GASTRIC OUTLET OBSTRUCTION POST ACID INGESTION IN PEDIATRICS

Burkan Nasr 1,3,4, Anwar Al Jounaeeed1, Ghaleb Al Sady, Ahmad Al Shehari3, Omar Ashour2, Walid Meklafi4, Saeed Al Bahlooli2, Ali Hiddan5

1Consultant Surgeon Department of Surgery Saudi Hospital at Hajjah Yemen.
2Consultant Pediatrician Department of Pediatrics Saudi Hospital at Hajjah Yemen.
3Department of Surgery Thamar University.
4Department of Surgery Sana’a University.
5Department of Surgery Aden University.

Abstract

Aim: Evaluate clinical pattern, diagnosis, surgical management and outcome of Gastric outlet obstruction in children post accidental ingestion corrosive (sulfuric acid of battery), also role of continuing public education to reduce and avoid incidence these unfortunate events.

Patients & Method: prospective study for 20 patients children with isolated gastric outlet obstruction post corrosive sulfuric acid ingestion was admitted and operated in Saudi hospital at Hajjah Yemen in period April 2015_April 2021. The study evaluates patients demographic data, clinical presentation, diagnosis and management, also included in this study the Comparison proportions between two surgical procedures used for management this patient (group (A) pyloric resection and gastroduodenostomy and group (B) gastrojejunostomy with Braun anastomosis) with P value >0.05 was non-significant.

Results: Twenty patients with gastric outlet obstruction (12 boys and 8 girls), (Mean age was 4.5). Main presenting symptom recurrent attacks vomiting and loss of weight. The interval between acid ingestion and presentation ranged from 3_4weeks (mean=3.5weeks). The History, Barium swallow and meal used as diagnostic tool because safe, inexpensive. Surgical procedure included group (A)pyloric resection and gastroduodenostomy (n=10) and group (B) gastrojejunostomy with Braun anastomosis (n=10). Comparison between the two surgical procedures show all safe, less morbid, no mortality and no significant difference in end outcome result follow-up period up 2 years, all patients are symptoms free and gained adequate weight.

Conclusion: for patients children post corrosive accident ingestion with gastric outlet obstruction The History, barium swallow and meal used as diagnostic tool. Early surgery between 4_6 weeks by resection or bypass remains the treatment of choice with best result. To prevent these unfortunate events by encourage the Family education about clear labelling of dangerous substances and keeps this substance Far from reaching the kids.

Key word: corrosive induce gastric outlet obstruction; pyloric stricture; gastric outlet obstruction in pediatrics

