

Sociodemographic Evaluation and the Outcomes of the Children Who had a Corrosive Ingestion History

Yakıcı Madde İçim Öyküsü Olan Çocukların Sosyodemografik Özellikleri ve Sonuçlar

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Abstract

Objective: Corrosive substance ingestion in childhood is a very important worldwide public health problem due to the fact that it causes many stressing effects on the health of child, on the family, society and health system. Demonstrating the sociodemographic risk factors of these patients may serve to develop prevention strategy.

Material and Methods: In this retrospective study, the sociodemographic risk factors and the outcomes of 143 patients who admitted to a university hospital pediatric emergency department because of corrosive substance ingestion between 01.01.2009 and 30.03.2010 were demonstrated.

Results: Half of the ingestions happened at home and 71% of the events occurred during summer. One third of the ingestions was bleach. Sixty nine percent of the corrosive substance was bought in non-packed form. Low education degree of the parents was found to be statistically meaningful on childhood corrosive ingestions ($p < 0.001$). Most of the patients healed spontaneously or with medical therapy, and 2.1% of the patients needed further esophageal dilatation.

Conclusion: Determining the group of children under risk, making efforts for increasing the education levels of parents, creating public awareness about the subject and assessing this situation from the neglect point of view, prohibiting the sale of unpacked house chemicals and law sanction could be possible effective measures in this respect. As ingesting corrosive substance threatens child health adversely, prevention should be essential.

Key words: Childhood corrosive ingestions, child health, pediatric intoxications

Özet

Amaç: Çocuklarda yakıcı madde içimi, tüm dünyada çocuk sağlığı, aile, toplum ve sağlık sistemi üzerinde ciddi baskıya neden olan önemli bir halk sağlığı sorunudur. Bu çocuklarda sosyodemografik risk etmenlerinin belirlenmesi koruyucu önlemlerin geliştirilmesine hizmet edebilir.

Gereç ve Yöntem: Geriye dönük olarak yapılan bu çalışmada, 01.01.2009 ve 30.03.2010 tarihleri arasında bir üniversite hastanesi çocuk acil servisine yakıcı madde içim öyküsü ile getirilen 143 çocuğun sosyodemografik risk etmenleri ve olayın sonuçları irdelenmiştir.

Bulgular: Yakıcı madde içimlerinin yarısı çocuğun kendi evinde, %71'i yaz aylarında yaşanmıştır. İçilen yakıcı maddelerin üçte biri çamaşır suyu olup, %69'u açık halde satın alınmıştır. Ana baba eğitim seviyesinin düşüklüğü ile çocukların yakıcı madde içimi arasında istatistiksel olarak anlamlı bir bağlantı bulunmuştur ($p < 0.001$). Hastaların çoğu kendiliğinden yada tıbbi tedavi yardımı ile düzeldiğinde, %2.1 hastada özofagus genişletme tedavisine gereksinim duyulmuştur.

Tartışma: Yakıcı madde içimi açısından risk altındaki çocukların erkenden belirlenmesi, ana baba eğitim düzeylerinin yükseltilmesine çalışılması, konuyla ilgili toplumsal farkındalık yaratılması, olayın çocuk gözetim ihmali penceresinden değerlendirilmesi, ev kimyasallarının açık şekilde satılmasının önlenmesi, konunun yasalarda yer alması gibi önlemler etkin ve koruyucu olabilir. Yakıcı madde içimi çocuk sağlığını ciddi olarak tehdit eden bir durumdur, engellenmesi temel yaklaşım olmalıdır.

Anahtar kelimeler: çocuklukta yakıcı madde içimi, çocuk sağlığı, çocuklukta zehirlenmeler

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Introduction

Ingestion of corrosive substances is an important worldwide public health problem in children (1). Although it is a preventable public health problem, these children are susceptible to the risks of pain, hospitalization, feeding difficulties, invasive procedures, anesthesia, medical treatment, or surgery in short term. In long term, chronic complications such as recurrent hospitalizations, esophageal dilatation therapy, gastrostomy, malnutrition, infection risk occur. However, ingestion of corrosive substances hardly cause to death occasionally.

The outcomes cause many stressful effects not only on the health of child and the family but on the society and health system, as well. Despite of the fact that, 95% of the child deaths caused by corrosive ingestions are reported in underdeveloped countries, implementing preventive measures, generating new standart therapy protocols, documentation of the outcomes or complications and conducting prevalence studies are currently incompetent issues in these countries (1).

