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ORIGINAL RESEARCH

Patient Profile and Pattern of upper gastrointestinal tract injury in children with corrosive poisoning: Experience of a tertiary care centre

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ABSTRACT

Background and Objectives: Globally, children represent 80% of all corrosive substance ingestion cases. Corrosive substances are common household substances that can be ingested either accidentally or intentionally with suicidal intent. Accidental ingestion is common in younger children while suicidal ingestion is more common among adolescents. Severity of injury depends upon the nature of corrosive, amount ingested, site of exposure and time at presentation to the hospital. Upper gastrointestinal endoscopy is an important investigation to decide further management. Upper gastrointestinal strictures are the most common long-term sequelae and are require endoscopic dilatations. The present study was done to study patient profile and pattern of upper gastrointestinal tract injury in children with corrosive poisoning at our tertiary care level teaching hospital. **Methods:** This hospital based prospective observational study was conducted at department of Pediatrics N.M.C.H Patna, Bihar, India over 3 years from Jan 2018 to December 2020 including consecutively admitted children of 1-15 years of age with a history of corrosive substance ingestion. Pertinent information was collected in a proforma and analysed. Upper G.I endoscopy was done in all children and findings recorded. **Result:** Over the study period, we enrolled 29 children in this study. Mean age of the study population was 4.4± 0.97 years. Mean weight was 14.9± 3.14 Kg. Males (17) outnumbered females (12) with a male: female ratio of 1.4:1. Duration of hospital stay (days) was 12.14 ± 6.33. Most of the ingestions were accidental in nature (93.1%). Acids (65.5%) were the predominant substance consumed as compared to alkalis (34,.5%). Dysphagia was the commonest clinical feature (86.2) followed by vomiting (79.3%). Site of injury was limited to pharyngeal inlet in 1 child (3.4%), only oesophagus in 5 (17.2%), only stomach in 9 (31.1%) and 14 (48.3%) had both oesophageal and gastric lesions on endoscopy. **Conclusion:** Corrosive injury continues to be a significant problem in children. Acids are more commonly consumed by children as compared to alkalis. Most of the children do have some form of injury to their gut as revealed by the endoscopy findings. As it is a preventable condition, active measures should be taken to reduce the incidence of corrosive ingestion and its consequences.

Key words: Caustic, corrosive, acids, alkali, endoscopy, injury, gut.

INTRODUCTION

Corrosive injuries to the upper gastrointestinal tract remain a major concern in developing countries like India, where corrosive substances are easily accessible to the common people. They are commonly used in the form of toilet cleaning agents, soaps, bleaches, disc batteries, etc. Globally, children represent 80% of all corrosive substance ingestion cases.[1] Children are more prone to ingest these hazardous substances than adults because they are unprotected and unaware of dangers. Over time, the incidence of corrosive injuries has decreased significantly in developed countries due to strong efforts like childproof containers and biohazard labelling. But in developing countries like ours, caustics are inexpensive, easily available, and often unlabelled for bio safety hazard. This problem is

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amplified by poor literacy and unawareness, especially in rural areas.

Corrosive ingestion poses a significant management challenge due to devastating effect on upper gastrointestinal tract in acute and chronic phases of the injury.[2] Once acute complications are managed, strictures may develop at any site starting from oropharynx. Severity of damage that ensues depends largely on the corrosive properties and the concentration of the ingested agent.[3] As alkaline substances have higher viscosity, they remain in contact with oesophageal mucosa for a longer time, so potentially they cause lesser distal injuries to stomach. Acids, on the other hand, have low viscosity, reach stomach faster, traverse along lesser curvature and reach pylorus where there is physiological stasis. Alkali causes liquefactive necrosis and cause deeper ulcer, while acids cause coagulative necrosis and cause superficial ulcers. The acute phase of ingestion is marked by an initial inflammatory response lasting for about 4 - 7 days in which there is thrombosis in arterioles and venules leading to necrosis followed by ulcer formation. Mucosal sloughing and bacterial invasion may develop after four to seven days following ingestion that may require use of anti-microbials. Ulcers extending beyond muscle layer may lead to perforation. Oesophagus is most likely to be perforated between 4-14 days. Fibroblasts reach the site of injury on day four and repair of the damaged mucosa starts at day ten. Stricture usually starts to develop by third week and completes over the next few months. As collagen deposition takes two weeks to start, strength of the injured tissue is poor in the initial three weeks, so, any endoscopic procedure is usually contraindicated till then.[4] From third week, scar retraction begins that may lead to shortening of gastrointestinal tract. At this time, pressure in the lower oesophageal stricture decreases that increases the frequency of gastroesophageal reflux. Such repeated acid exposure further accelerates stricture formation.[5] Antro-pyloric strictures have a propensity to cause gastric outlet obstruction. During the whole period, compromise in nutrition may lead to dyselectrolytemia, cachexia, apathy and poor quality of life.

