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Original Article

Esophageal and Gastric Stricture Formation Following Corrosive Ingestion in Our Local Population

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ABSTRACT

Corrosive substances are defined as chemicals which cause injury upon coming in contact with living tissues such as the skin, gastrointestinal tract, respiratory tract and eyes. These include acids, alkalis, oxidizing agents, hydrocarbons among others. **Objective:** To determine the frequency and difference in the frequency of upper gastrointestinal stricture formation following corrosive ingestion in the gastroenterology unit of Lady Reading Hospital, Peshawar. **Methods:** This cross- sectional study was held in the Gastroenterology unit of Lady Reading Hospital, Peshawar from 16th July, 2019 to 16th Jan, 2019. Detailed history was taken from the patient and the container of the chemical ingested was examined to find out the duration since ingestion, amount of chemical ingested, and the type of chemical ingested (acid or alkali). **Results:** Mean and SD for age was 35 ± 5.55. Mean and SDs for duration since ingestion. Mean and SDs for amount of corrosive ingestion was 24 ± 1.54. 50 (34.48%) patients were recorded in 10-25 years' age group and 95 (65.51%) patients were recorded in 26-40 years' age group. 97 (66.89%) patients were male, and 48 (33.10%) patients were female. 41 (28.27%) patients had acidic corrosion and 104 (71.72%) patients had alkali corrosion. As per frequencies and percentages for stricture formation, 57 (39.31%) patients had stricture formation. **Conclusions:** Although the mortality and morbidity of corrosive gastric injuries is high, the key to improve the survival is early identification of perforation, maintenance of nutrition and control of sepsis.

INTRODUCTION

Corrosive substances are defined as chemicals which cause injury upon coming in contact with living tissues such as the skin, gastrointestinal tract, respiratory tract and eyes. These include acids, alkalis, oxidizing agents, hydrocarbons among others. Ingestion of corrosive agents is an excruciating experience and represents an important public health problem. More than 5000 cases of caustic ingestion are reported annually in the United States with a majority being as a result of accidental ingestion in children [1, 2]. However, ingestion in adults is also common especially in psychiatric patients, alcoholics and those who attempt suicide [3]. The corrosive agents which are ingested are typically acids and alkalis and can result in serious injury to the upper gastrointestinal tract including the pharynx, esophagus and stomach [4]. The degree of injury depends on several factors such as the nature of the caustic substance (acid or alkali), the amount or concentration and the duration of contact [5]. Alkaline substances usually cause more serious injury as they are more palatable than acids and are therefore typically

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ingested in larger amounts. In addition, acids limit tissue damage because of coagulation necrosis and eschar formation while alkalis cause extensive tissue damage due to saponification of tissues [6]. The degree of injury is classified according to the depth. First-degree injuries are confined to the mucosa; second-degree burns extend to the submucosa while third-degree burns involve the entire thickness of the wall [7, 8]. The clinical presentation of caustic ingestion is variable, the most common serious complications being perforation and bleeding with a mortality rate of about 10-20% [9]. In patients who survive the acute stage, delayed complications include stricture and fistula formation, gastric outlet obstruction and an increased risk of malignancy, with esophageal stricture and gastric outlet obstruction being the most common. The frequency of esophageal stricture formation depends on the degree of burn and is about 90% for third-degree injuries and 30-70% for grade 2B injuries [10, 11]. Similarly, gastric outlet obstruction or stricture occurs in approximately 60% of patients with second or third-degree burns of the stomach [12]. An observational study of 50 patients with corrosive ingestion showed esophageal stricture formation in a total of 10 patients i.e., 20% (8 out of 43 patients with acid ingestion and 2 out of 7 patients with alkali ingestion) and gastric stricture formation in 20 patients i.e., 40% (19 out of 43 patients with acid ingestion and 1 out of 7 patients with alkali ingestion) [13]. Another study of 206 children to determine the outcome of caustic ingestion based on upper gastrointestinal endoscopy showed no statistically significant difference ($p = 0.32$) between the rate of development of esophageal stricture after acid ingestion (15.3%) and alkali ingestion (8.9%). The use of high doses of corticosteroids for the management of corrosive esophageal burns may prevent stricture development [14]. This study aims to find out the frequency of esophageal and gastric stricture formation following corrosive ingestion in our local population. This is because the commonly available poisons which are ingested most frequently vary from population to population and therefore the local frequency in our population might be different from that revealed by studies carried out in other populations. Also differences in factors like the time since ingestion till presentation to hospital might also lead to differences in rate of stricture formation. Therefore, my study will find out local data about the rate of stricture formation. This information will give an indication of the magnitude of the problem and will also help the health care professionals devise strategies in order to try and prevent stricture formation.

