Localized Argyria After Exposure to Aerosolized Solder

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GOAL

To understand localized argyria to better manage patients with the condition

OBJECTIVES

Upon completion of this activity, dermatologists and general practitioners should be able to:

1. Discuss how localized and generalized argyria differ.
2. Describe how to diagnose argyria.
3. Identify treatment options for argyria.

CME Test on page 320.

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We describe a patient with a rare case of localized argyria following exposure to aerosolized solder that clinically resembles generalized argyria. Classically, localized argyria presents with sharply demarcated blue-gray macules, while generalized argyria presents with diffuse blue-gray pigmentation. Our case is unusual because the patient presented with diffuse pigmentation seen with generalized argyria but restricted to the face and neck.

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Localized argyria is a rare disorder that occurs less frequently than generalized argyria. The pathogenesis involves direct implantation of silver in the skin or, more rarely, percutaneous absorption of silver salts via the eccrine glands. The silver salts are released into the surrounding tissues. Occupational exposure is the most common cause of localized argyria and occurs most frequently in miners, photographic laboratory workers, and jewelers. Round or oval well-demarcated blue-gray macules typically are seen.

Generalized argyria most often results from systemic treatment with drugs that contain silver salts or from inhalation of silver particulates in the workplace.[1] Generalized argyria usually presents with blue-gray discoloration of the skin, including

non–sun-exposed skin, the lips, tongue, mucous membranes, lunulae, and sclera. Permanent diffuse blue-gray pigmentary change of the skin is observed with generalized argyria.

Case Report

A 58-year-old man presented with an ashen color to his face that had progressed over several years. The patient denied taking any medications and had no significant past medical history. The results of a complete blood count, chemistry panel, liver function test, and hepatitis panel were within reference range. His serum silver level also was within reference range at 11 ng/mL (reference range, 0–14 ng/mL).

The results of a physical examination revealed diffuse blue-gray pigmentation distributed over the face and neck with a sharp line of demarcation at the collar (Figure 1). There was no photoaccentuation and no involvement of the nails, mucous membrane, or sclera. For the past 20 years, the patient worked as an electronics technician soldering silver-containing wire in the construction of electronic devices. He wore gloves, long-sleeved shirts, and pants but no protective mask.

The biopsy specimen revealed small, black, refractile granules within the membrane propria of the eccrine glands (Figure 2). Additional biopsy specimens were taken from the healthy skin of the right upper back and revealed no silver granules. These histologic features were consistent with argyria.

Comment

Localized argyria is a rare disorder that presents with asymptomatic blue-gray macules.[2] The lesions may be large and ill defined or sharply demarcated, resembling blue nevi.[1] The most common cause of localized argyria is occupational exposure; small silver particles enter the skin by mechanical impregnation of workers involved in silver mining, silver refining, silverware and metal alloy manufacturing, and photographic processing.[3] Localized argyria also has been attributed to surgical and dental procedures, silver earrings, and acupuncture needles.[4-6] Additionally, localized argyria may be caused by percutaneous absorption of silver salts via the eccrine glands, which most likely occurred in this case.

Generalized argyria most commonly results from long-term systemic use of silver-containing nose drops or colloidal silver–containing dietary supplements,[7] homemade silver solution,[8] and ingested or topical silver nitrate.[9] Inhalation of silver-bearing dust in industries such as silver refining or metal grinding also may cause generalized argyria. Corneal argyrosis associated with silver soldering has been previously reported[10,11]; full cutaneous examination was not described in these patients.

The presentation of generalized argyria typically begins with gray-brown staining of the gums that progresses to involve the skin diffusely. The mucocutaneous findings in argyria are the results of elevated serum silver levels, which lead to dermal and mucosal deposition of the metal.

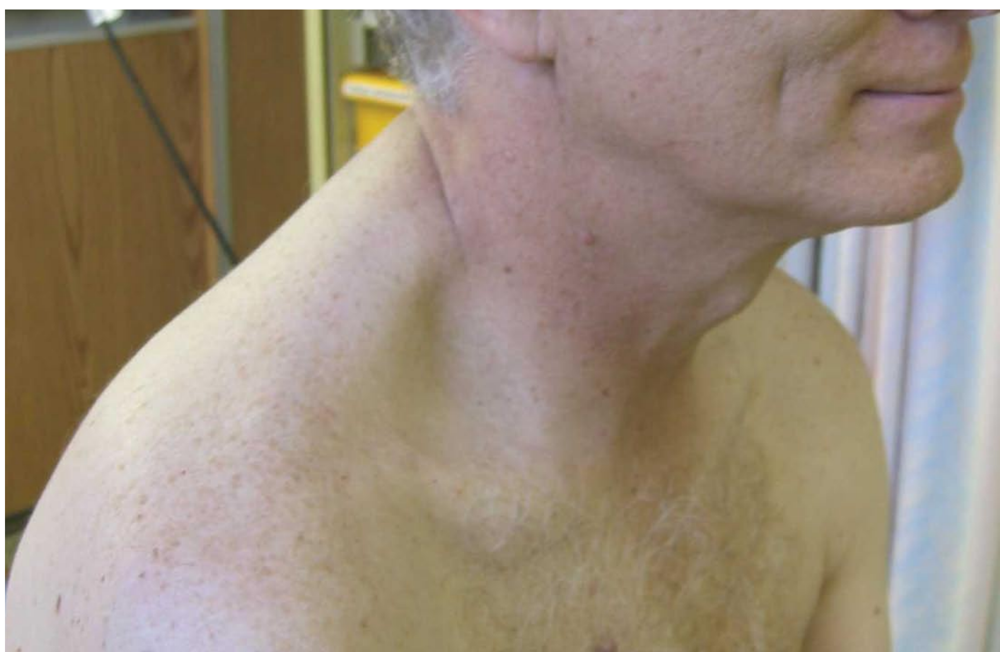

Figure 1. Line of demarcation at the collar.

