

Extent of Injury of Gastrointestinal tract due to accidental ingestion of chemicals among children at Bandar Abbass Children Hospital 2009-2011

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Abstract: Accidental Ingestion of burning material could lead to serious injury in different part of the gastrointestinal tract, mostly esophagus as it has the most contact with the swallowed material. The best diagnostic method is Endoscopy and Esophagoscopy. This study intended to assess the severity and extent of burning, its chronic complications and recommend appropriate preventive method of such catastrophe, occurring mostly in children 1-16 years of age. This cross-sectional study was carried out between March 2009 and February 2011, in which 78 cases of children who had accidentally ingested burning material and undergone therapy were under research. The type of ingestion material, the extent of esophagus injury, number of chest and abdomen radiographies, extent of exposure to X-ray, the applied therapeutic method and the long term complications were recorded and then assessed. 37.2% of the 78 children were girls, 62.8% boys 71.8% urban, 28.2% rural. 47 cases of children were poisoned with stronger materials and 29% with higher ones. Clinical signs included vomiting, oral irritation, bloody discharge, abdominal pain, coughing, loss of consciousness and respiratory distress respectively. 45% of the cases had normal degree of burning, 20% G1 burning, 12.5% G2a burning, 1/2% G2b burning, 6.2% G3a and 7.5% G3a burning. 11 children undergone surgery, 7 were diagnosed with esophagostenosis in a year follow-up and the extent of exposure to X-ray for each chest and abdomen graphy was 1/. This study concluded that accidental ingestion of chemical detergent by children lead to esophagus injury with different degree and extents. The complications are not limited to a period of time and might be life-long. Preventing would be a comprehensive solution in this regard which can be emphasized by ministry of health, media, manufacturers and sellers of chemical detergents be supplied in secure and tightly-capped containers with advise tags for families. Comical material must be sold in specific shop under supervision and limitation for stronger detergents.

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1. Introduction

The chemical ingestion by children include acidic and alkaline material such as detergent, all type of pipe openers, paint solvent surface cleansers, bleach and dishwasher liquid. Esophagus is the most vulnerable part of digestive tract which is injured following accidental ingestion of chemicals due to early and lasting contact with the swallowed materials. Its subtle mucosa and thin wall along with the lack of strong Immune mechanisms make it even more

susceptible to get injured (1-4). Esophagus injuries due to the alkaline ingestion are more common in southern urban areas of Iran where air conditioner are cleaned by such material. Once these chemicals are ingested accidentally by children, esophagostenosis is developed which is not treated easily. Dilatation using stent is the fundamental therapy for stenosis (5-9).

Incidence of esophagus injury due to the ingestion of chemicals is 15.8 in 10000(10). During the acute phase of poisoning by chemicals there exists

the risk of bleeding esophagus perforation and respiratory distress (11-12). Long-term complications of ingesting chemicals include stenosis in different part of the alimentary canal, theracheo esophageal fistula, shortening of the esophagus, lower sphincter incompetence, dismotility, false intramural diverticulum and SCC (10, 13, and 14). Swallowing stronger material in greater amounts, esp. alkaline which is tasteless and odorless, could cause severe burnings and be fatal (15). Some countries have restricted the density of chemicals in household stuff and their selling as well. Some others have decreased the density to less than 10%, stored in secure standard containers, while in developing countries (such Iran) no restriction laws have been passed in this regard (16,17).

In Iran such chemicals are stored in shiny colorful containers which attract children to attention and are uncapped quite easily (18). Different types of chemicals could lead to deep injuries in esophagus. The solid types are instantly spit out since they cause pain and irritation in mouth, but injure esophagus by sticking to oropharynx and proximal esophagus (17). Normal sodium hydroxide 10% causes the necrosis of mucosal, sub-mucosal and some fibers of the muscle layer in 10 second. 3n or 10.7% solution causes tranmural esophagus (10, 18). Acid causes ophagus perforation less often. Pyloric stenosis might lead to gastric outlet abstraction 3-10 weeks following acid ingestion (10, 19). Clinical manifestations include vomiting, bloody discharge, abdominal pain, diarrhea, oral and reparatory passage irritation and frequent coughing. Some patients might have no symptoms and complaints. Secondary complication of ingesting chemicals includes dysphagia and progressive vomiting which imply stenosis that is sometimes undetectable until a year after ingestion (11, 14, 19, 20, and 21). There are various methods to estimate the complications of chemical ingestion. Taking necessary precautions and the suspected cases of perforation, contrast radiography, contrast and non-contrast CT scan, radio nuclide scan and endoscopy are the diagnostic methods to estimate primary injuries during the acute phase after ingestion (1-3, 23, 24).

The extent of exposure to X-Ray is 0.02 for each chest radiography and 1.00 for each abdominal radiography. The period during which radiation effects remain in body is up to 3 days for chest and 6 days for abdominal (25). This study intended to determine the demographic characteristics of poisoning with chemicals and the effect of such material along with the extent of exposure to X-Ray for every digestive tract radiography in children. The findings could enhance the awareness of medical staff and consumers of such material. Also, it can help governments take

necessary steps regarding restrictions on household detergents.

2. Material and Methods

This was a cross- sectional study during which all 16-year-old and younger children who had accidentally ingested chemicals and referred to Bandar Abbess children Hospital between 2009-2011 were under research. The data was collected using a questionnaire which was designed by researcher. The items about the chemical included the type, the form (solid, liquid, crustal), characteristics (acid, alkaline) and burning power (PH from neutral range). The ones about patient included age, sex, place of living. Extent of exposure to X-Ray through radiography, number of visits to hospital and follow ups. The primary symptoms included drooling, dysphagia, respiratory distress, vomiting, digestive bleeding, coughing, hoarseness, abdominal pain and orophageal irritation.

