Eastern Journal of Medicine 13 (2008) 1 - 6

Original Article

An analysis of corrosive substance ingestion of children in eastern Turkey

Mehmet Melek[a*], Yeşim Edirne[a], Ufuk Çobanoğlu[b], Abdullah Ceylan[c], Muhammet Can[d]

[a]*Yuzuncu Yil University, School of Medicine, Department of Paediatrics Surgery, Van, Turkey.*
[b]*Yuzuncu Yil University, School of Medicine, Department of Thoracic Surgery, Van, Turkey.*
[c]*Yuzuncu Yil University, School of Medicine, Department of Pediatrics, Van, Turkey.*
[d]*Yuzuncu Yil University, School of Medicine, Department of Forensic Medicine, Van, Turkey.*

Abstract. In this study, we aimed at describing corrosive substance ingestion and related problems in Eastern Turkey. This type of injury is still a serious problem to be given a careful attention in our country like the other developing countries. The charts of children managed in our hospital with corrosive substance ingestion in the period of 1996- 2008 were evaluated retrospectively. Gender, age, ingested substance and the volume, symptoms, morbidity of caustic injury were considered in the analysis of the charts. We had 40 male and 35 female cases. 82% of children were under 5 years old. Mean age was determined as approximately 3.5 years. Bleach was the most common corrosive substance received and it was followed by hydrochloric acid. The volume of the ingested substance varied between 1-100 ml. The volume could not be estimated in 36 children. It was determined that 54% of ingested corrosive substance was in its original package. Twenty-five cases ingested the substance from food or drink containers that was stored somewhere in the kitchen. Five children had developed esophageal strictures. They were included in esophageal dilatation program. In our country the morbidity of caustic esophageal burn is still a problem that should be involved. Attention to the storage conditions and secured bottle cap seems to be the easiest and simplest way to prevent corrosive substance ingestion.

Key words: Corrosive substance ingestion, caustic burn, esophageal burn

1. Introduction

In developing countries, corrosive substance (CS) ingestion has also been recognized as the one of the major health problems in childhood. Acidic or alkaline cleaning materials used mostly in kitchens in liquid or powder form have been identified as common agents in CS ingestion in children (1,2). In our country the morbidity of caustic esophageal burn is still a problem that should be taken into consideration. In this study, we aimed to describe CS ingestion and related problems in Eastern Turkey.

2. Materials and methods

The charts of 75 children managed in our hospital with CS ingestion in the period of June 1996-April 2008 were evaluated retrospectively. Gender, age, ingested material and the volume, symptoms, first interventions, therapeutic outcome, morbidity of caustic injury and also season of the year were considered in the analysis of the charts. In some cases the ingested material could not be determined and are reported as not known. SPSS 13 program was used to analyze data.

3. Results

We have 40 male and 35 female cases. The age distribution of our cases is shown in (Fig. 1). The most frequent age of ingestion was between 1-3 years. 82% of children were under 5 years old. Mean age was determined as approximately 3.5 years (41,8±30,9 months).

Bleach was the most ingested CS with the rate of 45.3%, followed by hydrochloric acid 17.3%. The lime remover was the third (Table 1). 61.8% of bleach ingested children had no sign during physical examination. Ten cases had neither complaints nor physical examination findings. In general, there was no physical examination finding in approximately half of the 75 cases at the admission (Table 1).

*Correspondence: Mehmet MELEK
Yüzüncü Yıl Üniversitesi Tıp Fakültesi Çocuk Cerrahisi Kliniği. Van, Türkiye

