

# Epidemiological Profile and Management Outcome of Sodium Hypochlorite (NaOCl) Ingestion admitted at Northern Mindanao Medical Center from January 2015 to December 2018\*

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## ABSTRACT

**Background:** Caustic ingestion is a major public health problem worldwide [1]. It imposes huge economic burden in terms of medical cost to poorly resourced health system of developing countries [2]. Household cleaning products, such as sodium hypochlorite (NaOCl), are the most common cause of caustic exposure [3]. NaOCl ingestion consistently ranks second in caustic ingestion cases in Northern Mindanao Medical Center (NMMC) based on toxicology census from 2015 to 2018. The aim of this study is to determine the epidemiologic profile, clinical findings and outcome of admitted patients who ingested NaOCl.

**Methods:** This a single-center descriptive, cross-sectional study of 40 cases of sodium hypochlorite ingestion admitted at NMMC from January 2015 to December 2018.

**Results:** There were a total of 17 males and 23 females. Majority of patients were 0-5 years of age (46.5%; mean age of 2), followed by age range of 18-64 years old (40.0%; mean age of 35). Twenty-nine cases (72.5%) cases of NaOCl ingestion were accidental and the remaining 11 (27.5%) were non-accidental. The non-accidental cases belong to the 12-17 (mean age 15.3) and 18-64 (mean age 31) years old age groups at 33.3% and 66.7%, respectively, with prevalence in females at 81.8%. Non-accidental cases increase with age, and among females. Majority of all ingested less than 50 mL of NaOCl. Two non-accidental cases (18.2%) ingested more than 100 mL of NaOCl were observed to have more than 2 signs and symptoms. Majority of patients presented with vomiting. Greater portion of non-accidental cases complained of abdominal or epigastric pain (54.5% vs 10%), oropharyngeal erythema (9.1% vs 6.9), and odynophagia (45.5% vs 0). None of the patients had serious signs and symptoms. All patients were discharged improved and without sequelae.

**Conclusion:** Most NaOCl cases were accidental especially in children. Non-accidental cases increase significantly with age, with most cases found among adolescents and young adults, with higher prevalence among females. Majority of patients only ingested less than 50 mL, and that ingestion of 100 mL or more of NaOCl is associated with more than 2 signs and symptoms. The most predominant symptom is vomiting. Greater portion of non-accidental cases complained of abdominal or epigastric pain and odynophagia. None of the patients exhibit severe signs and symptoms. This study showed that all 40 cases of sodium hypochlorite ingestion did not have sequelae upon discharge.

**Keywords:** sodium hypochlorite, bleach, caustic ingestion

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*Disclosures: The author has formally acknowledged and signed a disclosure affirming the absence of any financial or other relationships (including personal connections), intellectual biases, political or religious affiliations, and institutional ties that could potentially result in a conflict of interest.*

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## INTRODUCTION

Caustic ingestion is a major public health problem worldwide [1]. Among other causes of acute poisoning referred to the Philippines National Poison Management and Control Center, ingestion of caustic substances is the main reason accounting to 23% of 500 poisoned each year [2]. Caustic ingestion imposes huge economic burden in terms of medical cost to poorly resourced health system of developing countries [1]. Household cleaning products are the most common cause of caustic exposure [3]. According to studies, household bleach, which the active ingredient is sodium hypochlorite (NaOCl), is the most commonly ingested agent in pediatric population [4]. The same is observed in studies involving adult population, and across age groups [1, 3]. Ingestion of NaOCl bleach usually results in benign clinical course [5]. Earlier literature recommends immediate endoscopic evaluation of all patients with alleged caustic ingestion. As of late, this blanket recommendation has been questioned by various investigators [6].

## OBJECTIVES

**General Objective:** To determine the epidemiological profile, clinical presentation, and management outcome of sodium hypochlorite (NaOCl) ingestion cases admitted at NMMC from January 2015 to December 2018.

### Specific Objectives:

- 1.) To describe the sociodemographic profile of NaOCl ingestion cases in terms of age, sex, place of origin.
- 2.) To describe the toxicology profile in terms of manner of incident (accidental, non-accidental), place of incidence (house, workplace), volume ingested, and time passed from ingestion to hospital presentation.
- 3.) To identify the presenting symptoms and physical examination following NaOCl ingestion.

