BRIEF COMMUNICATION

SODIUM HYPOCHLORITE POISONING AT THE UNIVERSITY OF GONDAR TEACHING HOSPITAL, NORTHWEST ETHIOPIA

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ABSTRACT

***Background**: Sodium hypochlorite (berekina in Amharic) is a transparent yellow solution which is liquid at room temperature. It is commonly found in bleach, water purifiers, and cleaning products. Accidental poisoning with detergents can pose a significant health risk. This is the first study on the incidence of sodium hypochlorite poisoning in Ethiopia as there has been no such report so far to the best of my knowledge. This study, I hope, will fill the gap of understanding and show the incidence, factors, and the management of such poisoning at the University of Gondar Teaching Hospital, northwest Ethiopia.*
***Methods**: This is a retrospective study of all sodium hypochlorite poisoning cases admitted and managed in the Emergency Department of the University of Gondar Hospital, from 2010 to 2014. Data was analyzed using SPSS 20.*
***Result**: Sodium hypochlorite poisoning accounted for 40.6% of all poisoning seen in the emergency room. Out of the 95 cases studied, 63 (66.32 %) consisted of women. The male to female ratio was 1:1.97. The majority of these patients, (52.63%) were in the 20-29 years of age category, and the number cases dropped as age increased. The study showed that 86 (90.53 %) of the cases were suicidal acts, whereby sodium hypochlorite was intentionally consumed. Only 9 (9.47 %) of the cases happened unintentionally. In 78.95% of the cases the poison was obtained from the patients houses exacerbated due to improper storage, owing to lack of awareness of their hazards. The other 15.79% of the poison was procured from stores, and the remaining 5.26% from unrecorded sources.*
***Conclusion**: The majority of the adult cases of sodium hypochlorite poisoning were intentional suicide attempts. Youth education regarding the risk of intentional poisoning, increasing awareness about safety requirements inside the home may be useful to reduce the incidence of poisoning. The development of practice by setting guidelines or increasing awareness relating to prescriptions regarding the management of sodium hypochlorite poisoning is also recommended.*

***Key words:** detergent, emergency, intentional, poisoning, sodium hypochlorite, suicide, unintentional, young*

INTRODUCTION

Paracelsus states, “All things are poisons and nothing is without poison; only the dose permits something not to be poisonous” (1). Poisoning was the leading cause of unnatural deaths and the third leading cause of hospital admission in India(2). Sodium hypochlorite, NaOC1 (also known as bleach, berekina in Amharic) is a transparent yellow solution liquid at room temperature commonly found in bleach, water purifiers, and cleaning products (3). It is an inorganic oxidizing substance effectively used as a disinfectant and bleaching agent for more than 100 years(4). It was first used as an antiseptic solution by Henry Dakin in 1915 (during the 1st World War(5). The World Health Organization’s (WHO) systematic review found that among all water quality interventions, household-based chlorination is the most cost-effective (6) and continues to be used around the world(7). Sodium hypochlorite solutions are cheap, easily available, and demonstrate good shelf life (8).

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Household water treatment using sodium hypochlorite has been recognized as a cost-effective means of reducing the burden of diarrhea and other waterborne diseases, especially among people in developing countries without access to improved water supplies(9).

Even though the concentration found in the solution used for washing and antiseptic solution is low, the consumption of excessive volumes may lead to organ toxicity. It is effective against a broad array of bacteria, spores, viruses, and fungi, and was widely used in this study area for cleansing, sanitizing, and disinfecting hard surfaces, towels, and clothes. It can be used in hot, cold, and hard water conditions. Although it is a common household bleaching agent, even small amounts may cause severe damages(10).

Accidental ingestion or dermal contact can pose a significant risk, but the majority of the affected individuals have minimal or no side effects (11). When it comes into contact with the tissue, it causes hemolysis and ulceration, inhibiting neutrophil migration and damaging endothelial and fibroblast cells (12). Individuals inappropriately exposed to sodium hypochlorite should receive emergency interventions which include removing the bleaching solution from the skin by flooding with water, removing swallowed bleaching solution by gastric lavage or emesis induction using a solution of sodium bicarbonate or milk (13).

Since there has been no study on the incidence of sodium hypochlorite poisoning in Ethiopia, the aim of the present study was to assess the incidence, associated factors, and the management of sodium hypochlorite poisoning at the University of Gondar Teaching Hospital, northwest Ethiopia.