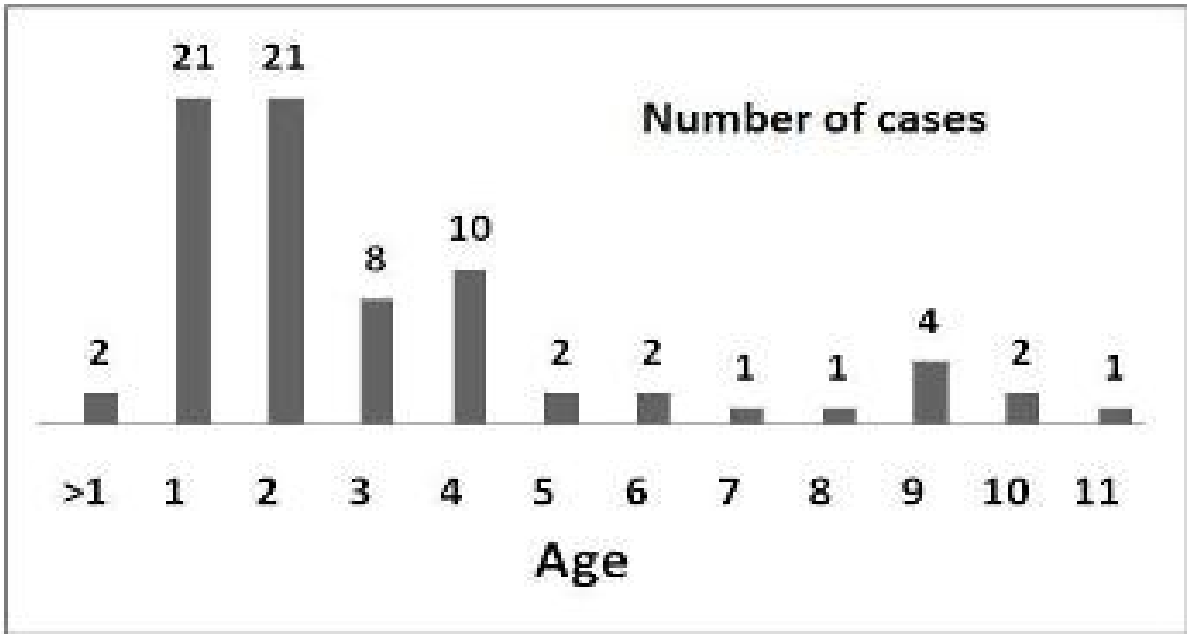

Fig. 1. Age distribution of 75 children.

Table 1. The type of ingested corrosive substance and the presence of physical examination finding

Substance	Number of patients (n)	Findings of physical examination findings	
		Present (n)	None (n)
Sodium hypochloride	34	13	21
Hydrochloric Acid	13	5	8
Limescale Solvent-Remover	6	4	2
Sink Unblocker –NaOH	4	4	-
Degreaser	3	3	-
Lime (Powder, Diluited)-CaOH	3	2	1
Dishwasher Polisher	3	1	2
Surface Cleaner	1	1	-
Vinegar	1	1	-
Zephiran –Benzalkonium Chloride	1	-	1
Cement	1	-	1
Disinol (Chlorobutanol+Phenol)	1	1	-
Not known	4	2	2
TOTAL	75	37	38

The majority of the lesions during the physical examination were in oral and perioral regions. The respiratory system signs took the second place.

The volume of the ingested substance varied between 1-100 ml. The volume in 36 children could not been estimated.

When the containers and storage place of the ingested substances were considered we determined that 54% of CS was in its original package. One third of the cases (25 cases) ingested the substance from food or drink containers that was stored somewhere in kitchen

such as plastic bottle, water or tea glasses or coffee cups.

The mean interval between ingestion and admission to our hospital was determined as 6,1±11 hours. The majority of these cases have attended to the hospital within the first 6 hours. All the children applied after the first 72 hours of ingestion have come with complaints resulting from stricture.

Table 2. Referring symptoms of the cases

Referring symptoms	Number and % of cases	
No complaints	32	42,6
Gastrointestinal system	38	50,6
Vomiting	25	
Hematemesis	3	
Nausea	1	
Constipation (cement ingestion)	1	
Diarrhea	2	
Swallow difficulty	3	
Disphagia solid foods	1	
Not be fed	1	
Weight loss	1	
Local irritation	7	9,3
Oral burning	1	
Swelling of lips	1	
Overflowing saliva from mouth	2	
Wounds on lips, mouth and tongue	2	
Bleeding from tongue and lips	1	
Respiratory system	7	9,3
Sore throat	1	
Cough	3	
Dispnea	3	
Other	5	6,6
Fever	3	
Changes in skin colour (rash etc.)	2	

Most of the referred symptoms have been composed of gastrointestinal symptoms which lead to vomiting. The symptoms of local irritation in seven cases and symptoms related to respiratory system in eight cases were determined. 32 children were admitted with no complaints (Table 2). Certain interventions proceeding referral to our hospital were determined in 17 cases. All of these critical interventions were performed at home, except the stomach irrigation which was performed in a hospital. All of the home interventions applied was to drink another liquid for neutralization of substance. Vomiting occurred in 7 (41.2%) of these 17 cases. Vomiting was amongst the symptoms in 16 (27.6%) of the other 58 cases brought to our hospital without any intervention. In the comparison between these groups performed by rate comparison method with Z test ($Z=0.30$, $p>0.05$), no statistically significant difference for vomiting was determined (Table 3).

