The "Blown Pupil": Imminent Death or Harmless Contamination?

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Abstract

Acute anisocoria and unilateral mydriasis is physically alarming to patients and diagnostically worrisome to clinicians. We report the case of a 14-year-old girl who presented to the pediatric emergency department with acute anisocoria and unilateral mydriasis after contacting an Angel's trumpet plant and who had complete resolution of symptoms four days following eye contamination. The Angel's trumpet plant contains three active components which can result in mydriasis: hycosamine, atropine, and scopolamine. The three active components occur in different parts of the plant, including on the small glandular hairs that cover the entire plant. This likely explains why even brief contact with the plant can result in unintentional contamination of the eye and in mydriasis. It is critical when obtaining a history from a patient with such a presentation to ask explicitly about any contact with plants prior to onset of symptoms. Although eye contamination with the Angel's trumpet plant is self-limited and resolves within a week, the appearance of a persistently unilateral mydriatic eye can be alarming to patients and clinicians, which too often results in an unnecessary, costly workup.

Keywords

anisocoria, mydriasis, Angel's trumpet, pediatric emergency medicine

Introduction

Anisocoria, or unequal pupil sizes, and mydriasis, pupil dilation, with acute onset can be caused by anatomical abnormalities, pharmacological contamination, or can be seen in a clustering of abnormal findings. In this case, a 14-year-old girl presented to the pediatric emergency department with acute anisocoria and unilateral mydriasis after contacting an Angel's trumpet plant. Numerous warm to tropical weather plants found in Hawai'i contain tropane alkaloids, such as atropine, scopolamine, and hycosamine, as seen in Table 1.[1]

The first Angel's trumpet plant, at that time listed as *Datura arborea*, was brought to Hawai'i in 1825, aboard the HMS Blonde.[2] The *Datura* and *Brusmansia* genera of plants are often used interchangeably due to all member plants initially being included in the genus *Datura*. In the 1970s taxonomist Tom E. Lockwood separated the genus *Datura* into two sub-genera: *Datura* and *Brusmansia*.[3] There continues to be confusion regarding what genus member plants belong to; therefore, case reports and poison control reports of contamination and ingestion interchange the genera. *Brusmansia x candida*, one of the many *Brugmansia* plants commonly referred to Angel's trumpet, is the most commonly cultivated species within this genus.[4] Despite the high number of plants cultivated, between 2014 and 2018 only eleven events of human exposure to members of these genera were reported to the Hawai'i Poison Center, out of the total 44 anticholinergic plant exposures that were reported.[5] Also, only one case report of acute anticholinergic toxicity related to Angel's trumpet tea ingestion has been published from Hawai'i.[6] In this case report, we examine the case of a 14-year-old female who presented to the pediatric emergency department with acute anisocoria and unilateral mydriasis after contacting an Angel's trumpet plant and who had complete resolution of symptoms four days following eye contamination. The case presentation was submitted to the Hawai'i Pacific Health Research Institute for review and was deemed not needing institutional review board approval, study number 2019-003.

Table 1. Common Warm to Tropical Weather Plants Containing Tropane Alkaloids Found in Hawai'i.[1]

Family Name	Genus and Species	Common Name
Soloanaceae	*Brusmansia x candida* or *Datura candida*	Angels' trumpet
Proteaceae	*Protea cynarioides*	Protea
Euphorbiaceae	*Euphorbia pulcherrima*	Poinsettia
Rhizophoraceae	*Rhizophora mangle*	American Mangrove
Convolvuaceae	*Convolvulus arvensis*	Morning glory

Case Presentation

A 14-year-old girl with a non-contributory past medical history presented to the pediatric emergency department with chief complaint of "right pupil very dilated and not changing with light changes." She woke up that morning in her usual state of health, went outside to film a video for a school project, and 30 minutes later developed right eye photophobia and right unilateral temporal headache with exposure to bright light. She rated the headache pain as 7/10 with exposure to bright light and 0/10 when in a dark room; neither eye was painful. She denied wearing contacts or placing eye drops in either eye. The patient initially denied touching anything unusual prior to touching her eyes. Subjectively, associated symptoms included blurry vision in both eyes with worse far vision in the right eye. She had participated in spring board diving competition the day prior to presentation, with associated repeated water impaction from three-meter height. The patient did spring board diving regularly as part of her athletic training and denied any significant trauma to her eyes or face outside of her normal regimen. No other neurological symptoms were present. There was no history of fever; illicit or prescribed drug contact, including scopolamine patch, or ingestion; or unintentional intoxication. She was not on any pertinent medications at the time of emer-

Figure 1. Photograph Taken in the Pediatric Emergency Department Hours After Onset of Symptoms Demonstrating Anisocoria with Right Pupil Mydriasis in a Brightly Lit Room. Consent to Use Picture Obtained from Patient's Mother and the Patient.

