

## ORIGINAL RESEARCH

# Epidemiology of Corrosive Injuries in Upper Gastro-Intestinal Tract: A Single Institutional Based Study

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### ABSTRACT

**Background:** Corrosive injuries to the upper gastrointestinal tract are still a major concern in developing countries like India, where the corrosive substances are easily accessible to the common people. The ingestion of corrosive substances produces a spectrum of damage in the upper gastrointestinal tract. Acids affect the stomach more commonly and they cause mucosal damage by coagulation necrosis and require longer duration of contact. On the other hand, alkalis cause liquefaction necrosis and as they are more viscous they tend to adhere to the oesophageal mucosa with only a relatively small amount reaching the stomach. **Aim and Objectives of Study:** To find out the types of caustic ingestion and the site, degree and extent of injury of the oesophagus and the stomach. **Methods:** Adult patients presenting with corrosive injury to the department of General Surgery and Surgical Gastroenterology in AIIMS Patna from 2016 to 2018. Total 32 adult patients were included in the study. Acute corrosive poisoning patients without any gastrointestinal symptoms and patients with acute corrosive injury who were haemodynamically unstable or who were suffering from respiratory distress were excluded. Upper G.I. Endoscopy was used to find out the severity and grade of injury of oesophagus and stomach. It was retrospective descriptive study. Grade of injury of oesophagus and stomach was determined by endoscopy based on Zargar's classification. **Result:** In our series, all caustic accidents involved acids (100% of cases) and the most frequently ingested agent was muriatic acid also known as hydrochloric acid (90.6%). Contrary to the traditional belief that the oesophagus is spared in acid ingestion, we found oesophageal damage in 25 out of 32 patients with acid ingestion (78.1%). **Conclusion:** Although alkaline substances account for most cases of caustic ingestion in Western countries, acid ingestion is more common in our society. Muriatic acid is the most common agent used in caustic ingestion in our society.

**Key words:** Corrosive injuries, Upper gastro-intestinal tract, Acids, Alkalis, Zargar's classification.

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### INTRODUCTION

Corrosive injuries to the upper gastrointestinal tract are still a major concern in developing countries like India, where the corrosive substances are easily accessible to the common people. These substances are used commonly in the form of toilet cleaning agents, soaps, bleaches, disc batteries, etc.

The ingestion of corrosive substances produces a spectrum of damage in the upper gastrointestinal tract. The severity of the resulting damage depends largely on the corrosive properties and the concentration of the ingested agent. The initial contact with the toxic agent on the mucosa causes inflammation, which if severe leads to necrosis in the first 24 hours. Extensive thrombosis of submucosal vessel is observed in 48 hours with inevitable necrosis of

mucosa although acid material may produce an eschar which limits the oesophageal damage. In the second and third week granulation tissue begins to replace the necrotic tissue and the process of structuring begins. It is in the period of four to fourteen days when the oesophagus is most likely to be perforated.<sup>1,2</sup>

The initial contact with the corrosive acids is cleared rapidly from the oesophagus to the stomach where they pool in the prepyloric area in response to corrosive induced pylorospasm.<sup>3, 4, 5</sup> Acids affect the stomach more commonly and they cause mucosal damage by coagulation necrosis and require longer duration of contact.<sup>6, 7</sup> Prolonged contact with the prepyloric mucosa results in the prepyloric stricture. Stricture can also occur in the antrum, body or in the pyloroduodenal area. When the volume of the

corrosive ingested is large, the entire stomach becomes scarred leading to a diffusely contracted stomach.

On the other hand, alkalis cause liquefaction necrosis and as they are more viscous they tend to adhere to the oesophageal mucosa with only a relatively small amount reaching the stomach. Thus the extent of oesophageal damage is greater with alkalis than with acids.

Acids and alkalis cause different patterns of injuries depending upon the quantity which has been ingested and the concentration. The severity and the extent of the oesophageal and the gastric damage which results from a caustic ingestion depends upon the following factors.