Clinical presentation is myriad and ranges from occasional asymptomatic to being moribund. Common symptoms include pain, nausea, vomiting, dysphagia, refusal to swallow and drooling of secretions. Those who present to the hospital late have a higher incidence of hematemesis or melena, respiratory symptoms, shock, metabolic acidosis, DIC and vital organ hypoperfusion. Management of such injuries is multidisciplinary, with an aim to reduce morbidity and mortality by early diagnosis, aggressive treatment of the life-threatening complications and long term follow up. An upper Gastrointestinal endoscopy should be performed in first 24 - 48 hours in all patients following corrosive ingestion to permit more precise diagnoses, planning of therapeutic regimens to facilitate early discharge of the patients.[6]

Aim and Objectives

To study the types of corrosive substance ingestion and the site, degree and extent of injury to the oesophagus and stomach in children

MATERIALS AND METHODS

Study setting: Deptt of Paediatrics N.M.C.H Patna.

Study duration: 3 years, from Jan 2018 to December 2020.

Study design: Hospital based prospective observational study.

Inclusion criteria: consecutively admitted children of 1-15 years of age with a history of corrosive substance ingestion were the eligible candidates for inclusion in the present study if they presented to us before 48 hours of ingestion.

Exclusion criteria: Children with ingestion of more than 1 poisonous substances, parents refusing consent, children who left against medical advice and children with incomplete data (including endoscopy findings) for the outcome variable and time variable were also not included in the final analysis.

Study technique: After obtaining written informed consent, we enrolled cases in this study. All such children were subjected to thorough physical examination and focused history taking from guardians to document pertinent factors. Information so obtained and data regarding baseline characteristics, admission diagnosis, demographic characteristics, presenting symptoms, laboratory details, upper GI endoscopy results and outcome were recorded in a structured proforma. All such children underwent upper gastrointestinal endoscopy after thorough history taking, detailed physical examination and stabilisation of airway, breathing and circulation. Endoscopic findings were graded using classification proposed by Zargar et al[7] as following:

Grade I: only erythema and edema, Grade IIa: haemorrhage, erosion, blisters and ulcers with exudates, Grade IIb: circumferential esophageal ulceration, Grade IIIa: scattered deep ulcers with brown, black, and grey discolouration. Grade IIIb: extensive deep ulcers with brown, black, and grey discolouration, Grade IV: esophageal perforation.

Statistical analysis: Pertaining data was first entered in Microsoft excel spreadsheet and then analysed by SPSS version 20 software. Results were presented as mean, median, interquartile range, standard deviation or percentage as appropriate. Dichotomous events were compared by Chi-Square test and continuous variables were compared by Student t-test. P value less than 0.05 was considered significant.

RESULT

Over the study period, we enrolled 29 children in this study. Mean age of the study population was 4.4± 0.97 years. Mean weight was 14.9± 3.14 Kg. Males (17) outnumbered females (12) with a male: female

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ratio of 1.4:1. Duration of hospital stay (days) was 12.14 ± 6.33. Table 1 depicts general characteristics of our study population.

Table 1: General characteristics of the study population

Parameter	Number (n=29)	Percentage
Age:		
<5 years	17	58.6%
5-10 years	9	31.1%
10-15 years	3	10.3%
Background:		
Rural	18	62.1%
Urban	11	37.9%
Socio-economic status		
Upper class	2	6.9%
Upper middle	2	6.9%
Middle	5	17.2%
Lower middle	9	31.1%
Lower	11	37.9%

Most of the ingestions were accidental in nature (93.1%). However, 2 children (6.9%) had consumed it intentionally because of suicidal intention. Acids (65.5%) were the predominant substance consumed as compared to alkalis (34,.5%) as shown in table 2 below. First gastrointestinal endoscopy was done within 72 hours of ingestion. A repeat upper gastrointestinal endoscopy was done in all children after 2 weeks of ingestion to look for stricture formation and on subsequent follow up if needed.

Table 2: Time and type related variables of the study population:

Parameter	Number (n=29)	Percentage
Type of ingestion:		
Accidental	27	93.1%
Intentional	2	6.9%
Time of presentation to our hospital:		
Within 24 hours of ingestion	21	72.4%
After 24 hours of ingestion	8	27.6%
Type of corrosive ingested:		
Acidic	19	65.5%
Alkaline	10	34.5%
Time of first Endoscopy:		
Within 24 hours of ingestion	8	27.6%
Between 24-48 hours of ingestion	7	24.1%
Between 48-72 hours of ingestion	3	10.3%
Beyond 72 hours of ingestion	11	37.9%

All 29 children enrolled in the present study were symptomatic. Dysphagia was the commonest clinical feature (86.2) followed by vomiting (79.3%). Major complications were seen in 8 children (27.6%) requiring ICU admission and further care. Urgent surgery was done in one child who had presented on day 1 of ingestion with gut perforation. Overall, 3 (10.3%) and approx. one-third of the children admitted to the PICU succumbed to the complications. Major causes of mortality were DIC, refractory shock and MODS.