1. INTRODUCTION:

Acid ingestion causing injury to the stomach was first reported in 1882, but it absolutely was not until 1962 that Karon described the pathophysiological events leading to stricture in those patients[1]. Corrosive acid ingestion could also be a typical source of morbidity within the developing world. The incident is incredibly higher in India and other developing countries because of unregulated sale of corrosive material within the market [2]. Children are particularly in danger of the accidental exposure to such substances thanks to inadequate parental supervision and careless storing of these chemicals at homes [3]. Both acid and alkali when consumed, cause significant injury to the upper digestive tract. The extent of injury depends upon several factors such as nature of the agent, amount, concentration and duration of exposure [2]. Typically, corrosive ingestion ends up in local reaction, esophageal damage and gastric injury therein order [4]. The stomach isolated injury with resulting in stenosis is extremely rare, accounting to as little as 3.8% of all the cases of corrosive ingestion, as reported in literature [5]. Acids produce coagulation necrosis of the tissue, and form an eschar at the positioning of injury resulting in segmental or extensive stricture formation within the long run. In contrast, alkalis produce penetrating or liquefaction
necrosis [6]. Acid is more likely than alkali to causing injury to stomach [7]. Small vessel thrombosis begins few hours after acids ingestion. It continues for 10_14 days beyond which bacterial infection along with inflammatory response and granulation tissue deposition dominates the pathological profile [8]. Healing process begins three weeks after the injury, leading to fibrosis and narrowing of lumen, ultimately resulting in stricture [9]. The age-old saying that “Acid licks the esophagus and bites the stomach” still holds good [10]. Squamous epithelium of esophagus and rapid passage through esophagus give some resistance and protection against acids but significant distensibility of stomach and acid induced reflex pyloric spasm. These factors prolong the contact period of acid with gastric mucosa and end with gastric deformity like small contracted stomach, hour glass, stenosis, pyloric strictures and gastric outlet obstruction [11]. In an exceeding study published by Ananth krishnan et al., acid ingestion was found to be accountable for 82.6% of chronic gastric injuries, the majority of them constituted by stricture [12]. Presentation of pyloric stricture post sulfuric acidic ingestion was present with recurrent attacks vomiting, loss of weight, and sign of dehydration. Diagnosis of children with acid induce gastric outlet obstruction mainly by History of corrosive intake, nature, time, type of substance ingestion , period of development pyloric stricture and clinical presentation post corrosive accident ingestion also upper gastrointestinal endoscopy & barium meal more helpful for diagnosis . Initially patients child post corrosive ingestion usually managed conservatively. Attempts at neutralizing the acids or alkalis are ill-advised and thus the resulting reaction from the neutralization process may do more harm and will be avoided. Patients post acidic ingestion with gastric outlet obstruction present dehydrated, electrolyte disturbed for that must be will hydration and correction electrolyte abnormalities and anemia before surgical management. Timing of surgery is controversial, but early surgical intervention remains the treatment of choice. Feeding jejunostomy and endoscopic balloon dilatation of stricture[5,13], gastrojejunostomy with or without vagotomy [14], pyloroplasty [15,16] or antrectomy with Billroth I anastomosis [17]are the surgical options available to management patients children post corrosive ingestion with gastric outlet obstruction . Each procedure possesses its advantages and disadvantages characters. [18], [19].

Patients and Methods:

Descriptive, comparison prospective study for 20 patients children operated post corrosive acid ingestion (sulfuric acid) induced pyloric stricture and gastric outlet in Surgery Department of Saudi hospital at Hajjah Yemen in period April 2015_ April 2021. All the patients who had gastric outlet obstruction or pyloric stricture post sulfuric acidic ingestion were made apart this study.

Preoperative diagnosis and workup was done with history and upper GI contrast studies. And the above criteria were followed. Age, gender, Clinical presentation, diagnostic tool and comparison between surgical procedures used for management all that variable included in our study.

Surgical management was take two groups, group A 10 of patients underwent pyloric resection and gastroduodenostomy, group B 10 patients underwent gastrojejunostomy with Braun anastomosis as primary surgical modality. Where Comparison study between two groups done. Statistical analysis was done using Statistical Packages for Social Sciences (SPSS), version 20.0 software (SPSS Inc. Chicago, IL, USA). both early and late complications of the two surgical procedures methods was not statistically different in the two studied groups (P > 0.05) as non-significant. These surgeries were carried by same team of surgeon Dr Burkan. Baseline characteristics of studied were statistically similar in two studied groups (P > 0.05). Time of operation was Similar, also nausea and vomiting, and at some point delayed discharge was not statistically different in the two studied groups (P > 0.05).

All patients taking care of pediatric medical doctor was stabilize the patients correction nutrition, electrolyte abnormalities and anemia before surgical management was take period stabilized about 5_7 days. We take consent for operation and for study and research from parents. Operation was taken under anaesthesia by consultant anesthesia doctor.