gency department presentation. Vital signs on presentation to the emergency room included a temperature of 36.7°C, blood pressure of 117/62 mmHg, heart rate of 61 beats per minute, respiratory rate of 20 breaths per minute, and peripheral capillary oxygenation of 100% on room air. On physical exam, she appeared in mild distress and the right pupil was dilated to approximately 5 mm, as seen in Figure 1, and was briefly and minimally reactive to direct and consensual light. The left pupil was approximately 3 mm in diameter and was reactive to direct light but not reactive to consensual light. No discharge, conjunctival injection, or discharge to bilateral eyes. Normal extraocular eye movements, tear film, and four quadrant visual acuity to confrontation. The remainder of the neurological exam was non-focal and within normal limits. Workup of the mydriasis in the emergency department included visual acuity, fluorescein exam, intraocular pressure measurement, pediatric neurology phone consult, and pediatric ophthalmology phone consult. The visual acuity was 20/20 in the right eye and 20/25 in the left eye. The intraocular pressure was measured with a tonometer and found to be 17 mmHg in the right eye, within normal limits. Pediatric neurology recommended brain magnetic resonance imaging and laboratory testing, including systemic lupus erythematosus panel, anti-myelin oligodendrocyte glycoprotein antibody, and anti-neuromyelitis optica antibody. Pediatric ophthalmology recommended brain magnetic resonance imaging and close follow up in clinic. The patient and her mother elected for 'watching and waiting', in the form of close follow up with their primary care physician and ophthalmology. Prior to discharge, patient's mother questioned the care team as to whether the patient's symptoms may have been due to the subject of her school video project, the Angel's trumpet plant. The presumptive diagnosis of mydriasis due to contact with the Angel's trumpet plant and contamination of both eyes, presumably right greater than left eye, was made. The patient followed up with pediatric ophthalmology the following day, by which time anisocoria was significantly improved. The patient's mother called the pediatric emergency department to inform care team that the patient's eyes were completely normal four days after presentation.

Discussion

Acute anisocoria and mydriasis is physically alarming to patients and diagnostically worrisome to clinicians on presentation. The etiology behind this presentation can most easily be broken down to anatomical, pharmacological, or a clustering of abnormal findings, as seen in Table 2.[7] A general history of present illness related to such a presentation will generally elucidate a history of trauma, contact with prescribed or illicit substances, or related neurological symptoms that will quickly remove most of these etiologies from the differential. In this case presentation, as well as the majority of other published case presentations related to Angel's trumpet plant exposure, very few patients shared with clinicians that they had been in contact with a plant immediately prior to their onset of mydriasis. Without this critical exposure history, clinicians are left with a broad, and potentially life altering etiology list that oftentimes result in neuroimaging, laboratory testing, and in some case reports, admission to the hospital for monitoring.

The Angel's trumpet plant contains three active components which can result in mydriasis: hycosamine, atropine, and scopolamine.[1] Various amounts of these three components occur in different parts of the plant, including on the small glandular hairs which nearly cover the entire plant, as confirmed by the

Table 2. Common Anisocoria and Unilateral Mydriasis Etiologies.[7]

Category	Common Etiologies
Anatomical	• Unilateral pupillary sphincter muscle pathology • Unilateral ciliary ganglion pathology • Unilateral short ciliary nerve pathology
Pharmacological	• Unilateral para-sympatholytic substance exposure • Unilateral sympathomimetic substance exposure • Unilateral anticholinergic substance exposure
Clustering of Symptoms	• Cranial nerve III palsy o Unilateral paralysis of eye adduction, depression, and elevation o Unilateral mydriasis o Unilateral ptosis

Dragendorff positive reaction observed in a study by Andreola, et alius.[8] Dragendorff reagent is a bismuth nitrate compound that creates a brown precipitate when it comes in contact with alkaloids in plant samples.[9] Since even the small hairs covering the Angel's trumpet plant contain alkaloids, this likely explains why even brief, non-significant contact with the plant can result in contamination of the eyes and resulting mydriasis, as seen in our patient. Since our patient had mydriasis with minimal reaction to direct and consensual light in the right eye as well as a non-reactive left pupil to consensual light, it is likely she contaminated both eyes after contacting the Angel's trumpet plant. The patient likely contaminated the right more than the left eye with the plant alkaloids. Absorption of the alkaloids via the conjunctivae, nasolacrimal canal, and nasal mucosa also bypasses first pass metabolism in the liver, which is likely why systemic symptoms, in the form of palpitations, occurred in those patients who had Angel's trumpet plant sap directly contaminate the eye.[10] Of note, the most likely cause of these systemic symptoms are atropine and hycosamine, as scopolamine via contact with the eye has been shown to not effect heart rate.[11] The relationship between extent of alkaloid eye contact and longevity of mydriasis also does not seem to be correlated, based on the multiple published care reports, as even those patients who only touched the plant also had symptoms up to one week following contact. In all reported cases of mydriasis reviewed for this case report, the mydriasis completely resolved within one week.[8,10,12–14]

Conclusion

The Angel's trumpet plant, as well as other tropane alkaloid containing plants, is common in Hawai'i as well as other warm or tropical weather climates and can cause adverse medical reactions even with non-significant contact with any portion of the plant, as seen in Figure 2. It is critical when obtaining a history from a patient with such a presentation to explicitly ask about any contact with plants prior to onset of symptoms. It is also critical to thoroughly document in the medical record when the patient and family decline the recommended imaging and bloodwork studies in the event of further decompensation or lack of symptom improvement. Although eye contamination with scopolamine, atropine, and hycosamine is self-limited and resolves within a week, the appearance of a persistently mydriatic eye can be alarming to patients and clinicians, which too often results in unnecessary neuroimaging, laboratory testing, and hospital admission.

Conflict of Interest

We certify that we have no financial affiliation/interest (eg, stock holdings, consultantships, honoraria) in the subject matter, materials, or products mentioned in this manuscript. None of the authors of this article have any conflict of interest to report, nor any interests represented with any products discussed or implied.

Figure 2. The Angel's Trumpet Flower Touched by the Patient. Photo Taken by the Patient's Mother and Used with Permission.

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