Published in final edited form as:

Cornea. 2020 November ; 39(11): 1433–1435. doi:10.1097/ICO.0000000000002323.

Anterior Segment Optical Coherence Tomography in Ocular Argyrosis

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Abstract

Purpose: To highlight the novel application of anterior segment optical coherence tomography (AS-OCT) to detect corneal silver deposition in a case of ocular argyrosis.

Methods: This is a case report and review of the literature.

Results: A 67-year-old male with a 30-year history of chronic occupational exposure to silver-halides secondary to photographic film manufacturing presented with significant ocular argyrosis. His ophthalmic exam was notable for bilateral, widespread pinpoint grey deposits throughout his conjunctiva and cornea at the level of Descemet's membrane. Further evaluation with AS-OCT showed deposition in two distinct, diffusely hyper-reflective bands, corresponding to Bowman's layer and Descemet's membrane.

Conclusions: AS-OCT provides a useful imaging modality in evaluating corneal deposition diseases. In this case of ocular argyrosis, AS-OCT led to the detection of a hyper-reflective Bowman's layer as well as Descemet's membrane, representing silver deposition in both of these anatomic locations.

Keywords

ocular argyrosis; corneal deposition disease; anterior segment optical coherence tomography

Introduction

Silver is a versatile chemical element that has long been valued for its thermal and electrical conductivity, reflectivity, antimicrobial property, and monetary value.¹ Over the last century, silver has been widely employed in silverware, jewelry, photography, electronics, and medicine. Subsequently, those employed in one of these fields are potentially at risk for developing argyrosis.¹

Ocular argyrosis develops after chronic periods of exposure to silver, via ingestion, inhalation or topical application¹. Clinically, this disease manifests as grey discoloration of the eyelid skin, conjunctiva, and cornea due to deposition of silver in these tissues.¹ Histology has confirmed silver deposits in the conjunctival epithelium, Descemet's

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Disclosure: No disclosures, no conflicts of interest

membrane, crystalline lens, as well as Bruch's membrane.²⁻⁵ While some patients may present with nyctalopia and blurry vision, oftentimes ocular argyrosis is asymptomatic.¹

The purpose of this case report is to describe a case of occupational ocular argyrosis and to highlight the application of anterior segment optical coherence tomography (AS-OCT) to improve our understanding of the specific anatomic location of corneal silver deposition. In this case, AS-OCT supports silver deposition in Bowman's layer, in addition to the more widely described Descemet's membrane. This novel AS-OCT finding expands our understanding of ocular argyrosis as well as the utility of AS-OCT in corneal deposition diseases.

Case report

A 67-year-old diabetic male with a 30-year history of chronic occupational exposure to silver-halides secondary to photographic film manufacturing presented to our cornea service for bilateral conjunctival discoloration. He was asymptomatic and did not endorse any ocular discomfort or visual changes. His best-corrected visual acuity (BCVA) was 20/25 in both eyes, and intraocular pressure was normal. His external exam was significant for bilateral, widespread pinpoint grey deposits throughout the bulbar and tarsal conjunctiva, caruncle as well as embedded in a nasal pterygium in the right eye (Fig 1A). The corneal exam was notable for a diffuse layer of hyper-reflective deposits at the level of Descemet's membrane that appeared equal and symmetric between both eyes (Figure 1B–C). There were no abnormalities noted in the lens of either eye aside from mild nuclear sclerotic cataracts, and the posterior exam, including a macular OCT, did not show evidence of silver deposition. Ancillary anterior segment testing included specular microscopy, which demonstrated a normal endothelial cell count in both eyes, and AS-OCT, which showed two distinct, diffusely hyper-reflective bands, corresponding to Bowman's layer and Descemet's membrane (Figure 1D). The patient's known history of chronic silver exposure and clinical findings of deposits dispersed throughout the conjunctiva and posterior cornea highly favored the diagnosis of ocular argyrosis. However, as part of a differential diagnosis, other metallic deposition diseases were considered in this case including Wilson's disease (copper), ocular chrysiasis (gold) or siderosis (iron).

Discussion

In generalized argyria, silver particles are absorbed into the bloodstream, forming complexes with protein, DNA, and RNA molecules.¹ From the blood, silver molecules can travel throughout the body and deposit in a wide variety of tissues such as the choroid and ciliary body.⁵ In contrast, topical exposure, such as from silver nitrate eye drops, tends to cause localized ocular argyrosis with intracellular uptake of silver by conjunctival epithelial cells, as well as extracellular deposition in Descemet's membrane.² Sun-exposed areas are particularly prone to hyperpigmentation, due to the process of photoreduction, where light transforms ionized silver into a dark metallic silver.¹ Hence, ocular argyrosis is most clinically prominent on the conjunctiva and cornea.

While silver deposition in Descemet's membrane has been widely reported,^{2, 3, 6} likely due to the relative ease of detection at the slit lamp, there have only been two reports demonstrating silver deposition in Bowman's layer. Of note, both of these case reports utilized confocal microscopy.^{4, 7} In this present case, we report the novel application of AS-OCT to further identify silver deposition in ocular argyrosis. The finding of increased hyper-reflectivity in Bowman's layer further supports the results from prior confocal microscopy studies and confirms deposition of silver at this anatomic location.

AS-OCT provides unprecedented insight into a wide variety of corneal pathology, providing the ability to localize and assess severity of disease with excellent resolution. This imaging modality can be particularly useful in describing and distinguishing corneal deposition diseases. For example, in Wilson's disease, copper deposition found in Kayser-Fleischer rings can be identified with AS-OCT as intense hyperreflectivity at the level of Descemet's membrane in the peripheral cornea.⁸ In contrast, deposits in drug-induced corneal verticillata are detected as a highly reflective band within the epithelium.⁹ Immunoglobulin deposition can also be identified as either anterior or posterior corneal hyperreflective plaques.¹⁰ In the present case, we demonstrate silver localization to both Descemet's membrane as well as Bowman's layer, which is unique among the deposition diseases described.

This case report describes the novel use of AS-OCT in ocular argyrosis, suggesting the deposition location of silver in Bowman's membrane in addition to Descemet's membrane. This report also furthers the role of AS-OCT as a non-invasive and accessible diagnostic modality for corneal deposition disease.

Funding:

Unrestricted departmental grant from the Research to Prevent Blindness (XH, NS, RAFW); NIH K08 award, EYE29012-01 (RAFW)

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Figure 1.

Silver deposition in the conjunctiva and the cornea. As both eyes demonstrated equal and symmetric findings, only the right eye is shown here. A. Widespread grey deposits throughout the conjunctiva, caruncle as well as a nasal pterygium. B. Magnified view of the right cornea showing diffuse silver deposition. C. Slit beam highlights posterior hyper-reflective deposits at the level of Descemet's membrane. D. AS-OCT shows two distinct, diffusely hyper-reflective bands (indicated by arrows), corresponding to Bowman's layer and Descemet's membrane.