Results:

Total number of patients in our study was twenty, Male 12 & Female 8. Mean age (4.5 years), range from 3 to 6 years. Type of corrosive was sulfuric acid. Intake of corrosive was accidentally. Period of development of gastric outlet obstruction was about 3_4 weeks days, mean (3.5) weeks. Table (1). Chart (1). Presentation and diagnosis Of Pyloric Stricture Post Sulfuric Acid Ingestion Initially presentation were mild gastritis. But latter develop Gastric outlet obstruction post acid ingestion within 3_4 weeks. Diagnosis by clear history of acidic battery ingestion, barium swallow and meal X-ray of upper gastrointestinal tract. All patients were optimized before operation. Meantime until operative period after ingestion of corrosive was about 30 days. Operative time (80 minutes). Table (2). Chart (2). Comparisons between two types of operations procedure used for management gastric outlet obstruction post sulfuric acidic ingestion in our patients. Procedure was divided into two groups, group A pyloric stricture resection and gastroduodenostomy (Billroth I) and group B posterior gastro-jejunalostomy with Braun anastomosis . No different between group A and B,10 patients in each Group ,Age between 3_6 years ,underwent Operation 4.6 weeks after acid ingestion, no intraoperative complications or blood transfusion, Pyloric stricture short segment in group A and long segment more than 2cm in group B. Time of operation equal between two groups about 80 minutes. All patients in each group start oral feeding at 3rd days post operation. No significant post operation complications including refeeding syndrome in two groups except one case develop post operation nausea and vomiting in group B make insignificant one day delayed discharge compare with group A was all
patients discharge 5th days post operation except one case in group B discharge in 6th days post operation. Table (3). Chart (3). On follow-up 6 months _2 years post operation all patients in the two groups were being well. Good general conditions, appetite, weight gain and normal lifestyle .no stricture or re-do operation were performed.

![Table 1: Incidence of gastric outlet obstruction post acidic ingestion in pediatrics by age and sex](image)

| Age per years | Male | Female | Total | % |
|---------------|------|--------|-------|---|
| 3 year's      | 2    | 0      | 2     | 10%|
| 4 year's      | 6    | 2      | 8     | 40%|
| 5 year's      | 4    | 4      | 8     | 40%|
| 6 year's      | 0    | 2      | 2     | 10%|
| Total         | 12   | 8      | 20    | 100%|
| %             | 60%  | 40%    | 100%  |

![Chart 1: Incidence of gastric outlet obstruction post acid ingestion in pediatrics by age and sex](image)

![Table 2: Presentation and diagnosis of gastric outlet obstruction Post Sulfuric Acid Ingestion](image)

| Presentation and diagnosis | Number of patients |
|----------------------------|--------------------|
| History of ingestion       | 20                 |
| Latent period              | 10                 |
| Vomiting and loss of weight| 20                 |
| Anemia                     | 10                 |
| Hypokalemia                | 16                 |
| Barium swallow and meal    | 20                 |
Chart 2: Presentation and diagnosis of gastric outlet obstruction post Acid Ingestion in pediatrics by number of patients

Table 3: Comparisons between two types of operations procedure used for management gastric outlet obstruction post acidic ingestion in pediatrics patients

| Groups of patients | Group A | Group B |
|--------------------|---------|---------|
| Type of operation procedure | Pyloric resection and gastroduodenostomy | Gastrojejunostomy with Braun anastomosis |
| Number of patients | 10 | 10 |
| Age of patients | 3-6 year's | 3-6 year's |
| Operation after acid ingestion | 4-6 weeks | 4-6 weeks |
| Pyloric stricture segment length | Short segment | Long segment |
| Intraoperative complications | 0 | 0 |
| Intraoperative blood transfusion | 0 | 0 |
| Time of operation per hour | 1.2 | 1.2 |
| Post-operative nausea and vomiting or illus | 0 | 2 |
| Post-operative wound infection | 0 | 0 |
| Start oral per days post-operative | 3 | 3 |
| Refeeding syndrome | 0 | 0 |
| Time of discharge per day post-operative | 5 | 6 |
| Wight gain 2 years follow-up | Good | Good |
| Re stricter 2 years follow-up | 0 | 0 |
| Re operations 2 years follow-up | 0 | 0 |

Chart 3: Compare between surgical procedure groups (A) and (B)
Figure 1: Sulfuric acid solution of battery

Figure 2: Barium swallow and meal for 5 years old male child with gastric outlet obstruction 4 weeks post sulfuric acidic ingestion August 2017.

