



Pediatric Eye Injuries by Hydroalcoholic Gel in the Context of the Coronavirus Disease 2019 Pandemic

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HAL Authorization

Title : Pediatric eye injuries by hydroalcoholic gel in the context of coronavirus Disease 2019 pandemic

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Key points:

Question: Is there an increase in severe ocular lesions related to alcohol-based hand sanitizer exposures in children since March 2020 ?

Findings: A national retrospective review from the French Poison Control Centers found a 7-fold increase of alcohol-based hand sanitizer-related ocular exposures in children in comparison with 2019, and a pediatric ophthalmology center reported 13% of patients requiring surgery for severe lesions.

Meaning: These findings support that despite the importance of alcohol-based hand sanitizers for controlling the spread of COVID-19, these agents should be used with caution, and likely kept away from young children.

Abstract

Importance: The COVID-19 pandemic has made alcohol-based hand sanitizers (ABHS) widely available in public places. This may warrant determining if cases of accidental ocular exposure are increasing, especially in children. **Objective:** To describe the epidemiological trend of pediatric eye exposures to ABHS, and to report the severity of the ocular lesions. **Design:** Retrospective case series from April 1st 2020 to August 24th 2020. **Setting:** Cases were retrieved from the national database of the French Poison Control Centers (PCC) and from a pediatric ophthalmology referral hospital in Paris. **Participants:** Cases of ocular exposure to chemical agents in children under 18 during the study period were reviewed. Cases of ABHS exposure were included. **Exposures:** The following data were collected: age, sex, circumstances of exposure, symptoms, size of the epithelial defect at first exam, time between the accident and re-epithelialization, medical and/or surgical management. **Main outcome and measure:** Comparison of the number of eye exposure to ABHS in children between April-August 2020 and April-August 2019. **Results:** Between April 1st and August, 24th 2020, there were seven times more pediatric cases of ABHS eye exposures reported in the PCC database compared to the same period in 2019 (9.9% of pediatric eye exposures in 2020 versus 1.3% in 2019, difference: 8.6% [IC95:7.4;9.9], $p<0.0001$). The number of cases occurring in public places increased in 2020 (from 16.4% in May to 52.4% in August). Similarly, admissions to our eye hospital for ABHS exposure increased at the same period (16 children in 2020 including 10 boys, mean age: 3.5 +/- 1.4 years, vs one boy of 16 months of age in 2019). Eight of them presented with a corneal and/or conjunctival ulcer, involving more than 50% of the corneal surface for six of them. Two cases required amniotic membrane transplantation. **Conclusions and Relevance:** These data support the likelihood of an increasing number of accidental ocular exposures to ABHS in the pediatric population. In order to maintain good public compliance with hand disinfection, these findings support that health authorities should ensure the safe use of these devices, and warn the parents and caregivers about their potential danger for children.

Introduction

Regular hand disinfection with alcohol-based hand sanitizer (ABHS) is one of the main barrier gestures to limit the spread of COVID-19.^{1,2} The recent widespread use of ABHS has been associated with an increase in accidental exposures since March 2020, especially in children.³ ABHS can be involved in eye injuries even though it is not a caustic solution but usually considered as irritant.³⁻⁵ While cases of ABHS ingestion have been recently reported and detailed^{3,6}, data is lacking regarding ABHS-related eye injuries.

Using the French Poison Control Centers (PCCs) database and a case series from a tertiary ophthalmologic referral center, the aims of this study are to assess the alarming increase in pediatric cases of ABHS ocular exposure and their circumstances, and to describe the ocular lesions and their management.

Methods

National epidemiological data

Cases of ocular exposure to chemical agents in children under 18 were reviewed using data from the French National Database of Poisonings (FNDP) between April 2020 and August 24th 2020, and between April 2019 and August 24th 2019. In France, eight PCCs manage toxic exposures reported by the public, caregivers and health professionals. Chemical agents are referenced in the national database of products with compositions, and classified by use. Cases of ocular exposure to ABHS were included in the study. For each case, the following data were collected: age, sex, circumstances of exposure, symptoms and severity of the lesion (according to the poisoning severity score⁷).

Case series

Electronic records of all children under 18 consulting the emergency department of a referral center in pediatric ophthalmology for ocular exposure to a chemical agent between April 2019 and August 24th 2019, and between April 2020 and August 24th 2020 were reviewed using the Query® software⁸. Cases exposed to ABHS were included and the following data were collected: age, sex, context of exposure,

size of the epithelial defect at first exam, time between the accident and complete re-epithelialization, medical and/or surgical management.

Both parts of the study followed the tenets of the declaration of Helsinki and the French regulation on consents and sharing (*Commission Nationale Informatique et Libertés*), and received the approval of our institutional committee. Statistical analysis was performed with the R software, using Chi² test or Fischer's exact test. Differences are given with a 95% confidence interval (IC95).

