

# **PATTERN OF ACUTE CORROSIVES POISONING AT POISONING CONTROL UNIT: A ONE YEAR RETROSPECTIVE CLINICAL STUDY.**

By

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## **Abstract**

**Introduction:** Acute corrosive poisoning is considered a major problem in clinical toxicology all over the world including Egypt as a result of their availability and easy accessibility. **Aim of the work:** To study and evaluate the hazardous effects of corrosive substances through retrospective study of the acute corrosive poisoning. **Materials and methods:** All acute corrosive poisoned patients who are admitted to Benha Poisoning Control Unit, Benha University Hospitals, Egypt, from 1<sup>st</sup> February 2018 to 31<sup>th</sup> January 2019 were included in the study. All demographic and clinical data were collected and analyzed. **Results:** Out of 2570 intoxicated cases, 245 cases (9.5%) were due to corrosives exposure, 67.8% were below the age of ten, 61.2% were males , 77.1% were unmarried and 58% came from rural areas. The majority of intoxication were during summer months (48.2%), and 54.3% of intoxicated patients were at home. The way of intoxication was mainly accidental (82.9%) and by oral way (90.6%). The most common causative agent was sodium hypochlorite (60.8%), followed by phenol (23.7%) and caustic potash (Potassium hydroxide) (15.5%). Commonly observed symptoms were GIT with respiratory manifestations (58.8%), respiratory manifestations (32.7%), dermal manifestation (7.3%) and CNS manifestations (0.8%). About 52% of patients were treated symptomatically: 32.6 % with oxygen, 10.2% treated by dermal decontamination and 4.5% with GIT decontamination. Most of cases (78 %) were improved and discharged, 18.4% referred for endoscopy and 3.7% discharged against medical advice. **Conclusion:** Acute corrosives poisoning

was mainly accidental toxic issue in Egypt among rural male children below 10 years old. Sodium hypochlorite found to be the commonest corrosive agent used and commonly observed symptoms were GIT with respiratory manifestations most of patients were treated symptomatically and most of them improved and discharged.

**Keywords:** Corrosives, Gastrointestinal and respiratory manifestations, Retrospective study, Poison control center and Benha.

### **Introduction**

Worldwide acute poisoning is considered as one of the most important causes of admission to Poison Control Center. Knowing the epidemiological characters is very important in putting the successful preventive measures and has great importance in prognosis of the outcome of the poisoning (Alazab et al., 2013). Also, poisoning needs the use of hospitals and poor health resources in developing countries which affects their economy; and can be decreased by early diagnosis and treatment (Ahuja et al., 2015).

Acute corrosive toxicity is considered a serious problem worldwide. Every year about five thousand to fifteen thousand cases of corrosive poisoning are registered in the USA (Park, 2014; Rollin et al., 2015). In Egypt, it had been reported that corrosives were responsible for about 58% of toxicity in children in the Middle Delta Poison Control Center (Sobeeh et al., 2018).

Also Kandeel and EL-Farouny (2017) found that 30% of cases of toxicity were due to corrosives in Menoufia Poison Control Center (MPCC) During the Year (2016). Corrosives are defined as any substances which can cause chemical destruction once they come in contact with body tissues like eye, skin, GIT or respiratory system (Radenkova-Saeva et al., 2016). Acids corrosives, change the tissue proteins to acid proteins and hemoglobin to hematine resulting in coagulative necrosis while alkalis, change the tissue proteins to proteinate and fats to soaps, leading to penetration and liquefactive necrosis (Chen et al., 2018). The degree of corrosive injuries depends on the time of contact, type, concentration or amount of the corrosive material used (Vezakis et al., 2016).

Corrosive exposure leads to dermal manifestations as intense pain, blistering with ulceration in tissues they come in contact with while inhalation may cause inflammation in the throat,

cough, chest crepitation or other respiratory system affection. Ingestion results in intense pain, burns in mouth and pharynx, vomiting, dysphagia and drooling of saliva; in severe cases, oesophageal or gastric perforation may occur resulting in shock and death (Dargan, 2016).

