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Popcorn Retinopathy: A Case of Retinal Vasculitis Associated with Exposure to Popcorn Flavoring

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Abstract

Purpose: Case report of a patient who developed retinal vasculitis with exposure to industrial popcorn flavoring.

Methods: We reviewed the patient's clinical history, exam, and imaging findings. A 31 year old male with no significant past medical history presented with neovascular glaucoma in the right eye and vascular sheathing in both eyes. He worked in a popcorn factory.

Results: The imaging and exam findings demonstrated vascular sheathing and severe ischemia consistent with a vasculitic process. He was treated with Anti-VEGF injections, panretinal photocoagulation, and Ahmed tubes shunt to the right eye.

Conclusion: This case suggests that there could be an association between exposure to the chemical compounds used in popcorn flavoring and retinal vasculitis. Visual complaints in individuals working with these compounds should be evaluated carefully.

Keywords: Retinal vasculitis; Proliferative retinopathy; Popcorn flavoring

Introduction

Bronchiolitis obliterans is an uncommon disorder of inflammation and fibrosis of the bronchioles which results in severe obstructive pulmonary disease [1,2]. While this disorder is more commonly found in lung transplant recipients, numerous reports have described the syndrome in non-smokers who have worked in microwave popcorn plants [2-5]. It has been proposed that the etiologic agent in these cases may be the chemical diacetyl, which is a common component of artificial butter flavorings [2]. While the precise mechanism by which this compound results in pulmonary disease remains uncertain, it has been proposed that it damages the epithelium of the airway [2]. Whether it is the only inciting agent or acts in concert with other chemical contained in butter flavorings such as acetic acid, butyric acid, 2 nonanone, and deca-delta-lactone remains to be determined [2,6].

While these pulmonary changes have been well described in individuals with this exposure, less has been reported regarding its effects on other organ systems. Given the inherent vascularity of the eye and its adnexa it is quite possible that it, too, may be affected by exposure to these compounds. While there has been a case of corneal irritation reported in a worker exposed to artificial butter flavorings, to our knowledge there have been no cases of retinal disease reported in individuals exposed to this compound [2]. Here we present a case of severe retinal vasculitis in an individual who worked in a popcorn packaging facility.

Case Report

A 32 year old male without significant past medical history presented to The Ohio State University Emergency Department with a three-week history of pain and redness in the right eye. The patient was initially seen at an outside hospital and found to have an elevated pressure in the right eye to 55mmHg with florid Neo Vascularization of the Iris (NVI). He was transferred to The Ohio State University for further evaluation. He stated that he had been seen by an optometrist seven years prior to presentation who had stated that "The blood vessels in my eye were collapsing." He denied any history of past medical conditions and denied taking any chronic medications other than over the counter pain medications. He denied any history of smoking or tobacco use. He did report occasional marijuana use but denied the use of intravenous drugs. He had no family history of early vision loss, heart disease, stroke or early death. In questioning the patient about possible exposure to toxins, he mentioned that he worked at a microwave popcorn-packaging factory and

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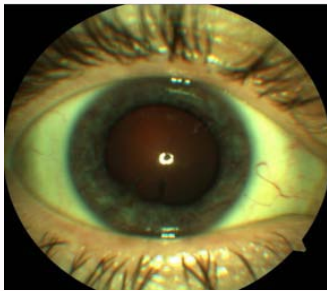


Figure 1: Anterior segment right eye. Florid neovascularization of the iris and posterior synechiae.

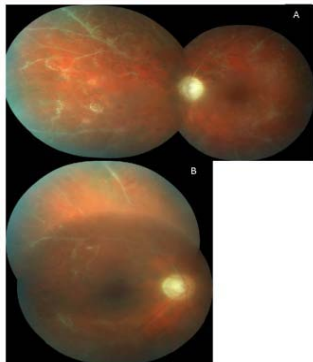


Figure 2: Color fundus photographs of the right eye (A) and left eye (B). On clinical exam there was a Weiss ring and 2+ vitreous cells in the right eye. There is optic disc pallor in both eyes. There is symmetrical attenuation of the arterioles and venules with sheathing in all four quadrants in both eyes.

that many of his coworkers became very sick and even died. He also indicated that his normal shift was 12 hours and it was rather common that he would be asked to work a double shift, so that would be 24 straight hours.