Even in countries like the USA, in which the production, storage and consumption of corrosive substances are regulated by laws, 200000 children are estimated to be poisoned by industrial cleaning substances annually (2).

In Turkey, the rate of corrosive ingestions are estimated between 3,3% and 28,1% almost in all intoxications during childhood (3-8). Ingestion of corrosive substances during childhood frequently occurs accidentally, except for suicide attempts in adolescent period (2,9). In order to cope with this public health problem, WHO (World Health Organisation) states the importance of determination of risk factors (1).

On the basis of the studies, being under five years old which is the increasing period of child's motor ability and curiosity as well as lower socioeconomic status, traditional and ethnical practices are determined as the most important risk factors on childhood corrosive ingestion (9,10,11). The aim of the study is to demonstrate the sociodemographic risk factors and the outcomes of the patients who were admitted to a university hospital pediatric emergency department with a history of corrosive substance ingestion retrospectively.

Methods

This retrospective study was conducted on 143 patients who were admitted to Mersin University Hospital Pediatric Emergency Service in Turkey between 01.01.2009 and 30.03.2010 with corrosive substance ingestion. The cases were selected by browsing the ICD codes; Y19 (exposure to chemicals and noxious substances), T28.6 (esophagus corrosions), T54.2 (caustic substances and their toxic effects), T52.9 (toxic effects of organic substance, undefined) and also by line drawing of the operation record book of pediatric surgery department.

After ingesting corrosive substance and appeal to emergency department, all the patients were firstly examined by pediatricians and then pediatric surgeons and they were hospitalized. The records of the emergency room practices, the esophagoscopy results and the given therapy protocols were collected from the patient files.

The classification of the endoscopic corrosive burns was made as below; (12)

Grade 0: Normal

Grade 1: Edema and hyperemia in mucosa

Grade 2a: Exudative and white membranes, superficial ulcers, erosive areas

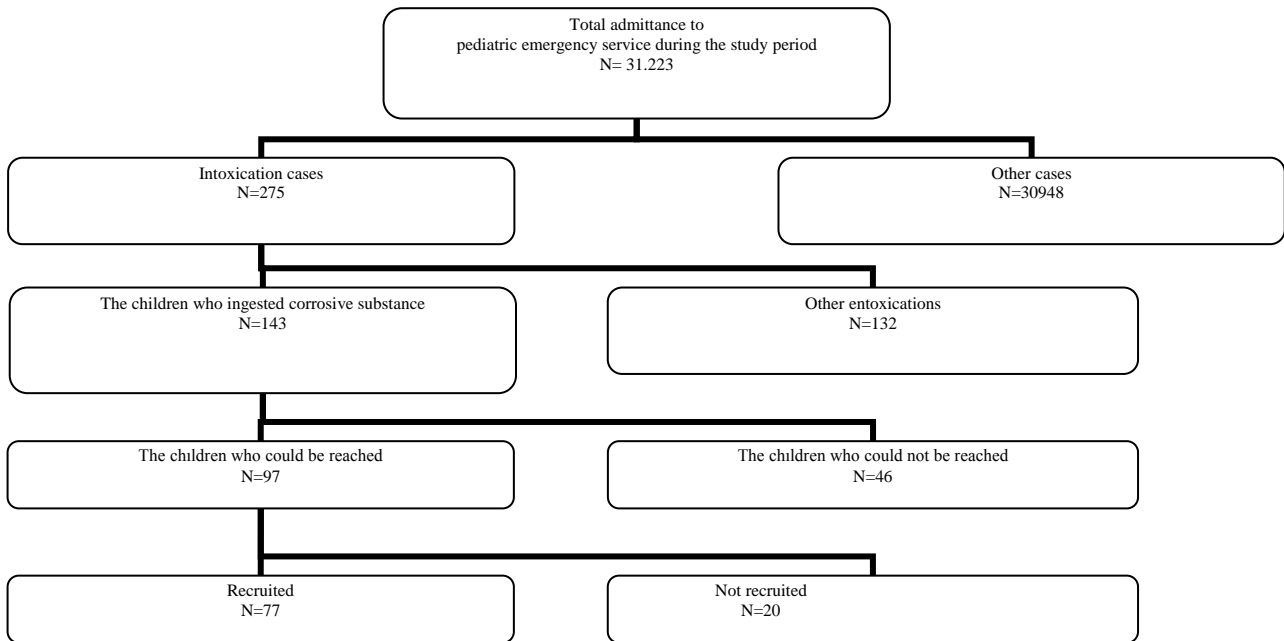
Grade 2b: Grade 2a finds+deep mutually exclusive or circular ulcerative areas