Generally, treatment of corrosives is conservative in case of minor complications while cases with life threatening complications need surgical treatment (Zargar et al., 1991; Ramasamy and Gumaste, 2003). The decision needs multiple specialists and depending on the severity of corrosive injuries, complications and the patient condition (Chibishev et al., 2012).

Although poisoning with household materials, including corrosive substances, is widespread and its consequences are severe, studies and researches about this topic are unfortunately few (Balme et al., 2012 and Cantrell et al., 2013).

### **Aim of work**

To study and evaluate the hazardous effects of corrosives substances through retrospective study of the acute corrosive poisoning.

### **Materials and methods**

**Study design:** This is a retrospective cross-sectional study.

**Place and duration of the study:** This study was conducted at Benha Poisoning Control Unit (BPCU), Benha University Hospitals, Egypt, from 1<sup>st</sup> February 2018 to 31<sup>th</sup> January 2019.

**Study sample:** The medical records of all patients with acute corrosives poisoning admitted to Benha Poisoning Control Unit (BPCU), Benha University Hospitals, Egypt; were studied. Out of 2570 intoxicated cases, 245 (9.5%) were corrosive intoxicated patients. Inclusion criteria included all records of corrosives cases admitted to the hospital during the study period.

**Study methods:** All data were collected from the patient files that included all records from admission till discharge as regarding:

#### **I- Socio-demographic data**

includes age, sex, marital state and residence.

#### **II- Circumstances of poisoning**

including seasonal variation, place of exposure, causative agents, manner of poisoning,

route of exposure, delay time between intoxication and hospital admission and finally the time of hospitalization.

**III- Patient's medical records** included the analysis of the followings data:

- 1- Symptoms of acute corrosives poisoning (Gastro intestinal tract, Respiratory, Dermal and Central nervous system).
- 2- Hospital treatment: Oxygen therapy, symptomatic treatment (as antibiotics, H<sub>2</sub> blockers or protein pump inhibitors, steroids, IV fluids) and gut decontamination (gastric lavage) was performed for some patient poisoned with phenol. Observation was in emergency room ranging from 6-12 hours or admission in inpatient BPCU, or referred for endoscopy if needed.
- 3- Patient's outcome: available data related to patient's outcome were collected as (improved and discharged, referred for endoscopy or discharged against medical advice (No mortality were recorded).

#### **Ethical approval**

All available data were collected from the medical records of the patients

in the archive of BPCU after the study was approved by Benha Research Ethical Committee.

#### **Consent**

Authors took the permission of the authority members of Benha Poison Control Unit.

#### **Data management**

The collected data were tabulated and analyzed using SPSS version 16 software (Spss Inc, Chicago, ILL Company). Categorical data were presented as number and percentages. Goodness of fit test and Fisher's Exact test were used to analyze them. Quantitative data were tested for normality using Kolmogorov Smirnov test assuming normality at  $p > 0.05$ . Quantitative data were expressed as mean  $\pm$  standard deviation if normally distributed or median and range if not. Kruskal Wallis test (KW) for 3 independent groups regarding non parametric variables.

## Results

**Table (1): Socio- demographic characteristics of the studied groups.**

Variables		No=245	%	p value Goodness of fit test
Age/years	Mean±SD	10.9±13.9		<0.001 **
	Median (Range)	3.0 (6 m- 65 y)		
	<10	166	67.8	
	10-19	16	6.5	
	20-29	31	12.7	
	30-39	18	7.3	
	40-49	10	4.1	
	50-59	1	.4	
	≥60	3	1.2	
Sex	Male	150	61.2	=0.001 ** -
	Female	95	38.8	
Marital status	Unmarried	189	77.1	<0.001 ** -
	Married	56	22.9	
Residence	Rural	142	58	=0.001 ** -
	Urban	103	42	

\*\* : Highly statistically significant

Table 1 showed that the age of the patients enrolled in this study ranged from 6 months to 65 years with the majority (67.8%) of cases aged less than 10 years , 61.2% were males, 77.1% were unmarried and 58% came from rural areas (highly statistically significant).