Table 3: Clinical features of the study population

Presentation	Number (n=29)	Percentage
Dysphagia	25	86.2%
Odynophagia	5	17.2%
Refusal to swallow	2	6.9%
Nausea/Vomiting	23	79.3%
Chest Pain	5	17.2%
Epigastric pain	9	31.1%
Breathing difficulty	2	6.9%
Upper G.I bleeding	4	13.8%
Shock	3	10.3%

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Metabolic acidosis	1	3.4%
Gut perforation	1	3.4%
Sepsis	2	6.9%
DIC	2	6.9%
Mortality	3	10.3%

No child showed normal findings in endoscopy. Site of injury was limited to pharyngeal inlet in 1 child (3.4%), only oesophagus in 5 (17.2%), only stomach in 9 (31.1%) and 14 (48.3%) had both oesophageal and gastric lesions on endoscopy as shown in table 4 below. On subsequent follow up, 7 (24.1%) children had strictures: 2 (6.9%) in oesophagus, 3 (10.3%) in stomach and 2 (6.9%) in both oesophagus and stomach. Overall, 5 of these 7 children (71.4%) required dilatation. Recurrent strictures were experienced in 2 of them (28.6%). Overall, a feeding gastrostomy was required in 1 (14.3%) of these 7 children. In another child, it was not feasible to overcome strictures and so, a gastric pull up surgery was done.

Table 4: Endoscopy findings of the study population

Parameter	Number (n=29)	Percentage
Site of injury:		
Only Pharyngeal inlet	1	3.4%
Only esophageal injury	5	17.2%
Only gastric injury	9	31.1%
Both esophageal and gastric injuries	14	48.3%
Initial grading of the injuries:		
Grade I	7	24.1%
Grade 2a	6	20.6%
Grade 2b	8	27.5%
Grade 3a	5	17.2%
Grade 3b	3	10.3%

DISCUSSION

Children constitute majority (nearly 80%) of all corrosive ingestion cases and the majority of this burden is contributed by developing countries. Corrosive ingestion is a common and preventable cause of esophageal and gastric injury in children. Acid ingestion is rare in the West and alkaline substances account for most cases of ingestion due to stringent control of sale of acids. Whereas, acid ingestion is common in India as hydrochloric acid is readily available over the counter as a cheap toilet cleaner. Not surprisingly, it is the most common corrosive ingested by lower socio-economic groups. In the present study too, ingestion of acids (65%) was more common than alkali ingestion (35%). Accidental consumption (>90%) was the most common cause for corrosive ingestion and less than 10% had consumed it intentionally. This can be attributed to the lower mean age of the participants in our study where suicidal tendency is quite rare. The most common clinical features were dysphagia (86%) followed by vomiting (80%). This is similar to the findings of Kumar A et al8 done in northern India. In our study, oropharyngeal lesions were present only in 31 % of the patients. Surprisingly, even in patients with normal oral examination findings, significant esophageal and gastric injury as well as stricture could be found. This correlates with studies which have shown poor predictive nature of oropharyngeal injuries in predicting the occurrence of esophageal or gastric injury following corrosive ingestion.[9] Overall, oesophageal injuries were less common than gastric injury in our study. Kruthika et al. reported oesophageal injuries (40%) to be more common followed by gastric injuries (35%).[10] This can be explained by a higher proportion of injury by acids than alkali in our study.

Endoscopy is the best means of assessing the extent and degree of injury as it avoids the occasional missed oesophageal burn without oral injuries. When evaluating the outcome of treatment, improvement in both the nutritional status and sustained esophageal patency, with an adequate lumen for normal food intake for growth and development, should be the reference points for successful dilatations. Contrary to the traditional belief that oesophagus is spared in acid ingestion, we found oesophageal damage in 7 out of 19 patients with acid ingestion (36.8%). Dilawari et al[11] also observed oesophageal involvement in 13 out of 15 patients with acid ingestion. DiCostanzo et al[12] 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.

CONCLUSION

Corrosive injury continues to be a significant problem in children. Acids are more commonly consumed by children as compared to alkalis. Most of the children do have some form of injury to their gut as revealed by the endoscopy findings. As it is preventable, active measures should be taken to reduce the incidence of corrosive ingestion and its consequences.

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Limitations: As the present study is a single centre study, its findings may not be truly representative of broader population. Second, due to relatively lesser sample size studied, a multivariate analysis to identify the risk factors for ingestion and its correlation with endoscopic findings could not be done.

Conflict of interest: None

Financial disclosure: None to declare

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