- 4.) To describe the clinical outcome of admitted NaOCl ingestion cases prior to hospital discharge.
- 5.) To establish the relationship of toxicology profile and clinical outcome.
- 6.) To establish the relationship of presenting symptoms, physical examination, and clinical outcome.

## MATERIALS AND METHODS

### Research Design

A single-center descriptive, cross-sectional study was conducted to determine the epidemiologic, clinical profile, and management outcome of NaOCl ingestion cases. Data collection method was done through review of records.

### Research Population

All NaOCl ingestion cases referred to Toxicology for co-management from the department of Internal Medicine and Pediatric from January 1, 2015 to December 31, 2018 in NMMC were included in the study.

**Inclusion Criteria:** All NaOCl ingestion patients' charts documented in the line list of the Hospital Operations and Management Information System (HOMIS) from January 1, 2015 to December 31, 2018 were included. These were patients from Pediatrics, Internal Medicine, and Family Medicine (Toxicology Unit) patients, managed and/or co-managed.

**Exclusion Criteria:** All NaOCl ingestion patients' data documented with concomitant intake of other substances such as medications, alcohol, and other substances were excluded.

### Instrumentation

Data were collected by the primary investigator through review of records using an abstraction form (Appendix A) which is the data collection form.

### **Data Collection and Management**

A letter was sent to the Data Privacy officer and to Health Information Management Service for permission for chart retrieval after obtaining approval from the Research Ethics Board of NMMC. A line list of NaOCl ingestion cases from January 1, 2015 to December 31, 2018 was secured from the Hospital Information Management System (HIMS). In consonance with the Data Privacy Act of 2012, all patients' data were anonymized using generated codes for each patient.

### **Data Analysis**

All data were analyzed using descriptive statistics. Values were expressed as mean, frequency, and percentage, as appropriate. The relationship of demographic profile and toxicology profile was established using the logistic regression utilizing DATatab statistics calculator [7].

## **RESULTS**

A total of 40 patient records were retrieved from the line list in compliance to the inclusion and exclusion criteria. There were 23 females (57.5%) and 17 males (42.5%) (Appendix B). Majority of patients were 0-5 years of age (19; 46.5%; mean age of 2), followed by age range of 18-64 years old (16; 40.0%; mean age of 35). Most patients (35; 87.5%) were from the province of Misamis Oriental which is the nearest locality served by the hospital.

Almost all of the incidents occurred at home (97.5%), with only 1 case occurred in workplace (2.5%) (Appendix C). Most of the patients (37; 92.5%) came in the emergency room less than 12 hours post ingestion (2.4 hours average time), 3 cases arrived more than 12 hours (22.3 hours average time), and none presented more than 48 hours. Majority of the cases (29; 72.5%) were accidental and the remaining 11 (27.5%) were non-accidental. All children 0-5 years experienced accidental ingestion. The non-accidental cases belong to the 12-17 (mean age 15.3) and 18-64 (mean age 31) years old age groups at 33.3% and 66.7%, respectively, with prevalence in females at

81.8%. Using the DATatab logistic regression tool [17], non-accidental cases increase significantly with age (Table 1). In addition, among the non-accidental cases, there were more females (Table 2), than males (Table 3).

Twenty-eight of the 29 accidental cases (96.5%) and 8 of the 11 non-accidental cases (2.7%) ingested less than 50 mL of NaOCl (average volumes of 14 mL and 27.5 mL, respectively) (Appendix C). One accidental (3.4%) and one non-accidental (9.1%) ingested approximately 50 mL. Two non-accidental cases (18.2%) ingested more than 100 mL of NaOCl (162.5 mL average volume) and were observed to have more than 2 signs and symptoms (Appendix D). Majority of the accidental (23; 79.3%) and non-accidental (9; 81.8%) cases presented with vomiting (Appendix E). Greater portion of non-accidental cases complained of abdominal or epigastric pain (6; 54.5%), and oropharyngeal erythema (1; 9.1%) compared to accidental cases (abdominal or epigastric pain: 3 (10%), and oropharyngeal erythema 2 (6.9%)). Odynophagia was reported in 5 cases of accidental ingestion and none non-accidental case. All 4 asymptomatic cases were accidental. None of the patients had serious signs and symptoms such as retrosternal pain, spitting of blood, hematemesis, oropharyngeal lesions or abdominal tenderness. All patients were discharged improved and without sequelae (Tables F-H).

