



Case Report

Severe hyponatremia associated catheter malposition in an intensive care patient[☆]

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Abstract We present a catheter related severe hyponatremia in a 2-month-old baby who was admitted to the pediatric intensive care. Imbalance of plasma sodium is commonly seen in pediatric intensive care patients. The water and sodium balance is a complex process. Especially, brain and kidneys are the most important organs that affect the water and sodium balance. Other mechanisms of the cellular structure include osmoreceptors, Na-K ATPase systems, and vasopressin. Hyponatremia is usually an iatrogenic condition in hospitalized patients due to mismanagement of water electrolyte imbalance. Central venous catheterization is frequently used in pediatric intensive care patients. Complications of central venous catheter placement still continue despite the usage of ultrasound guidance. Malposition of central venous catheter in the brain veins should be kept in mind as a rare cause of iatrogenic hyponatremia.

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1. Introduction

Hyponatremia is a common problem in intensive care units. Hyponatremia may be associated severe morbidity or even life threatening event [1]. The majority of hyponatremia cases are caused by dehydration [2]. It is usually an iatrogenic condition in hospitalized patients because of mismanagement of water electrolyte imbalance [3]. Central venous catheterization (CVC) is frequently used in pediatric intensive care unit

(PICU) especially for a patient who cannot be inserted peripheral venous access. Complications due to central venous catheter placement still exist despite the usage of ultrasound guidance. Here, a case of hyponatremia due to central catheter misplacement was reported.

2. Case

A 2 months old intubated baby was admitted to PICU with poor general condition. His past history was revealed that he was born at 33 weeks of gestation with 1600 grams weight. He had 10 days hospital stay due to respiratory distress. At the end of 10 days, he was discharged at home with breastfeeding. He was admitted to the emergency service with

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refusing the feeding for 4 days and respiratory distress for last day. At the emergency service intubation and cardiopulmonary resuscitation were applied because of respiratory and cardiac arrest. Then, he was transferred to our tertiary PICU. On admission to PICU; he had cold and pale skin with poor tissue perfusion and capillary refilling time was more than 4 seconds. He was hypotensive (55/35 (41) mmHg), tachycardia (pulse: 175/minute), and respiration was irregular. Blood gasses analyze showed severe metabolic acidosis. Serum Ph, bicarbonate and base excess were 7.10, 11 mmol/L and -14 mmol/L respectively. Serum lactate level was 9 mmol/L. There was no sign of dehydration at admission because he was hydrated in out center during cardiopulmonary resuscitation process. Depending upon chest x-ray findings and laboratory data findings including increased acute phase reactance and thrombocytopenia, pneumonia and septic shock were considered as possible causes and appropriate treatments were started including hydration, broad spectrum antibiotics, bicarbonate infusion, sedation (midazolam) and positive inotropic support (Dopamine 5 µg/kg per minute). Firstly, 20 mL/kg normal saline is loaded again. Arterial blood pressure increased up to 70/52 mm hg. Maintenance fluid (1500 mL/m² per day) was continued. Laboratory evaluation showed that hematocrit was 23.5%, hemoglobin was 7.1 g/dL, leukocyte count was 13,300/mm³, platelet count 27,600/mm³. Serum sodium level was 131 mmol/L, potassium was 6.2 mmol/L, blood urea nitrogen (BUN) was 26 mg/dL, creatinine was 0.67 mg/dL. Aspartate transaminase, alanin transaminase, creatinine kinase, total and direct bilirubin levels were 1574 U/L, 365 U/L, 1518 U/L, 3.78 mg/dL, 2.62 mg/dL respectively. C-reactive protein and procalcitonin levels were 24.4 mg/L and 1.6 ng/mL respectively. The patient was maintained intubated for duration of 60 days and during that period the patient was not able to be weaned off the mechanical ventilator secondary to persistent parenchymal lesions in both lung fields possibly due to acute respiratory distress syndrome or pneumonia.

