Characteristics of Severe Alcoholic Ketoacidosis with a Reversible Visual Disturbance

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Abstract

Purpose: To clarify the characteristics of AKA patients with visual disturbances.

Material and methods: An Ichushi and Pubmed search was undertaken to identify articles that reported patients with visual disturbances due to AKA. The clinical data in the articles were reviewed. This study also performed a subanalysis by classifying the patients with visual disturbance due to AKA into two groups: an arrest group, which experienced cardiac arrest during hospitalization and a no-arrest group, which did not.

Results: There were 12 case reports describing patients with visual disturbances due to AKA. There were 14 patients who showed a visual disturbance due to AKA. There were 11 males and 3 females. The range of age was from 44 to 68, with an average of 55 years old. Seven cases had loss of consciousness and the systolic blood pressure of in 12 cases was under 90 mmHg. All cases show arterial blood gas pH under 6.90 and severe metabolic acidosis. All but one of the visual disturbance cases improved after correction of acidemia by infusion of sodium bicarbonate or blood purification. Six cases experienced cardiac arrest during their hospitalization. Three cases finally died. The subanalysis showed the average pH on arrival in the arrest group was lower than that in the no-arrest group (6.63 vs. 6.75, respectively). And the survival ratio in the arrest group was smaller than that in the no-arrest group (50 vs. 100%, respectively).

Conclusion: Severe AKA was associated with visual disturbances, which could be cured by correction of acidosis. In addition, patients with severe AKA with a pH on arterial gas analysis under 6.70 tended to experience cardiac arrest and the patients with arrest had a poor prognosis. Physicians should understand how to treat such patients.

Introduction

Alcoholic Ketoacidosis (AKA) is an acute metabolic acidosis that typically occurs in people who chronically abuse alcohol and have a recent history of binge drinking, little or no food intake and persistent vomiting [1]. AKA is a result of starvation with glycogen depletion and counter-regulatory hormone production, an increased ratio of Nicotinamide Adenine Dinucleotide (NADH) to Nicotinamide Adenine Dinucleotide (NAD+) related to the metabolism of ethanol, and vo

Material and Methods

An Ichushi search (Japana Centra Revuo Medicine), which collected summaries of Japanese medical articles, was undertaken to identify articles from 1983 to 2011 using the key words “ethanol”, “acidosis” and “visual” or “blindness” to find manuscripts that reported patients with visual disturbances due to AKA. A Pubmed search was also undertaken to identify articles from 1976 to 2011 using the same key words. Additional articles were identified by a manual search of the references from the key articles.

The reports were reviewed to determine the gender, age, the degree of alcohol abuse, consciousness, pupil diameter, light reflex, systolic blood pressure on arrival, the results of an arterial blood gas analysis, the levels of alcohol, β-hydroxybutyrate, acetacetate, lactate and glucose, the incidence of cardiac arrest hospitalization, the need for intensive care, and the final outcome (survival or not).

This study also performed a sub-analysis classifying the patients with visual disturbances due to AKA into two groups: an arrest group,
which experienced cardiac arrest during hospitalization and a no-arrest group, which did not. The gender, age, consciousness, pupil diameter, light reflex, systolic blood pressure on arrival, and results of arterial blood gas analysis were compared between the two groups.

Both the chi-square test and Student’s t-test were used for the statistical analyses. A p value of less than 0.05 was considered to be significant.

Results

There were 15 case reports describing patients with visual disturbances due to AKA. There was no original report of treating such cases. Three reports were duplications; Thus a 12 case reports, including 4 English and 8 Japanese articles, were analyzed [7-18].

There were 14 patients who showed visual disturbances due to AKA. The background of these patients is shown in Tables 1 and Table 2. There were 11 males and 3 females. The range of age was from 44 to 68, with an average of 55 years old. Seven cases had loss of consciousness and the systolic blood pressure of 12 cases was under 90 mmHg. An arterial blood gas analysis showed that all cases had a pH under 6.90 and severe metabolic acidosis. All but one of the visual disturbance cases improved after correction of acidemia by infusion of sodium bicarbonate or blood purification. One case with blurred vision was not re-evaluated because of their immediate death following admission. The degree of visual disturbance was 11 cases of blindness, 2 cases of light perception only and one case of blurred vision. Six patients experienced cardiac arrest duration hospitalization. Four cases underwent cardiac arrest within several hours of arrival, one case within a day and one case within 2 days. Eleven cases required intensive care for organ failure and three patients died.

