

Pediatric Emergency Care

Diffuse corneal abrasion after ocular exposure to laundry detergent pod

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Abstract:	While ocular injury from alkaline household cleaning products is well described, there is less known about the significance and extent of injury with ocular exposure to detergent pods. We report a 12-month-old with diffuse corneal abrasion due to ocular contact with a laundry detergent pod. In addition to the known risks with aspiration with detergent pods, the potential for severe ocular injury is important for parents and clinicians to recognize. Children with ocular exposure to detergent pods should seek immediate medical care.

Diffuse corneal abrasion after ocular exposure to laundry detergent pod.

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Key Words: corneal abrasion, detergent pod, alkaline injury

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Case

A 12-month-old girl presented to the pediatric emergency department (PED) approximately 4 hours after she inadvertently squirted the contents of a laundry detergent pod into her right eye. The patient's grandmother immediately irrigated the eye with tap water. However, due to persistent redness and rubbing of the eye the patient was brought to the PED for evaluation. The patient's grandmother denied that the patient ingested any contents of the detergent pod and the patient did not exhibit vomiting or respiratory symptoms.

On physical examination, the patient was breathing comfortably in no distress. The right upper cheek was erythematous. The patient easily and willingly opened both eyes. The bulbar conjunctiva of the right eye was injected with a scant amount of whitish discharge on the eyelids. The pupil was of normal shape without hyphema. The left conjunctiva was clear. The remainder of the physical examination was normal.

The poison control center (PCC) was contacted and relayed that according to the manufacturer, the detergent product has a pH of 6.8-7.4, approximately the normal pH of the eye. The poison specialist therefore conveyed that detergent pods cause mild ocular irritation, similar to a shampoo or soap, and advised that there was a low likelihood of corneal abrasion or serious injury.

A fluorescein exam was performed on the affected right eye and revealed diffuse uptake of dye without focality. The patient was discharged with a diagnosis of chemical conjunctivitis and likely diffuse corneal abrasion and prescribed trimethoprim/polymyxin B ophthalmic drops. The patient's mother was advised to follow up with ophthalmology later that day due to concern of diffuse corneal abrasion.

At the ophthalmologist appointment, the patient's fluorescein examination was notable for a limbus to limbus corneal abrasion with peripheral corneal vascularization with no corneal infiltrate. Her extra-ocular movements were intact, pupils were reactive, optic nerve was sharp and pink, and retina was within normal limits with good foveal reflex. The pH of the cornea was 6. Due to the diffuse corneal abrasion, the Trimethoprim/polymyxin B ophthalmic drops were discontinued and a daily regimen of prednisone drops, moxifloxacin drops, erythromycin ointment, and 500 mg oral ascorbic acid were prescribed. Due to the extent of injury, the possibility of an amniotic membrane graft was discussed but the ophthalmology team decided on daily follow up with the treatment regimen prescribed. The following day, the pH of the injured eye was 7 and the abrasion had significantly improved with 360-degree peripheral epithelialization. Eight days after the initial incident, the patient's injury had resolved sufficiently to discontinue the prescribed ophthalmic regimen, and she was discharged from ophthalmology with no further follow up required.

Discussion

While detergent pod ingestions causing altered mental status and respiratory distress, occasionally requiring intubation, has been well reported,(1, 2) ocular injury associated with detergent pod contact has been less described. Case reports of eye injury from detergent pods in the UK have been reported as early as 2005,(3)

but we report, to our knowledge the first case of corneal abrasion resulting from contact with laundry pod detergent contents in the US. As illustrated in our case, the potential for serious ocular injury with detergent pods is not well known, as the PCC conveyed that the detergent pod was unlikely to cause corneal damage. Recognition of the potential for serious ocular injury from detergent pods is important for both parents and clinicians to further bolster injury prevention efforts related to these pods.

In 2010, one fifth of the telephone calls about detergent pods to two poison centers in London were related to ocular exposure, and 40% of ocular injuries in children under the age of 5 admitted to the Western Eye Hospital in London were due to chemical injury from detergent pods.(4) The exact mechanism of injury for both of these injuries remains a subject of debate, although there are several reports suggesting the high surfactant content present in the pods is responsible.(2-4)

