A CASE REPORT OF LITHIUM OVERDOSE PATIENT WITH LOW ANION GAP METABOLIC ACIDOSIS

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Abstract

Metabolic acidosis is commonly seen in the clinical setting especially in the critical cases. The choice of the treatment depends on the underlying causes of metabolic acidosis. Medical history is an essential key for determining the underlying cause of the disease. However the medical history provided by the patient or the family members is usually not complete when the patient arrived at the Emergency department. Therefore, further investigations such as physical examination and the laboratory tests are critical. Among all underlying causes of metabolic acidosis, Lithium overdose induced metabolic acidosis is not uncommon but diagnosis is often missed due to incomplete history of medication. Lithium intoxication could be treated by hemodialysis or hydration effectively depending on the serum lithium level and hemodynamic stability.

Key words: Metabolic acidosis, Lithium overdose, Low anion gap metabolic acidosis, Elevated osmolar gap metabolic acidosis, Unconscious patient

Introduction

Metabolic acidosis is commonly encountered in clinical setting. There are several causes of metabolic acidosis. Medical history and serology are essential for determining the cause. Lithium overdose is not uncommon but to correlate the metabolic acidosis with lithium overdose in an unconscious patient needs clinical experience.

We report a case of 41-year-old woman with loss of consciousness for unknown duration and the chest x-ray showed pneumonia.

Case Report

A 41-year-old woman was brought by the family members to Emergency Department (ED) due to loss of consciousness for unknown duration. The patient was found unconscious with urinary incontinence by her family at home few hours prior to admission. Upon arrival, the vital signs included blood pressure of 128/88 mmHg, the respiratory rate of 28 per minute and the heart rate of 106 per minute. Her conscious level was Glasgow coma score of 3. Physical examination revealed unequal pupils (right =4.0mm, left= 4.5mm) with no light reflex. Coarse crackles were noted over both lungs. No motor response and no babinski signs were noted. Laboratory data showed white blood cell count of 11350/mm³, Neutrophil of 92.4% and C-reactive protein of
9.47. The arterial blood gas showed respiratory acidosis (pH 7.26, PO\textsubscript{2} 82.6, PCO\textsubscript{2} 54.4, HCO\textsubscript{3} 23.9). She was thus intubated immediately. Chest X-ray showed right lower lobe pneumonia. Brain CT scan showed no acute injury. Toxicology screening showed negative for barbiturate, acetaminophen, amphetamine and morphine. She was then transferred to the medical intensive care unit (MICU). Metabolic acidosis was noted after admission with low anion gap (2 mmol/L) and high osmolar gap (143 mOsmol/kg). Flumazenil was given to rule out drug overdose with no improvement was observed. Empirical parenteral antibiotics, Metronidazole 500mg IV 8 hourly and Ceftriaxone 1gm IV 12 hourly, were given for pneumonia. Later her family told that she has psychiatric problem and was under the medications but they was not able to provide the names of the medication. All causes of low anion gap metabolic acidosis were ruled out except for lithium overdose. Blood sample was sent to another laboratory outside the hospital for serum lithium level but the result was not available immediately. The delayed treatment for lithium overdose could lead to serious complications and even death. Thus under the strong suspicion of lithium overdose induced metabolic acidosis, emergency hemodialysis was started immediately before laboratory result became available. Her consciousness level was improved right after hemodialysis. Nephrogenic diabetic insipidus (DI) was diagnosed later with the urine output of more than 3000cc per day, low urine osmolarity (220 mOsm/L) and hypernatremia (150mEq/L) while she was in MICU. Desmopressin (Minirin) was prescribed and DI was improved later. After few days, the result of serum lithium level became available (5.41mEq/L) which is higher than the usual therapeutic level of 0.7 to 1.2mEq/L. This result further confirmed the initial diagnosis. Another hemodialysis was done on the next day and the serum lithium level became within normal range. At the same time, the patient’s conscious level was improved gradually and she was discharged from the hospital 17 days after admission without any neurological deficits.