Grade 3a: Small necrotic areas, black-dark brown coloured esophagus wall

Grade 3b: Broad necrosis

In order to determine the sociodemographic characteristics of the patients and investigate the environmental risk factors, repeating accidental event of the index child (i.e. falling, hot water burn, ingestion of any other toxic substance or drugs, ect.) and the long term outcomes as well as the qualifications of the ingested corrosive substances, a questionnaire was prepared by means of the former studies. The questionnaire was prepared after crosshatching the literature on subject. All the researchers contributed to the process. All of the 143 families were not be able to be contacted due to the various reasons (i.e.wrong phone number, lack of current address, phone number change, etc.). The available 97 families were called up, informed accordingly and invited to the well child clinic of the hospital. The course of the patients were demonstrated in figure 1.

Figure 1. Flow chart for data availability



Seventy seven families responded to the invitation. After obtaining an informed consent, the parents (95% the mothers) were requested to answer the questionnaire. The interviews were conducted face to face by the researcher who was in charge of well child clinic. Meanwhile, the parents were asked about the possible long term complications of corrosive ingestion.

During the study period, a control group was generated with 78 patients who admitted to the pediatric emergency service other than corrosive ingestion history and every control case was selected randomly among the consecutive patient of every corrosive ingesting patient. The sample size control group was predetermined as the same as patient group.

Statistical analysis:

The data were processed and analyzed using the statistical package SPSS-11.5 for Windows.

Descriptive data were presented as proportions, means, and standard deviations. In Turkey primary school covers the first 8 years education period. As the number of high school (n:13) and university graduates (n:2) were low in patient group, the cut off point of education level of the parents was accepted as 8 years. In our country actual minimum wage is 600 TL=350 \$ hence the economical status of the families were assessed by comparing the monthly income of the family with minimum wage. While the univariate relationships between groups and sociodemographical characteristics; such as gender of the index child, age of mother, age of father, education levels of both parents, occupation of mother and monthly family income were evaluated by using chi-square tests, the difference of patient ages in study and control groups were analyzed with independent t test. According to univariate test results, multivariate logistic regression analysis were used to control confounding factors and to find the most significant factor for corrosive ingestion. Furthermore, derigueur clinically significant relationship among these survey items were

evaluated statistically by using univariate chi-square based tests. The two-tailed p values less than 0.05 were regarded as statistically significant for univariate analysis. The variables were added multivariate logistic regression model for the risk assesment if their p values were less than 0.10 or if they were confounding factors for the others.

Results

During the study period, 143 children were admitted to the pediatric emergency service of Mersin University Hospital with corrosive ingestion history which consisted of 52% (n=275) of total pediatric intoxication cases and 9.2% (n=1554) of total pediatric forensic cases. The sociodemographic characteristics of the study and control groups were shown on table 1.

Table 1. The sociodemographic characteristics of the study and control groups

Variables	Patient Group (n=77)		Control group (n=78)		p
	Number (n)	Percent (%)	Number (n)	Percent (%)	
Mean age of the children (in months)	58.1±4.13	-	73.8±59.4	-	0.057
Gender of the children					
Female	28	36.4	40	51.3	0.061
Male	49	63.6	38	48.7	
Age of the mothers					
20-29 years	32	41.6	18	23.1	0.065
30-39 years	33	42.9	48	61.5	
40-49 years	11	14.4	9	11.5	
Over 50 years	1	1.30	3	3.9	
Age of the fathers					
20-29 years	15	19.5	10	12.8	0.057
30-39 years	42	54.5	45	57.7	
40-49 years	14	18.2	18	23.1	
Over 50 years	6	7.8	5	6.4	
Education of the mothers					
≤8 years	62	80.5	37	47.4	<0.001
>8 years	15	19.5	41	52.6	
Education of the fathers					
≤8 years	56	72.7	30	38.5	<0.001
>8 years	21	27.3	48	61.5	
Occupation of the mothers					
Housewife	70	90.8	24	30.8	<0.001
Working	7	9.2	54	69.2	
Monthly income					
≤ minimum wage	38	49.4	29	37.2	0.999
> minimum wage	39	50.6	49	62.8	

In the study group, 78% (n=60) of the patients had no underlying diseases where 17 (22.1%) patients had. One patient out of 17 had a mental motor retardation which might be considered the reason of corrosive ingestion.

