Corneal Injury Caused by Imported Fire Ants in a Child With Neurological Compromise

Mariano Amador, MD; and F. Keith Busse Jr, MD

INTRODUCTION

Insect-induced ocular injuries with corneal involvement have been occasionally observed in the pediatric population. In all reported cases, corneal injuries have been inflicted by apids (bees).1-3 Vespids (wasps) have been implicated in a case of corneal injury inflicted on an adult.4 In general, the setting in which these incidents occur depicts a playful child in the outdoors who has an unfortunate encounter with a flying insect. Cases of nonwinged Hymenoptera causing ocular injury with corneal involvement have not been previously reported. We describe here the case of a 26-month-old boy with neurological compromise who suffered severe bilateral keratitis as a consequence of multiple imported fire-ant (Solenopsis invicta) stings.

Since its arrival to the United States in the 1930s, S invicta has been able to successfully expand its habitat. It is devoid of natural enemies, and is more aggressive than harvester ants, native fire ants, or other imported fire ants. S invicta constitutes up to 90% of the ant population in extensive areas of the southwestern states east to New Mexico.5 It is expected that all southwestern and west coast states will eventually be infested with S invicta and with hybrids of S invicta and Solenopsis richteri, the other imported fire ant.6 In the infested areas, envenomation and hypersensitivity reactions secondary to imported fire-ant stings are more common than to those of any other Hymenoptera.6 Most imported fire-ants stings are isolated events, occurring in the outdoors when a person comes in contact with the omnivorous insect. Recently, however, indoor attacks on human beings have been reported. These cases involved a newborn infant6 and two patients with Alzheimer's disease.7,8 Because of their physical limitations, the victims of these attacks were unable to respond appropriately to the fire-ant aggression. We report here the second case of indoor, multiple imported fire-ant stings in the pediatric population. This case emphasizes the significance of anticipating environmental threats in caring for children with chronic conditions.

CASE REPORT

A 26-month-old boy presented for treatment 20 hours after sustaining multiple import fire-ant stings. This child had severe hydrocephalus and developmental delay, as well as a known history of exposure keratitis secondary to bilateral congenital lagophthalms. All these conditions were thought to be associated with an underlying Dandy-Walker malformation, with which he was diagnosed shortly after birth.

Although unable to lift his head, our patient had recently begun to roll from the supine to the prone position. To avoid a fall from the bed, this child was placed on a rug on the floor of his apartment the day before presentation. He fell asleep, but suddenly awoke crying. His mother found him with numerous ants on his face and scalp. Shortly thereafter, his face became severely edematous and erythematous. His eyelids were particularly affected. The ants were identified by the entomologist of the local US Department of Agriculture as S invicta.

Physical Exam

The patient was crying without interruption. Vital signs were within normal limits. More than 150 2-mm to 3-mm pustules with erythematous base were found. Most of the lesions were scattered on the face and scalp, but some were also evident on the extremities, neck, chest, and abdomen. The face showed areas of severe edema and erythema (Fig 1).
Ophthalmic Exam
The exam was carried out under topical anesthesia with proparacaine 0.5% because of obvious discomfort. The patient was found to have poor fixation and following behavior of both eyes without preference. His eyelids were severely edematous and erythematous with yellowish crusting, and had multiple 2-mm to 3-mm pustules with erythematous base. Lagophthalmos of 1 mm to 2 mm on the right and 4 mm to 5 mm on the left was present. Intraocular pressures were normal by Tonopen. Pupil exam was normal. Severe bilateral conjunctival injection and corneal edema were noted. Pen light exam revealed bilateral corneal vascularization and scarring of the anterior stroma. These changes were sequelae of exposure keratitis and were thought to be unchanged from previous records.

The right cornea presented 20 annular and dot lesions, 0.5 mm to 2 mm in diameter, of estimated superficial and midstromal depth (Fig 2). At the 10 o’clock position, there were two conjunctival annular lesions with focal injection. The left cornea demonstrated 10 similar lesions. Corneal lesions were presumed sterile at presentation, and no cultures were obtained. No foreign bodies were found. Focal epithelial defects were observed upon fluorescein staining. Motility exam showed jerk-type horizontal nystagmus with variable esotropia. Slit-lamp examination to characterize the depth of lesions accurately and to assess stromal thinning was not performed because of difficulties arising from massive hydrocephalus, young age, and lack of patient cooperation.

TREATMENT
Oral diphenhydramine and ibuprofen, and local atropine 1% and prophylactic bacitracin ophthalmic ointment were administered. No patching was performed. Bacitracin ointment was administered every 8 hours for 10 days; then nightly for 3 weeks. Artificial tears were administered every 8 hours while awake.