METHOD

This was a retrospective study of all the sodium hypochlorite poisoning cases admitted and managed in the Emergency Department of the University of Gondar Hospital between 2010 and 2014. The hospital serves a population of more than 5 million and has a capacity of 1000 beds. Data were collected by chart review. Documents related to poisoning cases during the study period were sorted out and a questionnaire was completed. The key information included in the pre-structured format was gender, age, season, time of ingestion, causes of poisoning, types of poisons, poisoning route, patient status, treatment, and duration of hospital stay, and outcome of the treatment. Cases which were doubtful in terms of patient registration were excluded. Data were analyzed using SPSS 20.

Ethical Clearance: Ethical clearance was provided by the University of Gondar College of Medicine and Health Science Ethical Review Committee and permission to conduct the study at the hospital was provided by the Hospital Administration Office.

RESULT

During the study, 30,154 patients attended the Emergency Department of the University of Gondar. Of those, 234 were poisoning cases 130 of which were due to sodium hypochlorite poisoning; 95 (40.6%) of these had complete data to be included in the final analysis. The distribution of the cases with regard to sociodemographic characteristics was presented in Table 1. Out of 95 cases, 63 (66.32 %) were women with a male to female ratio of 1:1.97. The mean age

of the patients was 19.95 with a standard deviation of 7.73. The minimum age was 3months and the maximum was 50. The majority of the patients (52.63%) were between 20-29 years of age, followed by 34.71% who were 10-19. At above 30years of age, the risk tended to decrease with the geriatric age group (>=50 years), showing the least vulnerability (1.1%). Regarding their household location, 83.16% were urban (table 1).

Table 1: Sociodemographic characteristics of patients poisoned by sodium hypochlorite at the University of Gondar Teaching Hospital (N=95)

Age in	**Gender** Fre.(%)		
years	F	M	Total
<10	4(4.2)	4(4.2)	8(8.4)
10-19	26(27.34)	7(7.37)	33(34.71)
20-29	32(33.68)	18(18.95)	50(52.63)
30-39	0	3(3.16)	3(3.16)
>=50	1(1.1)	0	1(1.1)
Total	63(66.32)	32(33.68)	95(100)
Residents			
Urban	55(87.3)	24(75)	79(83.16)
Rural	8(12.7)	8(25)	16(16.84)
Total	63(100)	32(100)	95(100)

For 86 (90.53 %) of all the cases ingestions were suicidal acts. Only 9 %(9.47) of the cases were thought to have unintentionally committed ingestions, and the majority of these were in the pediatric age groups. At the time of admission, 70.53 % and 29.47% of the patients were conscious and unconscious, respectively. Liquid was the most common (90.6%) form of poison followed by inhalational (8.4%) and dermal (1%) contact. Oral ingestion was the most preferred (100%) route of administration of the poisoning agents. The most common source of poison (78.95%) was the home. Approximately, 16% of the product (15.79%) was bought from stores. The remaining 5.26% had no source recorded.

The time lapse between poison ingestion and the start of treatment varied from 13 minutes to 18 hours. The majority (60%) of the cases reached the hospital within 2 hours, with a mean time interval of 2.85 hours (Figure 1).

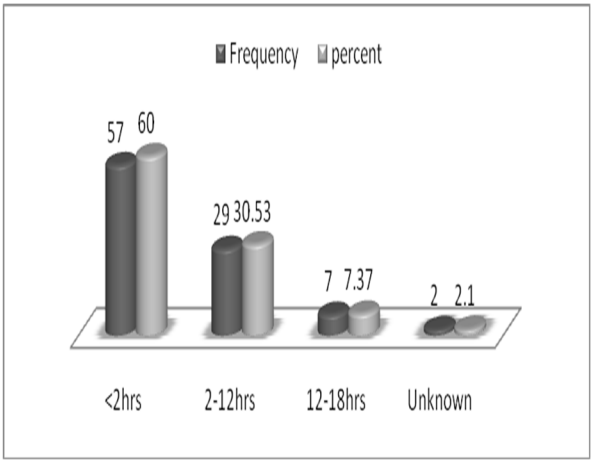

Figure1: *Time lapse of sodium hypochlorite poison at the University of Gondar Teaching Hospital (N=95)*