A history of repeating accidental events was 11.2 % (n=9) in the study group. The existence of repeated accidental events was higher (42.9%) in children of working mothers than the children of

housewives (7/70=10%), (p=0.036). There wasn't found any statistically significant relationship between having more than one accidental event and the mother's age (32.04±7.15, 31.00±5.07, p=0.658). Also, education level of the mother was not related to repeating accidental events (6/62=9.67% for ≤8, 4/15=26.67% for >8, p=0.104).

Multivariate logistic regression model was used to evaluate the corrosive ingestion risk using; age and gender of the children, education levels of both parents, occupation of mother and monthly income of the family. Age of mother was not added to model because multicollinearity problem. On the other hand, education level of mother had a confounding effect on the occupation of mother and also education level of father was a confounder for education level of mother. Hence, the results of multivariate logistic regression model included variables such as gender and age of children, education level and occupation of mother and education level of father (table 2). Finally low education level of father (≤ 8) was found to be the most effective risk factor on corrosive ingestion of children (OR=2.888, 95% CI:1.256-6.642).

The characteristics and distribution of ingested corrosive substances and the environmental conditions during the ingestion of corrosive substance were shown on table 3. Through the study period, 50% of the ingestions occurred during summer season (n=39). However, the rate of admittance to the pediatric emergency service rather than corrosive ingestions in summer was 24.2% (n=7550) of overall 31.223 pediatric emergency admittance annually.

Most of the children ingested non-packed corrosive substances. The factors effecting non-packed product usage were shown on table 4. Seventy four percent of the mothers (n=46) with the education of lower than 8 years (p=0.045)

were using non-packed products which, as estimated, were kept in non-original containers mostly. The mean admission time to the pediatric emergency department was 29.1±42.8 minutes. Statistically, early admittance to hospital was not related to educational level of the mother 30.13 ±44.47 minutes for ≤ 8 years of education and 25.00±36.25 minutes for >8 years of education, p=0,436). Also early admittance to hospital was not related to educational level of the father 33.18 ±48.73 minutes for ≤ 8 years of education, 18.33±16.45 minutes for >8 years of education, p=0,146). Seventy families (91%) took preventive measures at home after the event. Implementing preventive measures at home was not related to the age, educational or occupational status of the mother statistically (p=0.836, p=0.706 and p=0.113 respectively).

Forty three percent of the patients (n=32) vomitted after the corrosive ingestion. There has been determined a significant relation between vomitting and having been higher degree of endoscopic corrosive burn. Second degree of oesophagus burns were higher in patients with vomit (16/32=50%) than the patients who did not vomit (11/42=26%)(p=0,036). There was no relation between the amount of ingested substance and the degree of esophagus burns (p=0.998).

Table 2. Multivariate analysis of the factors effecting childhood corrosive ingestions

Variables		OR	95% CI	p value
Age of children		1.007	1.000-1.014	0.064
Gender	Male	1.746	0.848-3.594	0.130
	Female	Ref.		
Education level of mother	≤ 8	2.113	0.869-5.137	0.099
	>8	Ref.		
Education level of father	≤ 8	2.188	1.256-6.642	0.013
	>8	Ref.		
Occupation of mother	Housewife	1.565	0.524-4.680	0.423
	Working	Ref.		

Table 3: The characteristics of corrosive substances, their distributions and ingestions.

	No of patients (n=77)	Percentage (%)
The season which the corrosive substance was ingested		
Spring	23	29.9
Summer	39	50.6
Autumn	8	10.4
Winter	7	9.1
With whom the child was during corrosive substance ingestin		
With mother	38	49.4
With someone	36	46.7
Alone	3	3.9
The place where the child ingested corrosive substance		
At home	55	71.4
Out of home	22	28.6
The corrosive substance was sold		
Nonpacked	53	68.8
Packed	24	31.2
Ingested amount of the corrosive substance		
1-2 swallow	52	67.5
½-1 water glass	8	10.4
1 water glass	2	2.6
Unknown	15	19.5
The corrosive substance was kept in		
Kithchen	50	65
Bathroom	13	16.9
Balcony	2	2.6
In the wind	10	12.9
Locked cabinet	2	2.6
Existence of an extraordinary state during ingestion		
Yes	22	28.6
No	55	71.4
Implementing any preventive measures after the event		
Yes	70	90.9
No	7	9.1
Duration of admittance to hospital		
≤1 hour	71	92.2
1-3 hours	4	5.2
>3 hours	2	2.6
Ingested chemical		
Bleach	22	28.6
Lime solvent	15	19.5
Others (dye, washing softers..ect)	10	12.9
Fat solvent	9	11.7
Hydrochloric acid	8	10.4
Liquid detergent	6	7.8
Drain opener	4	5.2
Household acetic acid (vinegar)	2	2.6
Manure	1	1.3

