



Evaluation of Corrosive Substance Ingestion in the Pediatric Emergency Department

Çocuk Acil Servisinde Koroziif Madde Alımının Değerlendirilmesi

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Abstract

Introduction: The management of the patient who applied to the emergency department with corrosive substance exposure varies according to the characteristics of the substance and the clinical conditions of the patient. In this study; demographic and clinical characteristics, patient management strategies and prognosis of the children presenting with corrosive substance ingestion are presented.

Methods: Cases who applied with corrosive substance intake and were under the age of 18 were included in the study. Demographic data of the patients, characteristics of the substance, presence of intraoral lesions or any symptoms or signs, treatment and prognosis, radiographs and hospital stay were examined. Drool scores were calculated.

Results: One hundred-ten patients were included. The mean age of the patients was 41±13 months and 56 (50.9%) were male. 53% of the patients were asymptomatic at presentation. The most common symptom was nausea-vomiting, the most common finding was hyperemia in the oropharynx. The mean Drool score of the patients was 8.9±1.7. Seventy-seven patients (70%) took alkaline, 33 patients (30%) took acidic substances; 45 patients sodium hydroxide, 27 patients sodium hypochlorite, 26 patients took hydrochloric acid. Findings were mostly observed in hydrochloric acid and sodium hydroxide intake. Endoscopy was performed in 3 of the patients. The mean Drool score of the patients who underwent endoscopy was 6.7. No complications were observed in any of the patients in the follow-up.

Conclusion: Ingestion of corrosive substances is one of the important and preventable causes of emergency department admissions with chemical poisoning. There is usually accidental and small amount of

Öz

Giriş: Koroziif madde maruziyeti ile acil servise başvuran hastanın yönetimi maddenin özelliklerine ve hastanın klinik durumuna göre değişmektedir. Bu çalışmada; koroziif madde alımı ile başvuran çocukların demografik ve klinik özellikleri, hasta yönetim stratejileri ve hastaların prognozu sunulmaktadır.

Yöntemler: Koroziif madde alımı ile başvuran ve 18 yaşın altında olan olgular çalışmaya dahil edildi. Hastaların demografik verileri, maddenin özellikleri, ağız içi lezyonların veya herhangi bir semptom veya bulgunun varlığı, tedavi ve prognozu, grafileri ve hastanede kalış süreleri incelendi. Drool skorları hesaplandı.

Bulgular: Yüz on hasta çalışmaya dahil edildi. Hastaların yaş ortalaması 41±13 ay ve 56'sı (%50,9) erkekti. Hastaların %53'ü başvuru anında asemptomatikti. En sık görülen semptom bulantı-kusma, en sık bulgu orofarinkste hiperemiydi. Hastaların Drool skor ortalaması 8,9±1,7 idi. Yetmiş yedi hastanın (%70) alkali, 33 hastanın (%30) asidik madde alımı mevcuttu, içlerinden 45 hastanın (%40,9) sodyum hidroksit, 27 hastanın (%25) sodyum hipoklorit, 26 hastanın (%24) hidroklorik asit aldığı saptandı. Bulgular en fazla hidroklorik asit ve sodyum hidroksit alımında gözlemlendi (p=0,044). Hastaların 3'üne (%2,7) endoskopi yapıldı. Endoskopi yapılan hastaların Drool skor ortalaması 6,7 idi. Takiplerde hiçbir hastada komplikasyon görülmedi.

Sonuç: Koroziif madde alımları kimyasal zehirlenmelerle olan acil servis başvurularının önemli ve önlenebilir nedenlerinden biridir. Erken çocukluk döneminde sıklıkla kazara ve az miktarda alımlar söz konusudur. Hastalar asemptomatik olabilir veya nadiren ciddi

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intake in early childhood. Patients may be asymptomatic or rarely present with severe symptoms. It is important to know the chemical content of the ingested substance in order to predict the risk of damage to the gastrointestinal tract and respiratory system and to provide appropriate management in emergency services.

Keywords: Corrosive, child, emergency, poisoning

Introduction

Corrosive damage remains a concern for pediatric emergency clinicians. Accidental ingestion of corrosive substances is common in young children. It can clinically occur in a wide spectrum. While patients may be asymptomatic, they may also present with conditions that require immediate intervention such as necrosis or perforation.¹ Corrosive substances can be acidic or alkaline and cause chemical burns by different mechanisms. The most commonly ingested corrosive substances, especially household cleaning products, are degreasers with a strong basic effect, dishwashing detergents, polishes and lime removers with a strong acidic effect.² The first intervention and management of the patient who applied to the emergency room due to corrosive ingestion varies according to the chemical and physical properties of the substance, its amount, concentration, contact time in the tissues, and the patient's signs and symptoms. In this study, demographic and clinical characteristics, patient management strategies and prognosis of the children admitted to the pediatric emergency department of our hospital with corrosive substance intake are presented.

