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Pseudo-ElectrolyteImbalances among Pediatric Patients with Essential Thrombocythemia: Single Center Experience

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Essential thrombocythemia is very rare during childhood. The pseudo-electrolyte imbalances including hyperkalemia and hypercalcemia have been reported among adult patients with this condition. Due to the rarity of this condition in the pediatric age group, overtreatment and even hospitalization of these patients for correction of electrolyte imbalances is usually inevitable.

Herein, we reviewed the pseudo-electrolyte imbalances in our pediatric and adolescent patients with essential thrombocythemia between 2010 and 2014. Hyperkalemia at levels as high as 6.81 mEq/L were shown to be correlated with elevated thrombocyte counts without electrocardiographic changes

Key words: Children, electrolyte imbalance, essential thrombocytemia, pseudo-hyperkalemia, thrombocytosis

Introduction

During childhood thrombocytosis generally develops secondary to reactive processes like infection, inflammation, tissue damage or neoplasia [1]. Essential thrombocythemia (ET) is a very rare cause of thrombocytosis in children with an incidence of approximately 1/10,000,000 per year [2]. Common manifestations of ET are headache, dizziness, syncope, nausea, vomiting, thrombosis and hemorrhage [3]. Pseudo-hyperkalemia and hypercalcemia have been reported in adult patients with ET as a result of laboratory artifact [4-5]. This has not been known among pediatric hematologists because of its rarity in this age group leading to unnecessary laboratory investigation, overtreatment and unnecessary hospitalizations [6-7]. We retrospectively evaluated the relationship between platelet counts and serum electrolytes among pediatric patients with ET at our center.

Materials and Methods

Seven patients who were followed and/or treated or for ET between 2010 – 2014 in our center were retrospectively analyzed. Essential thrombocythemia was diagnosed according to the 2008 World Health Organization diagnostic criteria [8]. All laboratory data including hemogram and serum biochemistry that were performed at the same time were evaluated in detail retrospectively. Hemograms and serum electrolytes were performed with Coulter LH 780 Analyzer and Beckman Coulter AU680, respectively.

Spearman Correlation Test was used for detection of correlation between platelet counts and electrolyte levels.

Results

The median age of our patients was 12 years (range; 5.8 – 17.4 years). Laboratory data of the patients are summarized in Table 1. Twenty-seven laboratory analysis including hemogram and simultaneous serum potassium level measurements were evaluated. Twenty-five of them were with serum calcium and phosphorus level measurements. None of the patients had acute or chronic renal failure.

Median hemoglobin, and leukocyte count were 10.3 gr/dL (9.2 – 14.9), and 12.1x10³ /µL (5.6 – 26.6 x10³), respectively. JAK2 V617F mutation analysis

Table 1. General descriptive statistics of laboratory test results.

|	Number of tests	Median	Range
Platelet count (x109/L) (Normal; 130 – 400)	27	1430	808-3165
Serum potassium (mEq/L) (Normal; 3.5 – 5.1)	27	5.35	4.31-6.81
Serum calcium (mg/dL) (Normal; 8.8 – 10.8)	25	10.1	9.33-11.20
Serum phosphorus (mg/dL) (Normal; 3.5 – 6.6)	25	5.17	3.72-6.24

was performed in all patients. It was found positive in only one. Median platelet count was 1430x10⁹/L (808 – 3165 x 10⁹/L). Median potassium and phosphorous levels were 5.35 mEq/L (4.31 – 6.81mEq/L), respectively. On the other hand, median phosphorous level was 5.17 mg/dL (3.72 – 6.24 mg/dL). Median calcium level was 10.1 mg/dL (9.33 – 11.2 mg/dL). A strong positive correlation was found between serum potassium level and elevated platelet counts ($p <0.001$; r=0.65) (Figure 1).

The last patient with ET was a 10.8 year-old male who presented with a platelet count of 2136 x10⁹/L and his serum potassium, and phosphorus levels were 6.43mEq/L, and 4.83 mg/dL, respectively. He had received oral anti-potassium and anti-phosphorus treatments. After cessation of both anti-potassium and anti-phosphorus treatments, ECG was obtained at a serum potassium level of 6.81 mEq/L and

revealed no sign of hyperkalemia. Because we were not able to measure plasma electrolytes at our center, we obtained a blood sample of the patient in the laboratory and evaluated the serum electrolytes without any delay, serum potassium, calcium and phosphorus levels were measured as 4.37 mEq/L, 9.7 mg/dL, 5.2 mg/dL respectively.