- Corrosive properties of the ingested substance
- Amount, concentration, and physical form of the agent
- Duration of contact with the mucosa

The management of such injuries is multidisciplinary, which involves reducing the morbidity and mortality by accurate early diagnosis, aggressive treatment of the life threatening complications and long term follow up.

## 2. Aim and Objectives of Study

To find out the types of caustic ingestion and the site, degree and extent of injury of the oesophagus and the stomach

## MATERIALS AND METHODS

Adult patients presenting with corrosive injury to the department of General Surgery and Surgical Gastroenterology in AIIMS Patna from 2016 to 2018. Total 32 adult patients were included in the study. Acute corrosive poisoning patients without any gastrointestinal symptoms and patients with acute corrosive injury who were haemodynamically unstable or who were suffering from respiratory distress were excluded. Upper G.I. Endoscopy was used to find out the severity and grade of injury of oesophagus and stomach. It was retrospective descriptive study. Grade of injury of oesophagus and stomach was determined by endoscopy based on Zargar's classification. Data was analyzed following standard statistical protocol. The data collected from

all patients of corrosive injuries of upper G.I. tract of my study was tabulated, correlated and analyzed in details. Appropriate statistical tests were applied to my findings. The results were directed to establish the aim and objectives of the study.

## RESULT

Total 32 patients were studied for corrosive injuries from January 2014 to June 2015 in Surgical Gastroenterology department of Medical College & Hospital, Kolkata.

Ages of our patients ranged from 18-60 years with the mean age (mean± s.d.) of patients were 32.2500 ±12.7558 years and the median age was 29.0000 years.

Out of 32, 18 were females (56.3%) and 14 were males (43.7%).

Substances ingested were muriatic acid (n=29), sulphuric acid (n=2) and acetic acid (n=1) with causes of injury being suicidal (n=22) and accidental (n=10).

Patients presenting to the Department in duration < 1 week were 11(34.4%), in between 1week to 1 month were 9(28.1%) and more than 1 month were 12(37.5%). Sites of injury were both oesophagus and stomach (78.1%), only stomach (18.8%) and pharyngeal inlet (3.1%).

Most common grade of injury to occur was II (oesophagus) with III (stomach) with n=11 (35.5%). Grade of injury of oesophagus and stomach was determined by endoscopy based on Zargar's classification.

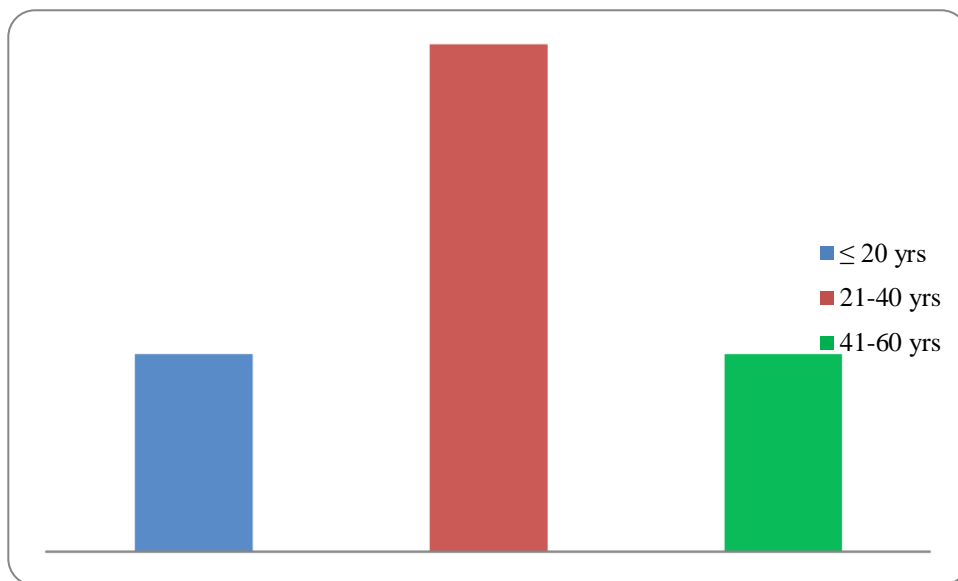
Zargar's grading of mucosal injury caused by corrosive ingestion