Figure 3: Intraoperative 4 years male with gastric outlet obstruction post sulfuric acidic ingestion 7/9/2017
Figure 4: Post pyloric stricture resection and gastroduodenostomy for 3 years old male with gastric outlet obstruction 4 weeks post sulfuric acidic ingestion 20/4/2019

Figure 5: Pyloric stricture resection and gastroduodenostomy for 6 years old female with gastric outlet obstruction 6 weeks post sulfuric acidic ingestion 4/8/2016

Figure 6: Barium meal for 5 years old female child with gastric outlet obstruction 4 weeks post sulfuric acidic ingestion 31 Jul 2016
Figure 7: Gastrojejunostomy 4 years old male with gastric outlet obstruction 5 weeks post sulfuric acidic ingestion 17/9/2019

Figure 8: Gastrojejunostomy with Braun anastomosis for 4 years old male with gastric outlet obstruction post sulfuric acidic ingestion 5 weeks 2/3/2018.

Figure 9: Pyloric Stricture resection and gastroduodenostomy for 5 years old male with gastric outlet obstruction 6 weeks post sulfuric acidic ingestion 2/1/2020
Discussion:

Corrosive ingestion in children may be a common problem in low income countries[5]. Yemen one among the developing countries that is increasing incidence of sulfuric acidic battery ingestion by pediatric, mostly incidental ingestion because increasing battery used for alternative energy for generating electricity specially during war period in Yemen and stopped community electricity. For that reason vitriol for device more available, unsafe packing and also it's color like water or stored in soda or beverage bottles in homes to which children have quick access, making incidental drinks by children more common. (Figure (1)). Similar for other study where Most of the youngsters after food intake and was losing weight altogether patients 20 patients started frequent episodic vomiting, rapid weight loss and decreased oral intake. All patients we received him in ER as presented with vomiting, rapid weight loss and decreased oral intake. (16). The exact prevalence and incidence of those injuries in Yemen is unknown and there is no local literature.

All operations 20 cases did in district hospital, Al Saudi hospital at Hajjah Yemen which only hospital in that district provide free medical services for all patients. The limited number of cases are thanks to rarity of those reasonably injuries.

20 pediatric patients diagnosis as gastric pyloric stricture post sulfuric acidic ingestion with gastric outlet obstruction manifestations, during 5 years period of our study, about 12 male and 8 female the age of patients between three to six years old. with peak age 4 years and 5 years, child with this age more active and check out became dependent and not able to Differentiate between different style of liquid. Also busy mother by care of latest infant. that reason make children more exposed thereto subject. In Karachi, Siddiqui et al. found that 41% of cases of accidental corrosive ingestion, the substances were stored in beverage bottles [20].

In our series all 20 child presented to us with the history from father or mother for accidental acid ingestion 3_4 weeks back was stored in beverage or bottle sometimes brought bottle with him. 10 patients felt initial latent period of 1 to 2 weeks following corrosive ingestion, was taken to an area peripheral hospital in his rural areas from where he was discharged after few hours of observation and good oral intake. After discharge he/she was tolerating oral diet but not fully recovered until 3_4 week, others 10 patients was mild slowly increasing symptoms not went hospital early due poorly family host at rural areas faraway from hospital. The gastric outlet obstruction can develop as early as 7 days and as late as 6 years looking on the extent of gastric damage [21].

In our patients show complete gastric outlet obstruction after sulfuric acidic ingestion at period 3_4 weeks. 3_4 weeks all 20 patients started frequent episodes of vomiting, especially after food intake and was losing weight altogether patients 100%. Similar for other study where Most of the youngsters present with vomiting, rapid weight loss and decreased oral intake [16]. All patients we received him in ER as came with dehydrated.