Among all the patients, only one went through EGD. This is a non-accidental case of 16-year-old female, who arrived at the emergency 2 hours after ingesting about 125 mL of NaOCl, and presented with symptoms of vomiting and odynophagia. EGD showed normal mucosa (Zargar Grade 0) of the esophagus and duodenum but there was a diffuse erythema and edema of the stomach (Zargar Grade I). The patient was discharged uneventfully.

**Table 1. Output of the regression model in non-accidental cases in age.**

	Coefficient B	Standard error	z	95% conf. interval
<b>Constant</b>	<b>-2.23</b>	<b>0.66</b>	<b>3.38</b>	<b>0.03 - 0.39</b>
<b>Age (year)</b>	<b>0.07</b>	<b>0.03</b>	<b>2.71</b>	<b>1.02 - 1.13</b>

Notes: dependent variable: manner of incident (accidental, non-accidental); independent variable: age; model for the prediction: non-accidental cases

**Table 2. Output of the regression model in non-accidental cases in females.**

	Coefficient B	Standard error	z	95% conf. interval
<b>Constant</b>	<b>-2.59</b>	<b>0.83</b>	<b>3.13</b>	<b>0.01 - 0.38</b>
<b>Sex Female</b>	<b>0.87</b>	<b>0.98</b>	<b>0.89</b>	<b>0.35 - 16.34</b>
<b>Age (year)</b>	<b>0.06</b>	<b>0.03</b>	<b>2.07</b>	<b>1 - 1.12</b>

Notes: dependent variable: manner of incident (accidental, non-accidental); independent variable: sex, age; reference category: male; model for the prediction: non-accidental cases

**Table 3. Output of the regression model in non-accidental cases in males.**

	Coefficient B	Standard error	z	95% conf. interval
<b>Constant</b>	<b>-1.72</b>	<b>0.83</b>	<b>2.06</b>	<b>0.04 - 0.92</b>
<b>Sex Male</b>	<b>-0.87</b>	<b>0.98</b>	<b>0.89</b>	<b>0.06 - 2.87</b>
<b>Age (year)</b>	<b>0.06</b>	<b>0.03</b>	<b>2.07</b>	<b>1 - 1.12</b>

Notes: dependent variable: manner of incident (accidental, non-accidental); independent variable: sex, age; reference category: female; model for the prediction: non-accidental cases

## DISCUSSION

Caustic ingestion is a public health problem worldwide [1]. It is more common in the developing countries, but still observed in the developed countries. Recent medical literature shows that caustic ingestion is seen in every age group, and may be either accidental or intentional. In a 4-year retrospective study by Khorasani A.G., et al (2017) [5], majority (89.2%) of their 65 patients accidentally ingested NaOCl and only 10.5%

intended to suicide. The same scenario was observed in our case where majority of the cases were accidental. Study done by of Batac-Dizon, et al (2013) [8] in the Philippine General Hospital of 320 cases of caustic ingestion among patients less than 19 years old showed that majority of the accidental cases (130 patients, 84%) were below 6 years old, which is in accordance to our results. Non-accidental corrosive substance ingestion was shown to be more prevalent in females at 56.2% in a study by Akuzu M. Z., et al (2019) [3]. The same trend was observed in our study. The most common reported symptom after NaOCl ingestion according to Khorasani A.G., et al (2017) was dysphagia (27 patients, 41.5%) followed by nausea and vomiting (20 patients, 30.8%) in 65 samples. In a 4-year retrospective study by Nikpour S., et al (2017), 54 cases of NaOCl ingestion were identified. About 33% (18) of patients were asymptomatic and the rest presented with mouth burning, drooling, dysphagia, dyspnea, and retrosternal pain. In our case, the most common symptom was vomiting and abdominal or epigastric pain and odynophagia were more common in accidental cases, and none presented with severe signs and symptoms.