Materials and Methods

It is a single-center retrospective descriptive study. Patients admitted to the pediatric emergency department with chemical poisoning between January 01, 2016 and December 31, 2018 were selected from our hospital database by using the ICD-10 codes of X49 (accidental poisoning and exposure by other and unspecified chemicals and harmful substances), T54.X (toxic effect: Corrosive acids/alkalis/unspecified/others), T28.0-T28.2, T28.5-T28.7 (Corrosive Gastrointestinal Burns). The content of the exposed chemical substance was examined, those with strong acidic (<2) and strong alkaline (pH>11.5) structures were accepted as corrosive substances.³ Cases under 18 years of age, who applied with corrosive substance intake, were included in the study. Patients with isolated inhalation, eye or skin contact, and those with missing data were excluded from the study.

Demographic data (age, sex) of all included patients, the time elapsed between the ingestion of the substance and admission, and the type and amount of the substance were recorded. Symptoms and/or signs of the patients (drooling,

semptomlar ile başvurabilirler. Gastrointestinal sistem ve solunum sistemi ile ilişkili hasar riskini öngörmek ve acil servislere uygun yönetimi sağlamak için alınan maddenin kimyasal içeriğinin bilinmesi önemlidir.

Anahtar Kelimeler: Koroziif, çocuk, acil servis, zehirlenme

nausea, vomiting, difficulty in swallowing, burning sensation, erythema in the oropharynx, ulcer or respiratory symptoms such as hoarseness, cough, bruising, shortness of breath, chest pain, dysphonia, stridor, tachypnea), their treatment and prognosis were recorded. X-rays (postero-anterior chest X-ray and standing direct abdominal X-ray) and length of hospital stay were examined.

Drool Score

The Drool score is a tool that shows the risk of stricture in the esophagus according to the clinical findings in the child. It was developed by Uygun et al.⁴ in a prospective study of 202 patients (Table 1). A score of ≤ 4 points as a result of this scoring is a predictor of esophageal stenosis. The Drool scores of all patients included in the study at the emergency service admission were calculated and recorded.

Corrosive substances ingested by the patients were examined. Chemical contents and pH values of the substances were recorded. They were divided into four groups as sodium hydroxide, sodium hypochlorite, hydrochloric acid and others. The clinical features and length of hospital stay of the cases were evaluated according to the groups.

This study was approved by the Ethics Committee of University of Health Sciences Turkey, Dr. Sami Ulus Gynecology, Child Health and Diseases Training and Research Hospital (date: E-21/09-208).

Statistical Analysis

Statistical analyses of the data obtained in the study were performed in IBM SPSS for Windows version 22.0 package program. Descriptive statistics were presented with frequency, percentage, mean, median, standard deviation, minimum and maximum values. The comparison between the groups was made using the Kruskal-Wallis test, since it did not conform to the normal distribution.

Results

Between January 2016 and December 2018, a total of 1100 patients were admitted to the pediatric emergency department of our hospital due to chemical substance exposure. Of these patients, 123 (11.1%) were exposed to corrosive substances. A total of 110 patients were included in the study. The mean age of the patients was 41 ± 13 months and 56 (50.9%) were

Table 1. Drool score

Findings	Score 0	Score 1	Score 2
D (Drool) increased drooling	≥12 hours	<12 hours	None
R (Reluctant) loss of appetite	≥24 hours	<24 hours	None
O (Oropharyngeal) lesions	Serious lesions (bleeding, erosion, burn, necrosis, ulcer)	Edema/hyperemia	None
O (Other) number of other symptoms	Fever, hematemesis, abdominal pain, retrosternal pain, dyspnea (≥2)	1	None
L (Leukocytosis)	≥20000	<20000	None

Table 2. Demographic and clinical characteristics of the patients

Characteristics	n (%)
All patients	110
Age (month, mean ± SD)	41±13
Gender	
Female	54 (49)
Male	56 (50.9)
Time between ingestion and admission (minute, mean ± SD)	91.7±23
Symptom	
No symptom	58 (53)
Drooling	5 (4.5)
Dysphagia	1 (0.9)
Dyspepsia	2 (1.8)
Nausea-vomiting	52 (47.2)
Respiratory symptoms	8 (7.2)
Finding	
Hyperemia in the oropharynx	35 (31.8)
Respiratory findings	3 (2.7)
Drool score (mean ± SD)	8.9±1.7

