Dead Sea Syndrome: A Case Report

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ABSTRACT

Dead Sea has 33.7% salinity which makes it one of the saltiest water on earth. Drowning and swallowing Dead Sea water with its high content of minerals affects significantly the electrolytes balance in the body. We report a nine year old boy who drown in the dead sea and developed secondary life threatening sever hypercalcemia and hypermagnesemia causing abnormal cardiac rhythm; he is successfully treated with hemodialysis. Physician who treat patients drown in the Dead Sea has to be aware of electrolyte abnormalities especially for calcium and magnesium and the proper method of management including hemodialysis or hemofiltration.

Key words: Dead Sea Syndrome, Drowning, Hypercalcemia

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Introduction

Dead Sea is a unique place on earth. The surface of the Dead Sea is 423 meters (1388 feet) below sea level which make it the lowest point on earth. It has 33.7% salinity which makes it one of the saltiest water on earth.[1]

The old wisdom that no one can drown in the Dead Sea is not true, floating on the back is easy but if they turn over or trip into the sea with face down it is easy to drown. Swallowing Dead Sea water with its high content of minerals affects significantly the electrolytes balance in the body. We report a nine year boy with near drowning in the Dead Sea who developed life threatening hypercalcemia and hypermagnesemia which needed hemodialysis for treatment, in addition to other well known complication of near drowning as lung injury and brain anoxia.

Case Report

A nine year old male child previously healthy presented to the emergency room of Queen Rania Abdulla children Hospital on the 19th of January 2013 after 3 hours of near drowning in the Dead Sea found floating on the surface of water for unknown time, he was resuscitated at local hospital. At ER his Glasgow Coma scale was 3-4/15, in respiratory distress, cyanosed, tachypnic, the pupils were reactive to light, the temperature was 35C°, blood pressure 140/90, heart rate 67 beat/ min, PO_2 measurement by pulse oximeter was 75% which improved to 92 on 5L/min O_2 given by face mask, Chest examination showed bilateral reduced air entry, cardiac examination showed irregular rhythm with bradycardia but normal S1, S2, the abdomen was soft and lax. In the emergency room; nasogastric tube was introduced for stomach decompression, elective intubation and atropine was given for bradycardia and external rewarming was done. After stabilization in the ER he was transferred to pediatric ICU. Brain CT scan was negative for intracranial hemorrhage but showed mild brain edema, chest X ray showed hyperinflation and increased bronchovascular marking.

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Electrocardiogram showed first degree heart block with normal QT interval and ST segment elevation Lab data showed blood urea nitrogen (BUN) 18mg/dl, Creatinine 0.6 mg/dl, sodium 147mEq/L, potassium 3.7 mEq/L, calcium 20.1 mEq/L, S. albumin 4.0 g/dL, phosphorous 7.9 mg/dL magnesium 6.08 mg/dL, glucose 243 mg/dL. PH 7.2, HCO_3 12.4, $PaCO_2$ 25 uric acid 11.2 mg/dL

The patient was connected to the respirator, fluid management by giving one and a half the maintenance requirements of normal saline 0.9% followed by furosemide injection which dropped calcium level from 21.9 to 19.5; hemodialysis was used as a rescue measure for the management of hypercalcemia through acute subclavian central line for the management of hypercalcemia and hypermagnesemia which dropped to 13 mg/dL, 3md/dL respectively immediately post dialysis as clearly shown in Fig. 1.

During ICU admission he developed fever for which he received ceftazidime and amikacin; blood culture was negative. He received methylprednisolone for the respiratory complication. On the third day he was extubated, transferred to the ward and discharged in a total of ten days admission.

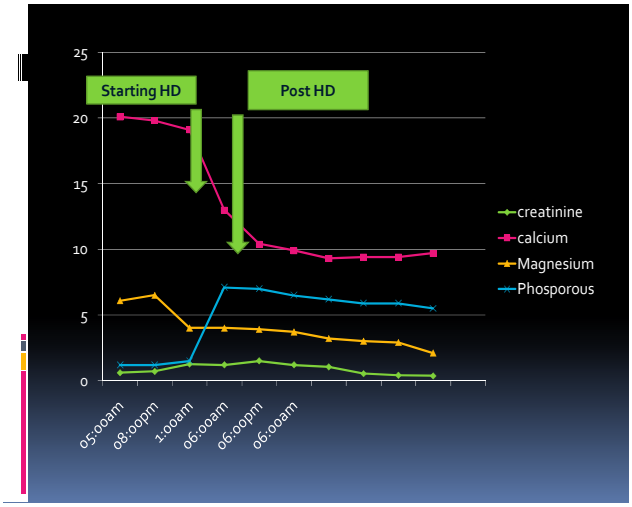

Fig. 1: The level of electrolytes with time during the course of treatment

Discussion

Drowning is the third most common cause of accidental death worldwide, accounting for 7% of all injury related deaths.[2]