Table 3. The first interventions performed before referring to our hospital and presence of vomiting after these interventions

Type of Intervention	Cases		Vomiting
	n	%	(n)
No intervention	58	27.5	16
With intervention	17	41.1	7
Drinking milk	8		3
Drinking ayran	3		3
Eating yoghurt	2		-
Drinking water	2		1
Drinking fruit juice	1		-
Gastric lavage	1		

In five children an esophageal stricture developed. Two of these cases had ingested hydrochloric acid and 1 of them had drunk degreaser. The volume of CS in developing stricture cases were unknown. Esophagoscopy and esophagography were performed to all of them. One case had the antral and the other pyloric injury leading to stenosis. The first was treated with gastrojejunostomy and the second was treated with pyloroplasty. These patients have also an esophageal stricture and they were included in esophageal dilatation program. During dilatation procedure, perforation of esophagus has developed in one case and tube thoracostomy was performed (Table 4).

At the evaluation of anamnesis of an 11-year female case revealed that she had ingested the CS to commit suicide.

It was determined that the season in which CS ingestion was the highest (26 cases) was autumn and the least (10 cases) was winter. In spring 19 cases and in summer 20 cases applied. The difference of CS ingestion amongst the seasons

Table 4. The data of the cases with esophageal stricture

Our cases developed esophageal stricture				
Gender/ Age	Corrosive	Esophagoscopy	Complication	Therapy
♂ 11 Years	Hydrochloric acid	Grade II burn	-	Dilatation program
♂ 2 Years	Vinegar	10 cm long stricture at the thoracal esophagus	-	Dilatation program
♀ 6,5 Years	Degreaser	Stricture at the tracheal bifurcation	-	Dilatation program
♂ 3,5 Years	?	Stricture at the tracheal bifurcation, Pyloric stenosis	-	Dilatation program+ Pyloroplasty
♀ 2,5 Years	Hydrochloric acid	Stricture at the thoracal esophagus + Antral Stricture	Esophageal Perforation	Dilatation program Thoracostomy Gastrojejunostomy

was evaluated by the rate comparison method with Z test. There was significant difference between winter and autumn seasons ($z=3.16$, $p<0.01$) and winter and summer seasons ($z=2.07$, $p<0.05$). Amongst the other months, there was no statistically significant difference for CS ingestion.

4. Discussion

In children, CS injury is an important health problem that can cause severe complications and even death affecting upper gastrointestinal system, mainly esophagus, and adjacent tissues (1-7).

Generally, it occurs in pre-school childhood, but newborn cases with higher morbidity and mortality has also been reported (2,8-12).

Mean age of our cases was determined as 3,5 years and male/female ratio was found close to each other. Although CS ingestion has been reported a bit more frequently in boys, generally gender distribution is equal in the world (8).

CS was ingested 54% from their original package in our series. Additionally, in 25 cases (33%) CS was stored in usual food and drink containers in the kitchen. Tea glass was the most frequent container with the rate of 71%.

We have only one 11-year-old girl, who attempted suicide with CS ingestion. Intentional ingestion of CS is a form of ingestion specific to adults and adolescents, but it has also been reported in childhood with a small percentage (5,7,8,13).

In our analysis, nearly half of the ingested CS consisted of sodium hypochlorite (liquid bleach). Alkaline agents, mainly corrosive cleaning products including substances like sodium hydroxide and sodium hypochlorite, are mostly responsible for esophageal burns in children (2,5,14,15).

In our series, more than half (38/75) of children did not have any positive physical examination signs. But, it is highlighted that the lack of physical examination signs or complaints does not mean esophageal burn is absent. The cases with non-affected esophagus despite significant oral burn lesions have also been reported (2,14,16,17). Nearly half of our cases had gastrointestinal system symptoms, mainly vomiting (50,6%). Secondly the respiratory system symptoms were encountered in our study. These symptoms have been reported as an important cause of mortality especially in newborns (11,12).

In the suspicion of CS ingestion, oral feeding should be stopped. Gastric lavage or attempts to vomit are not recommended in any way (7,14,18). In Turkey, after the ingestion the parents gives to children something oral at home traditionally such as milk, ayran (mixture of yoghurt and water) and yoghurt. Vomiting occurred in some of the children. There was no significance in vomiting between the children who were intervent or not intervent. We don't approve of making patients drink various liquids for neutralizing and diluting CS because of the potential of provoking vomiting and consequently causing unfavorable results.