SD: Standard deviation

male. Ingestions of corrosive substance were all accidental/unintentional and at small amounts. The mean time from the ingestion of corrosive substances to admission to the emergency department was 91.7±23 minutes. 53% of the patients were asymptomatic at admission. The most common symptom was nausea-vomiting, and the most common finding was hyperemia in the oropharynx (Table 2). The mean Drool score of the patients was 8.9±1.7.

When the corrosive substance content was examined, it was detected that 77 patients (70%) had alkaline substance intake, 33 (30%) had acidic substance intake. It was found that 45 patients (40.9%) ingested sodium hydroxide, 27 patients (25%) had sodium hypochlorite, 26 patients (24%) had hydrochloric acid (Table 3). Medical treatments applied to all patients are presented in Table 4. Possible perforation and chemical pneumonia were excluded by chest and standing direct abdominal radiographs. Fifty-two patients (47.2%)

Table 3. Swallowed corrosive substances

Corrosive agent	n (%)
All ingestions	110
Sodium hydroxide	45 (40.9)
Sodium hypochlorite	27 (25)
Hydrochloric acid	26 (24)
Other*	12 (16)
Corrosive agent form	
Solid	31 (28.1)
Liquid	79 (71.8)

* Potassium hydroxide, calcium hydroxide, alcohol benzene, nitric acid, sulfuric acid, hydrogen peroxide, aromatic hydrocarbon, sodium borate, citric acid

Table 4. Follow-up and treatment of patients

All patients	110
Patients admitted to the surgical service, n (%)	52 (47.2)
Length of stay in clinic (hour, mean ± SD)	35±9
Length of stay in the emergency room for patients not admitted to the clinic (hour, mean ± SD)	8.3±3.4
Treatment, n (%)	
Intravenous fluid	95 (86.3)
Proton pump inhibitor	90 (81.8)
Antibiotic	37 (33.6)
Complication	0

SD: Standard deviation

were hospitalized in the pediatric surgery clinic and the mean length of hospital stay was 35±9 hours.

The comparison of the data according to the corrosive substance content is presented in Table 5. While the findings were mostly observed for the intake of hydrochloric acid and sodium hydroxide (p=0.044), 80.7% of the group that drank hydrochloric acid was hospitalized in the surgical service (p=0.002). Endoscopy was performed in 3 (2.7%) of the patients. The mean Drool score of the patients who underwent endoscopy was 6.7. Grade 1 erosion was detected in the middle part of the esophagus and the gastroesophageal junction in one patient, and the Drool score was 6 at admission.

Table 5. Comparison of data according to corrosive substance content

	Sodium hydroxide	Sodium hypochlorite	Hydrochloric acid	Other	p
Patients (n)	45	27	26	12	
Symptoms (n)					
Drooling	1	1	2	1	0.325
Dysphagia	0	0	1	0	-
Dyspepsia	0	1	1	0	0.695
Nausea-vomiting	21	8	18	2	0.044
Respiratory symptoms	1	1	2	1	0.256
Finding (n)					
Oropharyngeal hyperemia	12	5	19	1	0.026
Respiratory findings	0	1	2	0	0.055
Drool score (mean ± SD)	9.1±0.6	8.9±0.8	8.6±1.1	9.5±0.4	0.765
Patients admitted to the service (n)	22	5	21	4	0.002
Length of stay in clinic (day, mean ± SD)	2±1	1.7±0.9	2.2±0.5	1.8±0.7	0.481

p<0.05 significant, SD: Standard deviation

No complications were observed in the follow-ups of the patients (Table 4). In the 3rd week after discharge, esophagus, stomach and duodenum radiographs were taken in 10 patients and no pathological findings were detected in any of them.

Discussion

Ingestion of corrosive substances is one of the important and preventable causes of pediatric emergency department admissions due to short- and long-term complications.⁵ Patients may be asymptomatic or present with drooling or swallowing difficulty, oropharyngeal lesions or burns, retrosternal or abdominal pain, hematemesis, vomiting, agitation, dyspnea, tachycardia, fever, and leukocytosis.¹ It can be difficult to predict esophageal damage when no symptoms or signs are present. The lack of consensus on patient management in the literature can be challenging for pediatric surgeons and emergency room clinicians.

