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

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**IMPORTANCE** The coronavirus disease 2019 (COVID-19) pandemic has made alcohol-based hand sanitizers (ABHS) widely available in public places. This may warrant determining whether cases of unintentional ocular exposure are increasing, especially in children.

**OBJECTIVE** To describe the epidemiologic trend of pediatric eye exposures to ABHS and to report the severity of the ocular lesions.

**DESIGN, SETTING, AND PARTICIPANTS** Retrospective case series conducted from April 1, 2020, to August 24, 2020. Cases were retrieved from the national database of the French Poison Control Centers (PCC) and from a pediatric ophthalmology referral hospital in Paris, France. Cases of ocular exposure to chemical agents in children younger than 18 years 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 examination, time between the incident and re-epithelialization, and medical and/or surgical management.

**MAIN OUTCOMES AND MEASURES** Comparison of the number of eye exposures to ABHS in children between April to August 2020 and April to August 2019.

**RESULTS** Between April 1 and August 24, 2020, there were 7 times more pediatric cases of ABHS eye exposures reported in the PCC database compared with the same period in 2019 (9.9% of pediatric eye exposures in 2020 vs 1.3% in 2019; difference, 8.6%; 95% CI, 7.4-9.9; P < .001). The number of cases occurring in public places increased in 2020 (from 16.4% in May to 52.4% in August). Similarly, admissions to the eye hospital for ABHS exposure increased at the same period (16 children in 2020 including 10 boys; mean [SD] age, 3.5 [1.4] years vs 1 boy aged 16 months in 2019). Eight of them presented with a corneal and/or conjunctival ulcer, involving more than 50% of the corneal surface for 6 of them. Two cases required amniotic membrane transplant.

**CONCLUSIONS AND RELEVANCE** These data support the likelihood of an increasing number of unintentional ocular exposures to ABHS in the pediatric population. 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.
Regular hand disinfection with alcohol-based hand sanitizer (ABHS) is one of the main barrier gestures to limit the spread of coronavirus disease 2019 (COVID-19).1,2 The widespread use of ABHS has been associated with an increase in unintentional exposures since March 2020, especially in children.3 Alcohol-based hand sanitizers can be involved in eye injuries, although it is not a caustic solution but usually considered as an irritant.3-5 While cases of ABHS ingestion have been reported and detailed,3,6 data are 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 Epidemiologic Data

Cases of ocular exposure to chemical agents in children younger than 18 years were reviewed using data from the French National Database of Poisonings (FNDP) between April 2020 and August 24, 2020, and between April 2019 and August 24, 2019. In France, 8 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 younger than 18 years consulting the emergency department of a referral center in pediatric ophthalmology for ocular exposure to a chemical agent between April 2019 and August 24, 2019, and between April 2020 and August 24, 2020, were reviewed using the Query software.8 Cases exposed to ABHS were included and the following data were collected: age, sex, context of exposure, size of the epithelial defect at first examination, time between the incident and complete re-epithelialization, and 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 the Clinical Research Center of the Rothschild Foundation Hospital. Consent to participate in epidemiological studies was obtained orally. Statistical analysis was performed with the R software (The R Foundation), using χ² test or Fischer exact test. Differences are given with a 95% confidence interval.

Results

National Epidemiologic Data

Between April 1, 2020, and August 24, 2020, the proportion of calls to PCCs associated with chemical eye splatter in children was significantly lower compared with the same period in 2019: 2336 cases (2.2% of pediatric calls) in 2020 vs 2553 cases (4.2% of pediatric calls) in 2019 (difference, 2.0%; 95% CI, 1.9-2.2; P < .001). The proportion of ABHS eye exposures significantly increased from 1.3% in 2019 (33 cases, mean [SD] age, 3.4 [3.8] years) to 9.9% in 2020 (232 cases, mean [SD] age 4.5 [3.5] years) (difference, 8.6%; 95% CI, 7.4-9.9; P < .001). 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 (Figure 1). Most cases were of null or mild severity (n = 269; 97.8%), where the

Key Points

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

Findings In this national retrospective review from the French Poison Control Centers, a 7-fold increase of alcohol-based hand sanitizer-related ocular exposures in children was found 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 coronavirus disease 2019, these agents should be used with caution and likely kept away from young children.
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 August 24; 8.0% of eye exposure and 52.4% of ABHS). All cases were associated with ABHS devices made available to the public in the context of COVID-19 (automatic or foot-controlled dispensers).

Case Series
Between April 1, 2020, and August 24, 2020, 1657 children were admitted to the ophthalmology emergency department of our hospital, including 80 (5%) for a chemical eye splatter. During the same period in 2019, 98 cases of eye splatter were registered among 2469 pediatric consultations (4%). There was no difference between the 2 periods regarding the proportion of chemical eye exposures among total pediatric consultations (difference, 0.9%; 95% CI, −0.4 to 2.1; P = .18). In 2019, only 1 boy (aged 16 months) was admitted for an exposure to ABHS (1% of chemical eye exposures). Comparatively, 16 cases of ABHS eye splatter (10 boys, mean [SD] age, 3.5 [1.4] years) were admitted in 2020 (20% of chemical eye exposures; difference, 19%; 95% CI, 8.9-29.1; P < .001). Eight children had a corneal and/or conjunctival ulcer, involving more than 50% of the corneal surface for 6 of them. Two of these children (12%) required amniotic membrane transplant (AMT) with general anesthesia after a median time of 3 days of medical treatment, because of delayed re-epithelialization. One case required this procedure twice because of an incomplete re-epithelialization 10 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 widespread use of ABHS during the COVID-19 pandemic and led to a National Public Health alert. Using 2 complementary data sets, 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 was associated with an increasing number of freely available ABHS devices in public places.

The pediatric specificity of this outbreak is most likely owing 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 1 m in height, delivering ABHS at the level of small children’s eyes. In addition, the delay in washing the eyes owing 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 contains 80% ethanol or 75% isopropanol, 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. Moreover, other irritant additives, including hydrogen peroxide, polyethylene glycol (to increase viscosity), perfumes, or essential oils, may increase the ABHS ocular toxicity.

Limitations
This study is a French national retrospective review; thus, it may not reflect the epidemiology of other countries. More in-
ternational reports are needed to confirm the trend that we observed.

Conclusions

To maintain good public compliance with hand disinfection, these findings support that health authorities should ensure

ARTICLE INFORMATION

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

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REFERENCES


