

Research Paper: The Outcomes of Accidental Ingestion of Hand Sanitizer



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ABSTRACT

Background: children are exposed to numerous chemicals, such as hand sanitizers and their associated poisoning. Awareness of such poisoning symptoms and their management is critical for healthcare providers, as it can induce dangerous conditions. This study evaluated the clinical and paraclinical parameters of children who ingested hand sanitizers.

Methods: In the first 6 months of 2020, the cases of children who accidentally ingested hand sanitizer and were referred to Akbar Hospital in Mashhad City, Iran (Referral pediatric poisoning center) were evaluated in this cross-sectional study. The relevant medical information and laboratory parameters were recorded.

Results: In total, 20 patients were evaluated; of whom, 80% were male. The Mean±SD age of the study subjects was 4.9±4.2 years (2-15y). The ingestion was accidental in the study participants. The amount of ingestion approximately equaled a sip (3-7cc). All clinical and laboratory parameters were normal according to their age. Only 1(5%) case presented metabolic acidosis. No study subject manifested hypoglycemia or the loss of consciousness. Thus, they only received supportive care and were observed for ≥12 hours.

Conclusion: Based on the present study results and absence of symptoms in the explored cases of hand sanitizer ingestion, the suitability of hand sanitizer solutions. Therefore, the formulation of these products should be carefully evaluated.

1. Introduction

In the last months of 2019, the novel Coronavirus Disease 2019 (COVID-19) caused huge concerns worldwide. In few months, millions of individuals were infected with the coronavirus. Multiple preventive measures were

consequently recommended by specialists and governments. Among the most recommendations were hand hygiene and social distancing. Individuals were recommended to use hand sanitizers instead of handwashing if water and soap were unavailable. According to the World Health Organization (WHO), hand sanitizers, i.e., effective against the COVID-19 contain 60% etha-

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nol, 70% isopropyl, or 1.25% hydrogen peroxide [1-3]. Very soon, due to frequent use, poisoning with a different chemical substance that almost all are supposed to be alcohol-based (hand sanitizers) was increased [3]. Furthermore, children are exposed to different chemical substances poisoning. This is because they frequently attempt to discover new materials and phenomena due to their development stages and curiosity. For children, the main means of discovering and understanding the environment and materials is to put different materials in the mouth and eat. Therefore, children are in danger of different types of poisoning. Awareness of the epidemiologic characteristics of pediatric patients poisoned with hand sanitizers and related medical manifestations and their management is critical for healthcare providers. Therefore, this study evaluated the clinical and paraclinical parameters of 20 children who accidentally ingested hand sanitizers.

2. Materials and Methods

From March to August 2020, when the Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV2) infection was at its peak in Iran, 20 children (aged <15y) were identified who accidentally ingested hand sanitizer. This cross-sectional study was performed in the referral center for children poisoning in Akbar Hospital, Mashhad City, Iran. Akbar Hospital is a referral center for poisoned children in the northeast of Iran. We enrolled all pediatric patients whose parents or guardians reported the ingestion of hand sanitizers and were admitted to the hospital. The accurate amount of ingestion was unclear; however, it almost equaled one sip (3-7cc). According to the patients' caregivers' or parents' reports and the examined children's mean age, the type of ingestion was accidental or unsupervised. Their clinical manifestations were recorded. In all explored patients, we measured methanol levels by colorimetric method (semi-quantitative). We monitored all enrolled children in the Hospital for ≥ 12 hours.

3. Results

During the 6 months of our study (March to August), 20 patients were admitted to Akbar Hospital's emergency department for 24 hours. Most of them (80%) were male and aged in the range of 2-15 years (Mean \pm SD: 4.9 \pm 4.2). There were no cases of hypoglycemia and the loss of consciousness. Blood methanol levels were negative (<3 mg/dL) in the studied children. We evaluated them for gastrointestinal, respiratory manifestations, and any clinical abnormalities; the relevant data suggested no complaints in the study participants. Para-Clinical pa-

rameters were normal in all patients except 1(5%) with mild metabolic acidosis (Table 1).

4. Discussion

The WHO has approved 3 solutions for the prevention of COVID-19, as follows: ethanol at 60% or isopropyl at 70%, and hydrogen peroxide at 1.25% [3]. Each of these substances can cause dangerous symptoms if ingested by children, even in small amounts. Sometimes, other substances have been mistakenly used as hand sanitizers, including solutions containing methanol and benzalkonium chloride, sodium hypochlorite, and so on. The symptoms of intoxication with each of them are briefly mentioned as follows: Ethanol, in small doses, inhibits the function of the cortex of the brain. It may cause the loss of consciousness, hypoglycemia, hypothermia, dysrhythmia, and metabolic acidosis. In children, the symptoms of poisoning usually appear if the serum level is >50 mg/dL [1-5]. There may also be various dysrhythmias. There is usually a risk of hypoglycemia and sometimes seizure between 2 and 10 hours after consuming ethanol, especially in children [5-7].

Methanol, or methyl alcohol, or wood alcohol is the simplest type of alcohol. This toxic alcohol is rapidly absorbed through the digestive tract, skin, and respiration, and distributed in the body. The signs and symptoms of methanol poisoning include the following: severe metabolic acidosis, renal impairment, visual impairment, and even effects on the basal glial margin of the brain [8].

