USE OF ARTERIAL BLOOD GAS TO DETERMINE THE SEVERITY OF ESOPHAGEAL AND GASTRIC INJURY IN CAUSTIC INGESTION CASES

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ABSTRACT

Background: Caustic ingestion has a wide range of gastrointestinal injuries form mild to severely fatal complications leading to long-term chronic diseases. Since simultaneous rapid use of various methods is difficult or sometimes impossible for determination of need to urgent surgery, initial use of arterial blood gas (ABG) in patients with caustic ingestion may be useful to determine the severity of the injury. Accordingly in this study the ABG data were assessed and compared with endoscopy and laparotomy results to determine the predictive value of ABG.

Patients and methods: In this retrospective study 274 consecutive patients with caustic injury attending to Loghman Hospital, Tehran, Iran since 2006 to 2013 were enrolled. Patients included two groups; under surgery and under conservative treatments. In second group, the interval between endoscopy and surgery with arrival time was assessed. Also the initial findings of ABG before treatment, and also the endoscopy and burning grading were determined and compared.

Results: The pH and BE alterations were significantly differed between died and alive patients (P=0.001). The endoscopic grading was reversely correlated with HCO₃⁻ (P=0.043, r=-0.274). Also the pH (P=0.041, r=-0.254) and pCO₂ (P=0.006, r=-0.0342) were reversely correlated to laparotomy grading.

Conclusions: Totally, according to the obtained results, it may be concluded that ABG alterations in patients with caustic injuries would result in faster appropriate decision-making for surgery need. For this matter pH less than 7.2 and BE changes more than fifty percent would show the more severe injury that require urgent surgery.

KEY WORDS: Caustic Ingestion, Grading, Arterial Blood Gas

INTRODUCTION

In patients with caustic ingestion, endoscopy within the first twelve hours is defined for grading and this required an endoscopist in the center in question; then, the patients is a candidate of the next step of treatment according to the endoscopic mucosal damage grading. In Stage I, he received conservative treatment and in case of Stage II and Stage III, he will be candidate for explorative laparotomy which indicates the possibility of late diagnosis and
improper treatment of the patients(1,2) that might lead to difficulty in resuscitation and mortality increase pre, intra and postoperatively. Therefore, using a faster and more precise criterion for exploratory surgery indication indicate ABG changes in tissue damage and possible requirement for taking treatment measures. Caustic ingestion has a wide range of gastrointestinal injuries form mild to severely fatal complications leading to long-term chronic diseases. It includes ingestion of acidic or alkaline agents with incidental origin in children younger than five years or to attempt for suicide in adults. For this reason the ingested volume is higher leading to more severe injuries accompanied with morbidity and mortality. The most common causes of death include aspiration pneumonia, peritonitis, and multi-organ failure (3). The severity of tissue injury is dependent to type of agent (pH less than 2), shape of the material, dilution of agent, initial tissue status, duration of exposure to the caustic agents and ingested volume. The most common locations of injury are gastric antrum and esophagus, respectively (4).

Clinical manifestations include odynophagia, vomiting, sore throat, and epigastric and chest pain. In cases with upper respiratory tract involvement the patients may have dysphonia, hoarseness, and stridor (5). In these patients the diagnostic and therapeutic procedures are initiated simultaneously including complete blood count, blood reservation, biochemical assays, arterial blood gas (ABG), cervical, chest, and abdominal radiography, patients' resuscitation, and antibiotic therapy. The standard diagnostic approach includes endoscopy to determine the depth and severity of injuries. However the indications, mucosal injuries classification, and the best time to do are doubtful.

According to Holinder and Fridman classification, post-corrosive endoscopic changes are classified in three degrees: First degree - superficial damage associated with hyperthermia, epithelial desquamation and mucous edema. Second degree - transmucous damage affecting all of the mucosal layers, followed by exudation, erosions and ulcerations. Third degree - transmural damage associated with ulcer's penetration in the deep layers of the tissue and neighboring organs. Delay in primary surgery would result in fatal outcomes in critical patients. Prediction of injury severity by endoscopy and sometimes laparatomy would help in diagnosis of depth and severity of injuries leading to more morbidity and mortality (4, 6). Since simultaneous rapid use of these methods is difficult or sometimes impossible, initial use of ABG in patients with caustic ingestion may be useful to determine the severity of the injury and is applicable in each setting. Accordingly in this study the ABG data were assessed and compared with endoscopy and laparatomy results to determine the predictive value of ABG.

PATIENTS AND METHODS

In this retrospective study 274 consecutive patients with caustic injury attending to Loghman Hospital, Tehran, Iran since 2006 to 2013 were enrolled. Patients included two groups; under surgery and under conservative treatments. In second group, the interval between endoscopy and surgery with arrival time was assessed. Also the initial findings of ABG before treatment, and also the endoscopy and burning grading were determined and compared.

Data analysis was performed among 274 subjects by SPSS (version 18.0) software [Statistical Procedures for Social Sciences; Chicago, Illinois, USA]. Chi-Square, Spearman, and Independent-Sample-T tests were used and were considered statistically significant at P values less than 0.05.

