CLINICAL VIGNETTE

Use of Hyperbaric Oxygen in the Treatment of Susac's Syndrome

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Case Summary

A 17-year-old female with a history of congenital low-frequency hearing loss in the left ear and chronic migraine presented for evaluation of worsening headaches and visual changes. Patient had been experiencing migraines which were preceded by visual auras since age 12. She described the auras as "looking through snow." Her migraines were also accompanied by nausea and paresthesia of the face and occasionally the arms. The migraines resolved after sleeping for several hours and taking over-the-counter analgesics. Over time the migraines became more frequent and associated with right-sided blurred vision which was different from the previous visual auras she had experienced. Sometime later she noticed the blurry vision in the right eye started to last longer and sometimes would occur without any headache. She also reported some mild hearing loss on the left. MRI of the brain one year prior to evaluation revealed multiple white matter lesions, many of which were in the corpus callosum, with a few that were noted to enhance. Patient was evaluated by Neurology and MRI findings were suggestive of Multiple Sclerosis (MS), however her history and clinical exam were not typical of a MS presentation.

Two years later, she was admitted with painless monocular vision loss of the right eye. Her initial examination revealed normal vital signs and her cardiopulmonary and abdominal examinations were unremarkable. She did not have rashes, oral ulcers or alopecia. Her neurologic examination revealed normal extraocular movements, no facial sensory asymmetry, symmetric shoulder shrug, midline tongue and symmetric elevation of palate and uvula. Her motor exam revealed no drift and excellent strength in all extremities. Finger-to-nose, fine finger movements and heel-knee-shin were all normal. Sensory exam was intact to primary modalities. Deep tendon reflexes are normal and symmetric. She was evaluated by Ophthalmology and examination revealed right central retinal artery occlusion. There was also slightly decreased hearing in the left ear.

Initial laboratory evaluation included normal urinalysis, comprehensive metabolic panel and complete blood counts. Rheumatologic testing revealed negative ANA, DSDNA, C3/C4, SM/RNP, Rheumatoid Factor, ANCA and Scleroderma antibodies. Inflammation markers ESR and CRP were normal. Lupus anticoagulant and Beta-2- Glycoprotein antibodies were negative, although Anticardiolipin IgM was slightly positive at 26 MPL (Negative is <10 MPL). Infectious disease testing revealed negative Coccidiosis antibodies, negative RPR and Toxoplasma antibodies. She had negative Hepatitis B and C serologies. Transthoracic as well as transesophageal echocardiogram revealed a small PFO, but otherwise showed normal ejection fraction and normal valves without vegetation. MRI revealed multiple foci of T2/FLAIR signal abnormality in the periventricular white matter of the cerebral hemispheres bilaterally and corpus callosum. There was also multiple punctate foci of DWI hyperintensity in the right superior frontal gyrus, bilateral corona radiata, periventricular white matter adjacent and to the atrium of right lateral ventricle and posterior to the atrium of the left lateral ventricle, possibly in the left inferior temporal gyrus and left cerebellum.

Given her symptoms, ophthalmological exam, and MRI findings the patient was diagnosed with Susac Syndrome and treated urgently with hyperbaric oxygen and methylprednisolone 1000 mg intravenously daily for three days and Intravenous Immunoglobulin (IVIG) for three days. She also received intravenous Rituximab 1000mg which was repeated two weeks later. The patient reported immediate improvement of her vision loss following treatment with near resolution over the next few days. She was discharged home with prednisone 60mg daily and was also started on Mycophelate Mofetil which was titrated up to 1500mg twice a day.

Discussion

Susac's syndrome is a rare disorder which is characterized by branch retinal artery occlusion, encephalopathy, and sensorineural hearing loss.[1,2] The exact etiology of the syndrome is not known but is thought to be due to an autoimmune endotheliopathy that affects the vasculature of the retina, brain, and inner ear.[1,2] It is thought that anti-endothelial cell antibodies cause vascular injury and deposition of thrombotic material in the lumen of small vessels.[1] The diagnosis of Susac's syndrome is based on MRI of the brain which shows the presence of hyperintense lesions in the corpus callosum,[2] retinal fluorescein angiography which shows multifocal fluorescence and audiometry which shows a hearing loss involving low and medium frequency sounds.[1,3,4]

Central Nervous System (CNS) symptoms, specifically migraine-like headaches, are usually the first symptom and reported in 80% of cases at clinical onset.[1] The disease course can be recurrent with fluctuating attacks. The disease is self-limiting but most patients have some residual mild

symptoms.[2,4,5] CNS involvement is the most severe and debilitating part of the syndrome but blindness and deafness occurs rarely.[6] Cases of dramatic severe dementia in a short period of time have also been reported. Aggressive treatment is recommended early in the course of the disease and for an extended period of time to prevent relapses.[1, 4, 6] There is no consensus on the best treatment for the syndrome given its rarity and how diagnosis is sometimes made late in the disease course.[1]

In terms of treatment, intravenous pulse dose steroids followed by slow tapering oral steroids have been used in several case studies.[1,4,5] One case described intravitreal triamcinolone.[3] Given the microangiopathic nature of the disease, anticoagulation has been used in some patients.[1,5,6] In severe cases such as the one presented, immunosuppressive agents and IVIG has been used.[1,5,6] On review of the literature there were only 2 cases described using hyperbaric oxygen therapy for Susac's Syndrome. The first report by Li at al.[7] described the use of hyperbaric oxygen treatment for retinal vascular disease. After administration the patient had reversal of visual acuity loss and partial reversal of visual field loss. The second case report was published in Spanish by Meca-Lallana et al.[8] demonstrating reduced visual abnormality with treatment of hyperbaric oxygen. These cases along with the case presented, demonstrate that hyperbaric oxygen therapy may have a role in treatment of ocular involvement of Susac's syndrome.

Conclusion

Given the occlusive nature of the disease, retinal ischemia is due to a hypoxic event which then results in release of proteases and lipases which eventually lead to tissue damage and toxin accumulation.[7] By administering hyperbaric oxygen, there is reversal of release of substances that cause destruction and reduced accumulation of toxins.[7] Our patient was given hyperbaric oxygen with substantial improvement in vision, back to 20/20 vision in her right eye. After several years of treatment, she remains clinically stable and her visual acuity and brain MRI have remained stable. With early and aggressive treatment her disease is in remission and she has been weaned off immunosuppression.

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