Results

National epidemiological data

Between April 1st and August, 24th 2020, the proportion of calls to the PCCs related to chemical eye splatter in children was significantly lower compared to the same period in 2019: 2336 cases (2.2% of pediatric calls) in 2020 versus 2553 cases (4.2% of pediatric calls) in 2019 (difference:2.0%, [IC95:1.9;2.2], $p<0.0001$). The proportion of ABHS eye exposures significantly increased from 1.3% in 2019 (33 cases, mean age: 3.4 years old \pm 3.8) to 9.9% in 2020 (232 cases, mean age 4.5 years old \pm 3.5)(difference:8.6% [IC95:7.4;9.9], $p<0.0001$). The proportion of ABHS eye splatters significantly increased during the study period from 5% in April 2020 to 9%, 10%, 11% and 15% in May, June, July and August 2020 (highest p value = 0.02)(Figure 1). Most cases were of null or mild severity (n=269, 97.8%), where the symptoms reported were pain, tingling sensation or conjunctival hyperemia. Six cases of moderate severity were reported, with limited keratitis.

In 2020, 63 cases of ABHS exposure occurred in a public place, while none was reported in 2019. The locations frequently found were stores and malls (n=47), restaurants (5 cases), open public places (5 cases), sports arena (1 case), movie theater (1 case), swimming pool (1 case), and other in the last 3 cases. Cases of ABHS exposures in public places are continuously increasing, from 5 in May (1.0% of eye exposure, 12.2% of ABHS), 9 in June (1.8% of eye exposure and 16.4% of ABHS), 16 in July, to 33 in August (up to 24th, 8.0% of eye exposure and 52.4% of ABHS). All cases were related to ABHS devices made available to the public in the context of COVID-19 (automatic or foot-controlled dispensers).

Case series

Between April 1st and August, 24th 2020, 1657 children were admitted to the ophthalmology emergency department of our hospital, including 80 (5%) for a chemical eye splatter. During the same time-period in 2019, 98 cases of eye splatter were registered among 2469 pediatric consultations (4%). There was no difference between the two periods regarding the proportion of chemical eye exposures among total pediatric consultations (difference:0.9% [IC95:-0.4;2.1], $p=0.18$). In 2019, only one boy (16 months old) was admitted for an exposure to ABHS (1% of chemical eye exposures). Comparatively, 16 cases of ABHS eye splatter (10 boys, mean age: 3.5 +/- 1.4 years) were admitted in 2020 (20% of chemical eye exposures)(difference:19% [IC95:8.9;29.1], $p<0.0001$). Eight children had a corneal and/or conjunctival ulcer, involving more than 50% of the corneal surface for six of them. Two of these children (12%) required amniotic membrane transplantation (AMT) under general anesthesia after a median time of three days of medical treatment, because of delayed re-epithelialization. One case required this procedure twice because of an incomplete re-epithelialization ten days after the first AMT (Figure 2). The median time between exposure and complete re-epithelialization for children with corneal ulcers was 13 days.

Discussion

This joint study of ophthalmologists and toxicologists illustrates collateral damages of the wide use of ABHS during the COVID-19 pandemic and led to a National Public Health alert.⁹ Using two complementary datasets, we showed a 7-fold increase in the number of ABHS eye exposures in children with several cases of serious corneal lesions, while such exposures were anecdotal before. This increase was especially noted after the end of the lockdown in France and related to an increasing number of freely available ABHS devices in public places.

The pediatric specificity of this outbreak is most likely due to the emplacement of the gel dispenser in the proximity of children's faces. Dispensers, often pressure-operated via a pedal, allow the delivery of unit doses of ABHS. However, these devices are usually around 3-foot high, delivering ABHS at the

level of small children's eyes. In addition, the delay in washing the eyes, due to a lack of access to a water supply or to the viscosity of certain preparations, is very detrimental to the ocular surface. The composition of ABHS is highly variable. Usually, it follows World Health Organization recommendations and contain 80% ethanol or 75% isopropanol,¹⁰ which are irritating products. Ethanol is widely used in corneal and refractive surgery to facilitate epithelial debridement. However, the protocol generally used by ophthalmologists involves a 20% diluted ethanol solution applied for 30 seconds maximum. A study has shown that ethanol not only has an immediate cytotoxic effect on corneal epithelial cells, but also reduces proliferation and induces apoptosis.¹¹ Moreover, other irritant additives, including hydrogen peroxide, polyethylene glycol (to increase viscosity), perfumes or essential oils may increase the ABHS ocular toxicity.

In order to maintain good public compliance with hand disinfection, these findings support that health authorities should ensure the safe use of ABHS. Caution in positioning the dispensers in public places, in addition to informative illustrations emphasizing the risk of accidental exposures in children are required in all countries in order to prevent further severe ocular injury.

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All of the authors contributed equally to this work.

The authors confirm that these patients have not been reported elsewhere.

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Figure 1:

Title : Proportion of ocular exposures related to ABHS among pediatric chemical eye splatters reported to the French Poison Control Centers between April 1st and August 24th 2019 and April 1st and August 24th 2020.

Legend : While there were less calls for chemical eye splatters (whole bars) in 2020 compared to 2019, the proportion of ABHS exposures was more important in 2020 (black shadings).

Figure 2:

Title: Severe ocular lesions and delayed re-epithelialization following ABHS eye exposure

Legend:

Two days after the accident, pain can be absent and eye redness can be the sole sign of corneal and conjunctival lesions (a), revealed during ophthalmological examination with fluorescein staining of the burnt surface (b). Twelve days after the splatter, despite an amniotic membrane transplantation performed at day 2, the cornea is not completely re-epithelialized (c), requiring another amniotic membrane suture under general anesthesia.