Clinicians in the study area used antacids (AL (OH)$_3$), omeprazole, and cimetidine in most cases (80%). In 16.84% of cases, gastric lavage was used for the treatment of sodium hypochlorite poisonings (Table 2). Only 2.1% of poisoned patients were linked with psychiatry clinics. The mean hospital stay was 1.04days (Table 2). No death was reported during the study. The yearly and monthly breakdowns of 95 sodium hypochlorite poisoning cases are shown in Figs. 2 and 3. The largest group of cases, (32.6%), fell between the months of December and February, the winter season in Ethiopia. In the present study, family problems were the leading cause of intentional poisoning, accounting for 60% (Table 2).

Table2: Factors contributing to poisoning, treatment and duration of hospital stay for patients poisoned by sodium hypochlorite at the University of Gondar Teaching Hospital (N=95)

Reasoning for poisoning	**Fre.(%)**
Quarrel with family member	57(60)
Love affairs	25(26.32)
Unemployment	3(3.16)
Psychiatric disorder	3(3.16)
Unknown	7(7.36)
Treatment	
Gastric lavage	16(16.84)
Activated charcoal	9(9.48)
Milk	5(5.26)
Antacid	50(52.63)
Antiemetic	5(5.26)
Combinations of the above methods	10(10.53)
Duration of hospital stay	
1-2day	78(82.11)
>2day	15(15.79)
disappear	2(2.1)

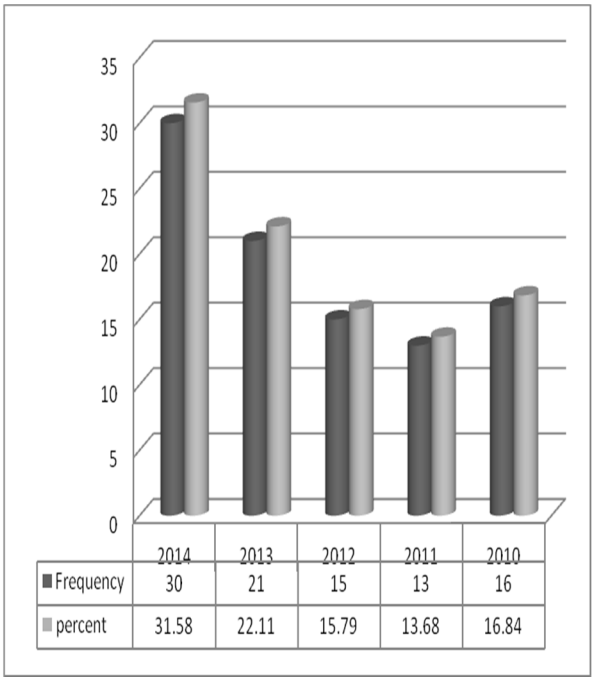

Figure2: *Yearly distribution of sodium hypochlorite poisoning cases at the University of Gondar Teaching Hospital (N=95)*

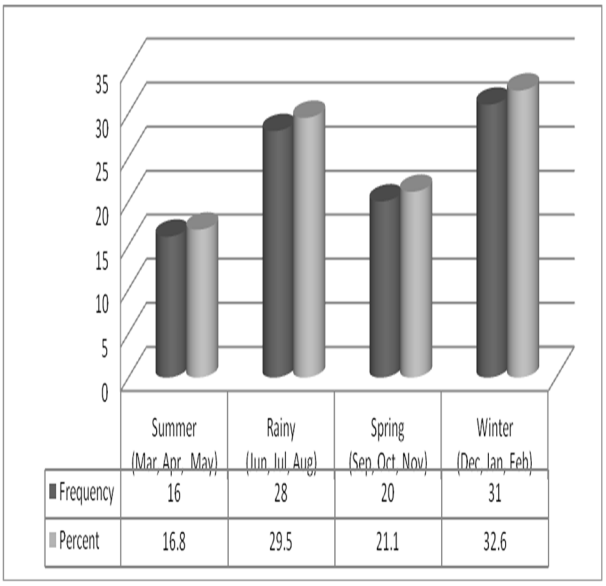

Figure 3: Seasonal distribution of sodium hypochlorite poisoning cases at the University of Gondar Teaching Hospital (N=95)

DISCUSSION

Sodium hypochlorite, one of the most common caustic substances, accounts for 0.32% of the emergency room admissions. A 15 year retrospective study of ingestion of caustic substances by Arévalo-Silva et.al noted that 26% of the ingestions were of chlorite solution out of a total of 50 cases (14).