Table 4. The factors effecting the usage of non-packed or packed products

	Usage of nonpacked product (n=53)	Usage of packed product (n=24)	p
Education of the mother			
≤8 years	46	16	0,045
>8 years	7	8	
Occupation of mother			
Housewife	50	20	0,135
Working	3	4	
Monthly Income			
≤ minimum wage	30	8	0,057
> minimum wage	23	16	
Any extraordinary condition during the ingestion			
Yes	36	19	0,312
No	17	5	
To whom with the child during ingestion			
With mother	41	22	0,134
With someone	8	2	
Alone	4	0	

Esophagoscopy was applied to 133 of the patients (the procedure was not required for 3 patients and refused by 7 families) (table 5). The initial esophagoscopy results of six patients were determined as stage 2B; three of whom were required further esophageal dilatation therapy. Two patients have been able to eat normally, but the third patient could be fed via gastrostomy currently. One suicide attempt existed in the study group and the patient healed without having any complications.

Table 5. The esophagoscopy results of the study group

Results	No of patients (n)	Percent (%)
0	21	27.,6
1	26	34.2
2A	21	27.6
2B	6	6.6
Not required	2	2.6
Refused	1	1.3
Total	77	100.0

Discussion

Since the corrosive substance ingestions has been an important threat on promotion of the child health in Turkey and in the world, the effecting factors on subject were inquired in this study. WHO also states the importance of determination of risk factors (1). Taking the literature into consideration, the argument and the interest are frequently focused on improving standard therapy protocols and treatment choices of both early and late complications of childhood corrosive ingestions. However, as the problem causes compulsory load on the child, parents, family, health system and community, determining the facilitative factors might serve to developing preventive measures.

In the study, the mean age of the study group was 58.1 ± 4.13 months and the result was supported by the literature (2,9,13,14,15,16,17). Depending on data by WHO, 80% of corrosive ingesting children are younger than 5 years old (1). In the period of 0-5 years, since the children are usually unaware of edible or not edible things, their curiosity and motor ability increase, they should be carefully monitored about the risks of intoxications and accidents. Although most of the childhood injuries, including corrosive ingestion, occur accidentally (18), the situation might be

considered as a sort of supervision neglect of children, as well. Making efforts about prevention of childhood corrosive ingestions also might serve decreasing neglect cases.

The male/female ratio was 1.7 in the study. Due to the fact, except for suicide attempts in adolescent period, males are more susceptible to corrosive ingestions (1,9,15,17), since boys tend to be more active and courageous as risk takers than girls. Although only 22.4% (n=17) of the study group had a concomitant disease, only one patient suffered from mental motor retardation which might be the facilitative factor on ingestion. In literature, any facilitative concomitant disease which increases corrosive substance ingestion weren't declared.

Educational level of the father was found to be the most effective factor on corrosive ingestions in the study. Seventy three percent of the fathers in the study group and 39% of the fathers in control group were educated under 8 years. There was a remarkable difference between groups. Though generally mothers are accepted as the primary caregivers and responsible parents of children in our community, educational level of the father rather than mother was found effective on ingestions. As most of the mothers were housewives in the study, earning money seemed to be father's duty primarily. Probably, of good quality of the father's occupation, which is directly related to the high educational level, provided higher life standard for the family. From this setting, suitable living conditions, supporting secure environment for the child and using appropriate cleaning products have been achieved easily in these families. Any how, it is well known that low educational level, having lack of knowledge on the topic and/or especially being illiterate are the two evident parental risk factors for corrosive substance ingestion in childhood (1).

In this study, 69% of the corrosive substances were bought in non-packed forms and using non-packed substances were related to the educational level of the mother. The percentage of the mothers having been educated under 8 years was higher in the study group (81%) when compared to the controls (48%). Having been unaware of the harmful effects of chemicals, low education is supposed to be a crucial factor not only for the choice of non-packed products; instead, keeping the chemicals in unsuitable containers (in food cups, water bottles and other possible storage

preferences), but also unconsciously choosing accessible places for storing. Additionally adverse effects of low education was shown on the neglect perception and attitudes of mothers (19).