**Table (2): Circumstances of poisoning of the studied groups.**

Variables		No=245	%	p value Goodness of fit test
Season	Summer	118	48.2	<0.001 **
	Spring	52	21.2	
	Autumn	52	21.2	
	Winter	23	9.4	
Place of exposure	Indoor	133	54.3	0.20
	Outdoor	112	45.7	
Manner of poisoning	Accidental	203	82.9	<0.001 **
	Suicidal	42	17.1	
Route of poisoning	Oral	222	90.6	<0.001 **
	Inhalation	23	9.4	
Causative agents	Sodium hypochlorite	149	60.8	<0.001 **
	Phenol	58	23.7	
	Caustic potash	38	15.5	
Delay time / hours	Mean±SD	0.9±0.22		-----
	Median (range)	1.0 (0.5-2)		
Duration of hospitalization / hours	Mean±SD	12.8±12		-----
	Median (range)	6.0 (1 hr.- 2 days)		

\*\* : Highly statistically significant.

As shown in table (2) there was seasonal variations at the time of poisoning as 48.2% occurred during summer, 82.9% was found to be accidental, 90.6% were exposed to corrosives orally and the main causative agent was sodium hypochlorite (60.8%) (highly statistically significant). The majority of cases (54.3%) occurred at indoor. The mean delay time among all cases was 0.9±0.22 hours, with minimum of 30 minutes and maximum of two hours. The majority of patients were admitted to the hospital one hour after the poisoning. The shortest hospital stay was one hour, while the longest one was two days.

**Table (3): Symptoms, treatment and outcomes among the studied groups.**

Variables		No=245	%	p value
Symptoms	GIT combined with respiratory	144	58.8	<0.001**
	Respiratory	80	32.7	
	Dermal	18	7.3	
	CNS	3	1.2	
Treatment	GIT decontamination	11	4.5	<0.001**
	Dermal decontamination	25	10.2	
	O <sub>2</sub> therapy	80	32.6	
	Symptomatic treatment (antibiotics, H <sub>2</sub> blockers or protein pump inhibitors, steroids, intravenous fluids)	129	52.7	
Outcomes	Improved and discharged	191	78	<0.001**
	Referred for endoscope	45	18.4	
	Discharged against medical advice	9	3.7	

\*\* : Highly statistically significant

CNS: Central nervous system

GIT: Gastro intestinal tract

O<sub>2</sub>: Oxygen

Table (3) showed that 58.8% of patients presented mainly with GIT with respiratory manifestations, 52.7% were treated symptomatically (antibiotics, H<sub>2</sub> blockers or protein pump inhibitors, steroids, intravenous fluids), 78% were improved and discharged (highly statistically significant).

**Table (4): Outcomes in correlation to the circumstances of poisoning of the studied groups.**

Variables		Improved and discharged (No=191)		Referred (No =45)		Discharged against medical advice (No =9)		Fisher's test	p value
		%	No	%	No	%	No		
Season	Summer	101	52.9	16	35.6	1	11.1	60.7	<0.001**
	Spring	50	26.2	0	0	2	22.2		
	Autumn	32	16.8	20	44.4	0	0		
	Winter	8	4.2	9	20	6	66.7		
Place of exposure	Indoor	109	57.1	18	40	6	66.7	4.78	0.086
	Outdoor	82	42.9	27	60	3	33.3		
Manner of poisoning	Accidental	161	84.3	38	84.4	4	44.4	7.63	0.023*
	Suicidal	30	15.7	7	15.6	5	55.6		
Route of poisoning	Oral	172	90.1	43	95.6	7	77.8	3.19	0.17
	Inhalation	19	9.9	2	4.4	2	22.2		
Causative agents	Sodium hypochlorite	114	59.7	32	71.1	3	33.3	10.502	0.023 *
	Phenol	50	26.2	7	15.6	1	11.1		
	Caustic potash	27	14.1	6	13.3	5	55.6		
Variables		Improved and discharged (No =191)		Referred (No =45)		Discharged against medical advice (No =9)		Kruskal Wallis test	p value
Delay time / hours.	Median	1.0		1.0		1.0		5.31	0.07
	Range	0.5-1		0.5-1		1-2			
Duration of hospitalization / hours.	Median	6.0		24.0		24.0		70.4	<0.001**
	Range	1-24		1-48		24-48			