The most important contributory factors to morbidity and mortality from drowning are hypoxemia, acidosis and multi-organ effects of these processes. Central nervous system (CNS) damage may occur because of hypoxemia sustained during the drowning episode (primary injury) or may result from arrhythmias, ongoing pulmonary injury, reperfusion injury, or multiorgan dysfunction (secondary injury), particularly with prolonged tissue hypoxia.

After initial breath holding, an involuntary period of laryngospasm is triggered by the presence of liquid in the oropharynx or larynx. Oxygen depletion and carbon dioxide retention occur. As the oxygen tension in blood drops further, laryngospasm releases, and the victim gasps, hyperventilates, possibly aspirate variable amounts of liquid.[3]

The Dead Sea water has 345 g of mineral per liter (34.5% or 34.5 g/100 ml). This salt concentration is about 7 to 10 times that of the oceans.[4]

The relative proportion of salts as compared with the Mediterranean Sea may be not different regarding sodium chloride NaCl, but the content of others as magnesium chloride MgCl2, calcium chloride CaCl2, potassium chloride KCl, and magnesium bromide MgBr2 is astonishingly higher. It's the high content of CaCl2 that gives the Dead Sea water its oily feel and provide it with its medicinal properties for smoothening of skin and cosmetic application. [5, 6]

The complications of near drowning according to Uriel Katz *et al*[6] are many including pneumonitis which could be due to aspiration and or chemical irritation by the high content of minerals, electrolyte disturbances as hypercalcemia and hypermagnesemia which leads to Abnormal cardiac rhythm, CNS damage due to hypoxic encephalopathy secondary to many factors as hypoxemia that occurred during the drowning episode (primary injury), arrhythmia, pulmonary injury. Other complications that may occur after drowning are reperfusion injury, multiorgan dysfunction particularly with prolonged hypoxia, trauma during drowning event and hypothermia.

Near drowning in the Dead Sea is a potentially lethal accident, the swallowing of the salty water causes acute combined hypercalcemia and hypermagnesemia. This, rather than aspiration, is

considered to be the main pathogenic factor.[8,9] In retrospective observational analysis of 69 patients By Lisa Saidel-Odes and Yaniv Almong they found that drowning in the dead sea is syndrome of life threatening electrolytes abnormalities along with lung injuries.

The most common ECG changes after near drowning in the in 37 patients who suffered from a near-drowning syndrome at the Dead Sea were sinus tachycardia, P wave changes , prolongation of PR interval, widening of QRS complex, inversion and broadening of T waves, Infra-His conduction disturbances, prominent U wave, lethal ventricular tachyarrhythmia. 35% of the 37 patients presented with ST segment depression. The corrected QT interval QTc was normal (expected to be shortened due to hypocalcaemia), Hypermagnesemia normalizes the QTc interval.[10]

Patients were treated with dialysis for severe hypercalcemia and hypermagnesemia complicated by cardiac arrhythmia. Following treatment there was a significant drop in calcium and magnesium levels and resolution of the cardiac arrhythmia. [11]

In treating hypercalcemia and hypermagnesemia; early recognition of these electrolyte abnormalities is mandatory. Gastric aspiration is preferred since even small amounts of Dead Sea water can cause electrolytes abnormalities. Forced diuresis using fluids and furosemide is one of the effective methods of decreasing the level of serum calcium, hemodialysis or hemodiafiltration if available is the method of choice for treating patients with hypercalcemia and hypermagnesemia especially with abnormal ECG findings or patients with renal impairment.[12]

Regarding the pulmonary complications; pneumonia occurs due to infection and or aspiration along with hypoxic bilateral pneumonitis. Superimposed infection may complicate the course, lung injury due to direct chemical irritation of the aspirated salt-rich water which occurs within 4 hours of aspiration.

The treatment of pulmonary complication is immediate O_2 supplement, with or without ventilatory support

Corticosteroid therapy may help in chemical pneumonitis and antibiotic treatment was aimed to cover against gram negative bacteria and anaerobes. [13, 14]

Conclusion

Near drowning in the Dead Sea is dangerous due to high content of minerals, one has to be aware of hypercalcemia and hypermagnesemia with their harmful effect on the heart, forced diuresis and early hemodialysis is recommended.

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