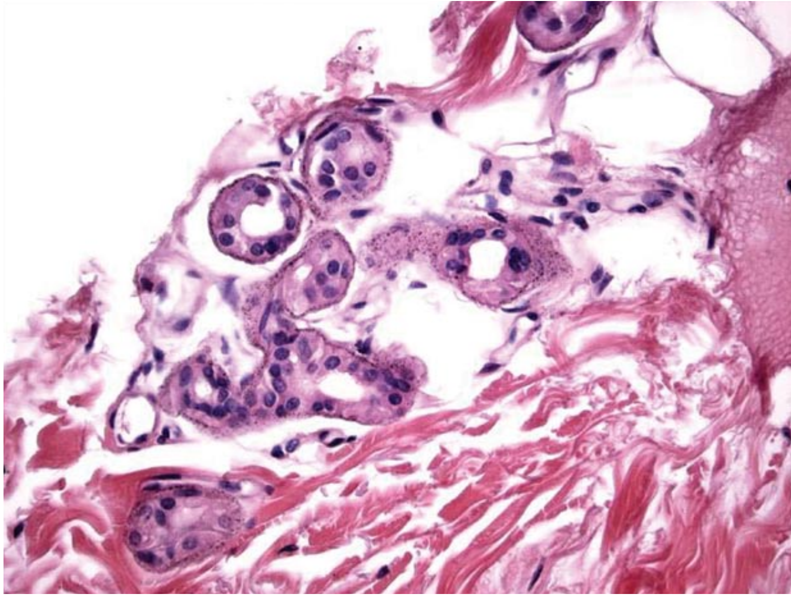

Figure 2. Small, black, refractile granules in the eccrine glands (H&E, original magnification ×40).

Histopathology evaluations reveal black-silver granules around the eccrine glands, in the walls of blood vessels, and along elastic fibers. The granules occasionally are found in the arrector pili muscles, perineural tissue, and around collagen fibrils. The slate gray, metallic, or blue-gray pigmentation seen in argyria may be clinically apparent after a few months but usually takes years to develop and depends on the degree of exposure.[12,13] In some patients, the entire skin may acquire a slate blue–gray color. Hyperpigmentation is most apparent in sun-exposed areas of the skin, especially the forehead, nose, and hands. Although pigmentary changes occur primarily in sun-exposed sites, the granules are deposited evenly throughout the skin. Light causes silver-containing compounds complexed with proteins in the skin to be reduced to elemental silver, similar to the process of developing photographs.[14] In addition, the silver stimulates melanocyte tyrosinase activity, which results in an increase in melanin production.[15] The sclerae, nail beds, and mucous membranes also may become hyperpigmented. Viscera, including the spleen, liver, and gut, tend to show a blue discoloration that is evident during abdominal surgery or at postmortem examination.

Our patient is unique because he presented with the diffuse pigmentary changes that would be seen with generalized argyria, but the pigmentary changes were limited to his face and neck. Other features suggestive of generalized argyria, such as sclerae and nail changes or silver impregnation in non–sun-exposed skin, were not present. The presence of silver granules in the eccrine glands of only exposed skin favors a diagnosis of localized argyria because of percutaneous silver absorption via the eccrine glands.

A careful history is necessary in the diagnosis of argyria, with inquiries about possible occupational and environmental exposure and the use of dietary supplements containing colloidal silver protein. Habitual use of silver-based nose drops may produce pigmentation that is most apparent on the nose and nail lunulae. Scar-localized argyria may occur secondary to the use of silver sulfadiazine cream.[16] Other causes of diffuse blue-gray pigmentation include medications (eg, phenothiazines, antimalarials, amiodarone, minocycline), heavy metal exposure (eg, mercury, bismuth, arsenic, gold, lead), hemochromatosis, ochronosis, cyanosis, polycythemia vera, and diffuse melanosis in metastatic melanoma.[17]

The average human body contains approximately 1 mg of silver.[18] Serum silver has a reference range of 0 to 14 ng/mL. The smallest amount of silver reported to produce generalized argyria in humans ranges from 5 to 40 g.[19] Although the amount of silver in argyria usually results in no serious effects on human health, a few cases of notable clinical symptoms and signs have been documented. Some of the complications of systemic toxic effects of silver include gastrointestinal tract catarrh, tissue wasting, uremia, albuminuria, fatty degeneration of the liver, hemorrhage, and idiopathic thrombocytopenia.[20]

The treatment of both localized and generalized argyria is difficult. Hydroquinone, depigmenting creams, and dermabrasion are not successful.[9] Selenium and sulfur have been shown to have favorable modifying effects on the metabolism and toxicity of silver by forming complexes with the silver. The Q-switched double-frequency Nd:YAG laser, which has been used in the treatment of tattoos, also may be effective in the treatment of localized argyria.[21] Unfortunately, no completely satisfactory treatment modality exists and some pigmentation remains permanent. However, sunscreens and opaque cosmetics may be helpful in masking discoloration and preventing further pigmentary darkening.[17]

To our knowledge, this is the first presented case of localized argyria secondary to aerosolized silver. This case emphasizes the need for skin protection in individuals with occupational exposure to aerosolized solder.

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