\*: Statistically significant

\*\*: Highly statistically significant

As shown in table (4) there was a highly statistically significant difference between the outcomes of poisoned patients and the season as 52.9% who were improved and discharged were in the summer. About 44% of the referred patients were in autumn

and 66.7% who were discharged against medical advice were in winter.

Also table (4) showed that there was a statistically significant difference between the outcomes of poisoned patients and the manner of poisoning as 84.4%, who were improved & discharged and who were referred, were accidentally poisoned.

There was a statistically significant difference between the outcomes of poisoned patients and the causative agents as 59.7%, of the improved & discharged and 71.1% of the referred patients, were intoxicated with Sodium hypochlorite.

**Table (5): Outcomes in correlation to the clinical results of the studied groups.**

Variables		Improved and discharged (No =191)		Referred (No =45)		Discharged against medical advice (No =9)		p value Goodness of fit test
		%	No	%	No	%		
Symptoms	GIT combined with respiratory	110	57.6	32	71.1	2	22.2	<0.001**
	Respiratory	70	36.6	10	22.2	0	0	
	Dermal	11	5.8	0	0	7	77.8	
	CNS	0	0	3	6.7	0	0	
Treatment	GIT decontamination	11	5.8	0	0	0	0	<0.001**
	Dermal decontamination	25	13.1	0	0	0	0	
	O <sub>2</sub> therapy	71	37.2	9	20	0	0	
	Symptomatic	84	44	36	80	9	100	

\*\* : Highly statistically significant  
CNS: Central nervous system

GIT: Gastro intestinal tract  
O<sub>2</sub>: Oxygen

Table (5) showed that there was a highly statistically significant difference between the outcomes and the patients' symptoms as 57.6% of the improved and discharged and 71.1% of the referred patients were complaining of GIT with respiratory manifestations.

Also it showed that symptomatic treatment was the most prevalent line of treatment among the three studied groups (highly statistically significant).

## Discussion

Although poisoning with household materials, including corrosive substances, is widespread and its consequences are severe, studies and researches about this topic are unfortunately few (Balme et al., 2012 and Cantrell et al., 2013). The present study aimed to evaluate and study the pattern of corrosive poisoning which was achieved by analysis of retrospective collected data of 245 cases of corrosives exposure which is about 9.5% of total poisoning cases (2570 cases) admitted to Benha Poisoning Control Unit, Benha University Hospitals, Egypt, from 1<sup>st</sup> February 2018 to 31<sup>th</sup> January 2019.

Concerning the socio-demographic characters of the patients, out of 245 patients enrolled in this study the highest percentage of cases admitted to the center (67.8%) was in the age group below ten years old (Table 1). Halawa et al. (2013) reported that children below seven years were the age group mostly affected. Fifty to eighty percent of corrosive cases occur in young age in America (Atiq et al., 2009; McKenzie et al., 2010 and Rafeey et al., 2016). Adedeji et al. (2013) reported that the most vulnerable age group to corrosive poisoning was the children; they were

15% in India and 25% in Nigeria. In contrast to the results of the current work, Hashmi et al., 2018 in their study on clinico-epidemiological characteristics of corrosive ingestion in South-Punjab Pakistan; reported that 80.1% of corrosive ingestion in the age group between 15-30 years old.

In Egypt, household cleaning substances are easily available at home and can be reached by the children, also they kept in non-safe packages or placed in containers previously used for food or drinks (Sobeeh et al., 2018). Children below ten years cannot distinguish between beneficial and poisonous drink due to immaturity of taste and smell. Also, at that age, they begin their curiosity in exploring their environment (Sarioglu et al., 2006 and Al-Binali et al., 2009).

