

CHLORINE BLEACH INGESTION IN CHILDREN: A REVIEW OF 80 CASES*

F. Cahit Tanyel MD**, Nebil Büyükpamukçu MD, Akgün Hiçsönmez MD******

Key words: chlorine bleach, sodium hypochlorite, caustic esophagitis

Chlorine bleaches which contain solutions of sodium hypochlorite and sodium hydroxide in water are one of the most common substances accidentally ingested by children around the world.

In experimental studies conducted in the USA, it was reported that bleaching agents containing 5-6% sodium hypochlorite and 0.005-0.015% sodium hydroxide had to be ingested in a high dosage to cause esophageal injury^{1,2}. Other clinical investigations carried out using the same concentrations of chlorine bleach have shown that no significant esophageal injury occurs after chlorine bleach ingestion (CBI)³⁻⁵. There are only four cases of esophageal strictures reported in the English medical literature which are assumed to have resulted from the suspected ingestion of chlorine bleach^{6,7}. Due to the questionable harmful effects of CBI, the diagnostic procedures are controversial. Routine esophagoscopies², esophagoscopies only if the patient has dysphagia or oropharyngeal lesions⁸⁻¹¹, and no diagnostic procedures⁴ have all been suggested.

On the other hand, the sodium hypochlorite and sodium hydroxide concentrations in bleaching agents differ among countries and in addition the trade mark bleaches of the same country might also differ³⁻¹¹. The bleaching agents in Turkey which contain 0.5% sodium hydroxide are more alkaline compared to those in the USA. It has been reported that the bleaches manufactured in Turkey can cause significant esophageal injury¹².

Our aim is to evaluate the clinical features of CBI with emphasis on its caustic effects.

* Department of Pediatric Surgery, Hacettepe University Children's Hospital, Ankara.

** Assistant Professor of Pediatric Surgery, Hacettepe University Faculty of Medicine.

*** Professor of Pediatric Surgery, Hacettepe University Faculty of Medicine.

Material and Methods

From 1976 to 1986, 80 patients whose ages ranged between eleven months and eight years (mean two years and eight months) were admitted to the Department of Pediatric Surgery of Hacettepe University Children's Hospital following CBI. There were 45 boys and 35 girls in the study group. 78 of the patients were admitted within 24 hours following ingestion, and all of them were subjected to esophagoscopic examination. The remaining two patients who were admitted after the strictures had developed were diagnosed by esophagographic and esophagoscopic examinations. The hospital records of the patients were evaluated retrospectively. The ingested amounts of chlorine bleach, symptoms, physical findings at admittance, esophagoscopic data and the outcome were recorded.

Results

Of the 78 patients who were admitted within 24 hours after ingestion, the amounts ingested were unknown in 38 and ranged from 10 ml to 200 ml in the remaining 40, with 10 ml in eight patients, 20 ml in six, 30 ml in six, 50 ml in 12, 75 ml in one, 100 ml in five and 200 ml in two patients. Thirty-three of the patients had vomited and 12 had begun to cough after the ingestion. Physical examinations revealed minimal oropharyngeal burns in two patients and chest roentgenograms demonstrated pneumonic infiltrations in ten patients. Routine esophagoscopic examinations performed within 24 hours following admittance revealed minimal burns in two and mucosal penetrating burns in one patient. One of the two patients with oropharyngeal burns also had esophageal burns. Esophageal burns were found in the patients who had ingested 30 ml, 75 ml and unknown amounts of bleach. Ten patients with pneumonic infiltrations were treated with daily injections of 800000 units of procaine penicillin and expectorants for a duration of ten days, and they recovered completely. Due to the risk of subsequent stricture formation, the patient who had had mucosal penetrating burns was treated with a combination of antibiotics, steroids and early bougienage. He received daily doses of penicillin and gentamicin for ten days, 2 mg/kg of prednisolone for a month, and bougienage twice weekly for a month. After receiving this treatment, there was no evidence of stricture formation. One patient aged two years, and the other aged three years, who presented with complicated esophageal strictures, were admitted to the hospital one and two months after CBI, respectively. The amounts ingested were unknown. One of the patients required colonic replacement, and the other was put on a dilatation program.