Isopropyl alcohol causes ketosis and is cardio-toxic. Furthermore, it can induce respiratory depression and the loss of consciousness [9]. Hydrogen Peroxide is a stimulant of the digestive mucosa. Oxygenated water, i.e., sold in pharmacies as dilute oxygenated water, is a solution of hydrogen peroxide in water; 3% of which is oxygenated water, it is colorless and odorless water, has a bitter taste, and is slightly acidic. This is a strong oxidizing liquid. It might cause symptoms similar to consuming a caustic substance [10].

Benzalkonium chloride is an organic salt, classified as a quaternary ammonium compound. It is also used in numerous consumer products, especially for antimicrobial activity. It is used in hand sanitizers. This substance used in a concentration above 0.1% irritates the skin and mucous membranes [11].

The present study recorded the clinical and paraclinical data of all children with a history of acute hand sanitizer ingestion, who was admitted to the hospital by parents

Table 1. The vital signs and test results of the explored children poisoned with hand sanitizer

Characteristics	Mean±SD	Healthy Range
Age (2-15) (y)	4.9±4.2	
Gender (male/female), number	4/1	
The duration of hospitalization, hours	48±0.5	
Respiratory rate/minute	24.2±4	18-35 according to the wide age range
Pulse rate/minute	85±10	70-90 according to the wide age range
Temperature (centigrade)	36.6-37.5	36-37
Blood glucose (mg/dL)	91±16.9	60-100
PH	7.37±0.04	7.35-7.45
HCO ₃ (meq/L)	21±1.8	22-26
PCO ₂ (mmHg)	35±5.5	38-42
Na (meq/L)	143±2.7	135-145
K (meq/L)	4.09±0.4	3.4-4.7

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or others. The precise ingredient and amount of ingested substance were unclear. This is because their labels were unclear; however, according to the suggested material for hand sanitizer and parents' history, all possible symptoms and signs and para-clinical parameters were evaluated.

The age range of the explored children was 2-15 years. However, there were only 4 cases aged over 7 years; most of the examined children aged under 7 years were completely exposed to the disinfectant by accident or due to the lack of supervision and easy access. Eighty percent of these children were male. Moreover, according to multiple sources, the percentage of male poisonings is usually slightly higher. Additionally, in the clinical and laboratory examination of the studied children, no pathological findings were found, except for one case of metabolic acidosis, i.e., unusual [6].

In the first half of 2020, the American Association of Poison Control Center reported 9504 cases of alcohol-based hand sanitizer exposure in children under 12 years of age. Accordingly, confusion, vomiting, and drowsiness can be caused by consuming small amounts of alcohol in children. In severe cases, it can cause respiratory arrest and death [12].

The current study data suggested no abnormal findings, except in one case with metabolic acidosis; however, some investigations indicated that ethanol poisoning in

children, even in small amounts (1 gr/kg), may generate symptoms, such as hypoventilation, the loss of consciousness, hypothermia, dysrhythmia, seizures, metabolic acidosis, vasodilation, and hypoglycemia [1-5].

We detected no progressive metabolic acidosis or the loss of consciousness, or renal dysfunction; these cases were reported in methanol and ethylene glycol poisoning patients. Methanol levels were also negative in all explored children [8].

Furthermore, the symptoms associated with digesting a caustic agent, such as hydrogen peroxide or benzalkonium chloride, including sialorrhea, restlessness, gastrointestinal intolerance, or the inflammation of the oral mucosa were not observed in our patients.

Childhood mortality of ethanol poisoning is rarely documented; a poor prognosis was noted in cases with symptomatic hypoglycemia, such as hypoglycemic seizure or coma [4]. Moreover, all studied patients were discharged from the hospital in good general conditions and we observed no death. In the present study, the exact amount of consumed sanitizer was not determined in history. Besides, it was often reported that the child consumed about one sip, i.e., approximately 3-7cc for children in the study age range.

During the study, the examined children's parents were requested to provide us with the container of the ingested solution. In about 70% of the research cases, it was a secondary container; in general, accurate information about the type or nature of the content was unavailable or inaccurate. In addition, there was no valid label. Therefore, the content of solutions, i.e., currently offered as a hand sanitizer in the market of Khorasan Razavi Province remains questionable.

The explored children were mostly asymptomatic during hospitalization; however, causing concern and imposing costs on the family and the treatment department needs to be considered as part of the adverse effects of sanitizer ingesting by children.

The number of cases was limited in this study; more extensive studies with a larger sample size are required, as a more complete laboratory study in this field. Moreover, blood ethanol levels could not be measured in the presented study site (Akbar Hospital). Thus, it is unclear the blood ethanol level concerned the solution ingested contained ethanol. Furthermore, we overlooked analyzing the contents of the hand sanitizer brought by the parents which may be the limitations of our study.

5. Conclusion

Awareness of the symptoms and management of children poisoning with hand sanitizer solutions is critical for healthcare providers; they may cause dangerous conditions, such as the loss of consciousness, hypoglycemia, hypothermia, hypotension, anxiety, and economic losses in the family. Additionally, based on this study results and the absence of major symptoms in the cases of hand sanitizer ingestion, the suitability of hand sanitizer solutions, i.e., currently offered in the market of Khorasan Razavi concerning formulation and concentration and associated additives as well as effectiveness against microbes, especially COVID-19 remain in doubt.

Ethical Considerations

Compliance with ethical guidelines

The informed consent of the participants, was done. Also there was the permission of the participants to cancel their participation.

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Author's contributions

Designing and writing the manuscript: Anahita Alizadeh; Drafting the manuscript: Nasrin Moazen; Concept mapping and data analysis: Nafiseh Pournadakhshan. The manuscript has been read and approved by all the authors.

Conflict of interest

The authors declared no conflict of interest.

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