The present study showed that males are more likely (61.2%) to suffer from corrosive injuries than females (Table 1); and this may be because the boys have more mobile behavior than the girls making them more vulnerable to poisoning (Seif et al., 2016). The existing result was in line with the study done by Ghonem and El Sharaby (2018) in their work on complications of acute corrosive toxicity who detected

that 52.3% of corrosive poisoning were males compared to 47.7% of females. Also Halawa et al. (2013) in their study on annual report of the Poison Control Centre, Ain Shams University Hospitals, Cairo, Egypt; reported that 55% male children were subjected to poisoning.

In contrast to the result of the current study, Hashmi et al. (2018) in their study at a Tertiary Care Hospital of Multan, South-Punjab, Pakistan; reported that females are more vulnerable to corrosive poisoning than males as corrosive agent were present at home for cleaning and washing purposes and women are more interested in cleaning compared to men.

The present work showed that most of cases were unmarried (77.1%) (Table 1) and this is logic as most of cases were under the age of ten.

Against the results of the current study, Parvathi et al. (2016) found that most of the cases detected were married.

As regards the residence, the present work revealed that most of cases (58%) came from rural areas (Table 1); this may be explained as BPCU serves the city of Benha and the surrounding villages most of which are considered rural. Ghonem and El Sharaby (2018)

founded at their work at Mansoura Toxic center; that the majority of patients (65.9%) were from rural areas. In contrast to the current work, Manzar et al. (2010) in Pakistan reported that children came from urban areas were more vulnerable (85%) compared to those who came from rural areas (15%). This may be because mothers were preoccupied with their jobs, leading to child neglect.

The highest number of patients was admitted during summer 48.2% (Table 2). This result was in accordance with that published by Sobeeh et al. (2018) at Menoufia Poison Control Center; who stated that the highest number of cases was admitted during summer followed by winter then spring lastly autumn. Also other studies conducted by Oguche et al. (2007) in North Eastern Nigeria stated that the highest number of admission was recorded during the hot months from March to June.

On studying the place of intoxication, the current work revealed that most of cases were intoxicated at home (Table 2). This result was in accordance with that published by Khodeary and Elkholy (2017) that reported that most of cases were exposed at home. Hung et al. (2008) revealed the same result. This

result can be explained as in Egypt, most of household cleaning substances are easily available at home and can be reached by the children and they were the most common cause of morbidity and mortality for pediatric poisoning (Sobeeh et al., 2018).

Concerning the manner of poisoning, the result of the current work revealed that most of cases were accidentally done (Table 2) and this can be explained as most of cases were children below ten years old. This was in agreement with Ghonem and El Sharaby (2018) who reported that (79.5%) of cases were accidentally poisoned. Also Sobeeh et al. (2018) founded that the most poisoning caused by accidental manner was the corrosives. Halawa et al. (2013) reported that 55% of their studied group was subjected to poisoning accidentally. In contrast to the present study, Chowdhury et al. (2013) in their study on Dhaka Medical College Hospital; founded that the majority (88.9%) of cases were suicidal and 6.3% were accidental.

About the route of exposure, the result of this work revealed that the route was mainly oral (Table 2). This was in accordance with Al-Shehri (2004) in Abha City – Southwestern

Saudi Arabia; who detected that the common household chemicals used in toxicity were in liquid forms.

Sodium hypochlorite was the most common corrosive substances used by the studied cases followed by phenol (Table 2). Abd El-Salam et al. (2013) founded that corrosives cases represented (17.4%) of the total poisoning cases and potash was the most common caustic substance followed by acids (chlorine and sulphuric acid). Similar findings were reported by Arici et al. (2012). Johnson and Brigger (2012) reported that ingestion of alkali was more prevalent than that of acid injury. In contrast to the result of this work, Ghonem and El Sharaby (2018) reported that acidic substances were more commonly used (63.6%) than alkali (36.4%). Also a study done by Chibishev et al. (2012) reported that most used corrosive material was hydrochloric acid, less frequent sodium hydroxide and sodium hypochlorite.