On exam the visual acuity was 20/400 in the right eye and 20/30 in the left eye. The intra-ocular pressure was 56mmHg in the right eye and 25mmHg in the left eye. There was diffuse haze of the right cornea with microcysts and bullae inferiorly. There was a small rust ring at 9 o'clock in the periphery. The iris showed florid NVI for 360 degrees with posterior synechiae at 5 and 7 o'clock (Figure 1). The anterior segment was normal in the left eye. The posterior segment exam showed optic disc pallor and severe, symmetric attenuation of both the arterioles and venules with sheathing in all four quadrants in both eyes (Figure 2). Fluorescein angiography showed dramatic capillary non-perfusion in both eyes with involvement of both the arterioles and venules (Figure 3). In the right eye there were many areas of capillary non-perfusion and an enlarged Foveal Avascular Zone (FAZ). In the late frames there was diffuse leakage from the vascular tree as well as from the optic nerve (Figure 3). Rheumatology and infectious disease consults were obtained. CT angiography of the neck and brain were normal. The urine drug screen was negative. The ACE was 35 (8-53), lysozyme was 8.0 (2.7-9.4), CRP was 1.8 (0-9.99), CBC was within normal limits, and his HIV test was non-reactive. Both bacterial and fungal blood cultures were negative.

The patient was admitted to the ophthalmology service and treated with Anti-VEGF injections (both eyes). He was placed on topical Anti-glaucoma medications, given intravenous Diamox and the following day an Ahmed tube was inserted in the right eye. Post-

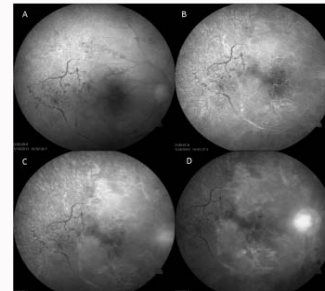


Figure 3: Fluorescein angiography (A 0:29, B 0:47, C 2:22, D 04:00). There is dramatic capillary non-perfusion in both eyes with involvement of both the arterioles and venules. In the right eye there were many areas of capillary non-perfusion and an enlarged Foveal Avascular Zone (FAZ). In the late frames there was diffuse leakage from the vascular tree as well as from the optic nerve.

operatively the IOP was 9 in the right eye. Panretinal photocoagulation was performed in both eyes.

Discussion

There have been numerous reports describing non-smoking workers in the popcorn/baking industry developing bronchiolitis obliterans [2-5]. Bronchiolitis obliterans is an uncommon disorder resulting in fibrosis and inflammation at the level of the bronchiole [1,2]. The end result is fibrosis and proliferative changes of the bronchioles resulting in severe outflow obstruction and air trapping [2]. The precise mechanism by which these changes arise remains uncertain, but there are histopathologic studies suggesting that this may result from exposure to unusually high levels of the chemical diacetyl [2,6]. The diacetyl provides the "buttery" taste and cream-like consistency to food products, specifically in microwave popcorn where it also gives the buttery smell that we are all familiar with when making the butter popcorn [2]. There are some other flavorings involved in addition to diacetyl, but they are mainly acetic acid derivatives; for example, butyric acid, 2-nonanone, 2, 3-pentanedione.

It is our thought that the diacetyl and the acetic acid derivatives that are used in the popcorn industry are likely at play in this case. The initial recommendations from the NIOSHA and OSHA has set an OEL (Occupational Exposure Limit) of 0.2mmp for diacetyl [7]. However, the new recommendations question whether the OEL should be adjusted to 0.001ppm as was proposed by Egilman *et.al* 2011[7]. A search of the literature and a discussion with one of the pathologists that did some of the lung pathology did not report any vasculitis associated with this diacetyl exposure. However, the drug Singulair (Montelukast) a Leukotriene-E receptor antagonist whose chemical structure includes acetic acid, has been associated with a Churg-Strauss-like vasculitis of the small and medium-sized vessels [8,9]. There have been several reports describing the Churg-Strauss-like eosinophilic vasculitis following the initiation of Montelukast for treatment of asthma [8,9].

In summary, we hypothesize that the exposure to the diacetyl and acetic acid derivatives present in the microwave popcorn flavor additives could have been the trigger for the retinal vasculitis in the clinical picture in this case.

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