The results of comparison between the arrest and no-arrest group are shown in Table 3. There was no significant difference associated with the sex, age, frequency of consciousness disturbance and systolic blood pressure on arrival between the two groups. The average pH on arrival in the arrest group was smaller than that in the no-arrest group. Patients with severe AKA associated with pH under 6.70 tended to experience cardiac arrest (p=0.05). In addition, the survival ratio in the arrest group was smaller than that in the no-arrest group (50 vs. 100%).

Discussion

This manuscript successfully demonstrated that severe AKA was associated with the occurrence of visual disturbances that could be cured by correction of acidosis. In addition, patients with severe AKA with a pH under 6.70 tended to experience cardiac arrest. Patients with severe AKA that experience cardiac arrest have a poor prognosis.

Three previous reports demonstrated severe metabolic acidosis other than AKA is associated with reversible blindness [19-21]. Two of those cases were due to metformin-associated lactic acidosis and one case was diabetic ketoacidosis. The pH in the all three of the cases was under 6.90 (6.65, 6.64, 6.89) and their visual acuity recovered immediately after correction of metabolic acidosis, as observed in the current study. Ten of the current cases were in shock, suggesting that circulatory insufficiency may contribute to the occurrence of visual disturbances, because cardiac arrest, which is worst type of circulatory insufficiency, results in mydriasis with loss of light reflexes. However, there were no reports of isolated circulatory insufficiency without unconsciousness leading visual disturbances, suggesting that circulatory insufficiency was not the main cause of the visual disturbance. In addition, a high value of serum alcohol over 500 mg/dl could lead to mydriasis with loss of light reflexes due to inhibition of the central nervous system [22]. However, none of the patients in which the of serum alcohol concentration was measured showed such a high level of serum alcohol. Moreover, patients with severe AKA cannot drink alcohol, so the high concentration of serum alcohol itself was not the main cause of the visual disturbances. Furthermore, thiamine deficiency may contribute to the occurrence of visual disturbances. However, 9 of the patients in the current series denied the possibility of a thiamine deficiency. Some cases in this study demonstrated increased lactate levels when it was measured, but AKA commonly was associated with lactic acidosis, especially in patients with sepsis, seizures, thiamine deficiency, or impaired liver function [23,24]. AKA with lactic acidosis often was treated as AKA [23,24]. Accordingly, the main cause of visual disturbance was thought to be AKA or AKA with lactic acidosis.

Animal studies suggest that retinal cell function may be extracellular pH dependent. Fish and tiger salamander retinal horizontal cell’s response to light is extracellular pH sensitive, and mammalian retinal cell function becomes disrupted at a extracellular pH of less than 7.0 [25-27]. In addition, the activation of acid-sensing ion channels by protons, which are the proton-gated cation channels widely expressed in peripheral sensory neurons and in the neurons of the central nervous system, has been reported to play an important role in a variety of physiological and pathological processes such as nociception, mechanosensation, synaptic plasticity, and acidosis-mediated neuronal injury [28]. These effects may extend to humans and may serve as an

Table 1: Background of subjects regarding age, sex, and physiological findings.

<table>
<thead>
<tr>
<th>No.</th>
<th>Age</th>
<th>Sex</th>
<th>Alcohol intake</th>
<th>Alcohol history</th>
<th>Conscious Level</th>
<th>Pupil diameter</th>
<th>Light reflex</th>
<th>Systolic BP</th>
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<td>unit</td>
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<td>g/day</td>
<td>year</td>
<td></td>
<td></td>
<td>mm</td>
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<td>40</td>
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<td>Male</td>
<td>180</td>
<td>over 8</td>
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<td>?</td>
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<tr>
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<tr>
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<td>over 110</td>
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<td>sluggish</td>
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<td>Alert</td>
<td>Dilated</td>
<td>sluggish</td>
<td>120</td>
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explanation for acidosis-associated vision loss. An AKA patient with pH 6.497 and hypotension did not demonstrate visual disturbance until his death [3]. Accordingly, both the severity and duration of acidosis might contribute to induce visual disturbances due to AKA.

More severe acidosis with visual disturbance due to AKA tended to have cardiac arrest. An animal study demonstrated that severe acidosis causes a decrease in ventricular performance by a direct depressant effect on the myocardium, impairs the myocardial response to catecholamine, decreasing cardiac muscle contractility and causing endocardial damage [29-32]. In addition, the energy crisis induced by impairment of fat and glucose metabolism or direct injury to the endocardium [29-32]. In addition, the energy crisis induced by impairment of fat and glucose metabolism or direct injury to the endocardium [29-32].

Conclusion

Severe AKA of itself resulted in the occurrence of visual disturbance, which could be cured by correction of acidosis. In addition, patients with severe AKA with an arterial gas pH under 6.70 tended to experience cardiac arrest. Accordingly, physicians should understand how to treat such patients.

References