Half of the patients ingested corrosive substances while they were with their mothers and the most of whom were housewives. However, on the other hand, repeated accidental events were higher in the children of working mothers. To invite the caretaker of the child with the parents, to well child clinic visits and give information about the potential dangers of corrosive ingestion might be an effective method for prevention.

Low economical status is a crucial risk factor on corrosive ingestion in childhood (1,9). In the study, half of the families' monthly income was under the minimum wage. According to the national economical statistical data, the poverty limit is reported as 3 times more than minimum wage in Turkey (20). In the study, although the corrosive ingestion was not found to be related with monthly income of the family, more than half of the families might be considered as living under low economical conditions.

Similar to previous studies, 71.4% of the children ingested corrosive substance at home. Accessibility to corrosive substances in living areas easily, keeping them in reachable cups and places (1,13) cause these accidents to happen mostly in domestic areas (17,21,22). In a study conducted with 743 patients, 48% of the children were shown to reach the corrosive substances easily (17). As mentioned before 69% of the children ingested non-packed products in the study and 78.9% of these substances were kept in drinking bottles, mostly in PET (Polyethylene Terephthalate) bottles. The easily accessible corrosive substances which are kept in non-labeled and/or non-packed conditions continue to be an important problem particularly in underdeveloped countries (2,13). In one of the studies of Bautista et al., 75% of the children were found to have been poisoned with the chemicals which were kept out of the original packages (17). Although the details of the content, packing styles and use of compulsory childproof covers in house cleaning chemicals were regulated by law, 200.000 children get poisoned annually in the USA and most of these intoxications are caused by cleaning house products which are kept in non-original packages (2).

Approximately one third of the ingested substances was bleach. According to the former or current reports from various countries, the bleach or particularly alkali substances were declared to be the most common ingested corrosive substances within the rate of 30-85% (9,10,14,15,16,17,23,24). Also there is a tendency to keep alkali agents in PET water bottles (25) as in our study. Nevertheless, in few studies, the ascite substances are claimed as the most ingested substances depending on geographical and ethnical characteristics of the community (1,9).

Corrosive substance ingestions happened mostly in summer and then in spring. For the kindergarten children, spending more time at home during summer holiday might be an important risk factor. As Mersin is located in the southest part of Turkey, living in a temperate zone and the climate's getting warmer earlier and making traditional house cleaning early in the spring might be another contributing factor. Finding the cleaning house products in sight and possible lack of supervision of the child during house cleaning might increase the possibility of ingestion. Similarly, in a study, ingesting corrosive substance was found to be increased during spring house cleaning period which was made just before a religious bairam (9). Nevertheless the most happening season was mentioned differently in literature (17,25).

Most of the children ingested corrosive substances from water bottles. As the average of enviromental temperature is higher than seasonal average in our region, it has become a predictable result for children to drink house cleaning chemicals accidentally which have been kept in water bottles. Though 60% of the children ingested 1-2 swallows of corrosive substance, they were brought to the pediatric emergency department in 15 minutes averagely. The longest duration was 4.8 hours. Studies show that, suitable time for admittance to emergency room is accepted as the first 48 hours. According to the declaration of WHO in 2009, proper admittance was met in only 19.5% of childhood corrosive ingestion cases (1). Ingesting small amounts and faster appeal to the pediatric emergency service might be the cause of lower complication rate in this study. Since the esophageal stricture rate was declared to be 3.7% to 85% in literature (1,2,9,13,25). 2.1% (n=3) of our patients needed esophageal dilatation therapy.

The rate of childhood corrosive substance ingestions were found to be decreased in the examples of longitudinal studies which were conducted before and after regulating the production and consumption of the cleaning products by law (17,18). Obligatory childproof cover use in concentrated chemicals was found to be the most effective measure in prevention (26). The packed household cleaning substances are usually sold in attractive; colored and simply covered packages in our country. After a notification of Ministry of Industry and Trade on the labeling of bleach and mechanical cleaning powders in 2005, only the written warning 'keep away from children' was added onto the labels. There are no other regulations currently (27).

Conclusion, prevention of corrosive ingestions in childhood is essential. Determining the group of children under risk, making efforts for improving the education level of community, creating public awareness about the subject and assessing the situation from the neglect point of view, prohibiting the sale of non-packed house chemicals and law sanction might be effective preventive measures in this respect.

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