Upon arrival at the surgical facility she had a wasted and emaciated appearance. Abdomen was scaphoid with fullness appearing in epigastrium after food intake. Succession splash was present and also the stomach was found to be dilated upon percussion. However, no mass was palpable in epigastrium. She underwent routine blood investigations which demonstrated anemia patients (50%) and hypokalemia in 16 patients (80%). Barium swallow and meal study were undertaken which revealed the presence of pyloric stenosis or obstruction. Esophagus and proximal stomach were found to be normal in appearance, the upper GI endoscopy for pediatric not available, for that not done. (Figure (2)). Figure (6). Early surgery is that the treatment of choice and is usually recommended by most, though timing of surgery remains controversial. (5,13), Early repair is proposed by Tekant et al [17], to prevent weight loss. Meanwhile, Chaudry et al. recommended later repair [18], based on their understanding that the fibrotic process develops over a period of your time, and maximum fibrosis should develop before intervening.

We opted for early repair 4_6 weeks as early after diagnosis and stabilize the patients, because all of our patients had total obstruction as evidenced in contrast study. Early surgical intervention enabled earlier feeding and prevented further weight loss and prolonged hospital stays, which give excellent result.

The dilemma is whether a straightforward bypass surgery like gastrojejunostomy would be acceptable or partial gastrectomy of the obstructed and gastroduodenal anastomosis may be more appropriate. Imran et al used Billroth I as their procedure of choice for management of gastric outlet obstruction. This was based upon the findings of injuries and scarring of the antrum. [22].

Kaushik R states that removal of non-viable gastric tissue is preferred and Billroth I had good outcome. [21].

Some other studies recommend ( Billroth I surgery in children with gastric outlet obstruction and reported uncomplicated outcomes.[17,5].

In our study 10 children patients post sulfuric acidic ingestion underwent pyloric resection and gastroduodenostomy supported intraoperative finding of pyloric stricture was short segment no sever fibrosis and adhesion which safe, non-complicated with good outcome. (Figure(4)). Figure (5). Figure (9). Figure (3).

Gastric resection might be associated with comorbidity if used patients with gastric outlet obstruction that associated with malnutrition and also that with extensive perigastric adhesion for that reason best option for this patients are gastrojejunostomy [16].

Özcan C performed gastrojejunostomy as procedure of 1st choice for all children who presented with gastric outlet obstruction due to acid ingestion.[15].

Early surgical intervention, individualized the surgical procedures consistent with the location and extent of the affected segment gives excellent result. Gastrojejunostomy may be a very safe operation with minimum morbidity and excellent long-term outcome.[19].
In our study 10 children patients post acidic ingestion with gastric outlet obstruction under went for gastrojejunostomy and Braun anastomosis supported intraoperative finding of pyloric stricture was long segment and sever adhesion which give good ending . Figure (7). Figure (8).

In an Egyptian series by El-Asmar et al, a range of procedures were performed in 26 patients, including gastrectomy, partial gastrectomy, Billroth 1, antrectomy, antroplasty, Finney pyloroplasty, Heineke-Mikulicz pyloroplasty and gastrojejunostomy [23]. Moderate mucosal injury with Partial obstruction usually responds to pyloroplasty, [18].