Grade 0	Normal examination
Grade 1	Oedema & hyperaemia of the mucosa
Grade 2a	superficial ulceration, erosions, friability
Grade 2b	Grade 2a + deep discrete or circumferential ulcerations
Grade 3a	Small scattered areas of multiple ulceration & areas of necrosis with brown black / greyish discoloration
Grade 3b	Extensive necrosis

**Table 1. Distribution of age of patients**

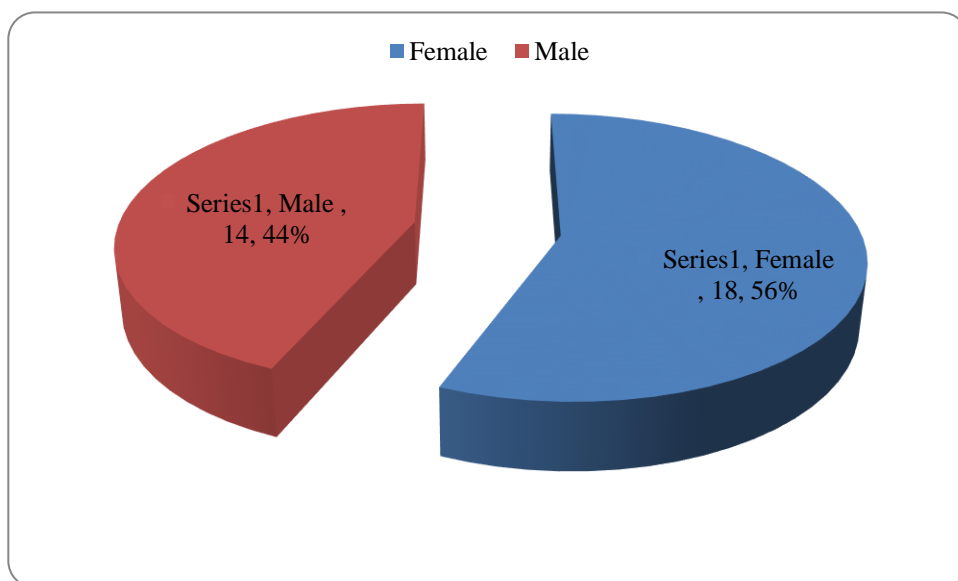
Age (Years)	Frequency	Percent
≤ 20	7	21.9%
21-40	18	56.2%
41-60	7	21.9%
<b>Total</b>	<b>32</b>	<b>100.0%</b>

The mean age (mean± s.d.) of patients was 32.2500 ±12.7558 years with range 18.0000 -60.0000 years and the median age was 29.0000 years.



**Table 2. Distribution of sex in all patients**

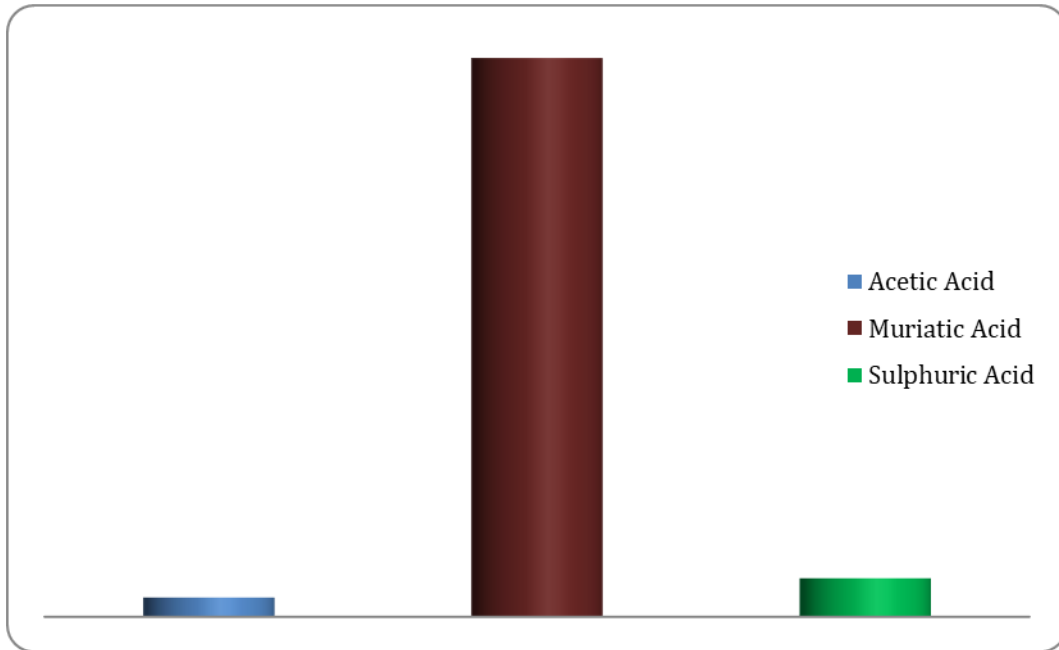
Sex	Frequency	Percent
Female	18	56.3%
Male	14	43.7%
Total	32	100.0%