The rate of ingestion of corrosive substances in all poisoning cases is between 8.6% and 51.4%, and its incidence has increased gradually, especially in recent years.⁶ It can be seen at any age, but it is common in children younger than 5 years old and boys constitute 50-62% of cases.⁵ The majority of young children are brought to the emergency room for accidental ingestion or skin/eye contact, and exposure in these patients is usually low. In our study, 123 cases of exposure to corrosive substances were presented to the pediatric emergency service for 3 years, and the ratio of all chemical poisoning cases was 11.1%. Similar to the literature, most of the cases were in early childhood and all had accidental exposure to caustic substance. The most commonly exposed

corrosive substances are household cleaning products such as bleach, dishwasher detergents and polishes, degreasers and lime removers.² These are products that are widely used and easily accessible in domestic cleaning today, they easily attract children's attention and cause unwanted situations.⁷ In our study, degreasers (sodium hydroxide) with alkali content and bleach (hydrochloric acid) with acidic content were the most commonly ingested corrosive substances.

In the ingestion of corrosive substances, the severity of the injury is related to the corrosive nature of the ingested substance (pH, acidic, alkaline), its amount, concentration, physical form (solid or liquid), and the duration of contact with the mucosa.⁸ Questioning these characteristics is a critical step in order to properly manage the follow-up and treatment process of patients and to predict the risk of damage. In this case, families should be encouraged to cooperate. It should be ensured that they bring the corrosive substance in question, show the photo of the product or say its name. Whether the substance taken is a branded product or not is not decisive in terms of burn rate.⁹ However, the chemical content and pH value of the product can guide. In our study, the products in question were reached and their chemical properties were evaluated. Only the amount of the substance taken was not clearly stated, but the amount taken was expressed as "low" in all cases. Most of the cases were asymptomatic at emergency service admission. Nausea or vomiting was seen in half of the patients, while increased drooling and respiratory symptoms were rarely seen. The presence of clinical findings was observed mostly in sodium hydroxide and hydrochloric acid intake. Although the causative agent's being strongly acidic or alkaline affected the clinical features of the patients,

the prognosis of all patients was good due to the small amount swallowed and medical treatments.

The presence or absence of symptoms in corrosive substance exposures does not show a linear relationship with the extent of esophagus-stomach damage.¹⁰ There are differences of opinion in the literature for the management of these patients. Some publications argue that clinical symptoms and the degree of esophageal damage are not correlated in this age group and emphasize that endoscopy should be performed in the pediatric age group whenever possible. On the other hand, it has been argued that endoscopy performed in the first 48 hours is unnecessary and does not make a significant contribution to the diagnosis, treatment and management of the patient.¹¹ The view supporting the use of non-invasive methods in these patients has suggested the use of the Drool scoring system, which is a new prognostic scoring system, and it has been accepted that this scoring is a high predictor of the development of esophageal stenosis.¹² In our study, the mean Drool score of all patients was 8.9. The mean Drool score of 3 patients who underwent endoscopy was 6.7, and the score of the patient with grade 1 injury was 6. Considering the general score average, the Drool score was lower in the patient who developed damage. No complications developed in any of the patients during the follow-up period. Therefore, we support the provision of supportive care in asymptomatic or rarely symptomatic patients and the use of the Drool scoring system, which is a practical and non-invasive tool for predicting clinical process.

Study Limitations

It is a single center, retrospective study. The number of patients undergoing endoscopy is small. This situation did not allow to discuss the necessity of endoscopy and the advantage of following only with Drool score. It can be guiding for future studies.

Conclusion

Ingestion of corrosive substances is one of the important and preventable causes of emergency department admissions with chemical poisoning. There are often accidental and small amounts of ingestion in early childhood. Patients may be asymptomatic or rarely present with severe symptoms. It is important to know the chemical content of the ingested substance in order to predict the risk of damage to the gastrointestinal tract and respiratory system and to ensure appropriate management in emergency departments.

Ethics

Ethics Committee Approval: This study was approved by the Ethics Committee of University of Health Sciences Turkey,

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Authorship Contributions

Surgical and Medical Practices: İ.B., M.M.G., N.T., Ö.B., D.E., Concept: R.M.Y., B.Ö., Design: R.M.Y., B.Ö., Data Collection or Processing: R.M.Y., A.Gü., Analysis or Interpretation: R.M.Y., C.D.K., Literature Search: R.M.Y., B.Ö., A.G., Writing: R.M.Y., A.Gü.

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