Esophagoscopy is a common method used as guiding and contributory in existence of lesion

and display the severity of damage, deciding therapeutic protocol (2-5,7,9). It is reported that an endoscopically burn classification is not reliable and doesn't correlate with clinical course, and that the severity of damage can not be determined by the esophagoscopic view of injury (14). Besides, even if early endoscopy has critical value to determine esophageal burns, it is reported that possible outcomes like stricture developing is not predetermined thoroughly with esophagoscopic studies alone (19). It has been showed that deep burns can be determined by evaluation of esophageal motility (20,21).

Our therapeutic protocol begins with stopping oral intake for the first 3 days. We performed esophagoscopy within the first 24-36 hours of ingestion. Oral nutrition with liquid foods begins at the end of 3 days, continuation with liquid and pulpy foods until the end of 21 days. The parents were asked to bring the child to outpatient's clinic with esophagography at the end of 21 days; the cases with swallow difficulty complaints or cases stricture determined on esophagography were included in dilatation program. Amongst the patients referred in the first 36 hours of ingestion with endoscopically positive burn findings, stricture development observed in only two children that required dilatation. Although several therapeutic models have been described for caustic injury management, there isn't any standard therapy protocol. The main aim of the therapy is to manage the early complications and to prevent stricture formation. It has been seen that along with supportive therapy, leaving esophagus to rest provided success for preventing the stricture development and the other complications (22,23). In none of the five cases with strictures, the amount of CS wasn't known. Three of them referred to us with nutrition problems. On esophagography of all these cases, stricture was determined in different severity and these cases were included in dilatation program. For strictures of corrosive injury, dilatation procedures and stent application have been reported as effective methods (4,9,10,14,24-26). When the dilatation is ineffective or impossible, various surgical replacement therapies may require (3,14,24,27,28). Perforation of esophagus during dilatation is an important remarkable complication 29. In our 2,5 year-old female case, perforation of esophagus happened during dilatation and this case, who also had antral stricture, was treated successfully by tube thoracostomy and gastrojejunostomy. The other case with pyloric stenosis was treated with pyloroplasty. For the treatment of gastric exit site obstruction, that is known to occur as a result of ingestion of mostly acidic substances, generally surgical intervention with suitable technique is required (10,30,31). For suitable patients, trying endoscopic balloon dilatation is proposed (9).

In developing countries, it has been reported that childhood caustic injury with CS is more frequent. There are numerous and large series of childhood CS injuries presented from the Turkish clinics, which supports that this issue is a quite serious problem for our country, and that effective and long-lasting preventions are required urgently (2,4,8,9,11,22-24,26,30). CS is mostly ingested as a result of carelessness and negligence of parents or the persons who takes care of the child (1,2,4,5,8). Attention to storage conditions and secured bottle caps seems as the easiest and simplest way of prevention of CS ingestion.

References

1. Havanond C, Havanond P. Initial signs and symptoms as prognostic indicators of severe gastrointestinal tract injury due to corrosive ingestion. J Emerg Med 2007; 33: 349-353.
2. Özgüner İF, Savaş Ç, Yavuz MS, et al. Çocuklarda kazara oluşan özofagus yanıkları. Süleyman Demirel Üniversitesi Tıp Fakültesi Dergisi 2002; 9: 7-9 (in Turkish).
3. Wasserman RL, Ginsburg CM. Caustic substance injuries. J Pediatr 1985; 107: 169-174.
4. Tiryaki T, Livanelioğlu Z, Atayurt H. Early bougienage for relief of stricture formation following caustic esophageal burns. Pediatr Surg Int 2005; 21: 78-80.
5. Janousek P, Kabelka Z, Rygl M, et al. Corrosive injury of the oesophagus in children. Int J Pediatr Otorhinolaryngol 2006; 70: 1103-1107.
6. Berthet B, Castellani P, Brioche MI, et al. Early operation for severe corrosive injury of the upper gastrointestinal tract. Eur J Surg 1996; 162: 951-955.
7. Andıran N, Sarıkayalar F. Pattern of acute poisonings in childhood in Ankara: what has changed in twenty years? Turk J Pediatr 2004; 46: 147-152.
8. Tekant G, Eroğlu E, Erdoğan E, et al. Corrosive injury-induced gastric outlet obstruction: a changing spectrum of agents and treatment. J Pediatr Surg 2001; 36: 1004-1007.
9. Contini S, Tesfaye M, Picone P, et al. Corrosive esophageal injuries in children. A shortlived experience in Sierra Leone. Int J Pediatr Otorhinolaryngol 2007; 71: 1597-1604.
10. Turan C, Özkan U, Özokutan BH, et al. Corrosive injuries of the esophagus in newborns. Pediatr Surg Int 2000; 16: 483-484.
11. Kushimo T, Ekanem MM. Acid ingestion in a 2-day old baby. West Afr J Med 1997; 16: 121-123.
12. Havanond C. Clinical features of corrosive ingestion. J Med Assoc Thai 2003; 86: 918-924.
13. Mutaf O: Çocuklarda Kostik Özofagus Yaralanmaları. In Başaklar AC (ed): Bebek ve Çocukların Cerrahi ve Ürolojik Hastalıkları. 1st ed. Ankara: Palme Publishing Company, 2006, pp 395-406.

