in more serious cases nonmelanoma skin cancers (NMSCs), squamous cell carcinomas (SCC), basal cell carcinoma (BCC), and cutaneous melanoma (CM) can develop.[17] One common cause of photophobia is the lack of melanocytes in the iris which causes more light to reach the back of the eye.[17] Disability glare or ocular stray light can also be more bothersome for patients with OCA, and thus potential solutions include iris print contact lenses to reduce the amount of light transmitted.[18]

Social Concerns

Persons with OCA on the African continent face social discrimination as a result of their condition. There is a general lack of understanding and knowledge regarding OCA in Africa, and despite efforts to educate the general population, persons with albinism are still the subjects of discrimination and violence. As a result, superstitious beliefs take hold, such as the culturally taboo concept that the person was conceived during menstruation or that albinism is a punishment from the gods for wrongdoing by one's ancestors.[19] Consequently, much discrimination is also directed towards the mother of a child with OCA.

Africans with OCA, especially children, are often the target of organ hunters who kill people with albinism to harvest their organs and body parts for use in potions in witchcraft. These gruesome acts are often performed on people while they are still alive to preserve the vital energy of the living person. Other body parts can be sold as charms. Poverty continues to be one of the main factors which contributes to this practice, and witchdoctors continue to fuel the underground market for body parts.[20]

Conclusion

As expected, O.N. exhibited decreased visual acuity but normal contrast sensitivity and full visual fields in each eye. Mild pendular nystagmus was present. O.N. reported glare sensitivity. She also was highly myopic, consistent with a disruption to emmetropization. She also did not express a strong need in pursuing magnification through low vision aids at her examination. O.N. did not reveal specifics

regarding her background and experiences living in the Democratic Republic of Congo. However, she shared that she had asylum in the United States and seemed excited to be learning more about resources available to her.

This case reviewed a patient with OCA from a region of the world in which various medical and social challenges remain significant. The patient will continue to benefit from rehabilitative services in the United States, and the patient's prognosis is positive as OCA is a stable condition. The patient will likely require minimal additional magnification through low vision devices throughout her lifetime. This case is an important reminder that the perception of clinical conditions is not uniform throughout the world, and continued emphasis on public education remains of utmost importance.

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CE@Home Online Questions August

Oculocutaneous Albinism (TPA)

Jasmine Junge,OD

Name:_____ License#_____ Date:_____

Answer the following 10 questions to the best of your ability. To receive CE credit, please fax in your answers to 916-448-1423 or mail them to California Optometric Association, Attn: CE, 2415 K Street, Sacramento, CA 95816. Answers are due by October 15, 2016. Test submissions are entered every Friday; transcripts are available every Saturday morning.

1. Photophobia and UV exposure are major public health concerns for individuals with albinism on the continent of Africa.

   a. True
   b. False

2. OCA patients do not often utilize low vision devices because of their extreme magnification needs.

   a. True
   b. False

3. In OCA, a majority of axonal fibers decussate ipsilaterally at the optic chiasm.

   a. True
   b. False

4. Patients with OCA often present with strabismus, nystagmus, and high refractive error.

   a. True
   b. False

5. The most common form of nystagmus in OCA is pendular in wave form.

   a. True
   b. False

6. Oculocutaneous albinism is a group of disorders involving the disruption of melanin biosynthesis.

   a. True
   b. False

7. All forms of OCA follow *an autosomal recessive* inheritance pattern.

   a. True
   b. False

8. Photoreceptor degeneration is the primary limiting factor for visual acuity in OCA.

   a. True
   b. False

9. The four types of OCA are classified based on the specific gene mutation involved.

   a. True
   b. False

10. OCA2 is the most common subtype in Africa.

    a. True
    b. False