By referring to the patient's records the items were checked. The collected data was analyzed with SPSS software version 16, descriptive statistics (frequency, percentage, mean and standard deviation) and chi-square test. The mucosal lesions of patients who had undergone Endoscopy were categorized according to ZARGE: grade zero normal mucosa, mucosal edema, and hyperemia were considered as G1a, also surface laceration and with membrane bleeding as G2a. Findings from G2a along with deep or G2b sigmoidal ulceration and multiple ulceration were assigned as G3a necrosis and G3b necrosis. Materials divided into the two groups of acid and alkaline based on their effects on digestive tract. Among these pipe opener as a strong kind of alkaline cause the most damage to the alimentary tube while dishwasher liquid, thinner and bleach caused the least damage as weaker chemicals.

Patients with no or slight G1 esophageal lesions were discharged from hospital after having received primary care and being under supervision for several hours. Patients with G2a and more severe cases were hospitalized to be treated. All patients with G2a and G3b got dilation every time they referred to hospital. Statistical findings were determined as relative frequency of multiple variables such as age, sex, type of burning material, form of ingested chemical, the degree of esophagus tissue burning, place of living. Number of referring to hospital, chest and abdominal radiograph. The mean of quantitative variables were determined.

3. Results

62.8% of 78 patients were boys and the rest were girls. The mean age was 3.01 ± 2.6 . The youngest one was 2 months and the oldest was 16. 71.8% were citizens and the rest were rural. Pipe opener chemicals

are used to open sinkholes and clean air conditioners. 48 patients (61.5%) were poisoned with opener chemicals (strong alkaline), 18 patients (23.1%) with thinner, 11 patients (14.1%) with bleach and only one (1.3%) with dishwasher liquid (weak acid). 60.3% of the burning materials or chemicals were solid, 37.2% liquids, 2.6% crystal. Vomiting, drooling, oral irritation, abdominal pain, respiratory distress, frequent cough and loss of consciousness were most typical clinical symptoms. 25.6% of patients had not undergone chest and abdominal radiography. 74.4%

had a radiograph for every time they had referred to hospital. Estimating the degree of burning, 46.2% were diagnosed as normal, 25.6% as G1 and 28.2% as G2a and more. 67.4% were hospitalized once, 27.2% between 2-8 times and 3.4% between 13-47 times.

Based on the finding on the table 1, Results of chi-square test indicates a significant relationship between type of burning material and degree of burning ($P=0.03$) in the way that the stronger burning material, the greater the degree of burning.

Table 1. Frequency and percent of burning based on the ingested burning material

	Normal	G1	G2a	G2b	G3a	G3b
Pipe opener	12(25%)	14(29.2%)	10(20.8%)	5(10.4%)	1(2.1%)	6(12.5%)
Bleach	9(81.8%)	2(18.2%)	0(0%)	0(0%)	0(0%)	0(0%)
Thinner	14(77.8%)	4(22.2%)	0(0%)	0(0%)	0(0%)	0(0%)
Dish wash liquid	1(100%)	0(0%)	0(0%)	0(0%)	0(0%)	0(0%)
Chi-square result		$P=0.031$		$df=15$		$X^2=26.78$

4. Discussions

Chemicals which are used as household components are accidentally at children's access due to the parents' inattention. Such detergents toxin to some extent (16, 26). The damage to digestive tract because of accidental chemical ingestion is emergency worldwide (27). Compact detergents cause acidosis, incompetence of nervous system, lung diseases and damage to liver and kidney (26). Chemicals are divided into two major groups: Acid and alkaline. Alkaline penetrates deep tissues and can irritate full thickness of esophagus due to the liquefying necrosis and mixing with cell wall lipid (1,2,27-30). The extent of damage to esophagus depends on the quantity, thickness, exposure to the chemical and secondary infections. The most common chemical ingested by children was alkaline (cleanser) in this study and other studies (32-34). Esophagoendoscopy that is done during the first 48 hours is very important in identifying the degree of damage to mucosa and treatment protocol (35-37). Similar studies were carried out in Turkey and Egypt which detect that the poisoning was more frequent in boys than girls and they were mostly 4 years of age (38-39). Statistical numbers of poisoning which chemical ingestion in developed countries are lower than developing countries (40). In an attempt to identify the degree of burning, 46.2% of patients had normal esophagus while 53.8% had abnormal results from endoscopy (G3b, G3a G2b). In similar study in U.S.A 82% of patients had normal or G1 burning, 18% G2 and no cases of G3 were reported. The study results are significantly lower than that of this study. Having no restriction or laws for manufacturing and selling strong household chemicals and detergents in developing

countries could account for such a difference in findings of these two studies. Most of the patients, who developed esophagostenosis in this study, had digested strong alkaline (pipe opener). Identifying the extent of damage due to direct contact with chemicals along with exposure to X-Ray for every visit at hospital was under research in this study. Patients who referred to hospital frequently due esophagostenosis were more probable to develop chest and abdominal consortium because of too much exposure to X-Ray. Clinical manifestations of damages due to accidental ingestion of chemicals have a significant role in predicting the range and depth of esophageal injury (32, 41-43). While other studies recommend endoscopy only for patients with clinical symptom

It seems easy to prevent ingestion burning and keep children more safe. Health ministry should give explicit direction to keep burning material out of reach of children, for family, factories, health care personnel and vender. There also some law should be added to constitution, by parliament to force producer moderate and modify PH, concentration and so provide sufficient information on production label. House and its furniture and air conditioner also should be cleaned by specific companies, as limitation of powerful detergent purchasing and usage. Broadcast corporations (TV, radio and magazine) could play essential role to inform people how to contract against toxicity. Performing above-mentioned would help to decrease whether governmental or personal recompense due to the burning materials.

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