Discussion

Potassium is a cation that exists predominantly in the intracellular compartment. Elevated level of potassium threatens life by effecting cardiac myocyte membrane potentials consequently resulting in arrhythmias. Therefore, emergent interventions are essential for management of hyperkalemia [9]. Increased serum potassium level in adult ET patients is a well-known situation and termed as pseudo-hyperkalemia. Its mechanism can be
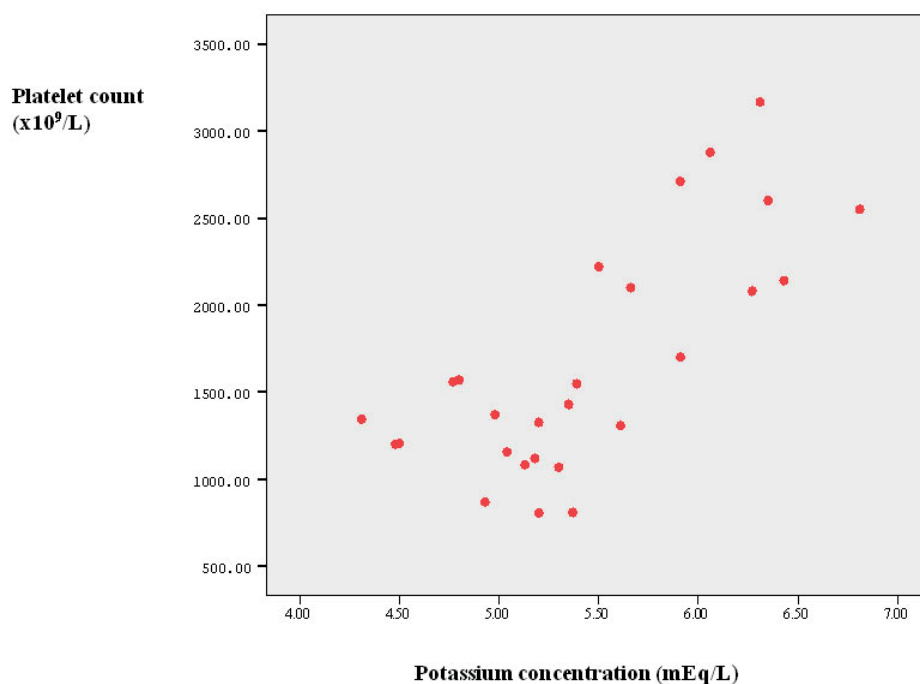
Figure 1. Association between platelet count and serum potassium level

explained with leak of potassium from platelets with enormous numbers after clot formation. It is a technical artifact correlated with platelet count [5] {Rodriguez-Cuartero, 2004 #5}. Rodriguez-Cuartero et al. demonstrate a significant relationship between high platelet count and potassium concentration in 37 ET patients with a mean age of 62 years [5]. Nijsten et al. measured both serum and plasma potassium levels in 182 previously healthy patients who had experienced trauma in their study. They found serum potassium levels greater than plasma levels, they also denoted the relation between the difference in serum and plasma potassium levels and platelet counts [10]. According to our knowledge, our study is the first report that has been performed in the pediatric age group. In our patients, we unfortunately did not have the chance to study plasma electrolytes. However, our patients had normal ECG findings even with serum potassium levels as high as 6.81 mEq/L, suggesting lower plasma electrolyte levels Since we had no opportunity to study plasma electrolytes, in the last patient who presented to our center we obtained blood samples in the laboratory and tested samples urgently, in order to decrease the hemolysis. Potassium is released slowly from degranulating platelets within a clot [4], based on this

we suggest sampling within the laboratory and testing electrolytes without delay in serum samples in order not to over-treat these patients.

In another study, Howard et al. revealed the association of hyperkalemia and thrombocytosis in 24 adult patients with ET. They also found elevated calcium levels in ET patients and showed that hypercalcemia is due to calcium secretion from platelet granules during in vitro coagulation [4]. In our study mean serum calcium and phosphorous levels were close to the upper limit of the normal value, but significance association with platelet count could not be demonstrated. Low incidence of ET in pediatric age group was the main drawback of this study, if the samples size were larger, we might have been able to show a statistically significant correlation between platelet counts and other serum electrolytes.

In conclusion, hyperkalemia in patients with ET may be secondary to a laboratory artifact. So, these patients should be protected from unnecessary investigations and treatments when isolated hyperkalemia is detected. Although ET is very rare during childhood, pediatricians and pediatric hematologists should be aware of pseudo-hyperkalemia in this situation.

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