METHODS

This cross-sectional study was held in the Gastroenterology unit of Lady Reading Hospital, Peshawar from 16 July 2019 to 16 Jan 2019. The sample size was 145 selected by non-probability consecutive sampling. It was calculated using the WHO software "Sample Size Determination in Health Studies". The formula for "Estimating a population proportion with specified absolute precision" has been used based on the following assumptions: Confidence Interval Strength: 95%. Absolute Precision (Margin of error): 8%. Anticipated frequency of gastric stricture formation in patients with corrosive ingestion: 40% [15]. All patients10-40 years old who present with ingestion of acid or alkali (assessed by inspecting the label on the container of the chemical ingested) capable of causing corrosive injury to the gastrointestinal tract to a minimum of 20 ml(determined by comparing the marking / fluid level of the chemical in the container before and after ingestion) during the previous 4 weeks were included. Patients who have completely vomited out the ingested caustic substance just after ingestion and patients with esophageal or gastric stricture secondary to a cause other than corrosive ingestion for example gastro esophageal reflux were excluded. The study was held after hospital ethical and research committee approval. The patients meeting the criteria of inclusion in the gastroenterology unit of Lady Reading Hospital, Peshawar was selected in the study after written informed consent (Annexure I). The purpose of the study and the benefits and risks was clarified to all the subjects right at the start of the study i.e. before recruitment. Detailed history was taken from the patient and the container of the chemical ingested was examined to find out the duration since ingestion, amount of chemical ingested and the type of chemical ingested (acid or alkali). The diagnosis of stricture formation was made at the time of endoscopy (which was done 4 weeks after the time of ingestion) grounded on the mentioned inclusion criteria in the operational definitions. All subjects were treated conferring to the standard care who present with corrosive ingestion. The data were entered and saved in SPSS version 23.0. The percentages and frequencies was calculated for qualitative / categorical variables such as gender, type of corrosive substance (acid/alkali) and presence/absence of stricture formation. 95 percent confidence intervals were calculated for the frequencies of stricture formation. Mean and S.D was calculated for the numerical / quantitative variables for example age, amount of corrosive ingested and duration since ingestion. The frequency of stricture formation was stratified according to gender, different age groups, duration of ingestion, amount of chemical ingested and the type of corrosive substance (acid or alkali). Post-stratification chi-squared test was applied in which a p value of ≤0.05 was considered

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significant. All results were presented in the form of tables and graphs.

RESULTS

The overall Mean age was 35. Mean and SDs for duration since ingestion. Mean and SDs for amount of corrosive ingestion was 24 ± 1.54. (Table 1).

Table 1: Descriptive Statistics (N=145)

Year	Mean
Age	35 ± 5.555
Duration since Ingestion	3 ± 0.67
Amount of chemical ingested	24 ± 1.54

50 (34.48%) patients were recorded in 10-25 years' age group and 95 (65.51%) patients were recorded in 26-40 years age group. 97 (66.89%) patients were male, and 48 (33.10%) patients were female (Table 2).

Table 2: Age and gender's distribution (N=145)

Age Group	Frequency (%)
10-25 Years	50(34.48)
26-40 Years	95(65.51)
Gender	
Male	97(66.89)
Female	48(33.10)

41 (28.27%) patients had acidic corrosion and 104 (71.72%) patients had alkali corrosion (Table 3).

Table 3: Frequency and Percentages for Type of Corrosive Substance (N=145)

Type of Corrosive Substance	Frequency (%)
Acidic	41(28.27)
Alkali	104(71.72)
Total	145(100)

As per frequencies and percentages for stricture formation, 57 (39.31%) patients had stricture formation (Table 4).