**Table 3. Distribution of agent in all patients**

Agent	Frequency	Percent
Acetic Acid	1	3.1%
Muriatic Acid	29	90.6%
Sulphuric Acid	2	6.3%
Total	32	100.0%

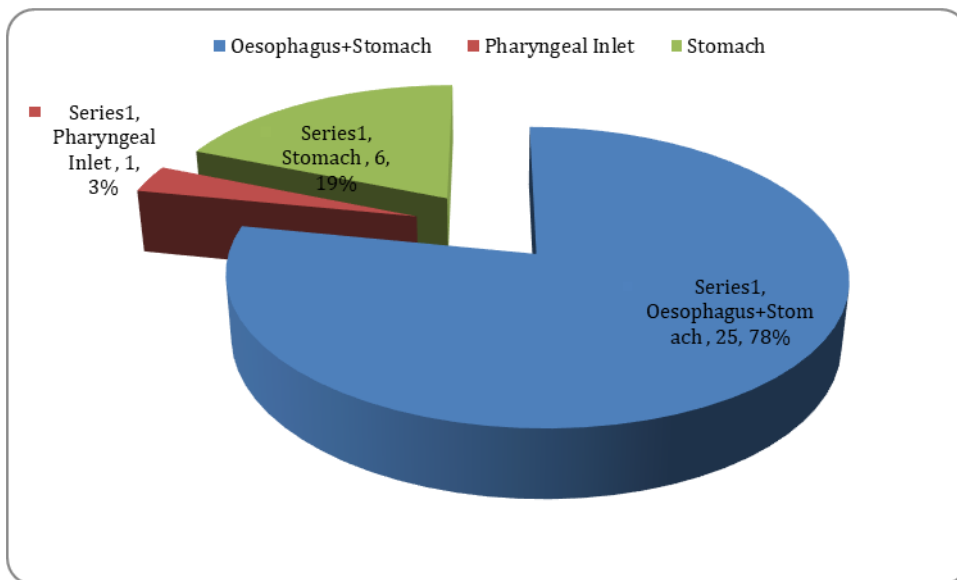
The commonest caustic ingestion was muriatic acid (90.6%).



**Table 4. Distribution of Site of Injury in all patients**

Site of Injury	Frequency	Percent
Oesophagus+Stomach	25	78.1%
Pharyngeal Inlet	1	3.1%
Stomach	6	18.8%
Total	32	100.0%

Oesophagus with stomach was involved in 78.1%, only stomach in 18.8% and pharyngeal inlet in 3.1%.