Follow up
Our patient was carefully observed for corneal perforation and bacterial keratitis, which did not develop. Bilateral eyelid edema and conjunctivitis progressively improved and resolved within 7 to 9 days. Multiple ring- and dot-shaped areas of inflammation persisted on both cornesas for 7 to 10 days. One month after the incident, ophthalmic exam revealed poor fixation and following. Pupils and intraocular pressures remained normal. Motility exam showed 25 prism diopters of esotropia with jerk nystagmus. Pen light exam showed no conjunctival injection, no discharge, and no tearing. Multiple discrete opacities replaced the areas of inflammation. Other corneal scars, sequelae of exposure keratitis, were unchanged.

DISCUSSION
Reactions to fire-ant stings have been classified as either limited local, severe local, or systemic. Our patient suffered a severe local reaction that has not been previously described. In addition to the skin lesions that correspond to those described by several authors, we observed a severe corneal inflammatory process.

Ocular lesions caused by bee and wasp stings have been described previously. They include conjunctival injection, chemosis, corneal edema and perforation, keratitis, hyphema, partial iris atrophy, lens subluxation, cataracts, heterochromia iridis, ophthalmoplegia, anterior and posterior capsular lenticular opacities, corneal opacities, anterior uveitis, peripapillary hemorrhages, optic disc edema, and optic neuritis. These lesions seem to be related to the toxic and allergic properties of bee and wasp venoms and to the mechanical trauma inflicted, including the fact that these insects often leave the sting apparatus attached as a foreign body.

We suspect that the fire-ant-induced ocular lesions described here, like lesions caused by bee and wasp stings, were the result of local trauma, as well as toxic and hy-
sensitivity reactions. However, both the composition of the fire-ant venom and its stinging mechanism differ significantly from the other Hymenoptera. Although the protein fraction of all Hymenoptera venoms (including fire ants) contains the main allergic components (i.e., phospholipases, hyaluronidases, and other peptides), the fire-ant venom does not contain the putative mediators of toxic reactions of bee and wasp venoms, i.e., the bioactive amines (histamine, dopamine, and norepinephrine) and the polypeptide toxins (meletin, apamin, mast-cell degranulating peptide, and minamine). Still, endogenous histamine may play a significant role in the pathogenesis of the lesions—dialkylpipеридины, the main components of fire-ant venom, have been shown to induce histamine release from mast cells. Dialkylpipеридины are cytotoxic per se and mediate most of the direct local and systemic toxic effects of fire-ant venom.

We hypothesize that the annular corneal lesions observed here were likely caused by central necrosis of the anterior corneal stroma in areas where a larger bolus of venom was delivered. No attached sting apparatus was found on the affected areas. This is consistent with the fact that, in contrast with other Hymenoptera, the 0.5-mm stinger does not detach from the fire ant, allowing a single ant to inflict multiple stings. Further studies are needed to assess the nature and extent to which the fire-ant sting and each of the components of the fire-ant venom might have contributed to the lesions observed. These studies will suggest whether other management strategies, such as the use of topical steroids, should be considered in future cases.

Our patient's severe developmental delay and chronic lagophthalmos prevented him from avoiding or limiting the multiple ant bites suffered. Interestingly, the cornea that was more severely affected was contralateral to the more severe lagophthalmos. We were unable to find an explanation for this observation. Even though fixation and following had improved 1 month after presentation, it remained poor. It was not possible to assess the long-term functional sequelae of the corneal injury suffered by this infant because he was lost to follow up. Poor fixation and following was documented before the incident, as part of his severe neurologic compromise associated with a Dandy-Walker malformation. New, less extensive corneal opacities appeared in addition to those caused by exposure keratitis, but we were unable to determine whether this child's already impaired vision returned to baseline.

The pediatricians evaluating children with ant stings on the face should rule out the presence of bites to the eyes. Prompt identification of ocular lesions will allow immediate ophthalmology referral to assess the extent of the problem and monitor for possible complications, such as corneal opacities, impaired vision, corneal perforation, and bacterial keratitis. The pediatrician also should evaluate the cutaneous and systemic manifestations secondary to the fire-ant stings and treat accordingly. Because children who are left unattended for prolonged periods of time may be more susceptible to multiple fire-ant stings, the possibility of neglect should be considered.

Children with neurologic compromise are more prone to suffer the consequences of imported fire-ant infestation as an environmental hazard. The interest of this report arises not only as a precedent in the pediatric and ophthalmology literature, but also from its implications in strengthening our efforts towards protecting children with incapacitating illnesses.

REFERENCES