In our study cases no performed Finney pyloroplasty or Heineke-Mikulicz pyloroplasty in any case. In a recent report Seleim et al. used laparoscopic diamond shaped antroduodenostomy for pyloric stricture [24]. Not used laparoscopic in our cases for management pyloric stricture post sulfuric acidic ingestion. This reflects the necessity to decide on the procedure on a case-by-case basis, looking on the involved segments of the stomach and knowledge of the surgeon. I used two types of operations procedure divided into two groups Group A pyloric resection and gastroduodenostomy and group B gastrojejunostomy with Braun anastomosis for gastric outlet obstruction post corrosive acidic ingestion. Were 10 patients in each group and comparisons between two groups by time, complications intraoperative and post operations complications were encountered. Post-operative feeding was started on 3th POD, initially liquid, then gradually semisolid and solid on 4th POD Patients were discharged on 5th POD. Except one patient from group B develop nausea and vomiting and mild distension after starting oral feeding which delayed discharge for one day was not significant comparisons with group A. All patients were followed up 6 months to 2 year. On follow-up, all patients were being well General conditions, appetite, weight gain were better. No re stricture or redo operation were performed. Was show no significant difference in end outcome in 2 style of operations in follow-up period 2 years. Successful outcomes were seen by the immediate return to oral diet and in medium-term, with good weight gain and continued tolerance of full oral diet.

(The prevention are better than treatment) To minimize and prevention incidents the corrosive substance by children, need collaboration and appropriate efforts by families, government, factories, health team and media should be made to handle adequately this matter, There is a great need for adult education and for legislation to ensure correct labeling, safe packaging in child proof containers and to restrict the strength of caustic agents. Therefore,[15], [25].

Conclusion:
Most patients present with recurrent attacks vomiting and loss of weigh. Clearly history of acidic battery ingestion and Barium swallow and meal used as diagnostic tool for pyloric stricture and gastric outlet obstruction post corrosive ingestion, early surgical intervention remains the treatment of choice. No significant differences in end result for Surgery management for acidic induced gastric outlet obstruction, Pyloric resection and gastroduodenostomy or Gastrojejunostomy is a very safe operation with minimum morbidity and excellent long-term outcome. Surgical procedure should be tailored according to the patient's general condition and extent of gastric injury and surgical doctor experience.

Recommendations:
Public awareness on proper storage of corrosive agents is very important. There should be education about clear labelling of dangerous substances and reduced accessibility to children. Avoidable circumstances is reduced by cautiousness in family as well as in every aspect of our community. For that there is a good need for fathers and mothers education and for legislation to make sure correct labeling, safe packaging in child proof containers. Chang bottle or solution color to create it difference from beverage or bottle.

References
1. Karon AB. The delayed gastric syndrome with pyloric stenosis and achlorhydria following the ingestion of acid--a definite clinical entity. Am J Dig Dis.1962;7(11):1041–1046.doi:10.1007/bf02231908. [PubMed] [Google Scholar].
2. Lakshmi CP, Vijayahari R, Kate V, Ananthakrishnan N. A hospital-based epidemiological study of corrosive alimentary injuries with reference to the Indian experience. Natl Med J India. 2013;26:31–36. [PubMed] [Google Scholar].
3. Urganci N, Usta M, Kalyoncu D, Demirel E. Corrosive substance ingestion in children. Indian J Pediatr 2014;81:675–679.
4. Contini S,Scarpiignato C. Caustic injury of the upper gastrointestinal tract: a comprehensive review. World J Gastroenterol.2013;19:3918–3930. PMC free article] [PubMed] [Google Scholar]
5. Ciftci AO, Senocak ME, Buyukpamukcu N, Hicsonmez A. Gastric outlet obstruction due to corrosive ingestion: incidence and outcome. Pediatr Surg Int. 1999;15(2):88–91. doi:10.1007/s0038300 50523. [PubMed] [Google Scholar].
6. Chibishev A, Simonovska N, Shikole A. Post-corrosive injuries of upper gastrointestinal tract. Prilozi. 2010;31:297–316.[PubMed] [Google Scholar]
7. Subba Rao KSVK, Kakar AK, Chandrasekhar V et al (1988) Cicatricial gastric stenosis caused by corrosive ingestion. Aust N Z J Surg 58:143–146. Article CAS Google Scholar
8. Andreoni B Farina ML Biffi R Crosta C Esophageal perforation and caustic injury: emergency management of caustic ingestion.Dis Esophagus. 1997; 10: 95-100. View in Article PubMed Crossref Google Scholar
9. Ionescu M, Tomulescu V, Gheorghe C, Popescu I (2000) [Post-caustic esophageal stenosis]. Chirurgia (Bucur) 95: 23-28. https://pubmed.ncbi.nlm.nih.gov/14959639/