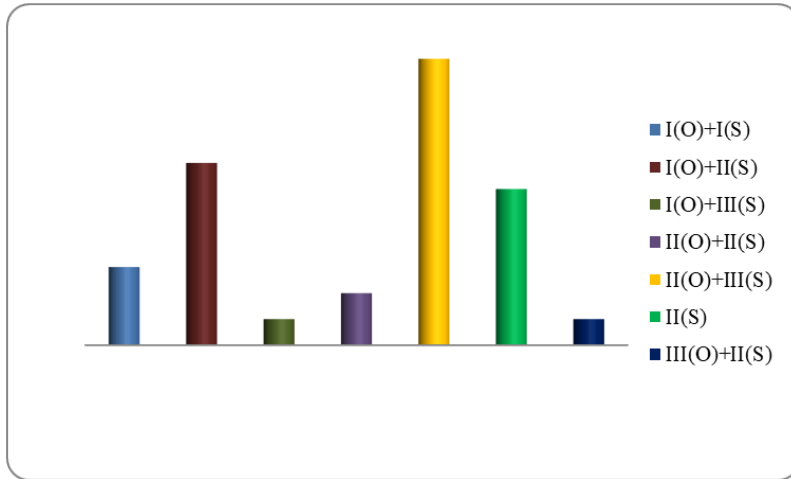


**Table5. Distribution of Grade of injury in all patients**

Grade	Frequency	Percent
I(O)+I(S)	3	9.7%
I(O)+II(S)	7	22.6%
I(O)+III(S)	1	3.2%
II(O)+II(S)	2	6.5%
II(O)+III(S)	11	35.5%
II(S)	6	19.4%
III(O)+II(S)	1	3.2%

<b>Total</b>	31	100.0%
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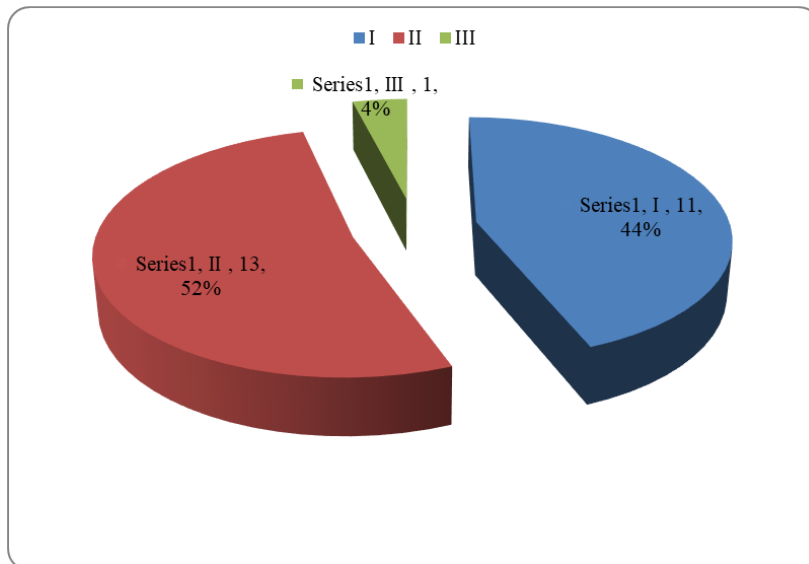
The commonest grade of injury due to caustic ingestion was grade II oesophageal injury (o) with grade III stomach injury (S). One patient was having only pharyngeal inlet injury.



**Table 6. Distribution of Grade of injury in Oesophagus in all patients**

Grade(o)	Frequency	Percent
<b>I</b>	11	44.0%
<b>II</b>	13	52.0%
<b>III</b>	1	4.0%
<b>Total</b>	25	100.0%