Ingestion of caustic substances induce damage to the esophagus and stomach that widely vary from mild esophagitis and gastritis to necrosis and perforation [9]. Esophagogastroduodenoscopy (EGD) is the most efficient tool for evaluating the mucosal integrity of the upper gastrointestinal tract after caustic ingestion [6]. The severeness of injury depends several aspects such as concentration of the substance, amount ingested, duration of contact with the mucosa, and the pH of the agent. Substances with pH of less than 2 or greater than 12 are extremely corrosive and can cause severe injury and burns in the upper gastrointestinal tract. Household bleach is a solution containing 1-6% NaOCl and when ingested rarely penetrate deep enough to damage the submucosa or muscularis

propria and usually results in benign clinical course [4, 5]. Study by Lamireau, et al (1995) [10] in 85 children who accidentally ingested caustic ingestion showed ingestion of NaOCl rarely resulted to severe lesions on EGD. Similarly, in 54 studied cases in the study by Nikpour, et al (2017) [8] showed NaOCl ingestion only resulted to normal or low-grade lesions in EGD: 51 (94.4%) had normal findings, 2 (3.7%) had Zargar I lesion (edema and erythema of the mucosa), and 1 (1.8%) Zargar IIA lesion (blisters, superficial ulcers) in the esophagus; 34 (63%) had normal findings and 20 had Zargar I lesion in the stomach; and 53 (98.1%) had normal findings and 1 (1.9%) had Zargar I lesion in the duodenum. They concluded that ingestion of NaOCl is not associated with high-grade lesions and that decision for endoscopy is based on severe signs and symptoms such as dysphonia, dyspnea, abdominal guarding, drooling, and mouth burns. Likewise, study by Akkuzu, et la (2019) [3] on corrosive ingestion showed that among 25 patients who ingested NaOCl only 4 patients (16%) had lesions limited to mucosal folds and no larger than 5mm in the esophagus, while others had normal EGD findings. The study concluded that endoscopic evaluation is not necessary in asymptomatic or mild cases of NaOCl ingestion. In our case, the one patient who underwent EGD had low-grade lesions and was discharged without sequelae.

## **CONCLUSION**

Almost all sodium hypochlorite ingestion occurred at home (97.5%). Most of the cases (72.5%) were accidental especially in children. Non-accidental cases increase significantly with age, with most cases found in the adolescents and young adults 33.3% and 66.7%, respectively, with higher prevalence among females. Most of the patients arrived at the hospital less than 12 hours post ingestion (2.4 hours average time). Majority of patients only ingested less than 50 mL, and that ingestion of 100 mL or more of NaOCl is associated with more than 2 signs and symptoms. The most

frequent symptom is vomiting. Large part of the non-accidental cases complained of abdominal or epigastric pain (54.5% vs 10%), oropharyngeal erythema (9.1 % vs 6.9), and odynophagia (45.5% vs 0). All 4 asymptomatic were accidental cases. None of the patients presented with severe signs and symptoms such as retrosternal pain, spitting of blood, hematemesis, oropharyngeal lesions or abdominal tenderness. All patients were discharged improved and without sequelae regardless of the manner of incident (accidental or non-accidental), volume ingested, or time elapsed from time of ingestion to arrival at the hospital. The extent of tissue damage depends upon the chemical nature of the caustic agent, with pH less than 2 and more than 12 being extremely corrosive and cause severe tissue damage. Household NaOCl is a stable base with pH of approximately 11 which may explain the favorable outcome. Nikpour, et al (2017) [8] suggested that further diagnostic examinations, including endoscopy, should be considered on the development of severe clinical manifestations such as dyspnea, drooling, abdominal guarding, and mouth ulcers.

## **LIMITATIONS**

Relationship between signs and symptoms and EGD findings were not included in this research due to inadequate population sample who underwent EGD in the specified study time frame.

## **RECOMMENDATION**

The researcher recommends to include in future studies adequate number of endoscopic findings in order to correlate it substantially to the clinical manifestation. Since most cases of NaOCl ingestion were accidental, it is suggested to include in the chart documentation the container of the chemical such as if it is in its original container or inside a water bottle, and the storage area namely in the toilet, sink, or laundry area in the promotion of safety awareness in handling and keeping of caustic chemicals.

For the improvement of the conduct of research, the following are the recommendations:

- 1.) Better research designs such as cross-sectional analytic, a case-control study design or a prospective cohort may be done in establishing the relationship of exposure to outcome variable.
- 2.) Longer study duration to establish a database of caustic ingestion cases can be established.
- 3.) For data collection concerns in the hospital, it is recommended by the proponents of this study that dedicated personnel be assigned in the retrieval of patients' charts ensuring that the identified line list of patients is included in the study.

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