Alkaline injury is accepted as a severe form of chemical ocular injury.(4) Commercial detergent pod contents are listed as having a pH of 6.8-7.4.(5) However, the main ingredient in laundry detergent pods is linear alkylbenzene sulfonate (LAS), an alkali with a pH of about 10 in a 1% solution,(6) although some manufacturers report a pH of 9 for their pods.(3) LAS is a typical anionic surfactant present in many household detergents. It is listed as the first ingredient in most detergent pods, but the third in liquid formulations, suggesting that the volume and/or concentration of the harmful alkali is more potent in the pod formulation.(5) A case series in 2010 reviewed 13 cases of pediatric ocular exposures to generic detergent pod contents, including 8 patients with ocular pH near normal after exposure. However in four of these cases, the pH of the eye was 8.0 or greater, which correlated with more extensive corneal epithelial damage.(4)

Ocular contact with the detergent preservative is an additional theoretical mechanism of injury. The most common preservative used in eye drops, benzalkonium chloride (BAC), has been shown to promote inflammation and alter precorneal mucins that may lead to epithelial cell death.(7, 8) BAC and benzisothiazolin, the preservative in detergent pods, are similar in that they share a quaternary ammonium structure. The ammonium group is lipophilic, and has been shown to penetrate and disrupt the outer layer of corneal epithelium.(8) It follows that benzisothiazolin in detergent pods is a possible driver of corneal injury. Contact dermatitis has also been reported after skin exposure to benzisothiazolin.(9) Our patient had right cheek erythema on exam, likely due to irritation from the detergent preservative.

While some experts suggest avoidance of irrigation with isotonic saline,(10) instead favoring aggressive irrigation with a universal buffer solution, such as Cederroth's solution,(11) this solution is not readily available in the emergency department. Isotonic saline is preferred to tap water which is hypotonic compared to the corneal stroma and can hypothetically cause corneal edema and drive the toxic irritant deeper into the corneal matrix.(12) Irrigation should be continued until the pH as tested in the conjunctival sac reaches neutral. Initial exam may be misleading, with minimal conjunctival injection due to blanching of the vessels, in which case fluorescein staining of the cornea and examination with a slit lamp is necessary to show the extent of epithelial loss. It is important for the emergency

medicine clinician to record the extent of corneal stromal damage, conjunctival and episcleral ischemia, and the extent of intraocular inflammation, in order to guide treatment and prognosis.(13)

For documented corneal abrasions from laundry detergent pods, an ophthalmologist should be consulted to assess the patient for deeper corneal injury and to guide management. Treatment includes an ophthalmic corticosteroid, such as prednisone acetate, which can decrease anterior chamber inflammation. Dosing intervals of 15 minutes to 1 hour may be required to more effectively reduce inflammation.(12)

Ascorbic acid has long been shown to be important in the wound healing process by aiding the production of collagen. More specifically for ocular injuries, ascorbic acid is found in very high concentrations in the aqueous humor, up to 20 times that found in plasma. After an alkali injury, the concentration of ascorbic acid can fall to a third of its normal value, severely inhibiting the body's natural ability to heal the injured eye. Both systemic and topical ascorbic acid are used in these injuries to restore wound healing function, as was prescribed for our patient.

Topical antibiotic use is a universally accepted prophylaxis against infection after corneal injury, and selection of a particular agent is at the discretion of the emergency medicine clinician or ophthalmologist. Tetracycline antibiotics, such as tetracycline and doxycycline, as well as fluoroquinolones, are reported in case reports.(12, 14)

Conclusion

While ocular injury from laundry detergent pod contents is an acknowledged danger in the pediatric population, the significance and extent of injury, as well as appropriate management, is not well documented. This case of diffuse corneal abrasion due to contact with detergent pod contents highlights the need for more widespread knowledge on the risks of pod detergents and management of these injuries.

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Response to Reviewer 1:

- Thank you so much for your comments and suggestions. Please find our comments and adjustments outlined below.

Reviewer comment: It is apparently not quite as well appreciated in the US (though the failure of their regional PCC to distinguish between the LDP exposure and that to routine liquid detergent strains credulity for me - I can't help but wonder if there might have been some miscommunication? Or, was this a case that presented early in the US epidemic, e.g., in the Spring of 2012?)

- We agree with the reviewer that ocular injury after exposure to laundry pod detergent is not as appreciated in the U.S., as our regional Poison Control Center had not previously seen this type of injury. This highlighted to use the utility of publishing this case in the U.S. literature to more widely disseminate the risk of ocular injury after exposure to laundry pod detergent.

Reviewer comment: I would suggest deleting all references to "Tide pods"- as these are only 1 of 3 or 4 brands commonly marketed in the US, and there have been numerous case reports of critically ill/ injured children after exposure to all of them.

- Thank you for this helpful suggestion. All references to Tide pods have been deleted and replaced with the terms “laundry detergent pod” or “detergent pod.”

Sincerely,
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