Table 4: Frequency and percentages for stricture formation (N=145)

Stricture Formation	Frequency (%)
Present	57(39.31)
Absent	88(60.68)
Total	145(100)

Stratification of age, gender, duration of corrosive ingestion and amount of chemical ingested has been done at Table 5.

Table 5: Stratification of stricture formation with age, gender, duration of ingestion, and amount of chemical ingested (n=145)

Variable	Stricture Formation	Frequency (%)	p-value
Age			
10-25 Years	Present	27(18.62)	0.008
	Absent	23(15.86)	
26-40 Years	Present	30(20.68)	
	Absent	65(44.82)	
Gender			
Male	Present	35(24.13)	0.257
	Absent	62(42.75)	
Female	Present	22(15.17)	0.257
	Absent	26(17.93)	
Duration of Ingestion			
< 2 Weeks	Present	32(22.06)	0.969
	Absent	37(25.51)	
>2 Weeks	Present	25(17.24)	0.969
	Absent	51(35.17)	
Amount of Chemical Ingested			
< 25 ml	Present	50(34.42)	0.813
	Absent	76(52.41)	
> 25 ml	Present	07(4.82)	0.813
	Absent	12(8.27)	

DISCUSSION

Corrosive substances are defined as chemicals which cause injury upon coming in contact with living tissues such as the skin, gastrointestinal tract, respiratory tract and eyes. These include acids, alkalis, oxidizing agents, hydrocarbons among others. Ingestion of corrosive agents is an excruciating experience and represents an important public health problem. Ingestion in adults is also common especially in psychiatric patients, alcoholics and those who attempt suicide. The effective therapy of corrosive injury requires early detection and treatment. Alas, despite all precautions, maintaining an esophageal lumen is not always possible. About 10-30% acoustic injury patients developed clinically visible esophageal strictures [16], and the rate was considerably higher in a previous study [17, 18]. Majority of patients had strictures that required to be replaced attributed to the significant amounts of caustic chemicals consumption for suicidal purpose. Management of esophageal strictures following damage was challenging, and dilatation was utilized in many hospitals [19]. Even after multiple dilations, strictures were found in approximately 48% of cases [20], and while the risk of severe complications, such as esophageal perforation, was low (0.9-1.5%) per procedure [21], numerous patients had higher risk of mortality [22]. Moreover, dilatation treatment necessitated numerous hospitalizations and various anesthetics with associated hazards [23]. It is still debatable that esophagus should be removed following colonic interposition. Several research have been conducted to investigate an association between cancer and esophageal damage. Although a higher risk of carcinoma was found in injured esophagus, no proof has been provided [24]. Earlier studies by Fan *et al.*, and Al-Hussaini *et al.*, utilized stomach, jejunum, and colon organs for esophageal replacement in patients with caustic burns [25, 26]. Long-term gastroesophageal reflux, ulceration, anastomosis, and increasing dysfunctional propulsion are

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all drawbacks of the stomach [27]. Just a few cases of jejunal interposition were conducted in our study due to the previously abdominal surgery and the colon and stomach were unable to be moved. With development of somatic and blood supply enhancement, replacement of esophageal related colon is long enough and produces esophagitis less late problems and acid resistance causing stricture. As a result, the colon may have benefits over other organs, and it is thought to be an excellent organ for replacement [28]. Treat a duodenal lesion is a challenging issue in the surgical therapy of caustic ingestion; decision making can be difficult in some circumstances, and every viable method entails risks and potential consequences. Severe lesions of the second section of the duodenum are generally treated conservatively, with the duodenal stump closed and several drainages from the duodenum area [29, 30]. The degree of the injury is determined by various factors, including the concentration of the substance, the amount consumed, the length of time the agent is in contact with the tissue, and the pH of the agent. Solid items attach easily to the mouth and throat, inflicting the most harm to these areas. Liquids, on the other hand, travel more swiftly via the mouth and throat, causing the most damage in the esophagus and stomach [31, 32].

CONCLUSIONS

Although acute corrosive stomach injuries have a high morbidity and mortality rate, early detection of perforation, maintaining nutrition, and controlling sepsis are the keys to improving survival.

Conflicts of Interest

The authors declare no conflict of interest.

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