During the hospital stay, differential diagnosis of persistent lung inflammation was investigated. In flow cytometric analyze due to persistent lymphopenia and thrombocytopenia showed severe primary immune deficiency so called that major histocompatibility complex class II (MHC class II) deficiency. Echocardiographic evaluation was unremarkable. Computed tomography of the thorax showed some nonspecific changes including air bronchogram and ground glass. The bronchoalveolar lavage (BAL) culture was negative. Cytopathological examination of the BAL fluid was unremarkable. No hemosiderin loaded macrophage and no eosinophil were seen in BAL fluid. Blood polymerase chain reaction for cytomegalovirus was positive (818.000 copy/mL). The lung biopsy for CMV could not be done due to poor condition of the patient. Ganciclovir treatment was started to be assumed CMV pneumonia. This treatment has been maintained for 70 days. During this period, the broad spectrum antibiotics were given several times for suspected or proven sepsis. The patient has stayed in the intensive care unit for 80 days. During the hospital stay, totally 4 times central catheter was placed for not possible

peripheral venous access. Before the last catheter placement, laboratory values showed that BUN was 21 mg/dL, creatinine was 0.45 mg/dL, serum sodium level was 153 mEq/L and serum potassium level was 3.4 mEq/L. It was thought to be associated with restricted fluid and continue diuretic infusion to prevent the pulmonary edema. Next day, a central catheter was inserted under ultrasound guidance to the left internal jugular vein because of impossibility of peripheral venous access. Catheter tip position was not checked with a chest x ray by an oversight. Next day, laboratory evaluation was performed again because of worsened general condition. Serum BUN, creatinine, sodium and potassium levels were 104 mg/dL, 1.64 mg/dL, 197 mEq/L and 5.4 mEq/L respectively. Daily urine output was similar between last days (3.7 mL/kg/hour). Blood pressure was normal entirely at the day. Hypernatremia was considered to be related with acute kidney injury, sepsis, diabetes insipidus or drug adverse effect. Some investigations were performed for hypernatremia etiology. Simultaneous blood and urine osmolality and urine electrolytes were sent. Serum and urine osmolality were 438 mOsm/kg, 524 mOsm/kg, respectively. Urine sodium, creatinine, potassium and calcium levels were 95 mmol/L, 30.48 mg/dL, 19.9 mmol/L and 2 mg/dL, respectively. Fractional excretion of sodium (FeNa) was 1,5%. Before the last catheter placement, totally 40 mL normal saline for infusion solution to administer the antibiotics and other medications was given in a day by central line. Enteral feeding was about 440 mL/d with formula by gavage. No any more fluid was given. One day later after the last catheter placement, poor general condition, tachypnea, tachycardia, fever, irritability, vomiting and deterioration of the level of consciousness were seen. Hypernatremia treatment was started. We continued to deliver fluid by this catheter line. Because we had to deliver the fluid especially saline for hypernatremia treatment. Free water deficit was calculated. Then 20 mL/kg normal saline was loaded over 1 hour and water deficit was planned to replace over 36 hours. The serum sodium levels were monitored closely during the fluid replacement. At following days, serum sodium level was not decreased although serum BUN, creatinine levels were decreased to normal ranges. The patient's platelet count was 16,700/mm³ at this point. Therefore, we thought that this problem can be related to intracranial hemorrhage. Then we performed brain computed tomography imagination; showed that there was a foreign body in the head (Fig. 1). Can it be catheter tip? We asked this question ourself. Then chest x-ray was performed to see where catheter lies. Chest x ray showed that catheter was laying upward (Fig. 2). The catheter was removed. Hypernatremia of the patient returned to the normal range for few days.

3. Discussion

Hypernatremia is a common problem in pediatric intensive care units. It is defined as serum sodium level above 145 mmol/L [4]. It is associated with mortality and morbidity.

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