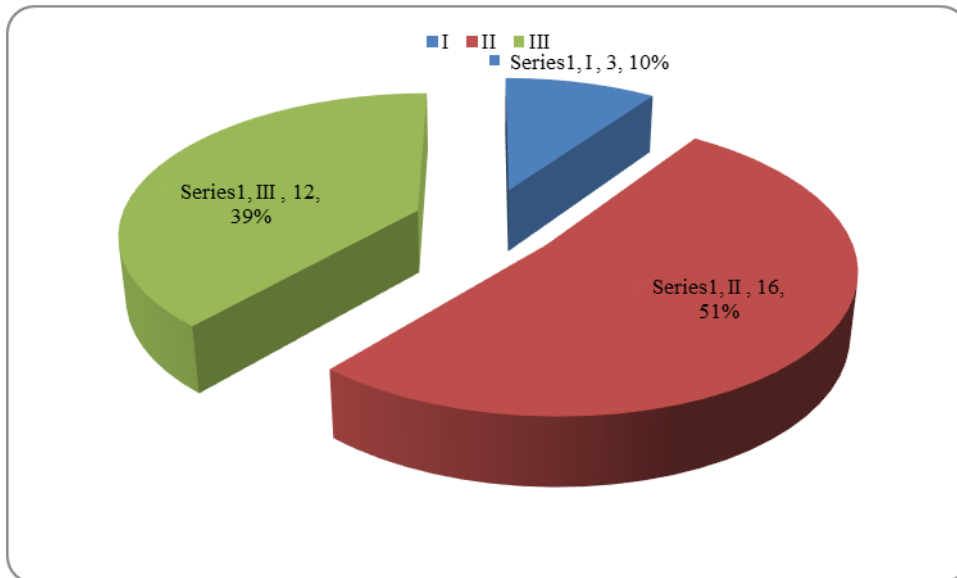
The commonest grade of oesophageal injury was grade II (52%).



**Table7. Distribution of Grade of injury in Stomach in all patients**

Grade(s)	Frequency	Percent
<b>I</b>	3	9.7%
<b>II</b>	16	51.6%
<b>III</b>	12	38.7%
<b>Total</b>	31	100.0%

The commonest grade of stomach injury was grade II (51.6%)



## DISCUSSION

Acid causes coagulation necrosis on tissue contact and it is well known that acids tend to destroy the stomach and spare the oesophagus.<sup>8, 9</sup> This is because of the relative resistance of the squamous epithelium to acid damage and the short duration of contact due to the rapid transit of acid through the oesophagus and pyloric spasm.<sup>10</sup> Acid injuries more often affect the antrum of the stomach, where antral stenosis results.<sup>11</sup> On the other hand, alkaline substances induce liquefaction necrosis, a process that leads to the dissolution of protein and collagen and frequently causes oesophageal burns and stricture and only occasionally produce gastric injury.<sup>12, 9</sup> Corrosive acid ingestion is rare in the West<sup>13</sup>, where alkaline substances account for most cases of caustic ingestion.<sup>10</sup> In contrast, acid ingestion is common in India where hydrochloric acid is readily available over the counter as a cheap toilet cleaner and is the most common corrosive ingested by lower socio-economic groups.<sup>14</sup> The commonest grade of injury due to caustic ingestion was grade II oesophageal injury (o) with grade III stomach injury (S). One patient was having only pharyngeal inlet injury.

In our series, all caustic accidents involved acids (100% of cases) and the most frequently ingested agent was muriatic acid also known as hydrochloric acid (90.6%). Contrary to the traditional belief that the oesophagus is spared in acid ingestion, we found oesophageal damage in 25 out of 32 patients with acid ingestion (78.1%). Dilawari et al also observed oesophageal involvement in 13 out of 15 patients with acid ingestion.<sup>13</sup> DiCostanzo et al have also observed oesophageal involvement in 11 out of 12 patients with acid ingestion, although the degree of damage in their patients was not specified.<sup>15</sup>

Endoscopy is the best means of assessing the extent and degree of injury as it avoids the occasional missed oesophageal burn without oral injuries.<sup>16, 17</sup>

The concomitant development of a severe hypopharyngeal stricture is an infrequent yet critical complication occurring in caustic ingestion. One case in our study developed pharyngeal inlet injury with hypopharyngeal stricture, which was successfully managed by dilatation.

## CONCLUSION

Caustic ingestion continues to be a complex clinical challenge and is a dangerous accident. In contrast to children, a suicide attempt is the usual cause of ingestion of corrosive substance in adults.

Although alkaline substances account for most cases of caustic ingestion in Western countries, acid ingestion is more common in our society. Muriatic acid is the most common agent used in caustic ingestion in our society.

Contrary to the traditional belief that the oesophagus is spared in acid ingestion, our study revealed that oesophageal damage is also common in acid ingestion.

**7. Conflict of interest:** None to declare.

**8. Financial disclosure:** we declare that this study hasn't received any financial assistance

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