Discussion

Household chlorine bleaches are regarded as much less dangerous corrosives⁵. As a result of clinical investigations that have revealed no esophageal injuries, routine esophagoscopy following CBI is not recommended^{9,10}. However, the reported chlorine bleaches contain 5-6% sodium hypochlorite and 0.005-0.015% sodium hydroxide²⁻⁴. On the other hand, the sodium hypochlorite and sodium hydroxide contents in bleaching agents may differ among countries¹¹. While bleaching agents in Turkey contain similar amounts of sodium hypochlorite as in other countries, their sodium hydroxide content is 0.5%¹². Contrary to reports regarding ingestion of bleach containing 5.5% sodium hypochlorite and 0.005-0.015% sodium hydroxide, our clinical data reports patients with esophageal burns who were admitted to the hospital within 24 hours after ingestion, and others with complicated esophageal strictures who did not receive treatment to prevent stricture formation such as a combined use of antibiotics, steroids and early bougienage, reported to reduce stricture formation¹³.

Corrosive esophageal burns following CBI are caused by the sodium hypochlorite content in the bleach. The hypochlorite oxidizes the protein, and the increased OH⁻ concentration increases the reaction². Since the concentration of sodium hydroxide in Turkish bleaches is greater (0.5%) than that reported from other countries (0.005-0.015%), it increases the corrosive effect of hypochlorite, and, therefore routine esophagoscopies after CBI are recommended.

In addition to the corrosive effect, the emetic and pulmonary irritant effects were also observed in our patients. The emetic effect, even in minimal amounts, is well recognized³. Among the previous reports on CBI, only French et al⁷ have reported pneumonitis as a concurrent finding in 8.1% of his patients. We observed pneumonia in ten of our cases of which only four had vomited. Although French et al⁷ have attributed pneumonia to aspiration, the exact mechanism is not clear. Therefore in addition to esophagoscopy examination, the respiratory system should also be thoroughly investigated because of the increased risk of pneumonia following CBI.

Summary

The clinical effects of accidental chlorine bleach ingestion in 80 children admitted between 1976-1986, were evaluated. The ingestion of chlorine bleaches containing 5.5% sodium hypochlorite and 0.5% sodium hydroxide resulted in caustic esophageal burns and esophageal strictures. In addition to the caustic effects, the emetic and pulmonary irritant effects were also observed. One patient was treated to prevent stricture formation, two patients for complicated strictures and ten patients for pneumonia. It is suggested that routine esophageal and pulmonary investigations be carried out following chlorine bleach ingestion.

REFERENCES

1. Yarrington CT Jr. The experimental causticity of sodium hypochlorite in the esophagus. *Ann Otol Rhinol Laryngol* 79:895, 1970.
2. Weeks RS, Ravitch MM. Esophageal injury by liquid chlorine bleach: experimental study. *J Pediatr* 74:911, 1969.
3. Landau GD, Saunders WH. The effect of chlorine bleach on the esophagus. *Arch Otolaryngol* (Chicago) 80:174, 1964.
4. Pike DG, Peabody JW Jr, Davis EW, et al. A re-evaluation of the dangers of clorox ingestion. *J Pediatr* 63:303, 1963.
5. Silverman A, Roy CC. *Pediatric Clinical Gastroenterology* (3rd ed). St. Louis: CV Mosby, 1983, p 145.
6. Chandler JR. Chlorine bleach effect on esophagus. *Arch Otolaryngol* (Chicago) 81:320, 1965.
7. French RJ, Tabb HG, Rutledge LJ. Esophageal stenosis produced by ingestion of bleach: report of two cases. *South Med J* 63:1140, 1970.
8. Hawkins DB, Demeter MJ, Barnett TE. Caustic ingestion: controversies in management. A review of 214 cases. *Laryngoscope* 90:98, 1980.
9. Howell JM: Alkaline ingestions. *Ann Emerg Med* 15:820, 1986.
10. Ramack BH, Peterson RG. Poisoning. In Kempe CH, Silver HK, O'Brien D (eds). *Current Pediatric Diagnosis and Treatment* (6th ed). Los Altos: Lange 1980, pp 879-907.
11. Leibbrandt CC, van Heyst ANP. Esophageal burns by chlorine bleach [letter]. *Arch Otolaryngol* 87:449, 1968.
12. Tanyel FC, Yurdakök M, Büyükpamukçu N. Türkiye'deki çamaşır sularının özefagusa etkilerinin deneysel olarak incelenmesi, *the Sixth Annual Meeting of the Turkish Association of Pediatric Surgeons*, September 26, 1986, Bursa, Turkey.
13. Fyfe AHU, Auldism AW, Corrosive ingestion in children. *Z Kinderchir* 39:229, 1984.