Corneal Thinning Induced by Self-administered Alum Substance: A Case Report and Analysis of the Active Components

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Abstract:
We report a case of severe ocular injury and impaired vision after self-administration of alum. A 56-year-old female administered an alum substance in the left eye and experienced severe corneal thinning, a scar, and decreased vision. The active compounds in the alum substance were analyzed using scanning electron microscopy. When topically administered, alum may cause severe ocular injury. Public awareness, early recognition of the injuries, and timely intervention may prevent permanent ocular damage.

Keywords:
Alum, corneal thinning, corneal toxicity, herbal medicine, visual impairment

Introduction
Folk remedies are widely practiced in underdeveloped countries in Asia, the Middle East, and North Africa. The ingredients in some of these substances could be animal or plant extracts. Approximately 80% of the population from the developing and developed countries use traditional services for diagnosis, treatment, prevention of disease, and maintenance of good health.

Alum is a group of hydrated double salts, usually consisting of aluminum sulfate, water, and the sulfate of another element. A whole series of hydrated double salts results from the hydration of the sulfate of a singly charged cation (e.g., K⁺) and the sulfate of any one of a number of triply charged cations (e.g., Al³⁺). The most important alums are potassium aluminum sulfate, also known as potassium alum or potash alum with a chemical formula of K₂(SO₄)₂·Al₂(SO₄)₃·24H₂O or KAl(SO₄)₂·12H₂O. Most alums are colorless, odorless, and exist as a white crystalline powder.

We report a case with central corneal thinning caused by self-administered alum substance that resulted in severe vision loss. To our knowledge, this is the first case of its kind in English peer-reviewed literature.

Case Report
A 56-year-old female was referred to King Khaled Eye Specialist Hospital, Riyadh, Saudi Arabia, with central corneal thinning in her left eye and a scar. She reported a painless decrease in vision following the self-application of alum substances to her left eye for eye redness and discomfort. She had no history of previous trauma, surgery, or any ophthalmic disorder. There was no history of any systemic illness or use of any systemic or topical medications. Ophthalmic examination indicated the...
best-corrected visual acuity of 20/20 in the right eye (OD) and counting fingers at 1 m in the left eye (OS). Intraocular pressure measured with applanation tonometry was within the normal range bilaterally. Examination of the right eye was unremarkable except for a mild cataract. Slit-lamp examination of the left eye indicated a quiet conjunctiva and central corneal scar with no corneal epithelial defect; there was corneal thinning without descemetocele, nuclear sclerosis, and a hazy view of the fundus [Figure 1]. B-scan ultrasonography OS indicated no pathology at the posterior pole. The alum substance was analyzed using scanning electron microscope (SEM) and revealed the elements shown in Figure 2.

Discussion

The prevalence of preventable blindness in developing countries may be twenty times higher than in developed countries.[4] This is especially pertinent as the vast majority of blind people reside in the underdeveloped parts of Africa and Asia. There are numerous reasons for visual disability in countries, such as Saudi Arabia. Preventable blindness can be significantly decreased through thorough public education efforts and provision of modern health care. Unfortunately, in the rural areas of Saudi Arabia, folk medicine is actively practiced. The topical use of folk remedies is a common practice in Central and Southern parts of Saudi Arabia.[4] Kermes is an insect’s dried body used as a folk medicine.[4] Kermes caused acute severe acidic injury when it was used by an Arabian male to treat his eyesore.[4] The use of Kermes resulted in severe acute ocular injuries, including corneal abrasion and severe conjunctival injury, as well as cicatrization of the conjunctiva with symblepharon formation.[4] As traditional medicines become popular worldwide, the knowledge increases in the toxicity related to these remedies.[5-6] Al Ghadeer et al. reported toxicity to the cornea of a 74-year-old male following self-application of latex from the herb Calotropis procera. C. procera is a xerophytic shrub of family Asclepiadaceae.[7] The irritant and pro-inflammatory properties of the milky white latex of C. procera have been well established.[8] Exposure to the latex irritates the mucous membrane and produces contact dermatitis and intense inflammation when injected locally in animal models.[8,9] Shivkar and Kumar[9] found that the injection of dried latex produces an intense inflammatory response involving edema and cellular infiltration in an animal model. They showed that this response was caused by the presence of histamine in the latex itself, as well as the release of mast cell histamine by the latex.

Garden cress (Lepidium sativum) is a well-known garden weed, also named Rashad and thevfaa, in Arabic, and it has a peppy nature with a tangy flavor and its seeds are called Haloon. It has many different uses as a medicine and is added for flavor in cooking.[10]

In the current case, the patient developed corneal thinning and a scar as sequelae of administering alum; SEM indicated the presence of aluminum and sulfur.

Alums are generally soluble in hot water and are used in various industrial and manufacturing processes. For example, the paper is sized by depositing aluminum hydroxide to the interstices of cellulose fibers. It is used in water-purification plants as a flocculating agent and as a binder for dyeing fabrics such as cotton to ensure the dye that remains insoluble. Alums are also used in pickling, baking powder, fire extinguishers, and as astringents in medicine.[3]

Injury from alum may stimulate the production and increased activity of matrix-degrading enzymes (collagenase and matrix metalloproteinase), which can cause stromal melting. In conclusion, ophthalmologists should be aware of the hazards of some of these folk remedies. Public education programs are essential to raise awareness regarding vision-threatening complications arising from the use of harmful folk remedies in the eye.

Figure 1: (a and b) Slit-lamp photos showing central corneal thinning surrounded by a scar

Figure 2: Scanning electron microscope was used with an energy dispersive X-ray spectrometer to identify elements present in an alum sample
Declaration of patient consent
The authors certify that they have obtained all appropriate patient consent forms. In the form the patient(s) has/have given his/her/their consent for his/her/their images and other clinical information to be reported in the journal. The patients understand that their names and initials will not be published and due efforts will be made to conceal their identity, but anonymity cannot be guaranteed.

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Conflicts of interest
There are no conflicts of interest.

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