RESULTS

In this study 50 patients (45.2%) were female. The mean age was 35.9 ± 17.1 years. Acid and alkaline ingestion were seen in 62% and 31%, respectively with 7% of cases as unknown agent. The mean time interval between ingestion and endoscopy was 4.4 ± 8.8 hours and the mean time to operation was 11.2 ± 7.4 hours. Totally, 23% of patients underwent laparatomy among them 85% were according to endoscopic grading and in 15% the clinical symptoms were considered. Type of surgery was total esphagogastrectomy in 38% and stent insertion with biopsy in 53%.

Twenty-six patients (9.5%) were died after caustic ingestion which was after operation in 19 subjects an the cause of death was unknown in 17 cases. The mean age of women under surgery was 41.5 and in mean was 40.7 years. The mean age of women under conservative therapy was 32.5 and in mean was 32.3 years. The ABG results are shown in Table 1. The pH and BE alterations were significantly differed between died and alive patients (P=0.001). The endoscopic grading was reversely correlated with HCO3 (P=0.043, r=-0.274). Also the pH (P=0.041, r=-0.254) and pCO2 (P=0.006, r=-0.0342) were reversely correlated to laparatomy grading.

Table 1: The pH, BE, and HCO3 alterations in two understudy groups

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Surgery</th>
<th>Conservative</th>
</tr>
</thead>
<tbody>
<tr>
<td>pH Changes</td>
<td>7.29</td>
<td>7.37</td>
</tr>
<tr>
<td>BE</td>
<td>-2.82</td>
<td>-1.15</td>
</tr>
<tr>
<td>HCO3</td>
<td>20.84</td>
<td>24.62</td>
</tr>
</tbody>
</table>

DISCUSSION

Although the numbers have decreased compared with in the past, cases of patients who ingest caustic substances and visit the emergency room are not rare (7). The caustic ingestion is usually seen to attempt for suicide among adults including acidic, alkaline, or industrial cleaners. The acid agents are less used due to severe burnings in lips and mouth mucosa but the alkaline agents are used with larger volume especially in detergents. The most common caustic agents include alkaline in whiteners and bleaching agents.
containing the hydrogen peroxide or sodium hydroxide material in the dilution range from 4 to 54 percent in different countries (7, 8).

In adults patients with caustic ingestion the severity of injury may be determined in first 24 hours. Thereafter the clinical steps may be determined according to severity of mucosal injury. In cases with Stage I, the treatment is usually conservative and in Stage II and III the explorative laparotomy is considered. Diagnostic faults would result in misdiagnosis and increased rate of mortality and morbidity during and after treatment. Use of a definite rapid index for grading such as ABG alterations may be beneficial. Accordingly in this study the ABG alterations were compared with endoscopic and surgical grading.

In previous studies it was recommended to perform endoscopy for assessment of all patients with caustic ingestion in first 12 hour from injury and it was not safe to perform after 24 hours. Also it was applicable only up to 96 hours and thereafter it should be avoided due to possibility of injuries. In such cases especially after fourth day use of this procedure was not rational and surgical grading was used. For this matter the ABG was compared with two methods including endoscopic and surgical grading (8-10).

All caustic agents would result in acidic alteration. So the acidosis and the related severity for it are an index for conditions in patients. The acidosis in pH less than 7.2 demonstrates higher severity and as parallel as decreased pH the prognosis is poorer with less survival. Hence pH and BE may be indicators of severity of injury and gastrointestinal tract necrosis. It was established in our study in cases with endoscopic grade more than 1 which required urgent explorative laparotomy. However the use of ABG at arrival would result in shorter consumed time in comparison with endoscopy procedure. The severity of injury to gastrointestinal tract after caustic ingestion is related to type of agent and clinical symptoms. This effect is indirectly seen in ABG or directly in endoscopy by observation of injured mucosa.

Cheng et al (11) divided 129 patients with caustic ingestion injuries into two groups according to treatment. Group 1 consisted of 30 patients who underwent surgery and two who should have. Group 2 consisted of 97 patients treated conservatively. In groups 1 and 2, the mean pH was 7.22 +/- 0.12 and 7.38 +/- 0.06, respectively, and the mean base excess (BE) was -12.0 +/- 5.2 and -1.8 +/- 3.7, respectively. Both these values were significantly different between groups 1 and 2 as well as our study. Another study by Otcu et al (12) demonstrated that Blood pH level was decreased in subjects with household bleach, but not different in those with acid or alkaline ingestion. Also in their study the pH did not differ in patients with or without esophageal injury. Their different results may be due to study among pediatric patients despite our study and the study by Cheng et al (11).

Totally, according to the obtained results, it may be concluded that ABG alterations in patients with caustic injuries would result in faster appropriate decision-making for surgery need. For this matter pH less than 7.2 and BE changes more than fifty percent would show the more severe injury that require urgent surgery. However further studies with larger sample size should be carried out to attain more definite result for consideration in diagnostic approaches in caustic ingestion cases.

REFERENCES