10. Marks IN Bank SWerbeloff LFarman JLouw JH The natural history of corrosive gastritis. Report of five cases. Am J Dig Dis. 1963; 8: 509-524 Scopus (25) Crossref Google Scholar

11. Roy M Jr, Calonje MA, Mouton R (1962) Corrosive gastritis after formaldehyde ingestion: report of a case. N Engl J Med 266: 1248-1250. https://doi.org/10.1056/nejm196206142662403.

12. Ananthakrishnan N, Parthasarathy G, Kate V (2010) Chronic corrosive injuries of the stomach—a single unit experience of 109 patients over thirty years. World J Surg 34: 758-764.[PubMed][Google Scholar].

13. Hwang TL, Chen MF. Surgical treatment of gastric outlet obstruction after corrosive injury - can early definitive operation be used instead of staged operation? Int Surg 1996;81:119-21. [PUBMED].

14. Solt J, Bajor J, Szabo M, Horvath OP. Long-term results of balloon catheter dilation for benign gastric outlet stenosis. Endoscopy 2003;35:490-5.

15. Ozcana C, Erquna O, Sena T, Mutafa O. Gastric outlet obstruction secondary to acid ingestion in children. J Pediatric Surg 2004;39:1651-3.

16. Sharma S, Debnath PR, Agrawal LD, Gupta V. Gastric outlet obstruction without oesophageal involvement: A late sequela of acid ingestion in children. J Indian Assoc Pediatr Surg 2007;12:47-9.

17. Tekant G, Eroglu E, Erdogan E, Yesildag E, Emir H, Buyukunal C, et al. Corrosive injury-induced gastric outlet obstruction: J Pediatr Surg. 2001;36(7):1004–1007.doi:10.1053/jipsu.2001.24725. [PubMed] [Google Scholar]

18. Chaudhary A, Puri AS, Dhar P, Reddy P, Sachdev A, Lahoti D, et al. Elective surgery for corrosive induced gastric injury. World J Surg. 1996;20(6):703–706.doi:10.1007/s002689900107.

19. Collure DW. Pyloric obstruction following the ingestion of corrosive acid. Ceylon Med J 1989;34:135-7. [PUBMED].

20. Siddiqui E, Ejaz K, Kazi SGI, Siddiqui S, Raza SJ. Mothers' education and working status; do they contribute to corrosive poisoning among paediatric patients of Karachi, Pakistan? J Pak Med Assoc. 2013;63(8):992–996.

21. Kaushik R, Singh R, Sharma R, et al. Corrosive-induced gastric outlet obstruction. Yonsei Med J. 2003; 44: 991-994[PubMed] [Google Scholar].

22. Imran M, Akhtar W, Wahab R, Rehman FU, Rehman IU, Naeem M. Corrosive induce gastric outlet obstruction and management. J MedSci. 2017;25(3):319–322. [Google Scholar].

23. El-Asmar KM, Allam AM. Surgical management of corrosive-induced gastric injury in children: 10 years' experience. J Pediatr Surg. 2018;53(4):744-747. doi:10.1016/j.jpedsurg.2017.05.014. [PubMed] [Google Scholar].

24. Seleim HM, Wishahy AMK, Abouelfadl MH, et al. Laparoscopic Diamond for Post corrosive Pyloric Cicatization: A Novel Approach. J Laparoendosc Adv Surg Tech A. 2019;29(4):538541. doi:10.1089/lap.2018.0182. [PubMed] [Google Scholar]

25. Shukla RM, Mukhopadhyay M, Tripathy B B, Mandal K C, Mukhopadhyay B. Pyloric and antral strictures following corrosive acid ingestion: A report of four cases. J Indian Assoc Pediatr Surg 2010;15:108-9