**Discussion**

Acid-base disorders are commonly encountered in the critical care setting. Early determination of the causes of metabolic disorder enables the correct treatment. Metabolic disorder is secondary to abnormal changes in plasma HCO\textsubscript{3} and decreased plasma [HCO\textsubscript{3}] results in acidosis and increased plasma [HCO\textsubscript{3}] results in alkalosis. The causes of metabolic acidosis can be divided into two categories: those with an elevated anion gap and those with a low anion gap. The common causes for high anion gap include ketoacidosis, lactic acidosis, intoxication, advanced renal failure and severe rhabdomyolysis. The causes of low anion gap are listed in Table 1.1,2

Therefore, calculation of anion gap is important in metabolic acidosis. The normal anion gap is approximately 8 to 12 mEq/L. The osmolar gap is another useful diagnostic clue in causes of overdose. Common causes of an elevated osmolar gap and the formula are outlined in Table 2.3

Lithium is commonly used in the treatment of bipolar disorders. It has a narrow therapeutic index and hence lithium overdose risk is relatively high. Lithium is completely absorbed from the upper gastrointestinal (GI) tract within 8 hours after oral administration and mainly excreted through the kidney (95%). The peak serum level was reached at 1 to 2 hours after oral administration. Lithium is also available in sustained-release presentation and the peak serum levels generally reaches within 4 to 5 hours after ingestion but it can continue to increase for 3 to 4 days.4 The half life of a single dose of lithium is from 12 to 27 hours but it varies with the age of the patient. The half life increases to approximately 36 hours in elderly persons due to decreased glomerular filtration rate (GFR).5

The most common clinical manifestation of lithium overdose is altered mental status. Acute lithium overdose may induce electrocardiogram changes such as prolonged QT interval, transient ST segment depression and inverted T waves in lateral precordial leads. Lithium overdose may
It is important to consider lithium overdose as one of the differential diagnoses in unconscious patient with low anion gap metabolic acidosis. With early and correct diagnosis, immediate appropriate treatment would save the lives and avoid serious complications from delayed treatment.

### Table 1. Differential diagnosis of low anion gap

- Hypercalcemia
- Hypermagnesemia
- Hyperkalemia
- Cationic immunoglobulins (as in plasma cell dyscrasias)
- Bromide intoxication
- Nitrates
- Lithium

### Table 2. Differential diagnosis of an elevated osmolar gap

- Isopropanol
- N-propanolol
- Propylene glycol
- Ethylene glycol
- Methanol
- Formaldehyde
- Paraldehyde
- Mannitol
- Diethyl ether ingestion
- Lithium overdose

also induce nephrogenic diabetes insipidus. The common adverse effects of lithium are listed in Table 3.3

Hemodialysis is a mainstay for the treatment of lithium intoxication. The indications for hemodialysis include any patient with lithium intoxication who presents with coma, convulsions, respiratory failure, deteriorating mental status, or renal failure. One should also strongly consider hemodialysis for any patient with chronic lithium therapy and serum lithium levels of more than 4 mEq/L, or for patients who develop serious cardiac or neurologic symptoms with lithium levels between 2.5 and 4 mEq/L. Intermittent hemodialysis can effectively reduce plasma levels of lithium, but a rebound of lithium levels often occurs between dialysis sessions. Therefore, continuous forms of hemodialysis have also been used with much success.7,8

It is important to consider lithium overdose as one of the differential diagnoses in unconscious patient with low anion gap metabolic acidosis. With early and correct diagnosis, immediate appropriate treatment would save the lives and avoid serious complications from delayed treatment.
References

鋰藥物過量中毒併低陰離子間隙差之代謝性酸中毒患者個案報告

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摘要

臨床上的重症患者常併發代謝性酸中毒。治療的方式主要依病因來做決定。病史是找出病因不可缺的重要因子。但通常到急診的病人及家屬都無法提供完整的病史。因此更進一步的檢查如詳細的體檢和抽血檢驗就更顯得相當重要。造成代謝性酸中毒的原因有很多，但鋰藥物過量中毒雖不少但卻常被忽略。鋰藥物過量中毒的治療依血清濃度和病人狀況而決定。

關鍵詞：代謝性酸中毒，鋰藥物過量中毒，低陰離子間隙差，高滲透壓間隙代謝性酸中毒，意識不清之患者