The high rate of potash cases may be explained as even low concentrations of alkali can lead to severe injury affecting the upper respiratory tract causing laryngeal edema and airway complications (Lupa et al, 2009).

The mean delay time between

poisoning and admission to hospital in the present work was relatively short (0.9 h.) and ranged from 0.5-2 hours (Table 2); this may explain the high - percentage of improved outcome. Ghonem and El Sharaby (2018) reported that the delay time in their work was from 0.5-10 hours. In contrast to the results obtained by Abd El-Salam et al. (2013) in their work on Poison Control Center – Ain Shams University , who reported the highest mean delay time in cases of corrosive cases was (10.62 hr.) and reported that this long delay time could explain the severe complications that occurred even with little corrosive ingestions (Lupa et al, 2009).

On studying the hospital stay, the result of the current work revealed that the longest hospital stay was 2 days and the shortest stay was one hour. Hashmi et al. (2018) from Pakistan , reported that the mean hospital stay was 11.8 days  $\pm$  11.1 and the shortest hospital stay was one day. Chibishev et al. (2012) detected the time interval was between 1 and 3 hours.

About the most common symptoms affecting the patients; the present work revealed that GIT symptoms combined with respiratory manifestations were the most common one (statistically

significant) (Table 3). Hashmi et al. (2018) reported that GIT symptoms were the most common symptoms than the respiratory due to the highly effective protective mechanism of the pharynx and glottis. Also, Vezakis et al. (2016) found that GIT symptoms predominate. Caganova et al. (2017) reported that 15.5% of cases had respiratory complications in corrosive intoxicated cases.

About the hospital treatment, the current study revealed that most of patients were treated symptomatically with antibiotics, H<sub>2</sub> blockers or protein pump inhibitors, steroids, intravenous fluids followed by treatment with oxygen, then treatment by dermal decontamination and finally treatment with GIT decontamination (Table 3). These results were in accordance with which was published by Al-Binali et al. (2009) in their study on pattern of corrosive ingestion in southwestern Saudi Arabia and reported that most of the patients were treated with antibiotics and 9.7% received H<sub>2</sub> blockers while 68.1% received IV hydrocortisone.

On reviewing the outcomes of the patients, most of the cases were improved and discharged, 18.4% referred for endoscope and small number of

cases was discharged against medical advice (Table3). Improvement of the majority of cases may be attributed to medical staff management competence and short delay time that allowed early intervention before permanent or severe pathological damage. These results were in agreement with Contini et al. (2009) who found that death rate in the cases ranged from zero to 11.9%. Comparable results in other studies, endoscopy was needed in 31.7% of cases (Al Binali et al. 2009), 84% of cases (Contini et al. 2007) and 100% of cases (Huang et al. 2004). This difference in study results may be attributed to different in management protocol for corrosives intoxication adopted by different Poison Control Centers, or difference in severity of cases' presentation.

### **Conclusion and Recommendations:**

From the results of the present study it can be concluded that acute corrosives poisoning is an accidental toxic issue in Egypt among rural male children below 10 years old. Sodium hypochlorite was the most common causative agent and commonly observed symptoms were GIT with respiratory manifestations; most of the patients were treated symptomatically and most of them improved and discharged. So, the current study

recommends the following:

- Educational programs to increase the awareness about the hazardous effects of corrosives.
- Advice factories fabricating corrosives to produce these chemicals in childproof and adequately labelled containers, with clear warning statements and first aid in case of exposure.
- Awareness of parents who must focus with their children and not to be distracted from them, especially since most of the cases are children and avoid placing household cleaning or bleaching agents and chemicals in places that are easily accessible or in bottles previously used for eating or drinking.

### **Conflicts of interest**

Authors have declared that no conflict of interest exists.

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