CASE REPORT

Longitudinal medical surveillance showing lack of progression of argyrosis in a silver refiner

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Silver is a recognized cause of argyrosis and argyria. This case report describes blood silver levels and longitudinal ophthalmological examination in a previously reported case of argyrosis over a 5-year period.

Key words: Argyria; argyrosis; silver.

INTRODUCTION

The deposition of silver in the eyes is known as 'argyrosis' and deposition in the skin is termed 'argyria'. The conditions occur occupationally in silver refiners, silver nitrate and silver oxide manufacturers and silver solderers with local discoloration of the skin also reported in jewellers. Non-occupational exposure resulting in argyria and argyrosis has been reported following the medicinal use of silver compounds in eye drops, burn creams and anti-smoking aids. It has also been described as a complication of the use of silver filigree in surgical operations and in the wearing of silver earrings.

TOXICOKINETICS

In an occupational setting, silver enters the body through inhalation or ingestion. It may also come into direct contact with the skin and conjuctiva resulting in local discoloration. Ionic silver circulating in the blood is thought to be mostly associated with red blood cells and globulins and deposits in the tissues by forming complexes with proteins. These compounds can be reduced to metallic silver either by exposure to UV light or by reductases in the internal organs resulting in discoloration of the skin. Silver is therefore more often seen in areas of the skin exposed to sunlight. Silver is also thought to stimulate melanin production thereby increasing the discoloration. Silver is sequestered largely by the liver but also by the kidneys and is excreted predominantly in the faeces.

CASE REPORT

This case of argyrosis in a 51 year old silver refiner was first reported in 1995 having been first noted in 1993 after the individual had spent seven years working in a refinery where silver was purified electrolytically and cast into ingots.

Initial blood silver (measured by atomic absorption spectrometry) was found to be 74 μg/dl and environmental monitoring in the refinery area after identification of the case revealed personal sampling results of between 0.11–0.17 mg/m³ (229 min sampling period) and 0.1

Figure 1. Blood silver levels (μg/l) over 5 years from initial finding.
mg/m³ (224 min sampling period) in the casting area, with static samples showing levels between 0.03–0.07 mg/m³ as background levels in the electrolytic area. It is likely that the results reflect a mixture of exposure to both silver and silver compounds. No other refinery workers were affected. The occupational exposure standard (OES) for silver compounds is 0.01 mg/m³ (8 hour TWA) with an OES for metallic silver of 0.1 mg/m³.

At the time of this writing, 18 months had lapsed since clinical diagnosis with no progression of the argyrosis and no appearance of clinical argyria. The ophthalmologist had initially reported corneal and conjunctival argyrosis with normal vision (6/5 both eyes) and normal retinal scans. The blood silver fell to 6 μg/dl over 18 months as environmental control of silver and silver compounds improved through better local exhaust ventilation (LEV) over the electrolytic tanks.

MANAGEMENT

In this situation occupational exposure was reduced by improved LEV but it still left the question of whether the lowered levels of silver could lead to further pigmentation in the eyes or skin. The clinical problem was to identify the level of exposure which would not lead to further discoloration of the eyes or skin.

A search of databases was undertaken for papers published over the last 50 years using the key words ‘argyria’, ‘argyrosis’ and ‘silver’. Search of HSELINe, CISDOC and NIOSHTIC yielded 46 references and a further 94 were obtained from Toxline, Medline and Excerpta Medica and 74 from Index Medicus (1947–66 only). The aim was to identify the available published evidence, to critically review it and then to develop a management plan.

The review identified 214 references (some of which were duplicates) which largely consisted of case reports, a few cross-sectional occupational studies and studies describing effects found with medicinal silver compounds. Only one paper described longitudinal blood silver measurements. This study described monitoring over three months of the effect on blood silver levels of using a silver-containing chewing gum as an anti-smoking aid. No argyrosis was found during the study period.

In the absence of useful published data, with improved environmental control, an informed worker and a means of assessing any deterioration by regular clinical examination by a consultant ophthalmologist, it was decided to monitor the situation as the individual continued to work.

Sequential blood silver levels were taken on a six-monthly basis with a minimum of annual appointments for clinical examination and serial photography of the eyes.

FOLLOW-UP

Over the 5-year period the individual continued to work full time in a silver refinery where he was exposed to soluble silver compounds, notably silver nitrate and silver oxide. His serial blood silver results are shown in Figure 1. Over the 5-year study period his average blood silver (whole blood) measured by atomic absorption spectrometry was 11.2 μg/l (range 6–19 μg/l). Unexposed levels up to 0.3 μg/l have been reported (Dr T. Delve, personal communication, 1993).

During this time serial clinical and photographic examinations reported no progression of argyrosis; clinical examination also failed to identify any new argyria.

CONCLUSION

Exposure to soluble silver compounds sufficient to lead to blood silver levels averaging 11.2 μg/l over a 5-year period failed to lead to any progression of clinical argyrosis in this patient. It is not always possible to use an evidence based approach to clinical occupational medical problems due to inadequate published data.

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REFERENCES