Poisons may be classified into (three groups) domestic household, medicinal household, and garden poisons. Sodium hypochlorite is considered as a domestic household poison and is often used as antiseptic solution for washing clothes, floors, and latrines(2). Sodium hypochlorite, which is in either powder, tablet, or liquid form is widely used in the study area due to its low price and easy availability. Unfortunately, this makes it readily accessible as a means of selfharm and puts individuals, especially children, at risk of accidental exposure. The current study noted

that the majority of the cases were from urban areas, most likely due to increased accessibility. Most of the victims were in the 10-29 years of age group which is similar to the reports of other studies (15). This group is so active physically, mentally, and socially that individuals are prone to stressors which may lead to the conviction that poison terminates life with little suffering and expose themselves to a marked rate of suicidal actions (16). In the present study, 90.53% of the cases ingested the chemical as a suicide attempt which was consistent with findings of other studies (17).

The study revealed that more cases (32.6%) occurred during winter. It has been suggested that the attempts are related to students' getting their first semester results from universities, colleges, and high schools (18); the season is also characterized by the celebrations of religious holidays for the majority of the people of the country. It is during these times that there is more use of the chemical for cleaning of clothes, floors, and latrines making the product more widely accessible. The reason behind the high incidence of poisoning in the study area from year to year is related to the accessibility of the chemicals along with urbanization which is directly associated with the utilization of the chemicals for washing and cleaning.

Most of (66.32%) of the poisoning cases in the present study were seen among women in concordance with other reported results (19). The reason might be family conflicts and social problems. The most common (78.95%) source of the chemicals was the home, depending upon the manner they are stored, which is often improper owing to lack of awareness of their hazards.

The mean time it takes from the poisoning point to arrival at the hospital is very important for decreasing mortality (20). In our study, the vast majority of cases arrived within 12 hours of ingestion, which likely contributed to no death reports (Figure 1). The other reason for the absence of casualties was the low (5%) concentration of the chlorine available in the study area.

Ingestion is the most frequent route of exposure(21), which is likely due to the availability of preparations in liquid forms for different purposes and, the ease of administration and the possibility to administer it without the aid of trained professionals.

Most patients in this study ingested sodium hypochlorite for the purpose of selfharm. Our finding was similar to rates reported by Vijayanath et.al, 2012 (22). However, in the study performed by Arévalo-Silva, ingestion was accidental in the majority (67%) of cases and was consumed only in a suicide attempt in 33% of the time (14).

As far as the medical management of these poisoning cases is considered, gastric lavage is not recommended. In addition, it is against best medical practice to induce emesis or offer activated charcoal(23), due to the risk of vomiting at re-exposure of the oral or esophageal mucosa to the offending substance. This risk worsening the injury or esophageal perforation. Activated charcoal is relatively contraindicated in caustic ingestions because of poor adsorption and endoscopic interference. Unfortunately, in the present study 30(31.6%) patients received gastric lavage and charcoal which suggests that education around best treatment practices should be improved. If we administer small amounts of diluents as soon as possible after a solid or granular alkaline ingestion, it is

helps to remove particles that adhere to the oral or esophageal mucosa(24). The most common recommended management principles for sodium hypochlorite poisoning in ingestion form is supportive care (ABC), dilutant with 4 to 8 ounces of milk or water if the patient is conscious(25).

CONCLUSION

The majority of adult sodium hypochlorite poisoning cases in Gondar, Ethiopia, are the result of intentional ingestion as parts of suicide attempts. This suggests that Ethiopia could work to improve awareness about safety requirements inside homes, especially with young children, or young adults who may be susceptible to intentional or unintentional ingestions. Toxicology screening tests are recommended at hospitals for a proper identification of the type and level of poisonous substances that lead to early and proper management of these cases.

As we have seen, adequate information in the charts of patients and improving medical record-keeping are also suggested for better information access and to improve epidemiological datasets. The development of practice setting guidelines or increased awareness relating to timely prescribing regarding the management of sodium hypochlorite poisoning is also recommended.

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