14. Mamede RCM, De Mello Filho FV. Treatment of caustic ingestion: an analysis of 239 cases. Dis Esophagus 2002; 15: 210-213.
15. Crain EF, Gershel JC Mezay AP. Caustic ingestion symptoms as predictors of esophageal injury. Am J Dis Child 1984; 138: 863-865.
16. Gaudreault P, Parent M, McGuigan MA, et al. Predictability of esophageal injury from sign and symptoms: a study of caustic ingestion in 378 children. Pediatrics 1983; 71: 767-770.
17. Vale JA. Position statement: gastric lavage. American Academy of Clinical Toxicology; European Association of Poisons Centres and Clinical Toxicologists. J Toxicol Clin Toxicol 1997; 35: 711-719.
18. Kuhn JR, Tunell WP. The role of initial cineesophagography in caustic esophageal injury. Am J Surg 1983; 146: 804-806.
19. Lamireau T, Rebouissoux L, Denis D, et al. Accidental caustic ingestion in children: is endoscopy always mandatory? J Pediatr Gastroenterol Nutr 2001; 33: 81-84.
20. Genç A, Mutaf O. Esophageal motility changes in acute and late periods of caustic esophageal burns and its relation with prognosis in children. J Pediatr Surg 2002; 37: 1526-1528.
21. Baskın D, Urgancı N, Abbasoğlu L, et al. A standardised protocol for the acute management of corrosive ingestion in children. Pediatr Surg Int 2004; 20: 824-828.
22. Gün F, Abbasoğlu L, Celik A, et al. Early and late term management in caustic ingestion in children: a 16-year experience. Acta Chir Belg 2007; 107: 49-52.
23. Kochhar R, Ray JD, Sriram PV, et al. Intralesional steroids augment the effects of endoscopic dilation in corrosive esophageal strictures. Gastrointest Endosc 1999; 49: 509-513.
24. Mutaf O. Treatment of corrosive esophageal strictures by long-term stenting. J Pediatr Surg 1996; 31: 681-685.
25. Atabek C, Surer İ, Demirbag S, et al. Increasing tendency in caustic esophageal burns and long-term polytetraflourethylene stenting in severe cases: 10 years experience. J Pediatr Surg 2007; 42: 636-640.
26. Gündogdu HZ, Tanyel FC, Büyükpamukçu N, et al. Colonic replacement for the treatment of caustic esophageal strictures in children. J Pediatr Surg 1992; 27: 771-774.
27. Hendren WH, Hendren WG. Colon interposition for esophagus in children. J Pediatr Surg 1985; 20: 829-839.
28. Karnak İ, Tanyel FC, Büyükpamukçu N, et al. Combined use of steroid, antibiotics and early bougienage against stricture formation following caustic esophageal burns. J Cardiovasc Surg (Torino) 1999; 40: 307-310.
29. Özcan C, Ergün O, Şen T, et al. Gastric outlet obstruction secondary to acid ingestion in children. J Pediatr Surg 2004; 39: 1651-1653.
30. Çiftçi AO, Şenocak ME, Büyükpamukçu N, et al. Gastric outlet obstruction due to corrosive ingestion: incidence and outcome. Pediatr Surg Int 1999; 15: 88-91.
31. Boukthir S, Fetni I, Mrad SM, et al. High doses of steroids in the management of caustic esophageal burns in children. Arch Pediatr 2004; 11: 13-17.